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Vincent Hugonnot & Leica Chavoutier

A modern record of one of the rarest European mosses, *Ptychomitrium incurvum* (*Ptychomitriaceae*), in Eastern Pyrenees, France

Abstract

Hugonnot, V. & Chavoutier, L.: A modern record of one of the rarest European mosses, *Ptychomitrium incurvum* (*Ptychomitriaceae*), in Eastern Pyrenees, France. — Fl. Medit. 26: 5-10. 2016. — ISSN: 1120-4052 printed, 2240-4538 online.

A new Eastern Pyrenean (Pyrénées-Atlantique department, France) record of the very rare species *Ptychomitrium incurvum* (Schwägr.) Spruce (*Ptychomitriaceae*) is mentioned. It is a national extension of the small known European area of this species. The new localitiy is briefly described and compared with the data of literature.

Key words: floristic, bryophyte, Pyrénées-Orientales.

Introduction

Ongoing bryological surveys in the Pyrénées-Orientales department (France) have already yielded several remarkable species. Among the most noticeable are *Jamesoniella undulifolia* (Nees) Müll.Frib. (Hugonnot 2012), *Hygrohypnum styriacum* (Limpr.) Broth. (Hugonnot 2013a), *Bryum valparaisense* Thér. (Hugonnot 2013b), *Tayloria splachnoides* (Schleich. *ex* Schwägr.) Hook. (Hugonnot 2009) or *Geocalyx graveolens* (Schrad.) Nees (Hugonnot 2014). *Ptychomitrium incurvum* (Schwägr.) Spruce was recently observed in the Pyrénées-Orientales (France) and, being a very rare element of the European bryoflora, deserved to be mentioned.

The Amphiatlantic distribution of *Ptychomitrium incurvum* has been reviewed and mapped by Frahm (2013a). It is widespread in Eastern North America, from Canada (Southern Ontario) to Texas. The political occurrence of the species in North America was updated in Reese (2007). Most of known occurrences are concentrated in Southern United States whereas it is rare in the North. In Canada the species is considered Extinct, the only record dating back from 1828 (Ireland & Ley 1992). *P. incurvum* is also recorded in South America (Ecuador), following Reese (2007). In Europe, it is of much more restricted occurrence in South-Western Alps. It is recorded in Southern Switzerland (Tessin) (http://www.nism.uzh.ch/map/map_en.php) (Amann 1918) and Northern Italy (Piemont and Lombardia) (Aleffi & al. 2008). In the Pyrenees, it was previously known in Spain,

from one record in Navarra and three from France, in Pyrénées-Atlantiques and Hautes-Pyrenées departments (Frahm 2013a; Husnot 1892-1894). It is considered Regionally Extinct in Spain (Casas & al. 2009; Brugués & al. 2014), and its status in France was uncertain. In Europe, the only modern records are those of Frahm, who observed the species in Tessin (Fig. 1).

In the present note, the new locality of *P. incurvum* is briefly described and compared with literature data.

All the samples were collected by the author and are deposited in the private herbarium of V. Hugonnot. Nomenclature of liverworts and mosses follows, respectively, Ros & al. (2007) and Ros & al. (2013).

New locality data

FRANCE. Pyrénées-Orientales, Vallespir, Saint-Laurent-de-Cerdans, South-West of Puig de Sant Miquel, 820 m, 42° 21' 5,8'' N; 2° 37' 11,1'' E, *Hugonnot 12 may 2015* (Herbarium Hugonnot).

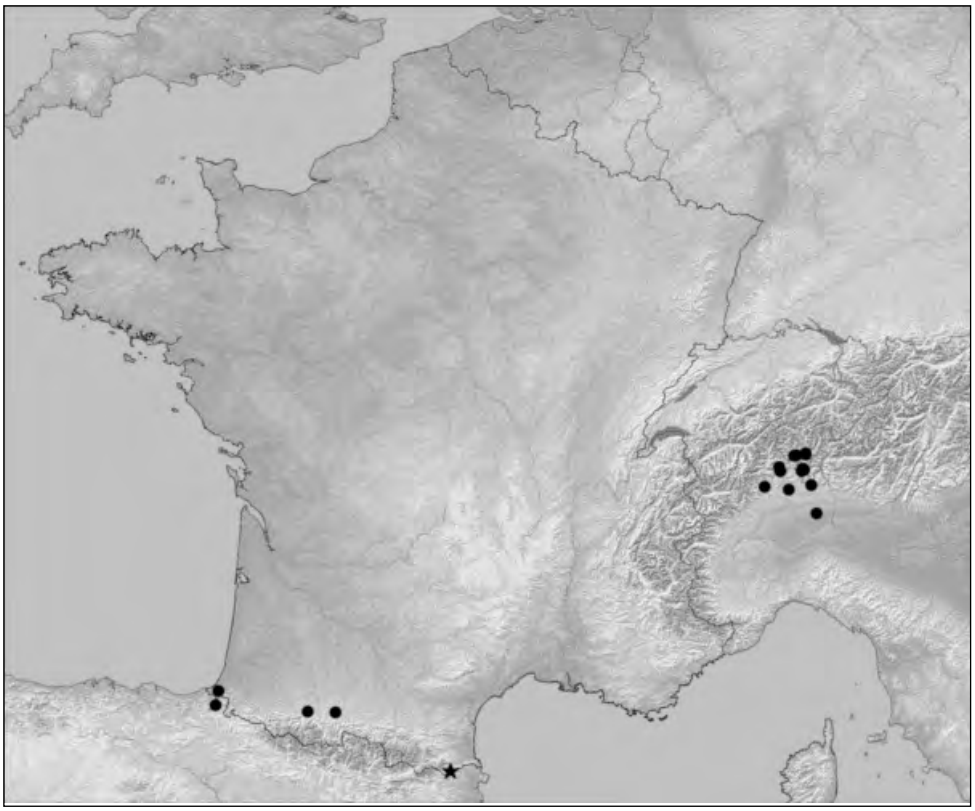

Fig. 1. European map of *Ptychomitrium incurvum* (Schwägr.) Spruce (star : Pyrénées-Orientales record).

The collected material was made of deep glossy green-blackish small rounded cushions, the largest tufts reaching 0,5 cm high, with strongly crisped and obtuse-entire leaves (Fig. 2). The leaves were characteristically concave at the apex, often feebly cucullate. Male buds were located at the base of perichaetium, just below seta (gonioautoicous). Sporophytes were plentiful, with mitrate calyptra (though at the period of record most of them were fallen off).

P. incurvum was observed on small granite blocks (not in crevices but on the surface) along a path. Surroundings are dominated by ancient acidophilic chesnut groves. Approximately 5 widely spaced tufts were observed growing on two blocks distant from several meters. Immediate associate were sparse and included isolated individuals or small tufts of *Ptychostomum capillare* (Hedw.) Holyoak & N. Pedersen, *Grimmia longirostris* Hook., *Lophozia excisa* (Dicks.) Dumort., *Orthotrichum anomalum* Hedw., *Ptychomitrium polyphyllum* (Dicks. ex Sw.) Bruch & Schimp. and *Schistidium confertum* (Funck) Bruch & Schimp.

Climate

The climate of Vallespir is difficult to characterize because of variability, mostly influenced by altitude. Vallespir is the most rainy region of all Pyrénées-Orientales. Total annual rainfall reaches 1100 mm/year. The summers are warm but the drought period is mostly less than one month. Storms are very frequent from May to August and certainly play an important role for summer growth of bryophytes. Average annual temperature stands near 12 C°. The winter temperatures can go down very low in this region.

Discussion

The recognition of *Ptychomitrium incurvum* offers no special difficulties even in the field, thanks to the combination of a striking glossy green-blackish colour, the crisped and contorted leaves and the occurrence on rocks. *Ptychomitrium polyphyllum* is locally associated with *P. incurvum* but is a very distinct plant, being much more robust and having leaves with dentate margins (they are entire in *P. incurvum*). *Ptychomitrium nigrescens* (Kunze) Wijk & Margad. is of comparable size, but has acute and plane leaves (they are obtuse and cuculate in *P. incurvum*) and longer seta (2-3 mm in *P. incurvum* against 5 mm in *P. nigescens*). *P. nigrescens* is a very rare species in France, not recorded in Pyrénées-Orientales, but only in Var. Illustrations and descriptions of *Ptychomitrium incurvum* are provided in Limpricht (1890), Crum & Anderson (1981), Cortini Pedrotti (C), Reese (2007), Brugués & Ruiz (2015) and they do not seem to show any appreciable morphological variation.

Ptychomitrium incurvum is one of the rarest moss species of Europe (Frahm 2013a) and it is still rather incompletely known. It generally grows on acidic rocks (granite, schist, etc.) (Reese 2007; Frahm 2013a), but also on calcareous ones (Limpricht 1890) so that it is considered indifferent (Augier 1966; Crum & Anderson 1981; Reese 2007). It likes dry and hot microhabitats, somehow paradoxically, shows an affinity towards humid climate. Violent and frequent summer storms in Vallespir probably allow the species to be wetted a large part of the year. Though mostly reported as growing in natural habitat, it has been

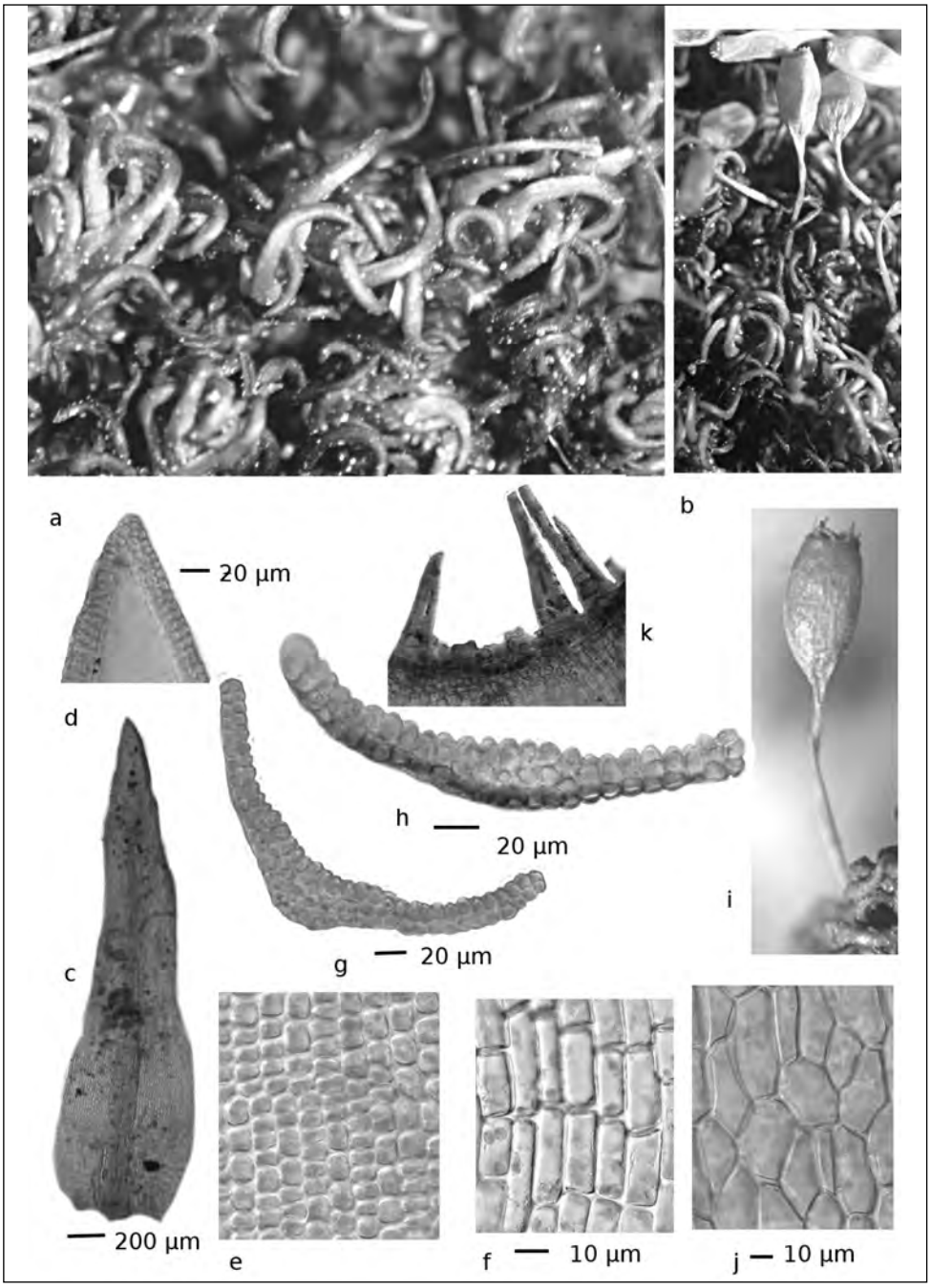

Fig. 2. *Ptychomitrium incurvum* (Schwägr.) Spruce: a, b: habit; c: vegetative leaf; d: apex of the vegetative leaf; e: areaolation at mid-leaf; f: areolation at leaf base; g, h: transverse section through leaf; i: sporophyte; j: exothecium areolation; k: rim of capsula showing remnants of peristome.

mentioned on artificial substrates too, including walls (Augier 1966) or tombstone (Cosepac 2002). It was additionally described colonizing rocks along a forest path (Frahm 2013a), which is also the case for the population of Pyrénées-Orientales. It suggests that the species tolerates a certain degree of artificialization. The base of trees or logs have also been mentioned as occasional potential substrates (Crum & Anderson 1981).

Sporophytes are always seen in *P. incurvum*. It is a gonioautoicous species which freely produces capsules. Hence production of spores is certainly not a limit to the spread of the species. This, combined with the occurrence in man-made habitats, suggest a certain dynamism of the species. Two days were spent in vain searching for potential source populations following the discovery of *P. incurvum* in Vallespir. Only five tufts could be spotted. It seems that the other European populations are also very small (Frahm 2013a). The rarity of the plant in Europe is puzzling and may relate to phytogeographic history. Vallespir region in the Oriental part of the Pyrenees hosts a remarkable assemblage of Southern Alps species (Insubrian species in Frahm 2013b). *Fabronia ciliaris* (Brid.) Brid., *Syntrichia fragilis* (Taylor) Ochyra, *Frullania riparia* Lehm. or *Campylopus oerstedianus* (Müll.Hal.) Mitt. are among the most noticeable species. For such species, recent long distance dispersal from Eastern North American sources is unlikely. It is unlikely too for *P. incurvum* since at least three small widely separated western European populations are recorded. A parallel evolution from a common and more or less ancient widespread ancestor population has been hypothesized (Herzog 1926; Frahm 2013a). A competing hypothesis would be that of rare ancient dispersal events from North American sources followed by subsequent independent evolution. Surely the origin and evolution of the disjunction of *P. incurvum* invite further study using molecular tools.

P. incurvum is clearly at risk of extinction in Europe. Modern observations are rare and isolated, and the known populations are made of a few individuals. The conservation status of the species appears somewhat obscure due to the lack of adequate knowledge (DD in Switzerland, Italy; RE in Spain; unknown status in France) but *P. incurvum* is included as a candidate for the future Red List of Europe (Hodgetts 2015). It was not observed recently in South-Western France, Spain nor Italy. In North America, the species seems to be much more abundant and globally not threatened. Yet, in Ontario, at the Northern border of the known range, *P. incurvum* could never be refound in spite of intensive research (Cosepac 2002).

In the future, *P. incurvum* should be the subject of targeted surveys in Southern France but also in Spain and Italy.

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P. Chène, M. Bourge & R. Verlaque

Study of the *Digitalis* genus 5: the species *Digitalis lutea*

Abstract

Chène, P., Bourge, M. & Verlaque, R.: Study of the *Digitalis* genus 5: the species *Digitalis lutea*. — Fl. Medit. 26: 11-18. 2016. — ISSN: 1120-4052 printed, 2240-4538 online.

The chromosome number of species belonging to the genus *Digitalis* L. is mainly $2n = 56$, except for *D. lutea* L. In the latter, distinct counts and ploidy levels have been reported: $2n =$ 48-56 and $2n = 96$-112. Depending on the authors, this taxon is treated either as a single species with two subspecies: *D. lutea* subsp. *lutea* and subsp. *australis* (Ten.) Arcang., or as two distinct species in Italy: *D. lutea* and *D. micrantha* Schweigg. However, in S. France and Corsica, classical discriminant characters of these taxa seem less reliable than in Italy. In addition, a phylogenetic study sets plants of subsp. australis from Tuscany and Corsica in two distinct clades. To clarify this situation, flow cytometry, karyological, morphological and pollen studies were carried out on a large sample from different geographical sources. Results confirmed the validity of the two infra-specific taxa, which differ in their ploidy levels (*D. lutea* subsp. *lutea* $2n = 112$; *D. lutea* subsp. *australis* $2n = 56$), 2C DNA content and macro- and micro-morphological traits.

Key words: *Plantaginaceae*, flow cytometry, chromosome number, morphology, pollen.

Introduction

In the enlarged *Plantaginaceae* Juss. (Olmstead & al. 2001), the small tribe *Digitalideae* (two genera) occupies a marginal position on the basis of its genetics, phytochemistry and morphology (Albach & al. 2005). In addition, we might mention very rare karyological characters for the family, such as the basic chromosome number $x = 7$ and strong polyploidy in the genus *Digitalis*. Among the 20-25 species of this genus, *D. lutea* L. is the only one that presents $2n = 56, 112$. According to the morphological systematics, it belongs to the section *Tubiflorae* Benth., characterized by cylindrical small corollas: 8-25 mm (Werner 1960; Heywood 1972; Luckner & Wichtl 2000). However, recent genetic studies rejected this polyphyletic section, including *D. atlantica* Pomel (Algeria), *D. lutea* (W Europe) and *D. viridiflora* Lindl. (Balkans) in the section *Macranthae* Heyw. (clade I), while the systematic position of other species remains unsolved in clade II (Bräuchler & al. 2004; Herl & al. 2008).

In Italy, two related taxa were historically recognized as separate species *D. lutea* L. and *D. micrantha* Roth ex Schweigg. (Béguinot 1902; Fiori & al. 1905; Pignatti 1982), or as

two different subspecies, *D. lutea* subsp. *lutea* and *D. lutea* subsp. *australis* (Ten.) Arcang. (Werner 1960; Heywood 1972; Zangheri 1976). According to the literature, they possess distinct morphological features and geographical ranges: *D. lutea* subsp. *lutea* with long corollas (15-25 mm), in northern latitudes (N-E. Spain, continental France, N. Italy to Germany), and *D. lutea* subsp. *australis* with smaller corollas (9-15 mm), in the Apennines and Corsica (Werner 1960; Heywood 1972; Pignatti 1982; Luckner & Wichtl 2000). This distinctive character, useful to identify Italian plants, seems less relevant in S. France and Corsica, where flowers tend to be smaller: <16mm (Litardière 1928; Gamisans & Jeanmonod 2007; Tison & Foucault 2014; Tison & al. 2014). This may explain why old French floras only indicate *D. lutea* (without mention of subspecies). In addition, a genetic study has shown that both *D. lutea* subsp. *australis* from Corsica and *D. lutea* subsp. *lutea* from continental France belong to clade I, while *D. lutea* subsp. *australis* from Tuscany belongs to clade II (Bräuchler & al. 2004).

The frequent unknown origin (perhaps botanic gardens) of some plants used for karyological studies makes data on chromosome accounts of *D. lutea* quite confusing. Under the name *D. micrantha* Schrad., the subsp. *australis* was counted as $2n = 48$ (Haase-Bessell 1921) and $2n = 56$ from Italy (Campania: Larsen 1955; Ombria: Pedrotti & Cortini Pedrotti 1971). All other reports as "*D. lutea"* are $2n = 56$ in Spain (Angulo Carpio 1957; Olgun 1979) and Italy (Tuscany: Löve & Löve 1982), but also: $2n = 96$ (Haase-Bessell 1921; Delay 1947) and $2n = 112$ (Michaelis 1931; Buxton & Dark 1934) of unknown origin.

The aim of this study is to assess the validity of infra-specific taxa of *D. lutea* in Italy and France, using flow cytometry, karyological, morphological, pollen and epidermal data.

Materials and methods

Sampling, culture and observations

The seeds used in this study were collected at stations geographically isolated from each other, in France and Italy (Table 1). Seeds were sown in standard garden compost and allowed to germinate during 2-3 weeks, at 15-18°C, under constant light period (9 h/day, 2×30 W neon lights; Solar Natur T8, 9000K), and with regular watering. Each seedling was transferred into an individual pot for 2-3 months, then planted in a garden (Alsace, France), under the same culture conditions in order to avoid any morphological variations linked to environmental parameters.

Morphological studies of plants of different origins, *D. lutea* subsp. *lutea* from France (Ardennes) and Italy (Piedmont) and *D. lutea* subsp. *australis* from Italy (Apennine) and Corsica, were carried out in the middle part of inflorescences (5 individuals/site, and, for each parameter, 6 to 10 measurements and observations/plant). For the epidermis, dried cauline leaves (two per locality) were hydrated for 2 h in hot water; fragments of the lower epidermis were sampled with tweezers, stained with iodine green, and then mounted in glycerol between slide and cover-slide. On each slide, more than 30 stomata were measured; glandular hairs and wall cells were drawn.

Alexander's stain was used to distinguish between abnormal (blue-green coloured) and normal (magenta-red) pollen grains. Aperture numbers and polar axis sizes of mature grains were established (30 measures/sample) to assess the relationships between ploidy

level and cell size. Epidermis and pollen samples were observed by light microscopy (15×50, Leitz Dialux 20).

Flow cytometry

The total nuclear DNA amount was assessed by flow cytometry according to Marie & Brown (1993). *Lycopersicon esculentum* cv "Montfavet" (2C = 1.99 pg) or *Petunia hybrida* PxPc6 (2C = 2.85 pg) were used as an internal standard. Leaves of the internal standard and *Digitalis* were chopped using a razor blade in a plastic Petri dish with 1 ml of Gif nuclei-isolation buffer (45 mM $MgCl_2$, 30 mM sodium citrate, 60 mM MOPS, 1% (w/v) polyvinylpyrrolidone 10,000, pH 7.2), containing 0.1% (w/v) Triton X–100, supplemented with 5 mM sodium metabisulphite and RNAse (2.5 U/ml). The suspension was filtered through 50 µm nylon mesh. The nuclei were stained with 50 µg/ml propidium iodide (a specific DNA fluorochrome intercalating dye), and kept for 5 min at 4°C. DNA content of 5,000–10,000 stained nuclei was determined for each sample using a cytometer (CyFlow SL3, Partec-Sysmex. Excitation 532 nm, 30 mW; emission through a 630/30 nm band-pass filter). The total 2C DNA value was calculated using the linear relationship between the fluorescent signals from the stained nuclei of *Digitalis* taxa and the internal standard. The mean value was calculated from measurements of samples comprising 6 to 14 individuals, according to populations. Statistical analysis was carried out by Mann-Whitney Rank Sum Test (SigmaPlot v. 11.0).

Chromosome numbers

As the 2C-DNA content is not always correlated with chromosome numbers (Suda & al. 2006), chromosome counts were also performed. For the two subspecies of *D. lutea* (Table 1), seedlings were obtained from seeds germinating in Petri dishes. After a cold pre-treatment at 4°C for 24 h, root tips were fixed with an ethanol-acetic acid solution (4:1, v/v), kept at room temperature for two weeks, and then stored at -18°C until used. Seedlings were stained in 45% aceto-carmine-ferriacetate, boiled for 3 min, and then squashed between slide and cover-slide. Five seedlings per locality were observed by light microscopy (15×100, Leitz Dialux 20) and the best mitotic metaphases were drawn using a camera lucida.

Results and Discussion

Flow cytometry analysis reveals that in each subspecies, all plants present similar 2C DNA content, regardless of their geographical origin: coefficient of variation (standard deviation/mean) < 0.5 for both taxa (Table 1). In addition, subsp. *australis* and subsp. *lutea* significantly differ in their DNA content ($p<0.001$), with an average of 3.12 ± 0.13 pg (n = 42) and 5.23 ± 0.16 pg (n = 58), respectively. These data present a high taxonomic value, because closely related taxa of clade I (Bräuchler & al. 2004), with $2n = 56$, possess a constant but very distinct genome size from each other: *D. mariana* Boiss. 1.12 pg, *D. purpurea* L. 1.87 pg and *D. thapsi* L. 2.08 pg (Castro & al. 2012). To our knowledge, no 2C DNA value has been reported for clade II taxa.

Table 1. Geographical origin, 2C DNA content and chromosome numbers of *D. lutea* L. studied.
[1] Average followed by standard deviation; (n): number of plants studied. [2] Seeds from a commercial source.

subsp.	**Origin**	**2C DNA content (pg)**[1]	**Chromosome counts**
australis	France: Corsica, San Nicolao	3.08 ± 0.13 (n = 14)	2*n* = 56
	Italy: Campania, Roccamonfina	3.07 ± 0.09 (n = 12)	2*n* = 56
	Italy: Abruzzo (Sant'Eufemia)	3.23 ± 0.05 (n = 6)	
	Italy: Apennine[2]	3.16 ± 0.14 (n = 10)	
lutea	France: Ardennes, Vendresse	5.32 ± 0.18 (n = 8)	
	France: Vosges, Wattwiller	5.35 ± 0.21 (n = 10)	2*n* = 112
	France: Alps, Gières	5.11 ± 0.09 (n = 12)	
	France: Massif-Central, Cussac sur Loire	5.14 ± 0.06 (n = 8)	
	France: Pyrénées, Melles	5.19 ± 0.12 (n = 7)	
	France: Provence, Massif de Ste Baume and N-D. du Figuier		2*n* = 112 2*n* = 112
	Italy: Liguria, Val Nervia	5.29 ± 0.07 (n = 7)	2*n* = 112
	Italy: Piedmont, Monte Leco	5.25 ± 0.25 (n = 6)	

The karyological study of *D. lutea* was rather difficult, owing to the numerous, small and often agglutinated chromosomes. This may explain some differences in published numbers (48 *vs* 56, and 96 *vs* 112). Nevertheless, in good metaphases we always found: 2*n* = 56 (L = 1.2 to 2.2 µm) in *D. lutea* subsp. *australis* and twice that number in *D. lutea* subsp. *lutea* 2*n* = 112 (L = 0.9 to 1.8 µm). Thus, chromosome counts show two ploidy levels in *D. lutea*, each of them corresponding to one subspecies, as suggested by cytometric data. It should be noted that 2C DNA values of subsp. *lutea* are only 1.7 fold higher than those of subsp. *australis*. Similar results have been found in other genera (*e.g*. Fridlender & al. 2002), and depending on the techniques used. As previously reported for many taxa (Favarger 1967), these two cytotypes show a clear geographical structuring: subsp. *australis* in the southern area (Corsica and Apennines), and the higher ploidy level, subsp. *lutea,* widespread in the north. These distinct chromosome numbers may explain the sterility of natural hybrids between the latter (2*n* = 112) and some European species with 2*n* = 56 (Tison & Foucault 2014), but also with subsp. *australis* in Tuscany (Fiori 1925).

Our results confirm and complete previous chromosome counts, with the exception of 2*n* = 56 for *D. lutea* from Spain (Angulo Carpio 1957; Olgun 1979). The plants cultivated by Olgun, in the botanical garden of Istanbul university, came from 'Spain-France, Pyrenees'. However, our individuals which also originated from the Pyrenees have the same 2C DNA content as all our samples of subsp. *lutea* with 2*n* = 112 (Table 1), and the description of Spanish plants (Benedi & Hinz 2009) corresponds exactly to this subsp. Two hypotheses can be proposed, either rare populations of subsp. *australis* persist in N Spain (S-W limit of the species), or the accounts of Angulo Carpio (1957) and Olgun (1979) refer to the closely related NW Spain endemic: *D. parviflora* Jacq. (2*n* = 56).

Pollen grains of *D. lutea* subsp. *lutea* differ from those of subsp. *australis* by having higher polar axis, aperture number (3-4 *vs* 3) and anomaly rate (Table 2). An increase in these parameters is usually linked with higher ploidy level (Fukushima & Shoichi 1964;

Table 2. Distinctive characters between the two subspecies of *Digitalis lutea*.

	subsp. *lutea*	subsp. *australis*
Raceme	Densely flowered Unilateral tendency	Very densely flowered Multilateral tendency
Sepals	Non-overlapping, without scarious margin	Overlapping at their lower part, with narrow scarious margin
Corolla : length diameter	 20.8 ± 1.3 mm 5.7 ± 0.5 mm	 15.5 ± 1 mm 4.2 ± 0.4 mm
Corolla shape in posterior view from base to top	Diameter increases near 1/3 of the length, and remains the same until lobes	Diameter increases near 1/2 of the length, and decreases below the lobes
Corolla ornamentation	No ornamentation observed	Red macula present at the junction between the lobes
Fruit	Ovoid generally	Sub-globular generally
Pollen grains : polar axis length aperture number abnormal pollen	 24 ± 2 µm 3-4 30-55%	 19.8 ± 1.1 µm 3 <10%
Length of stomata	37.5 ± 2.5 µm	26.9 ± 2 µm

Joshi & Raghuvanshi 1966). The slight difference between polar axis lengths suggests that both taxa are high polyploids, probably 16x for subsp. *lutea* and 8x for subsp. *australis*. In the genus *Digitalis,* leaf epidermal structures possess great taxonomic value (Serrano & al. 2014). Regardless of their origin, all plants studied share similar characters: scarce glandular hairs (short with a unicellular stalk and a uni- or bicellular head) and sinuous cell walls (*vs* nearly straight in clade II). However, as expected, they significantly differ by their stomata lengths, *D. lutea* subsp. *lutea* (37.5 ± 2.5 µm) and subsp. *australis* (26.9 ± 2 µm), which are correlated with ploidy levels (Bidault 1971).

Morphological study of numerous plants, of various origins and cultivated under the same conditions, highlights distinctive characters between subsp. *lutea* and subsp. *australis* (Table 2). Most of them have already been described in monographs (Béguinot 1902; Werner 1960 Luckner 2000) and floras (*e.g.* Fiori 1925; Heywood 1972; Pignatti 1982), confirming their discriminant value. We also found new quantitative and qualitative characters – shape of the corolla (in posterior view, Fig. 1), epidermis and pollen - that could be used to identify these two taxa. On the other hand, the strong morphological likeness between Corsican subsp. *australis* and French subsp. *lutea*, and the high rate of abnormal pollen on the mainland, may suggest an autopolyploid origin of subsp. *lutea* from Corsican plants (while isolated Apennine populations could have derivated).

In conclusion, our biosystematics study of *D. lutea* shows that subsp. *lutea* and subsp. *australis* are two distinct taxa that mainly differ by their ploidy levels. Our data also indicate that Corsican and Apennine populations possess certain similar taxonomic traits (chromosome number, 2C DNA content, pollen, epidermis and morphology), suggesting that they belong to the same taxon: subsp. *australis.* This result is not in agreement with the first genetic tree setting Corsican and Apennine plants of *D. lutea* subsp. *australis* in two different clades (Bräuchler & al. 2004). In a second study, using a new molecular maker with the

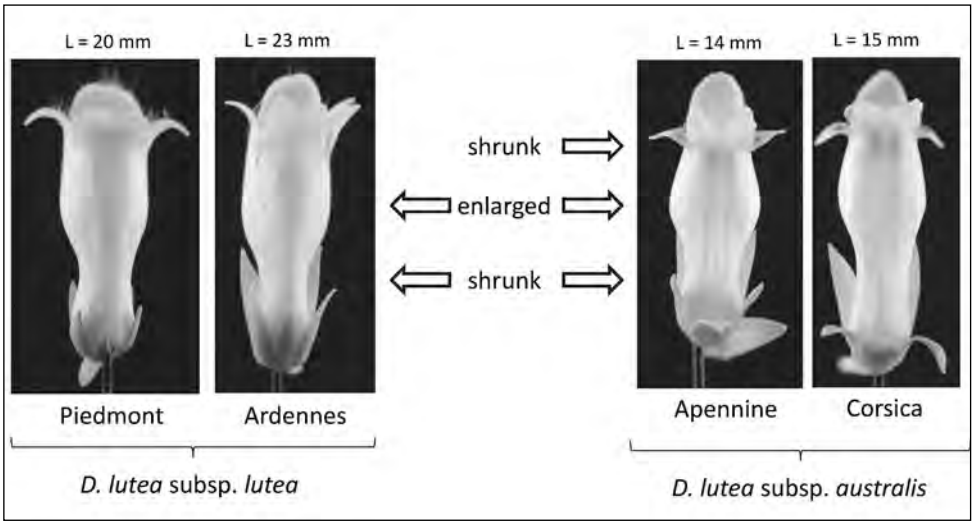

Fig. 1. Photographs of corolla, in posterior view, of *D. lutea* subsp. *lutea* and subsp. *australis,* of different geographical origins. Differences in the shape of the corolla are highlighted by arrows. Lengths (in mm) of the corolla are indicated.

same GenBank accessions, some taxa (such as *D. lutea* subsp. *australis* and *D. atlantica* Pomel) were not included (Herl & al. 2008), making any comparison or confirmation impossible. It should be noticed that the phylogeny of polyploids is often very difficult to assess (Mansion & al. 2005). Thus, the systematics of *D. lutea* needs further genetic investigation, using clearly identified plants, collected outside hybridization zones (such as Tuscany, where subsp. *australis* may produce hybrids with subsp. *lutea* and with *D. ferruginea* L. of clade II), and with more than one individual (herbarium exsiccata) per taxon.

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Golden crownbeard (*Verbesina encelioides*, *Asteraceae*), first record for the Tunisian flora

Abstract

Sayari, N., Mekki, M. & Taleb, A.: Golden crownbeard (*Verbesina encelioides*, *Asteraceae*), first record for the Tunisian flora. — Fl. Medit. 26: 19-24. 2016. — ISSN: 1120-4052 printed, 2240-4538 online.

A new alien plant – *Verbesina encelioides* (*Asteraceae*) – was recorded in Tunisia at Hencha-Sfax. Its identification was based on specimens' examination and relevant literature. A floristic exploration was made during October-November 2013 to map the spatial distribution and to measure some biological traits of this species. Within an area of 40 km² and along 35 km of roadsides 19 infestations we recorded. The large part of them was located in ruderal environments and in lesser extent in field crops. During field trips we noted *V. encelioides* behavior in each habitat. It is a drought tolerant erect annual plant, germinating in early spring or autumn; some seedlings may survive the winter season. From the observations this species look like more adapted to roadsides than to field crops.

Key words: xenophytes, alien flora, Tunisia, invasive weed.

Introduction

Asteraceae family in the Tunisian flora comprises 109 genera and 282 species (Le Floc'h & al. 2010). However, there were no herbarium or literature data of the genus *Verbesina* in Tunisia (CABI 2015). This monophyletic genus is the largest one in the tribe *Heliantheae*. It contains about 300 world-wide species of herbs, shrubs and trees, ranging from eastern Canada to central Argentina (Panero & Jansen 1997). Robinson & Greenman (1899) divided it into 12 sections, using characters such as corolla color, inflorescence morphology, capitulum size, and ray flowers presence.

Verbesina enceliodes is a member of the section *Ximenesia* (Coleman 1966). It was divided into two subspecies (*encelioides* and *exauriculata*) (Coleman 1974). It is native to North and South America (Wagner & al. 1990). Panero & Jansen (1997) studies support a North American origin for this genus. It has successfully naturalized in many warm regions of the world. Its current world distribution includes the five continents of America (Argentina, Arizona, Hawaii, Mexico), Africa (Algeria, Egypt, Morocco), Asia (India, Saudi Arabia, Yemen), Europe (Belgium, France, Spain) and Oceania (Australia, Victoria) (CABI 2015).

V. enceliodes figures on the European Plant Protection Organization (EPPO) observation list of Invasive Alien Plants (EPPO 2015). It was recently recorded in Morocco, where it colonizes wastelands, roadside borders and field crops (Taleb & Bouhache 2006). It is regarded as a noxious weed in several states of the United States of America (Jain & al. 2008). In particular, it is problematic for peanut farmers in southern states of the United States (Feenstra & Clements 2008). In Australia, it occurs as a weed of sandy loams along roadsides, stock routes, field headlands and in some woodland communities (Parsons & Cuthbertson 2001). In North India, it is a prominent weed infesting field crops and abundant along roadsides and railway tracts and on the wastelands, occurring mostly in sandy and sandy-loam soils (Kaul & Mangal 1987).

In Tunisia, it was detected in 2011 at Hencha-Sfax. The way of its introduction and time of its arrival remain unknown. The present paper is its first report in Tunisia. It is an alert of probable emerging problem and a starting point for its management plan, including quarantine and potential eradication.

Material and methods

Species and subspecies identification

Specimens were collected from the infested habitat and examined to identify the species based on dichotomous genus and species keys of the *Asteraceae* (Haines 2011), relevant literature (Parker 1972; Kaul & Mangal 1987; Wagner & al. 1990; Taleb & Bouhache 2006) and online databases (e.g. Euro+Med Plantbase, African plant database). Subspecies identification was based on the description of the auricles shape and position, achene apices shape and phyllaries length (Coleman 1966).

Plant biology in the study site

Specimens were collected from agricultural fields and pathway borders to study the subspecies biological traits (plant height, capitula number.plant^{-1} and achenes number per capitulum^{-1}).

Plant distribution in Tunisia

The study site covers 40 km² around the detected infestation in 2011 along the highway (A1: Tunis-Sfax) at Hencha-Sfax (Lat. 35°07' N, Long. 10°45'E, Altitude: 62 m; (ANME 2005)). It is a semi-arid region with an annual rainfall of 200-300 mm.

The study site was monitored from October to November 2013 for the plant presence and to map its distribution across its total area and along 35 km of pathways. Infestations were localized with a Global Positioning System (GPS) Garmin eTrex Vista by recording their geographic coordinates (degrees of latitude and longitude) captured in their centers. Geographic records were used to generate the plant distribution map.

Results and discussion

Species distinguishing features

Capitula are composed with 10-15 yellow ray flowers and numerous disk flowers. Lobes of disk corollas are not villous-tomentose. Capitulum receptacles are convex

and chaffy with foliaceous involucral bracts. The Cypsela (achene) body is with evident lateral wings. Pappus composed of two short awns (1-2.5 mm). Leaves are opposite, upper ones alternate, ovate or deltoid, 7.0-9.5 cm long by 3.7-4.5 cm wide. Both leaf surfaces are hairy but upper surfaces are more hairless; leaf margins are coarsely and often irregularly serrate; upper leaf petioles are dilated at base to form a pair of stipules like auricles. It has a taproot system and many branched stems, coved by fine white hairs. Height of adult plants varies from 2 to 20 dm. In average, plants growing in pathways (8-20 dm) were taller than those growing in agricultural fields (2-10 dm).

Subspecies distinguishing features

Our observations allowed to deduce that auricles are semi-ovate which borne on petioles of most leaves, achene wing apices are acute and phyllaries (bracts) mostly averaging more than 12 mm long. Accordingly, we conclude that the collected specimens belong to the subspecies *encelioides* (Fig. 1).

Fig.1. *Verbesina encelioides* subspecies *encelioides* at Hencha-Sfax, 20 August 2011 (Photo by N. Sayari).

Biology of Verbesina encelioides *subsp.* encelioides *in the study site*

Our observations allowed to deduce that the plant is an annual herb with a germination peak taking place during the spring. However, some achenes germinate in autumn and may survive throughout the winter season. It exhibits efficient self- and cross-pollination with a main flowering peak from July to November. A plant produces 29 to 254 capitula. In average, plants growing in pathways hold much more capitula (127 ± 93) than those growing in agricultural fields (57 ± 37). A capitulum produces 37 to 175 achenes. Commonly, those providing from plants growing in agricultural fields were more prolific (103 ± 46), compared to capitula of plants growing in pathways (88 ± 26). In fact, for mature plants excessive vegetative growth can have a negative impact on reproduction. These findings confirm the invasive behavior of the plant including high seed production (as many as 300-350 seeds per capitulum and numerous capitula per plant), seed dormancy, ability to tolerate dry conditions, and possible allelopathic effects. According to Booth & al. (2010), rapid growth from vegetative stage through to flowering stage and high seed production are among the ideal characteristics of invasive weeds. Furthermore, its winged achenes are easily dispersed by light winds (Kaul & Mangal 1987).

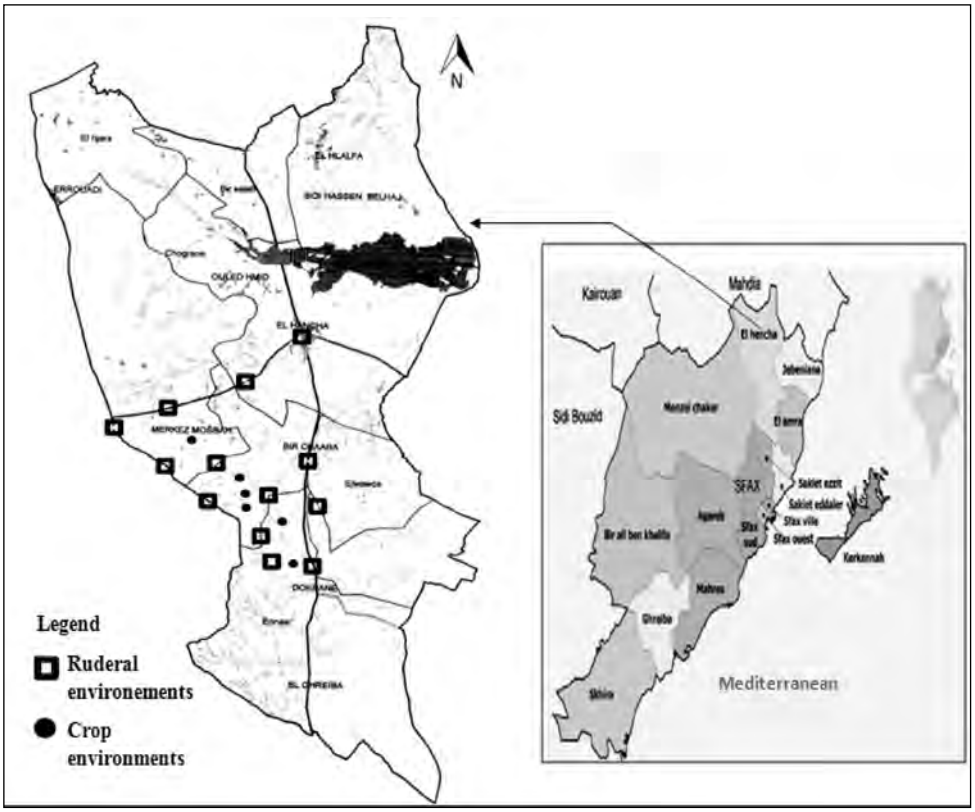

Fig.2. *Verbesina encelioides* subsp. *encelioides* distribution map at Hencha-Sfax (2013).

Distribution in Tunisia of V. encelioides *subsp.* encelioides.

Results showed that the weed is not yet widespread in Tunisia. Within the study site 19 infestations we recorded (Fig. 2). 78% of them occur in ruderal zones (pathways and urban zones) and 22% occur in orchards (olive and almond). In ruderal environments *V.encelioides subspecies encelioides* was found associated to other weed which the most abundant were *Nicotiana glauca* Graham, *Solanum elaeagnifolium* Cav., *Scolymus hispanicus* L. and *Hordeum murinum* L. However, in the crop environments (orchards) weed flora composition changed and *V. encelioides subspecies encelioides* was found associated to *Cynodon dactylon* (L.) Pers. which grouws mainly around trees, *Amaranthus albus* L., *Diplotaxis muralis* (L.) DC. and *Portulaca oleracea* L.

Conclusions

Our findings provide an updated of the range of *Asteraceae* family in Tunisia. The genus *Verbesina* is reported here for the first time. The taxon *Verbesina encelioides* subsp. *encelioides* is a North American plant recently detected in Tunisia. Actually, its presence is limited to few locations in the Center-East of Tunisia, a semi-arid region. In fact, it is a drought tolerant erect annual plant, germinating in early spring or autumn with a main flowering peak from July to November. The plant grows better in ruderal zones than in agricultural fields. In fact, the large part of the infestations (78%) was recorded in ruderal zones. However, the plant is easily dispersed and it is likely to establish elsewhere in the semi-arid region. It can be considered as an emerging invasive plant in Tunisia which requires the implementation of an appropriate management plan, including quarantine and potential eradication.

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F. Scafidi, F. M. Raimondo & G. Domina

First record of *Euphorbia graminea* (*Euphorbiaceae*) in Italy

Abstract

Scafidi, F., Raimondo, F. M. & Domina, G.: First record of *Euphorbia graminea* (*Euphorbiaceae*) in Italy. — Fl. Medit. 26: 25-30. 2016. — ISSN: 1120-4052 printed, 2240-4538 online.

Euphorbia graminea Jacq. (*Euphorbiaceae*), a species native from Central America through northern South America, from Northern Mexico to Peru, has been found naturalized near Palermo (Sicily). This is the first record for Italy and Europe.

Key words: xenophytes, alien flora, *Euphorbia* subgen. *Chamaesyce*, Sicily.

Introduction

The genus *Euphorbia* L. s. l. (*Euphorbiaceae*) is the third largest genus of flowering plants, with almost 2000 species (Ernst & al. 2015). It is well known for the remarkable diversity of succulent and non-succulent plants that are avidly grown by horticultural enthusiasts (Yang & al. 2012). Despite this large variability of life forms, the entire genus is characterized morphologically by the presence of a cyathium (Prenner & Rudall 2007).

In the vascular flora of Italy, *Euphorbia*, includes 88 specific and infraspecific taxa (Conti & al. 2005), 14 of which are considered non-native (Celesti-Grapow & al. 2009, 2010). In Sicily, according to Raimondo & al. (2010), 38 specific and subspecific taxa are present; the alien species are: *E. humifusa* Willd., *E. maculata* L., *E. nutans* L., *E. prostrata* Aiton, *E. heterophylla* L., *E. valerianifolia* Lam. (= *E. akenocarpa* Guss.). Three additional species were recently recorded: *E. hyssopifolia* L. from Vittoria (Ragusa) and Pantelleria island by Banfi & Galasso (2014), *E. serpens* Kunth, from the territory of Aci Trezza (Catania) by Ardenghi & Cauzzi (2015) and *E. hypericifolia* L. from the Taormina territory (Messina) Sciandrello & al. (2016).

In December 2015, during floristic research in the territory of Palermo (NW Sicily), a considerable population of an unknown species of *Euphorbia* subgen. *Chamaesyce* was discovered. On the basis of literature and herbaria studies it was referred to *E. graminea* Jacq., an alien species not previously reported from Italy and Europe (Euro+Med 2006 -; DAISIE online Database; Celesti-Grapow & al. 2009, 2010).

Material and Methods

Plant material was collected in the field. Herbarium specimens were deposited in the *Herbarium Mediterraneum Panormitanum* (PAL).

The morphology of the species is described on the basis of material collected in Sicily, in agreement with relevant descriptions (Webster & Bruch 1967; Herndon 1994; Yang et al. 2005; Vincent 2013).

Data about the habitat and the population size of *E. graminea* are based on personal observations in the field. Nomenclature of the species found together with *E. graminea* follows Euro+Med (2006 -).

Results and Discussion

Euphorbia graminea Jacq., Select. Stirp. Amer. Hist. 151, 1763
≡ *Adenopetalum gramineum* (Jacq.) Klotzsch & Garcke, Abh. Königl. Akad. Wiss. Berlin 1859: 47, 1860
≡ *Agaloma graminea* (Jacq.) D.B.Ward, Phytologia 89: 226, 2007
≡ *Eumecanthus gramineus* (Jacq.) Millsp., Publ. Field Mus. Nat. Hist., Bot. Ser. 2: 413, 1916
≡ *Euphorbia graminea* var. *lancifolia* Millsp., Publ. Field Columb. Mus., Bot. Ser. 1: 372, 1898
≡ *E. graminea* var. *virgata* Millsp., Publ. Field Columb. Mus., Bot. Ser. 1: 372, 1898

Annual or perennial herb, 15-80(-150) cm tall, stem ascending or erect, often branching from the base and dichotomously branched distally. Leaves alternate below, opposite above (around the cyanthia); petioles 8-13(-30) mm long, pubescent; lamina ovate-rounded to oblong, 17-40 (-50) × 10-20 (-25) mm, acuminate to acute at apex, acute to obtuse at base, entire, pubescent on both surfaces. Cyanthia in short to long pedunculate cymes; leaf opposite, linear or lanceolate, 20-30 × 4-7 mm; involucre turbinate, 1-1.6 mm long, pubescent outside; petaloid appendage white, obcordate at apex, 2-4(-5) mm long. Capsule 2-3 mm, exserted from the cyanthia; seeds angular, ovoid, rugose, 1.5 × 1.3 mm, grey or whitened (Webster & Bruch 1967; Herndon 1994; Yang & al. 2005; Vincent 2013).

Euphorbia graminea is a native weed from northern Mexico to Peru (Webster & Bruch 1967). It belongs to *E.* sect. *Alectoroctonum* (Schltdl.) Baill., a taxonomically complex group that includes 115 species, characterized by the presence of tiny, mostly glanduliform stipules, petaloid gland appendages, and usually entire leaves (Yang & al. 2012).

This species is considered invasive (Randall 2002) and has been found outside its native range in Palau (Fosberg & al. 1980), Caroline Islands (Fosberg & Canfield 1980), Fiji Islands (Smith 1991), Hawaii (Stone Charles & al. 1992; Wagner & al. 1999), Taiwan (Yang & al. 2005), Galapagos Islands (Guézou & al. 2010), Nigeria (Aigbokhan & Ekutu 2012). Ward & Housel (2007) confirmed *E. graminea* as a recent introduction to the flora of Florida, previously incorrectly identified as *E. oerstediana* (Klotzsch & Garcke) Boiss. In California, this species occurs only as agricultural or garden weed (Rosatti 2011). According to Danin & al. (2009), this species occurs in Israel in nurseries and their surroundings but has no tendency to get established in semi-natural habitats.

Euphorbia graminea was found in the northwestern part of Sicily, in the territory of Boccadifalco near Palermo (Figs. 1, 2), along the edge of a country road (WGS84 coordinates: 38° 06′ 55.03″ N, 13° 18′ 27.26″ E).

The population consists of about 300 individuals growing in an area of 150 m^2 (Fig. 3). The vegetation consists of annual or perennial, ruderal herbaceous species , dominated by: *E. graminea* (with a 20% cover), *Rubus ulmifolius* Schott, *Galactites tomentosus* Moench, *Paretaria judaica* L., *Euphorbia peplus* L., *Sonchus oleraceus* L., *Ochlopoa annua* (L.) H. Scholz, *Urtica dioica* L., *Mercurialis annua* L., *Erodium malacoides* (L.) L'Hér., *Arum italicum* Mill., *Borago officinalis* L., *Dittrichia viscosa* (L.) Greuter, *Avena fatua* L. and *Piptatherum miliaceum* (L.) Coss. Other ruderal alien species occur in the same site: *Pennisetum setaceum* (Forssk.) Chiov., *Ricinus communis* L., *Arundo donax* L. and *Oxalis pes-caprae* L.

In the site studied, the species seems well-established and can be easily considered naturalized due to the production of a large quantity of seeds and abundant sexual reproduction.

The vector of introduction is uncertain. Probably, *E. graminea* was introduced accidentally, considering the fact that the growing site is located about 150 m away from a garden centre; thus the most plausible hypothesis is that it escaped from plant containers kept inside (compare with Ward & Housel (2007) and Vincent (2013)).

The status of *E. graminea* in Sicily should be permanently monitored, considering its potential spread from the site where it has been recorded.

Specimina visa: ITALY (SIC): Boccadifalco (Palermo), along the edges of a country road, 38° 06′ 55.03″ N, 13° 18′ 27.26″ E, 105 m a.s.l., 21 Dec 2015, *F. Scafidi s. n.* (PAL 102716!).

Fig. 1. Habit of *Euphorbia graminea* in Boccadifalco near Palermo (Sicily).

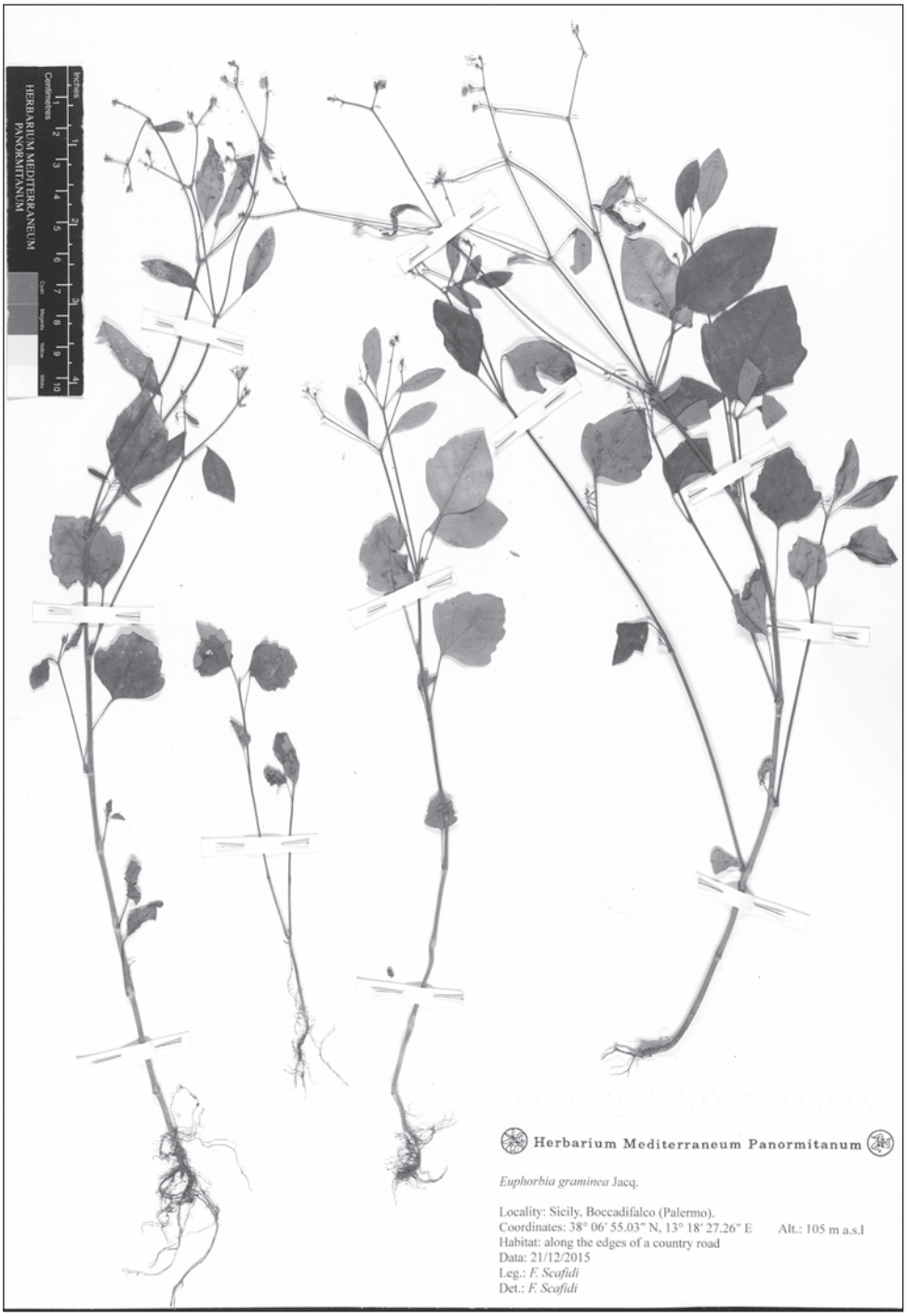

Fig. 2. Herbarium specimen of *Euphorbia graminea* from Boccadifalco (Palermo, Sicily).

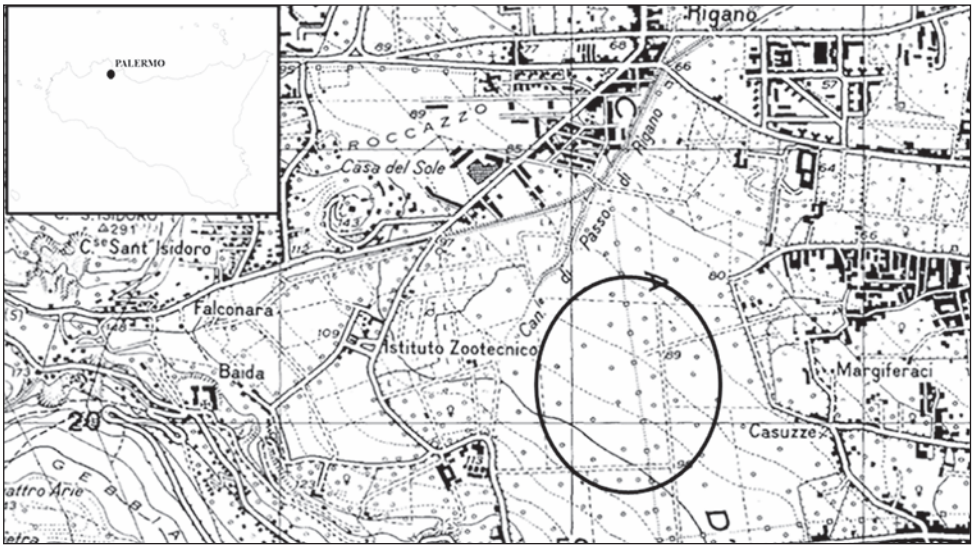

Fig. 3. Location of the population of *Euphorbia graminea* in Sicily.

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Flora and vegetation of Mt Aphrodisio (Peloponnisos, Greece)

Abstract

Baliousis, E.: Flora and vegetation of Mt Aphrodisio (Peloponnisos, Greece). — Fl. Medit. 26: 31-61. 2016. — ISSN: 1120-4052 printed, 2240-4538 online**.**

This paper presents 650 specific and infraspecific taxa of the vascular flora of Mt Aphrodisio, NW Peloponnisos. All the records are new as the mountain was until now floristically unexplored. For each taxon, local distribution and habitat types are presented. *Crypsis alopecuroides* is new record for Peloponnisos. Its flora comprises also 29 Greek and 22 Balkan endemics. Some of the records concern rare taxa in Greece, in Peloponnisos or regional endemics, which are, therefore, chorologically significant, such as *Arenaria guicciardii*, *Alkanna methanaea*, *Erysimum pectinatum*, *Anthemis brachmannii*, *Silene gigantea* subsp. *hellenica*, *Delphinium hellenicum*, *Galium capitatum*, *Verbascum daenzeri*, *Trifolium tenuifolium*, *Glinus lotoides*, *Helleborus odorus* subsp. *cyclophyllus*, *Galanthus reginae-olgae* subsp. *vernalis*, *Bromus parvispiculatus*, *Crypsis schoenoides*, *Gaudiniopsis macra*. The main vegetation types are also described.

Key words: biodiversity, phytogeography, vegetation, Peloponnisos, Mediterranean.

Introduction

Mt Aphrodisio is located at the northwestern part of Peloponnisos and belongs to the homonymous unit according to the phytogeographical division in “Flora Hellenica” (Strid & Tan 1997). More specifically it constitutes the border between the prefectures of Arkadia and Achaia in contact with the prefecture of Ilia. Its name is derived by the sanctuary of goddess Aphrodite situated on a saddle-shaped pass between the main peeks of the mountain at 1150 m.

The main peaks of Mt Aphrodisio (Fig. 1), Mavri Vrisi (1445 m) and Neraidorrachi (1369 m) are located in its main axis which has a NW-SE orientation. Northern and western boundaries of the investigated area are clearly demarcated by the rivers Seiraios and Erimanthos respectively. Southern foothills of the mountain are crossed by the river Ladonas from the homonymous artificial lake to the hydroelectric power plant near the village Kato Spatharis. Eastward the slopes of the mountain descend to small plains around the village Dafni.

Geologically, the investigated area belongs to the geotectonic unit of Olonos-Pindos. The main substrates are limestones followed by radiolarites and flysch. Longitudinal zones of these types of rocks mainly with SW-NE orientation continuously succeed each other in the whole area. Talus cones are restricted to small areas in the slopes which descend to rivers Ladonas, Erimanthos and Seiraios. Alluvial deposits occupy a narrow strip of land formed by Seiraios river in the north. Conglomerates cover a relatively extensive zone south of the village Voutsis (IGME 1978). In general the geological landscape is quite fragmented and this is sometimes reflected in the distribution pattern of the various types of

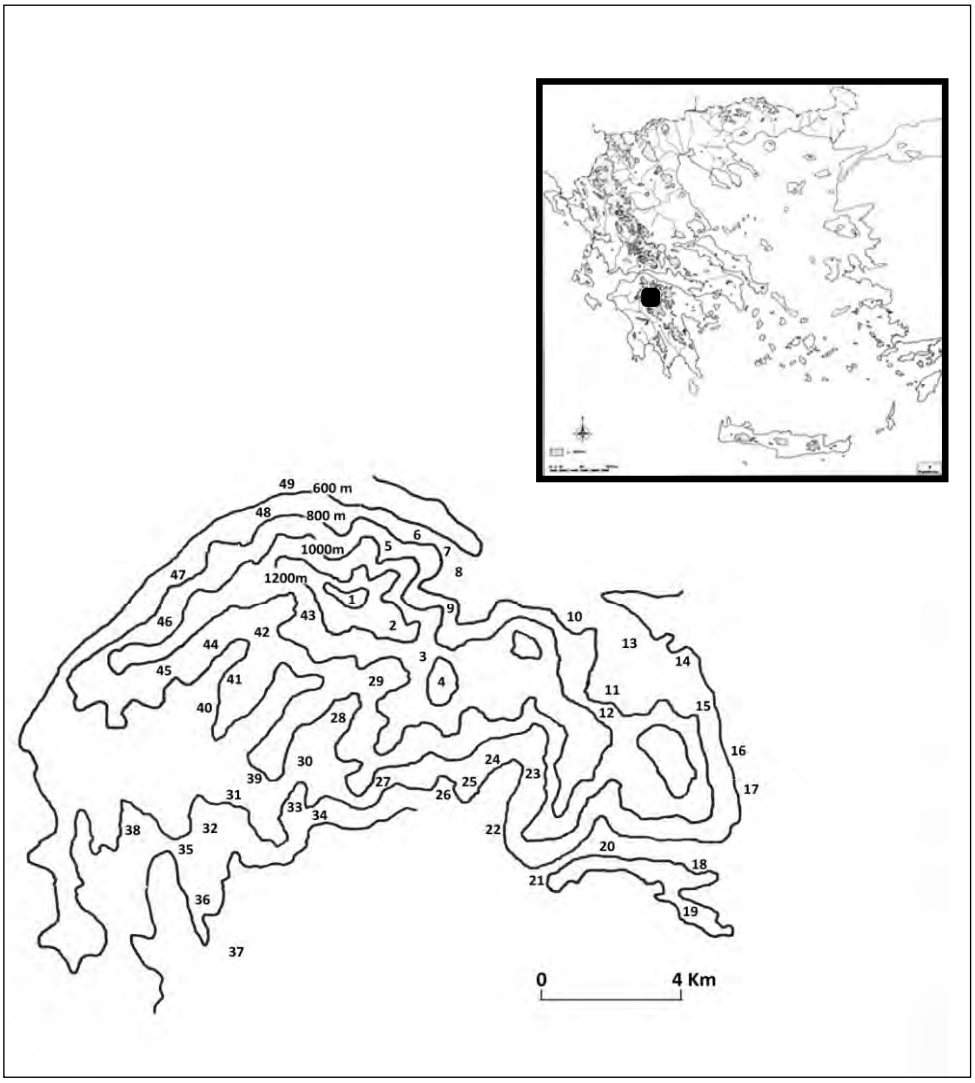

Fig. 1. Geographical position of Mt Aphrodisio in Greece and a map of the investigated area.

vegetation. The maximum boundaries of the investigated area are defined by the coordinates 37˚44’48” to 37˚51’54”N and 21˚47’40” to 22˚03’25”E.

The nearest meteorological station which provides full climatic data is that of Kalavrita situated at 731 m. According to climatic diagram by Emberger (1955, 1959) and Sauvage (1963), the bioclimate of the area is humid with cool winter. The dry period, according to the ombrothermic diagram by Bagnouls & Gaussen (1957) lasts approximately four months. The mean annual height of precipitation in the meteorological stations of Tripotama (550 m) and Dafni (580 m) situated at the northern parts of the investigated area reaches approximately 1000 mm. Regional and local differences exist depending on altitude and topography.

Human intervention on the ecosystems of the mountain is on decline nowadays. A few decades ago the area was relatively densely populated with numerous villages dispersed in its lower altitudinal zone. The main occupation of the inhabitants was raising of sheep and goats in combination with the cultivation of the low productivity stony terrain. Arkadia was famous since antiquity for its pastures where the god Panas acted protecting the breeders. Livestock breeding still remains the base of the local economy but its size has dramatically reduced since it is practiced by a few elderly people. The majority of the villages look nowadays abandoned or inhabited by few people. Most of the productive age people abandon the area seeking professional occupation in the biggest cities of Peloponissos and in Athens. Thus the area is nowadays sparsely populated and many villages are lacking of young generation. There is also no prospect of touristic development as in other areas of Arkadia. As this situation seems irreversible the future of the local ecosystems is expected to be prosperous. Natural vegetation dominated by *Quercus coccifera* has already taken over abandoned anthropogenic habitats such as stony fields.

Aphrodisio is one of the few floristically unexplored mountains of Greece. Bibliographical data concerning previous reports are lacking and that stimulated my interest to conduct this study. The aim of this study is also to reveal the vascular plant diversity of medium sized mountains of Greece which are less investigated as compared to higher massifs.

Material and methods

The study is based on collections and field observations made from 2005 to 2013. Collections were conducted in various localities and habitats of the mountain in all the seasons of the year in order to obtain a precise idea of the character of its flora. All specimens, about 1500, are temporarily kept in my personal herbarium. Species identification and/or nomenclature were based mostly on Davis (1965-1985), Tutin & al. (1968, 1972, 1976, 1980, 1993), Greuter & al. (1984, 1986, 1989), Strid & Tan (1997, 2002), Greuter & Raab-Straube (2008) and Dimopoulos & al. (2013). Families, genera, species and subspecies are listed within the major taxonomic groups in alphabetical order. In the following catalogue only spontaneous and subspontaneous taxa are recorded. Transliteration of localities is in accordance with “*Flora Hellenica”* (Strid & Tan 1997, 2002).

Localities (Fig. 1)

1. Summit Mavri Vrisi, 1445 m, 21.6.2005.
2. Between summit Mavri Vrisi and the sanctuary of Aphrodite, 1150-1300 m, 14.5.2015, 5.6.2005, 28.3.2006, 25.6.2006.
3. Sanctuary of Aphrodite, 1150 m, 14.5.2015, 5.6.2005, 28.3.2006, 25.6.2006, 25.5.2013.
4. Summit Neraidorrachi, 1150-1369 m, 25.5.2013.
5. c. 0.5 km SE of Dechouni village, 850 m, 24.5.2013.
6. Between Dechouni and Dechouneika villages, 700 m, 24.5.2013.
7. Dechouneika village, 620 m, 24.5.2013.
8. Crossroad to Kondovazena and Dechouni villages, 620 m, 24.5.2013.
9. Between Dechouneika village and the sanctuary of Aphrodite, 700-900 m, 26.5.2013.
10. c. 0.5 km N of Vesini village, 700 m, 26.5.2013.
11. Nasia village, 700 m, 26.5.2013.
12. c. 1 km S of Nasia village, 700-800 m, 26.5.2013.
13. Between Nasia and the crossroad to Dafni, 550-700 m, 26.5.2013.
14. Between Dafni and the crossroad to Nasia, 550-600 m, 25.5.2013, 26.5.2013.
15. Dafni village, 600 m, 24-26.5.2013.
16. Between Dafni and Pournaria village, 500-600 m, 25.5.2013.
17. Pournaria village, 520 m, 25.5.2013.
18. Mouria village, 460 m, 25.5.2013.
19. Eastern shores of Ladona artificial lake, 420 m, 14.10.2005, 18.6.2006, 24.6.2006.
20. Between Mouria village and the dam of Ladona lake, 430-460 m, 25.5.2013.
21. Dam of Ladona lake, 430 m, 25.5.2013.
22. Between Pera Vachlia village and the dam of Ladona lake, 430-600 m, 25.5.2013.
23. Pera Vachlia village, 600 m, 25.5.2013.
24. Vachlia village, 620 m, 25.5.2013.
25. Between Vachlia and Dimitra villages, 540-620 m, 25.5.2013.
26. Dimitra village, 540 m, 25.5.2013.
27. Between Kondovazena and Dimitra villages, 540-700 m, 25.5.2013.
28. Kondovazena village, 700 m, 11.10.2005, 22.2.2006, 27.3.2006, 25.6.2006, 25.5.2013, 26.5.2013.
29. Between Kondovazena and the sanctuary of Aphrodite, 700-1100 m, 25.6.2006, 25.5.2013.
30. Between Kondovazena and the crossroad to Peleki village, 600-700 m, 11.10.2005, 22.2.2006, 27.3.2006, 25.6.2006, 19.4.2012, 25.5.2013.
31. Crossroad to Peleki village, 600 m, 19.4.2012.
32. Between the crossroad to Peleki and Voutsis villages, 550-600 m, 14.5.2005, 5.6.2005, 25.6.2006, 19.4.2012.
33. Between the main road and the monastery of Klivoka, 450-630 m, 25.5.2013.
34. The monastery of Klivoka, 450 m, 22.2.2006, 25.5.2013.
35. Voutsis village, 550 m, 19.4.2012.
36. Between Voutsis village and the hydroelectric power plant near Kato Spatharis village, 210-550 m, 14.5.2005, 19.4.2012.

37. Hydroelectric power plant near Kato Spatharis village, 210 m, 14.5.2005, 5.6.2005, 25.6.2006, 19.4.2012.
38. Monastiraki village, 600 m, 19.4.2012.
39. Southern slopes of Koprisies summit, 650-750 m, 19.4.2012.
40. c. 1.5 km S of Aposkia village, 800 m, 19.4.2012.
41. Aposkia village, 840 m, 19.4.2012.
42. c. 0.5 km NE of Soudeli settlement, 850 m, 21.6.2005.
43. Between Soudeli and the summit of Mavri Vrisi, 900-1400 m, 21.6.2005.
44. Velimachi village, 860 m, 19.4.2012.
45. Kardaritsi village, 900 m, 19.4.2012.
46. Between Kardaritsi and Paralogi villages, 800-900 m, 19.4.2012.
47. Paralogi village, 800 m, 19.4.2012.
48. c. 1 km S of Tripotama village, 600 m, 19.4.2012, 24.5.2013.
49. Tripotama village, 540 m, 19.4.2012, 24.5.2013.

Habitats

a. *Quercus coccifera* dominated scrub often mixed with scattered deciduous species such as *Fraxinus ornus*, *Quercus pubescens*, *Crataegus monogyna*, *Acer monspessulanum* subsp. *monspessulanum*, mainly limestone.
b. Open rocky places, limestone.
c. Stony meadows with scattered individuals of *Quercus coccifera* and *Crataegus heldreichii*.
d. *Quercus frainetto* forest, mainly radiolarites.
e. *Quercus pubescens* forest.
f. *Quercus frainetto-Quercus pubescens* mixed forest.
g. *Carpinus orientalis* forest.
h. Mixed deciduous forest with *Quercus pubescens, Carpinus orientalis, Fraxinus ornus.*
i. Limestone cliffs.
j. Macchie with *Quercus coccifera*, *Arbutus unedo*, *Erica arborea*, *Pistacia lentiscus*, *Calicotome villosa*.
k. *Platanus orientalis* forest.
l. Open grazed places.
m. Damp to wet places by springs or road margins, ditches and brooks.
n. Fallow and abandoned fields.
o. Fields (mainly olive groves and walnut orchards).
p. Forest roadsides.
q. Road cuttings.
r. Roadsides.
s. Street margins and disturbed places.
t. Stone walls and dry stone walls.
u. Muddy places by lake margins.

Plant list

The following abbreviations are used: Bal. = E. Baliousis; obs. = field observation; phot. = photograph; s.n. = without number. Names of taxa not native to the investigated area are set in square brackets.

PTERIDOPHYTA

ASPLENIACEAE
Asplenium ceterach L. – 2b, *Bal. 1902;* 4b, *Bal. 8342;* 30a, *Bal. s.n*.
Asplenium onopteris L. – 5a, *Bal. 8147;* 10g, *Bal. 8794*.
Asplenium trichomanes L. *s.l.* – 2b, *Bal. 1903;* 6k, *Bal. 8144;* 5a, *Bal. 8146;* 10g, *Bal. 8795.*

DENNSTAEDTIACEAE
Pteridium aquilinum (L.) Kuhn subsp. *aquilinum* – 42p, *Bal. 2123;* 2e, *Bal. 2304;* 48e, *Bal. 8233;* 36r, *Bal. obs*.

EQUISETACEAE
Equisetum arvense L. – 14m, *Bal. 8667*.
Equisetum ramosissimum Desf. – 34m, *Bal. 8511*.
Equisetum telmateia Ehrh. – 37k, *Bal. 1781*.

POLYPODIACEAE
Polypodium cambricum L. – 34i, *Bal. 2232*.

PTERIDACEAE
Adiantum capillus-veneris L. – 37m, *Bal. s.n.*

SELAGINELLACEAE
Selaginella denticulata (L.) Spring – 34a, *Bal. 8522*.

SPERMATOPHYTA

GYMNOSPERMAE

EPHEDRACEAE
Ephedra foeminea Forssk. – 34i, *Bal. 8474*.

ANGIOSPERMAE
DICOTYLEDONES

ACANTHACEAE
Acanthus spinosus L. – 7*l*, *Bal. obs.;* 8r, *Bal. obs.;* 28n, *Bal. obs.;* 23r, *Bal. obs.*

ACERACEAE
Acer monspessulanum L. subsp. *monspessulanum* – 2c, *Bal. 2531;* 12d, *Bal. 8745*.
Acer sempervirens L. – 34a, *Bal. 8536*.

AMARANTHACEAE
[*Amaranthus albus* L.] – 19u, *Bal. 2161*.

ANACARDIACEAE
Pistacia lentiscus L. – 36j, *Bal. obs*.
Pistacia terebinthus L. subsp. *terebinthus* – 30a, *Bal. 8398;* 32a, *Bal. obs.;* 31a, *Bal. obs.*

APIACEAE
Anthriscus sylvestris subsp. *nemorosus* (M. Bieb.) Koso-Pol. – 41k, *Bal. 6190.*
Bubon macedonicum L. – 27q, *Bal. 8611*.
Bupleurum glumaceum Sm. – 42p, *Bal. 2099;* 2c, *Bal. 2544;* 30n, *Bal. s.n.*
Chaerophyllum nodosum (L.) Crantz – 7k, *Bal. 8082;* 6k, *Bal. 8122*.
Chaerophyllum temulum L. – 7m, *Bal. 8081*.
Daucus carota subsp. *maximus* (Desf.) Ball – 32r, *Bal. 2632*.
Daucus guttatus Sm. subsp. *guttatus* – 32r, *Bal. 2015;* 7n, *Bal. 8073;* 33p, *Bal. 8430;* 30n, *Bal. 8575*.
Elaeoselinum asclepium (L.) Bertol. subsp. *asclepium* – 9a, *Bal. 8800*.
Eryngium amethystinum L. – 1c, *Bal. 2071;* 4c, *Bal. 8376.*
Eryngium campestre L. – 30r, *Bal. 2610;* 7l, *Bal. obs*.
Eryngium creticum Lam. – 33p, *Bal. 8431.*
Foeniculum vulgare Mill. – 28r, *Bal. 2619;* 14r, *Bal. obs.*
Geocaryum parnassicum (Boiss. & Heldr.) Engstrand – 4c, *Bal. 8333*.
Helosciadium nodiflorum (L.) W.D.J. Koch – 7m, *Bal. 8074*.
Heracleum sphondylium subsp. *ternatum* (Velen.) Briq. – 13m, *Bal. 8781*.
Lagoecia cuminoides L. – 5r, *Bal. 8172*.
Malabaila aurea (Sm.) Boiss. – 34p, *Bal. 8493*.
Oenanthe pimpinelloides L. *s.l.* – 37m, *Bal. 1780*.
Opopanax hispidus (Friv.) Griseb. – 34p, *Bal. 8467*.
Orlaya daucoides (L.) Greuter – 2c, *Bal. 1981;* 1c, *Bal. 2052;* 5a, *Bal. 8178*.
Orlaya grandiflora (L.) Hoffm. – 33p, *Bal. 8429*.
Scaligeria napiformis (Spreng.) Grande – 37r, *Bal. 2023;* 34p, *Bal. 8524;* 9a, *Bal. 8801.*
Scandix australis subsp. *grandiflora* (L.) Thell. – 2c, *Bal. 1886;* 5a, *Bal. 8174;* 4c, *Bal. 8334;* 8r, *Bal. s.n.*
Scandix pecten-veneris L. – 7n, *Bal. 8093.*
Smyrnium perfoliatum L. *s.l.* – 30n, *Bal, 6155;* 7n, *Bal. 8075.*
Tordylium apulum L. – 2c, *Bal. 1887;* 31r, *Bal. s.n.;* 7r, *Bal. s.n*.
Tordylium officinale L. – 7r, *Bal. 8078*.
Torilis africana Spreng. – 42p, *Bal. 2108;* 2c, *Bal. 2566;* 7r, *Bal. 8080;* 34p, *Bal. 8479;* 9r, *Bal. 8802*.
Torilis arvensis subsp. *recta* Jury – 37m, *Bal. 2024;* 28m, *Bal. 2624*.

Torilis leptophylla (L.) Rchb. f. – 5r, *Bal. 8173;* 7n, *Bal. s.n.*
Torilis nodosa (L.) Gaertn. – 2c, *Bal. 2008;* 7n, *Bal. 8079*.

APOCYNACEAE
Vinca herbacea Waldst. & Kit. – 2c, *Bal. 1868;* 30a, *Bal. 2261;* 39a, *Bal. 6164*.
[*Vinca major* L. subsp. *major*] – 41n, *Bal. obs.;* 47n, *Bal. obs.*

ARALIACEAE
Hedera helix L. subsp. *helix* – 41k, *Bal. obs*.

ARISTOLOCHIACEAE
Aristolochia microstoma Boiss. & Spruner – 2c, *Bal. 1866;* 7n, *Bal. 8110;* 4c, *Bal. 8366.*
This is the westernmost locality of this Greek endemic.

ASTERACEAE
Achillea ligustica All. – 12p, *Bal. 8760.*
Achillea setacea Waldst. & Kit. – 3c, *Bal. 1987;* 1c, *Bal. 2127;* 2c, *Bal. 2555;* 4c, *Bal. 8283.*
Anthemis arvensis L. *s.l.* – 2c, *Bal. 2007;* 48p, *Bal. 8253;* 12p, *Bal. 8777*.
Anthemis arvensis L. subsp. *arvensis* – 43c, *Bal. 2074*.
Anthemis brachmannii Boiss. & Heldr. – 33p, *Bal. 8423*.
This finding fills the gap between the populations of this species in northern and southern Peloponnisos already reported by Halácsy (1902).
Anthemis chia L. – 2c, *Bal. 1802;* 1c, *Bal. 2073;* 4c, *Bal. 8278;* 32o, *Bal. s.n.*
Anthemis cotula L. – 5p, *Bal. 8189;* 33p, *Bal. 8421*.
Bellis perennis L. – 2c, *Bal. 1791;* 7n, *Bal. 8064*.
Bellis sylvestris Cirillo – 30a, *Bal. 2136*.
Calendula arvensis L. – 41s, *Bal. 6197;* 34p, *Bal. 8532;* 38r, *Bal. obs*.
Carduus pycnocephalus L. – 37r, *Bal. 2647;* 5r, *Bal. 8185*.
Carthamus lanatus subsp. *baeticus* (Boiss. & Reut.) Nyman – 29r, *Bal. 2609*.
Centaurea calcitrapa L. – 3r, *Bal. 8293*.
Centaurea pichleri Boiss. – 2c, *Bal. 1794;* 1c, *Bal. 2081*.
Centaurea raphanina subsp. *mixta* (DC.) Runemark – 2c, *Bal. 1796;* ibid., *Bal. 2597;* 4c, *Bal. 8356*.
Centaurea solstitialis L. subsp. *solstitialis* – 43p, *Bal. 2080;* 2c, *Bal. 2598*.
Chondrilla juncea L. – 28r, *Bal. 2146;* 7n, *Bal. 8057*.
Cichorium intybus L. – 34p, *Bal. 8546*.
Cirsium vulgare (Savi) Ten. – 2c, *Bal. 2603;* 29r, *Bal. 2608*.
Crepis dioscoridis L. – 27q, *Bal. 8609*.
Crepis foetida L. subsp. *foetida* – 5p, *Bal. 8191;* 34p, *Bal. 8482*.
Crepis fraasii Sch. Bip. subsp. *fraasii* – 5a, *Bal. 8183;* 34a, *Bal. 8529;* 12d, *Bal. 8741;* 10g, *Bal. 8793*.
Crepis neglecta subsp. *graeca* (Vierh.) Rech. f. – 2c, *Bal. 1793;* 43c, *Bal. 2077;* 31r, *Bal. 6142a;* 5a, *Bal. 8188;* 4c, *Bal. 8277*.
Crepis rubra L. – 2c, *Bal. 1799;* 3c, *Bal. 1986;* 5p, *Bal. 8192;* 8r, *Bal. s.n.;* 4c, *Bal. 8285.*

Crepis sancta (L.) Bornm. – 2c, *Bal. 1792;* 43c, *Bal. 2076;* 31r, *Bal. 6142b;* 4c, *Bal. 8282.*
Crepis setosa Haller f. – 28r, *Bal. 2627*.
Crepis zacintha (L.) Loisel. – 33p, *Bal. 8420*.
Crupina crupinastrum (Moris) Vis. – 2c, *Bal. 2569;* 4c, *Bal. s.n*.
Cynara cardunculus L. subsp. *cardunculus* – 37r, *Bal. 2616*.
Dittrichia viscosa (L.) Greuter *s.l.* – 26r, *Bal. obs*.
Echinops sphaerocephalus L. subsp. *sphaerocephalus* – 30r, *Bal. 2615*.
[*Erigeron sumatrensis* Retz.] – 28s, *Bal. 2139*.
Filago arvensis L. – 42p, *Bal. 2098;* 12p, *Bal. 8769.*
Filago eriocephala Guss. – 48p, *Bal. 8252*.
Filago gallica L. – 48p, *Bal. 8254;* 12p, *Bal. 8768.*
Filago pyramidata L. – 48p, *Bal. 8217;* 30n, *Bal. 8578;* 12p, *Bal. 8770*.
Galactites tomentosus Moench – 30o, *Bal. 8560*.
Hedypnois rhagadioloides (L.) F.W. Schmidt subsp. *rhagadioloides* – 5r, *Bal. 8184;* 33p, *Bal. 8422;* 12p, *Bal. 8707*.
Helminthotheca echioides (L.) Holub – 37r, *Bal. 2648*.
Hypochaeris cretensis (L.) Bory & Chaub. – 2c, *Bal. 1961;* 7n, *Bal. 8055;* 5p, *Bal. 8190;* 4c, *Bal. 8290;* 34p, *Bal. 8526*.
Inula verbascifolia (Willd.) Hausskn. *s.l.* – 34i, *Bal. 8557;* 26q, *Bal. 8615.*
Lactuca viminea subsp. *ramosissima* (All.) Arcang. – 1c, *Bal. 2075.*
Lapsana communis subsp. *adenophora* (Boiss.) Rech. f. – 12p, *Bal. 8738*.
Leontodon crispus subsp. *asper* (Waldst. & Kit.) Rohlena – 2c, *Bal. 1798*.
Leontodon tuberosus L. – 30r, *Bal. 2137;* 32r, *Bal. s.n.;* 49r, *Bal. obs*.
Matricaria chamomilla L. – 19s, *Bal. 2163;* 7r, *Bal. 8059*.
Notobasis syriaca (L.) Cass. – 18r, *Bal. obs*.
Onopordum illyricum subsp. *cardunculus* (Boiss.) Arènes – 3r, *Bal. 2602;* 29r, *Bal. 2612;* 7r, *Bal. obs.;* 14r, *Bal. obs.*
Pallenis spinosa (L.) Cass. subsp. *spinosa* – 33p, *Bal. 8425.*
Phagnalon rupestre subsp. *graecum* (Boiss. & Heldr.) Batt. – 34i, *Bal. 8466;* 27q, *Bal. 8604.*
Picnomon acarna (L.) Cass. – 2c, *Bal. 2599;* 6r, *Bal. obs.;* 29r, *Bal. obs.;* 27r, *Bal. obs*.
Picris pauciflora Willd. – 9r, *Bal. 8817*.
Picris rhagadioloides (L.) Desf. – 32r, *Bal. 2636;* 33p, *Bal. 8424;* 34p, *Bal. 8480;* 26r, *Bal. 8624*.
Pilosella bauhini (Schult.) Arv.-Touv. *s.l.* – 12d, *Bal. 8705*.
Pilosella cymosa subsp. *sabina* (Sebast.) H.P. Fuchs – 4c, *Bal. 8287*.
Podospermum canum C.A. Mey. – 2c, *Bal. 1797;* 7r, *Bal. 8038;* 4c, *Bal. 8280*.
Ptilostemon afer (Jacq.) Greuter subsp. *afer* – 29r, *Bal. 2613*.
Ptilostemon chamaepeuce (L.) Less. – 34i, *Bal. 8468*.
Ptilostemon stellatus (L.) Greuter – 37r, *Bal. 2040;* 30r, *Bal. 2614;* 33p, *Bal. 8446;* 30o, *Bal. 8559;* 26r, *Bal. 8623;* 12p, *Bal. 8708;* 48p, *Bal. s.n.*
Pulicaria odora (L.) Rchb. – 12d, *Bal. 8717.*
Reichardia picroides (L.) Roth – 31r, *Bal. 6145;* 27r, *Bal. 8607*.
Rhagadiolus stellatus (L.) Gaertn. – 37r, *Bal. 1768;* 32o, *Bal. 6125;* 7n, *Bal. 8060;* 6k, *Bal. 8132;* 34p, *Bal. 8481*.

All the specimens were initially determined as *Rhagadiolus edulis* Gaertn. which according to Dimopoulos & al. (2013) is a synonym.

Scolymus hispanicus L. subsp. *hispanicus* – 30r, *Bal. 2611;* 15l, *Bal. obs*.
Scorzonera crocifolia Sm. – 9r, *Bal. 8798*.
Scorzoneroides cichoriacea (Ten.) Greuter – 12p, *Bal. 8726.*
Senecio vernalis Waldst. & Kit. – 2c, *Bal. 1800;* 46p, *Bal. obs*.
Senecio vulgaris L. – 2c, *Bal. 1801;* 4c, *Bal. 8279;* 41s, *Bal. obs.;* 45s, *Bal. obs.*
Silybum marianum (L.) Gaertn. – 7r, *Bal. obs.;* 6n, *Bal. obs.;* 15l, *Bal. obs.;* 26r, *Bal*. *obs.;* 17r, *Bal. obs.*
Sonchus asper subsp. *glaucescens* (Jord.) Ball – 31r, *Bal. 6146*.
Tragopogon porrifolius subsp. *eriospermus* (Ten.) Greuter – 30r, *Bal. 6154;* 9r, *Bal. 8799.*
Tragopogon samaritani Heldr. & Sartori ex Boiss. – 2c, *Bal. 2596;* 4c, *Bal. 8288*.
Urospermum picroides (L.) F.W. Schmidt – 48p, *Bal. 8234*.
[*Xanthium spinosum* L.] – 31r, *Bal. 6141*.
Xeranthemum inapertum (L.) Mill. – 2c, *Bal. 1795*.

BETULACEAE
Carpinus orientalis Mill. – 40a, *Bal. 6171;* 5a, *Bal. 8167;* 34a, *Bal. 8553;* 22r, *Bal. 8636;* 10g, *Bal. 8786.*
Ostrya carpinifolia Scop. – 34a, *Bal. 8478*.

BORAGINACEAE
Alkanna methanaea Hausskn. – 48p, *Bal. 8231*.
Anchusa azurea Mill. – 23r, *Bal. obs.*
Anchusa undulata subsp. *hybrida* (Ten.) Bég. – 2c, *Bal. 1837;* 42p, *Bal. 2082;* 32r, *Bal. 6133*.
Anchusella cretica (Mill.) Bigazzi, Nardi & Selvi – 2c, *Bal. 1838;* 32o,r, *Bal. 6114;* 39a, *Bal. 6168;* 7r, *Bal. s.n.;* 4c, *Bal. s.n.;* 44s, *Bal. obs.;* 49r, *Bal. obs*.
Buglossoides incrassata (Guss.) I.M. Johnst. subsp. *incrassata* – 2c, *Bal. 1841;* 4c, *Bal. 8368*.
Cerinthe major L. – 30r, *Bal. 6151*.
Cerinthe retorta Sm. – 34p, *Bal. 8472*.
Cynoglossum columnae Ten. – 7n, *Bal. 8097;* 44r, *Bal. obs*.
Cynoglossum creticum Mill. – 2c, *Bal. 1836;* 7n, *Bal. 8096*.
Echium italicum subsp. *biebersteinii* (Lacaita) Greuter & Burdet – 7r, *Bal. obs.;* 49r, *Bal. obs.;* 15r, *Bal. obs.;* 28r, *Bal. obs.;* 26r, *Bal. obs*.
Echium plantagineum L. – 48p, *Bal. 8229;* 30o, *Bal. 8564;* 14r, *Bal. obs.*
Heliotropium europaeum L. – 28s, *Bal. 2141*.
Myosotis ramosissima Rochel subsp. *ramosissima* – 2c, *Bal. 1839*.
Myosotis sylvatica subsp. *cyanea* (Hayek) Vestergren – 2c, *Bal. 1840;* 5a, *Bal. 8149;* 4c, *Bal. 8369*.
Onosma frutescens Lam. – 34i, *Bal. 8501;* 27q, *Bal. 8613*.
Symphytum bulbosum K.F. Schimp. – 7k, *Bal. 8095;* 48k, *Bal. 8230;* 12d, *Bal. s.n.;* 6k, *Bal. obs*.

BRASSICACEAE
Aethionema saxatile subsp. *graecum* (Boiss. & Spruner) Hayek – 2c, *Bal. 1831;* 39q, *Bal. 6159;* 4b, *Bal. 8306;* 31a, *Bal. s.n.*
Alliaria petiolata (M. Bieb.) Cavara & Grande – 40k, *Bal. 6185;* 7k, *Bal. 8091;* 41s, *Bal. obs.;* 36k, *Bal. obs.;* 47s, *Bal. obs*.
Alyssum foliosum Bory & Chaub. – 43c, *Bal. 2126;* 2c, *Bal. 2553;* 4c, *Bal. 8302*.
Alyssum montanum subsp. *repens* (Baumg.) Schmalh. – 2c, *Bal. 1835*.
Alyssum murale Waldst. & Kit. – 2c, *Bal. 1966*.
Alyssum siculum Jord. – 2c, *Bal. 1828;* 4c, *Bal. 8300.*
Alyssum simplex Rudolphi – 32r, *Bal. 6128;* 28r, *Bal. 8587;* 14r, *Bal. 8669;* 9r, *Bal. 8820.*
Alyssum strigosum Banks & Sol. – 2c, *Bal. 2547*.
Arabis sagittata (Bertol.) DC. – 34q, *Bal. 8544*.
Arabis turrita L. – 34q, *Bal. 8471*.
Arabis verna (L.) R.Br. – 2c, *Bal. 1829;* 4c, *Bal. 8298.*
Aurinia saxatilis subsp. *orientalis* (Ard.) T.R. Dudley – 32r, *Bal. 2022;* 34i, *Bal. 8485;* 28r, *Bal. 8586;* 27q, *Bal. 8599*.
Bunias erucago L. – 32o, *Bal. 6120*.
Calepina irregularis (Asso) Thell. – 32o,r, *Bal. 6119;* 41s, *Bal. s.n.;* 35r, *Bal. obs.;* 47r, *Bal. obs.;* 38r, *Bal. obs.*
Capsella bursa-pastoris (L.) Medik. – 2c, *Bal. 1847;* 32o, *Bal. 6121;* 48p, *Bal. 8241;* 4c, *Bal. 8295;* 41s, *Bal. s.n.;* 47s, *Bal. obs*.
Cardamine graeca L. – 6k, *Bal. 8130*.
Cardamine hirsuta L. – 2c, *Bal. 2275;* 40r, *Bal. 6187;* 48p, *Bal. 8214*.
Clypeola jonthlaspi L. subsp. *jonthlaspi* – 2c, *Bal. 1832;* 39a, *Bal. 6169;* 32r, *Bal. s.n.*
Draba muralis L. – 41t, *Bal. 6189;* 4c, *Bal. 8294.*
Draba praecox Steven – 2c, *Bal. 2276;* 40r, *Bal. 6186.*
Draba verna L. – 4c, *Bal. 8307*.
Erysimum asperulum Boiss. & Heldr. – 48p, *Bal. 8250*.
Erysimum pectinatum Bory & Chaub. – 4c, *Bal. 8305*.
Hirschfeldia incana (L.) Lagr.-Foss. – 7r, *Bal. 8092;* 33p, *Bal. s.n.*
Hornungia petraea (L.) Rchb. – 4c, *Bal. 8303*.
Isatis tomentella Boiss. & Balansa – 27q, *Bal. 8600*.
Lepidium coronopus (L.) Al-Shehbaz – 19u, *Bal. 2511*.
Lepidium draba L. subsp. *draba* – 47s, *Bal. obs*.
Lepidium graminifolium L. – 28s, *Bal. 2140*.
Lepidium hirtum subsp. *nebrodense* (Raf.) Thell. – 2c, *Bal. 1830.*
Lunaria annua subsp. *pachyrhiza* (Borbás) Maire & Petitm. – 34p, *Bal. 8470*.
Malcolmia graeca subsp. *bicolor* (Boiss. & Heldr.) Stork – 2c, *Bal. 1834;* 43c, *Bal. 2056;* 4c, *Bal. 8297*.
Microthlaspi perfoliatum (L.) F.K. Mey. – 2c, *Bal. 1833;* 30r, *Bal. s.n.;* 43c, *Bal. s.n*.
Nasturtium officinale R. Br. – 35m, *Bal. 6111;* 34m, *Bal. 8515*.
Rapistrum rugosum (L.) All. – 28r, *Bal. 8838*.
Rorippa sylvestris (L.) Besser subsp. *sylvestris* – 19u, *Bal. 2160*.
Sisymbrium officinale (L.) Scop. – 2c, *Bal. 1846;* 4c, *Bal. 8299*.
Sisymbrium orientale L. – 4c, *Bal. 8296;* 45s, *Bal. obs*.

CAESALPINIACEAE
Cercis siliquastrum L. – 34a, *Bal. s.n.;* 7k, *Bal. obs.;* 26a, *Bal. obs.*

CAMPANULACEAE
Asyneuma limonifolium (L.) Janch. subsp. *limonifolium* – 43c, *Bal. 2070*.
Campanula ramosissima Sm. – 37r, *Bal. 1771;* 2c, *Bal. 2558;* 28s, *Bal. 2621;* 7r, *Bal. 8061;* 5p, *Bal. 8205;* 28t, *Bal. 8592;* 10p, *Bal. 8796;* 12p, *Bal. s.n.*
Campanula spatulata subsp. *spruneriana* (Hampe) Hayek – 2c, *Bal. 1951;* 5a, *Bal. 8204;* 4c, *Bal. 8322*.
Campanula versicolor Andrews – 21q, *Bal. obs*.
Legousia falcata (Ten.) Fritsch ex Janch. – 28r, *Bal. 8836*.
Legousia hybrida (L.) Delarbre – 2c, *Bal. 1861;* 39r, *Bal. 6161;* 4c, *Bal. 8324.*
Legousia speculum-veneris (L.) Chaix – 2c, *Bal. 2006;* 5a, *Bal. 8169*.

CAPRIFOLIACEAE
Sambucus nigra L. – 15n, *Bal. 8644*.

CARYOPHYLLACEAE
Arenaria guicciardii Heldr. ex Boiss. – 43c, *Bal. 2063;* 2c, *Bal. 2540;* 4c, *Bal. 8321*.
A Greek endemic which is rare and scattered in the mountains of Kriti, southern parts of mainland, Ionian and E Aegean islands (Phitos 1997). Its finding in various localities of Mt Aphrodisio and Mt Likeo (Baliousis 2013), particularly in their upper altitudinal zone, extends considerably its distribution in Peloponnisos.
Arenaria leptoclados (Rchb.) Guss. – 2c, *Bal. 2542;* 7r, *Bal. 8106;* 4c, *Bal. 8319*.
Arenaria serpyllifolia L. – 43c, *Bal. 2064*.
Cerastium brachypetalum subsp. *roeseri* (Boiss. & Heldr.) Nyman – 2c, *Bal*. *1857;* 43c, *Bal. 2066;* 32r, *Bal. 6130;* 31r, *Bal. 6135a;* 4c, *Bal. 8312*.
Cerastium glomeratum Thuill. – 2c, *Bal. 1856;* 31r, *Bal. 6135b*.
Cerastium illyricum subsp. *brachiatum* (Lonsing) Jalas – 48p, *Bal. 8240;* 4c, *Bal. 8314*.
Holosteum umbellatum L. – 2c, *Bal. 2283.*
Minuartia globulosa (Labill.) Schinz & Thell. – 2c, *Bal. 2536;* 9r, *Bal. 8804*.
Minuartia hamata (Hausskn. & Bornm.) Mattf. – 43c, *Bal. 2058;* 4c, *Bal. 8316*.
Minuartia hybrida (Vill.) Schischk. – 5p, *Bal. 8180*.
Minuartia mesogitana (Boiss.) Hand.-Mazz. *s.l.* – 4c, *Bal. 8315*.
Petrorhagia dubia (Raf.) G. López & Romo – 39r, *Bal. 6157;* 48p, *Bal. 8239;* 4c, *Bal. 8318;* 12p, *Bal. 8757*.
Petrorhagia glumacea (Bory & Chaub.) P.W. Ball & Heywood – 32r, *Bal. 2017;* 2c, *Bal. 2571;* 33p, *Bal. 8462;* 30r, *Bal. 8571;* 9r, *Bal. 8803*.
Petrorhagia illyrica (L.) P.W. Ball & Heywood subsp. *illyrica* – 43c, *Bal. 2062;* 2c, *Bal. 2564*.
Polycarpon tetraphyllum (L.) L. – 34p, *Bal. 8551.*
Saponaria calabrica Guss. – 3q, *Bal. 1855;* 43p, *Bal. 2067;* 7r, *Bal. 8108;* 32r, *Bal. s.n.;* 39q, *Bal. s.n.;* 46q, *Bal. obs.*
Scleranthus verticillatus Tausch – 4c, *Bal. 8310*.
Silene conica L. – 4c, *Bal. 8320*.

Silene cretica L. – 2c, *Bal. 1854;* 4c, *Bal. 8323.*
Silene gigantea subsp. *hellenica* Greuter – 34p, *Bal. 8490;* 27q, *Bal. 8605*.
Silene italica subsp. *peloponnesiaca* Greuter – 2c, *Bal. 1949;* 2e, *Bal. 2563;* 12d, *Bal. 8718*.
Silene nocturna L. – 28s, *Bal. 8835*.
Silene nutabunda Greuter – 26q, *Bal. 8630*.
This is the northernmost locality of this species endemic to Peloponnisos.
Silene vulgaris subsp. *macrocarpa* Turrill – 7n, *Bal. 8107*.
Silene vulgaris (Moench) Garcke *s.l.* – 31q, *Bal. 6148;* 9r, *Bal. 8809*.
Stellaria apetala Ucria – 2c, *Bal. 1859;* 42p, *Bal. 2061;* 32o, *Bal. 6122*.
Stellaria cupaniana Jord. & Fourr. – 28s, *Bal. 2265;* 39r, *Bal. 6162*.
Stellaria media (L.) Vill. – 30n, *Bal. 6152.*
Velezia rigida L. – 9q, *Bal. 8805*.

CHENOPODIACEAE
Chenopodium vulvaria L. – 19u, *Bal. 2162.*

CISTACEAE
Cistus creticus subsp. *eriocephalus* (Viv.) Greuter & Burdet – 5a, *Bal. 8166;* 14r, *Bal. 8691;* 12d, *Bal. 8727*.
Cistus salviifolius L. – 12d, *Bal. 8728*.
Fumana arabica (L.) Spach – 26q, *Bal. 8621*.
Fumana thymifolia (L.) Webb – 26q, *Bal. 8620*.
Helianthemum nummularium (L.) Mill. subsp. *nummularium* – 2c, *Bal. 1862;* 5a, *Bal. 8187;* 31a, *Bal. s.n*.
Helianthemum salicifolium (L.) Mill. – 2c, *Bal. 1863;* 39r, *Bal. 6158;* 4c, *Bal. 8395*.
Tuberaria guttata (L.) Fourr. – 48p, *Bal. 8218*.

CONVOLVULACEAE
Calystegia silvatica (Kit.) Griseb. – 37r, *Bal. 2026;* 12d, *Bal. 8764.*
Convolvulus arvensis L. – 1c, *Bal. 2068;* 7o, *Bal. s.n.;* 4c, *Bal. s.n.*
Convolvulus cantabrica L. – 32r, *Bal. 1849;* 2c, *Bal. 1970;* 30r, *Bal. 8566;* 39r, *Bal. s.n.;* 33p, *Bal. s.n.*
Convolvulus elegantissimus Mill. – 2c, *Bal. 1971;* 2e, *Bal. 2524;* 4c, *Bal. 8365.*

CRASSULACEAE
Sedum amplexicaule subsp. *tenuifolium* (Sm.) Greuter – 43c, *Bal. 2107;* 2c, *Bal. 2549;* 7k, *Bal. 8083;* 4c, *Bal. 8383;* 12d, *Bal. 8719;* 22d, *Bal. s.n*.
Sedum caespitosum (Cav.) DC. – 4c, *Bal. 8384*.
Sedum cepaea L. – 28m, *Bal. 2628;* 34i, *Bal. 8475.*
Sedum hispanicum L. – 2b, *Bal. 1945;* 27q, *Bal. 8601.*
Sedum laconicum Boiss. & Heldr. subsp. *laconicum* – 2b, *Bal. 1946;* 43c, *Bal. 2125;* 4b, *Bal. 8382*.
Sedum rubens L. – 37r, *Bal. 1947;* 7n, *Bal. 8084;* 30r, *Bal. 8413;* 14r, *Bal. 8688*.
Umbilicus chloranthus Heldr. & Sartori ex Boiss. – 26t, *Bal. 8629*.

Umbilicus horizontalis (Guss.) DC. – 4b, *Bal. 8388;* 34i, *Bal. 8494*.
Umbilicus rupestris (Salisb.) Dandy – 34q, *Bal. 8523.*

CUCURBITACEAE
Bryonia cretica L. – 28r, *Bal. 2617.*
Ecballium elaterium (L.) A. Rich. – 26s, *Bal. obs.*

DIPSACACEAE
Cephalaria ambrosioides (Sm.) Roem. & Schult. – 27q, *Bal. 8612*.
Knautia integrifolia (L.) Bertol. *s.l.* – 2c, *Bal. 1848;* 32r, *Bal. 2640;* 7n, *Bal. 8098;* 6n, *Bal. 8116;* 5p, *Bal. 8203;* 48p, *Bal. 8249;* 4c, *Bal. 8391;* 12p, *Bal. 8767*.
Pterocephalus plumosus (L.) Coult. – 33p, *Bal. 8433*.

ERICACEAE
Arbutus unedo L. – 36j, *Bal. obs*.
Erica arborea L. – 36j, *Bal. obs*.

EUPHORBIACEAE
Euphorbia apios L. – 2c, *Bal. 1884;* 4c, *Bal. 8380*.
Euphorbia helioscopia L. – 2c, *Bal. 1883;* 32o, *Bal. 6115*.
Euphorbia peplus L. – 32r, *Bal. 6131*.
Mercurialis annua L. – 39r, *Bal. s.n.;* 45t, *Bal. obs.;* 28t, *Bal. obs.;* 26t, *Bal. obs.;* 15t, *Bal. obs*.

FABACEAE
Anthyllis vulneraria subsp. *rubriflora* (DC.) Arcang. – 2c, *Bal. 1813;* 42p, *Bal. 2113;* 5a, *Bal. 8157;* 9r, *Bal. 8826.*
Astragalus depressus L. subsp. *depressus* – 2c, *Bal. 1825;* 1c, *Bal. 2128;* 4c, *Bal. 8350.*
Astragalus glycyphyllos subsp. *glycyphylloides* (DC.) Maire & Petitm. – 22r, *Bal. 8635;* 12p, *Bal. 8750*.
Astragalus hamosus L. – 37r, *Bal. 2046;* 5r, *Bal. 8150*.
Bituminaria bituminosa (L.) C.H. Stirt. – 31r, *Bal. 6144;* 14r, *Bal. obs.;* 29r, *Bal. obs.;* 26r, *Bal. obs.*
Calicotome villosa (Poir.) Link – 34a, *Bal. 8502;* 36j, *Bal. obs.;* 31a, *Bal. obs.;* 27a, *Bal. obs.*
Chamaecytisus hirsutus (L.) Link *s.l.* – 40r, *Bal. 6175.*
Coronilla scorpioides (L.) W.D.J. Koch – 2c, *Bal. 1821;* 30r, *Bal. 8410;* 33p, *Bal. 8453;* 9r, *Bal. s.n*.
Dorycnium herbaceum Vill. – 42p, *Bal. 2118;* 12p, *Bal. 8723;* 22r, *Bal. obs*.
Dorycnium hirsutum (L.) Ser. – 37r, *Bal. 2037;* 34q, *Bal. 8538;* 22r, *Bal. obs.*
Hippocrepis biflora Spreng. – 30r, *Bal. 8411;* 9r, *Bal. 8825*.
Hippocrepis emerus subsp. *emeroides* (Boiss. & Spruner) Greuter & Burdet ex Lassen – 2c, *Bal. 1822;* 40a, *Bal. 6174;* 34a, *Bal. 8497;* 36j, *Bal. obs.;* 32a, *Bal. obs*.
Hymenocarpos circinnatus (L.) Savi – 7r, *Bal. 8071;* 30r, *Bal. 8402;* 22r, *Bal. 8641;* 31r, *Bal. s.n.;* 32r, *Bal. s.n.;* 12p, *Bal. s.n*.

Lathyrus amphicarpos L. – 2c, *Bal. 1817.*
Lathyrus aphaca L. – 37r, *Bal. 1762;* 42p, *Bal. 2110;* 2c, *Bal. 2532;* 14r, *Bal. 8672b;* 30r, *Bal. s.n.*
Lathyrus digitatus (M. Bieb.) Fiori – 2c, *Bal. 1811;* 9a, *Bal. 8831*.
Lathyrus laxiflorus (Desf.) Kuntze – 40a, *Bal. 6179;* 5a, *Bal. 8158;* 22d, *Bal. s.n*.
Lathyrus niger (L.) Bernh. – 12p, *Bal. 8763*.
Lathyrus pratensis L. – 14m, *Bal. 8650*.
Lathyrus setifolius L. – 47r, *Bal. 6201*.
Lathyrus sphaericus Retz. – 14r, *Bal. 8671;* 12p, *Bal. 8702;* 9q, *Bal. 8830*.
Lens ervoides (Brign.) Grande – 37r, *Bal. 1763;* 34p, *Bal. 8548;* 12p, *Bal. 8701*.
Lotus angustissimus L. – 48p, *Bal. 8219;* 12p, *Bal. 8753*.
Lotus conimbricensis Brot. – 30r, *Bal. 8568;* 14r, *Bal. 8679*.
Lotus longisiliquosus R. Roem. – 32r, *Bal. 2012;* 26r, *Bal. 8627*.
Lotus ornithopodioides L. – 30r, *Bal. 8409;* 9r, *Bal. 8829;* 37r, *Bal. s.n.;* 32o, *Bal. s.n*.
Lotus tenuis Willd. – 32r, *Bal. 2011;* 42m, *Bal. 2111;* 14m, *Bal. 8647*.
Lupinus albus subsp. *graecus* (Boiss. & Spruner) Franco & P.Silva – 22r, *Bal. 8639.*
Medicago arabica (L.) Huds. – 37r, *Bal. s.n.;* 7o, *Bal. 8067;* 6n, *Bal. 8129;* 5r, *Bal. 8179;* 8r, *Bal. s.n.;* 32o, *Bal. s.n*.
Medicago coronata (L.) Bartal. – 27r, *Bal. 8603;* 26q, *Bal. 8622*.
Medicago lupulina L. – 37r, *Bal. 1761;* 7r, *Bal. 8072;* 3r, *Bal. 8352;* 14r, *Bal. 8651;* 22r, *Bal. s.n.*
Medicago minima (L.) Bartal. – 37r, *Bal. s.n.;* 2c, *Bal. 1812;* 7r, *Bal. 8068;* 6n, *Bal. 8119;* 5r, *Bal. 8163;* 4c, *Bal. 8351;* 30r, *Bal. 8407;* 34p, *Bal. 8510;* 31r, *Bal. s.n.;* 48p, *Bal. s.n.;* 33p, *Bal. s.n.;* 30r, *Bal. s.n.;* 12p, *Bal. s.n.;* 9r, *Bal. s.n*.
Medicago monspeliaca (L.) Trautv. – 4c, *Bal. 8390*.
Medicago orbicularis (L.) Bartal. – 2c, *Bal. 1818;* 5p, *Bal. 8160;* 4c, *Bal. s.n*.
Medicago polymorpha L. – 6n, *Bal. 8118;* 5r, *Bal. 8162;* 34p, *Bal. 8498;* 14r, *Bal. 8681;* 10p, *Bal. 8797;* 48p, *Bal. s.n.;* 30o, *Bal. s.n.;* 12p, *Bal. s.n*.
Medicago rigidula (L.) All. – 2c, *Bal. 1820;* 7r, *Bal. 8069;* 5a, *Bal. 8161;* 48p, *Bal. 8227;* 4c, *Bal. 8354;* 12p, *Bal. s.n.*
Medicago sativa subsp. *falcata* (L.) Arcang. – 2c, *Bal. 1979;* 28s, *Bal. 8594*.
[*Medicago sativa* L. subsp. *sativa*] – 13r, *Bal. 8783*.
Melilotus graecus (Boiss. & Spruner) Lassen – 42p, *Bal. 2121;* 33p, *Bal. 8456;* 9r, *Bal. 8828;* 26q, *Bal. obs.*
Melilotus indicus (L.) All. – 14r, *Bal. 8649*.
Melilotus italicus (L.) Lam. – 34p, *Bal. 8477*.
Melilotus neapolitanus Ten. – 42p, *Bal. 2117;* 33p, *Bal. 8459;* 34p, *Bal. 8514*.
Onobrychis aequidentata (Sm.) d'Urv. – 33p, *Bal. 8461;* 26q, *Bal. 8617*.
Onobrychis alba subsp. *pentelica* (Hausskn.) Nyman – 2c, *Bal. 1819*.
Onobrychis caput-galli (L.) Lam. – 37r, *Bal. 1766b;* 48p, *Bal. 8225;* 12p, *Bal. 8703;* 30r, *Bal. s.n.*
Ononis spinosa subsp. *antiquorum* (L.) Arcang. – 32r, *Bal. 2018;* 2c, *Bal. 2529.*
Ononis viscosa subsp. *breviflora* (DC.) Nyman – 33p, *Bal. 8460.*
Ornithopus compressus L. – 14r, *Bal. 8678;* 12p, *Bal. s.n*.
Scorpiurus muricatus L. – 30r, *Bal. 8401;* 34p, *Bal. s.n.;* 9r, *Bal. s.n*.

Securigera cretica (L.) Lassen – 30r, *Bal. 8400;* 33p, *Bal. 8451*.
Securigera securidaca (L.) Degen & Dörfl. – 37r, *Bal. 1765;* 30r, *Bal. 8399;* 27r, *Bal. 8597.*
Spartium junceum L. – 48e, *Bal. obs.;* 36r, *Bal. obs*.
Tetragonolobus purpureus Moench – 30n, *Bal. 6150.*
Trifolium angustifolium L. – 42p, *Bal. 2114;* 6n, *Bal. 8123;* 33p, *Bal. 8457;* 34p, *Bal. 8549.*
Trifolium arvense L. – 12d, *Bal. 8697.*
Trifolium aurantiacum Boiss. & Spruner – 2c, *Bal. 1816;* 43p, *Bal. 2115;* 5a, *Bal. 8154;* 4c, *Bal. s.n.;* 12p, *Bal. s.n.*
Trifolium campestre Schreb. – 37r, *Bal. 1766a;* 34p, *Bal. 8513;* 14r, *Bal. 8674;* 12p, *Bal. 8730;* 43p, *Bal. s.n.;* 4c, *Bal. s.n.*
Trifolium cherleri L. – 3c, *Bal. 1975;* 5r, *Bal. 8152;* 48p, *Bal. 8221;* 4c, *Bal. 8347;* 30r, *Bal. 8405;* 34p, *Bal. s.n*.
Trifolium dalmaticum Vis. – 37r, *Bal. 2028*.
Trifolium glomeratum L. – 12d,p, *Bal. 8734;* ibid., *Bal. 8749.*
Trifolium grandiflorum Schreb. – 2c, *Bal. 1815;* 43p, *Bal. 2116;* 5a, *Bal. 8153;* 4c, *Bal. 8353*.
Trifolium hirtum All. – 12p, *Bal. 8700.*
Trifolium lappaceum L. – 32r, *Bal. 2019;* 33p, *Bal. 8458;* 30m, *Bal. 8567*.
Trifolium leucanthum M. Bieb. – 5a, *Bal. 8151;* 4c, *Bal. 8343;* 12p, *Bal. 8698;* 9q, *Bal. 8823*.
Trifolium nigrescens Viv. – 37m, *Bal. 1760;* 3c, *Bal. 1972a;* 5r, *Bal. 8155;* 48p, *Bal. 8224;* 4c, *Bal. 8345*.
Trifolium ochroleucon subsp. *roseum* (C. Presl) Lassen – 22r, *Bal. 8640;* 12d, *Bal. 8694*.
Trifolium pallidum Waldst. & Kit. – 37m, *Bal. 2030;* 19p, *Bal. 2518;* 7r, *Bal. 8065;* 48p, *Bal. 8223;* 33p, *Bal. 8455;* 12p, *Bal. 8732;* 14r, *Bal. s.n.*
Trifolium patens Schreb. – 14m, *Bal. 8645*.
Trifolium physodes M. Bieb. – 37m, *Bal. 1757;* 2c, *Bal. 1809;* 2e, *Bal. 1978;* 39a, *Bal. 6167;* 4c, *Bal. s.n.;* 30a, *Bal. s.n.;* 34p, *Bal. s.n*.
Trifolium pignantii Fauché & Chaub. – 22d, *Bal. 8633;* 12p, *Bal. 8693*.
Trifolium pratense L. – 37m, *Bal. 1759;* 42m, *Bal. 2119;* 28m, *Bal. 2626*.
Trifolium repens L. – 3c, *Bal. 1972b;* 37m, *Bal. 2027;* 42m, *Bal. 2120;* 7o, *Bal. 8066*.
Trifolium resupinatum L. subsp. *resupinatum* – 19u, *Bal. 2510;* 34m, *Bal. 8518;* 30m, *Bal. 8576;* 14r, *Bal. 8673*.
Trifolium scabrum L. – 5r, *Bal. 8156;* 48p, *Bal. 8226*.
Trifolium stellatum L. – 2c, *Bal. 1814;* 5p, *Bal. 8164;* 4c, *Bal. 8344;* 30r, *Bal. 8406;* 33p, *Bal. 8454;* 48p, *Bal. s.n*.
Trifolium striatum L. – 2c, *Bal. 1977;* 4c, *Bal. 8348;* 12p, *Bal. 8733;* 9q, *Bal. 8822.*
Trifolium subterraneum L. – 37r, *Bal. 1758;* 2c, *Bal. 1810;* 6n, *Bal. 8125;* 8r, *Bal. s.n.;* 48p, *Bal. 8228;* 4c, *Bal. 8346;* 12p, *Bal. 8755;* 12d, *Bal. s.n.*
Trifolium tenuifolium Ten. – 48p, *Bal. 8220;* 14f, *Bal. 8675.*
Trifolium tomentosum L. – 5p, *Bal. 8206;* 34p, *Bal. 8509.*
Trigonella corniculata (L.) L. *s.l.* – 42p, *Bal. 2122;* 9r, *Bal. 8827*.
Trigonella gladiata M. Bieb. – 2c, *Bal. 2561;* 9r, *Bal. 8821*.

Tripodion tetraphyllum (L.) Fourr. – 33p, *Bal. 8450*.
Vicia angustifolia L. – 31r, *Bal. 6140;* 5p, *Bal. 8159;* 34p, *Bal. 8517;* 14r, *Bal. 8646*.
Vicia hybrida L. – 37r, *Bal. 1764;* 2c, *Bal. 1827;* 39r, *Bal. 6160*.
Vicia laeta Ces. – 22r, *Bal. 8634*.
Vicia lathyroides L. – 2c, *Bal. 1824;* 4c, *Bal. 8355;* 12p, *Bal. 8780*.
Vicia lutea L. subsp. *lutea* – 14r, *Bal. 8672a.*
Vicia melanops Sm. – 28r, *Bal. 8833.*
Vicia parviflora Cav. – 9q, *Bal. 8819*.
Vicia villosa subsp. *eriocarpa* (Hausskn.) P.W. Ball – 42p, *Bal. 2112;* 30n, *Bal. 6156;* 6n, *Bal. 8117;* 14r, *Bal. 8648*.

FAGACEAE
Quercus coccifera L. – 39a, *Bal. obs.;* 4c, *Bal. s.n.;* 30a, *Bal. obs.;* 36j, *Bal. obs.;* 32a, *Bal. obs.;* 31a, *Bal. obs.;* 40a, *Bal. obs.;* 46a, *Bal. obs.;* 5a, *Bal. obs.;* 9a, *Bal. obs.;* 29a, *Bal. obs.;* 27a, *Bal. obs.;* 22a, *Bal. obs.;* 16a, *Bal. obs*.
Quercus frainetto Ten. – 22d, *Bal. 8632;* 14f, *Bal. 8689;* 12d, *Bal. 8716.*
Quercus ilex L. – 34a, *Bal. 8496*.
Quercus pubescens Willd. – 2e, *Bal. 1878;* 48e, *Bal. 8257;* 4c, *Bal. 8386;* 14f, *Bal. 8690;* 9a, *Bal. obs.;* 27a, *Bal. obs.;* 22a, *Bal. obs*.

FUMARIACEAE
Corydalis solida subsp. *incisa* Lidén – 2b, *Bal. 2287.*
Fumaria officinalis L. subsp. *officinalis* – 2c, *Bal. 1864;* 28t, *Bal. 8591*.

GENTIANACEAE
Blackstonia perfoliata (L.) Huds. subsp. *perfoliata* – 34p, *Bal. 8533*.
Centaurium erythraea Raf. subsp. *erythraea* – 12p, *Bal. 8714*.
Centaurium tenuiflorum (Hoffmanns. & Link) Fritsch subsp. *tenuiflorum* – 32r, *Bal. 2013.*

GERANIACEAE
Erodium cicutarium (L.) L'Hér. – 2c, *Bal. 1869;* 43c, *Bal. 2069;* 5p, *Bal. 8175;* 4c, *Bal. 8358*.
Erodium malacoides (L.) L'Hér. – 31r, *Bal. 6143*.
Geranium asphodeloides Burm. f. subsp. *asphodeloides* – 6k, *Bal. 8128;* 12d*, Bal. 8722.*
Geranium brutium Gasp. – 32o, *Bal. 6116;* 36r, *Bal. obs.;* 41r, *Bal. obs.;* 7r, *Bal. obs.;* 37r, *Bal. obs.;* 39o, *Bal. obs.;* 45s, *Bal. obs*.
Geranium columbinum L. – 31a, *Bal. 6139;* 39r, *Bal. 6163;* 6k, *Bal. 8126;* 7k, *Bal. s.n.;* 12p, *Bal. s.n.;* 9r, *Bal. s.n.*
Geranium dissectum L. – 37m, *Bal. 1777;* 32o, *Bal. 6117;* 12p, *Bal. 8758;* 7m, *Bal. s.n.*
Geranium lucidum L. – 2b, *Bal. 1871;* 32t, *Bal. 6124;* 4b, *Bal. s.n.;* 47t, *Bal. obs.*
Geranium macrostylum Boiss. – 2b, *Bal. 1872;* 4b, *Bal. 8361*.
Geranium molle L. – 31r, *Bal. 6147;* 6n, *Bal. 8127;* 4c, *Bal. 8359;* 5p, *Bal. s.n.*
Geranium purpureum Vill. – 37r, *Bal. 1778;* 32r, *Bal. 6129;* 30r, *Bal. s.n*.
Geranium rotundifolium L. – 7r, *Bal. 8051;* 45s, *Bal. obs*.

HYPERICACEAE
Hypericum perforatum L. *s.l.* – 32r, *Bal. 2634;* 14r, *Bal. 8684*.
Hypericum perfoliatum L. – 33p, *Bal. 8473*.

LAMIACEAE
Acinos graveolens (M. Bieb.) Link – 2c, *Bal. 1845;* 9r, *Bal. 8806*.
Acinos suaveolens (Sm.) Loudon – 43p, *Bal. 2060*.
Ballota acetabulosa (L.) Benth. – 3c, *Bal. 1989;* 4c, *Bal. 8336*.
Calamintha nepeta subsp. *glandulosa* (Req.) P.W. Ball – 28r, *Bal. 2134*.
Clinopodium vulgare subsp. *orientale* Bothmer – 42p, *Bal. 2124;* 2e, *Bal. 2567;* 5a, *Bal. 8186;* 12d, *Bal. 8729*.
Lamium amplexicaule L. – 2c, *Bal. 1843;* 41s, *Bal. 6191*.
Lamium bifidum Cirillo subsp. *bifidum* – 28s, *Bal. 2263;* 41s, *Bal. obs*.
Lamium garganicum subsp. *striatum* (Sm.) Hayek – 2b, *Bal. 1842;* 4b, *Bal. 8337*.
Marrubium vulgare L. – 7n, *Bal. 8103;* 15l, *Bal. obs*.
Melissa officinalis subsp. *altissima* (Sm.) Arcang. – 32o, *Bal. 6126;* 7k, *Bal. 8102;* 34m, *Bal. 8521;* 12p, *Bal. 8737*.
Mentha spicata subsp. *condensata* (Briq.) Greuter & Burdet – 32m, *Bal. 2635;* 7m, *Bal. 8105*.
Micromeria juliana (L.) Rchb. – 32a, *Bal. 2021;* 2b, *Bal. 2575;* 33p, *Bal. 8449;* 26q, *Bal. 8619;* 5a, *Bal. s.n.;* 30a, *Bal. s.n.;* 9r, *Bal. s.n.*
Origanum vulgare subsp. *hirtum* (Link) A. Terracc. – 19r, *Bal. 2164;* 3c, *Bal. 2572;* 7r, *Bal. 8104*.
Phlomis fruticosa L. – 36r, *Bal. obs.;* 32n, *Bal. obs.;* 46a, *Bal. obs.;* 8a, *Bal. obs.;* 27a, *Bal. obs.*
Phlomis samia L. – 4c, *Bal. 8339;* 12d, *Bal. 8712;* 9a, *Bal. obs.*
Prunella laciniata (L.) L. – 43p, *Bal. 2057;* 3c, *Bal. 2527;* 6r, *Bal. 8143;* 5p, *Bal. 8148;* 12p, *Bal. 8724*.
Salvia fruticosa Mill. – 34a, *Bal. 8491*.
Salvia pomifera subsp. *calycina* (Sm.) Hayek – 32q, *Bal. 2020;* 27q, *Bal. 8595*.
Salvia verbenaca L. – 41s, *Bal. 6192;* 26r, *Bal. 8614;* 13r, *Bal. 8785;* 9r, *Bal. 8818*.
Salvia verticillata L. subsp. *verticillata* – 33p, *Bal. 8438;* 26r, *Bal. 8616.*
Salvia virgata Jacq. – 32r, *Bal. 1844*.
Salvia viridis L. – 30n, *Bal. 8572*.
Scutellaria rupestris subsp. *parnassica* (Boiss.) Greuter & Burdet – 30r, *Bal. 8414;* 33p, *Bal. 8448*.
Sideritis purpurea Talbot ex Benth. – 7r, *Bal. 8101;* 33q, *Bal. 8439;* 9q, *Bal. 8807*.
Stachys graeca Boiss. & Heldr. – 9r, *Bal. 8808.*
Stachys spinulosa Sm. – 37r, *Bal. 1769;* 33p, *Bal. 8436*.
Teucrium capitatum L. subsp. *capitatum* – 2c, *Bal. 2573;* 48p, *Bal. 8251;* 33p, *Bal. s.n.;* 30r, *Bal. s.n.*
Teucrium chamaedrys L. subsp. *chamaedrys* – 2c, *Bal. 2574;* 4c, *Bal. 8338;* 26q, *Bal. 8618.*
Teucrium flavum subsp. *hellenicum* Rech. f. – 33q, *Bal. 8437.*
Teucrium scordium L. subsp. *scordioides* (Schreb.) Arcang. – 34m, *Bal. 8516*.
Thymbra capitata (L.) Cav. – 36r, *Bal. 2645*.
Thymus longicaulis subsp. *chaubardii* (Rchb. f.) Jalas – 2c, *Bal. 1953;* 43c, *Bal. 2053;* 4c, *Bal. 8340.*

LAURACEAE
Laurus nobilis L. – 34a, *Bal. 8535*.

LINACEAE
Linum bienne Mill. – 28r, *Bal. s.n.*
Linum corymbulosum Rchb. – 2c, *Bal. 2543;* 30r, *Bal. 8412;* 33p, *Bal. 8426*.
Linum pubescens subsp. *sibthorpianum* (Margot & Reut.) P.H. Davis – 33p, *Bal. 8427;* 12p, *Bal. 8735*.

LORANTHACEAE
Loranthus europaeus Jacq. – 2e, *Bal. 2523* parasitize on *Quercus pubescens*.

LYTHRACEAE
Lythrum junceum Banks & Sol. – 37m, *Bal. 1770*.

MALVACEAE
Alcea biennis subsp. *cretica* (Weinm.) Valdés – 32r, *Bal. 2631*.
Malva neglecta Wallr. – 5r, *Bal. 8165*.
Malva setigera Schimp. & Spenn. – 33p, *Bal. 8432;* 9q, *Bal. 8811*.
Malva sylvestris L. – 28r, *Bal. 8837;* 24r, *Bal. obs.;* 14r, *Bal. obs*.
Malva unguiculata (Desf.) Alef. – 34p, *Bal. 8484*.

MOLLUGINACEAE
Glinus lotoides L. – 19u, *Bal. 2159*.
This is a rare species in Greece and particularly in Peloponnisos where it has been registered only in one locality near Kalamata (Strid & Tan 1997, dot maps).

MORACEAE
Ficus carica L. subsp. *carica* – 28s, *Bal. obs.;* 26s, *Bal. obs.*

NYCTAGINACEAE
[*Mirabilis jalapa* L.] – 28s, *Bal. obs*.

OLEACEAE
Fraxinus ornus L. – 40a, *Bal. 6173;* 34a, *Bal. 8495;* 32a, *Bal. obs.;* 22a, *Bal. obs.;* 12d, *Bal. obs*.
Phillyrea latifolia L. – 2e, *Bal. 2521;* 40a, *Bal. 6182;* 34a, *Bal. 8540;* 5a, *Bal. s.n.;* 31a, *Bal. obs.;* 9a, *Bal. obs.;* 29a, *Bal. obs.;* 27a, *Bal. obs.;* 22a, *Bal. obs*.

ONAGRACEAE
Epilobium lanceolatum Sebast. & Mauri – 19m, *Bal. 2165*.

OROBANCHACEAE
Bellardia latifolia (L.) Cuatrec. subsp. *latifolia* – 31r, *Bal. 6134*.

Orobanche minor Sm. – 7r, *Bal. 8053*.
Phelipanche nana (Reut.) Soják – 7r, *Bal. 8054*.

PAPAVERACEAE
Papaver apulum Ten. – 4c, *Bal. 8364*.
Papaver rhoeas L. – 2c, *Bal. 1882;* 26s, *Bal. 8628;* 14r, *Bal. 8664*.

PLANTAGINACEAE
Plantago afra L. – 31r, *Bal. 6137;* 33p, *Bal. 8463;* 27r, *Bal. 8602*.
Plantago bellardii All. subsp. *bellardii* – 48p, *Bal. 8216;* 12p, *Bal. 8773*.
Plantago lagopus L. subsp. *lagopus* – 31r, *Bal. 6138;* 34p, *Bal. 8476*.
Plantago lanceolata L. – 2c, *Bal. 1867;* 19u, *Bal. 2519;* 5r, *Bal. 8176;* 30m, *Bal. 8562.*

PLATANACEAE
Platanus orientalis L. – 41k, *Bal. obs.;* 7k, *Bal. obs.;* 36k, *Bal. obs.;* 48k, *Bal. obs.;* 49k, *Bal. obs.;* 28k, *Bal. obs.*

PLUMBAGINACEAE
Armeria canescens (Host) Boiss. – 2c, *Bal. 1948*.
Plumbago europaea L. – 28r, *Bal. 2132*.

POLYGALACEAE
Polygala monspeliaca L. – 2c, *Bal. 2556*.

POLYGONACEAE
Polygonum arenastrum Boreau – 28s, *Bal. 2145*.
Rumex bucephalophorus L. subsp. *bucephalophorus* – 12p, *Bal. 8771*.
Rumex conglomeratus Murray – 37m, *Bal. 2035;* 42m, *Bal. 2092;* 28m, *Bal. 2629*.
Rumex conglomeratus x *Rumex pulcher* – 37m, *Bal. 2033*.
Rumex cristatus DC. – 28m, *Bal. 8585*.
Rumex obtusifolius L. *s.l.* – 37m, *Bal. 1776*.
Rumex pulcher L. subsp. *pulcher* – 4c, *Bal. 8357*.
Rumex pulcher L. *s.l.* – 19u, *Bal. 2516;* 7r, *Bal. 8086*.
Rumex tuberosus L. subsp. *tuberosus* – 2c, *Bal. 1954;* 4c, *Bal. 8393*.
Rumex tuberosus L. *s.l.* – 2c, *Bal. 1876*.

PORTULACACEAE
Portulaca oleracea L. *s.l.* – 28s, *Bal. 2143*.

PRIMULACEAE
Anagallis arvensis L. – 37r, *Bal. s.n.;* 33p, *Bal. 8447;* 12p, *Bal. 8776*.
Cyclamen hederifolium Sol. ex Aiton *s.l.* – 30a, *Bal. 2147;* 34a, *Bal. 8555;* 40a, *Bal. s.n.;* 7k, *Bal. s.n.;* 12d, *Bal. s.n.*
Lysimachia atropurpurea L. – 36r, *Bal. 1850;* 33p, *Bal. 8428;* 14r, *Bal. obs.*
Samolus valerandi L. – 34m, *Bal. 8519*.

RANUNCULACEAE

Anemone apennina subsp. *blanda* (Schott & Kotschy) Nyman – 2c,e, *Bal. 2286;* 40a, *Bal. 6184;* 46a, *Bal. obs*.

Clematis vitalba L. – 28r, *Bal. 2620;* 7k, *Bal. s.n*.

Consolida ajacis (L.) Schur – 8a, *Bal. 8210;* 30n, *Bal. 8570;* 13r, *Bal. 8784*.

Delphinium hellenicum Pawl. – 30r, *Bal. 2652*.

Ficaria cf. *ficarioides* (Bory & Chaub.) Halácsy – 2c, *Bal. 2278*.

F. ficarioides is generally distinct from *F. verna*, but apparently intermediate plants have been observed, e.g., on Mt Klokos in N Peloponnisos, and it is possible they hybridise in areas of contact (Strid 2002). It seems that the above mentioned specimen belongs to this category.

Ficaria verna Huds. *s.l.* – 2c, Bal. 2277.

Helleborus odorus subsp. *cyclophyllus* (A. Braun) Maire & Petitm. – 2e, *Bal. 2302*.

To my knowledge this is the southernmost locality of this Balkan endemic.

Nigella damascena L. – 2c, *Bal. 2010;* 7n, *Bal. 8062;* 33p, *Bal. 8464;* 8r, *Bal. s.n*.

Ranunculus chius DC. – 34p, *Bal. 8528*.

Ranunculus gracilis E.D. Clarke – 2c, *Bal. 1873;* 39a, *Bal. 6166;* 40q, *Bal. 6176;* 5a, *Bal. 8181*.

Ranunculus muricatus L. – 34m, *Bal. 8527;* 30r, *Bal. 8577.*

Ranunculus neapolitanus Ten. – 37m, *Bal. 1767;* 22r, *Bal. 8638;* 9r, *Bal. 8810*.

Ranunculus paludosus Poir. – 28r, *Bal. 8834*.

Ranunculus psilostachys Griseb. – 2c, *Bal. 1874;* 4c, *Bal. 8371*.

Ranunculus sardous Crantz – 19u, *Bal. 2512;* 35m, *Bal. 6112;* 7m*, Bal. 8063.*

Ranunculus sprunerianus Boiss. – 2c, *Bal. 1875*.

Ranunculus velutinus Ten. – 6k, *Bal. 8133;* 12d, *Bal. 8742;* 10g, *Bal. 8789.*

RHAMNACEAE

Paliurus spina-christi Mill. – 37r, *Bal. 2045*.

Rhamnus saxatilis subsp. *prunifolia* (Sm.) Aldén – 4c, *Bal. 8375*.

ROSACEAE

Agrimonia eupatoria L. subsp. *eupatoria* – 12d, *Bal. 8715.*

Aremonia agrimonoides (L.) DC. *s.l.* – 40a, *Bal. 6177;* 5a, *Bal. 8168;* 22d, *Bal. 8637;* 12d, *Bal. 8740*.

Crataegus heldreichii Boiss. – 2c, *Bal. 1877;* 1c, *Bal. 2083;* 4c, *Bal. 8374*.

Crataegus monogyna Jacq. – 2e, *Bal. 2607;* 39a, *Bal. 6165;* 12d, *Bal. 8711*.

Geum urbanum L. – 6k, *Bal. 8124*.

Potentilla micrantha DC. – 2e, *Bal. 2301*.

Potentilla reptans L. – 19u, *Bal. 2517;* 14m, *Bal. 8663*.

Prunus mahaleb L. – 7k, *Bal. 8100;* 22d, *Bal. 8631*.

Pyrus spinosa Forssk. – 2e, *Bal. 2605;* 36r, *Bal. obs.;* 46n, *Bal. obs.;* 48e, *Bal. obs.*

Rosa canina L. – 12d, *Bal. 8761.*

Rosa pulverulenta M. Bieb. – 1c, *Bal. 2059*.

Rosa sempervirens L. – 37r, *Bal. 2034*.

Rubus sanctus Schreb. – 28r, *Bal. 2625.*
Sanguisorba minor subsp. *balearica* (Nyman) Muñoz Garm. & C. Navarro – 37r, *Bal. s.n*.

RUBIACEAE
Crucianella angustifolia L. – 1c, *Bal. 2106;* 2c, *Bal. 2570;* 4c, *Bal. 8367;* 12p, *Bal. s.n.*
Crucianella latifolia L. – 37r, *Bal. 1789b;* 34p, *Bal. 8488*.
Cruciata laevipes Opiz – 42p, *Bal. 2096;* 7r, *Bal. 8099;* 45s, *Bal. obs.*
Cruciata pedemontana (Bellardi) Ehrend. – 2c, *Bal. 1805*.
Galium aparine L. – 7n, *Bal. 8112;* 28r, *Bal. 8588.*
Galium capitatum Bory & Chaub. – 2c, *Bal. 1808*.
Galium intricatum Margot & Reut. – 2c, *Bal. 1957;* 7r, *Bal. 8111;* 5a, *Bal. 8170;* 34p, *Bal. 8520*.
Galium murale (L.) All. – 28t, *Bal. 8590b*.
Galium peloponnesiacum Ehrend. & Krendl – 2c, *Bal. 1806;* 2c, *Bal. 1955;* 43c, *Bal. 2094*.
Galium tenuissimum M. Bieb. – 43c, *Bal. 2091*.
Galium verticillatum Danthoine – 2b, *Bal. 1804;* 43c, *Bal. 2072;* 4b, *Bal. 8389.*
Galium verum L. subsp. *verum* – 8r, *Bal. 8209;* 14r, *Bal. 8666*.
Rubia peregrina L. – 34a, *Bal. 8554*.
Sherardia arvensis L. – 37r, *Bal. 1789a;* 2c, *Bal. 1807;* 31r, *Bal. s.n.;* 32o, *Bal. s.n.;* 7n, *Bal. s.n.;* 6n, *Bal. s.n.;* 5p, *Bal. s.n.;* 8r, *Bal. s.n.;* 48p, *Bal. s.n.;* 4c, *Bal. s.n.;* 33p, *Bal. s.n.;* 9r, *Bal. s.n*.
Theligonum cynocrambe L. – 7r, *Bal. 8094;* 32o, *Bal. s.n.;* 41t, *Bal. s.n.;* 34p, *Bal. s.n.;* 28t, *Bal. obs*.

SALICACEAE
Salix alba L. – 14m, *Bal. 8661*.

SANTALACEAE
Osyris alba L. – 36j, *Bal. 1772*.

SAXIFRAGACEAE
Saxifraga hederacea L. – 41t, *Bal. 6188*.
Saxifraga rotundifolia L. *s.l.* – 4b, *Bal. 8362*.
Saxifraga tridactylites L. – 47t, *Bal. 6205*.

SCROPHULARIACEAE
Scrophularia canina subsp. *bicolor* (Sm.) Greuter – 7r, *Bal. 8056;* 44r, *Bal. obs.;* 29r, *Bal. obs.;* 27r, *Bal. obs*.
Scrophularia peregrina L. – 47s, *Bal. 6207*.
Verbascum daenzeri (Fauché & Chaub.) Kuntze – 12q, *Bal. 8739*.
Verbascum macrurum Ten. – 30r, *Bal. 2150;* 43p, *Bal. obs.;* 29r, *Bal. obs.*

SIMAROUBACEAE
[*Ailanthus altissima* (Mill.) Swingle] – 15r, *Bal. obs.;* 17r, *Bal. obs*.

ULMACEAE
Ulmus minor Mill. subsp. *minor* – 48k, *Bal. 6198*.

URTICACEAE
Parietaria judaica L. – 45t, *Bal. obs.;* 28t, *Bal. obs.;* 26t, *Bal. obs.;* 15s, *Bal. obs.*
Urtica dioica L. – 28r, *Bal. 2618;* 7k, *Bal. 8113;* 4c, *Bal. 8392;* 41n, *Bal. obs.;* 44s, *Bal. obs.;* 47n, *Bal. obs.;* 6k, *Bal. obs*.

VALERIANACEAE
Centranthus ruber subsp. *sibthorpii* (Boiss.) Hayek – 34i, *Bal. 8499*.
Valeriana italica Lam. – 2b, *Bal. 1860;* 9q, *Bal. 8814*.
Valerianella dentata (L.) Pollich – 48p, *Bal. 8256;* 34p, *Bal. 8534*.
Valerianella discoidea (L.) Loisel. – 2c, *Bal. 1880*.
Valerianella echinata (L.) DC. – 2c, *Bal. 1879;* 4c, *Bal. 8331*.
Valerianella eriocarpa Desv. – 9r, *Bal. 8816*.
Valerianella turgida (Steven) Betcke – 2c, *Bal. 1881;* 4c, *Bal. 8330*.

VERBENACEAE
Verbena officinalis L. – 28m, *Bal. 8584*.

VERONICACEAE
[*Antirrhinum majus* L. *s.l.*] – 44s, *Bal. obs.;* 28s, *Bal. obs.;* 26s, *Bal. obs.*
[*Cymbalaria muralis* G. Gaertn., B. Mey. & Scherb. subsp. *muralis*] – 28t, *Bal. 8590a.*
Digitalis laevigata subsp. *graeca* (Ivanina) Werner – 5p, *Bal. 8182;* 34p, *Bal. 8489*.
Kickxia elatine subsp. *crinita* (Mabille) Greuter – 30r, *Bal. 8569;* 26r, *Bal. 8625*.
Linaria pelisseriana (L.) Mill. – 48p, *Bal. 8232.*
Linaria simplex Desf. – 4c, *Bal. 8332*.
Veronica anagallis-aquatica L. subsp. *anagallis-aquatica* – 35m, *Bal. 6113;* 34m, *Bal. 8531*.
Veronica arvensis L. – 32r, *Bal. 6132;* 41s, *Bal. 6193;* 5r, *Bal. 8171*.
Veronica chamaedrys subsp. *chamaedryoides* (Bory & Chaub.) M.A. Fisch. – 12d, *Bal. 8713;* 10g, *Bal. 8790*.
Veronica cymbalaria Bodard – 47t, *Bal. 6206.*
Veronica glauca subsp. *chaubardii* (Boiss. & Reut.) Maire & Petitm. – 2c, *Bal. 1865;* 43c, *Bal. 2079;* 4c, *Bal. 8335*.
Veronica hederifolia L. – 2c, *Bal. 2281.*
[*Veronica persica* Poir.] – 28r, *Bal. 2229;* 32o, *Bal. 6118;* 41s, *Bal. 6195.*
Veronica triloba (Opiz) Opiz – 41s, *Bal. 6194.*

VIOLACEAE
Viola kitaibeliana Schult. – 2c, *Bal. 1888*.
Viola odorata L. – 2e, *Bal. 2300*.
Viola phitosiana Erben – 2c, *Bal. 2299*.

ZYGOPHYLLACEAE
Tribulus terrestris L. – 28s, *Bal. 2142.*

MONOCOTYLEDONES

ALISMATACEAE
Alisma plantago-aquatica L. – 37m, *Bal. 2032*.

ALLIACEAE
Allium amethystinum Tausch – 34p, *Bal. 8465;* 27q, *Bal. 8596*.
Allium ampeloprasum L. – 32r, *Bal. 2633;* 13r, *Bal. 8782*.
Allium chamaespathum Boiss. – 30a, *Bal. 2148*.
Allium flavum subsp. *tauricum* (Besser ex Rchb.) K. Richt. – 2c, *Bal. 2568*.
Allium guttatum subsp. *tenorei* (Parl.) Soldano – 2c, *Bal. 2565*.
Allium subhirsutum L. subsp. *subhirsutum* – 34a, *Bal. 8492*.

AMARYLLIDACEAE
Galanthus reginae-olgae subsp. *vernalis* Kamari – 2e, *Bal. 2298*.
Sternbergia lutea (L.) Spreng. subsp. *lutea* – 30r, *Bal. 2129;* 2c, *Bal. 2294.*

ARACEAE
Arum italicum Mill. subsp. *italicum* – 7k, *Bal. 8037.*

ASPARAGACEAE
Asparagus acutifolius L. – 2e, *Bal. 2520;* 30a, *Bal. 6153;* 7k, *Bal. 8087.*

ASPHODELACEAE
Asphodeline lutea (L.) Rchb. – 34i, *Bal. 8500*.
Asphodelus ramosus L. subsp. *ramosus* – 37m, *Bal. 1775;* 32r, *Bal. 2643;* 39a, *Bal. 6170;* 30n, *Bal. 8565;* 14r, *Bal. obs*.

All the above mentioned specimens belong to var. *nervosus* (Pomel) Z. Díaz & Valdés. Their large fruits, 10-12 × 8-9 mm (*Bal. 2643*), 9-10 x 7-9 mm (*Bal. 1775*) meet the size expected in *A. nervosus* Pomel (= *A. messeniacus* Heldr. ex Halácsy). Var. *nervosus* occurs also in Mt Likeo (*Bal. 6110*, with fruits 9-10 × 8 mm and length of tepals up to 13-14 mm). It covers also the area between the two mountains (*Bal. obs.*). These specimens confirm the expected distribution of this variety in Greece (Díaz Lifante, *in litt*.). The fruits are larger than those in specimens from Mt Pendelikon (Baliousis 2011) in Attiki, with fruits of 5.5-7.5 × 4-7 mm, which correspond to the var. *ramosus* (= *A. microcarpus* Viv.), as it was delimited in the revision of the genus *Asphodelus* (Díaz Lifante & Valdés 1996).

CYPERACEAE
Carex distachya Desf. – 2c, *Bal. 1901*.
Carex distans L. – 14m, *Bal. 8655*.
Carex flacca subsp. *serrulata* (Spreng.) Greuter – 37m, *Bal. 1782;* 2c, *Bal. 2594;* 12d, *Bal. 8731*.
Carex otrubae Podp. – 37m, *Bal. 2042;* 14m, *Bal. 8652*.
Cyperus fuscus L. – 19u, *Bal. 2158*.

Cyperus longus L. *s.l.* – 37m, *Bal. 2043;* 32m, *Bal. 2638;* 28m, *Bal. 8580*.
Scirpoides holoschoenus (L.) Soják – 37m, *Bal. 2044;* 42m, *Bal. 2095;* 32m, *Bal. 2642;* 28m, *Bal. 8582;* 14m, *Bal. 8654*.

DIOSCOREACEAE
Dioscorea communis (L.) Caddick & Wilkin – 6k, *Bal. 8131;* 10p, *Bal. 8792*.

HYACINTHACEAE
Bellevalia dubia subsp. *boissieri* (Freyn) Feinbrun – 2c, *Bal. 1853;* 32r, *Bal. s.n.*
Drimia numidica (Jord. & Fourr.) J.C. Manning & Goldblatt – 31r, *Bal. obs.;* 39a, *Bal. obs.;* 36r, *Bal. obs.;* 27r, *Bal. obs*.
Muscari comosum (L.) Mill. – 7r, *Bal. 8088;* 4c, *Bal. 8325*.
Muscari neglectum Guss. ex Ten. – 2c, *Bal. 1852;* 30r, *Bal. s.n.*
Ornithogalum collinum Guss. subsp. *collinum* – 30a, *Bal. 2256;* 32o, *Bal. s.n.;* 39o, *Bal. obs*.
Ornithogalum fimbriatum subsp. *gracilipes* (Zahar.) Landström – 2c, *Bal. 2293;* 4c, *Bal. 8329.*
Ornithogalum montanum Ten. – 2c, *Bal. 1851;* 4c, *Bal. 8328*.
Ornithogalum nutans L. – 4c, *Bal. 8327*.
Ornithogalum prasinantherum Zahar. – 14r, *Bal. 8692*.
Ornithogalum sibthorpii Greuter – 30a, *Bal. 2231*.
Prospero autumnale (L.) Speta – 30a, *Bal. 2131*.
Scilla nivalis L. *s.l.* – 2c,e, *Bal. 2289.*

IRIDACEAE
Crocus cancellatus subsp. *mazziaricus* (Herb.) B. Mathew – 2c, *Bal. 2295;* 4c, *Bal. 8341.*
Crocus hadriaticus Herb. – 30r, *Bal. 2130*.
Crocus nivalis Bory & Chaub. – 2c,e, *Bal. 2297*.
Crocus olivieri J. Gay subsp. *olivieri* – 2c, *Bal. 2296*.
Gladiolus italicus Mill. – 32n, *Bal. 8839*.
[*Iris germanica* L.] – 28n, *Bal. obs.*
Iris tuberosa L. – 30a, *Bal. obs*.
Iris unguicularis subsp. *carica* (Wern. Schultze) A.P. Davis & Jury – 30r, *Bal. 2239;* 40r, *Bal. 6180*.
Romulea linaresii subsp. *graeca* Bég. – 30a, *Bal. 2230*.

JUNCACEAE
Juncus bufonius L. – 30m, *Bal. 8561;* 14r, *Bal. 8685*.
Juncus inflexus L. – 42m, *Bal. 2093;* 34m, *Bal. 8512;* 28m, *Bal. 8581;* 14m, *Bal. 8653.*
Luzula forsteri (Sm.) DC. *s.l.* – 40a, *Bal. 6183;* 5a, *Bal. 8177;* 12d, *Bal. 8721;* 10g, *Bal. 8788*.

LILIACEAE
Gagea amblyopetala Boiss. & Heldr. – 2c, *Bal. 2291*.
Gagea bohemica (Zauschn.) Schult. & Schult. f. – 2c, *Bal. 2292*.
Gagea graeca (L.) Irmisch – 36r, *Bal. 6208*.
Gagea villosa (M. Bieb.) Sweet – 2c, *Bal. 2290*.

ORCHIDACEAE
Anacamptis coriophora subsp. *fragrans* (Pollini) R.M. Bateman, Pridgeon & M.W. Chase – 30r, *Bal. 8574*.
Anacamptis laxiflora (Lam.) R.M. Bateman, Pridgeon & M.W. Chase subsp. *laxiflora* – 14r, *Bal. 8665*.
Anacamptis pyramidalis (L.) Rich. – 20r, *Bal. 8642;* 8r, *Bal. obs.;* 14r, *Bal. obs.;* 33p, *Bal. obs.;* 22r, *Bal. obs.*
Epipactis helleborine (L.) Crantz subsp. *helleborine* – 14f, *Bal. 8670;* 12d, *Bal. 8704*.
Ophrys lutea subsp. *galilaea* (H. Fleischm. & Bornm.) Soó – 30a, *Bal. obs*.

POACEAE
Achnatherum bromoides (L.) P. Beauv. – 32a, *Bal. 2641;* 34p, *Bal. 8541*.
Aegilops biuncialis Vis. subsp. *biuncialis* – 2c, *Bal. 2001a;* ibid., *Bal. 2587;* 5p, *Bal. 8198b;* 4c, *Bal. 8258b;* 33p, *Bal. 8443b*.
Aegilops comosa Sm. subsp. *comosa* – 2c, *Bal. 2001c;* ibid., *Bal. 2588;* 6n, *Bal. 8140a;* 5p, *Bal. 8198a;* 33p, *Bal. 8443a;* 9r, *Bal. 8832*.
Aegilops markgrafii (Greuter) Hammer – 34p, *Bal. 8508*.
Aegilops neglecta Bertol. subsp. *neglecta* – 2c, *Bal. 2586;* 32r, *Bal. 2637;* 7n, *Bal. 8047;* 8a, *Bal. 8211;* 4c, *Bal. 8258a;* 33p, *Bal. 8442;* 12p, *Bal. 8762*.
Aegilops triuncialis L. subsp. *triuncialis* – 2c, *Bal. 2001b;* ibid., *Bal. 2589;* 7n, *Bal. 8046;* 6n, *Bal. 8140b;* 33p, *Bal. 8441;* 12p, *Bal. 8759*.
Aira elegantissima Schur – 5a, *Bal. 8194;* 4c, *Bal. 8309*.
Alopecurus myosuroides Huds. – 41s, *Bal. 6196*.
Alopecurus rendlei Eig – 7r, *Bal. 8045;* 14m, *Bal. 8660*.
Anthoxanthum odoratum L. – 48k, *Bal. 8245;* 12d, *Bal. 8720*.
Avena barbata Link subsp. *barbata* – 14r, *Bal. 8657;* 12p, *Bal. 8747*.
Avena sterilis subsp. *ludoviciana* (Durieu) Gillet & Magne – 28r, *Bal. 8589;* 37r, *Bal. s.n.*
Brachypodium glaucovirens (Murb.) Sagorski – 28m, *Bal. 2623*.
Brachypodium retusum (Pers.) P. Beauv. – 2c, *Bal. 1998;* 43c, *Bal. 2087;* 42c, *Bal. 2102;* 5a, *Bal. s.n.;* 4c, *Bal. 8275;* 34a, *Bal. s.n*.
Brachypodium sylvaticum (Huds.) P. Beauv. subsp. *sylvaticum* – 37m, *Bal. 2041;* 7k, *Bal. 8041;* 12d, *Bal. 8709*.
Briza humilis M. Bieb. – 4b, *Bal. 8271*.
Briza maxima L. – 37r, *Bal. 1784;* 7n, *Bal. s.n.;* 49r, *Bal. obs.*
Bromus alopecuros Poir. *s.l.* – 37r, *Bal. 1787;* 7r, *Bal. 8040;* 30r, *Bal. 8417.*
Bromus hordeaceus subsp. *mediterraneus* (H. Scholz & F.M. Vázquez) H. Scholz – 2c, *Bal. 1992*.
Bromus intermedius Guss. subsp. *intermedius* – 37r, *Bal. 1788;* 43c, *Bal. 2103;* 2c, *Bal. 2577;* 5a, *Bal. 8193;* 4c, *Bal. 8273;* 12p, *Bal. 8774.*
Bromus madritensis L. *s.l.* – 2c, *Bal. 1898;* 5p, *Bal. 8197*.
Bromus parvispiculatus H. Scholz – 2c, *Bal. 1892*.
A recently described species. In Peloponnisos it has been registered from a few localities of its northern parts. The species is certainly undercollected (Scholz 2008).
Bromus scoparius L. – 48p, *Bal. 8236*.
Bromus squarrosus L. subsp. *squarrosus* – 2c, *Bal. 1994;* 43c, *Bal. 2086;* 4c, *Bal. 8274.*

Bromus sterilis L. – 2c, *Bal. 1996;* 43c, *Bal. 2085;* 7n, *Bal. 8050;* 48p, *Bal. s.n.;* 4c, *Bal. 8269;* 34p, *Bal. 8506;* 14r, *Bal. 8659*.
Bromus tectorum L. – 2c, *Bal. 1899;* 43p, *Bal. 2054;* 4c, *Bal. 8264*.
Catapodium rigidum (L.) C.E. Hubb. – 2c, *Bal. 1997;* 5p, *Bal. 8195;* 34p, *Bal. 8543;* 4c, *Bal. s.n.;* 33p, *Bal. s.n.;* 30r, *Bal. s.n.*
Crypsis alopecuroides (Piller & Mitterp.) Schrad. – 19u, *Bal. 2157*.
This is the first record of this species from Peloponnisos.
Crypsis schoenoides (L.) Lam. – 19u, *Bal. 2156*.
Cynosurus echinatus L. – 2c, *Bal. 1897;* 7n, *Bal. 8039;* 30r, *Bal. 8418;* 33p, *Bal. s.n.;* 34p, *Bal. s.n.;* 30n, *Bal. s.n.*
Cynosurus effusus Link – 5a, *Bal. 8200;* 4c, *Bal. 8276*.
Dactylis glomerata subsp. *hispanica* (Roth) Nynan – 2c, *Bal. 1900;* 4c, *Bal. 8262;* 12d, *Bal. s.n.*
Dasypyrum villosum (L.) P. Candargy – 43p, *Bal. 2084;* 7n, *Bal. 8044.*
Festuca arundinacea Schreb. *s.l.* – 7k, *Bal. 8049.*
Festuca jeanpertii subsp. *achaica* (Markgr.-Dann.) Markgr.-Dann. – 2c, *Bal. 1889;* 1c, *Bal. 2089;* 43c, *Bal. 2101*.
Festuca jeanpertii (St.-Yves) Markgr. subsp. *jeanpertii* – 2c, *Bal. 2585a*.
Gastridium sp. – 34p, *Bal. 8530;* 12p, *Bal. 8746*.
Gaudinia fragilis (L.) P. Beauv. – 37r, *Bal. 1790;* 32r, *Bal. 2014b;* 6n, *Bal. 8142;* 48p, *Bal. 8244;* 30r, *Bal. 8419;* 33p, *Bal. 8444;* 14r, *Bal. 8658.*
Gaudiniopsis macra (M. Bieb.) Eig *s.l.* – 42p, *Bal. 2105*.
Hainardia cylindrica (Willd.) Greuter – 32r, *Bal. 2014a;* 30r, *Bal. 8416;* 14r, *Bal. 8686.*
Helictochloa agropyroides (Boiss.) Romero Zarco – 4c, *Bal. 8268*.
Helictotrichon convolutum (C. Presl) Henrard – 2c, *Bal. 2579*.
Holcus lanatus L. subsp. *lanatus* – 42m, *Bal. 2100;* 32m, *Bal. 2644*.
Hordeum bulbosum L. – 2c, *Bal. 2581;* 6n, *Bal. 8141*.
Hordeum geniculatum All. – 7r, *Bal. 8052*.
Hordeum murinum subsp. *leporinum* (Link) Arcang. – 2c, *Bal. 1891;* 7r, *Bal. 8043;* 4c, *Bal. 8265;* 34p, *Bal. 8556.*
Hyparrhenia hirta (L.) Stapf – 33p, *Bal. 8440;* 26r, *Bal. 8626;* 27r, *Bal. obs*.
Lolium multiflorum Lam. – 37m, *Bal. 1785*.
Lolium perenne L. – 7n, *Bal. 8042*.
Lolium cf. *perenne* L. – 19u, *Bal. 2513*.
Lolium rigidum Gaudin subsp. *rigidum* – 2c, *Bal. 1999;* 32r, *Bal. s.n.;* 37r, *Bal. 2031b;* 43c, *Bal. 2088;* 42p, *Bal. 2104;* 7n, *Bal. 8077;* 5p, *Bal. 8201;* 4c, *Bal. 8266;* 30r, *Bal. 8415;* 34p, *Bal. 8507;* 14r, *Bal. 8687;* 12p, *Bal. 8748*.
Melica ciliata L. subsp. *ciliata* – 2c, *Bal. 1990;* ibid., *Bal. 2591*.
Melica uniflora Retz. – 10g, *Bal. 8787*.
Phleum phleoides (L.) H. Karst. – 2c, *Bal. 1893;* 43c, *Bal. 2090;* 4c, *Bal. 8259*.
Piptatherum miliaceum (L.) Coss. *s.l.* – 28r, *Bal. obs*.
Poa annua L. subsp. *annua* – 19m, *Bal. 2514*.
Poa bulbosa L. *s.l.* – 2c, *Bal. 1894;* 4c, *Bal. 8261;* 7n, *Bal. s.n.;* 12p, *Bal. s.n*.
Poa compressa L. – 2c, *Bal. 2585b*.

Poa timoleontis Heldr. ex Boiss. – 2c, *Bal. 1890*.
Poa trivialis subsp. *sylvicola* (Guss.) H. Lindb. – 37m, *Bal. 1786;* 7k, *Bal. 8048*.
Polypogon monspeliensis (L.) Desf. – 37m, *Bal. 2039;* 34m, *Bal. 8503*.
Polypogon viridis (Gouan) Breistr. – 34m, *Bal. 8537*.
Psilurus incurvus (Gouan) Schinz & Thell. – 31r, *Bal. 6136;* 5p, *Bal. 8196;* 48p, *Bal. 8243;* 12p, *Bal. 8756*.
Rostraria cristata (L.) Tzvelev – 48p, *Bal. 8235;* 34p, *Bal. 8505.*
[*Setaria pumila* (Poir.) Roem. & Schult.] – 28s, *Bal. 2152.*
Stipa capensis Thunb. – 30r, *Bal. 8579*.
Stipa holosericea Trin. subsp. *holosericea* – 2c, *Bal. 2005.*
Trachynia distachya (L.) Link – 33p, *Bal. 8445;* 27r, *Bal. 8598;* 12p, *Bal. 8779;* 9r, *Bal. s.n*.
Vulpia ciliata Dumort. subsp. *ciliata* – 2c, *Bal. 1895*; 5p, *Bal. 8199;* 4c, *Bal. 8263*.
Vulpia myuros (L.) C.C. Gmel. – 2c, *Bal. 2004;* 12p, *Bal. 8736*.

RUSCACEAE
Ruscus aculeatus L. – 7k, *Bal. 8089;* 6k, *Bal. obs.*

SMILACACEAE
Smilax aspera L. – 34a, *Bal. 8552;* 25a, *Bal. obs*.

Vegetation

The largest part of the investigated area is covered by open scrub, macchie and deciduous Oak forests. Transitional vegetation types also exist depending on the intense of human influences and bioclimatic conditions.

The dominant vegetation type of the mountain is *Quercus coccifera* scrub in various stages of transition to dense impenetrable macchie. It covers mainly the lower altitudinal zone of the mountain (500-1100 m) predominantly on limestone. As they occupy the inhabited zone these formations have received great pressure by man especially in the past. *Quercus coccifera* is almost always accompanied by *Phillyrea latifolia* and frequently both species constitute a characteristic association. These formations are often interspersed with scattered individuals of deciduous elements such as *Quercus pubescens*, *Fraxinus ornus*, *Crataegus* spp., *Acer monspessulanum* subsp. *monspessulanum*, *Carpinus orientalis* and *Pistacia terebinthus* subsp. *terebinthus* the latter especially at lower altitudes. Open space of overgrazed units is often covered by *Phlomis fruticosa* dominated phrygana vegetation. This is more obvious in western parts of the mountain along the road which connects the villages Kardaritsi and Paralogi.

In places where topoclimatic and edaphic conditions are appropriate e.g. localities with more humid conditions and deeper soil *Quercus pubescens*, *Carpinus orientalis* and *Fraxinus ornus* form pure stands or mixed deciduous woods. These formations are indicators of local differentiations in ecological conditions. *Quercus pubescens* presents its optimum of growth in northern slopes of the mountain. In this case it alters perceptibly the physiognomy of *Quercus coccifera- Phillyrea latifolia* communities described earlier. Its cover increases with altitude while the proportion of sclerophyllus elements declines. Its

abundance ranges from a few isolated individuals in 600 m to numerous vigorous and tall plants at approximately 1000 m. In the latter zone *Quercus pubescens* forms open forests where *Quercus coccifera* constitutes the shrub layer.

Quercus frainetto forests locally intermixed with *Quercus pubescens* or *Fraxinus ornus* occupy a relatively large area in eastern parts of the mountain, mainly around Nasia village. Characteristic species of the underfloor are the following: *Brachypodium sylvaticum*, *Crepis fraasii* subsp. *fraasii*, *Geranium asphodeloides* subsp. *asphodeloides*, *Veronica chamaedrys* subsp. *chamaedryoides*, *Epipactis helleborine* subsp. *helleborine*, *Ranunculus velutinus*, *Phlomis samia, Aremonia agrimonoides s.l.*, *Pulicaria odora*, *Crataegus monogyna, Cyclamen hederifolium.* Open spaces are characterized by *Pteridium aquilinum* subsp. *aquilinum.* The presence of many young individuals of *Quercus frainetto* indicates good rates of regeneration.

The upper zone of the mountain above 1100 or 1200 m is deforested. It is characterized by stony meadows which are occasionally interrupted by rocky outcrops. The meadows are interspersed with strongly browsed shrubs of *Quercus coccifera*, *Crataegus heldreichii* and solitary trees of *Quercus pubescens*. Characteristic species of the herb layer are the following: *Scandix australis* subsp. *grandiflora*, *Alyssum siculum*, *Aethionema saxatile* subsp. *graecum*, *Ornithogalum montanum*, *Lamium garganicum* subsp. *striatum*, *Thymus longicaulis* subsp. *chaubardii*, *Veronica glauca* subsp. *chaubardii*, *Astragalus depressus* subsp. *depressus*, *Geranium macrostylum*, *Myosotis sylvatica* subsp. *cyanea*, *Corydalis solida* subsp. *incisa*, *Sedum amplexicaule* subsp. *tenuifolium*, *Ranunculus psilostachys*, *Eryngium amethystinum.* It hosts also a significant number of Greek endemics relatively rare in the area such as the following: *Geocaryum parnassicum*, *Cerastium illyricum* subsp. *brachiatum*, *Ornithogalum fimbriatum* subsp. *gracilipes*, *Aristolochia microstoma*, *Erysimum pectinatum*, *Sedum laconicum* subsp. *laconicum*. Grass cover is relatively high and dominated by *Festuca jeanpertii s.l.*, *Phleum phleoides*, *Brachypodium retusum* and *Poa bulbosa*. Patches with deeper soil host thick populations of herbaceous species such as *Capsella bursa-pastoris*, *Trifolium stellatum*, *Trifolium nigrescens*, *Stellaria* spp., *Sisymbrium officinale*, *Geranium molle*, *Urtica dioica*. Their floristic composition is similar to those of pastures in the lower altitudinal zone. It is obvious that one of the main ecological factors that have shaped the physiognomy of the upper part of the mountain is grazing by goats and sheep. Small occurrences of flysch in this zone are easily distinguished dy the predominance of *Pteridium aquilinum* subsp. *aquilinum.*

Vegetation units with *Abies cephalonica* are absent though this species is relatively abundant in the nearby Mt Lambia. There seems to be no restrictions related to bioclimatic or edaphic conditions and the upper parts of the mountain could potentially sustain such formations.

Finally, an extensive area with conglomerates in the lower altitudinal zone of the mountain (200-500 m) south of the village Voutsis bears a floristically differentiated type of macchie consisting of *Quercus coccifera*, *Arbutus unedo*, *Erica arborea*, *Pistacia lentiscus* and *Calicotome villosa.* The lower altitude, the geological substrate and the relatively high air humidity favored the development of this type of macchie.

Streams dispersed all over the investigated area are often lined by *Platanus orientalis* woods. Their floristic composition is strongly influenced by man as many of them cross inhabited areas.

Discussion

According to the present investigation, 650 taxa were found to comprise the vascular flora of Mt Aphrodisio. *Crypsis alopecuroides* is a new record for Peloponnisos. The largest in number of taxa families are the following: *Fabaceae* (90), *Asteraceae* (73), *Poaceae* (69).

The endemic vascular flora consists of 29 taxa (4.5 %). It includes some rare or local taxa such as *Geocaryum parnassicum*, *Aristolochia microstoma*, *Alkanna methanaea*, *Erysimum asperulum*, *Erysimum pectinatum*, *Anthemis brachmannii*, *Silene gigantea* subsp. *hellenica*, *Delphinium hellenicum*, *Galium capitatum*, *Verbascum daenzeri*, *Viola phitosiana*. It seems that there is a higher proportion of Greek endemics in higher altitudinal zone as 11 (37.9 %) of them were found exclusively at altitudes above 1000 m. There are only three regional endemics of Peloponnisos, *Anthemis brachmannii*, *Erysimum pectinatum* and *Silene nutabunda*, growing on the mountain. This is a characteristic difference with the flora of Mt Likeo (Baliousis 2013) which comprises nine taxa of this chorological category. The latter mountain is situated at about the same longitude but in southern Peloponnisos and as a result it includes a number of regional endemics with distribution confined to southern Peloponnisos. Both mountains have about the same size and the same geological history as they belong to the same geotectonic unit. Additionally, they have been investigated to the same extent by the same author. Thus their difference in number of endemics can presumably be attributed to the southern geographical position of Mt Likeo. Balkan endemics are represented by 22 taxa (3.4 %). The number of adventive taxa is rather small (11 taxa) as compared to the ones of mountains which include heavily urbanized areas such as Mt Pendelikon (Baliousis & Yannitsaros 2011; Baliousis 2011).

The physiognomy of the vegetation is dominated by *Quercus coccifera*. The most important deciduous element is *Quercus pubescens*, a basic constituent of the vegetation types discerned in northern slopes. Finally *Quercus frainetto* forms pure or mixed forests in eastern parts of the mountain.

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A list of macromycetes from Calabria (southern Italy)

Abstract

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On the basis of literature data and personal observation, a list of 338 species (319 *Basidiomycetes*, 18 *Ascomycetes* and 1 *Zygomycetes*) belonging to 156 genera included in 70 families is here reported for Calabria. Comparing the literature data with our records we confirmed the presence of 281 species while 57 are new for Calabria.

Key words: fungi, ecology, distribution, *Basidiomycetes*, *Ascomycetes*, *Zygomycetes*.

Introduction

Calabria is one of the Italian regions with the highest rate of forest areas (41%). On a total forest area of 612,931 hectares, 31% of the land area (amounting to 468,000 hectares) are covered by woodland (Iovino & Menguzzato 2000a). The most represented type of vegetation are characterized by the presence of *Fagus sylvatica* L. and *Abies alba* Mill. occasionally mixed with *Pinus nigra* subsp. *laricio* Maire (Ciancio & al. 1995, 2008). Mixed and pure forests of evergreen and deciduous oaks, coppice and *Castanea sativa* Mill. groves, high and low maquis, garrigues and reforestation with Mediterranean pines are also distributed in the territory (Iovino & Menguzzato 2000b).

As reported by Venturella & al. (2011) a remarkable number of macrofungi are present within the different types of vegetation of Calabria. The data reported for Calabria in the Checklist of Basidiomycetes from Italy (Onofri & al. 2005) derived from the lists of macrofungi by C. Lavorato & M. Rotella and, A. Contin (unpublished personal lists), the book of Bernicchia (1990) and the publications of Bernicchia & Padovan (1991), Lavorato & Lavorato (1985) and, Roseti & al. (1998). No other publications on macromycetes of Calabria are available at the time of writing this publication.

In this paper, based on research carried out directly in the field, we confirmed the presence of some macromycetes and provided a list of new species for Calabria.

Materials and Methods

Periodical observation in forest ecosystems in the Ferdinandea territory (Serre Calabresi), prevalently characterized by pure or mixed stand of *F. sylvatica* and *A. alba*, were carried out from 1999 until nowadays. In particular we investigated the woods of Ferdinandea (800-1400 m a.s.l.) and Archiforo (900-1080 m), the localities of Stilo, Bivongi, Brognaturo, Mongiana and, Serra San Bruno (province of Reggio Calabria and Vibo Valentia) and the forest ecosystems belonging to the municipalities of Sorianello, the wood of Prastu, Spadola, Lacina, Monte Pecoraro, Santa Maria and, Certosa di Serra San Bruno. The wood of Archiforo, extended 4913,61 ha, is a Site of Community Importance (SCI, code IT9340121) which almost entirely falls in the municipality of Serra San Bruno (province of Vibo Valentia). The wood represent ca. 26.5 % of the territory of the Regional Natural Park of the Serre.

The collections were made through samplings of each ascoma and basidioma. The surveys were limited to macromycetes that were visible to the naked eye (1 mm in size) (*sensu* Arnolds 1981).

The fungi were identified on fresh based on macro-morphological and microscopic features according to the methodology adopted by Venturella & al. (2015a, 2015b, 2016). The following keys, books and monographies were used for identification: Dennis (1978); Moser (1980); Jülich (1989); Candusso & Lanzoni (1990); Ryvarden and Gilbertson (1993–1994); Courtecuisse & Duhem (1994); Basso (1999); Bernicchia & Gorjón (2010); Breitenbach & Kränzlin (1984, 1986, 1991, 1995, 2000); Robich (2003) and Bernicchia (2005).

Finally the unpublished lists of Lavorato & Rotella and, A. Contin, the book of Bernicchia (1990) and the publications of Bernicchia & Padovan (1991), Lavorato & Rotella (1985) and, Roseti & al. (1998) have been compared with our collections.

The nomenclature of vascular plants follow The Euro+Med PlantBase - The Information Resource for Euro-Mediterranean plant diversity (http: //www.emplantbase.org/home.html) while the nomenclature of fungi is referred to Index Fungorum (http://www.indexfungorum.org/names/names.asp).

Distribution data based on The Universal Transverse Mercator (UTM) are also provided for each taxon.

The herbarium specimens were prepared in a hamper ventilator and kept in the personal Herbarium of G. Pisani and in the Herbarium SAF of the Department of Agricultural and Forest Sciences in the University of Palermo.

Species diversity and ecological notes

The literature data in addition to our research carried out in forest areas of Calabria have shown the presence of 338 species belonging to 156 genera included in 70 families. 60 families belong to the class *Basidiomycetes*, 9 to the class *Ascomycetes* and 1 to the class *Zygomycetes*. The largest number of genera (140) and species (319) belongs to the *Basidiomycetes*. 18 fungi are *Ascomycetes* included in 15 genera and 9 families. *Pilobolus kleinii* Tiegh. (*Pilobolaceae*) is the only species belonging to *Zygomycetes*. Comparing the

literature data with our records we confirmed the presence of 281 species (131 genera and 63 families) (Electronic supplementary file 1) while 57 species (25 genera and 7 families) are first record for Calabria (Electronic supplementary file 2). The presence of these species in the forests of Calabria is not ruled out even in the past but their failure to find by other researchers is certainly to be attributed to climatic factors that have limited their appearance in some years of observation.
The fungi were collected in an altitudinal range of 225-1995 m mainly within the mixed wood of *Abies alba* and *Fagus sylvatica* in the woods Ferdinandea and Archiforo. The fungi were collected mainly in autumn, but depending on the weather conditions of the year, they were also regularly collected in the summer months. Many trees of the Calabrian forests form ectomycorrhiza and this is demonstrated by the high number of species belonging to the families *Russulaceae* (40), *Boletaceae* (32), *Tricholomataceae* (24) and, *Amanitaceae* (13). The saprotrophs are also widely available on different organic residues, on the litter and the many wood residues that are found abundantly in the forests. In the forests of Calabria there are also many species that grow on living plants, on stumps, cones, roots and fallen branches of large and small size. Their appearance is favored by the presence on the Calabrian territory of old-growth forests and by the type of forest management (Ciancio & al. 2005, 2008). They are mainly represented by species of the families *Agaricaceae* (23), *Hygrophoraceae* (9), *Mycenaceae* (9), *Physalacriaceae* (9), *Omphalotaceae* (8) and, *Strophariaceae* (7).

Discussion and Conclusions

Although this study concerns a restricted part of the territory of Calabria the number of species surveyed is sizable. In fact if we compare the diversity of species reported in our survey with that of a wider area of Basilicata (Venturella & al. 2016) we can assume that an extension of field investigation in all the Calabrian territory could show a fungal diversity comparable with that of Sardinia, currently the Italian region with the highest number of fungal species (Venturella & al. 2011). The fungal diversity of Calabria is strongly influenced by plant diversity and species composition in forest ecosystems and the impact of forest management. The high number of ectomycorrhizal fungi (182 species), which corresponds to 53.8 % of the total number of surveyed fungi, is an expression of the good health of the forests of Calabria and the functioning of ecosystems (Amaranthus 1998).

Some interesting species both for their role in the ecosystem than for applicative potential were surveyed during our study. *Pilobolus kleinii*, growing on dung, is a rare species in Italy while *Rhizocybe vermicularis*, recently described by Alvarado & al. (2015), is reported from the Ferdinandea territory in a mixed wood of *Abies alba* and *Fagus sylvatica*. The presence of *Pleurotus columbinus* on dead trunk of *A. alba* in the Archiforo wood increases the number of species of the genus *Pleurotus* in Italy (Zervakis & al. 2014; Venturella & al. 2015a) and the number of oyster mushrooms which can be cultivated on various ligninocellulosic wastes (Mandeel & al. 2005) and investigated for their healing properties (Schillaci & al. 2013). *Schenella simplex*, a species which appears to be exclusively associated with conifers of diverse genera (Estrada Torres & al. 2005) is reported for the first time in a *Castanea sativa* wood. *Ramaria bataillei*, a species known from many European countries, especially from the

Alps in central and western Europe (Franchi & Marchetti 2001), is reported for the first time in Calabria and in southern Italy too. *Tylopilus porphyrosporus* is a widespread species of Europe, especially in the north, but is infrequent in Italy (Watling & Hills 2005). A very important record is that of *Phylloporus pelletieri*, short-listed for inclusion in Appendix I of the Bern Convention, by the European Council for Conservation of Fungi (ECCF), and included on the Red Lists of 12 European countries (Dahlberg & Croneborg 2003). *Sarcodon scabrosus*, a northern European species apparently mycorrhizal with pines (Hrouda 1999) was found in a *Q. ilex* wood of the Ferdinandea territory. The distribution in Italy of *Artomyces pyxidatus*, a widespread species but uncommon in Europe, is scattered (Onofri & al. 2005) as also that of *Cortinarius cyanites*, *C. claricolor*, *Entoloma cetratum*, *Phaeoclavulina abietina* and, *Ramaria largentii*. Data reported in this paper also confirmed the preference of *Alessioporus ichnusanus* for the Mediterranean environment. Finally significant reports are those of *Cystolepiota sistrata*, so far reported only for Lazio, Tuscany and, Trentino Alto Adige (Onofri & al. 2005). The presence of *Amanita spadicea*, a basidiomycetes with predominant distribution in central and northern Italy, and *Clavaria acuta*, reported by some amateur groups only twice in northern Italy and more recently in Sardinia, is noteworthy.

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Current status of *Asplenium sagittatum* (*Aspleniaceae*) in the Maltese islands

Abstract

Mifsud, S., Napier, M., Fenech, S. & Cassar, L. F.: Current status of *Asplenium sagittatum* (*Aspleniaceae*) in the Maltese islands. — Fl. Medit. 26: 69-80. 2016. — ISSN: 1120-4052 printed, 2240-4538 online.

Asplenium sagittatum is a rare, indigenous fern which was assumed extinct in the dated Maltese Red Data book until 2008 when a small number of individuals was rediscovered. New records of this fern are reported, including a large and important population located in the north of mainland Malta. For the first time, the anatomical characters of Maltese material are described and compared with those of material from central Europe. The paper also presents taxonomical clarifications dealing with *A. scolopendrium*, as also the results of a local Red List assessment for this endangered fern.

Key words: *Asplenium scolopendrium*, flora of Malta, Central Mediterranean region, Red List, pteridophytes, ferns.

Introduction

Ten species of ferns are listed in the inventory of Maltese flora, with the latest addition being an endemic subspecies of *Polypodium vulgare* L. (Peroni & al. 2013). The following pteridophytes are known to occur in the Maltese islands: *Selaginella denticulata* (L.) Spring (rare), *Equisetum ramosissimum* Desf. (frequent but of localized distribution), *Adiantum capillus-veneris* L. (frequent), *Anogramma leptophylla* (L.) Link (locally frequent), *Asplenium sagittatum* (DC) Bange (rare), *A. ceterach* L. (rare), *A. trichomanes* L. (rare), *A. marinum* L. (very rare), *Pteridium aquilinum* (L.) Kuhn (very rare) and *Polypodium vulgare* subsp. *melitensis* Peroni A., Peroni G. & Mifsud S. (very rare). *Salvinia natans* (L.) All. was recorded by Gulia (1909) but has not been recorded since and it is hence assumed that this species has either been extirpated within its range in the Maltese Islands or that its presence has, over the course of over a century, been overlooked; an alternative possibility is that the 1909 record was misidentified. Similarly, the authenticity of old records of *Asplenium scolopendrium* L. recorded by Gulia (1909) and Borg (1927) is uncertain, and there is assumed to be misidentification (with *A. sagittatum*), as noted by Sommier & Caruana Gatto (1915) and discussed in further detail below.

In Malta's dated Red List (Lanfranco 1989), *Asplenium marinum* and *A. sagittatum* were listed as possibly extinct, due to lack of substantiated records. However, these species have been rediscovered in small numbers in recent years (Lalov & al. 2008; Mifsud 2010a, 2010b). Recent findings include a large population of *A. sagittatum* at Qammieh, Mellieha, which is described in this contribution. We also present the findings of cytological examination of individuals from this population, to increase knowledge of Maltese material of this species, and to enable comparison with *A. scolopendrium*, which was reported over a century ago (Gulia 1909).

Distribution

Asplenium sagittatum is a species of pan-Mediterranean distribution, found in Spain (including the Balearic islands), France (including Corse), Italy (including Sardinia and Sicily), as well as in Malta, Croatia, Greece, Lebanon, Syria, Israel, Jordan, Libya, Algeria, Tunisia and Morocco (Greuter & al. 1984; GBIF, 2013), Palestine, the Anatolian plateau, and the Aegean islands (GBIF 2013). It has an array of synonyms (= *A. hemionitis* Sw. [non L. 1753]; *Phyllitis hemionitis* Kuntze; *Phyllitis sagittata* (DC.) Guinea & Heywood; *Scolopendrium sagittatum* DC. and *S. hemionitis* Lag.). There has not been full consensus regarding the separation of the genus *Phyllitis* from *Asplenium*; notwithstanding, and without going into the merits of classification and nomenclature, *Asplenium sagittatum* is used in this communication, in concurrence with established classifications such as Euro+Med (2006-), Tropicos (2015), and The Plant List (2013) and in line with recent treatments, for example, by Hassler (2015).

In the Maltese Islands, *Asplenium sagittatum* has been recorded under different synonyms from coastal rocks and wells in various locations (Fig. 1 and Table 1). These include the vicinity of an area referred to as **Mistra rocks,** on the northern coastal stretch of **Nadur,** better known as **Rdum il-Kbir** (Duthie 1872; Caruana Gatto 1892; Sommier & Caruana Gatto 1915; Borg 1927), **Mellieħa** (Caruana Gatto 1892; Gulia 1909; Sommier & Caruana Gatto 1915; Borg 1927), **Għajnsielem** (Borg 1927), **Dwejra** in Gozo (Gulia 1909; Sommier & Caruana Gatto 1915; Borg 1927), **Nadur valley** (Gulia 1909; Sommier & Caruana Gatto 1915), **Xlendi valley** (Gulia 1909; Sommier & Caruana Gatto 1915; Borg 1927**), Ras il-Kala, Qala** (Gulia 1909; Sommier & Caruana Gatto 1915; Borg 1927), **Wied Babu** (Gulia 1909; Borg 1927), **Wied Għomor** (Gulia 1909; Borg 1927), **Għajn Tuffieħa** (Borg 1927), **Wied il-Għasel** (Borg 1927), and wells in **Birkirkara, Lija**, and **Mosta** (Borg 1927).

The lack of substantiated records for several decades after Borg's (1927) records led to the assumption that *A. sagittatum* had possibly become extirpated (Lanfranco 1989), and as a result of its extended absence, this was subsequently considered to have become extinct locally (Tabone 2007). However, in April 2008, Lalov & al. (2008) carried out numerous field searches which led to its rediscovery at five different sites (Table 1: pop 1-5). Their records consisted of populations with 25 individuals or less. In March 2009, one of the authors [SM] found a sizeable population of 30–40 specimens (including young sporophytes) in a deep fissure within the scree at Mistra rocks in Gozo (Table 1: pop6), and an additional small cluster of four specimens two months later (Table 1: pop7). The extent of its local distribution was further broadened when the same author discovered scattered specimens within the scree of Rdum Majjiesa on October 2010 (Table 1: pop8).

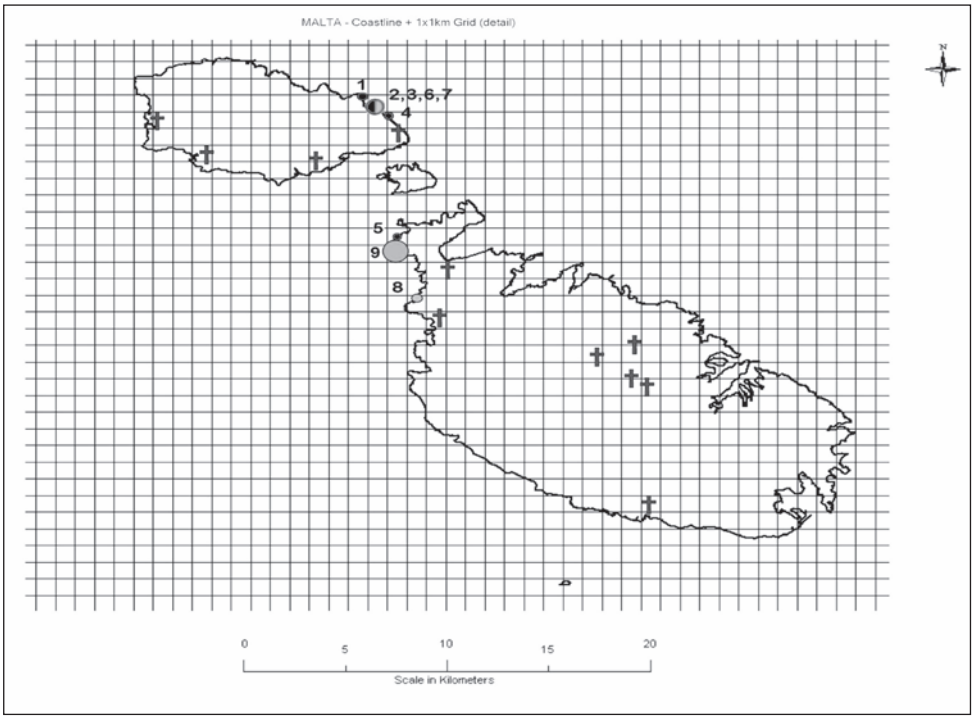

Fig. 1. Distribution of *Asplenium sagittatum* in the Maltese islands. Legend: Circles indicate populations which have been rediscovered during the last eight years - black by Lalov & al. (2008) only; gray by present authors during the last six years (of which some have already been reported by Lalov & al (2008)); numbers refer to toponyms in table 1; † indicate historical records which have not been reconfirmed in recent years.

In May of 2015, three of the present authors [SF, SM and LFC] were conducting fieldwork to assess the status of *Hyoseris frutescens* Brullo & Pavone within il-Qammieh area, Mellieha (Fenech 2015), when a large population of ferns with long, unlobed fronds was observed at the base of a relatively dark, inaccessible limestone fissure. (Table 1: pop9). Due to the inaccessibility of the population, a second visit was planned with appropriate abseiling equipment. This latest discovery, on which the present communication is based, comprises a large population within a deep crevice at Qammieh, L-Ahrax tal-Mellieha.

Habitat context

The Maltese islands, comprised almost entirely of sedimentary rocks of Tertiary age, lie on the Siculo-Tunisian sill, (Schembri 1997; Cassar 2010). The islands support no perennial fluvial sources (beyond sparse ephemeral streams, fed by seepage from spring-lines) and few permanent bodies of water (with the exception of few small wetlands dependent on seasonal run-off during the wet season). The highest elevations are 253 m a.s.l. and 190 m a.s.l. on the islands of Malta and Gozo, respectively (Schembri 1997; Cassar 2010) and the indigenous vegetation

is thus within the limits of the Thermo-Mediterranean zone. The climate is typified by dry, hot summers and mild, wet winters, with the landscape largely influenced by this biseasonality (Cassar 2010). The ensuing semi-aridity and the pervasive lack of woodlands do not provide abiotic conditions that favour widespread colonization by ferns.

The Qammieh region, which lies on the northern Ahrax promontory, is characterized by exposed Upper Coralline Limestone, with karstic features predominating. The wind-swept (due to exposure to northerly winds) plateau surface is colonized by a suite of biotopes typical of garrigue and phrygana assemblages. The underlying Blue Clay, a more dynamically malleable stratigraphy and which is thus prone to inducing mass movement, is largely responsible for slippage; such processes lead to the formation of boulder screes and deep limestone crevices on and around the plateau escarpment, within which species like *Asplenium sagittatum* thrive.

Material and Methods

A visit to the site of this newly-discovered population (Table 1: pop9) was conducted in July 2015, when one of the authors (MN) descended into the rocky limestone fissure, using specialized abseiling equipment. Natural belay formations within the karstic Upper Coralline Limestone were used to secure abseiling lines, while another of the authors (LFC) acted as belayer. Dyneema slings of 120 cm and 2 locking carabiners were used for this purpose.

During this sampling exercise, three fronds were collected for identification and taxonomical purposes. It was noted that the fern population colonized the lower-most sloping southern face (north-facing) of the fissure, where conditions were rather humid, and its immediate, lower sides, where substrate had accumulated; this substrate consisted of a combination of fugitive sediments, comprising terrarossa and palaeosol, conveyed into the 15 m deep fissure from the Upper Coralline Limestone karstic surface via freshwater runoff and aeolian dynamics. Owing to the dense population, and to the relatively inaccessible location and conditions in the gorge, it was difficult to accurately count individuals and population size was thus estimated. The conditions at the site were noted to be ideal for growth of *Asplenium sagittatum.* In addition to it at the bottom of the fissure, *Adiantum capellus-veneris* L. was also present in small numbers, as were other rupestral species, namely *Hyoseris frutescens* Brullo & Pavone and *Hypericum aegyptium* L., on the upper, exposed reaches of the limestone fissure (albeit in limited number). Another site visit was carried out by one of the authors [SM] on April 2nd 2016, to survey the north-facing scree of Rdum il-Qawwi.

Anatomical examinations focused on the spores and the epidermis of fronds of specimens collected during this abseil The stomata and cells of the abaxial epidermis are of diagnostic value (Peroni & al. 2008) and were examined using a × 100 and × 400 light microscope. The epidermis was peeled carefully under a dissecting microscope (× 16) using a razor blade and mounted in 10% glycerol aqueous solution. Stomata types referred to are based on Cotthem van (1970) and Peroni & Peroni (2004).

Red listing of the species was conducted according to IUCN guidelines (IUCN 2012a) and Categories and Criteria (IUCN 2012b), with a grid of 2 km × 2 km used for determining Area of Occupancy.

Results

Overview

The population at il-Qammieh was noted to be quite dense in comparison with the other Maltese populations, with as many as 10 mature ferns/m^2 colonizing a stretch of about 25 m in length and of a varying width of 1–2 m, totalling an estimated 300–400 individuals. This effectively appears to be the largest population of *Asplenium sagittatum* within the Maltese islands recorded to-date and, as a consequence, is of conservation significance, both in terms of species and habitat. Population 5 (Table 1), also from the same area, suggests that other pockets with this fern may be present in non-accessible sites along the scree and cliffs of this area. During the second site visit of the 2nd April 2016, some 40 specimens of *Asplenium trichomanes* were discovered at Rdum il-Qawwi. This species is also rare and endangered in the Maltese islands; it was listed as 'possibly extinct' in the Red Data Book (Lanfranco 1989), but its presence was subsequently reconfirmed by Tabone (2007) and by one of the present authors (Mifsud 2009).

Habitat preference

The microhabitats of the various populations of *A. sagittatum* in Malta share common characteristics of a damp, shaded, sheltered location in chambers or caverns formed by scree, in caves within shattered rock profiles, or in rock fissures of Upper Coralline Limestone in coastal scree areas. Thus far, only the population at Qammieh is known to receive direct sunlight for a short period of time; this was measured on 10th October 2015 by [SF], with a total of 57 min of direct sunlight (between 11:50 and 12:47) recorded.

Taxonomy and anatomy

The following morphological description of *A. sagittatum* is based on Population 9 (Table 1, Fig. 2), since, as noted above, this is a relatively large population of about 400 individuals, and the examination of three fronds in this case did not cause any harm to the population.

Ferns have 6–10 tufted leaves, with laminae measuring between 8–24 cm long; they are dark green, glossy above, narrowly deltoid or oblong-deltoid with an entire margin, with a sub-acute tip and auricled base with a broad-cordate to typical hastate shape, usually cordate in young fronds and becoming hastate in mature fronds, forming two oppositely divergent, broadly-triangular lobes up to 6 cm from tip to midrib. The petiole is slightly shorter from the lamina, is dark-green to black at the lower half and with slender, brownish, hair-like scales. Sori are cinnamon brown when mature, narrowly elliptical to rectangular, with each receiving two veins at the base and apex, located in a row between the frond's margin and midrib at an angle of 45 °, usually with another series of shorter sori in the lower half of large fronds. Sporangia are 180–220 µm in diameter with about 20 amber to brown annulus cells. The size of the spores is (31.3–) 34.9 (–39.8) × (23.2–) 26.5 (– 28.7) µm [n = 25] including the winged exospore, which is about 2 µm broad. The stomata of the abax-

Table 1. List of substantiated records of *Asplenium sagittatum* and related population sizes from Malta.

Population ref. no. and date	**Site, Locality, Island**	**Size** (no. of individuals)	**Landform**	**Observed by**
1. Apr. 2008	Western part of Mistra rocks, Nadur, Gozo	25	n/a	Lalov & al. (2008)
2. Apr. 2008	Central part of Mistra rocks, Nadur, Gozo	4	n/a	Lalov & al. (2008)
3*. Apr. 2008	Eastern part of Mistra rocks, Nadur, Gozo	20	Rocky cavities between large displaced boulders forming a scree (= mass movement dynamics)	Lalov & al. (2008)
4. Apr. 2008	Rdum San Filep, Nadur, Gozo	5	Rocky cavities between large displaced boulders forming a scree	Lalov & al. (2008)
5. Apr. 2008	Rdum il-Qawwi, Mellieha, Malta	22	Shaded cliff side	Lalov & al. (2008)
6*. Mar. 2009	Eastern part of Mistra rocks, Nadur, Gozo	35**	Deep limestone fissures	SM ^
7. May. 2009	Central part of Mistra rocks, Nadur, Gozo	3	Rocky cavities between large displaced boulders forming a scree	SM ^
8. Oct. 2010	Rdum Majjiesa	5	Rocky cavities between large displaced boulders forming a scree	SM ^
9. May 2015	Rdum il-Qawwi/Qammieh area Mellieha, Malta	300-400**	Deep limestone fissure receiving partial sunlight	SM, LFC, SF ^
*Populations 3 and 6 are likely the same location. ^ Unpublished new records ** Mats of prothallic growth and many young specimens were observed				

ial surface were (42.3–) 49.9 (–57.2) × (34.8–) 40.7 (–47.3) µm [*n* = 27], polocytic (3-4(5) cells), or less frequently anomocyctic ((4)5–7 cells). The epidermal cells are deeply sinuous and approximately 80–120 µm in length along their longest axis. In comparison with the abaxial epidermis, the adaxial surface is without stomata, and consists of smaller (c. 80 µm along their longest angle) cells that are less sinusoidal and usually with angular wide lobes (Figure 3a-d).

The macro-morphological features of the Maltese population correspond to those of *A. sagittatum* (e.g. Pignatti (1982); Crabbe & al. (1993); Ferrarini & al. (1986); Ormonde (1998); Peroni & Peroni (2004)); however, cellular anatomy discrepancies were noted when compared with reports of Peroni & Peroni (2004), Ferrarini & al. (1986); and Rossello & al. (1990) in Peroni & Peroni (2004). The stomata and spores sizes measured from *A. sagittatum* (Malta) are reported and compared in Table 2.

It was found that the material of *A. sagittatum* from Qammieh, Malta has remarkably larger stomata, slightly larger spores, and different morphology of the epidermal layers. The spore ornamentation of the Maltese material seems to be more pronounced than that illustrated by Peroni & Peroni (2004), with a broader exospore wing of about 2–3 µm (Figs. 3H and 3I). The upper epidermis consists of cells that are larger (60–80 µm) and much more lobed (Figs. 3A and 3C) from 27–45 µm, as documented by Peroni & Peroni (2004) and illustrated in Figs. 3F and 3G. The abaxial epidermis cells (Figs. 3B and 3D) are more similar to those illustrated for *A. scolopendrium* than to those illustrated for *A. sagittatum* (Peroni & Peroni 2004), being more deeply sinuous and with longer lobe-like

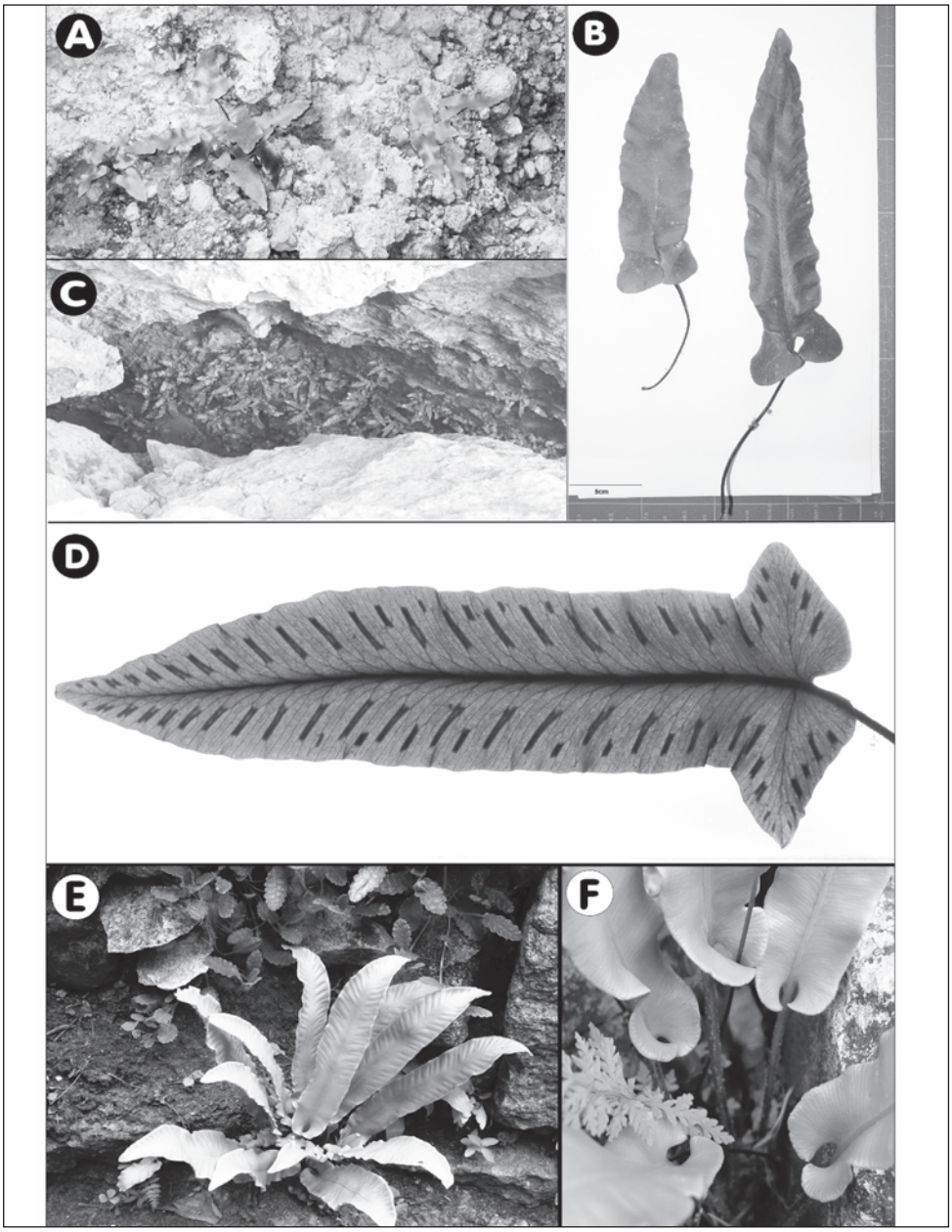

Fig. 2. *Asplenium sagittatum,* Malta. **A**. Eastern part of Mistra Rocks, Nadur, Gozo (March 2009); **B.** Young and mature fronds (Rdum il-Qawwi, Qammieh, Mellieha, July 2015); **C.** Rdum il-Qawwi, Qammieh, Mellieha, largest population ever recorded in Malta represented by over 300 plants (July 2015); **D.** Mature frond showing sori, venation, and basal divergent triangular lobes (Rdum il-Qawwi, Qammieh, Mellieha, July 2015); 2E-2F *Asplenium scolopendrium,* Warsaw, Poland. **E.** Whole plant (Jul 2015); **F.** Leaf bases showing cordate base (July 2015). Photos by Stephen Mifsud.

Table 2. Measurements of stomata and spores from *A. sagittatum* in Qammieh, Mellieha, Malta and comparison against reported measurements.

	Stomata length (µm)	**Stomata width** (µm)	**Spore length** (µm)	**Spore width** (µm)
Studies specimens				
A. sagittatum, Qammieh, Mellieha	(42.3-) **49.9** (- 57.2)	(34.8-) **40.7** (- 47.3)	(31.3-) **34.9** (- 39.8)	(23.2-) **26.5** (- 28.7)
Reported measures				
Peroni & Peroni (2004)	(33-) **40.9** (-48)	(27-) **31.7** (-36)	(27-) **30.8** (-36)	–
Ferrarini & al. (1986)	–	–	(24-) **29.7** (-34)	–
Rossello & al. (1990)	–	–	**27.3**	–
Ormonde (1998)	–	–	–	(24-) **27-30** (-33)

projections. This overall foliar anatomy of the Maltese *A. sagittatum* is hence more similar to *A. scolopendrium* sensu Peroni & Peroni (2004) (Fig. 3G). Since currently these foliar variabilities are not of any taxonomic importance, even at an infraspecific level, the examined Maltese material was treated as *Asplenium sagittatum*, the morphological plasticity of which was already demonstrated by Ferrarini & al. (1986).

Red Listing and conservation

In Malta, *A. sagittatum* was historically recorded as *Scolopendrium hemionitis* Sin. (Duthie 1872; Caruana Gatto 1893; Gulia 1909; Caruana Gatto 1915), while *A. scolopendrium* was recorded as *Scolopendrium vulgare* L. (Gulia 1909; Borg 1927). None of the aforementioned pioneering naturalists recorded both species concurrently in their respective works, with the exception of Gulia (1909); (it should nevertheless be noted that Gulia also catalogued previous records in his account of Maltese ferns). While it is difficult to ascertain if these early records truly represent two different species of spleenworts in Malta, it can be safely assumed that *A. scolopendrium* was misidentified and confused with *A. sagittatum*, owing to the fact that recent records all attest to *A. sagittatum*. Such a conclusion has already been suggested by various authors, including Sommier & Caruana-Gatto (1915), Lanfranco (1989), and Lalov & al. (2008). Such misidentification may have also arisen because young fronds of *A. sagittatum* have cordate leaf bases that look superficially like *A. scolopendrium* (Ferrarini & al. 1986; Marchetti 2004). Confusion of *A. scolopendrium* with *A. sagittatum* was also reported in the past in Italy (Marchetti 2004).

Using the current substantiated records of *A. sagittatum*, in Malta the Extent of Occurrence (EOO) is calculated to be 7.5 km^2 while the area of Occupancy (AOO) is 16 km^2. Population trend cannot be estimated since no counts have ever been published. Assuming that several historically recorded populations have become extinct, the number of locations has decreased by more than half over a 100 years; however, the rate of decrease over the last 10 years is uncertain with reference to application of criteria A. The current population size is estimated to be > 300 but < 800 individuals.

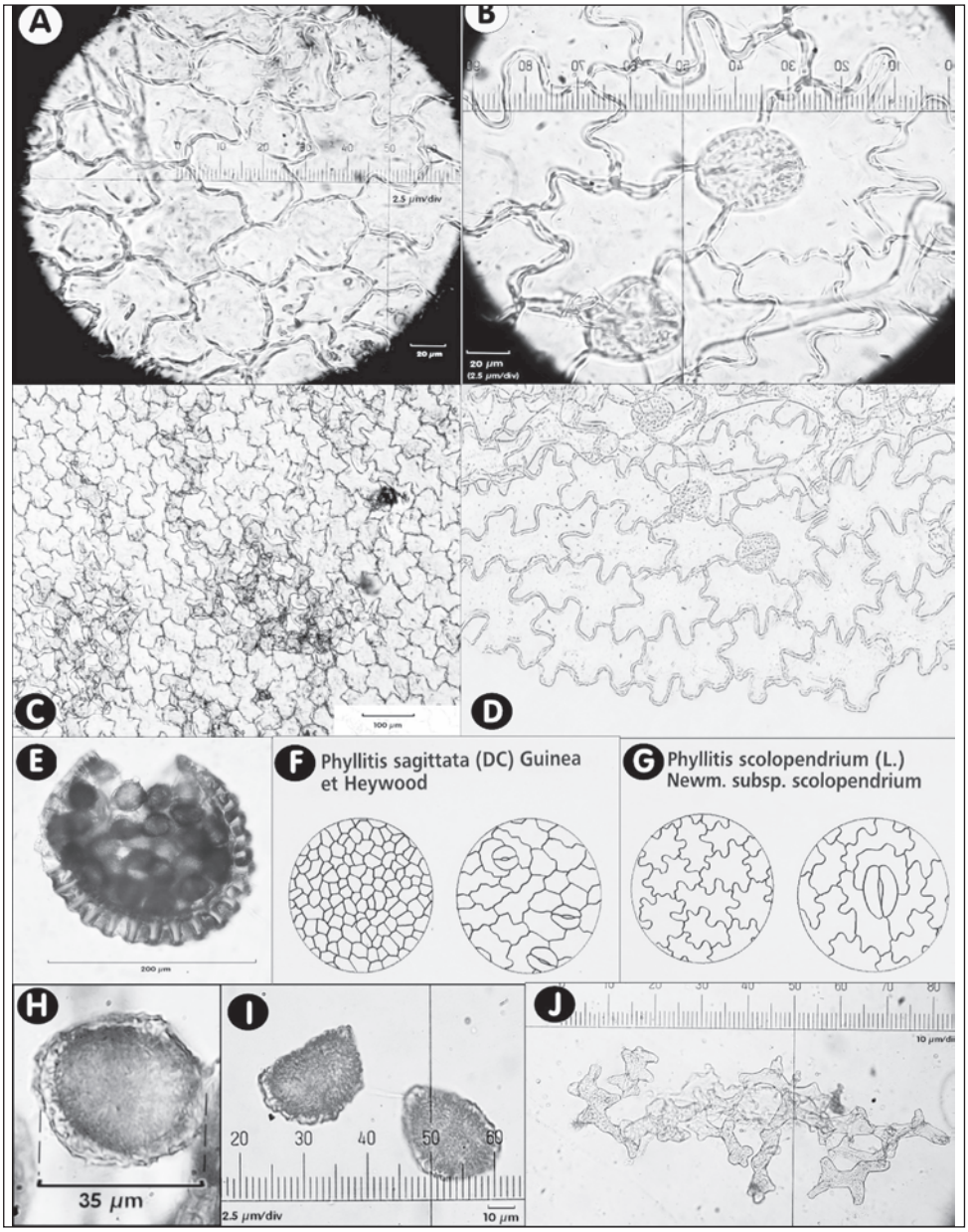

Fig. 3. Anatomical examination of *A. sagittatum*, from material at Rdum il-Qawwi, Qammieh, Mellieha, July 2015. **A.** Epidermis cells of adaxial face frond; **B.** Epidermis cells and stomata of abaxial face; **C.** Adaxial epidermis (low magnification); **D.** Abaxial epidermis (low magnification); **E.** Sporangium; **F.** Illustration of epidermis (left abaxial, right adaxial) of *Asplenium sagittatum*; **G.** Illustration of epidermis (left abaxial, right adaxial) of *Asplenium scolopendrium*; **H-I.** Spores; **J.** Chlorenchyma cells from the mesophyll layer. Photos by Stephen Mifsud. Illustrations **F** and **G** adapted from Peroni & Peroni (2004, pp 95-96).

Since *A. sagittatum* resides in inaccessible cavities and fissures in cliff screes, mostly located in areas that are protected at international level (Natura 2000 sites), the populations are not endangered by direct anthropogenic activities such as picking, land reclamation, grazing, construction works, or invasion by alien species. However, one major threat is habitat loss as a result of stochastic events, such as a tremor resulting in mass movement (landslide or scree collapse). Moreover, the decline of subpopulations during the last few decades, leading to 'presumed extinction' (Lanfranco 1989) must also be considered. It is unclear why so many populations are not extant, but one feasible explanation may relate to the reduction of natural water supply from springs emanating from perched aquifers, mainly due to the latter's continuous deterioration and exploitation by human agency, especially during the late 20th century.

Based on available data for the Maltese Islands, the Red List assessment of *Asplenium sagittatum* is EN B1ab (i,ii,iii); due to the small geographic scale of Malta, the resulting criteria obtained from the current AOO and EOO were downgraded by one level in accordance with IUCN (2012a) (assessor: Stephen Mifsud, September 2015).

Conclusions

Two new records of *Asplenium sagittatum* have been discovered from the boulder scree and rock fissures at Rdum Majjiesa and il-Qammieh, respectively. The latter comprises about 300-400 mature specimens, making it the most significant population in the Maltese Islands when compared to other reported populations that comprise of only a few individuals. Moreover, *Asplenium trichomanes* was also discovered at Rdum il-Qawwi, limits of Qammieh.

The cytology of the epidermis and the morphology of the spores were found to differ somewhat from documented descriptions of this species, but these slight differences are not considered to be of any taxonomic importance. A Red List assessment was carried out on the existing populations reported in the last ten years, resulting in 'endangered' status; this is an upgrade from Lanfranco (1989) assessment ('presumably extinct'). Given that all current records refer to *A. sagittatum*, there is considerable doubt over the listing of *A. scolopendrium* in historical records and the current authors assume that these records should be considered as referring to *A. sagittatum.*

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The Libyan Collections in FI (Herbarium Centrale Italicum and Webb Herbarium) and Studies on the Libyan Flora by R. Pampanini – Part 2

-The original material of new taxa conserved in the herbarium
-Proposals for typification and documentation of typifications already made (Phanerogams, families from N to Z)
-Conclusions
-Addenda & Corrigenda

Abstract

Cuccuini, P., Nepi, C., Abuhadra, M. N., Banfi, E., Domina, G., Luccioli, E., Miranda, S., Pagitz, K., Thiv, M. & Vela, E.: The Libyan Collections in FI (Herbarium Centrale Italicum and Webb Herbarium) and Studies on the Libyan Flora by R. Pampanini – Part 2. — Fl. Medit. 26: 81-143. 2016. — ISSN: 1120-4052 printed, 2240-4538 online.

This work is the continuation of Part 1, published in 2015, and comprises the reconstruction of the original collections of new taxa described by R. Pampanini and other botanists and, where possible, typification of the new names and taxonomical updating. The material studied for the most part concerns Libyan specimens held in the FI and FI-W herbaria but in some case also K, LD, MPU, P, PAD, PAL, ULT. Other material, which Pampanini studied in Florence was subsequently conserved in other herbaria. Specimens belonging to 21 families have been examined, from the *Najadaceae* to *Zygophyllaceae*. As well as typification, bibliographical data have been provided for those already typified. In this second part, a total of 113 names have been indexed and 91 typified, taking the names validly published in the entire work to 353, of which 286 are typified. Also on this occasion, we have provided taxonomic updates for each taxon. The Conclusions present a synthetic sum of the taxa still recognised taxonomically (entirely, in new combinations, or with a new status) in recent works on the Flora of N. Africa, in general revisions of various systematic groups, or reconsidered by the authors of this present work. We have also investigated the phyto-geographic origins of the taxa [according to the dominions proposed by Quézel (1978) for N. Africa]. Finally we have very briefly indicated the presence of material of the R. Pampanini collections (for Cyrenaica, together with R. E. G. Pichi Sermolli in 1934) in the most important herbaria.
The paragraph "Addenda et Corrigenda" has been added to the final part of the treatise and relates chiefly to taxa omitted from the first part, either on account of new information or as a result of errors which came to light after publication.

Key words: museology, nomenclature, taxonomy, typification, Flora of Libya, N. Africa, phytogeography, Addenda & Corrigenda.

Introduction

The second part of the work on Libyan collections kept or studied at FI herbarium is the continuation of Cuccuini & al. (2015).

It starts with *Najadaceae* and ends with *Zygophyllaceae* family. The methods used are the same as the first part. At the end of the work, in addition to the conclusions, the coordinators have added a paragraph of 'Addenda et Corrigenda' that, as far as possible, recovers materials not previously found or corrects inaccuracies and errors in the first part.

CATALOGUE

Continuation from Cuccuini & al. (2015). For the legend of format, see Cuccuini & al. (2015). As compared with the first part, several new authors of taxa and collectors are included here. Among the former are A. Engler, P. Pavone, S. Pignatti, H. Scholz and D. Viviani, and among the second, Della Cella (as collector of the material represented in two tables by D. Viviani), A. Figari Bey, and G. A. A. Krause (the last included in the list of collectors but non mentioned in the text of the first part).

***Najadaceae* (S. Miranda)**

New taxon: *Najas minor* var. *longifolia* Corti in Flora e Vegetazione del Fezzan e della Regione di Gat. Reale Società Geografica Italiana **1**: 30. (1942).

Typus: [Libya], Fezzan occidentale: reg. di Gat, Elbarcat, 700 m., (1180), fossetto emissario della sorgente grande, abbondantissima, 02/03/1934. Leg. R. Corti. (FI016321, Lectotypus designated here).

Other Syntypi from the original collection: (1181-1186) (FI016322-FI016327).

Accepted name: *Najas minor* Allioni see: L. Triest in: Mém. Acad. Roy. Sci. Outre-Mer, Cl. Sci. Nat. Méd. Collect. 8vo n.s., 21: 59. 1987.

Note: also Jafri in: Fl. Lib.113: 2-4. 1984a; in Triest 1987: 59, there is the complete citation of the Type, but the author declares: "*non vidi*"; on the sheet of the lectotypus there is a small label with a handwritten note (no. 000292) in pencil by Corti.

***Oleaceae* (G. Domina)**

New taxon: *Phillyrea latifolia* var. *magnifica* Pamp. in Arch. Bot. XII(1): 40. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 73. (1938).

Type: Libya, Cirenaica, fra el Hania e Messa: l.d. Mregheb (6093), 09/05/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli, (FI001160, Lectotypus designated here).

Accepted name: *Phillyrea latifolia* L.

Note: the specimen no. 6093 is made up of two sheets mounted together clearly belonging to the same collection. In the first there is a piece of newspaper with the new name of the taxon handwritten by Pampanini.

***Orobanchaceae* (G. Domina & M. Abuhadra)**

New taxon: *Cistanche lutea* f. *pallida* Pamp. in Arch. Bot. XII(1): 43. (1936a). Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 75. (1938).

Type: Libia, Cirenaica: Tra Bir Acheim e el-Mechili, Trigh Enver Bei Bir Bu Usceica (7355), 26/03/1933, Leg. R. Pampanini, (FI003688, Lectotypus designated here).
Other syntypus from the original collection: C.: el-Mechili, Uadi Ramla (7356), 27/03/1933, Leg. R. Pampanini (FI003689).
Accepted name: *Cistanche phelypaea* (L.) Cout.
Note: the specimen 7355 is accompanied by a strip of newspaper with the name of the new taxon handwritten by Pampanini; specimen 7356 is made up of three sheets.

New taxon: *Cistanche violacea* f. *bicolor* Pamp. in: Arch. Bot. XII(1): 43. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 75. (1938).
Type: Libia, Cirenaica: Msus (7365), 20/03/1933, Leg. R. Pampanini (FI003690) (Lectotypus designated here).
Other syntypi from the original collection: C: Steppa di el-Agheila (7363), 14/03/1933, Leg. R. Pampanini (FI003691); C.: esc-Sceleidima, a sud-est di Bengasi (7364), 20/03/1933, Leg. R. Pampanini (FI003692); C.: Zuetina, a nord-est di Agedabia (7366), 11/03/1934, Leg. R. Pampanini & R.E.G. Pichi Sermolli (FI003693).
Accepted name: *Cistanche violacea* (Desf.) G. Beck in Hoffmanns & Link.
Note: the specimen no. 7363 is accompanied by a strip of newspaper with the name of the new taxon handwritten by Pampanini; the specimen no. 7365 is made up of three sheets.

***Papaveraceae* (P. Cuccuini & C. Nepi)**

The genus *Hypecoum* was considered by Jafri in Fl. Lib. 44. (1977b) as belonging to the family of the same name (*Hypecoaceae*). The present publication does not recognise this choice (under the same criterion, the genus could be placed in the *Fumariaceae*) and the genus is maintained in the *Papaveraceae*.

New taxon: *Hypecoum aequilobum* Viv. in Fl. Lib., specimen: 7-8, tab. III, fig. 3. (1824).
Typus (Lectotypus): Fl. Lib., specimen, 1824, "H. in Cirenaica", tab. III, fig. 3. (Typified by Jafri S.M. H. (as typus) in Fl. Lib. 44: 5. 1977). (Fig. 1).
Epitypus: Libia, Cirenaica: tra Agedabia e Antelat a Bag Lia (2802), 10/04/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli (FI).
Accepted name: *Hypecoum aequilobum* Viv.
Other material: Libia, Cirenaica: El Grein presso Marsa el Brega (2801), 08/04/1934. Leg. Pampanini & R.E.G. Pichi Sermolli (FI).
Note: the Epitypus is under *Hypecoum aequilobum* Viv. var. *stenolobum* Pamp. [an invalid name since Pampanini 1936: 26, recorded it as "..*Nomen novum*, *H. aequilobum* Viv. Fl. Libyc. Specim. p. 7, tab. 3. 1824 (*sensu stricto*)", thereby indicating the autonym of *H. aequilobum* (*H. aequilobum* var. *aequilobum*). Given that the original collection, kept in GE, cannot be located (S. Peccenini *in litteris* 2016), the typus is represented by the only surviving element of original material: table 3, fig. 3, details e, f, g, h of Viviani, Fl. Libyc. Specim. Since the Lectotypus could be ambiguous, we designate also as Epitypus the specimen R. Pampanini & R.E.G. Pichi Sermolli 2802.

New taxon: *Hypecoum aequilobum* var. *platylobum* Pamp. in Arch. Bot. XII(1): 26. (1936a); Prodr. Fl. Cir. p.: 209 (sub *H. aequilobum* p.p.: specim. Zanon, Maugini). 1930.

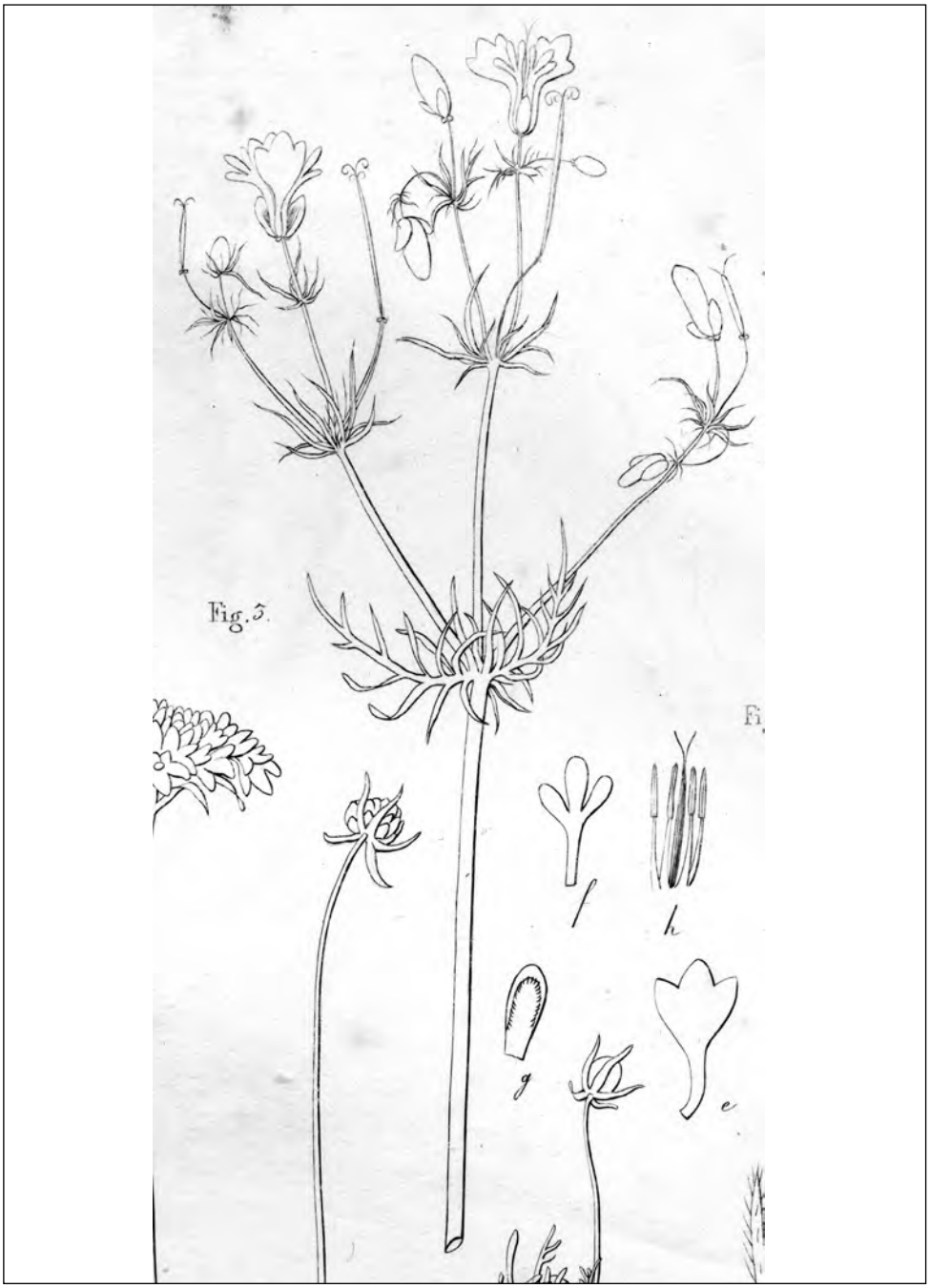

Fig. 1. *Hypecoum aequilobum* Viviani, Figure 3, details e, f, g, h of table III, published in *Florae Libycae specimen*, 1824, Lectotypus, kept in the library of Centro Studi Erbario Tropicale of Florence.

Type: [Libya], Cirenaica, Bengasi: Palmeto (Monastir), 06/03/1922. Leg. A. Maugini, (FI003911, Lectotypus designated here).
Other syntypi from the original collection: [Libya], Cirenaica, Bengasi: Gariunes, (623), 26/04, FI003912; Be.: Punta Giuliana (579[3]), 21/03/1916, FI003913. Leg. V. Zanon. Be.: Palmeto, primavera 1921, FI003910; Be.: fra Selmani e Suani Osman, 12/02/1922, FI003908; Be.: Hauari, 02/ 1922, FI003909. Leg. A. Margini. (All in FI).

Accepted name: *Hypecoum aequilobum* Viv. s.l.

Note: the collection assembled by Pampanini in 1933-34, which was not mentioned in the pubblication by Pampanini (1938), even though it was part of the original collection, is composed of the following specimens: Cirenaica: Tra Agedabia e el Agheila, Melch en Nogra (2797), 15/03/1933. Leg. R. Pampanini. C.: Tra Agedabia e Antelat a Bag Lia (2798), 10/04; C.: el Gioch tra Agedabia e Saumnu (2799), 10/04.; C.: ez Zuetina a nord est di Agedabia (2800), 11/04/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli, (all material in FI).

New taxon: *Hypecoum pendulum* var. *zoddae* Pamp. in Arch. Bot. VIII: 111. (1932).

Type: Holotypus: [Libya], Tripolitania, Garian: In cultis, Garian, 700 m., 24/3/1931. Leg. G. Zodda, (FI)

Accepted name: *Hypecoum pendulum* L. s.l.

Note: the material cited is not present in FI under this name, but sub. *H. pendulum* L. var. *paradoxum* Pamp. (a *nomen nudum*) with the same data handwritten by Pampanini himself. Initially, Pampanini probably decided on the first name and only later preferred the second in honour of Zodda, but did not leave any written notes to this effect. There is no doubt that this is the same taxon, seeing that the description in the protologue also corresponds perfectly even though the lack of flowers has complicated identification.

New taxon: *Papaver rhoeas* var. *trichocarpum* Pamp. in Bull. Soc. Bot. Ital. (1-3): 13. (1914a); Pl. Tripol.: 115. (1914e).

Type: Holotypus: [Libya], Tripolitania, Tarhuna: Uadi Tersiva, pianura a S.W. di Ras Maader (2082), 01/04/1913. Leg. R. Pampanini, (FI).

Accepted name: *Papaver rhoeas* L., see Dobignard & Chatelain 5: 53. 2013.

Note: this name does not appear among those mentioned by Kadereit J.W. 1988.

New taxon: *Roemeria hybrida* f. *latiloba* Pamp. in Bull. Soc. Bot. Ital. (1-3): 13. (1914a); Pl. Tripol.: 116. (1914e).

Type: [Libya], Tripolitania, Tarhuna.: Ras Bu Tauil (4463), 21/03/1913. Leg. R. Pampanini. (FI, Lectotypus designated here).
Other syntypi from the original collection: [Libya], Tripolitania, Tarhuna: Abiar Milgha (412), 28/02; T., Ta.: Uadi Msaaba a Kars Doga (867), 18/03; T., Ta.: Ras Ghenai (1557), 25/05; T., Garian: Ras Bu Ganus (3937), 27/04/1913. Leg. R. Pampanini. (All syntipi in FI).

Accepted name: *Roemeria hybrida* (L.) DC. subsp. *hybrida*, see Dobignard & Chatelain 5: 56. 2013.

Note: this last work improperly considers *Roemeria hybrida* (L.) DC. var. *hybrida* which, however, Pampanini never established. The authors probably found and took this error from the Flora of Libya, Jafri (1977b) or from Flora dell'Afrique du nord (1964).

New taxon: *Roemeria tenuifolia* Pamp. in Nuovo Giorn. Bot. Ital. n.s. 26: 211-12. (1919).
Type: [Libya], Cirenaica: Fuehat (79), marzo 1918. Leg. V. Zanon (FI, Lectotypus designated here)
Other syntypi from the original collection: Egitto, Regione mediterranea, molto comune nei coltivi dell'antica marea verso Alessandria, anche nel deserto di Ramle di Abukir, dell'Istmo di Suez, del Sinai, Marzo e Aprile 1867. Leg. Figari Bey (FI).
Accepted name: *Roemeria hybrida* (L.) DC. subsp. *hybrida*, see Dobignard & Chatelain 5: 56. 2013; also in Le Floc'h & al. (2010).
Note: in Fl. Lib. 40: 8. 1977 *Roemeria tenuifolia* Pamp. = *Roemeria hybrida* (L.) DC. var. *hybrida*. Although Jafri (Jafri 1977b) considers it a synomyn, he points out the main distinguishing characters : " …. *has almost glabrous fruits (2.5-4 cm long) on robust thickened pedicels up to 7 cm long*", but does not consider them sufficient for recognising a new taxon.
For Boulos, as comb. e stat nov. *R. hybrida* DC. var. *tenuifolia* (Pamp.) Boulos, in Candollea 34(1): 37. 1979; moreover, in 1933, Pampanini declared a comb. et status nov. for this taxon: *Roemeria hybrida* DC. var. *tenuifolia* (Pamp.) Pamp. (on the FI herbarium card). He never published it as such, but as *R. hybrida* DC. f. *tenuifolia* (Pamp.) Pamp., Pampanini (1936a).

***Plantaginaceae* (P. Cuccuini & C. Nepi)**
New taxon: *Plantago albicans* var. *augustifolia* f. *syrtica* Pamp. in Arch. Bot. XII(1): 43. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3) 75. (1938).
Type: Holotypus: Libia, Cirenaica: fra Agheila e Maaten Giofer (7451), 15/03/1933. Leg. R. Pampanini, (FI003820).
Accepted name: *Plantago albicans* L.

New taxon: *Plantago albicans* var. *desertica* Pamp. in Agric. Colon., 10: 365. (1928).
Type: [Libya], Cirenaica: Fra l'Uadi Faregh e Maatan Risam, 18/04/1928. leg. G. Krüger, (FI003824, Lectotypus designate here).
Isolectotypi: (FI003821, FI003822, FI003823).
Accepted name: *Plantago albicans* L , see Siddichi M. A. in: Fl Lib.: 67: 21-22. 1979; also Dobignard & Chatelain 5: 101. 2013.
Note: two of the 4 specimens mentioned above carry labels signed by Pampanini as well as the original ones, handwritten and signed by Krueger (FI003823, FI003824).

New taxon: *Plantago albicans* var. *lanata* Pamp. in Bull. Soc. Bot. Ital.: 18. (1914a); Pl. Tripol.: 226. (1914e).
Type: Holotypus: [Libya]: Tripolitania, Tarhuna: Pianura dell'Uadi Ksea (2405), 07/04/1913. Leg. R. Pampanini, (FI003825).
Accepted name: *Plantago albicans* L.
Note: although modern, even recent, Floras, indices and nomenclatural catalogues carry descriptions that include many previously described varieties under the same species, the presence of such different entities in similar habitats suggests the need for an in-depth investigation over the territory.

New taxon: *Plantago albicans* var. *macropoda* Pamp. in Bull. Soc. Bot. Ital. (1-3): 18. (1914a); Pl. Tripol. p.: 226. (1914e).
Type: Holotypus: [Libya], Tripolitania, Tripoli: Uadi Megenin presso Ain Zara (3508), 22/04/1913. Leg. R. Pampanini, (FI003826).
Accepted name: *Plantago albicans* L.

New taxon: *Plantago coronopus* var. *commutata* f. *pubescens* Pamp. in Arch. Bot. XII(1): 44. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 76. (1938).
Type: Libia, Cirenaica: Sidi Ahmed el Magrun, a sud di Bengasi (7500), 17/03/1933. Leg. R. Pampanini, (FI003830, Lectotypus designated here).
Other syntypi from the original collection: Cirenaica: Msus (7501), 20/03, (FI003907); C., Mechili : Uadi Ramla (7502), 27/03/1933. Leg. R. Pampanini, (FI003827).
Accepted name: *Plantago weldenii* Rchb. s.l.
Note: specimen 7500 carries a piece of newspaper with the name of the new taxon handwritten in blue pencil by Pampanini.

New taxon: *Plantago coronopus* var. *commutata* f. *villosa* Pamp. in: Arch. Bot. XII(1): 44. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 76. (1938).
Type: Libia, Cirenaica: fra Derna e Mechili: Uadi el Hescia (7505), 10/4/1933. Leg. R. Pampanini, (FI003829, Lectotypus designated here).
Other syntypi from the original collection: Libia, Cirenaica: Agheila, giardini (7504), 15/03, (FI003828); C.: fra Sidi Frag e el Magrun a nord di Agedabia (7503), 11/03/1933, Leg. R. Pampanini, (FI003934); (all material in FI).
Accepted name: this material is an intermediate form between *P. crypsoides* Boiss. and *P. weldenii* Rchb., probably close to *P. weldenii* Rchb., sensu Dobignard & Chatelain (2013).
Note: the label for no. 7503 (FI003934) does not indicate "... e El Magrun", moreover a piece of newspaper on the specimen carries the name of the new taxon handwritten in blue pencil by Pampanini.

Plumbaginaceae **(G. Domina)**
New taxon: *Limonium bonduellei* f. *gigantifolia* Corti in Flora e Vegetazione del Fezzan e della Regione di Gat. Reale Società Geografica Italiana 1: 1-203. 1942.
Type: [Libya], Fezzan Settentrionale, sul Gargáf a nord di Brach, (1233), 14/02/1934, Leg. R. Corti (FI003575, Lectotypus designated here).
Other syntypi from the original collection: Fezzan occidentale, valico tra Elbárcat e l'U. Iséien- nell'Uadi in roccia, verso Elbárcat (1231), 13/03/1934. Leg. R. Corti.
Accepted name: *Limonium bonduellei* (Lestib.) O. Kuntze.
Note: the syntypus: Fezzan occidentale, valico tra Elbárcat e l'U. Iséien- nell'Uadi in roccia, verso Elbárcat (1231), 13/03/1934. Leg. R. Corti, cited in the original publication, was not found in FI.

New taxon: *Limonium teuchirae* Brullo in Webbia 33(1): 148. 1978.
Type: Holotypus (CAT12956) [Libya, Cyrenaica], Sebchet el Cuz (Bengasi), 15/09/1974. Leg. S. Brullo & F. Furnari. (by Brullo in Webbia 33(1): 148. 1978).

Isotypi: (CAT12957-CAT12957-13), (FI003916).
Accepted name: *Limonium teuchirae* Brullo.

New taxon: *Limonium vaccarii* Pignatti ex Brullo in Webbia 33(1): 148. 1978.
Type: Holotypus: [Cyrenaica]: Tobruk, 23/05/1912 (147). Leg. A. Vaccari (PAD).
Isotypes in FI and in PAL.
Accepted name: *Limonium vaccarii* Pignatti ex Brullo.
Note: taxon described for the first time with the illegitimate name of *Statice delicatula* Béguinot & Vaccari (1912), non Girard. (1844). Pignatti (1963) published it as *Limonium sibthorpianum* subsp. *vaccarii*, but without a description (*nomem nudum*). Finally the taxon was re-described by Brullo (1978) who attributed the name to Pignatti. In FI, an isotype is probably lost.

New taxon: *Statice delicatula* var. *subrotundifolia* Bèg. & Vaccari in Sec. Contr. Fl. Lib.: 29. 1913.
Type: Lectotypus (designated by Brullo 1978: 146): Libia, Cirenaica, Derna in collibus aridis saxosis maritimis prope il faro, 21/10/1912, Leg. A. Vaccari, no. 148 Fl. Lyb. Exs. (PAD).
Isolectotypi: FI003576, PAD.
Accepted name: *Limonium subrotundifolium* (Bèg. & Vaccari) Brullo in Webbia 33(1): 145. 1978.
Note: collecting data: Cirenaica: Derna presso il faro, (148), 31/10/1912 (in Bibl.) 21/10/1912 (on the label).

New taxon: *Statice pruinosa* var. *hirtiflora* Cavara & Grande in Bull. Orto Bot. Univ. Napoli 9 (1): 49. 1928.
Typus: [Libya, Cyrenaica]: Costoni aridi di Porto Bardia (Marmarica), 21 febb. 1924, Leg. F. Cavara & L. Grande (FI, Lectotypus designated here).
Accepted name: *Limonium pruinosum* (L.) Chaz., Suppl. Dict. Jard. 2: 36. 1790.
Note: the specimen includes also one handwritten label with the description of the plant and taxonomic notes.

New taxon: *Statice tubiflora* var. *zanonii* Pamp. in Nuovo Gior. Bot. Ital. n.s. 24:148. (1917).
Type: [Libya], Cirenaica: Bengasi, Giok, 20/04/1916 (611), leg. V. Zanon, (FI, Lectotypus designated here).
Accepted name: *Limonium zanonii* (Pamp.) Domina in Willdenowia 41(1): 131. 2011.
Note: Giok Kebir falls within the Bengasi municipality, the different dates on the *exsiccatum* label and in the original publication is, probably, a transcription mistake. In any case, not knowing if the other specimens have been lost, we, prudently, prefer to designate it as the lectotypus of the name.

***Poaceae* (E. Banfi)**
New taxon: *Aegilops bicornis* var. *anathera* Eig in Bull. Soc. Bot. Genève sér. 2 (19): 325. 1928.
Type: Isolectotypus: [Libya], Cyrenaica: [Benghasi] Juliana, an den Saliner, 3/04/1883.

Leg. Ruhmer s.n. (401) (by M.W. van Slageren, Wageningen Agric. Univ. Papers 94-7: 12, 145. 1994; formerly marked by von Slageren 06/1992 as *Aegilops bicornis* (Forssk.) Jaub. & Spach. var. *mutica* [Asch.] Eig).

Accepted name: *Triticum bicorne* f. *muticum* Asch. in Mágyar Bot. Lapok 6: 10. 1902 (mistakenly reported as unranked in Tropicos). The synonymisation of *Aegilops* L. with *Triticum* L., phylogenetically suitable (Petersen & al. 2006; Sandve & al. 2015) although so far put into practice by only a few authors, is accepted in the new editions of the Checklist of the Italian vascular Flora (Conti & al. eds. in progress) and Flora d'Italia (Pignatti ed., in progress). Under *Aegilops* the legitimate name at variety rank (priority) seems to be *Ae. bicornis* var. *mutica* Post in Fl. Syria: 901. 1896 and such name is obviously based on a different type material (Haifa, Israel).

Note: this taxon is not more than a mere expression of the normal intrapopulational diversity of the species referring to the degree of development of awns (from complete to absent), especially in proximal and median spikelets.

New Taxon: *Aristida obtusa* f. *arenosa* Corti in Flora e Vegetazione del Fezzan e della Regione di Gat. Reale Società Geografica Italiana 1**:** 43. 1942.

Type: Holotypus: Fezzan Settentrionale, tra Bir el Ghelania e Brach, presso l'Uadi Issa, ca. 400 m. Leg. R. Corti (FI).

Accepted name: *Stipagrostis obtusa* (Delile) Nees.

Note: this form falls within the diversity pattern of the taxon described as *Aristida foexiana* Maire & Wilczek in Bull. Soc. Hist. Nat. Afrique N. xxv: 322. 1934 and also annotated in FI as *Aristida obtusa* var. *pubescens* Andreansky (?). In all cases it fits the normal range of variation of the species.

New taxon: *Avena beguinotiana* Pamp. in Arch. Bot. XII (2): 18. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari, 8 (3): 60. (1938).

Type: Libia, Cirenaica: Amseat a sud di Bardia (361), 24/03/1933. Leg. R. Pampanini (marked by B. Baum 1973) (FI, Lectotypus designated here).

Other material, Paralectotypi (marked as such by B. Baum 1973): Cirenaica, Sirte: Steppa di Agheila (360), 14/03/1933. Leg. R. Pampanini. C., Sirte: El Grein presso Marsa Brega (362), 8/04/1934; C.: Sahabi (Saniet el Hamar) a sud est di Agedabia (363), 9/04; C.: tra Agedabia e Antelat a Bag Lia (364), 10/04/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli (all material in FI).

Accepted name: *Avena ventricosa* Balansa ex Cosson (Valdés & Scholz 2009).

Note: Scholz H. in Willdenowia 7 (2): 420. 1974b refers to the type in FI but no other details are provided.

New taxon: *Brachypodium distachyon* var. *genuinum* f. *mite* Pamp. in Bull. Soc. Bot. Ital. (1-3): 11. (1914a); Pl. Tripol.: 13. (1914e).

Type: [Libya], Tripolitania, Garian: Bu Gheilan (4553), 24/04/ 1913. Leg. R. Pampanini (FI, Lectotypus designated here).

Other material, Syntypi: Tripolitania, Tarhuna: Uadi (Tersiva) Tenziua nelle steppe (1952), 1/04/1913; T., Mesellata: Cussabat sul Ras Gelà (4400), 13/04/1913. Leg. R. Pampanini, (all material in FI).

Accepted name: *Brachypodium distachyon* (L.) P. Beauv.
Note: considered by authors till now as a synonym of *B. distachyon*.

New taxon: *Brachypodium distachyon* var. *genuinum* f. *typicum* subf. *puberulum* Pamp. in Arch. Bot. XII(1): 18. (1936a). Rend. Sem. Fac. Sc. Univ. Cagliari, VIII(3): 60. (1938).
Type: Libia, Cirenaica, Martuba, a sud est di Barce: Uadi el-Bgar (410), 8/04/1933. Leg. R. Pampanini, (FI, Lectotypus designated here).
Other material, Syntypi: Cirenaica, Mechili: Uadi Ramla (409), 27/03/1933; Cirenaica, Cirene: es Saf-Saf, Uadi Bu Meddas (411), 18/04/1933. Leg. R. Pampanini.
(Unpublished) Cirenaica, Cirene: Uadi Buten (412), 18/04/1933. Leg. R. Pampanini, (all material in FI).
Accepted name: *Brachypodium distachyon* (L.) P. Beauv.
Note: this taxon seems not to have been taken into account by systematic investigations and presumably it falls within the normal diversity range of the species.

New taxon: *Brachypodium distachyon* var. *hispidum* Pamp. in Bull. Soc. Bot. Ital. (1-3): 11. (1914a); Pl. Tripol.: 14. (1914c).
Type: [Libya], Tripolitania, Mesellata: Cussabat, Ras Gelà (3076), 13/04/1913. Leg. R. Pampanini, (FI, Lectotypus designated here).
Other material, Syntypi: Tripolitania, Garian: Bu Gheilan (3612), 24/04/1913; Tripolitania, Garian: Uadi Garian (3859), 26/04/1913. Leg. R. Pampanini.
(Unpublished) Tripolitania, Mesellata, Colline a N-W di Cussabat (2992), 12/04/1913. Leg. R. Pampanini, (all material in FI).
Accepted name: *Brachypodium distachyon* (L.) P. Beauv. var. *hispidum* Pamp. (Weiller M. in Maire R. & Weiller M., Fl. Afrique N.: 280. 1955).
Note: separable from the nominal variety by glumes and lemmas hairy on entire surface.

New taxon: *Brachypodium distachyon* var. *hispidum* f. *confusum* Pamp. in Bull. Soc. Bot. Ital. 1914(5): 49. (1914b)
Accepted name: *Brachypodium distachyon* (L.) P. Beauv.
Note: in FI there is a sheet that bears following annotations: Cyrenaica, Uadi el-Kuf, fra Gasr Beni Gdam e Sidi Abd el Uahed (no. 413), 6/04/1933. Leg. R. Pampanini. It should be highlighted that the original material upon which Pampanini based his description of this taxon is not known.

New taxon: *Brachypodium distachyon* var. *hispidum* f. *intermedium* Pamp. in Bull. Soc. Bot. Ital. (1-3): 11. (1914a).; Pl. Tripol.: 14. (1914c).
Type: [Libya], Tripolitania, Tarhuna: Uadi Tersiva (Tenziua), Ras Maader (2044), 1/04/1913. Leg. R. Pampanini, (FI, Lectotypus designated here).
Other material, Syntypus: Tripolitania, Garian: Uadi Garian (4060), 29 aprile 1913. Leg. R. Pampanini.
Accepted name: *Brachypodium distachyon* (L.) P. Beauv. var. *hispidum* Pamp.
Note: it falls within the synonymy of var. *hispidum* despite Weiller M. in Maire R. & Weiller M., Fl. Afrique N.: 281. 1955, treating it as a good form. Pampanini (1938)

recombined later his taxon as *B. distachyon* P. B. var. *pubens* Beck f. *intermedium* Pamp., however without providing explanations on the matter.

New taxon: *Brachypodium distachyon* var. *hispidum* f. *pseudosubtile* Pamp. in Bull. Soc. Bot. Ital. (1-3): 11. (1914a): 11; Pl. Tripol. p.: 14. (1914c).
Type: [Libya], Tripolitania, Tarhuna, Uadi Ksea, Ras Argobinani (2414), 8/04/1913. Leg. R. Pampanini, (FI, Lectotypus designated here).
Other material, Syntypus: Tripolitania, Tarhuna, Uadi Sart (1753), 27/03/1913. Leg. R. Pampanini, (FI).
Accepted name: *Brachypodium distachyon* (L.) P. Beauv.
Note: taken into consideration as a good taxon by Weiller M. in Maire R. & Weiller M., Fl. Afrique N.: 280. 1955.

New taxon: *Brachypodium distachyon* var. *velutinum* Pamp. in Bull. Soc. Bot. Ital. (1-3): 11. (1914a); Pl. Tripol. p.: 14. (1914c).
Type: Libia, Cirenaica, Tarhuna: Uadi Ksea, Ras Argobinani (2483), 8/04/1913. Leg. R. Pampanini (FI, Lectotypus designated here).
Other material, Syntypi: Tarhuna: Kasr Daun (4401), 7/04/1913; Garian: Ras Tecut (3805), 26/04/1913; Garian: Uadi Garian (3852), 26/04/1913; Garian: Bu Gheilan (4402), 24/04/1913. Leg. R. Pampanini, (all material in FI).
Accepted name: *Brachypodium distachyon* (L.) P. Beauv.
Note: Pampanini's taxon is accepted by Weiller M. in Maire R. & Weiller M., Fl. Afrique N.: 281. 1955.

New taxon: *Brachypodium distachyon* var. *velutinum* f. *gussonei* Pamp. in Arch. Bot. XII (2): 18. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari, VIII (3): 61. (1938).
Type: Libia, Cirenaica: Slonta, steppa sassosa (423), 17/04/1933. Leg. R. Pampanini & R.E.G. Pichi Sermolli, (FI, Lectotypus designated here).
Other material, Syntypi: Cirenaica, Cirene, Melchifaf (424), 7/04/1933. Leg. R. Pampanini.
Cirenaica, Cirene: Uadi Belgadir (426), 26/04/1934; Cirenaica, El Beda: Uadi Uardama (427), 2/05/1934; Cirenaica, El Beda: Uadi Scisu (428), 7/05/1934; Cirenaica: Derna (425), 21/04/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli.
Accepted name: *Brachypodium distachyon* (L.) P. Beauv.
Note: because of the lack of a recent systematic investigation, at present this name is accepted as a synonym of *B. distachyon.* The intent by the author of establishing the new form is clearly expressed in the sheet label of Lectotypus.

New taxon: *Bromus chrysopogon* Viv. in Fl. Libyc. Spec.: 4. t. 2. 1824 [before August 1824]
Type: Neotypus: Cirenaica, Merg: Sidi Gibrin, 17/03/1922. Leg. A. Maugini, det. R. Pampanini as *Bromus scoparius* L. var. *psilostachys* Hal., (by Scholz H., Willdenowia 7 (2): 409. 1974a) (FI).
Accepted name: *Bromus chrysopogon* Viv. (Valdés & Scholz 2009).

New taxon: *Bromus fasciculatus* f. *parlatorei* Pamp. in Arch. Bot. XII (2): 18. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari, VIII(3): 61. (1938).

Type: Libia, Cirenaica, fra Bir Acheim e Mechili: l.d. Bir Zeidan (470), 26/03/1933. Leg. R. Pampanini (FI, Lectotypus designated here).

Other material, Syntypi: Cirenaica, Bir Acheim-Acroma: l.d. Sedra (468), 22/03/1933; Cirenaica fra Tobruk e Bardia: l.d. Sidi Bu Amud (469), 23/03/1933. Leg. R. Pampanini, (all material in FI).

Accepted name: *Anisantha fasciculata* (C. Presl) Nevski (Valdés & Scholz 2009).

Note: Pampanini (loc. cit.) identifies his plant with *Bromus fasciculatus* f. b of Parlatore (Fl. It. I: 411. 1850) who provides a short description of this variant but not the name: "*spiculis pubescentibus, palea superior longius ciliata*". This morphotype, the same as the Libya material in FI, possibly marks the southern portion of the Mediterranean range of the species, which northwards includes at least Sicily and Pantelleria.

New taxon: *Bromus hordaceus* var. *molliformis* f. *villosus* Pamp. in Bull. Soc. Bot. Ital. (1-3): 11. (1914a); Pl. Tripol. p.: 16. (1914c).

Type: Holotypus: [Libya], Tripolitania, Tarhuna: Uadi Msaaba a Kasr Doga, nell'acquitrinio (972), 18/03/1913. Leg. R. Pampanini (FI). (Indicated by C. Steinberg in Bot. Jahrb. Syst. 102 (1-4): 419. 1981).

Accepted name: *Bromus hordeaceus* L. subsp. *molliformis* (Billot) Maire & Weiller.

Note: the specimen, as annotated by H. Scholz (revision 1971, FI in sched.), is too young to be definitively determined.

New taxon: *Bromus macrostachys* f. *pubescens* Pamp. in Arch. Bot. XII (1): 18. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari, VIII (3): 61. (1938).

Type: Libia, Cirenaica, el-Beda, Uadi Scisu (495), 07/05/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli, (FI, Lectotypus designated here).

Other material, Syntypi: Libia, Cirenaica, Barce: l.d. Sidi Ahmed Cheila (488), 06/04/1933. Leg. R. Pampanini. Cirenaica, Derna: Uadi Naga (489), 21/04/1934; Cirenaica: Lamluda; Cirenaica, el-Beda: Uadi Messaf-saf Ain Legmeila (490), 22/04/1934; Cirenaica, el-Beda, Uadi El Kuf: l.d. Bu Breica (493), 27/04/1934; Labrach [el-Abrach on label], Mghernes, (494), 04/05/1934; Slonta, macchia (492), 25/04/1934 Leg. R. Pampanini & R.E.G. Pichi Sermolli, (all material in FI).

Accepted name: *Bromus alopecuros* L. subsp. *biaristulatus* (Maire) Acedo & Llamas (Acedo C. & Llamas F., Fl. Medit. 4: 203-212. 1994).

Note: the current synonym (basionym) is *Bromus lanceolatus* Roth subsp. *biaristulatus* Maire. The specimen collected at Lamluda is not in FI.

New taxon: *Bromus rubens* f. *intermedius* Pamp. in Bull. Soc. Bot. Ital. (1-3): 11. (1914a); Pl. Tripol.: 17. (1914c).

Type: Holotypus: [Libya], Tripolitania, Tarhuna: Colline a est di Kasr Tarhuna (1834), 28/03/1913. Leg. R. Pampanini, (FI). (Indicated by C. Steinberg in Bot. Jahrb. Syst. 102 (1-4): 422. 1981).

Accepted name: *Anisantha rigida* (Roth) Hyl. (Valdés & Scholz 2009; marked as *Bromus rigidus* Roth by K. Ammann, 14/12/1990).

Note: this taxon has nothing to do with *Anisantha rubens* (L.) Nevski (≡ *Bromus rubens* L.) which bears much smaller spikelets, glumes and lemmas.

New taxon: *Ctenopsis pectinella* var. *pubescens* Pamp. in Bull. Soc. Bot. Ital. (1-3): 11. (1914a); Fl. Tripol.: 19. (1914c).

Type: [Libya], Tripolitania, Uadi Teziu(v)a (Tersiva) nella steppa (1953), 1/04/1913. Leg. R. Pampanini, (FI, Lectotypus designated here).

Other material, Syntypi: Tripolitania, Tarhuna: Colline a E di Kasr Tarhuna (1845), 28/03/1913; idem (2113), 4/04/1913; Tripolitania: Kasr Daun (2294), 7/04/1913. Leg. R. Pampanini, (all material in FI).

Accepted name: *Festuca pectinella* Delile (≡ *Ctenopsis pectinella* [Delile] De Not. ≡ *Vulpia pectinella* [Delile] Boiss.).

Note: nowadays *Ctenopsis* De Not. and *Vulpia* C.C. Gmel. are better regarded as sections of *Festuca* L. (Soreng & al. 2015).

New taxon: *Dactylis glomerata* var. *spicata* Pamp. in Arch. Bot. XII (2): 19. (1936a) [*D. glomerata*, Prod. Fl. Cir. p. 116, var. *hispanica*, Prod. Fl. Cir. p. 116 (p.p. specim Cassinera)]; Rend. Sem. Fac. Sc. Univ. Cagliari, VIII(3): 61. (1938).

Type: Libia, Cirenaica, Umm er-Rzem a sud est di Barce, Uadi Suenia (622), 18/04/1934, FI003601. Leg. R. Pampanini & R.E.G. Pichi Sermolli, (Lectotypus designated here).

Other material, Syntypi:

Published by Pampanini (1938): Cirenaica, Naughia a sud est di Bengasi (611), 10/03/1933, FI003606; Cirenaica, fra Bengasi e Soluch, Giardina (612), 10/03/1933, FI003607; Cirenaica, Apollonia, l. d. Rgua (618), 11/04/1933, FI003613; Cirenaica, fra Derna e Mechili: l. d. Siret Medanaat (616), 10/04/1933, FI003512; Cirenaica, Martuba, Uadi Bgar (615), 08/04/1933, FI003611; Cirenaica, Marmarica, fra Tobruk e Bardia, Uadi Sahal (613), 23/03/1933, FI003608. Leg. R. Pampanini.

Cirenaica, tra Bengasi e Agedabia, Sidi Ahmed el-Magrun (619), 07/04/1934, FI003614; Cirenaica, Uadi Scechaba (625), 01/05/1934, FI003598; Cirenaica, Messa, Uadi Tmista (624), 29/04/1934, FI003599; Cirenaica, Messa a ovest di Cirene, Sfonta (628), 08/05/1934, FI003595; Cirenaica, Beda, Uadi Madfa (626), 01/05/1934, FI003597; Cirenaica, Uadi Msuria (629), 10/05/1934, FI003604; Cirenaica, Umm er-Rzem a sud est di Barce (621), 18/04, FI003603; Cirenaica, Uadi Scisu (627), 07/05/1934, FI003596; Cirenaica, Chersa (620), 16/04/1934, FI003602; Cirenaica, el-Ghegab a sud est di Cirene, steppa a Poterium (623), 28/04/1934, FI003600; Cirenaica, fra Gubba e l'Uadi Latrun: l.d. Argub Dasc (630), 14/05/1934, FI003615. Leg. R. Pampanini & R.E.G. Pichi Sermolli.

Cited by Pampanini (1936) in the protologue: Cirenaica, Marmarica, Tobruk, 1918, Leg. F. Cassinera. Cirenaica, Bengasi, Karmu, 28/02; Bengasi, fra Guarscià e Gariunes, 10/03; Bengasi, Suani Bazar, 10/03; Bengasi, Rahba, 13/03; Bengasi, fra Ganfuda e Suani Tica, 26/03; Regima, primavera; Bengasi, Sidi Kalifa, primavera; Bengasi, Lete, primavera; Bengasi, Ganfuda, primavera; Bengasi, Selmani, primavera; Bengasi, Kuebia, primavera; Bengasi, Kseibia, primavera; Derna, primavera 1922. Leg. A. Maugini, (all material in FI).

Unpublished: el-Gubba (617), 07/04, FI003610; Umm er Rzem (614), 08/04/1933,

FI003609. Leg. R. Pampanini; tra Barce e Tocra Bu Goeir (613), 15/5/1934, FI003605. Leg. R. Pampanini & R.E.G. Pichi Sermolli. (FI).

Accepted name: *Dactylis glomerata* L.

Note: the pattern of diversity in *D. glomerata* is far from being understood, especially in the North African sector of its range. The proposal of even specific rank (*Dactylis spicata* [Pamp.] Guglielmo & Scalia in Boll. Accad. Gioenia Sci. Nat. Catania 18 [325]: 234. 1985) is currently devoid of any justification.

New taxon: *Dactylis glomerata* var. *spicata* f. *intermedia* Pamp. in Arch. Bot. XII (2): 19. (1936a) (*D. glomerata* var. *hispanica*, Prod. Fl. Cir, p. 117 p.p. specim. Zanon, Maugini); Rend. Sem. Fac. Sc. Univ. Cagliari, VIII (3): 61. (1938).

Type: Libia, Cirenaica, Cirene: Ghegab a sud est di Cirene, steppa a *Poterium* (640), 28/04/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli, (FI003656, Lectotypus designated here).

Other material, Syntypi:

Published by Pampanini (1938):

Cirenaica, fra Tocra e Tolmeta (636), 28/04/1933, FI003648; Cirenaica, Slonta (635), 17/04/1933, FI003647; Cirenaica, Slonta, steppa a Poterium (634), 17/04/1933, FI003646; Cirenaica, Derna, Uadi Naga (633), 09/04/1933, FI003645; Cirenaica, Martuba, Uadi Bgar (632), 08/04/1933, FI003644. Leg. R. Pampanini.

Cirenaica, Cirene, Uadi Hofra (645), 05/05/1934, FI003661; Cirenaica, Messa, Gasr Zaarura (641), 03/05/1934, FI003657; Cirenaica, Beda, l.d. Sfeiat (642), 04/05/1934, FI003658; Cirenaica, Uadi Scisu (646), 07/05/1934, FI003662; Cirenaica, el-Abrach, Mghernes (643), 04/05/1934, FI003659; Cirenaica, el-Abrach, Mghernes, macchia (644), 04/05/1934, FI003660; Cirenaica, fra Gubba e Uadi Latrun, l.d. Argub Dasc (648), 14/05/1934, FI003664; Cirenaica, Uadi Derna (647), 12/05/1934, FI003663; Cirenaica, Bomba, l.d. El Gefar (638), 8/4/1934, FI003650; Cirenaica, fra Gubba e Uadi el-Atrun, l.d. Argub Gazal (649), 14/05/1934, FI3665; Cirenaica, Marana a est di Barce steppa a *Artemisia* (639), 25/04/1934, FI003651; Cirenaica, tra Bengasi e Agedabia Sidi Ahmed el-Magrun (637), 7/4/1934. Leg. Pampanini & R.E.G. Pichi Sermolli, (FI003649).

Cited by Pampanini (1936) in the protologue: Cirenaica, Bengasi: [between] due Palme e Benina (452), 16/03; Cirenaica, Bengasi, Raaba (563), 13/04; Cirenaica, Bengasi, Cimitero nuovo, luogo ombroso (563), 20/03/1916. Leg. V. Zanon.

Cirenaica, Derna: vivaio di Derna, primavera; Cirenaica, Merg, Ridotta Zorda, 30/03; Cirenaica, Merg, piana a ovest di Merg., 09/04; Bengasi: Rahba, 15/03/1922; Cirenaica: Ma(a)tan Borgù, 06/1919 (2 campioni). Leg. A. Maugini. (all material in FI).

Accepted name: *Dactylis glomerata* L.

Note: see the discussion for var. *spicata*.

New taxon: *Diplachne festuciformis* H. Scholz in Willdenowia 11(1): 98. 1981.

Typus: Holotypus: Fezzan: El Jofra, Socna, oasi artificiale, campi. Leg. C. Ricceri & H. Steinberg (sub *Puccinellia distans* Parl. aff. subsp. *festuciformis*) (FI).

Accepted name: *Diplachne uninervia* (J.Presl) Parodi.

Note: marked as holotypus by H. Scholz 1981 and reidentified as *Leptochloa fusca* subsp.

uninervia (J. Presl) N. Snow by N. Snow, 31/08/2007. The accepted name in Valdés & Scholz (2009) is *Leptochloa uninervia* (J. Presl) Hitchc. & Chase, where the choice of the specific rank is undoubtedly suitable. However, it was demonstrated (Hilu & Alice 2001; Peterson & al. 2012) that *Diplachne* P. Beauv. and *Leptochloa* P. Beauv. are monophyletic, non-sister lineages, so Soreng & al. (2015) have provided the final separation of the two genera in the subtribe Eleusininae. These are easily distinguished by the synapomorphies of the spikelet that is dorsally compressed in *Diplachne*, laterally compressed in *Leptochloa*.

New taxon: *Koeleria pubescens* var. *tripolitana* Domin in Bull. Soc. Bot. Ital. (1-3): 12. (1914a); Pl. Tripol.: 24. (1914c).
Type: [Libya], Tripolitania, Tripoli: Ain Zara (3464), nell'acquitrinio, 22/04/1913. Leg. R. Pampanini, (FI, Lectotypus designated here).
Other material, Syntypus: Tripolitania, Garian: uadi Garian (4345), 07/05/1913. Leg. R. Pampanini, (FI).
Accepted name: *Rostraria litorea* (All.) Holub
Note: mistakenly reported in Valdés & Scholz (2009) as *Rostraria pubescens* (Lam.) Trin.

New taxon: *Koeleria salzmannii* var. *cossoniana* f. *glabra* Pamp. in Arch. Bot. XII (2): 19. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari, VIII(3): 62. (1938).
Type: Libia, Cirenaica: Tra Agedabia ed el-Agheila l.d. Melch en Nogra, 15/03/1933 (801), 15/03/1933. Leg. R. Pampanini, (FI, Lectotypus designated here).
Other material, Syntypi: Cirenaica, Marsa Brega; Cirenaica, Agedabia, Haseiat, l. d. Bag Lia; Cirenaica, fra Agedabia e Sonnu; Cirenaica, Zuetina 1933-34. Leg. R. Pampanini & R.E.G. Pichi Sermolli.
Accepted name: *Rostraria salzmannii* (Boiss.) Holub (Dobignard & Chatelain 2010).
Note: in FI there is the lectotype (no. 801), while the remaining original material, cited by Pampanini (1938), is missing.

New taxon: *Koeleria salzmannii* var. *cossoniana* f. *lobulata* Domin in Bull. Soc. Bot. Ital. (1-3): 12. (1914a); Pl. Tripol.: 25. (1914c).
Type: Holotypus: [Libya], Tripolitania, Garian: Bu Gheilan, nell'acquitrinio (3670), 24/04/1913. Leg. R. Pampanini, (FI).
Accepted name: *Rostraria salzmannii* (Boiss.) Holub (Dobignard & Chatelain 2010).
Note: further original material referable to this taxon doesn't seem to exist.

New taxon: *Koeleria salzmannii* var. *cossoniana* f. *villosa* Pamp. in Arch. Bot. XII (2): 20. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari, VIII (3): 62. (1938).
Type: Libia, Cirenaica, Ridotta Tilger a 10 km da Agedabia, (808), 07/04/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli, (FI, Lectotypus designated here).
Other material: Syntypus: Cirenaica, tra Agedabia ed el-Agheila: l.d. Melch en Nogra (807), 15/03/1933. Leg. R. Pampanini, (FI).
Accepted name: *Rostraria salzmannii* (Boiss.) Holub (Dobignard & Chatelain 2010).

New taxon: *Koeleria salzmannii* var. *longiflora* Domin in Bull. Soc. Bot. Ital. (1-3): 12. (1914a); Pl. Tripol.: 26. (1914c) (in herb. sub var. *longiglumis*).
Type: [Libya], Tripolitania, Tarhuna: Abiar Milgah, sul Ras Ter (1098), 19/03/1913. Leg. R. Pampanini, (FI, Lectotypus designated here).
Other material, Syntypi: Tripolitania, Tarhuna: Pianura di Kam el-Gaar (1877), 31/03/1913; Tripolitania, Tarhuna: Uadi Msaaba (839), 18/03/1913; Tripolitania, Tarhuna: Abiar Milgah a Migi (1059), 19/03/1913. Leg. R. Pampanini, (all material in FI).
Accepted name: *Rostraria salzmannii* (Boiss.) Holub
Note: in Bull. Soc. Bot. Ital. 1914 is published only the sheet no. 1877, but subsequently in Pl. Tripol.: 26 also the specimens 839, 1059 and 1098 (lectotype) are published; they all belong to the original material. In the same work Pampanini refers about the Domin's opinion that two forms are recognizable, the first one "f. *minor*" labelled "*aristulis brevioribus*" [shorter awns], corresponds to the sheet 839, the second one, without a name but with a short description, corresponds to the sheet no. 1059.

New taxon: *Koeleria salzmannii* var. *longiflora* subvar. *aurata* Pamp. in Bull. Soc. Bot. Ital. (1-3): 12. (1914a); Pl. Tripol. p: 26. (1914c). (in herb. sub *K. salzmannii* var. *cossoniana* subvar. *aurata* Pamp.
Type: [Libya], Tripolitania, Tarhuna, Ras Ghenai (4383), 25/03/1913. Leg. R. Pampanini, (FI, Lectotypus designated here).
Other material: Syntypus: Tripolitania, Tarhuna, Colline a est di Kasr Tarhuna (1835), 28/03/1913. Leg. R. Pampanini, (FI).
Accepted name: *Rostraria salzmannii* (Boiss.) Holub

New taxon: *Koeleria salzmannii* var. *pampaninii* Domin in Bull. Soc. Bot. Ital. (1-3): 12. (1914a); Pl. Tripol.: 26. (1914c).
Type: [Libya], Tripolitania, Tripoli: Ain Zara, nell'acquitrino (3466), 22/04/1913. Leg. R. Pampanini, (FI, Lectotypus designated here).
Other material: Syntypus: Tripolitania, Tarhuna, Uadi Ksea, Ras Argobinani (2422), 08/04/1913. Leg. R. Pampanini, (FI).
Accepted name: *Rostraria salzmannii* (Boiss.) Holub
Note: the specimen no. 2422 is dubitatively cited by Pampanini (1914b) but is probably lost in FI; the lectotype sheet bears an autograph label of Domin.

New taxon: *Lagurus ovatus* f. *oblongus* Pamp. in Bull. Soc. Bot. Ital. (1-3): 12. (1914a); Pl. Tripol.: 27. (1914c).
Type: Holotypus: [Libya], Tripolitania, Tripoli, Suani Beni Aden, nella steppa [2(1)4], 25 febbraio 1913. Leg. R. Pampanini, (FI).
Accepted name: *Lagurus ovatus* L. subsp. *ovatus* (marked by Messeri 1942, as *Lagurus ovatus* subsp. *communis* var. *genuinus* Messeri).
Note: in Pampanini's Pl. Tripol. (1914), certainly in error, the sheet is indicated as no. 214 instead of 24; on the other hand all publication data fit perfectly the data labelled on the specimen sheet, which also represents the only evidence for this taxon in FI.

New taxon: *Libyella* Pamp. in Bull. Soc. Bot. Ital.: 150. 1925.; Libya, I: 68-74. 1927.
Type: *Libyella cyrenaica* (Durand & Barr.) Pamp., basionym: *Poa cyrenaica* Durand & Barratte Fl. Lib. Prodr. I: 268. 1910.
Accepted name: *Poa* L. (Soreng & al. 2015).
Note: monospecific genus, see *Poa cyrenaica*.

New taxon: *Oryzopsis coerulescens* var. *grandis* Pamp. in Arch. Bot. XII (2): 20. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari, VIII(3): 62. (1938).
Type: Holotypus: Libia, Cirenaica: Ain Mara (926), 28/04/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli, (FI).
Accepted name: *Piptatherum holciforme* subsp. *longiglume* (Hausskn.) Freitag (Valdés & Scholz 2009).
Note: marked by H. Scholz (1971) as the typus of *Oryzopsis coerulescens* var. *grandis* Pamp. The same author in Willdenowia 7(2): 420. 1974 refers to the typus in FI but doesn't provide any information on collecting data, making the typification invalid.

New taxon: *Poa cyrenaica* Durand & Barratte in Fl. Lib. Prodr. I: 268. 1910.
Type: [Libya], Cyrenaica, Bengasi (379), 10/02/1883. Leg. Ruhmer (FI, Lectotypus designated here).
Accepted name: *Poa cyrenaica* Durand & Barr.
Note: the sheet no. 379 was labelled (in 2014) by R. Soreng (US) as isotypus, but he never designated a type (Soreng *in litteris* 2014); likewise M. Röser (Hal), who has been involved in studies on *Libyella*, didn't designate any type for this genus (Röser *in litteris* 2014).

New taxon: *Poa vaginata* Pamp. in Arch. Bot. XII (2): 20. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII (3): 62. (1938).
Type: Holotypus: Libia, Cirenaica, Umm er Rzem a sud est di Barce: Uadi Suenia (1060), 18/4/1934. Leg. R Pampanini & R.E.G. Pichi Sermolli, (FI003616).
Accepted name: *Poa vaginata* Pamp. (Valdés & Scholz 2009; Dobignard & Chatelain 2010).
Note: in Sherif & Siddiqi (1988) curiously two other specimens are cited that were collected by Pampanini and not cited by him. The reason is due to the fact that the two mentioned specimens were identified as *P. vaginata* not by Pampanini but by H. Scholz (1971) which had borrowed them. Although the authors of Poaceae in Flora of Libya, refer to them at FI, they had not seen them, but simply consulted the *specimina visa* of Scholz's paper as is also evident from the citation of that work in their bibliography, used to make the record of this taxon in the Libyan flora. The same applies to the indication of the typus which is only a bibliographic citation. The two samples are: Cyrenaica, southeast of Barce, Wadi el Bgar (1024), 04.08.1933. Leg. R. Pampanini; Cyrenaica, between Derna and Mechili, Gat and Dghigh (1028), 04.10.1933. Leg. R. Pampanini (sub *Poa bulbosa* L.), which obviously are not part of the original collection.

New taxon: *Polypogon monspeliensis* f. *exilis* Pamp. in Agric. Colon., XXII: 362-63, t. I, f. 5 (recto). 1928. Considered relative to this taxon is also the material of *P. monspeliensis* Desf. indicated in Agric. Colon. XX: 457. (1926).
Type: [Libya], Cirenaica: Oasi di Giarabub, 02/06/1926 (field label), 06-07/1926 (*herbarium* label). Leg. G. Krüger, (FI, Lectotypus designated here).
Other material, Syntypi: Cirenaica, Oasi di Giarabub, 01/06 and 06/1926 (field labels concerning the same sample), 06-07/1926 (herbarium labels); Cirenaica, Giarabub, 24/02/1927 (field labels), 10/02/1927 (herbarium labels). Leg G. Krüger, (all material in FI).
Accepted name: *Polypogon monspeliensis* (L.) Desf.
Note: possibly synonym of var. *minor* Coss. & Durieu (Algeria), which is also a synonym of the species (Dobignard & Chatelain 2010).

New taxon: *Scleropoa philistaea* f. *pauciflora* Pamp. in Bull. Soc. Bot. Ital. (1-3): 12. (1914a); Pl. Tripol.: 36. (1914c).
Type: Holotypus: [Libya], Tripolitania, Tarhuna: Uadi Msaaba a Kars Doga, nell'acquitrinio (958), 18/03/1913. Leg. R. Pampanini, (FI).
Accepted name: *Desmazeria philistaea* (Boiss.) H. Scholz
Note: likely a depauperate individual falling within the normal variability of the species.

New taxon: *Vulpia danthonii* var. *tripolitana* Pamp. in Bull. Soc. Bot. Ital. (1-3): 12. (1914a); Pl. Tripol. p.: 39. (1914c).
Type: [Libya], Tripolitania, Garian: Kasr Garian, margini dei campi (4312), 4/05/1913. Leg. R. Pampanini, (FI, Lectotypus designated here).
Other material, Syntypus: Tripolitania, Tarhuna, Uadi Sart (4397), 27/03/1913. Leg. R. Pampanini, (FI).
Accepted name: *Festuca danthonii* Asch. & Graebn.
Note: a better known synonym of Pampanini's taxon is *Vulpia ciliata* Dumort. var. *tripolitana* (Pamp.) Maire & Weiller. It represents no more than the expression of an accentuated hairiness in glumes and lemmas within the normal range of the species. For the inclusion of the species in the genus *Festuca*, see Soreng & al. (2015).

***Potamogetonaceae* (S. Miranda)**
New taxon: *Potamogeton crispus* f. *integrifolius* Corti in Flora e Vegetazione del Fezzan e della Regione di Gat. Reale Società Geografica Italiana 1: 28. 1942.
Type: Holotypus: [Libya], Fezzan occidentale, Regione di Gat: Tunin (Gat) 2° deposito d'acqua, (1280), 700 m., 05/03/1934. Leg. R. Corti, (FI).
Accepted name: *Potamogeton crispus* L. *sensu* Fl. Lib. 114: 7-8. 1984b.
Note: on the sheet there is a small label bearing a handwritten note in pencil by Corti.

***Primulaceae* (P. Cuccuini & C. Nepi)**
New taxon: *Anagallis linifolia* f. *candida* Pamp. in Bull. Soc. Bot. Ital. (1-3): 15. (1914a); Pl. Tripol.: 187. (1914c)
Type: Holotypus: [Libya], Tripolitania, Garian: Kasr Garian, nei campi incolti (nei maggesi [on the label]) (4130), 30/04/1913. Leg. R. Pampanini, (FI).

Accepted name: *Lysimachia monelli* subsp. *linifolia* (L.) Peruzzi see Dobignard & Chatelain 5: 168. 2013, s.l.

New taxon: *Anagallis linifolia* var. *litoralis* Pamp. in Bull. Soc. Bot. Ital. (1-3): 15. (1914a); Pl. Tripol.: 187. (1914c).
Type: Holotypus: [Libya], Tripolitania, Tripoli: Fra Tripoli e Gargaresc (22), 14/02/1913. Leg. R. Pampanini.
Accepted name: *Lysimachia monelli* L. subsp. *monelli*, see Dobignard & Chatelain 5: 168. 2013.

New taxon: *Coris monspeliensis* var. *syrtica* f. *dentata* Pamp. in Bull. Soc. Bot. Ital. (4-9): 18. 1920.
Original material: Libia, Tripolitania: dintorni di Nalut, 1913. Leg. Capitano Antonetti.
Accepted name: *Coris monspeliensis* L. sensu Ali S. I. in Fl. Lib 6: 1-3. 1077.
Note: the *exsiccatum* came to Pampanini by means of E. Chiovenda who, in turn, had received it from General A. Zola together with further specimens collected by others in Tripolitania. The specimen, collected by a soldier, Captain Antonetti, is not present in FI, nor in RO (A. Tilia *in litteris* 2016).

***Ranunculaceae* (P. Cuccuini & C. Nepi)**
New taxon: *Adonis microcarpa* var. *intermedia* f. *lutea* Pamp. in Bull Soc. Bot. Ital. (1-3): 14. (1914a); Pl. Tripol.: 117. (1914c).
Type: [Libya]: Tripolitania, Tarhuna: Ras Ghenai (1553), 25/03/1913. Leg. R. Pampanini, (FI, Lectotypus designated here).
Syntypi from the original collection: [Libya], Tripolitania, Mesellata: Cussabat, nelle messi (2699), 10/04; Me.: Cussabat, nei margini dei campi (2744), 10/04; Me.: sul Ras Gelà (3082), 13/04; T., Tarhuna: Ras Bu Tauil (1301), 21/04; Ta.: Uadi Tenziua, nelle messi (1971), 01/04; Ta.: Uadi Ksea sul Ras Argobinani (2509), 08/04/1913. Leg. R. Pampanini.
Accepted name: *Adonis microcarpa* DC. by C. Steinberg, (07/1970).
Note: in FI there are specimen nos. 1553 and 3082 only. In Fl. du l'Afr. du Nord, Quézel includes our taxon under *A. dentata* (Quézel 1964). Indeed he considers *A. dentata* as subdivided into three varieties: *genuina*, *intermedia* and *microcarpa* and lists a series of related subvarieties, among which the subvar. *lutea* is the one with "yellow flowers" but without specifying to which var. it refers. For this reason it was not possible to relate the names of the two taxa together (which, in any case, would refer to comb. and stat nov.).

New taxon: *Clematis flammula* var. *sancti-marini* f. *angustissima* Pamp. in Nuovo Gior. Bot. Ital. n.s. 31: 211. (1924).
Type: [Libya], Cirenaica, Regione di Merg: Uadi Umm el Anain, 28/05/1922. Leg. A. Maugini, (FI001167, Lectotypus designated here); previously quoted as Holotypus by Wang Wen-Tsai in Acta Phytotaxonomica Sinica 41(2): 158. 2003, see note.
Isolectotypus: (FI).

Accepted name: *Clematis flammula* var. *stenophylla* Heldr. ex Huntze see Wang Wen-Tsai, in Acta Phytotaxonomica Sinica 41(2): 153-158. 2003.

Note: there are two specimens in FI which carry the data for the previously mentioned taxon. The Editor for the Ranunculaceae Family, Wang Wen-Tsiai (2003) examined both specimens twice (as shown by the photographs loaned on 06/05/2000 to G and on 04/07/2001 to PE).

Since the FI technician who took the photographs numbered the two images twice both times, taking the second as an attachment to the first, the Chinese scholar was probably misled and mistakenly believed that the collection consisted of two sheets somehow linked together, a situation which he did not make clear. This is not the case, as the two specimens are clearly autonomous. For this reason we are dealing with a case of mistaken identity of the type itself (see article 9.9 of ICN-McNeill & al. 2012) which consequently should not be defined as a Holotypus but rather as a Lectotypus. The lectotypus, although effectively established, consists of two distinct, unrelated specimens. One single specimen, indicated as FI001167, can therefore be designed here (2nd step) as Lectotypus (see article 9.17 of ICN-McNeil & al. 2012).

New taxon: *Ranunculus asiaticus* var. *bereniceus* Pamp. in Nuovo Gior. Bot. Ital. n.s. 24: 136. (1917).

Original material: [Libya], Cirenaica: Fuehat, 03/03 (319bis); C.: Due Palme, luoghi rocciosi, 03/03, (228, 228 bis), 26/02/1916 (267). Leg. V. Zanon.

Accepted name: *Ranunculus asiaticus* L., see Dobignard & Chatelain 5: 190. 2013.

Note: the author, in Pampanini (1916), thinks that the new variety described is a hybrid between *R. asiaticus* var. *flavus* and *R. asiaticus* var. *grandiflorus*. The material is not kept in FI.

New taxon: *Ranunculus asiaticus* var. *bicolor* Pamp. in Bull Soc. Bot. Ital. (1-3): 14. (1914a); Pl. Tripol.: 119. (1914c).

Typus: [Libya], Tripolitania, Tarhuna: Abiar Milgha, (437), 28/02/1913. Leg. R. Pampanini, (FI003792, Lectotypus designated here).

Isolectotypi: (441-FI003790, 436-FI003793, 438-FI003791, 439-FI003784, 4468-FI003785).

Other syntypi from the original collection: [Libya], Tarhuna.: Abiar Milgha a Migi (4469), 28/02, (FI003789); Ta.: Abiar Milgha sul Ras Ter (1087), 19/03, (FI003787); Ta.: Kasr Tarhuna (628), 12/03, (FI003788); Ta.: Ain Scersciara (633), 14/03/1913. Leg. R. Pampanini, (FI003786).

Accepted name: *Ranunculus asiaticus* L. see Dobignard & Chatelain 5: 190. 2013; also in Fl. Lib. 108. 1984.

New taxon: *Ranunculus asiaticus* var. *grandiflorus* Bég. & Vaccari in Ann. di Bot. XII(1):105. 1914.

Original material: [Libya]: Tripolitania: Misrata nei campi arenosi e lungo la sebckha tra questa città e Ras Zurug, 06/03/1913. Leg. A. Vaccari.

Accepted name: *Ranunculus asiaticus* L. see Dobignard & Chatelain 5: 190. 2013.

Note: the material is not kept in FI; other material is present in MOD (*non vidi*).

New taxon: *Ranunculus asiaticus* var. *intermedius* Pamp. in Arch. Bot. XII(1): 25. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 65. (1938).
Type: Libia, Cirenaica: Cirene l.d. Melchifaf (2733), 7/4/1933. Leg. R. Pampanini, (FI003492, Lectotypus designated here).
Other syntypi from the original collection: Libia, Cirenaica, Cirene: es Saf-Saf (2734), 18/04/1933. Leg. R. Pampanini, (FI003493). C., Umm er Rzem, a sud est di Barce: Uadi esc Suenia (2735), 18/4/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli, (FI003494).
Accepted name: *Ranunculus asiaticus* L. in Dobignard & Chatelain 5: 190. 2013.
Note: on the sheet of Lectotypus (FI003492) there is a piece of newspaper with the name of the new taxon handwritten in blue pencil by Pampanini.

New taxon: *Ranunculus asiaticus* var. *kermesinus* Pamp. in Arch. Bot. XII(1): 25. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 65. (1938).
Type: Holotypus: Libia, Cirenaica, Cirene: l.d. Melchifaf (2736), 7/04/1933. Leg. R. Pampanini, (FI).
Accepted name: *Ranunculus asiaticus* L. s.l.
Note: on the specimen there is a piece of newspaper with the name of the new taxon handwritten in blue pencil by Pampanini.

New taxon: *Ranunculus asiaticus* var. *sanguineus* f. *purpureus* Bég. & Vaccari in Schedae ad Fl. Lyb. Exs. P. 35, n° 100 (1914), *nomen nudum*.
Original Collection: [Libya], Cyrenaica: Derna, sulle colline alt. 1''-300 m. 1914; Leg. A. Vaccari (FI ?, PAD!).
Accepted name: *Ranunculus asiaticus* L.
Note: this specimen is not kept in FI.

New taxon: *Ranunculus asiaticus* var. *vulgaris* f. *croceus* Bég. & Vaccari in Schedae ad Fl. Lyb. Exs., 35. n° 99. 1913, *nomen nudum*. Contr. Fl. Lib.: 46. 1912; Sec. Contr. Fl. Lib. Roma: 26. 1913 (idem ma senza località); Modena 22; Terzo Contrib. Fl. Lib., Ann. Di Bot. 12: 105. 1913 (idem). (All sub *R. asiaticus* var. *vulgaris* DC.)
Original material: [Libya, Cyrenaica], Marmarica: Tobruk, in collibus aridis saxosis, solo calcareo, 01/03/1913. Leg. A. Vaccari (FI).
Accepted name: *Ranunculus asiaticus* L. see Dobignard & Chatelain 5: 190. 2013.
Note: only one specimen corresponds to this name in FI (published as Sched. n°99 in FI. Lib. Exs) and is sub *R. asiaticus* var. *grandiflorus*. The publication does not give any explicit description of the morphological characteristics.
The bibliographical citations mentioned on the sched. n° 99 of FI. Lib. Exs. all refer to *R. asiaticus* var. *vulgaris* DC. and relate to the following specimens respectively: Marmarica: Tobruk nei colli aridi i calcarei, 24/01, 20/02/1912. Leg. A. Vaccari.; *sine loco*; Marmarica: Tobruk nella costa sud del golfo, 12/01/1913. Leg. A. Vaccari.

New taxon: *Ranunculus bullatus* var. *cyrenaicus* Pamp. in Nuovo Gior. Bot. Ital. n.s. 26: 212 (1919).
Type: Lectotypus: [Libya], Cirenaica, Bengasi: Fra le Due Palme e la linea ferroviaria di Benina, in direzione del Giok Kebir (24), 05/01/1917. Leg. V. Zanon, (FI001168).

Marked as Lectotypus by R. M. Baldini, 11/04/2000, and later typified by R. Baldini & C. Jarvis, in Bull. Nat. Hist. Mus. Lond. (Bot.) 32(1): 11. 2002.

Other syntypi from the original collection: Cirenaica, Bengasi: Due Palme (24), 01/1915, (FI003679); C. Bengasi: Casa Auari (50 C), 12/1917, (FI003696). Leg. V. Zanon.

Accepted name: *Ranunculus cytheraeus* (Halácsy) Baldini, in Baldini & Jarvis, (2002).

New taxon: *Ranunculus cyclocarpus* Pamp. in Arch. Bot. XII(1): 25-26. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 65. (1938).

Type: Libia, Cirenaica: Apollonia, l.d. Rgua (2750), 11/04/1933. Leg. R. Pampanini, (FI003469, Lectotypus designated here).

Other syntypi from the original collection: Libia, Cirenaica, Cirene: es Saf-Saf (2752), 18/04, (FI003471); C.: Lamluda macchia (2749), 09/04, (FI003467); C., Apollonia: l.d. Rgua (2750), 11/04, (FI003469); C., Uadi el Kuf: fra Gasr Beni Gdam e Sidi Abd el Uahed, (2751), 11/04, (FI003468); C., el Gubba: Siret-Bettamer (2748), 7/4/1933. Leg. R. Pampanini (FI003466).

Cirenaica, Cirene: es Saf-Saf (2753), 21/04, (FI003470); C., el Beda: Uadi El Kuf: l.d. Bu Breica (2756), 27/04, (FI003474); C., el Beda: Uadi Messaf-Saf , Ain Legmeila (2754), 22/04, (FI003472); C., el Beda: Uadi Beregt (2755), 24/04, (FI003473); C., el Beda: Uadi Uardama (2757), 02/05, (FI003475); C., Cirene: Uadi Hofra (2758), 05/05, (FI003476); C., Cirene: Uadi Bu Nabeh (2759), 15/5/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli, (FI003477).

Accepted name: *Ranunculus cyclocarpus* Pamp. see Dobignard & Chatelain 5: 193. 2013 and also Fl. Lib. 108: 43. 1984.

Note: this is a Libyan endemic limited to Cyrenaica and in particular to the area of the Akhdar Jebel, the chain that stretches from Barce (to the west) almost as far as Derna (to the East). Specimen no. 2748 is accompanied by a piece of newspaper with the note, handwritten by Pampanini, "*Ranunculus* sp. nov."

New taxon: *Ranunculus flabellatus* var. *amphicarpus* Pamp. in Arch. Bot. XII(1): 25. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 65. (1938).

Original Collection: Libia, Cirenaica, Cirene: Saf-Saf 1933; C.: Slonta, steppa sassosa, (sub *R. flabellatus* f. *amphicarpa)* 17/04/1933. Leg. R. Pampanini (FI, only the 2nd specimen).

Accepted name: *Ranunculus paludosus* var. *amphicarpus* (Pamp.) Boulos comb. nov. (see Boulos 1979a).

Note: this specimen (Cirene: Saf-Saf 1933) is not present in FI, whilst there is another specimen: Cirenaica, Slonta, steppa sassosa (2744), 17/04/1933. Leg. R. Pampanini, corresponding to the apparently unpublished description in the protologue (Pampanini 1936a). We say "apparently" because of the uniqueness of the specimen Pampanini mentions (1938) and the fact that the specimen bears the usual piece of newspaper with the name of the new taxon (although under a different rank – f. *amphicarpica* Pamp.). Probably the name on the label is the first provisional hypothesis of the new taxon.
Thus it is probable that Pampanini wished to refer to this specimen and not the one published (may be with mistaken locality, but next to the one quoted on the label) in Pampanini (1938). Considering the margin of doubt that remains, we have not gone ahead with typification.

***Rhamnaceae* (M. Thiv)**

New taxon: *Rhamnus alaternus* f. *intermedia* Pamp. in Arch. Bot. XII(1): 36. 1936; Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 70. (1938).

Type: Libia, Cirenaica, Messa a ovest di Cirene: Uadi Tmista (4812), 29/04/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli, (FI003747, Lectotypus designated here).

Accepted name: *Rhamnus alaternus* L.

Note: Pampanini (1936) did not indicate a type specimen in his description of the taxon. In accordance with ICN Art. 40.1 and 9.11 (McNeill & al. 2012) a lectotype is selected here. This specimen has a piece of newspaper with the name of the new taxon handwritten in blue pencil by Pampanini. It therefore very likely represents the material on which the description is based on.

New taxon: *Rhamnus alaternus* var. *microphylla* Pamp. in Arch. Bot. XII(1): 36. 1936; Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 70. (1938).

Type: Libia, Cirenaica, Fra El Garib e Tolmeta: Uadi el Fahaga (4813), 14/04/1933. Leg. R. Pampanini, (FI003748, Lectotypus designated here).

Accepted name: *Rhamnus alaternus* L.

Note: the same points as shown for the nomenclatural treatment of *Rhamnus alaternus* f. *intermedia* also apply to *Rhamnus alaternus* var. *microphylla*.

New taxon: *Rhamnus pendula* Pamp. in Arch. Bot. XII(1): 36. 1936; Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 70. (1938).

Type: Libia, Cirenaica, El Beda, U. Msuria (4859), 10/05/1934; leg. Pampanini & R.E.G. Pichi Sermolli, (FI003750, Lectotypus designated here).

Isolectotypus: ULT (*non vidi*).

Other original material: Cirenaica, Apollonia: U. Scechaba (4858), 01/05/1934, (FI003749); Cirene: U. BuNabeh (4860), 15/05/1934. leg. R. Pampanini & R.E.G. Pichi Sermolli, (FI003751).

Accepted name: *Rhamnus alaternus* L.

Note: in the original description no type material was indicated. In Jafri S.M.H., Fl. Lib. 30: 9. (1977c) specimen no. 4859 is selected as type, kept in two Herbaria (FI and ULT). In FI there is also the unpublished specimen but part of the original collection: Cirene: U. Belgadir (4857), 26/04/1934. Leg. R. Pampanini & R. E. G. Pichi Sermolli, unpublished. According to preliminary molecular analyses, *R. pendula* is distinct from other *R. alaternus* accessions. This taxon is, however, nested within the *R. alaternus* group. Therefore, until molecular studies are completed, *R. pendula* is here regarded as a synonym of *R. alaternus*.

New taxon: *Rhamnus tripolitana* Engler, in Pflanzenw. Afr. iii, II (Engl. & Drude, Veg. Der Erde, ix.) 311 (1921).

Type: [Libya], Tripolitanien, [Tripoli]: Qasr Safran (928), 23/4/1881. Leg. G. A. A. Krause, (FI001177, Lectotypus designated here).

Accepted name: *Rhamnus tripolitana* Engler

Note: Engler (1921) states a close relationship between *R. tripolitana* and *R. alaternus* because of their racemose inflorescences. This shrub is moreover characterised by 1.5-

2 × 1-1.5 cm, elliptic leaves which are yellowish-tomentose on the lower surface. According to a letter from Diels to Pampanini, the specimen housed at FI is a fragment of the type of *R. tripolitana*. This specimen at FI seems to be the only original material of this taxon because the specimen at B is likely destroyed (R. Lücking in litteris 2016). The material at FI is, however, too sparse to infer the taxonomic status of *R. tripolitana*. Therefore, it is refrained from drawing conclusions.

***Rosaceae* (K. Pagitz)**

New taxon: *Rubus cyrenaicae* Hruby in Arch. Bot. XII(1): 28-29. (1936a); Rend. Sem. Fac. Sc. Univ. CagliariVIII(3): 67. (1938).

Type: Lectotypus: Libia, Cirenaica: U. Derna, 12/051934 (3413), R. Pampanini & R.E.G. Pichi Sermolli, sub. "*R. cyrenaicus*, Hruby 232", (FI003453) by E. Monasterio-Huelin & H. E. Weber, in: Edinb. J. Bot. 53 (3): 316 (1996).

Syntypi: L.: Cirenaica, Cirene: Uadi Belgadir (3411), 26/04, (FI003454); C.: Uadi Hofra (3412), 05/05/1934. leg. R. Pampanini & R.E.G. Pichi Sermolli (FI003455).

Accepted Name: *Rubus ulmifolius* Schott var. *anoplothyrsus* Sudre

Note: *Rubus cyrenaicae* Hruby is part of *R. ulmifolius* Schott, and a synonym of *Rubus ulmifolius* var. *anoplothyrsus* Sudre [see E. Monasterio-Huelin & H. E. Weber in: Edinb. J. Bot. 53 (3): 311-322 (1996)]. The designated lectotype includes two inflorescences, both syntypi display only vegetative parts. All the specimens show autographic slips by Hruby, one of the syntypi also a second by Pampanini. The specimens originate from all three sites listed in Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 67. (1938).

New Taxon: *Rubus mussolinii* Hruby (= *R. cyrenaicae* × *ulmifolius*) in Arch. Bot. XII(1): 29. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 67. (1938).

Original material: Libia, Cirenaica, el Beda: Uadi Messaf-saf 1933-34. Leg. Pampanini & R.E.G. Pichi Semolli.

Note: the original material of this taxon is probably lost. Description and the mentioned hybrid-status (*R. ulmifolius* × *R. cyrenaicae*, the latter is also *R. ulmifolius*) indicate that this taxon belongs also to *Rubus ulmifolius* Schott.

New Taxon: *Rubus mussolinii* (= *R. cyrenaicae* × *ulmifolius*) f**.** *cuneatiformis* Hruby in Arch. Bot. XII(1): 29. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 67. (1938).

Type: Libia, Cirenaica, el Beda: U. Messaf-saf Ain Legmeila, 22/04/1934 (3414), Pampanini & R.E.G. Pichi Sermolli, (FI003451, Lectotypus designated here).

Isolectotype: (FI003452).

Accepte name: *Rubus ulmifolius* Schott.

Note: *Rubus mussolinii* Hruby f. *cuneatiformis* Hruby is part of *Rubus ulmifolius* Schott; on the sheet of the Lectotypus there are two autographic slips by Hruby (at the bottom, on the left), and by Pampanini (in blue pencil). On the Isolectotype an autograph is missing, but it is obviously part of the same collection. *Rubus mussolinii* f. *cuneatiformis* is documented from the *locus classicus* only.

New Taxon: *Rubus mussolinii* (= *R. cyrenaicae* × *ulmifolius*) f**.** *pseudanisodon* Hruby in Arch. Bot. XII(1): 29. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 67. (1938).

Type: Libia, Cirenaica, el Beda – U. Msuria, 10/05/1934 (3415). Leg. Pampanini & R.E.G. Pichi Sermolli, (FI003450, Lectotypus designated here).
Accepted name: *Rubus ulmifolius* Schott.
Note: *Rubus mussolinii* Hruby f. *pseudanisodon* Hruby is part of *Rubus ulmifolius* Schott; on the sheet of the Lectotypus there are two autographic slips by Hruby (at the bottom, on the left), and by Pampanini (by blue pencil). The text by Hruby indicates *R. cyrenaicae* × *anisodon* f. *bastardianus* Sudre. *Rubus anisodon* is one of Sudre's valueless microspecies of *R. ulmifolius* (Sudre 1908-1913, Rubi Europae, p. 71 f.). *Rubus mussolinii* Hruby f. *pseudanisodon* Hruby is written in blue by Pampanini on a separate label. The *herbarium* specimen originated from the only site documented for this taxon.

New Taxon: *Rubus mussolinii* f**.** *repens* Hruby **(=** *R. supercyrenaicae* × *ulmifolius* var**.** *anisodon***)** in Arch. Bot. XII(1): 29-30. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 67. (1938).
Type: Libia, Cirenaica, el Beda: U. Urdama, 02/05/1934 (3416). Leg. Pampanini & R.E.G. Pichi Sermolli, (FI003416, Lectotypus designated here).
Accepted name: *Rubus ulmifolius* Schott.
Note: *Rubus mussolinii* Hruby f. *repens* Hruby is part of *Rubus ulmifolius* Schott; on the sheet of the Lectotypus there are two autographic slips by Hruby (at the bottom, on the left), and by Pampanini (in blue pencil). Initially Hruby wrote *Rubus mostarensis* Sudre (= *R. ulmifolius* × *sanctus*), then he replaced *sanctus* by *cyrenaicae* f. *repens* Hruby. *Rubus mussolinii* Hruby f. *repens* Hruby is written in blue by Pampanini on a separate label. The *herbarium* specimen originates from the only site documented for this taxon.

New Taxon: *Rubus mussolinii* f**.** *vulgatiformis* Hruby in Rend. Sem. Fac. Sc. Univ. CagliariVIII(3): 67. (1938).
Type: Libia, Cirenaica, Cirene: U. Bu Nabeh, 15/05/1934 (3417). Leg. Pampanini & R.E.G. Pichi Sermolli, (FI003448, Lectotypus designated here).
Accepted name: *Rubus ulmifolius* Schott
Note: *Rubus mussolinii* Hruby f. *vulgatiformis* Hruby is part of *Rubus ulmifolius* Schott; on the sheet of the Lectotypus there are two autographic slips by Hruby (at the bottom, on the left), and by Pampanini (in blue pencil). Initially Hruby wrote *anisodon* × *sanctus*, then he replaced this by *R. mussolinii* Hr. (= *ulmifolius* × *cyrenaicae*) f. *vulgatiformis*, which is also written in blue by Pampanini on a separate label.

New Taxon: *Rubus pampaninii* Hruby **(=** *R. cyrenaicae* × *sanctus***)** in Arch. Bot. XII(1): 30. (1936a); Rend. Sem. Fac. Sc. Univ. CagliariVIII(3): 67. (1938).
Original material: Libia, Cirenaica, Cirene: Uadi Belgadir 1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli.
Note: the original material of this taxon is probably lost. The description is not detailed enough to allow a confident classification. The taxon is most likely part of R. *ulmifolius* or a segregate of it.

New Taxon: *Rubus pampaninii* (= *R. cyrenaicae* × *sanctus*) f. *fissidens* Hruby in Arch. Bot. XII(1): 30. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 67. (1938).

Type: Libia, Cirenaica, Cirene: U. Begadir, 26/04/1934 (3418). Leg. Pampanini & R.E.G. Pichi Sermolli, (FI003446, Lectotype designated here).
Accepted name: *Rubus ulmifolius* Schott
Note: on the sheet of Lectotypus there are two autographic slips by Hruby (at the bottom, on the left), and by Pampanini (in blue pencil).

New Taxon: *Rubus pampaninii* (= *R. cyrenaicae* × *sanctus*) f. *subvestitus* Hruby in Arch. Bot. XII(1): 30. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 67. (1938).
Type: Libia, Cirenaica, Cirene: U. Bu Nabeh, 15/05/1934 (3419). Leg. Pampanini & R.E.G. Pichi Sermolli, (FI003447, Lectotype designated here).
Accepted name: cfr. *Rubus ulmifolius* Schott
Note: the *herbarium* specimen is rather inadequate. The taxon is most likely part of R. *ulmifolius*. On the sheet of Lectotypus there are two autographic slips by Hruby (at the bottom, on the left), and by Pampanini (in blue pencil).

***Rubiaceae* (E. Vela)**
New taxon: *Asperula cyrenaica* f. *hispidula* Pamp. in Arch. Bot. XII(1): 45. 1936; Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 76. (1938).
Type: Libia, Cirenaica: fra Gubba e l'Uadi el Atrun: l.d. Argub Gazal (7599), 14/05/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli, (FI003732, Lectotypus designated here).
Syntypus from the original collection: Cirenaica: Apollonia: Uadi Scechaba (7598), 01/05, (FI003731).
Accepted name: *Asperula cyrenaica* (E.A. Durand & Barratte) Pamp. (by Dobignard A. & Chatelain C., In: Index Synon. Fl. Afr. N. 5: 254. 2013).
Note: forma *hispidula* is part of the variation of the species, but this variation does not overlap the variation of the "rather variable species" (Jafri S. M. H. In: Flora of Libya, 65: 30. 1979) *A. hirsuta* Desf. sensu stricto from Morocco, Algeria and Tunisia.

New taxon: *Asperula cyrenaica* f. *villosa* Pamp. in Arch. Bot. XII(1): 45. 1936; Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 76. (1938).
Type: Libia, Cirenaica, Uadi El Kuf: fra Gasr Beni Gdam e Sidi Abd el Uahed (7601), 11/04/1933. Leg. R. Pampanini, (FI003734, Lectotypus designated here).
Syntypus from the original collection: Libya, Cirenaica, Uadi el Kuf: fra Gasr Beni Gdam e Sidi Abd el Uahed (7600), 06/04/1933, (FI003733, Leg. R. Pampanini).
Accepted name: *Asperula cyrenaica* (E.A. Durand & Barratte) Pamp. (by Dobignard A. & Chatelain C. in: Index Synon. Fl. Afr. N. 5: 254. 2013).
Note: forma *villosa* is part of the variation of the species, but this variation does not overlap the variation of the "rather variable species" (Jafri S. M. H. in: Flora of Libya, 65: 30. 1979) *A. hirsuta* Desf. *sensu stricto* from Morocco, Algeria and Tunisia.

New taxon: *Putoria calabrica* f. *lactea* Pamp. in Arch. Bot. XII(1): 45. 1936; Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 76. (1938).
Type: Libia, Cirenaica, Messa a ovest di Cirene: Uadi Tmista (7666), 29/04/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli, (FI003685, Lectotypus designated here).

Accepted name: *Plocama calabrica* (L. f.) M. Backlund & Thulin (by Dobignard A. & Chatelain C. in: Index Synon. Fl. Afr. N. 5: 269. 2013.).

Note: although the white flowered form is only known from Cyrenaica, it can appears mixed with the typical pink flowered form in a same locality (cf. "c. 5 km from Susa, on way from Shahat", S.I. Ali 770 (ULT), S. I. Ali 771 (ULT); in Jafri 1979, Flora of Libya 65: 4 and should be considered as an individual achromatic form.

***Rutaceae* (G. Domina)**

New taxon: *Haplophyllum vermiculare* var. *cyrenaicum* Pamp. in Nuovo Giorn. Bot. Ital. 24: 147. (1917)

Type: Cirenaica: Raaba (78), 04/[19]15, Leg. V. Zanon (FI, Lectotypus designated here).

Other syntypi from the original collection: C.: Sciallabi el Bebas (304), 24/02; C.: Giuliana, Forte (406), 04/06; C.: Raaba (641),07/06; C.: Cimitero Nuovo (643), 07/06/1916, Leg. V. Zanon (all material in FI).

Accepted name: *Haplophyllum tuberculatum* (Forsk.) Juss.

Note: the printed *herbarium* labels bring the handwriting by Pampanini. The field labels bring the handwriting by Zanon. The *herbarium* specimens are slightly morphologically different; the specimen that better fits the original description is designated as Lectotypus.

New taxon: *Haplophyllum vermiculare* var. *cyrenaicum* f. *latifolium* Pamp. in Nuovo Giorn. Bot. Ital. 24: 148. (1917)

Type: Holotypus: [Libya], Cirenaica: Raaba (642), 7 giugno 1916. Leg. V. Zanon (FI001166).

Accepted name: *Haplophyllum tuberculatum* (Forsk.) Juss.

Note: the *herbarium* labels are handwritten by Pampanini.

***Santalaceae* (P. Cuccuini & C. Nepi)**

New taxon: *Thesium erythronicum* Pamp. in Arch. Bot. XII(1): 22-23. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 64. (1938).

Type: Libia, Cirenaica: Uadi el Atrum (1824), 14/05/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli, (FI003694, Lectotypus designated here).

Isolectotypus: K000431436.

Syntypus from the original material: Libia, Cirenaica, Beda: l.d. Sfeiat (1823), 04/05/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli, (FI003695).

Accepted name: *Thesium erythronicum* Pamp. by Jafri S.M.H. In: Fl. Lib. 14: 2. 1977d; also in Dobignard & Chatelain 5: 283. 2013.

Note: only specimen 1824 is mentioned in Pampanini (1936a), but both are cited in Pampanini (1938).

***Scrophulariaceae* (M. Abuhadra & P. Cuccuini)**

(The genera *Antirrhinum* and *Linaria* are placed in *Plantaginaceae* by Dobignard & Chatelain 2013).

New taxon: *Antirrhinum gebelicum* Brullo & Furnari in Webbia 34(1): 168. (1979).

Type: Isotypus: Cirenaica: Uadi el Cuf, 1/05/1974. Leg. S. Brullo & F. Furnari (FI). Holotypus (CAT).
Accepted name: *Antirrhinum gebelicum* Brullo & Furnari
Note: as *Antirrhinum tortuosum* Bosc. ex Vent. in Dobignard & Chatelain 5; 71. 2013.

New taxon: *Antirrhinum tenue* Viv. in Fl. Lib. specimen, 33, tab. XVI, fig. 5 and 6. 1824.
Type: "*In tumulis arenosis Magnae Syrteos*", [leg. P. Della Cella, see note], in Viviani, Florae libycae specimen: tab. XVI, fig. 5, 6 (Lectotypus designated here), (Fig. 2).
Epitypus: Tunisia: in incultis Sfax, 02/06/1854, Kralik, Pl. Tunet. n° 118 (sub. *Linaria viscosa* Dum., FI-W).
Isoepitypi: K, P.
Accepted name: *Linaria tenuis* (Viv.) Spreng. see Viano (1978a), Sutton (1988), Dobignard & Chatelain 5: 95. 2013.
Note: P. Della Cella collected plants in Libya (from Tripoli to western border of Egypt) in 1817 and delivered the complete collection to Prof. D. Viviani from Genova to be studied. With regard to *Linaria tenuis* (Viv.) Spreng, Viano (1978) states that the typus for the taxon is held in FI, but there is no trace of it there. Viano adds that Murbeck, in 1898, had already proposed a Neotypus (Tunisia: *in incultis* Sfax, 02/06/1834, Kralik, PI. Tunet. no: 118) conserved in LD *Herbarium*, but again where it is not to be found (P. Frödén, *in litteris* 2016). Sutton (1988) had already reported other possible isoneotypes at K as seen by Murbeck (where on the contrary there is only a note written by a technician in pencil who cites it under the work by Murbeck) and subsequently found also in FI, K and P, the latter two sub *Linaria viscosa* Dum. Murbeck settled for this choice since he had judged the material Viviani described to be an immature and dwarf specimen of what was subsequently confirmed in nature, and this was cause of later incorrect interpretations by other botanists of the time. Since he had never been to Genova, where the material of Viviani was held (but no longer present because it was destroyed during the 2nd World War), he had probably seen the drawing published in Viviani (1824) as well as read his work. It is not clear what material of Kralik Murbeck examined, since he neither declared it nor do any of the specimens carry any evidence of his revisions. However, in our opinion the choice Murbeck made is incorrect, as there still exists an element of the original collection. This is table XVI, fig. 5 and 6; x -calyx; y -corolla, (actually for fig. 6 Viviani, in his work (1824) on page 33, says: "*fig. 6 huius speciei varietas altera*" without specifying anything else) where it is published as an essential part of the protologue for *Antirrhinum tenue*. However, the illustration is "ambiguous" as it refers to a juvenile phase of the species Viviani identified and is insufficient for the purpose of precise application of the name. For this reason, it is legitimate to designate the cited image as Lectotypus, supported by an auxiliary specimen as epitype, specified in the above mentioned Kralik specimen no. 118 held in FI-W, in as much the most suitable among those identified.

New taxon: *Linaria fruticosa* f. *dentata* Pamp. in Bull. Soc. Bot. Ital. (1-3): 15. (1914a); Pl. Tripol.: 206. (1914c).
Type: [Libya], Tripolitania, Tarhuna: Uadi Sart (1768), 27/03/1913. Leg. R. Pampanini. (Lectotypus designated here, FI005921).

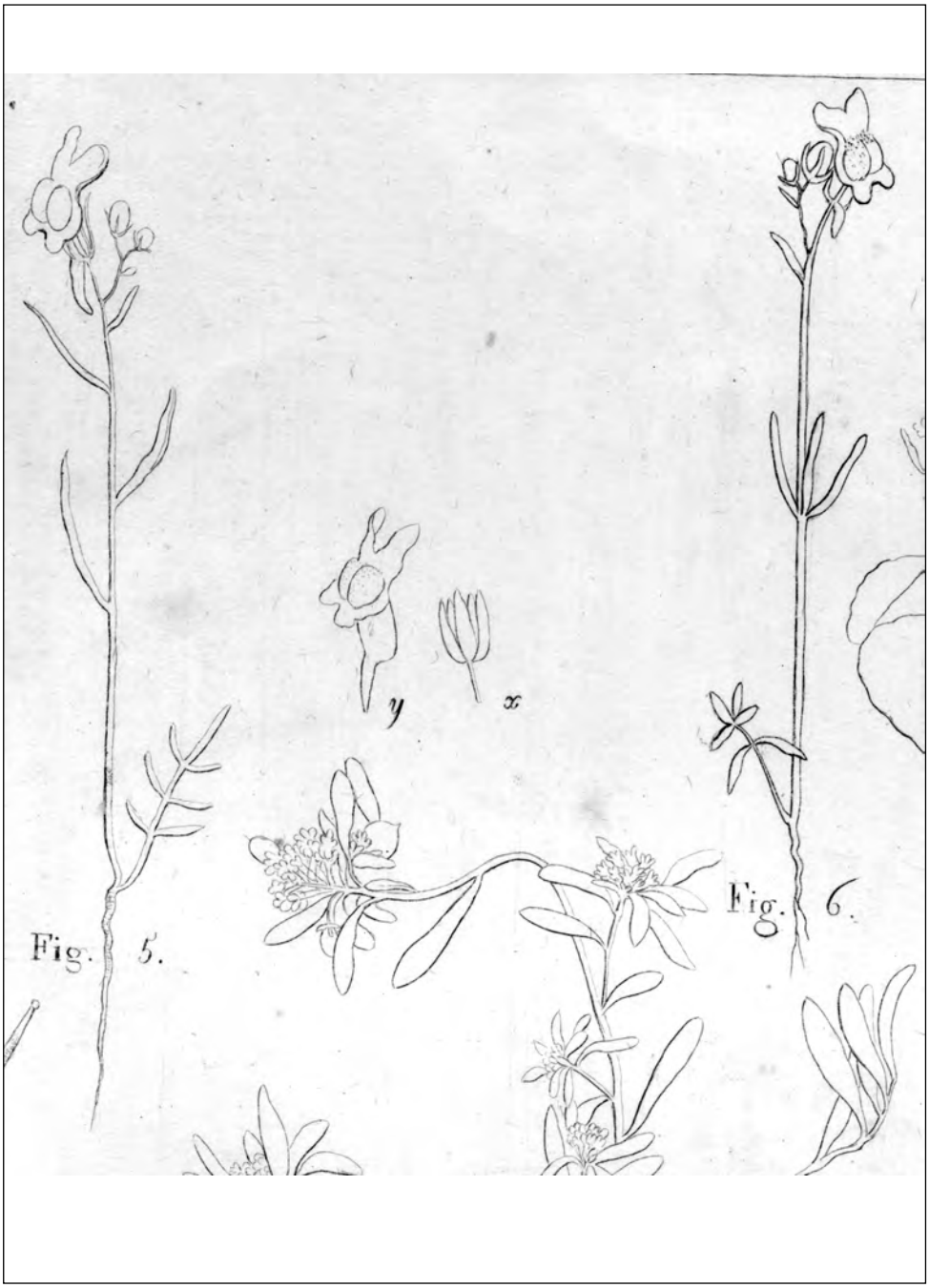

Fig. 2. *Antirrhinum tenue* Viviani, Figures 5 and 6, details x, y of table XVI, published in *Florae Libycae specimen*, 1824, Lectotypus, kept in Biblioteca di Scienze (Botanica), Università di Firenze.

Other syntypus from the original collection: Tripolitania, Ta.: Ain Scersciara (713), 14/03/1913. Leg. R. Pampanini, (FI005908).

Accepted name: *Kickxia aegyptiaca* subsp. *fruticosa* (Desf.) Qaiser (by M. Abuhadra, *in litteris* 2013), also in Fl. Lib. 88: 65. 1982.

Note: Sutton (1988) cites all infraspecific *L. fruticosa* taxa only under: Microfiches 2: 118, but it is Wickens: 15. (1975) who gives all the Syntypi (Tarhuna, Pampanini 921; Garian, Pampanini 3862 & 4138).

New taxon: *Linaria fruticosa* f. *integrifolia* Pamp. in Bull. Soc. Bot. Ital. (1-3): 16. (1914a); Pl. Tripol.: 206. (1914c).

Type: [Libya], Tripolitania, Tarhuna: Uadi Msaaba a Kasr Doga (921), 18/03/1913 . Leg. R. Pampanini, (FI005909, Lectotypus designated here).

Other syntypi from the original collection: Tripolitania, Garian: Uadi Garian (3862), 26/03, (FI005910); Ga.: Kasr Garian, nei campi incolti (4138), 30/04/1913. Leg. R. Pampanini, (FI005911).

Accepted name: *Kickxia aegyptiaca* subsp. *fruticosa* (Desf.) Qaiser (by M. Abuhadra, *in litteris* 2013), also in Fl. Lib. 88: 65. 1982.

Note: Sutton (1988) cites all infraspecific *L. fruticosa* taxa only under: Microfiches 2: 118, but it is Wickens: 15. (1975) who gives all the Syntypi (Tarhuna, Pampanini 921; Garian, Pampanini 3862 & 4138).

New taxon: *Linaria fruticosa* var. *litoralis* Pamp. in Bull. Soc. Bot. Ital. (1-3): 16. (1914a); Pl. Tripol. : 206. (1914c).

Type: [Libya], Tripolitania, Tripoli: Gargadesc (25), 16/02/1913. Leg. R. Pampanini, (FI005912, Lectotypus designated here).

Other syntypus from the original collection: T., Tripoli.: Oasi di Zanzur (179), 23/02/1913. Leg. R. Pampanini.

Accepted name: *Kickxia aegyptiaca* (L.) Nabelek subsp. *fruticosa* (Desf.) Qaiser (by M. Abuhadra, *in litteris* 2013), also in Fl. Lib. 88:65. 1982 and in Dobignard & Chatelain 5: 87. 2013.

Note: Sutton (1988) cites all infraspecific *L. fruticosa* taxa only under: Microfiches 2: 118, but it is Wickens: 15. (1975) who gives all the Syntypi (Tarhuna, Pampanini 921; Garian, Pampanini 3862 & 4138).

New taxon: *Linaria fruticosa* f. *villosa* Pamp. in Pl. Tripol.: 206. (1914c).

Type: [Libya], Tripolitania, Tarhuna: Uadi Tenziua sul Ras Maader (2053), 01/04/1913. Leg. R. Pampanini, (FI005914, Lectotypus designated here).

Other syntypus from the riginal collection: T.-Tripoli: Aziza al Fonduc Scebani (4368), 09/05/1913. Leg. R. Pampanini (FI005915).

Accepted name: *Kickxia aegyptiaca* (L.) Nabelek subsp. *fruticosa* (Desf.) Qaiser (by M. Abuhadra, *in litteris* 2013), also in Fl. Lib. 88: 65. 1982 and in Dobignard & Chatelain 5: 87. 2013.

Note: Sutton (1988) does not consider this infraspecific taxon of *L. fruticosa*.

New taxon: *Linaria haelava* var. *cyrenaica* Pamp. & Zanon in Nuovo Giorn. Bot. Ital. n.s. 26 (3): 216. 1919. (Ruhmer no. 256, 1883).

Type: [Libia], Cyrenaica: Bengazi (256), 07/01/1883. Leg. G. Ruhmer (sub. *Linaria haelava* Del.), (FI003729, Lectotypus designated here).

Other syntypus from the original collection: [Libya], Cirenaica, Bengasi: Sciallabi el Bebas, marzo 1918. Leg. V. Zanon (FI ?).

Accepted name: *Linaria haelava* var. *cyrenaica* Pamp. & Zanon

Note: as *Linaria laxiflora* Desf. subsp. *calcarlongum* Qaiser in Fl. Lib. 88: 56. 1982, as *Linaria haelava* (Forssk.) Delile in Dobignard & Chatelain. The specimen collected by Zanon is not kept in FI.

The taxon has moreover often been identified in the Cyrenaic area in all specialist works that look at this group of *Linaria*: in fact both S. Viano (1978b) and D. A. Sutton (1988) speak about it as a probable autonomous entity, already interpreted as a taxon described in the past as *Antirrhinum laxiflorum* var. *angustifolium* Viv. (Viviani, 1824), Fl. LIb.: 33. 1824, and *Linaria haelava* var. *cyrenaica* Pamp. & Zanon, (Pampanini & Zanon 1919), Nuovo Giorn. Bot. Ital. 26(3): 216. 1919. Only the rather brief description remains of the first, whilst the original material mentioned by the author still exists for the second. For that matter, in the Flora of Libya, Qaiser M. (1982) also considers *L. haelava* var. *cyrenaica* as a synomyn of a new taxon: *L. laxiflora* var. *carcarlongum*. But the protologue mentions the difference from the autonymic variety, which both Pampanini and Sutton had previously noted, i.e. : «..plants with filiform leaves, glabrous inflorescences with up to 4 mm pedicels and a longer spur than *L. laxiflora* [as in *L. haelava*] …. and also slightly under 1 mm long tuberculated seeds [as in *L. haelava*], grey-blackish in colour – [this last character is difficult to evaluate because the material tends to lighten towards brown when dry]. Moreover, Viviani in his description clearly speaks about a hairy inflorescence (..., *calicibus hirsutis* !), consequently only the name Pampanini gave fully interprets the characters which Viano and Sutton described from the specimens. Thus we are faced with a new taxonomic entity, that has apparently reached a certain stability, of an original *L. haelava* with some characters of *L. laxiflora*.

Sutton in his treatment (Sutton 1988) added further material for comparison, for the most part cases which well show these diagnostic characters. It is true that more recently such situations in nature have been considered as falling under the variability of *L. haelava* (Dobignard & Chatelain 2013). On the contrary, we believe that the distribution shown by the material examined, and also confirmed indirectly by Qaiser, corroborates the validity of the varietal taxon Pampanini (1919) established as an endemic from North –West Cyrenaica.

New taxon: *Linaria tarhunensis* Pamp. in Bull. Soc. Bot. Ital. (1-3): 16. (1914a); Pl. Tripol.: 206 - 7. (1914c).

Type: Lectotypus: Tripolitania, Tarhuna: Uadi Tersiva, pianura a S. W. del Ras Maader (2079), 01/04/1913. Leg. R. Pampanini, FI005918 (by D. A. Sutton: 404. 1988).

Other Syntypi from the original collection: T, Tarhuna: Uadi Tenziua(Tersiva), nelle messi (1961), 01/04, (FI005917); T. Ta.: Abiar Milgha a Migi (4554), 28/02/1913. Leg. R. Pampanini, (FI005919).

Accepted name: *Linaria tarhunensis* Pamp. (by D. A. Sutton: 404. 1988); also in: Fl. Lib. 88: 50, 52. 1982; and by M. Abuhadra, *in litteris* 2013.

Note: already in his publication regarding the new taxon, Pampanini fears some doubts about its rank and immediately after the binomial he points out in brackets: *(An potius: L. fallax Coss*. var. *tarhunensis m ?)*.

New taxon: *Linaria tenuis* var. *laxiflora* Pamp. in Bull. Soc. Bot. Ital. (1-3): 16. (1914a); Pl. Tripol. : 208. (1914c).

Type: Holotypus: [Libya], Tripolitania: Tripoli, Oasi di Tripoli ad Henni (3553), 23/04/1913. Leg. R. Pampanini. (FI).

Accepted name: *Linaria tenuis* (Viv.) Spreng. (by M. Abuhadra, *in litteris* 2013).

Note: Sutton mentions this taxon for Libya (Sutton: 432.1988), placing it under *L. tenuis L*. specifying " ..Plants… with lax inflorescence…", but he says also that its status had not yet been confirmed. The poor state of the material in our Herbarium (FI), even though it is the depository for the original collection, prevents us from analysing the problem more thoroughly.

New taxon: *Scrophularia arguta* f. *albiflora* Pamp. in Bull. Soc. Bot. Ital. (1-3): 16. (1914a); Pl. Tripol.: 209. (1914c).

Type: Holotypus: [Libya], Tripolitania, Tarhuna: Abiar Milgha a Migi (533), 28/02/1913. Leg. R. Pampanini, (FI005920).

Accepted name: *Scrophularia arguta* Soland. see Qaiser M. in Fl. Lib. 88: 3. (1982), by M. Abuhadra, *in litteris* 2013.

***Solanaceae* (P. Cuccuini & C. Nepi)**

New taxon: *Hyoscyamus muticus* subsp. *brevibracteatus* Corti in Nuovo Giorn. Bot. Ital. 45: 219. (1938).

Type: [Libya, Cyrenaica], Reg. di Auenát: letto del torrente che dalla cima di Auenát scende all'Uadi Abd el Málech, raro tra i 100e i 1400m., (1496) 19/4/1933. Leg. L. Di Caporiacco, (FI, Lectotypus designated here).

Other syntypus from the original collection: [Libya, Cyrenaica], Reg. di Auenát: Ultimo affluente di sinistra di Carcúr Brahim, salendo alla vetta principale, (1497), 02/ 1933. Leg. U. Monterin, (FI).

Accepted name: *Hyoscyamus muticus L.*

Note: Corti also alludes to another specimen collected by U. Monterin, which he believes can be attributed to this taxon. The doubt he expresses is due to the fact that the specimen is sterile: this is no. 1497 (the label inaccurately gives 1933, when it should be 1934, since Prof. Monterin guided a mission to the Libyan Sahara and Tibesti on behalf of the Italian Geographical Society in February-April, 1934).

New taxon: *Solanum nigrum* var. *alatum* f. *robustum* Pamp. in Arch. Bot. XII(1): 42. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 75. (1938).

Type: Holotypus: Libia, Cirenaica, Cirene: Uadi Belgadir (7194), 26/04/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli, (FI003730).

Accepted name: *Solanum villosum* Mill. subsp. *villosum* see Edmonds & Chweya (1997).

Note: as *Solanum nigrum* var. *villosum* L. in Fl. Lib. 62: 8-9. 1978; it should be noted that the hairs on the specimen do not have glands, see Edmonds & Chweya (1997).

***Tamaricaceae* (P. Cuccuini & C. Nepi)**

New taxon: *Tamarix pauciovulata* var. *micrantha* Corti in Reale Soc. Geografica Italiana I: 191-192. (1942).

Type: [Libya], Fezzan occidentale, Reg. di Gat: Presso Féuet nella piana sabbiosa e sassosa fuori oasi (1533), 04/03/1934. Leg. R. Corti, (FI001178, Lectotypus designated here).

Isolectotypi: nos.1534-35. (FI).

Accepted name: *Tamarix macrocarpa* (Ehremb.) Bunge see Dobignard & Chatelain 5: 245. 2013.

Note: the Lectotypus and specimens n. 1534-35 all have drawings and handwritten notes by Corti. For this taxon, Corti (1942) also mentions specimen no. 1558, which, as it is sterile, is attributed to the species s.l. All three specimens from the original collection are considered on the same level, since Corti designated them with different, progressive numbers for reasons linked to the collection and management of the material, as can be seen from the final typewritten labels where the number was added in pen later; as *T. passerinoides* Delile var. *passerinoides* in Fl. Lib. 66: 21. (1979).

***Valerianaceae* (P. Cuccuini & C. Nepi)**

New taxon: *Centranthus calcitrapae* f. *albiflorus* Pamp. in Bull. Soc. Bot. Ital. (1-3): 18. (1914a); Pl. Tripol.: 235. (1914c).

Type: [Libya], Tripolitania, Tarhuna: Abiar Milgha, sul Ras Ter (1068), 19/03/1913. Leg. R. Pampanini, (FI003736, Lectotypus designated here).

Other Syntypi from the original collection: Tripolitania, Mesellata.: Msid di Mesellata (2610), 9/04, (FI003739); T., Tarhuna.: Abiar Milgha, sul Ras Neb (1192), 19/03, (FI003737); Ta.: Abiar Milgha, a Migi (1029), 19/03, (FI003741); Ta.: Ras Ghenai (1540), 25/03, (FI003743); Ta.: Uadi Sart (1750), 27/03 (FI003738); Ta.: Uadi Sart (2132), 03/04, (FI003745); Ta.: Uadi Ksea sul Ras Argobinani (2451), 08/04, (FI003740); T., Garian: Ras Tecut (3706), 26/04, (FI003742); Ga.: Ras Bu Ganus (3943), 27/04, (FI003744); Ga.: Uadi Garian sul Ras Omcteba (4109), 29/04/1913. Leg. R. Pampanini, (FI003746).

Accepted name: *Centranthus calcitrapae* (L.) Dufr., see Richardson in Bot. J. Linn. Soc. 71(3): 231. (1975).

Note: specimen no. 2132, in Pampanini (1914a) is erroneously given as no. 2133. Richardson (1975), does not consider the taxon.

New taxon: *Valerianella discoidea* var. *berenicea* Pamp. in Arch. Bot. XII(1): 45. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 76. (1938).

Type: Holotypus: Libia, Cirenaica: Giardina, tra Bengasi e Solluh (7791), 10/03/1933. Leg. R. Pampanini, (FI003735).

Accepted name: *Valerianella chlorodonta* Coss. & Durieu (by H.N. Le Houerou, 16/07/1960), also Alavi S. A. in Fl. Lib. 46: 6-7. (1977).

***Violaceae* (P. Cuccuini & C. Nepi)**

New taxon: *Viola scorpiuroides* var. *inflata* Pamp. in Bull. Soc. Bot. Ital.: 117. (1912).

Type: [Libya], Cirenaica: Derna, Ridotta "Piemonte", piani cespugliosi ed erbosi verso l'Halg Bu-Rues, 02/1912. Leg. M. Longa, (FI003808, Lectotypus designated here).

Isolectotypus: FI003807.

Accepted name: *Viola scorpiuroides* Coss., in Fl. Lib.13: 1. (1977e), also in Dobignard & Chatelain 5: 352. (2013).

Note: the lectotypus has the original label handwritten by M. Longa, while the identification is signed by R. Pampanini. The label of the isolectotypus is handrwritten by R. Pampanini.

***Zygophyllaceae* (P. Cuccuini & C. Nepi)**

New taxon: *Fagonia kahirina* var. *pseudocretica* Pamp. in Arch. Bot. XII(1): 33-34. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 69. (1938).

Type: Lectotypus: Libia, Cirenaica: El Gtafia a sud di Agedabia, [13/03/]1933, Pampanini no. 4565 (FI) [FI003902] (by El Hadidi, in Mitt. Bot. München 11: 393, fig 7, E. 1974.).

Accepted name: *Fagonia scabra* Forssk., in B-A. Beier 3(3): 251. 2005 and in Dobignard & Chatelain 5: 358, 359. (2013).

Note: El Hadidi cites erroneously no. 4564 as the typus, whilst in actual fact it is no. 4565. The typus was identified by M. N. El Hadidi (10/06/1972) as *Fagonia sinaica* Boiss. var. *pseudocretica* (Pamp.) Hadidi comb. nov. (= *F. scabra* Forssk.), see Bot. Not. 125(4): 531. 1972, Mitt. Bot. Munchen 11: 393, fig 7, E. 1974, and Fl. Lib. 38: 22. 1977. Dobignard & Chatelain 5: 358. 2013, erroneously cite *Fagonia pseudocretica* Pamp. given when Pampanini actually described *F. kahirina* var. *pseudocretica* Pamp., see Arch. Bot. XII(1): 33-34. (1936a).

List of non-validly published names, according to article 24.3 of ICN (McNeill & al. 2012), by R. Pampanini, material of which is held in FI.

Orobanchaceae

New taxon: *Cistanche lutea* f. *genuina* Pamp. in Arch. Bot. XII(1): 42. (1936a). Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 75. (1938).

Original Collection: Cirenaica Umm er Rzem; Bomba; C.: Bomba: El Gefar; fra Bir Acheim e Mechili; Mechili: Uadi Ramla 1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli.

New taxon: *Cistanche violacea* f. *genuina* Pamp. in Arch. Bot. XII(1): 43. (1936a). Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 75. (1938).

Original Collection: Cirenaica: Agheila; C.: Uadi Faregh: l.d. Maaten Giofer; C.: fra Agedabia e Saunnu (? Fruct); C.: Saunnu; C.: fra Soluch e Sceleidima 1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli.

Rubiaceae

New taxon: *Asperula cyrenaica* f. *genuina* Pamp. in Arch. Bot XII(1): 45. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 76. (1938).

Original Collection: Cirenaica, Beda: Uadi Scisu; C.: Uadi derna 1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli.

Conclusions

The work is complete. This second part of the work "treats" 112 (113 if including the name of a new genus) new names considering all those validly published [therefore excluding any names falling under article 24.3 of the ICN (McNeill 2012]. Of these, once excluding those already subjected to nomenclatural studies, 91 (+ 1 genus) have been typified; in two cases it was necessary to also provide two epitypes since the typi (images) were considered to be"ambiguous". It should also be remembered that we could not always designate types for reasons linked to the problematic availability of materials from the various original collections or for insufficient material at hand. Therefore, the catalogue (1st and 2nd part) considers a total of 353 new names, whilst 286 typifications have been carried out. Our study has examined a total of approximately 23,000 specimens, selecting about 1,500 from the original collections.

Phyto-geographical Assessment

With so many abundant collections at hand, we also attempted to estimate their phyto-geographical value with respect to the areas Quézel considered in 1978. According to Quézel (1978) the Libyan territory covers from 8 to 13 of the phyto-geographical regions into which the French scholar divided North Africa. These are the A: North African Steppe, B: Cyrenian-Mediterranean, C: East African Steppe, D: North Saharan, E: North-East Saharan, and very marginally F: Central Saharan, G: High Mountain Saharan and H: South Saharan. As can be seen, Fig. (3) shows the presence of the investigated taxa, found in 6 out of the 8 mentioned regions. In particular, regions B and A are the most predominant, with C, E, D exhibiting important values in decreasing order, with sporadic occurrences in F. This distribution results not only from the geographical characteristics of the itineraries followed by the collectors of the specimens held in FI or studied there. It also stems from the floristic reality of Libya itself, thus confirming the representative value of the material taken as a whole (Cavara F. 1926; Corti R. 1942; Quézel 1978; Brullo & Guglielmo 2001).

Present taxonomical value

During the revision of the first part of this work, we were asked to evaluate on the present taxonomical validity of the taxa considered in the work. Now that our work is complete, we feel we can give an answer. We took the work by Maire & al. (1952-1987) as the starting point for our reply, since it homogeneously illustrates the area in which Libya lies. And as the reference for our final evaluation, we concentrated on the only Flora for that country, the "Flora of Libya" (*Auctores vari* 1977-1988), whilst for nomenclatural updating the work by Dobignard and Chatelain (2010-2013), as well, obviously, as individual updating or re-evaluation of individual taxon ensuing from these general works. For this investigation, see Tab. (1) in which data can be summed up as follows. Starting from the work by Maire, two thirds of the taxa are presented, in particular those of Pampanini, of which as many as 62 are recognised as good taxa (directly or under *comb*. or *stat. nov.*). The most recent treatments, the "Flora of Libya" and that by "Dobignard & Chatelain", recognise 32 and 43 taxa respectively, again as such or under combinations or new status. To these a further 10 taxa may be added as a result of other recent investigations or revi-

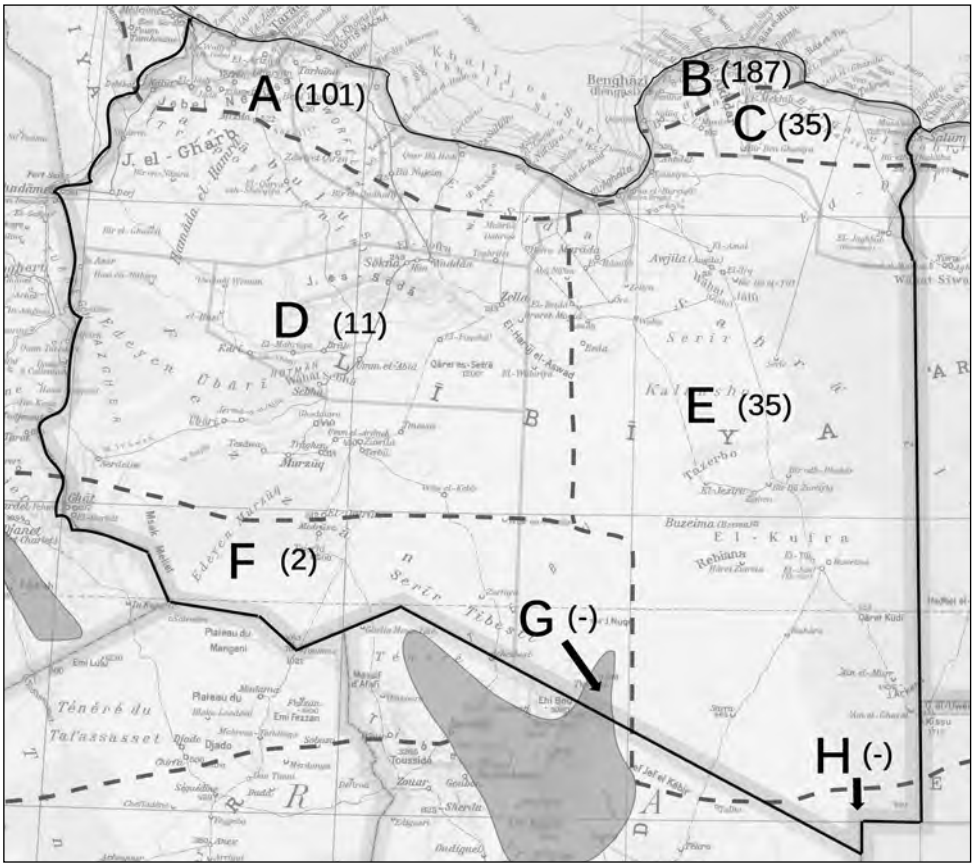

Fig. 3. Phytogeographical division of Libya in accordance with the domains set up by Quézel (1978) for Northern Africa. For each area, indicated by a letter, the number of detected types in this research (1st and 2nd part) is reported in round brackets. Rarely, when typification was not possible, the original materials are indicated. Legend: **A**: Steppic-Northern African Domain; **B**: Cyrenian-Mediterranean Domain ; **C**: Steppic-Eastern African Domain; **D**: Northern Saharan Domain; **E**: North-eastern Saharan Domain; **F**: Central Saharan Domain; **G**: Saharan-Hight Mountain Domain; **H**: Southern Saharan Domain.

sions. The latter are material which for the most part come from Cyrenaica (respectively 26, 37, 8) and secondly Tripolitania (5, 5, 2). Only one taxon is for Fezzan (1, 1, -). These data faithfully reflect the proportions found from the material examined in the phytogeographical context. Considering this as a whole, we can say that this is due to the fact that Cyrenaica has historically been far more investigated, and to its multiple and peculiar morpho-ecological aspects that exalt its floristic wealth.

Connections with the Collections

As regards the collections, as well as the obvious prevalence of the material Pampanini collected himself (together with Pichi Sermolli for the 1934 Cyrenaica col-

Tab. 1. Comparative table of taxa considered still valid taxonomically, housed at FI, in comparison with 'Flora of Libya', 'Index synonimique de la flore d'Afrique du nord' and other recent revisions.

***Auctores vari*: Flora of Libya, 1977-1988, & regions**	**Collector/s**	**Dobignard & Chatelain, 2010-2013, & regions**	**Collector/s**	**Other references, & regions**	**Collector/s**	**Bibliography According to "Other references"**
Alliaceae		**Alliaceae** *Allium greuteri* Brullo & Pavone, CYR	Brullo & Furnari			
Allium longanum Pamp., CYR.	Longa	=	=			
Apiaceae *Pachyctenium mirabile* Pamp. & Maire, CYR.	Pamp. & Pichi	**Apiaceae** =	=			
Asteraceae *Anthemis kruegeriana* Pamp., CYR.	Krueger	**Asteraceae** =	=			
Atractylis phazaniae Corti, FEZ.	Corti	=	=			
Carthamus divaricatus Beg. & Vaccari, CYR	Vaccari	=	=			
Crepis taraxacifolia var. libyca Pamp. ≡ *C. libyca* (Pamp.) Shabet., CYR.	Zanon	=	=			
		Ifloga spicata var. labillardieri Pamp.≡*I. labillardieri* (Pamp.) Zayed & Zareh, CYR.	Ruhmer			
Picris mauginiana Pamp., CYR.	Maugini	=	=			
		Spitzelia saharae var. cyrenaica Pamp.≡*Picris cyrenaica* (Pamp.) Lack, CYR.	Krueger			
		Tolpis virgata ssp. *apolloniae* Brullo & Furnari, CYR.	Brullo & Furnari			
Boraginaceae Alkanna tripolitana Bornm.≡ *Alkanna tinctoria* ssp. *tripolitana* (Bornm.) Qaiser, TRIP.	Bornmueller	**Boraginaceae** =	=			

Tab. 1. continued.

		Echium italicum var. scaettae Pamp.≡*E. italicum* ssp. *scaettae* (Pamp.) Greuter, CYR.	Maugini			
		Lithospermum hispidulum ssp. cyrenaicum Pamp.≡*Lithodora hispidula* ssp. *cyrenaica* (Pamp.) Brullo & Furnari, CYR.	Pamp. & Pichi			
		Brassicaceae		**Brassicaceae** Diceratella sahariana Corti≡ *Morettia sahariana* (Corti) Jafri & Sabah , CYR. or. *Diceratella sahariana* Corti	Corti	Jafri & Sabah (1980) Boulos (1979a)
		Matthiola incana ssp. *cyrenaica* Brullo & Furnari [with dubt]*, CYR.	Brullo & Furnari	*Matthiola incana* ssp. *cyrenaica* Brullo & Furnari, CYR .	Brullo & Furnari	Brullo & Furnari (1979a)
Capparaceae Capparis sicula var. kruegeriana Pamp.≡*C. spinosa* ssp. *orientalis* var. *kruegeriana* (Pamp.) Jafri, CYR	Krueger					
		Caprifoliaceae Lonicera persica var. occidentalis Pamp.≡*L. nummularifolia* var. *occidentalis* (Pamp.) Brullo & Furnari., CYR.	Cavara			
Caryophyllaceae *Silene marmarica* Bég. & Vaccari, CYR.	Vaccari	**Caryophyllaceae** =	=			
		Petrorhagia rupestris Brulllo & Furnari, CYR.	Brullo & Furnari			
Convolvulaceae *Convolvulus maireanus* Pamp., CYR.	Pamp. & Pichi	**Convolvulaceae** =	=	**Convolvulaceae**		

Tab. 1. continued.

				Convolvulus oleifolius var. *angustifolius* Bég. & Vaccari, CYR.	Vaccari	Wood in: Cuccuini & al. (2015)
				Convolvulus oleifolius var. *pumilus* Pamp., CYR.	Pamp.	=
Crassulaceae Sedum mirum Pamp.≡*Umbilicus mirus* (Pamp.) Greuter, CYR.	Pamp. & Pichi	=	=			
Dipsacaceae *Scabiosa oberti-manetti* Pamp., TRIP.	Pamp.	**Dipsacaceae** Scabiosa oberti-manetti Pamp.≡*Lomelosia oberti-manetti* (Pamp.) Greuter & Burdet, TRIP.	=			
				Ephedraceae *Ephedra altissima* var. *tripolitana* Pamp., TRIP.	Pamp.	Freitag in Cuccuini & al. (2015)
Ericaceae *Arbutus pavari* Pamp., CYR.	Pamp.	**Ericaceae** =	=			
				Euphorbiaceae *Euphorbia gebelica* Brullo, CYR.	Brullo	Brullo & Furnari (1996)
Fabaceae *Astragalus taubertianus* Pamp., CYR.	Ruhmer	**Fabaceae** =	=			
Lathyrus pseudocicera Pamp., CYR.	Maugini	=	=			
Geraniaceae		**Geraniaceae** Erodium hirtum var. cyrenaicum Pamp.≡*Erodium cyrenaicum* (Pamp.) Guitt., CYR.	Longa	**Geraniaceae**		
		Iridaceae *Romulea ligustica* ssp. *vaccarii* Bég. & Vaccari, CYR.	Vaccari			

Tab. 1. continued.

Lamiaceae		**Lamiaceae** *Ballota andreuzziana* Pamp,. CYR.	Maugini	**Lamiaceae**		
Origanum cyrenaicum Bég. & Vacc., CYR.	Vaccari	=	=			
Satureja fortii Pamp., CYR.	Maugini	=	=			
Satureja timbra f. *albiflora* Pamp. CYR (with doubt)	Pamp			*Satureja timbra* f. *albiflora* Pamp. CYR.	Pamp.	N. Feinbrun-Dothan (1978)
Teucrium lini-vaccari Pamp., TRIP.	Pamp.	=	=			
Teucrium zanonii Pamp. , CYR.	Zanon	=	=			
Liliaceae *Gagea* × *pampanini* A. Terracc., TRIP.	Pamp.	**Liliaceae** *Gagea pampanini* A. Terracc. [pro hybr.], TRIP.	=			
		Scilla autumnalis var. cyrenaica Pamp.≡*Prospero cyrenaicum* (Pamp.) Step., CYR.	Zanon			
Pavaveraceae *Hypecoum aequilobum* Viv. CYR.	Della Cella; Pamp. & Pichi (epitype)	**Papaveraceae** =	=			
Plumbaginaceae		**Plumbaginaceae** *Limonium teuchirae* Brullo, CYR.	Brullo &Furnari	**Plumbaginaceae**		
		Limonium vaccarii Pignatti ex Brullo, CYR.	Vaccari			
Statice delicatula *var.* subrotundifolia Bèg. & Vaccari≡*Limonium subrotundifolium* (Bèg. & Vaccari) Brullo, CYR.	Vaccari	=	=			
Statice pruinosa var. hirtiflora Cavara ≡*Limonium pruinosum* var. *hirtiflorum* (Cavara) Tack., CYR.						
		Statice tubiflora var. zanonii Pamp. ≡*Limonium zanonii* (Pamp.) Domina, CYR.	Zanon			

Tab. 1. continued.

Poaceae		**Poaceae**		**Poaceae** *Brachypodium distachyon* var. *hispidum* Pamp., TRIP.	Pamp.	Banfi, in the present study
Bromus crysopogon Viv., CYR.	Maugini	=	=			
Poa vaginata Pamp., CYR.	Pamp.	=	=			
Ranunculaceae *Ranunculus cyclocarpus* Pamp., CYR	Pamp.	**Ranunculaceae** =	=	**Ranunculaceae**		
				Ranunculus flabellatus var. amphicarpus Pamp.≡*R. paludosus* var. *amphicarpus* (Pamp.) Boulos, CYR.	Pamp.	Boulos (1979a)
Santalaceae *Thesium erythronicum* Pamp., CYR.	Pamp.	**Santalaceae** =	=	**Santalaceae**		
Scrophulariaceae Antirrhinum tenue Viv.≡*Linaria tenuis* (Viv.) Spreng., CYR.?	Della Cella; Kralik (epitype)	**Scrophulariaceae** =	=	**Scrophulariaceae**		
				Linaria haelava var. *cyrenaica* Pamp., CYR.	Ruhmer	Cuccuini in Cuccuini & al. (2015)
Linaria tarhunensis Pamp., TRIP.	Pamp.	=	=			
Zygophyllaceae Fagonia kahirina var. pseudocretica Pamp.≡ *F. sinaica* var. *pseudocretica*(Pamp.)Hadidi, CYR.	Pamp.					

lection), the Zanon, Maugini and particularly Krueger collections also appear in the material he studied. These were essential for some parts of Cyrenaica, and the care and attentiveness can be seen in the new taxa described and in the number of those remaining accepted. Regarding other botanists, the taxa described by Corti for the Fezzan and Béguinot (but collected by A. Vaccari) for all north Libya deserve special mention. Finally, we must remember the older material of Ruhmer, which played an important part in typifications as well as the true historical pearls among the taxa of Viviani, Durand & Barratte and Engler respectively, some of which still held accepted. Obviously, more recent collections are also important, such as those of Brullo and Furnari (in general, duplicates in FI), whose taxonomic validity was "helped" by their modernity, or those of Ricceri and Steinberg who assembled the last important Libyan collections held in FI. Thus we have an extremely varied panorama of collections which, taken as a whole, and starting from the original and precious "Erbario Libico" are a valuable research tool for the study of the Libyan Flora.

Presence of specimens of R. Pampanini and R.E.G. Pichi Sermolli's collections in other Herbaria

This short chapter describes the existence of Libyan collections in other Italian or foreign Herbaria, the originals of which are held FI. Only the main collection of the old 'Erbario Libico', that is the Pampanini collections, are considered.

From the existing bibliography (printed and on line), and in particular the Index Herbariorum (Thiers, B. [continuously updated] ed. on line), and Index Herbariorum-Collectors (Vegter 1983), the records for Pampanini and Pichi Sermolli regarding Libya refer exclusively to FI, BR in Belgium and ULT in Libya. Furthermore, some herbaria web sites appear to refer to material from Cyrenaica (see Table 2). But the literature cited in the first part of this work (Cuccuini & al. 2015), including unedited additional catalogues and, in this second part, exchanges (see the exchange records and indices for 1958-1969), mention that several sets of duplicates were made of the Tripolitania (1913) as well as the Cyrenaica collections (1933, 1934). It seems that no duplicates of the Tripolitania collections exist in other herbaria although, while studying them, Pampanini frequently contacted P, B and W herbaria. On the contrary, as far as the Cyrenaica collections are concerned, it seems that, thanks to Pichi Sermolli, who was custodian of both collections (1933, 1934) for a long period after the death of Pampanini, as many as 26 variously sized series of duplicates were made, of which 16 were sent to the same number of herbaria, as specified in Tab. (2).

Tab. 2. The materials belonging to R. Pampanini e R. Pampanini & R.E.G. Pichi Sermolli (Cyrenaica 1934) sent to the other Herbaria and the presence in virtual herbaria of typus material s. l. are recorded.

Herbaria (Code)	**Country**	**Specimens**	**Sending Date**	**Presence in virtual Herbaria, coll. 1933, 1934**	**Typus material *s. lato***
A	USA	46	03/01/1962		
BG	Norway	9	12/10/1961		
BM	England	113	12/09/1961		
BR	Belgium	156	13/09/1961	1933(1), 1934(1)	1
G	Switzerland	462	20/06/1953, 26/04/1960-28/04/1961	1933(6), 1934(6)	7
GE	Italy	61	02/01/1962		
HUJ	Israel	69	12/10/1961		
K	England	621	02/05/1960-28/04/1961	1933(5), 1934(10)	5
L	Nederland	165	12/09/1961	unavailable	
LISC	Portugal	17 (23)	01/1968		
MA	Spain	23	01/1968		
MO	USA	37	03/01/1961		
MPU*	France	2	Sent directly to Maire by Pampanini before 1938	1933 (2)	2
NY	USA	13	28/09/1961		
S**	Sweden	93	14/09/1961	1933(5), 1933(2)	
W	Austria	301	12/09/1961	1933(1), 1934 (4)	3
ULT ***	Libya	28	After 1968		

*not sent as exchange; ** in S also 1 specimen collected by Vaccari in 1912; *** sent to ULT directly to L. Boulos, moreover in ULT there are duplicates by Ricceri & Steinberg 02/1978 (Fezzan)

Alphabetical Index of the Taxa in this work

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Sometimes the same locality is written with a different spelling, e.g.: Gfonta or Sfonta, Maaten or Maten, Sceilabi or Sciallabi, U. Messaf-saf or Saf Saf, Kasr or Gasr. Both versions are given in the list; the taxa followed by '*' (an asterisk), even if mentioned in their protologues or in publications connected with them, are not present at FI. This index also includes localities in the *Addend*a and *Corrigenda*.

Abiar Milgha (*Ranunculus asiaticus* var. *bicolor*, *Roemeria hybrida* f. *latiloba*)
Abiar Milgha a Migi (*Centranthus calcitrapae* f. *albiflorus*, *Koeleria salzmannii* var. *longiflora*, *Linaria tarhunensis*, *Ranunculus asiaticus* var. *bicolor*, *Scrophularia arguta* f. *albiflora*)
Abiar Milgha sul Ras Neb (*Centranthus calcitrapae* f. *albiflorus*)
Abiar Milgha sul Ras Ter (*Centranthus calcitrapae* f. *albiflorus*, *Koeleria salzmannii* var. *longiflora*, *Ranunculus asiaticus* var. *bicolor*)
Acroma (Bir Acheim), l.d. Sedra (*Bromus fasciculatus* f. *parlatorei*)
Agedabia, l.d Bag Lia (*Koeleria salzmannii var. cossoniana f. glabra**)
Agedabia see el Gtafia
Agedabia (steppa a sud di) (*Atractylis prolifera* var. *albiflora*)
Agedabia e Antelat (tra) a Bag Lia (see also Agedabia l.d. Bag Lia, Haseiat) (*Avena beguinotiana, Hypecoum aequilobum, Hypecoum aequilobum* var.*stenolobum*)
Agedabia e el Agheila (fra) l.d. Melch en Nogra: (*Hypecoum aequilobum* var. *platylobum*, *Koeleria salzmannii* var. *cossoniana* f. *glabra*, *Koeleria salzmannii* var. *cossoniana* f. *villosa*)
Agedabia see Sahabi (Saniet el Hamar)

Agedabia e Saumnu (or Sonnu) (tra), l.d. el Gioch: (*Hypecoum aequilobum* var. *platylobum*, *Koeleria salzmanni var. cossoniana f. glabra****)**
Agheila (el - Steppa di) (*Avena béguinotiana, Cistanche violacea* f. *bicolor*)
Agheila (*Plantago coronopus* var. *commutata* f. *villosa*)
Agheila e Maaten Giofer (fra) (*Plantago albicans* var. *augustifolia* f. *syrtica*)
Ain Legmeila (Uadi Messaf-saf) (*Bromus macrostachys* f. *pubescens*, *Ranunculus cyclocarpus*, *Rubus mussolinii**, *Rubus mussolinii* f. *cuneatiformis*)
Ain Mara (*Oryzopsis coerulescens* var. *grandis*)
Ain Scersciara (*Linaria fruticosa* f. *dentata*, *Ranunculus asiaticus* var. *bicolor*)
Ain Zara (Tripoli) (*Koeleria pubescens* var. *tripolitana*, *Koeleria salzmannii* var. *pampanini*)
Alessandria (Egitto, nei coltivi dell'antica marea verso) (*Roemeria tenuifolia*)
Amseat (*Avena béguinotiana*)
Apollonia, l. d. Rgua (*Dactylis glomerata* var. *spicata, Ranunculus cyclocarpus*)
Apollonia, Uadi Scechaba see Uadi Scechaba
Antica marea presso Alessandria (Egitto): (*Roemeria tenuifolia*)
Argub Dasc, fra Gubba e l'Uadi Latrun (*Dactylis glomerata* var. *spicata*, *Dactylis glomerata* var. *spicata* f. *intermedia*)
Argub Gazal, fra Gubba e l'Uadi Latrun (*Asperula cyrenaica* f. *hispidula*, *Dactylis glomerata* var. *spicata* f. *intermedia*)
Auenát (cima di – verso l'Uadi Abd el Málech) (*Hyoscyamus muticus* subsp. *brevibracteatus*)
Aziza al Fonduc Scebani (*Linaria fruticosa* f. *villosa*)
Barce: l. d. Bu Gseir (*Bromus macrostachys* f. *pubescens*)
Barce: l.d. Sidi Ahmed Cheila (*Bromus macrostachys* f. *pubescens*)
Barce e Tocra (fra), Bu Go(s)eir: (*Dactylis glomerata* var. *spicata*)
Beda: l.d. Sfeiat (*Dactylis glomerata* var. *spicata* var. *intermedia*, *Thesium erythronicum*)
Beda: Uadi El Kuf l.d. Bu Breica (*Bromus macrostachys f. pubescens, Ranunculus cyclocarpus)*
Beda: Uadi Madfa (*Dactylis glomerata* var. *spicata*)
Beda see Uadi Msuria
Bengazi (*Linaria haelava* var. *cyrenaica, Poa cyrenaica*)
Bengasi e Agedabia, Sidi Ahmed el Magrun see Sidi Ahmed el Magrun
Bengasi e Sollu(c)h (fra) see Giardina
Bir Acheim e Mechili (Trigh Enver Bei: Bir Bu Usceica) (*Cistanche lutea* f. *pallida*)
Bir Acheim e Mechili (fra), l.d. Bir Zeidan (*Bromus fasciculatus* f. *parlatorei*)
Bir Bu Usceica see Bir Acheim e Mechili (Trigh Enver Bei: Bir Bu Usceica)
Bir el Ghelania e Brach see Uadi Issa
Bir Zeidan (fra Bir Acheim e Mechili) (*Bromus fasciculatus* f. *parlatorei*)
Bomba, l.d. El Gefar (*Dactylis glomerata* var. *spicata* f. *intermedia*)
Bu Breica see Beda, Uadi El Kuf
Bu Gheilan (Garian) (*Brachypodium distachyon* var. *genuinum* f. *mite*, *Brachypodium distachyon* var. *hispidum*, *Brachypodium distachyon* var. *velutinum*, *Koeleria salzmannii* var. *cossoniana* f. *lobulata*)
Bu G(o)seir see Barce
Carcúr Brahim (ultimo affluente di sinistra di) (*Hyoscyamus muticus* subsp. *brevibracteatus*)
Casa Auari (*Ranunculus bullatus* var. *cyrenaicus*)
Chersa (*Dactylis glomerata* var. *spicata*)
Cimitero nuovo (*Dactylis glomerata* var. *spicata* f. *intermedia*, *Haplophyllum vermiculare* var. *cyrenaicum*)
Cirenaica (H[abitat] in) (*Hypecoum aequilobum* – drawing*)*
Cirene (Uadi Bogadir or Belgadir) (*Rhamnus pendula*)
Cirene: l.d. Melchifaf see Melchifaf

Cussabat (Colline a nord-ovest di) (*Brachypodium distachyon* var. *hispidum*)
Cussabat, margini dei campi (*Adonis microcarpa* var. *intermedia* f. *lutea*
Cussabat, nelle messi (*Adonis microcarpa* var. *intermedia* f. *lutea*)
Cussabat sul Ras Gelà (*Adonis microcarpa* var. *intermedia* f. *lutea*), *Brachypodium distachyon* var. *genuinum* f. *mite*, *Brachypodium distachyon* var. *hispidum*)
Derna (*Brachypodium distachyon* var. *velutinum* f. *gussonei, Dactylis glomerata* var. *spicata*)
Derna (prope il faro): (*Statice delicatula* var. *subrotundifolia*)
Derna (sulle colline) (*Ranunculus asiaticus* var. *sanguineus* f. *purpureus*)* n. nudum
Derna, Uadi Derna (*Asperula cyrenaica* f. *genuina*, *Dactylis glomerata* var. *spicata* f. *intermedia*, *Rubus cyrenaicae*)
Derna: Uadi Naga see Uadi Naga
Derna e Mechili (fra), l.d. Siret Medanaat see Siret Madanaat
Derna e Mechili (fra), Uadi Hiscia/el Hescia (*Plantago coronopus* var. *commutata* f. *villosa*)
Derna (vivaio): (*Dactylis glomerata* var. *spicata* f. *intermedia*)
Due Palme (*Ranunculus asiaticus* var. *bereniceus**, *Ranunculus bullatus* var. *cyrenaicus*)
Due Palme e Benina (fra): (*Dactylis glomerata* var. *spicata* f. *intermedia*)
Due Palme e la linea ferroviaria di Benina, in direzione del Giok Kebir (fra le) (*Ranunculus bullatus* var. *cyrenaicus*)
Elbárcat (Reg. di Gat-Fezzan occidentale) (*Najas minor* var. *longifolia*)
Elbárcat e l'U. Iséien (valico tra), verso Elbárcat. Fezzan occidentale: (*Limonium bonduellei* f. *gigantifolia*)*
El Garib e Tolmeta (fra, Uadi el Fahaga) (*Rhamnus alaternus* var. *microphylla*)
El Ghegab: (*Dactylis glomerata* var. *spicata*)
El Grein: (*Avena béguinotiana, Hypecoum aequilobum* var. *stenolobum*)
El Gubba (*Dactylis glomerata* var. *spicata*)
Féuet (Reg. di Gat, presso; nella piana sabbiosa e sassosa) (*Tamarix pauciovulata* var. *micrantha*)
Fonduc Scebani see Aziza
Fuehat :(*Ranunculus asiaticus* var. *bereniceus**, *Roemeria tenuifolia*)
Ganfuda (*Dactylis glomerata* var. *spicata*)
Ganfuda e Suani Tica (*Dactylis glomerata* var. *spicata*)
Gargadesc (*Linaria fruticosa* var. *litoralis*)
Gargáf (sul), a nord di Brach. Fezzan settentrionale: (*Limonium bonduellei* f. *gigantifolia*)
Garian (in cultis) (*Hypecoum pendulum* var. *zoddae*)
Gariunes (*Hypecoum aequilobum* var. *platylobum*)
Gasr Beni Gdam e Sidi Abd el Uahed (fra-Uadi el Kuf): (*Asperula cyrenaica* f. *villosa*, *Brachypodium distachyon* f. *confusum, Ranunculus cyclocarpus*)
Gasr Zaarura see Messa
Ghegab (*Dactylis glomerata* var. *spicata*, *Dactylis glomerata* var. *spicata* f. *intermedia*)
Giardina (*Dactylis glomerata* var. *spicata***,** *Valerianella discoidea* var. *berenicea*)
Giok [Kebir] (*Statice tubiflora* var. *zanonii*)
Giuliana (Forte di) (*Haplophyllum vermiculare* var. *cyrenaicum*)
Giuliana (Punta) (*Hypecoum aequilobum* var. *platylobum*)
Gtafia (*Fagonia kahirina* var. *pseudocretica*)
Guarscià e Gariunes (fra): (*Dactylis glomerata* var. *spicata*)
Gubba e l'Uadi el Atrum, (fra) l.d. Argub Gazal see Argub Gazal
Gubba e l'Uadi Latrun (fra), l.d. Argub Dasc see Argub Dasc
Halg Bu-Rues see Ridotta Piemonte (Derna)
Hania e Messa (fra) see Mregheb
Hauari (Regione di Bengasi) (*Hypecoum aequilobum* var. *platylobum*)

Henni see Oasi di Tripoli
Heseiat see Agedabia e Antelat
Istmo di Suez (nel deserto dell'Egitto): (*Roemeria tenuifolia*)
Juliana (near Benghasi): (*Aegilops bicornis* var. *anathera*)
Kam el Gaar (pianura di) (*Koeleria salzmannii* var. *longiflora*)
Karmu (*Dactylis glomerata* var. *spicata*)
Kasr Daun (*Brachypodium distachyon* var. *velutinum*, *Ctenopsis pectinella* var. *pubescens*)
Kars Doga see Uadi Msaaba
Kasr Garian, nei campi incolti (*Anagallis linifolia* f. *candida*, *Linaria fruticosa* f. *integrifolia*)
Kasr Garian (margini dei campi) (*Vulpia danthonii* var. *tripolitana*)
Kasr Tarhuna (*Ranunculus asiaticus* var. *bicolor*)
Kasr Tarhuna (colline a est di) (*Bromus rubens* f. *intermedius*, *Ctenopsis pectinella* var. *pubescens*, *Koeleria salzmannii* var. *longiflora* subvar. *aurata*)
Kseibia (*Dactylis glomerata* var. *spicata*)
Kuebia (*Dactylis glomerata* var. *spicata*)
Labrach (el Abrach ?), Mghernes (*Bromus macrostachys* f. *pubescens*, *Dactylis glomerata* var. *spicata* f. *intermedia*)
Lamluda (*Bromus macrostachys* f. *pubescens**, *Ranunculus cyclocarpus*)
Lete (*Dactylis glomerata* var. *spicata*)
Ma(a)tan Borgù: (*Dactylis glomerata* var. *spicata* f. *intermedia*)
Maaten Giofer see Uadi Faregh
Magnae Syrteos (grande Sirte): (*Antirrhinum tenue* - drawing)
Maraua (*Dactylis glomerata* var. *spicata* f. *intermedia*)
Marsa Brega (*Koeleria Salzmanni* var. *cossoniana* f. *glabra**)
Marsa Brega see el Grein
Martuba, Uadi Bgar (*Brachypodium distachyon* var. *genuinum* f. *typicum* sf. *puberulum*, *Dactylis glomerata* var. *spicata, Dactylis glomerata* var. *spicata* f. *intermedia*)
Mechili: Uadi Ramla (*Cistanche lutea* f. *pallida*, *Plantago coronopus* var. *commutata* f. *pubescens*)
Melch en Nogra see Agedabia e el Agheila (fra)
Melchifaf (*Brachypodium distachyon var. velutinum* f. *gussonei, Ranunculus asiaticus var. intermedius*, *Ranunculus asiaticus var. kermesinus**)*
Melch en Nogra seeAgedabia e el Agheila (tra) l.d. Melch en Nogra
Merg (piana Ovest): (*Dactylis glomerata* var. *spicata* f. *intermedia*)
Merg see Sidi Gibrin
Messa, Uadi Tmista, l. d. Umm Rcham (*Dactylis glomerata* var. *spicata*, *Putoria calabrica* f. *lactea*)
Messa, Gasr Zaarura (*Dactylis glomerata* var. *spicata* f. *intermedia*)
Mghernes see Labrach
Migi see Abiar Milgha
Misrata e Ras Zug (Fra, nei campi arenosi e lungo la sebhka) (*Ranunculus asiaticus* var. *grandiflorus**)
Mregheb (*Phyllyrea latifolia* var. *magnifica*)
Msid di Mesellata (*Centranthus calcitrapae* f. *albiflorus*)
Msus (*Cistanche violacea* f. *bicolor*, *Plantago coronopus* var. *commutata* f. *pubescens*)
Nalut (dintorni di) (*Coris monspeliensis* var. *syrtica* f. *dentata**)
Naughia (*Dactylis glomerata* var. *spicata*)
Oasi di Giarabub (*Polypogon monspeliensis* f. *exilis*)
Oasi di Tripoli ad Henni (*Linaria tenuis* var. *laxiflora*)
Oasi di Zanzur (*Linaria fruticosa* var. *litoralis*)
Palmeto (Monastir) (*Hypecoum aequilobum* var. *platylobum*)
Porto Bardia (sui costoni aridi) (*Statice pruinosa* var. *hirtiflora*)

Qasr Safran (*Rhamnus tripolitana*)
Ra(h)aba (*Dactylis glomerata* var. *spicata, Dactylis glomerata* var. *spicata* f. *intermedia*, *Haplophyllum vermiculare* var. *cyrenaicum*, *Haplophyllum vermiculare* var. *cyrenaicum* f. *latifolium*)
Ramle di Abukir (nel deserto di-Egitto): (*Roemeria tenuifolia*)
Ras Argobinani see Uadi Ksea
Ras Bu Ganus (*Centranthus calcitrapae* f. *albiflorus*, *Roemeria hybrida* f. *latiloba*)
Ras Bu Tauil (*Adonis microcarpa* var. *intermedia* f. *lutea*, *Roemeria hybrida* f. *latiloba*)
Ras Ghenai (*Adonis microcarpa* var. *intermedia* f. *lutea*, *Centranthus calcitrapae* f. *albiflorus*, *Koeleria salzmannii* var. *longiflora* subvar. *aurata*, *Roemeria hybrida* f. *latiloba*)
Ras Omcteba see Uadi Garian
Ras Tecut (*Brachypodium distachyon* var. *velutinum*, *Centranthus calcitrapae* f. *albiflorus*)
Regima (*Dactylis glomerata* var. *spicata*)
Rgua see Apollonia
Ridotta Piemonte (verso l'Halg Bu-Rues) (*Viola scorpiuroides* var. *inflata*)
Ridotta Tilgher (a 10 Km da Agedabia) (*Koeleria salzmannii* var. *cossoniana* f. *villosa*)
Ridotta Zorda (Merg) (*Dactylis glomerata* var. *spicata* f. *intermedia*)
Saf-Saf (es-Cirene) (*Ranunculus asiaticus* var. *intermedius*, *Ranunculus cyclocarpus*, *Ranunculus flabellatus var. amphicarpus* *)
Saf –Saf, Uadi Bu Meddas (*Brachypodium distachyon* var. *genuinum* f. *typicum* sf. *puberulum*)
Sahabi (Saniet el Hamar) (*Avena béguinotiana*)
Sceleidima (esc-) (*Cistanche violacea* f. *bicolor*)
Sciallabi (*Sceilabi*) el Bebas (*Haplophyllum vermiculare* var. *cyrenaicum*, *Linaria haelava* var. *cyrenaica**)
Sedra see Acroma
Sebchet el Cuz (*Limonium teuchirae*)
Selmani e Suani Osman (fra) (*Dactylis glomerata* var. *spicata, Hypecoum aequilobum* var. *platylobum*)
Sfax (TUNISIA); (*Antirrhinum tenue*)
Sfeiat see Beda
Sf(l)onta (also Ghfonta?) (Messa): (*Dactylis glomerata* var. *spicata*)
Sidi Ahmed Che(i)la see Barce
Sidi Ahmed el Magrun (fra Bengasi e Agedabia): (*Dactylis glomerata* var. *spicata*, *Dactylis glomerata* var. *spicata* f. *intermedia*, *Plantago coronopus* var. *commutata* f. *pubescens*)
Sidi Bu Amud see Fra Tobruk e Bardia
Sidi Frag e El Magrun (fra) (*Plantago coronopus* var. *commutata* f. *villosa*)
Sidi Gibrin (Merg) (*Bromus chrysopogon*)
Sidi Kalifa (*Dactylis glomerata* var. *spicata*)
Sinai (nel deserto dell'Egitto): (*Roemeria tenuifolia*)
Siret Bettamer (el Gubba) (*Ranunculus cyclocarpus*)
Siret Medanaat, fra Derna e Mechili (*Dactylis glomerata* var. *spicata*)
Slonta (*Brachypodium distachyon* var. *velutinum* f. *gussonei*, *Bromus macrostachys* f. *pubescens*, *Dactylis glomerata* var. *spicata* f. *intermedia*, *Ranunculus flabellatus* var. *amphicarpus*)
Slonta (steppa a *Poterium*) (*Dactylis glomerata* var. *spicata* f. *intermedia*)
Socna (el Jofra – oasi artificiale) (*Diplachne festuciformis*)
Suani Bazar (Dactylis glomerata var. spicata)
Suani Beni Adem (nella steppa) (*Lagurus ovatus* f. *oblongus**)
Tobruk (*Dactylis glomerata* var. *spicata*, *Limonium vaccarii*)
Tobruk (in collibus aridis) (*Ranunculus asiaticus* var. *vulgaris* f. *croceus*) Nomen nudum
Tobruk e Bardia (fra): l.d. Sidi Bu Amud (*Bromus fasciculatus* f. *parlatorei*)
Tocra e Tolmeta (fra) (*Dactylis glomerata* var. *spicata* f. *intermedia*)
Tripoli e Gargaresc (fra) (*Anagallis linifolia* var. *litoralis*)

Tunin, 2° deposito d'acqua (Reg. di Gat – Fezzan occidentale) (*Potamogeton crispus* f. *integrifolius*)
Uadi Abd el Málech see Auenát
Uadi Belgadir(or Bogadir, Beldgadir) (*Brachypodium distachyon* var. *velutinum* f. *gussonei*, *Rhamnus pendula*, *Rubus cyrenaicae*, *Rubus pampaninii** (= *R. cyrenaicae* x *sanctus*)**,** *Rubus pampaninii* f. *fissidens*, *Solanum nigrum* var. *alatum* f. *robustum*)
Uadi Beregtd (Beda) (*Ranunculus cyclocarpus*)
Uadi Bgar see Martuba
Uadi Buten (Cirene) (*Brachypodium distachyon* var. *genuinum* f. *typicum* sf. *puberulum*)
Uadi Beregd see Beda
See also Cirene Uadi Bu Meddas
Uadi Bu Meddas see also Saf Saf (as)
Uadi Bu Ms(c)eifa see Tolmeta
Uadi Bu Nabeh (Cirene) (*Ranunculus cyclocarpus*, *Rhamnus pendula*, *Rubus mussolinii* f. *vulgatiformis*, *Rubus pampaninii (= R. cyrenaicae x sanctus) f. subvestitus*)
Uadi Derna (*Dactylis glomerata* var. *spicata* f. *intermedia*, *Onopordum cyrenaicum*, *Rubus cyrenaicae*)
Uadi el Atrum (*Thesium erythronicum*)
Uadi el Fahaga see Garib e Tolmeta
U(W)adi el K(C)uf (*Antirrhinum gebelicum*)
Uadi El Kuf l.d. Bu Breica see Beda
Uadi Faregh e Maatan Risam (fra l') (*Plantago albicans* var. *desertica*)
Uadi Garian (*Brachypodium distachyon* var. *hispidum*, *Brachypodium distachyon* var. *hispidum* f. *intermedium, Brachypodium distachyon* var. *velutinum*, *Koeleria pubescens* var. *tripolitana*, *Linaria fruticosa* f. *integrifolia*)
Uadi Garian sul Ras Omcteba (*Centranthus calcitrapae* f. *albiflorus*)
Uadi Hofra (Cirene) (*Dactylis glomerata va*r. *spicata* f. *intermedia, Ranunculus cyclocarpus, Rubus cyrenaicae)*
Uadi Issa (tra Bir el Ghelania e Brach) (*Aristida obtusa* f. *arenosa*)
Uadi Ksea (pianura dell') (*Plantago albicans* var. *lanata*)
Uadi Ksea, sul Ras Argobinani (*Adonis microcarpa* var. *intermedia* f. *lutea*, *Brachypodium distachyon* var. *hispidum* f. *pseudosubtile*, *Brachypodium distachyon* var. *velutinum*, *Centranthus calcitrapae* f. *albiflorus*, *Koeleria salzmannii* var. *pampanini**)
Uadi Madfa see Beda
Uadi Megenin presso Ain Zara (*Plantago albicans* var. *macropoda*)
Uadi Messaf-saf (Beda) (*Rubus mussolinii**)
Uadi Messaf-saf see also Ain Legmeila (Beda)
Uadi Msaaba (*Koeleria salzmannii* var. *longiflora*)
Uadi Msaaba, a Kars Doga (*Bromus hordaceus* var. *molliformis* f. *villosus*, *Linaria fruticosa* f. *integrifolia*, *Roemeria hybrida* f. *latiloba*, *Scleropoa philistea* f. *pauciflora*)
Uadi Msuria (Beda) (*Dactylis glomerata* var. *spicata*, *Rhamnus pendula*, *Rubus mussolinii* f. *pseudanisodon*)
Uadi Naga (Derna) (*Bromus macrostachys* f. *pubescens, Dactylis glomerata* var. *spicata* f. *intermedia*)
Uadi Ramla (Mechili) (*Brachypodium distachyon* var. *genuinum* f. *typicum* sf. *puberulum*)
Uadi Sahal, Fra Tobruk e Bardia (*Dactylis glomerata* var. *spicata*)
Uadi Sart (*Brachypodium distachyon* var. *hispidum* f. *pseudosubtile*, *Centranthus calcitrapae* f. *albiflorus*- 2 specimens, *Linaria fruticosa* f. *dentata*, *Vulpia danthonii* var. *tripolitana*)
Uadi Scechaba (*Asperula cyrenaica* f. *hispidula*, *Dactylis glomerata* var. *spicata*, *Rhamnus pendula*)
Uadi Scisu (Beda) (*Brachypodium distachyon* var. *velutinum* f. *gussonei*, *Bromus macrostachys* f. *pubescens*, *Dactylis glomerata* var. *spicata*; *Dactylis glomerata* var. *spicata* f. *intermedia*)
Uadi esc Suenia see Umm er Rzem

Uadi Tenziua/Tersiva (nella steppa) (*Brachypodium distachyon* var. *genuinum* f. *mite*, *Ctenopsis pectinella* var. *pubescens*)
Uadi Tenziua (nelle messi) (*Adonis microcarpa* var. *intermedia* f. *lutea*, *Linaria tarhunensis*)
Uadi Tenziua, pianura a S. W. del Ras Maader (*Linaria tarhunensis*, *Papaver rhoeas* var. *trichocarpum*)
Uadi Tenziua, sul Ras Maader (*Brachypodium distachyon* var. *hispidum* f. *intermedium*, *Linaria fruticosa* f. *villosa*)
Uadi Tmista (Cirene) (*Dactylis glomerata var. spicata, Rhamnus alaternus f. intermedia*)
Uadi Uardama (*Brachypodium distachyon* var. *velutinum* f. *gussonei*, *Dactylis glomerata* var. *spicata* f. *intermedia*, *Ranunculus cyclocarpus*, *Rubus mussolinii* f. *repens*)
Uadi Umm el Anain (Regione di Merg) (*Clematis flammula* var. *sancti-marini* f. *angustissima*)
U(W)adi Zigza (*Paronychia arabica* subsp. *tibestica* var. *fezzanica*)
Umm er Rzem (Barce) (*Dactylis glomerata* var. *spicata*)
Umm er Rzem, Uadi Suenia (*Dactylis glomerata* var. *spicata*, *Poa vaginata*, *Ranunculus asiaticus* var. *intermedius*)
Wadi el Bab (*Allium greuteri*)
Zuetina a nord est di Agedabia (*Cistanche violacea* f. *bicolor*, *Hypecoum aequilobum* var. *platylobum*, *Koeleria Salzmanni* var. *cossoniana* f. *glabra**)
Zuetina see Ghemines

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Contribution of the Authors:

P. Cuccuini & C. Nepi: Coordinators, Museology and the other taxa (*Papaveraceae*, *Plantaginaceae*, *Primulaceae*, *Ranunculaceae*, *Santalaceae*, *Scrophulariaceae* (Cuccuini with M. Abuhadra), *Solanaceae*, *Tamaricaceae*, *Valerianaceae*, *Violaceae*, *Zygophyllaceae*)
Mohamed N. Abuhadra: *Orobanchaceae* (with G. Domina), *Scrophulariaceae* (with P. Cuccuini)
E. Banfi: *Poaceae*
G. Domina: *Oleaceae*, *Orobanchaceae* (with M. Abuhadra), *Plumbaginaceae*, *Rutaceae*
E. Luccioli: graphic
S. Miranda: *Najadaceae*, *Potamogetonaceae*
K. Pagitz: *Rosaceae*
M. Thiv: *Rhamnaceae*
E. Vela: *Rubiaceae*

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The reader is referred to the References of Part 1 (Cuccuini & al. 2015) for any works not mentioned in this second part

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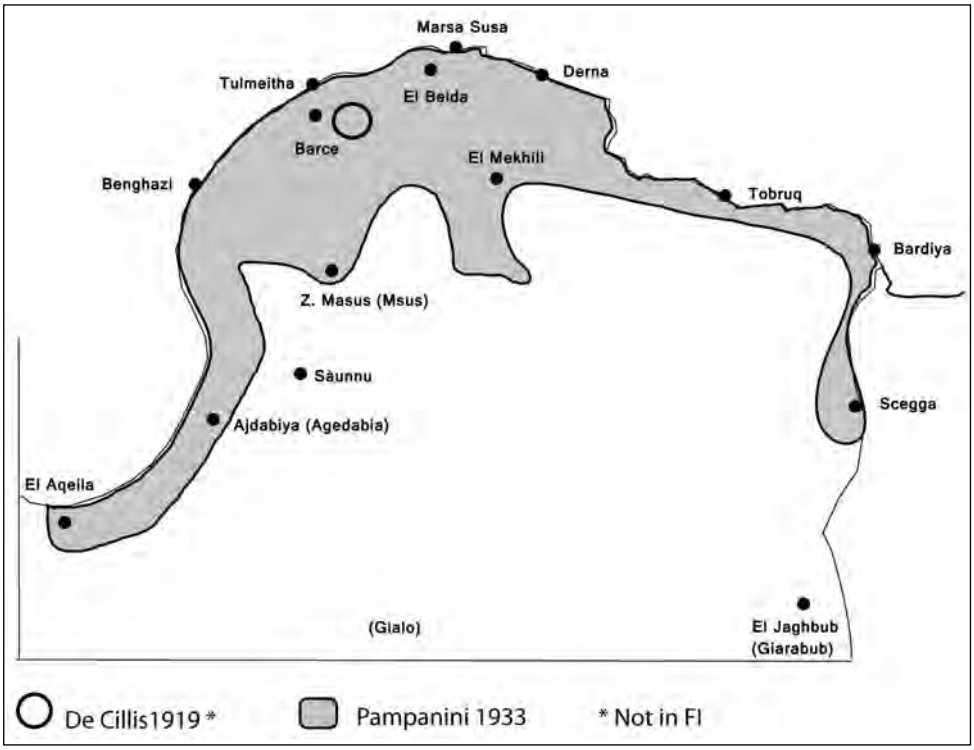
" " (1939-1977)
" " (1978- 2005)
" " (2005-….)
Indici scambi (nos 1-70)
Indici scambi (nos. 71-126)
Raccolte Cirenaiche dei Proff. R. Pampanini e R.E.G. Pichi Semolli (Serie duplicate (1933-1934)
Registro arrivi e spedizioni piante (1949-1970)

Addenda et Corrigenda
The data on the following list were either omitted (as they were unknown at the time), erroneously or only partially illustrated or mentioned in the 1st part of this work (Cuccuini & al. 2015).

Addenda
In "Phytogeographical placing of collection areas" pag. 23.
In figure 5, with regard to the area of Pampanini's collections of 1933, the part between Bardiya and Scegga is missing. Moreover we added the collection locality of De Cillis near Barce, limited to material considered in Cuccuini & al. (2015).

Alliaceae
New taxon: *Allium greuteri* Brullo & Pavone in Willdenowia 13(1): 115. 1983.
Type: [Libya], Cirenaica: Wadi el Bab, 16/05/1981. Leg. Brullo S. & Furnari by Brullo & Pavone in Willdenowia 13(1): 115. 1983, Isotypus in (B, CAT, FI),
Holotypus (CAT)
Accepted name: *Allium greuteri* Brullo & Pavone see Dobignard & Chatelain 1: 65. 2010.

Asteraceae
New taxon *Atractylis prolifera* Boiss. var. *albiflora* Cavara (sub *Atractylis prolifera*) in Bullettino dell'Orto Botanico R. Università di Napoli 9(1): 51 (1928); *nomen nudum*.



***Corrige* Fig. 1**. Collections by De Cillis in 1919 and Pampanini's in 1933.

Original material: [Libia], Cyrenaica: steppa a sud di Agedabia, 25/04/1925. Leg. F. Cavara (FI).

New taxon *Onopordum cyrenaicum* Maire & Weiller in Bull. Soc. Hist. Nat. Afr. Nord. 30 (4-5). 285. 1939.
Type: Lectotypus: Lybie, Cyrenaique: Uadi Derna (901), punti(e)s picneuses, 25/04/1938. Leg. R. Maire & M. Weiller. (FI) (Designated (as typus) by S. A. Alavi in Fl. Lib. 107: 246.1983).
Isolectotypus MPU
Accepted name: *Onopordum cyrenaicum* Maire & Weiller, see Dobignard & Chatelain 2: 330. 2011a; also in Fl. Lib. 107: 245-46. 1983.
Note: the specimen kept in FI is marked as Holotypus by P. Hein 2002; a 2nd syntypus is held in MPU. The transcripton of the labels of both specimens (MPU and FI) slightly differs from the texts published in Maire & Weiller (1939).

Illecebraceae
(In Dobignard & Chatelain (2011b) in *Caryophyllaceae*)
New taxon: *Paronychia arabica* subsp. *tibestica* var. *fezzanica* Chaudri [sub. *P. arabica* subsp. *desertorum* (Boiss.) Batt.] in Chaudri: A revision of Paronychiinae.- Meded. Bot. Mus. Utrecht **285:** 208. 1933. Utrecth.
Type: Holotypus: [Libya]: Fezzan sett., Wadi Zigza, ca 400 m. sul fondo pietroso sabbioso, (1196), 15/04/1933. Leg. R. Corti (FI). By Chaudri in: Chaudri 285: 209. 1968
Accepted name: *Paronychia arabica* subsp. *tibestica* var. *fezzanica* Chaudri, by Chaudri in Chaudri 285: 209. 1968
Note: as *P. arabica* subsp. *tibestica* Quézel in Dobignard & Chatelain 3: 223. 2011b.
In our opinion, the morphological differences observed by Chaudri (1968) and by us confirm his taxonomic decision in the subsp. *tibestica* Quézel group, regarding the autonomic var. and var. *fezzanica*. This is also considering the investigation the Pakistan scholar managed to perform on all the mountain material from Tibesti, among other things very far from Tibesti itself, including Chad. Therefore we recognise the validity of the proposition Chaudri put forward regarding var. *fezzanica*.

Corrigenda
—Pag. 32**:**
Alliaceae
In Cuccuini & al. 2015 Pampanini's specimen 1349 of *Allium aschersonianum* f. *laeve* Pamp. was erroneously indicated as Holotypus following B.E.E. de Wilde-Duyfjes (1976), nevertheless this author cited some other syntypi.
New taxon: *Allium aschersonianum* f. *laeve* Pamp. in Arch. Bot. (Forlì) XII(1): 21. (1936a); Rend. Sem. Fac. Sc. Univ. Cagliari VIII(3): 63 (1938).
Type: Libia, Cirenaica, [Marmarica]: Tobruk (1349), 23/3/1933. Leg. R. Pampanini, (FI003619, Lectotypus designated here)
—Pag. 34
Apiaceae
In the 1st part of this work (Cuccuini & al. 2015), typification of *Pachyctenium mirabile* Pampanini & Maire on page 34 is partially in error as only one plant of specimen n. 5637 (the one top right on the sheet) was designated as lectotypus for the reasons explained in the note. But after a more careful reading of Art. 8.2 of the ICN (McNeill & al. 2012) that defines the meaning of "specimen", i.e. intended "as gathering, or part of a gathering of a single species or infraspecific taxon made at one time.." we decided to choose the whole of specimen no. 5637 as Lectotypus for this name. Therefore the designation of the previous Lectotypus as well as identification of the Isolectotypus on the same sheet should be considered ineffective.

Type: Libya, Cyrenaica, El Beda: Uadi Beregd (5637), 27/04/1934. Leg. R. Pampanini & R.E.G. Pichi Sermolli. (FI). (Lectotypus designated here)

Consequenly the legend for Fig. 9 on page 37 should read:
Specimen no. 5637, collected by R. Pampanini in Libya in 1933 and consisting of the plant *P. mirabile* Maire & Pamp. photographed in Arch. Bot. 12(2). 1936 (top right on sheet), is the Lectotypus of the taxon.

There are several misprints and illegible parts in Cuccuini & al. (2015) ; (not enclosed in taxonomic index).

—Pag. 22
In List of Collectors
corrige
Longa A.: Cyr.
—Pag. 48
in *Cladanthus arabicus* var. *pygmaeus* Pamp.
corrige
Type: ……22/04/1913
—Pag. 53
In *Launaea resedifolia* var *pulchella* Pamp.
corrige
Other material: [L., C.,], Sirtica orientale: Maatan Risam: Gasr es Sahabi, 18/04/1928. Leg. G. Krueger, (FI003567). This specimen is not cited in the Protologue.
The "**Note**"paragraph is deleted.
—Pag. 64
In *Silene setacea* var. *glabrescens* Pamp.
corrige
Type…… el Acheim-Acroma
—Pag. 85
In *Trigonella stellata* var. *micrantha* Pamp
corrige
Syntypi…….4191(FI003427); 4187 [signed twice]
—Pag. 109
The *Lavatera* genus is at page: 109
corrige
Lavatera brioniifolia Mill. *.....100, 101
Lavatera olbia subsp. cyrenaica Pamp. 100
Lavatera olbia subsp. cyrenaica var. vestita Pamp. 100
—Pag 131
In Reference
After 'Rosuà 1986' all publications attributed to him are actually P.A. Saccardo's.
corrige
Rosùa, J.- L. 1986: Contribucion al Estudio del Genero *Rosmarinus* L. en el Mediterraneo occidental. – Lagascalia **14(2):** 179-187.
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—Pag. 23
Caption of fig. 4, illegible
***Corrige* Fig. 2.**

—Pag. 23
Caption of fig. 5, illegible
***Corrige* Fig. 3.**

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Convolvulaceae

In the first part of this work (Cuccuini & al. 2015), the material for the genus *Convolvulus*, so competently and scientifically considered by J.R.I. Wood, was published (along with some typifications). However, we were entirely unaware of the date of Wood's publication (see Wood & al. 2015), and did not see a copy of his article until after our own was published. Wood & al. (2015) pre-dates the first part of our work, and this has led to an unfortunate situation with overlaps in coverage, and changes in the bibliographical priority of some typifications.

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M. Puglisi, P. Campisi, M. G. Dia & M. Privitera

New interesting moss records from the Pollino National Park (Southern Italy)

Abstract

Puglisi, M.,Campisi, P., Dia M. G. & Privitera M.: New interesting moss records from the Pollino National Park (Southern Italy). — Fl. Medit. 26: 145-150. 2016. — ISSN: 1120-4052 printed, 2240-4538 online.

Some interesting moss records in Pollino National Park, noteworthy protected area of the southern Apennines, are reported. Among them, *Mnium spinosum* and *Brachythecium tommasinii* are new to southern Italian peninsula, *Grimmia laevigata*, *G. montana*, *G. tergestina*, *G. trichophylla* and *Orthotrichum pumilum* are new to Basilicata region, and, finally, *Campylidium sommerfeltii* is rare in southern Italy and little known in Mediterranean area.

Key words: mosses, new records, Pollino.

Introduction

The Pollino massif is the highest mountain range of the Southern Apennines located in Italy between Basilicata and Calabria regions. This mountain chain is included within the Pollino National Park, the largest National Park in Italy. The landscape of the protected area is characterized by the occurrence of *Pinus leucodermis* Antoine, which, having the Italian range restricted to this area, is the symbol of the park. In addition to this species, the Pollino massif hosts several other interesting amphi-adriatic species (e.g. *Festuca bosniaca* Kumm. & Sendtn, *Sesleria autumnalis* (Scop.) F.W. Schultz, etc.), testifying the biogeographical relation with the southern Balkans. Moreover, many endemics (e.g. *Campanula scheuchzeri* subsp. *pollinensis* (Podlech) Bernardo, Gargano & Peruzzi, *Hieracium terraccianoi* Di Grist., Gottschl. & Raimondo, *Ranunculus pollinensis* (Terr.) Chiov., *Sesleria calabrica* (Deyl.) Di Pietro, etc.) and boreal or arctic-alpine species (e.g. *Orthilia secunda* (L.) House, *Saxifraga aizoides* L., *Carex pallescens* L., *Carex vesicaria* L., *Senecio alpinus* (L.) Scop.) are found too. From a geological point of view the Pollino is mostly composed of Meso-Cenozoic limestone rocks of sedimentary origin, with outcrops of ophiolitic rocks (basalt vulcanites) characterizing “Timpa della Murge” and “Timpa di Pietrassasso”.

Despite the botanical interest of the massif, the bryophyte flora of this mountain system is not yet well known; no specific study on the bryoflora of the Pollino is known at present,

but only sporadic reports in old papers with more general topic on the Italian bryoflora (Brizi 1890; Bottini 1894; Zodda 1913) and recent contributions, regarding some new records, have been provided by Campisi & al. (2008), Puglisi & al. (2009), D'Avella & al. (2011) Colacino & al. (2013), Puglisi & al. (2014).

Material and Methods

During a fieldtrip with students of Catania University to the Pollino National Park in June 2013, some floristic and vegetation surveys were conducted and some interesting bryopyte records were done.

The nomenclature of bryophyte taxa follows Söderström & al. (2016) for liverworts and Ros & al. (2013) for mosses. The Italian regional distribution is based on Aleffi & al. (2008), while the chorotypes and the ecological features are drawn from Hill & Preston (1998) and from Dierssen (2001), respectively. The specimens are kept in the Vegetal Biology Section of the Department of Biological, Geological and Environmental Sciences of University of Catania (CAT).

Results

In this paper the occurrence of some rare mosses in Italy, as well as of some taxa previously unknown in the Basilicata region, is reported from the Pollino National Park. They are *Mnium spinosum* (Voit) Schwägr. and *Brachythecium tommasinii* (Sendtn. ex Boulay) Ignatov & Huttunen, new to southern Italy, *Campylidium sommerfeltii* (Myrin) Ochyra, very rare in southern Italy, *Grimmia laevigata* (Brid.) Brid., *G. montana* Bruch & Schimp., *G. tergestina* Tomm. ex Bruch & Schimp., *G. trichophylla* Grev. and *Orthotrichum pumilum* Sw., new records for the Basilicata region.

Mnium spinosum (Voit) Schwägr.

Italy, Basilicata, Conte Orlando Refuge (Pollino National Park), 1200 m a.s.l., 39°49'0.79"N 15°58'56.80"E, in rock crevices together with *Anomodon viticulosus* (Hedw.) Hook. & Taylor and *Encalypta streptocarpa* Hedw., 23 June 2013, *M. Privitera* (CAT).

This chionophilous moss mainly grows on humus and turf among rocks in coniferous forests, beechwoods and oakwoods. *Mnium spinosum*, a Circumpolar Boreal-montane species is present in Europe, northern and central Asia, China, Turkey and N. America (Smith 2004). In Italy it is known in almost all the northern regions, while it is rare in the center of the peninsula. The new Lucanian locality is the first one reported in southern Italy, representing the southern limit of the range of this species.

Brachythecium tommasinii (Sendtn. ex Boulay) Ignatov & Huttunen

Italy, Basilicata, Piano Iannace (Pollino National Park), 1650 m a.s.l., 39°56'31.63"N,

16°11’53.06”E, on calcareous rocks, with *Homalothecium sericeum* (Hedw.) Schimp., *H. philippeanum* (Spruce) Schimp. and *Porella platyphylla* (L.) Pfeif, 22 June 2013, *M. Puglisi*; Conte Orlando Refuge 1200m, 39°49’0.79”N 15°58’56.80”E, on calcareous rocks, 23 June 2013, with *Cirriphyllum crassinervium* (Taylor) Loeske & M. Fleisch. and *Tortella tortuosa* (Hedw.) Limpr. var. *tortuosa*, 23 June 2013, *M. Puglisi*.

It is an epilithic moss that lives on shady basic rocks. It is temperate-montane species distributed in Northeast and Central Asia and in Europe (Düll, 1985). Not very common in the Mediterranean area (Hodgetts 2015; Ros & al. 2013), in the Italian peninsula is known only from some northern and central regions, representing a new record for the southern part. Moreover, it has been reported from Sicily where its presence, based only on old reports, is to be confirmed.

Campylidium sommerfeltii (Myrin) Ochyra

Italy, Basilicata, Conte Orlando Refuge (Pollino National Park), 1200 m a.s.l., 39°49’0.79”N 15°58’56.80”E, on soil covering calcareous rocks, 23 June 2013, *M. Privitera* (CAT).

It is a cryophylous-mesothermic moss that lives on calcareous soils over rocks, humus and sometimes on rotten wood. Widely distributed in the Americas, it is also present in North and East Asia and Europe, where is rather common in the eastern countries. (Hedenäs 2014; Hodgetts 2015). Also in the Mediterranean area it is mainly present in the eastern regions (Ros & al. 2013). In Italy this species is distributed in northern and central regions and is known only by old reports from Campania and Puglia. The species is new to Basilicata where it is at the southern limit of its range.

Grimmia laevigata (Brid.) Brid.

Italy, Basilicata, Timpa delle Murge, (Pollino National Park), 1210 m a.s.l., 39°58’47,7”N 16°15’10,2”E, on dry, exposed rocks, 22 June 2013, *M. Privitera* (CAT).

It is a species sensitive to acidic precipitation and eutrophication and its frequency decreases in polluted areas (Dierβen 2001). It lives on acidic to slightly basic rocks on different continents (Hastings & Greven 2007). This Circumpolar Southern-temperate species is widespread in Europe, but endangered or regionally extinct in some countries (Norway, Ireland, Belgium, Germany, Luxembourg, Netherlands, Romania, Belarus, Estonia) (Hodgetts 2015). Well-known in Italy, it is new to Basilicata.

Grimmia montana Bruch & Schimp.

Italy, Basilicata, Piano Iannace (Pollino National Park), 1700 m a.s.l., 39°56’23,75”N, 16°11’44,38”E, on rocks, 22 June 2013, *M. Privitera* & *M. Puglisi* (CAT).

This acrocarpous moss grows on exposed, well-illuminated mostly acidic rocks where forms dark green, sometimes almost blacks cushions. Regionally it has a tendency to

decline due to air pollution (Dierβen 2001). It is a Circumpolar-temperate species distributed in Europe, Asia, North Africa, Macaronesia and North America (Smith 2004). In Italy, where it was assessed as "Endangered" by Cortini Pedrotti & Aleffi (1992), it is known only in a few regions; it is new to Basilicata.

Grimmia tergestina Tomm. ex Bruch & Schimp.

Italy, Basilicata, Timpa delle Murge (Pollino National Park), 1210 m a.s.l, 39°58'47,7"N 16°15'10,2"E, on dry, exposed rocks, 22 June 2013, *M. Privitera* .

This species forms whitish green cushions on rocks and cliffs, mostly on dry mountain habitats. It occurs in Europe, Asia, , North Africa, North, Central and South America (Smith 2004). Rather common in northern Italy, it becomes rarer in the central and southern part of the peninsula, where it was known only from Campania.

Grimmia trichophylla Grev.

Italy, Basilicata, Piano Iannace (Pollino National Park), 1700 m a.s.l., 39°56'23,75"N, 16°11'44,38"E, on rocks, 22 June 2013, *M. Puglisi* .

It mostly grows on exposed, dry, acidic rocks outcrops, boulders and cliffs. It is widespread in the temperate areas of Northern, Central and Southern South America, Southwestern Asia, North Africa, Macaronesia, Australasia and Europe (Smith 2004). The Lucanian report fills one of the few gaps in the Italian regional distribution of the species.

Orthotrichum pumilum Sw.

Italy, Basilicata, Conte Orlando Refuge (Pollino National Park), 1230 m a.s.l., 39°49'02.58"N 15°58'44.11"E, on trunks of *Fagus sylvatica* L., together with *Frullania dilatata* (L.) Dumort.., *Homalothecium sericeum* (Hedw.) Schimp., *Orthotrichum striatum* Hedw., *Radula complanata* (L.) Dumort, 23 June 2013, *M. Privitera*; Visitone Refuge, 1430 m a.s.l., 39°56'21.71"N, 16°08'42.07"E, together with *Frullania dilatata*, *Hypnum cupressiforme* Hedw. var. *cupressiforme* and *Orthotrichum affine* Schrad ex Brid., 22 June 2013, *M. Privitera* (CAT).

O. pumilum preferably grows on trunks and branches of trees in open forests. It is an European-temperate species distributed in Europe, Asia, North Africa, Macaronesia and North America (Smith 2004). Mainly known in northern Italy, it is rare in central and southern peninsula. This report is the first for Basilicata.

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Updates on the bryophyte flora of the lowland woods and temporary ponds west of Lake Trasimeno (Central Italy)

Abstract

Poponessi, S., Aleffi, M., Gigante, D. & Venanzoni, R.: Updates on the bryophyte flora of the lowland woods and temporary ponds west of Lake Trasimeno (Central Italy). — Fl. Medit. 26: 151-162. 2016. — ISSN: 1120-4052 printed, 2240-4538 online.

A study of the bryophytes of the lowlands west of Lake Trasimeno, a very peculiar territory for its geological, biogeographical and bioclimatic traits, was carried out. The data here reported were collected in a mosaic of woods and Mediterranean temporary ponds, the latter indicated as priority natural habitats under the Habitats Directive 92/43/EEC with the code 3170*. Research led to the identification of 44 taxa of bryophytes (13 liverworts and 31 mosses), among which 5 liverwort and 8 moss species are new records for the Umbria region, while one is confirmed. Particularly interesting is the presence of 13 liverwort taxa considered, according to the European Committee for Conservation of Bryophytes (ECCB), under threat at different levels in Europe. The study offers new outcomes on neglected aspects of the flora of central Italy and represents a considerable improvement of the floristic, biogeographical and ecological understanding of its bryophytic component.

Key words: liverworts, mosses, Habitats Directive 92/43/EEC, ecology, Umbria, Mediterranean.

Introduction

Temporary wet ecosystems are, by definition, amphibious systems whose maintenance depends on alternation of wet and dry periods during the year (Deil 2005). From the bryological point of view, these environments are poorly investigate although they accommodate rare taxa whose presence depends on their peculiar hydrogeological conditions (Cogoni & al. 2009).

The distributional range of these habitats includes the Mediterranean Basin; they are present in Mediterranean and Submediterranean Italy (Biondi & al. 2009, 2012), however, their actual occurrence is restricted and very localized, due to their intrinsically peculiar ecology as well as to human impact and environmental changes, including climate change (Gigante & al. 2007, 2013b; Bagella & al. 2010; Bagella & Caria 2012, 2013; Poponessi & al. 2014b). For these reasons they are very precious habitats, hosting fragile ecosystems.

Bryological data from the wide area surrounding the study site date back to several decades ago (Cortini Pedrotti 1985; Aleffi 1992), except for a recent survey by Poponessi & al. (2014a) and Ellis & al. (2015). The vascular component has been studied in the 80s (Pedrotti & al. 1980; Pedrotti 1982) and recently reorganized in an updated phytosociological framework including six amphibian vegetation types belonging to the phytosociological alliances *Isoëtion duriei* Br.-Bl. 1936, *Cicendio filiformis-Solenopsion laurentiae* Brullo & Minissale 1998, *Eleocharition acicularis* Pietsch 1967 and *Ranunculo ophioglossifolii-Oenanthion fistulosae* De Foucault 2012 (Gigante & al. 2013b). These vegetation syntaxa include, respectively, the Mediterranean ephemeral spring blooming communities, the acidophilous Mediterranean-Atlantic spring blooming communities, the Continental communities of fluctuating water with loamy or silty-clayey soils and the hygrophilous Atlantic-Mediterranean meadows on clayey nutrient-rich substrata (Biondi & al. 2014).

Study area

The study area is represented by the Piana di Ferretto in Central Italy (Fig. 1), a large flat territory between 260 and 320 m a.s.l. on the west side of the Lake Trasimeno (Perugia, Umbria), the largest lake in Peninsular Italy. It is a site with a remarkable conservational value, for flora and fauna as well as for plant communities (Landucci & al. 2011, 2013; Gigante & al. 2013a; Velatta & al. 2014), some of which currently at serious risk (Reale & al. 2012). Due to the occurrence of several Habitats included in the Annex I to the 92/43/EEC Directive (besides the already mentioned 3170*, also 4030, 6420, 91M0 and 92A0) the site has been designated as a S.A.C. belonging to Natura 2000 (IT5210020).

The geologic substratum is represented by sandy-clayey Plio-Pleistocenic sediments originating oligotrophic, leached and decarbonated soils (Giovagnotti & al. 2003). In the rain period the argillaceous fraction of the soils retains water and causes flooding conditions. The resulting pond system is scattered over an area of about 2,500 Ha, interspersed in a complex mosaic of forests, heaths, agricultural fields and small settlements. The ponds are purely fed by rainwater and get totally dry during the summer drought period.

From the bioclimatic point of view, the area belongs to the Mediterranean Bioclimate (Mesomediterranean belt), with transitional traits to the Submesomediterranean Variant of the Temperate Bioclimate (Gigante & Venanzoni 2007).

Materials and methods

A total of four sampling sites in the study area have been repeatedly investigated in the period February-June of the years 2012-2015. These areas are representative of the eco-mosaic of temporary pools and host a well-developed range of different pool typologies, according to Gigante & al. (2013b). In order to take into account a wide range of different ecological conditions, all the types of temporary pools present in the area have been monitored, including waterlogged soils, shallow flat ponds and basin-shaped ponds with steep borders, according to Deil (2005). In each sampling site, a changeable number of ponds was present, from a minimum of 8 to a maximum of 20.

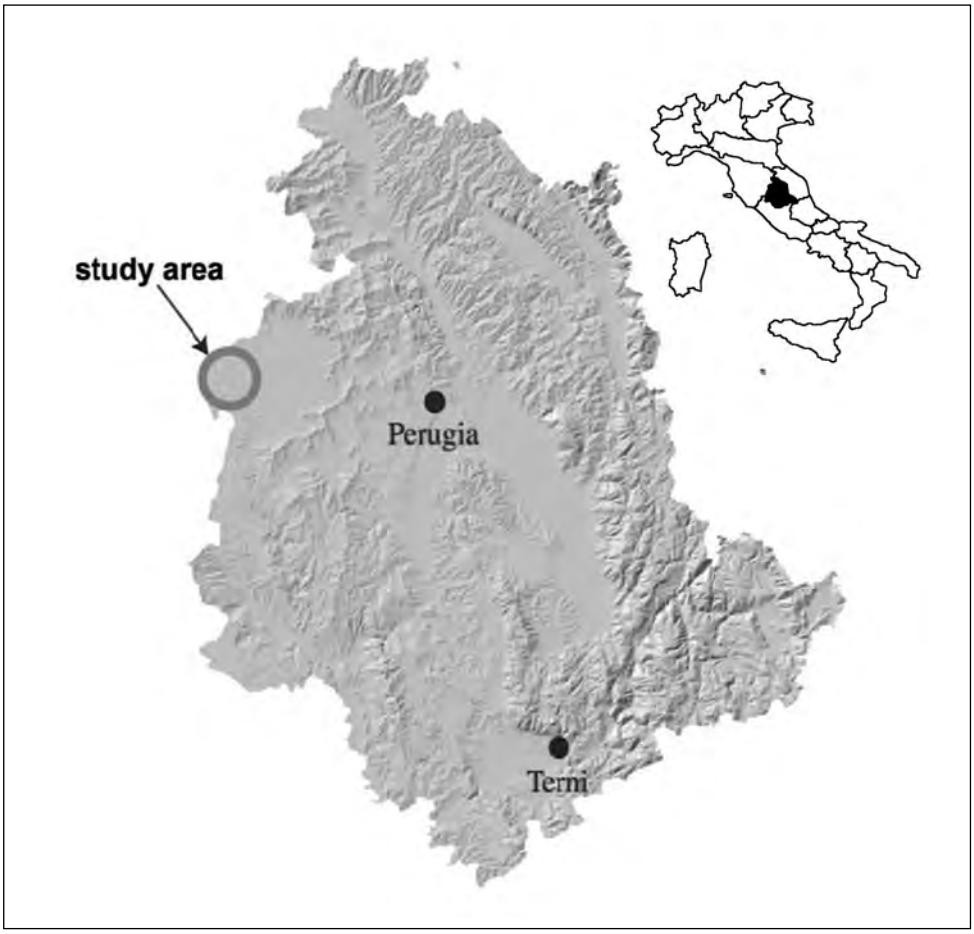

Fig. 1. Physiographic Map of Umbria and study area (modified from LIDAR DTM of Umbria Region, freely available at http://www.pcn.minambiente.it/GN/en/).

The Universal Transverse Mercator (UTM) coordinates of the centroids and the used acronyms for each site are indicated in Table I.

The *exsiccata* were stored in the Herbarium PERU of the Department of Chemistry, Biology and Biotechnologies, University of Perugia and labels are available on the web at http://www.anarchive.it (Panfili & al. 2004; Lucarini & al. 2015). The nomenclature of taxa follows Söderström & al. (2016) for the liverworts and Ros & al. (2013) for the mosses.

Results

The research allowed the identification of 44 bryophyte taxa: 13 liverworts and 31 mosses. According to Aleffi & al. (2008) and Ellis & al. (2016), 5 liverworts and 9 mosses are new

records for the Umbria Region and one moss is confirmed. The complete list of the identified bryophytes is reported hereafter. Each taxon is listed in alphabetical order, with a short description of its habitat in each location where it was collected (locations are indicated by the acronym reported in Table I). The new taxa for the Umbria region are marked with an asterisk (*), the symbol "#" indicates a confirmation of the presence in the region.

Table 1. Collecting localities and coordinates of mosses and liverworts taxa.

Station	Coordinates	Acronym
Podere Coccolargo	43°10'24.26"N-12°00'02.13"E	PC
Podere Marella	43°10.083'N-11°58.267'E	PM
Monelli	43°9.933'N-11°59.638'E	MO
Le 7 Strade	43°9.576'N-12°0.288'E	7S

List of taxa

LIVERWORTS

Cephaloziella rubella (Nees) Warnst. PC and 7S: very localized and rare on waterlogged soil with *Isöetes histrix* Bory, drying phase.

**Fossombronia caespitiformis* De Not. ex Rabenh. subsp. *multispira* (Schiffn.) J.R.Bray & D.C.Cargill. MO: moderately abundant, on waterlogged soil with *Isöetes histrix.*

Fossombronia pusilla (L.) Nees. PC: moderately abundant, on clayey-sandy waterlogged soil with *Isöetes histrix* and on partially shaded pool systems with *Callitricho-Ranunculetum*; PM: moderately abundant, on waterlogged soil with *Isöetes histrix*.

Fossombronia wondraczekii (Corda) Dumort. ex Lindb. MO: very localized, along the edge of ponds with *Callitricho-Ranunculetum*.

Gongylanthus ericetorum (Raddi) Nees. PC and PM: very localized, on clayey-sandy waterlogged soil with *Isöetes histrix*, drying phase; MO: very localized, on waterlogged soil shadowed by *Calluna vulgaris* (L.) Hull; 7S: widespread but always with a few individuals, on waterlogged soil with *Isöetes histrix,* drying phase.

#*Phaeoceros laevis* (L.) Prosk. 7S: very localized, on waterlogged soil with *Isöetes histrix,* drying phase.

**Riccardia chamedryfolia* (With.) Grolle. PC: very localized, on waterlogged soil with *Isöetes histrix,* drying phase.

Riccia beyrichiana Hampe MO: very localized, on waterlogged soil digged by wild boars.

**Riccia canaliculata* Hoffm. PC: abundant, on waterlogged clayey soil in the shadow of *Pinus pinea* L.; PM: at the edge of a clayey pond.

**Riccia crozalsii* Levier. 7S: very localized, on waterlogged soil with *Isöetes histrix*.

Riccia gougetiana Durieu & Mont. var. *gougetiana*. MO: widespread but always with a few individuals, on waterlogged soil digged by wild boars.

Riccia sorocarpa Bisch. PC, PM and MO: widespread but always with a few individuals, on waterlogged clayey-sandy soil with *Isöetes histrix,* sometimes on soil digged by wild boars.

**Riccia subbifurca* Warnst. *ex* Croz. PC and MO: widespread but always with a few individuals, on waterlogged soil with *Isöetes histrix* and on clayey and clayey-sandy waterlogged soils.

Mosses

Anomodon viticulosus (Hedw.) Hook. & Taylor. MO: abundant, on dry soil at the edge of the wood.

Archidium alternifolium (Hedw.) Mitt. PC and PM: abundant, on waterlogged soil, sometimes on soil digged by wild boars; MO: widespread but always with a few individuals; 7S abundant on waterlogged soil, with *Isöetes histrix,* drying phase.

Atrichum undulatum (Hedw.) P.Beauv. PC: widespread but always with a few individuals, on waterlogged soil with *Isöetes histrix*; MO: abundant, on waterlogged soil in drying phase.

Barbula unguiculata Hedw. MO: very localized, on bare soil in glades with *Calluna vulgaris*.

Calliergonella cuspidata (Hedw.) Loeske. PC and MO: abundant, on waterlogged soil; PM: on the border of a basin-shaped pool.

Campylopus brevipilus Bruch & Schimp. PC: very localized, on waterlogged soil.

**Campylopus introflexus* (Hedw.) Brid. MO: abundant, on waterlogged soil, drying phase, and in a large glade.

**Campylopus pilifer* Brid. MO: very localized, in a wooded glade with *Campylopus introflexus.*

**Dicranella cerviculata* (Hedw.) Schimp. MO: very localized, on acidic flat soil in between the heath.

**Dicranella staphylina* H.Whitehouse: PC: very localized, on acidic flat soil.

Dicranum scoparium Hedw. MO: abundant, in a wooded glade.

Didymodon luridus Hornsch. MO: abundant, on a moist slope at the border of a basin-shaped pond.

Entosthodon fascicularis (Hedw.) Müll.Hal. PC, PM and MO: widespread but always with a few individuals, on waterlogged soil, sometimes on soil digged by wild boars.

**Ephemerum recurvifolium* (Dicks.) Boulay. MO: widespread but always with a few individuals, on waterlogged soil.

Fissidens bryoides Hedw. var. *bryoides*. MO: very localized, on a moist slope at the border of a basin-shaped pond.

Fissidens dubius P.Beauv. MO: very localized, on a moist slope at the border of a basin-shaped pond.

Funaria hygrometrica Hedw. MO: very localized, along the edge of a basin-shaped pool.

Hypnum cupressiforme var. *lacunosum* Brid. MO: abundant, in a wooded glade.

Imbribryum alpinum (Huds. *ex* With.) N. Pedersen. MO: abundant, on waterlogged soil with *Isöetes histrix,* drying phase; 7S: on clayey waterlogged soil.

**Plagiomnium ellipticum* (Brid.) T.J.Kop. MO: widespread but always with a few individuals, on a moist slope at the border of a basin-shaped pond.
Pleuridium acuminatum Lindb. 7S: widespread but always with a few individuals, on waterlogged soil with *Isöetes histrix,* drying phase.
**Pohlia nutans* (Hedw.) Lindb. MO: widespread but always with a few individuals, on waterlogged soil.
Polytrichum formosum Hedw. MO: abundant, on acidic and dry soil, in a wooded glade.
Polytrichum juniperinum Hedw. MO: abundant, in between the heath.
Pseudoscleropodium purum (Hedw.) M.Fleisch. PC: very common, on waterlogged soil, drying phase; MO: very common, in between the heath.
Ptychostomum capillare (Hedw.) D.T.Holyoak & N.Pedersen. PM and MO: widespread but always with a few individuals, on waterlogged soil in drying phase and in between the heath.
Ptychostomum pseudotriquetrum (Hedw.) J.R. Spence & H.P. Ramsay var. *pseudotriquetrum*. PC, PM and MO: abundant, on waterlogged soil with *Isöetes histrix,* drying phase.
**Racomitrium ericoides* (Brid.) Brid. 7S: abundant, on drying soil.
Tortella squarrosa (Brid.) Limpr. MO: localized, in a dry *facies* of *Serapio-Isöetetum*.
Tortula muralis Hedw. MO: localized, along the edge of a basin-shaped pool.
Tortula truncata (Hedw.) Mitt. MO: localized, along the edge of a basin-shaped pool.

Discussion

The here reported bryophytic survey shows a high level of floristic and biogeographical diversity for a Mediterranean temporary pond system in central inland Italy. It significantly improves the knowledge of a territory, which was already known for providing peculiar habitats for rare and endangered taxa, especially as concerns the liverworts (Hugonnot & Hébrard 2004). Indeed, among the collected species, particularly interesting is the finding of thirteen liverworts included in the *Checklist and country status of European bryophytes – towards a new Red List for Europe* (Hodgetts 2015). They present different levels of threat, according to the IUCN categories and criteria (IUCN 2014).

The liverworts *Fossombronia caespitiformis* subsp. *multispira, F. wondraczekii* and *Riccia beyrichiana* are considered Critically Endangered (CR) for Italy (Hodgetts, 2015). The first is assigned to the Tropical-Temperate phytogeographical element (Dierßen 2001).

The distribution range of *F. caespitiformis* subsp. *multispira* is still rather poorly known because its taxonomy has only recently been elucidated (Lockhart & al. 2012). Both the known subspecies (*F. caespitiformis* subsp. *multispira* and *F. caespitiformis* subsp. *caespitiformis*) occur in nearly all of the Mediterranean countries and in Madeira and the Canary Islands (Ros & al. 2007). In Italy it is quite rare; in particular, in the North it was formerly known only in Liguria on the basis of old records (Aleffi & al. 2008).

As concerns *Fossombronia wondraczekii*, in Europe it is assigned to the Circumboreal phytogeographical element, and is a mesohygrophilous, photo-sciaphilous and terricolous species (Dierßen 2001; Aleffi & Esposito 2005). Ellis & al. (2015) recently confirmed the presence of this taxon in Central and Northern Italy, including Umbria. In the South, *F. wondraczekii* is present also in Campania and Sicily, as reported by Aleffi & al. (2008).

The rich group of taxa belonging to the genus *Riccia*, mainly distributed in the Mediterranean region, is common in the habitat types "Mediterranean temporary ponds" (3170*) and "Oligotrophic waters containing very few minerals generally on sandy soils of the West Mediterranean with *Isöetes* spp." (3120) (Grillas & al. 2004b; Cogoni 2009).

In these habitats many species of rare bryophytes at the national or regional level can be found, however still little is known about both their phenology and conservation status (Hugonnot & Hébrard 2004). Most species show an "annual shuttle" life strategy (e.g. *Riccia* sp. pl., *Fossombronia* sp. pl., *Ephemerum* sp. pl.), which mainly consists of seasonality of reproduction, large spores with small dispersal capacity and absence of innovations (asexual propagation). This strategy perfectly fits to a habitat which is present only for a short period but which predictably reappears within the same spot or in the neighborhood, hosting the same community (During 1979).

The presence of species of the genus *Riccia* in the study area is very interesting.

For some taxa the edge of the temporary pools is a favourable habitat: it is the case, e.g., of *Riccia sorocarpa* var. *sorocarpa, R. subbifurca, R. beyrichiana, R. crozalsii*, *R. canaliculata*, according to Hugonnot & Hérbrard (2004).

Riccia beyrichiana was reported for the first time for Umbria by Cortini Pedrotti (1985) on sandy soils in the area around the Lake Trasimeno; its present discovery in the MO site confirms the presence in the region. In Italy it is reported in Piedmont, Lombardy, Apulia and Sardinia, (Aleffi & al. 2008). Its range includes North America, North and Central Europe (Düll, 1983), the Iberian Peninsula, France, Corse, Sardinia, Italy, Malta and Greece (Ros & al. 2007).

Riccia canaliculata and *R. crozalsii* are considered Endangered (EN) in Italy (Hodgetts 2015). The first is very rare in the Italian territory, it is reported in Lazio and Sardinia on the basis of new records (Aleffi & al. 2008).

Riccardia chamedryfolia is considered Vulnerable (VU) in Italy, according to Hodgetts (2015).

Other species considered Near Threatened (NT) according to Hodgetts (2015) are: *Riccia subbifurca* and *Phaeoceros laevis*, respectively a new record and a confirmation for Umbria region (Aleffi & al. 2008), *Riccia gougetiana* var. *gougetiana*, *R. sorocarpa* var. *sorocarpa*, *Cephaloziella rubella, Fossombronia pusilla* and *Gongylanthus ericetorum.*

At the sites PM and MO it was possible to observe how the areas disturbed by the presence of wild boars, have been colonized especially by liverwort species belonging to the *Riccia* genus. This type of soil disturbance seems to affect in particular the vascular and bryophytic component of the pools, however the action of the animals, by originating new bare surfaces, favors the settlement of entities of the genus *Riccia* (Grillas & al. 2004b).

The present study refers only to floristic aspects, however in Italy there is a recent impulse to the study of bryophytic coenoses from a phytosociological point of view (Puglisi & Privitera 2012).

In the study area, aspects referable to the bryophyte-dominated community *Riccietum gougetianae* Marstaller 1993, recently reported for the first time for Italy by Puglisi & al. (2016), were frequently observed. They seem to be quite spread in habitats with moist soils, often associated with the presence of *Isöetes histrix*. Interesting samples of the recently described association *Riccietum canaliculatae* Puglisi & Privitera 2016 were also observed. This is a typical community of the Mediterranean ponds and in the study area it

develops on largely bare clayey wet deposits. Traces of *Riccio sorocarpae-Funarietum fascicularis* Lecointe 1978 *fossombronietosum* Lecointe 1978, *Pleuridio acuminatae-Archidietum alternifolii* Puglisi & Privitera 2016 and *Campylopus introflexus*-dominated community were also noticed in the area. The last community, as also indicated by Puglisi & al. (2016), does not typically belong to the Mediterranean pond system. Indeed, it was observed in areas where the substrate is generally drier, close to the forest edge.

Among the moss species characteristic of these environments the following ones can be mentioned: *Archidium alternifolium, Imbribryum alpinum, Ptychostomum pseudotriquetrum* var. *pseudotriquetrum, Entosthodon fascicularis, Tortula truncata, Campylopus introflexus* (Grillas & al. 2004a; Hugonnot & Hébrard 2004).

Dicranella cerviculata is a new report to Umbria region. It was ecently reported from the Abruzzo region (Puglisi & al. 2011).

Campylopus introflexus in Europe is considered a neophytic moss, from the Southern hemisphere (Hill & al. 2006). According to the most recent European distributional data, the presence of the species is documented for Turkey (Blockeel & al. 2009a), Estonia (Vellak & al. 2009), Corsica (Cogoni & al. 2009), and Spain (Ellis & al. 2013), showing a remarkable enlarging of its distribution area.

Other species rare in Italy according to Aleffi & al. (2008), worth to be mentioned, are *Dicranella staphylina, Ephemerum recurvifolium, Pleuridium acuminatum* and *Campylopus brevipilus.*

This study provides basic floristic and chorological information for the realization and definition of the Italian Red , currently in progress (Rossi & al. 2014). It offers an updated overview of the bryological flora of Mediterranean temporary ponds in central Italy and contributes significantly to improve the knowledge of a floristically rich territory in a frequently neglected taxonomic field.

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I. Camarda, A. Brunu, L. Carta & G. Vacca

Incendies, pâturage et biodiversité dans la montagne du Gennargentu (Sardaigne)

Abstract

Camarda, I., Brunu, A., Carta L. & Vacca G.: Incendies, pâturage et biodiversité dans la montagne du Gennargentu (Sardaigne). — Fl. Medit. 26: 163-177. 2016. — ISSN: 1120-4052 printed, 2240-4538 online.

The relationship between plants, fire and grazing of free-ranging domestic herbivores in the Gennargentu mountain (Sardinia) are analysed. Sheep, cattle, goats, horses, donkeys and pigs are present in the different seasons of the year and often simultaneously. This causes a strong impact, contributes to the degradation of forest vegetation and favors the development of the Mediterranean macchia and garrigue. Plant self-defense and resilience against fire and animals in different habitats are discussed. Thanks to the presence of thorns, toxic or aromatic compounds many species can live in the presence of a strong pressure from grazing animals. An effective form of defence is also represented by habitats inaccessible to animals from where plants propagate from year to year, seeds or vegetative propagules that help maintain the species. Moreover, thorny plants can be a shelter for many different species that are well protected from the browsing of animals and can thus complete their biological cycle. In relation to fire, plants are able to survive thanks to the biological adaptations to their underground organs, thermo - resistant seeds. Finally, the joint action of fire and grazing promotes clearings that favour the development of light-demanding plants, and allow the germination of several species from the soil seed bank. Therefore, the abundance or scarcity of the populations of many species depend upon the combinations of these elements, which are generally considered harmful to the conservation of plants which are considered or endangered according to international criteria.

Key words: fire, defend, domestic herbivores, Gennangetu, Sardinia.

Introduction

L'importance des incendies et du pâturage sur la biodiversité est reconnu par de nombreux auteurs (entre autres: Naveh 1974; Tomaselli 1976; Le Houérou 1981; Di Castri 1981; Aru & al. 1982 ; Dell & al. 1986;; Noy-Meir 1995, Enne & al 1998;. Pulina & al. 1994, 1998; Francesconi, 1998; Nolan & al. 1999; Sternberg & al. 2000; Roggero & al. 2002; Camarda 2004; Papanastasis 2009; Caballero & al. 2011) qui mettent en évidence l'influence de ces facteurs sur les processus dynamiques de la végétation méditerranéenne. En

* Extended and enriched version of the oral presentation given at the XV Optima meeting in Montpellier, 6-11 June 2016.

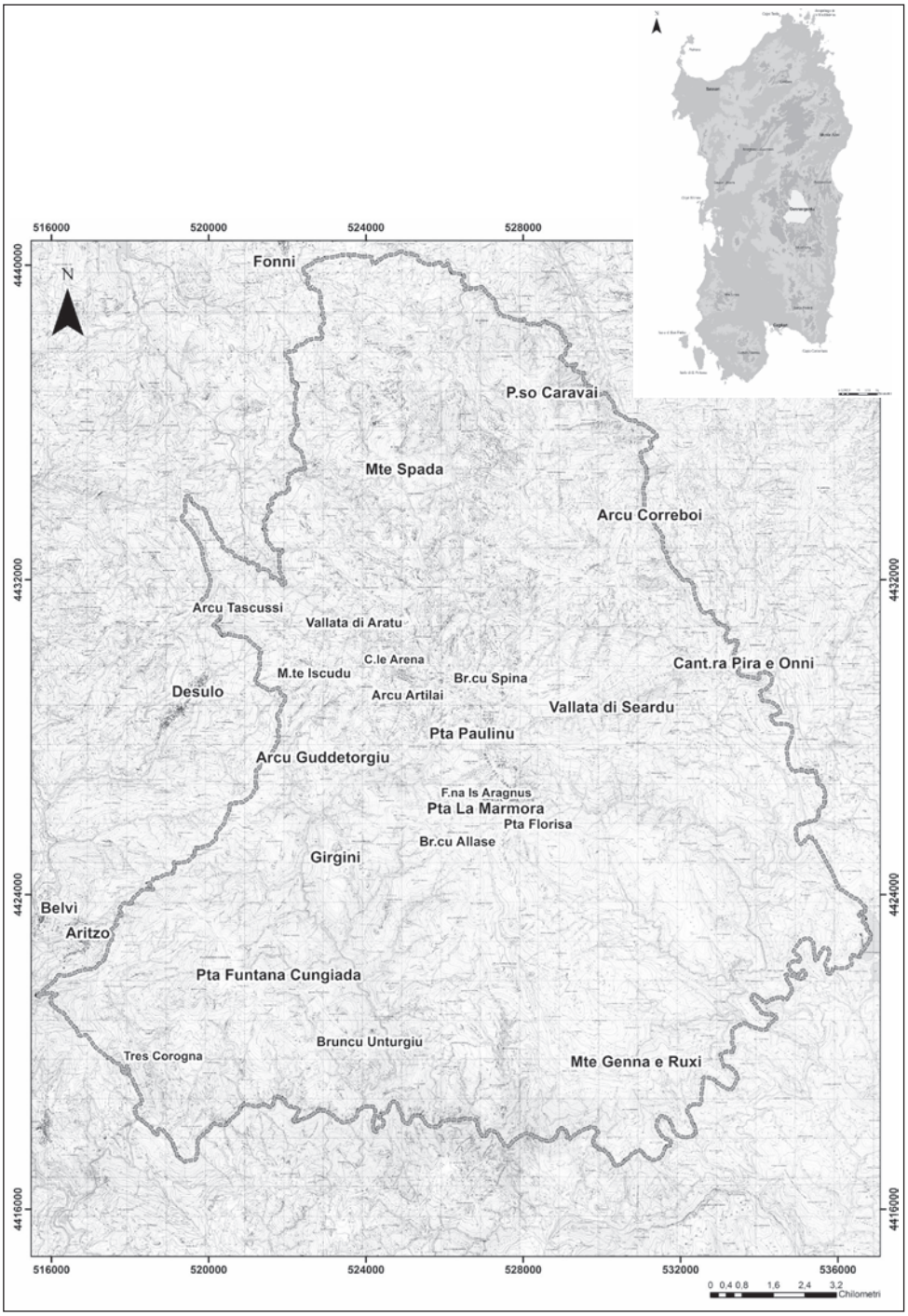


Fig. 1. Délimitation de l'aire d'étude (d'après Arrigoni & Camarda 2015).

Sardaigne, les études sur le pâturage, la production, l'amélioration, la résilience et la démographie couvrent différents aspects (Valsecchi 1969; Camarda 1977, 1982, 1984, 1990, 1992; Bullitta & Casu 1980; Caredda 1986; Caredda & al. 1996; Pulina & al. 1994; Roggero & al. 2002; Farris & Filigheddu 2008; Pisanu & al. 2012; Bagella & al. 2013). Plus en générale, Putzu & al. (2007) et Pilla & Pulina (2014) analysent la question des pâturages par rapport au paysage, en identifiant le paysage zootechnique comme la principale composante du territoire méditerranéen, tandis qu'une contribution sur l'influence du pâturage et de la composante de la flore endémique en Sardaigne a été analysée par Camarda & al. (2015).

Le Gennargentu (Figure 1), la plus haute montagne de la Sardaigne, a été largement étudié du point de vue botanique pour la flore (Arrigoni & al. 1977-1991; Bacchetta & al. 2013; Arrigoni & Camarda 2015) et pour la végétation (Gamisans, 1976, 1977; Pignatti-Wikus & al. 1980; Arrigoni 1987; Brullo & al. 2001; Brunu 2011; Carta & al. 2015). Toutefois, l'impact des animaux à la vaine pasture est peu analysée dont la présence affecte et modifie la structure du paysage du territoire (Camarda & al. 2015a).

Matériels et méthodes

Le pâturage

La Sardaigne, comme la plupart des îles et des côtes méditerranéennes a une millénaire tradition d'élevage à l'état libre, encore très répandu. Les animaux domestiques les plus nombreux sont les moutons, à suivre les chèvres, les bovins et encore les porcs, les chevaux et les ânes. A l'état sauvage, ne manquent pas les sangliers et les mouflons. Les activités traditionnelles aujourd'hui (au dehors de voitures pour les transports) se déroulent et sont assez similaires auxquelles des siècles passés, comme a été décrit par Alberto Ferrero de La Marmora (1826). Huttes et cabannes pour les personnes et refuges pour les animaux sont contruits avec de troncs et de ramailles de chêne pubescent sur une base des pierres sans mortier de ciment. Il manque presque de tout de modernes maisons et fermes.

Cette étude prend en compte les relations entre la flore, la végétation, le pâturage et l'incendie, phénomènes souvent strictement lié l'économie pastorale traditionnelle (Camarda & al. 2015) pour évaluer l'impact des animaux domestiques par rapport à la conservation de la flore dans cette montagne. On a analysé les relations dynamiques entre les différents types de végétation en ce qui concerne les incendies et le pâturage, les différentes composantes floristiques des communautés végétales, des espèces comestibles et de celles rejetées par le bétail. La mosaïque végétale provient en grande partie des utilisations humaines, pâturage et feu. Les données de base, sont tirées de plus recents travaux de Arrigoni & Camarda (2015), Camarda & al. (2015a) et Carta & al. (2015). L'étude prend en compte la surface au-dessus de mille mètres du niveau de la mer, caracterisée par une différenciation géo-morphologique, pédologique remarquable et par un climat continental humide. Les habitats des prairies et garrigues des zones les plus élevées sont ceux de plus grand intérêt qui coexistent avec le pâturage et le feu. Les espèces qui constituent les habitats les plus courants sont: *Juniperus sibirica* Burgsd., *J. oxycedrus* L., *Erica arborea* L., *E. scoparia* L., *Arbutus unedo* L., *Genista corsica* (Loisel.) DC., *G. pichisermolliana* Valsecchi, *Berberis aetnensis* C. Presl, *Santolina insularis* (Genn. ex Fiori) Arrigoni, *Astragalus*

genargenteus Moris*, Thymus catharinae* Camarda*, Teucrium marum* L.*, T. polium* L*, Lamyropsis microcephala* (Moris) Dittr. & W. Greuter. Ces espèces donnent lieu souvent à des garrigues avec des associations endémiques exclusives qui font également l'objet du pâturage.

La Flore

Les familles *Poaceae, Asteraceae, Fabaceae, Caryophyllaceae, Lamiaceae, Rosaceae* et *Brassicaceae* représentent ensemble le 45% du total (Arrigoni & Camarda 2015**)** et elles sont également les plus importantes pour l'alimentation du bétail. Au sein de la zone délimitée par l'enquête, le Gennargentu a 675 taxons avec 105 espèces endémiques (16,8%) et cette montagne est sans doute la région de plus grand intérêt botanique de la Sardaigne. Les spectres biologique et chorologique ont mis en évidence le caractère encore haut-méditerranéen de la flore (Arrigoni & Camarda 2015) mais avec une forte composant mesophytique, boréale et orophytique

Type biologique

En particulier, de chaque espèce on a considéré: type biologique (Camarda 1989), toxicité, palatabilité, présence d'épines, rareté et habitat, à savoir les facteurs qui affectent leur viabilité. Les hémicryptophytes (47,6%) ont la percentage la plus haute (Arrigoni & Camarda 2015), grâce à la protection de leurs organes de multiplication végétative, au niveau (*Sagina pilifera* (DC.) Fenzl*, Plantago sarda* C. Presl*, Mentha requienii* Bentham) ou en dessous du sol (les géophytes, 9,6%) (*Crocus minimus* DC*, Bunium alpinum* subsp. *corydalinum* (DC.) Nyman*, Allium parciflorum* Viv*, Ornithogalum corsicum* Jord. & Fourr.*)* sont également très répandues et souvent très abondantes. Les chamephytes (5,9%) se défendent contre la morsure des animaux et du vent avec les formes à cuisson produisant des graines protégées aussi par des épines. Les phanérophytes (5,9%) sont repandues jusque aux zones les plus hautes et tous sont soumis à la forte pression du pâturage. Les thérophytes héliophiles (33,2%) profitent de la dégradation des formations forestières et préforestières surtout dépuis le passage du feu.

Plantes et animaux

La plupart des terres du Gennargentu appartiennent aux domaines communaux et tous les habitants ont le droit d'exercer le pâturage. Cela conduit souvent à surpâturage qui provoque la dégradation de la végétation, l'érosion des sols et favorise le développement des garrigue avec les espèces les plus résistantes. Certaines espèces très communes telles que *Asphodelus ramosus* L.*, Drimia pancration* (Steinh.) J. C. Manning & Goldblatt*, Paeonia morisii, Ferula communis* L. et *Thapsia garganic*a L. sont refusées par toutes les espèces de bétail, ce qui favorise leur sélection et donc aussi leur abbondance. En effet elles peuveni être broutées seulement en été lorsque les feuilles sont sèches et évidentement perdent de toxicité. Très souvent, grand quantité de phytomasse ne signifie pas une bonne pasture, au contraire de plus, p. ex., l'asphodèle et la férule empêchent la croissance d'autres espèces utiles à l'alimentation des animaux. Les forêts, les maquis, les garrigues, les prairies offrent de différentes possibilités d'approvisionnement, non seulement pour la différente composition floristique, mais aussi par rapport à la saison.

Les vaches appartientent à des races locales, souvent de petite taille, qui donne la possibilité d'atteindre grandes parcours aussi sur les endroits les plus difficiles et raides. Le chèvres sont de véritables athlètes qui préfèrent les maquis et les garrigues et peuvent atteindre quelconque presque endroit où il y a des plantes comestibles. Parmi les autres mammifères, les porcs vont boulverser le sol à la recherche de bulbes, rhizomes et racines; les chevaux et les ânes sont peu nombreux mais ils sont capables d'aller brouter presque partout. Les animaux sauvages (sangliers et mouflons) sont assez communs mais il n'ont pas de gros impact sur les plantes.

Incendie

Dans le libre pâturage, systématiquement jusqu'au passé récent, l'incendie était une pratique pastorale dans le but de favoriser la croissance de la masse herbeuse ou bien la repousse des bourgeons comestibles des arbustes, dans ce cas surtout *Erica arborea, Arbutus unedo, Phillyrea latifolia* L. Les incendies sont toujours présent, bien que moins fréquentes que dans le passé.

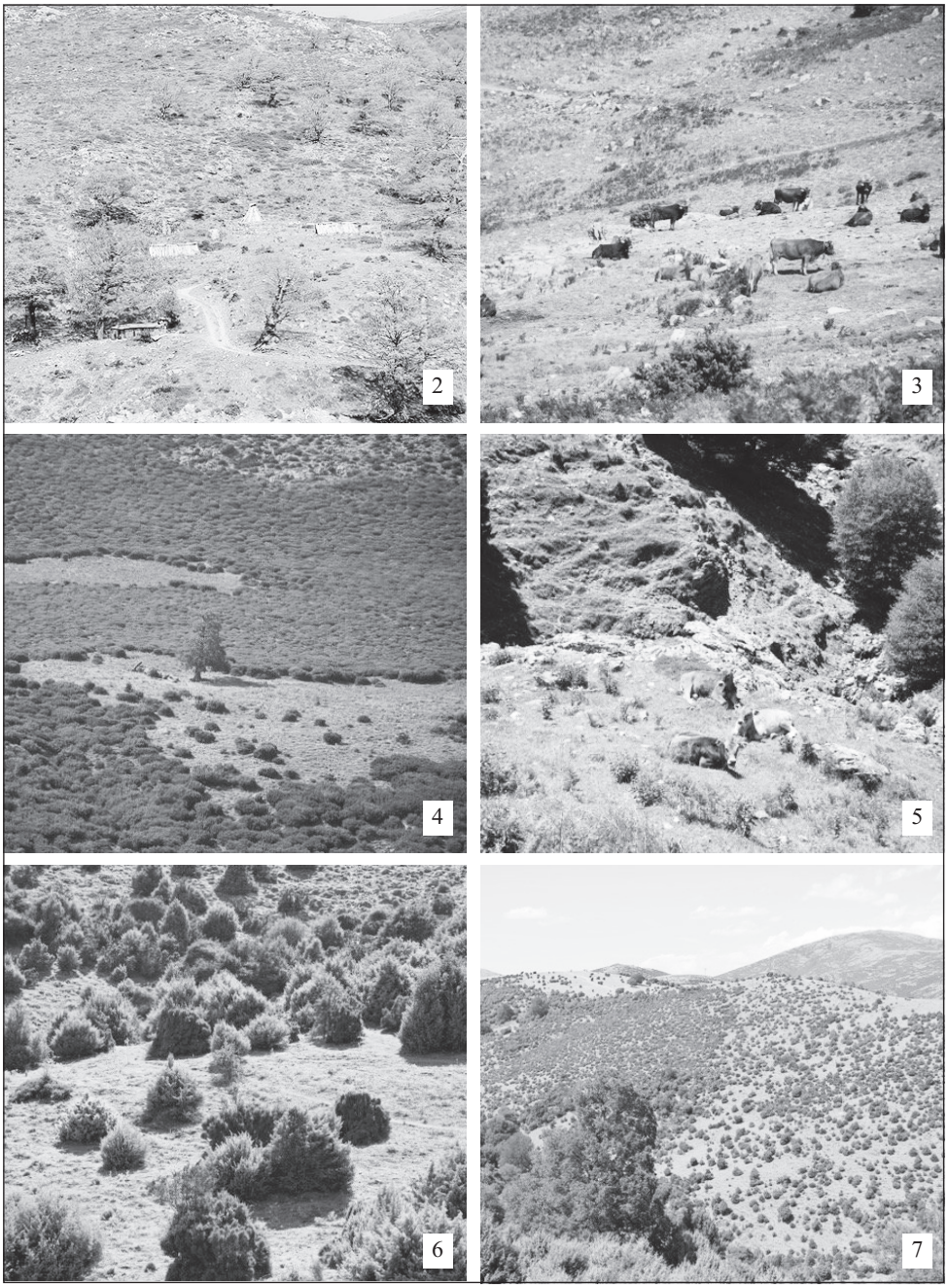
Le feu favorise les plantes qui possèdent:

a) grand nombre de graines résistants aux températures élevées;
b) adaptation des formes biologiques avec bulbes ou rizhomes profonds;
c) production de substances aromatiques, toxiques ou répulsives pour le bétail;
d) branches ou feuilles épineuses refusées ou très difficiles à brouter, avec graines protégés par les épines.

En effet, le feu, détruisant la végétation originelle, favorise indirectement le développement des espèces épineuses, aromatiques et toxiques qui sont refusés par les animaux et pourtant ont plus de possibilités de se propager au contraire des autres plantes qui sont comestibles.

La combinaison du pâturage et du feu favorise la formation à *Juniperus oxycedrus*, tandis que les maquis mésophyles à *Erica arborea, Arbutus unedo, Erica scoparia, Phillyrea latifolia*, proviennent en grande partie de la dégradation des forêts de *Quercus pubescens*Willd. et *Q.ilex* L. L'incendie répété maintien les bruyères et les maquis à *Arbutus unedo* grace à leur forte capacité à émettre des rejets. Les habitats à *Taxus baccata* L. et *Ilex aquifolium* L., fortement influencés par le pâturage et le feu, ont des traits toujours significatifs dans des zones moins accessibles des endroits rocheux et dans les zones humides.

Les effets des incendies sont très différent selon les différents tipe de végétation. Les habitats moins touchés sont ceux des falaises, qui représentent un obstacle objectif envers le feu et les animaux, les zones humides et les rivières. Les suberaies parcourues par le feu après eux ans de l'incendie montrent généralement des signes de reprise, tandis que les arbres de chêne vert ou de chêne pubescent sont souvent totalement détruits. Après le feu la colonisation naturelle avec *Juniperus oxycedrus* est très lente à cause du surpâturage. C'est à dire que l'évolution de la végétation est fortement influencée pas seulement par la composition floristique, mais à la fois par le type d'animaux, par leur nombre et par leur présence saisonnière.



Figs. 2-7. **2.** Hutte traditionnelle et des abris pour les animaux; **3-4.** Vaches dans les garrigues (à gauche) et bruyères avec des zones herbeuses (à droite); **5.** Vaches et *Vincetoxitcum hirundinaria,* plante toxique réfusée par les animaux; **6-7.** Exemplaires modelés par la morsure des animaux et paysage pastoral du *Juniperus oxycedrus*.

Toxicité

Les plants ont une efficace dèfense contre les animaux par la production de substances toxiques telles que des alcaloïdes et des glucosides. La toxicité des plantes est un important élément de défense qui contribue, en même temps, à leur diffusion. *Daphne oleoides* Schreber*, Digitalis purpurea* L., *Euphorbia insularis* Boiss.*, Euphorbia meuselii* Mazzola & Raimondo, *Gentiana lutea* L., *Leucojum pulchellum* Salisb., *Pancratium illyricum* L., *Paeonia morisii* Cesca, Bernardo & N.G. Passal.*, Verbascum conocarpum* Moris, *Ranunculus cordiger* Viv., *Vincetoxicum hirundinaria* subsp. *contiguum* (Koch) Markgraf sont refusées du tout et doivent leur abondance aux glucosides et alcaloïdes, aussi que au fait que les animaux broutent d'autres espèces en créant un environnement propice à leur développement.

Habitat

Les rochers, les éboulis et les falaises sont des stations d'abri qui protègent à la fois contre les animaux et le feu. De certaines espèces telles que *Sorbus aria* (L.) Crantz*, S. praemorsa* (Guss.) Nyman et *Lonicera cyrenaica* Viv.*,* très broutées par les chèvres, sont connues seulement très peu de plantes dans toute la montagne. Les espèces rupicoles: *Saxifraga cervicornis* Viv.*, Hieracium irginianum* Arrigoni*, Limonium morisianum* Arrig*, Armeria sardoa* Sprengel , *Galium schmidii* Arrig.*, Dianthus siculus* C. Presl.*, Dianthus siculus* subsp. *cyatophorus* (Moris) Arrigoni*, Stachys corsica, Prunus prostrata* Labill. sont assez communes.

Résultats

Les forêts

Les forêts offrent différents types de pâturage. La forêt de *Quercus pubescens* permet d'avoir au sol une bonne quantité d'herbe utile aux animaux, en raison de l'absence de feuilles dans la période d'automne et d'hiver, d'autre part, le pâturage excessif empêche la croissance de nouvelles plantes. Le paysage à *Q. pubescens* (pâturage à garrigue arborée) est constitué par grands arbres raréfiés avec structure colonnaire ainsi modifiée par l'élagage des branches. En effet les jeunes branches des chênes, surtout dans le passé, étaient un aliment pour les animaux pendant l'été. Un grand tronc et petites branches, coupées régulièrement; ce qui contribue à affaiblir la plante en favorisant la presence de maladies fongiques et, à long terme, à la chute des arbres aussi. Le sous-bois de la forêt de *Q. ilex* est extrêmement faible d'herbes. Dans ce cas, la principale source d'alimentation pour le bétail est représentée par les glands en automne et en hiver. Les feuillage et les jeunes pousses de *Q. ilex* sont aussi soumis au pâturage en particulier par les vaches et les chèvres, ce qui empêche le développement ou bien, avec les vieux grands arbres, vont créer un paysage pastoral très caractéristique.

Dans le Gennargentu, *Ilex aquifolium* constitue des forêts mixtes avec *Taxus baccata* et *Quercus pubescens* et il y a la présence d'arbres monumentaux fortement modifiés dans leur structure d'origine pour la coupe des branches pour l'alimentation du bétail. Exemplaires monumentales de *I. aquifolium* sont éparpillés un peu partout.

Une autre espèce typique des montagnes du Gennargentu est *Taxus baccata* qui est une plante toxique [it is indeed a toxic plant;], mais cependant elle est broutée par les vaches. *T. baccata* ne forme pas de grandes forêts, mais elles sont d'un particulier intérêt, se composant d'arbres monumentaux, tandis que les petites plants sont très rares.

Les aulnaies à *Alnus glutinosa* caractérisent le réseau hydrographique entière et elles abritent nombreuses espèces endémiques et rares. D'autre coté les animaux pendant les heures les plus chaudes en été aiment reposer à l'ombre des arbres et au frais en déposant une importante quantité de matière organique.

Juniperus oxycedrus est l'une des espèces plus communes et va constituer la série climacique dans les zones les plus arides et rocheuses. Les étapes d'évolution commencent à partir de zones brûlées. Les chèvres et les vaches broutent les feuilles épineuses et la croissance extrêmement lente prend beaucoup de temps pour la formation des forêts compactes.

Le maquis

Presque tous les arbustes ou petits arbres (*Crataegus monogyna, Arbutus unedo, Erica arborea, Pyrus amygdaliformis, Prunus avium, Phillyrea latifolia, Rhamnus persicifolia* Moris*, Prunus spinosa* L.*, Amelanchier ovalis* Medic.*, Sorbus praemorsa, S. aria*) sont broutés par les animaux et le développement de nouvelles plantes est affectée par la forte pression exercée à cause de leur presence.

Arbutus unedo, Phillyrea latifolia, Erica arborea, E. scoparia sont les éléments les plus communs qui se développent après l'incendie et, grâce à leur extraordinaire pouvoir d'émettre de nouvelles pousses, forment de vastes maquis jusqu'à 1.500 d'altitude. Dans le maquis composè par *Erica arborea* et *Erica scoparia* la combustion des bruyères permet la reprise des espèces herbacées comestibles, mais aussi de *Pteridium aquilinum* (L.) Kuhn et *Asphodelus ramosus* rejetées par le bétail. La végétation originaire se reconstitue dans quelques années ou forme une mosaïque très articulée sur de zones très vaste.

Les garrigue à arbustes épineux et plantes aromatiques

Juniperus sibirica est l'espèce la plus caractéristique de la montagne au-dessus de 1200 mètres d'altitude. Le génévrier nain est refusé par le bétail, il a tendance à faire des formations compactes qui représentent un obstacle au pâturage. C'est la raison pour laquelle dans le passé il a été systématiquement brûlé mais en favorisant les garrigues à *Astragalus genargenteus* et *Genista corsica* grâce à leurs épines qui contrastent bien la morsure des animaux.

Les èpines sont encore de puissants moyens de protection et, au moins en certains moments de l'année, peuvent protéger la formation et la maturation des graines. Dans le même temps, de nombreux chamephytes formant cuissons épineux représentent également des zones de refuge et des habitats favorables à d'autres espèces herbacées. *Genista corsica* et *Genista pichi-sermolliana* sont pourvues de fortes branches épineuses et dans les zones rocheuses ou arides elles couvrent de grandes surfaces. De petites garrigues sont costituées en même temps par *Berberis aetnensis* avec des épines très pointues et très robustes. Le garrigues son caracterisées aussi par des espèces aromatiques refusées, parmi lesquelles on signale *Thymus catharinae*, *Teucrium massiliense* L., *Mentha insularis*, *Tanacetum audibertii* (Req.) DC., *Santolina insularis, Helichrysum italicum* subsp. *microphyllum* (Willd.) Nyman.

Les espèces épineuses, en particulier les espèces du genre *Genista*, mais aussi *Astragalus, genargenteus, Prunus prostrata* et *Berberis aetnensis*, grâce à leurs graines dures et aux fortes épines, occupent de grandes superficies qui donnent un abri à de nombreuses espèces herbacées endémiques ou rares de petite taille. Donc, espèces qui défendent efficacement autres espèces telles que *Viola limbarae*, *Gagea* sp. pl., *Thesium italicum*, *Saponaria alsinoydes*, *Cerastium boisserianum, Valeriana montana.* En même temps, de nombreuses espèces herbacées telles que *Carlina macrocephala, Ptilostemon casabonae* (L.) W. Greuter*, Dipsacus valsecchiae* et la très rare *Lamyropsis microcephala* sont protegées grâce à la présence de leurs fortes épines dans toutes les parties de la plante.

Les prairies

Les prairies sont d'origine sécondaire formées à la suite des incendies du maquis, mais évoluent rapidement vers la garrigue, néanmoins dans certains endroits les graminées forment de pelouses assez stables avec *Brachypodium rupestre* (Host) Roem. & Schult.*, Arrhenatherum sardoum* (Schrnid) Brullo, Minissale & Spampinato*, Festuca morisiana* Parl.*, Gentiana lutea*, résistentes grâce à la présence de solides rhizomes ou des touffes très compactes, bien que très recherchés et broutés par le bétail. Dans les zones plus basses et dégradées *Carlina corymbosa, Dactylis glomerata* L. et *Asphodelus ramosus* sont les espèces les plus communes.

Schéma du dynamisme vers les formations herbacées

Dans le Gennargentu n'existe pas une zone à pelouses climaciques, c'est à dire qu'elles provient de la dégradation des maquis et des garrigues. Les rapports dynamiques de la végétation du Gennargentu ont été analysé par Carta & al. (2015). Le schéma suivant montre les principales étapes de dégradation, à partir des différents types physionomiques de la végétation climacique et azonales, vers les formations herbacées, résultant de l'action commune du feu et du pâturage avec les espèces caractérisantes. Vastes espaces sont occupés par les maquis à *Erica arborea* et *Erica scoparia*, suivis par la phase terminale des processus de dégradation qui amènent presque toujours vers les garrigues à *Genista corsica, G. pichisermoliana, Thymus catharinae, Teucrium marum, Teucrium polium* et donc aux prairies à *Brachypodium rupestre Pteridium aquilinum*, *Carlina corymbosa* L.*, Asphodelus ramosus*. La profondeur du sol, le type de substrat rocheux, la pierrosité, l'intensité du pâturage et de types d'animaux et la frèquence des incendies sont les facteurs qui contribuent à donner la configuration du paysage du Gennargentu à partir de forêts de *Quercus ilex* dans les zones les plus basses jusqu'aux genévrier naine des zones le plus hautes selon le schéma suivant semplifié.

Forêt de *Quercus ilex*

maquis à *Quercus ilex, Arbutus unedo, Erica arborea, Phillyrea latifolia*
maquis à *Erica arborea* et *Erica scoparia*
garrigue à *Erica arborea* et *Genista corsica*
garigue à *Genista corsica, Thymus catharinae* et *Helichrysum italicum* subsp. *microphyllum*
prairie à *Pteridium aquilinum* et *Carlina corymbosa*.

Forêt de *Quercus pubescens*
maquis à *Erica arborea* et *Erica scoparia*
garrigue à *Erica arborea* et *Genista pichisermolliana*
garrigue a *Genista pichisermolliana* et *Thymus catharinae*
garrigue à *Genista corsica*,*Thymus catharinae* et *Helichrysum italicum* subsp. *microphyllum*

prairie à *Brachypodium rupestre*
prairie à *Pteridium aquilinum* et *Carlina corymbosa*
Forêt de *Juniperus oxycedrus*
maquis à *Erica arborea* et *Juniperus oxycedrus*
garrigue à *Erica arborea* et *Thymus catharinae*
garrigue à *Genista corsica* et *Thymus catharinae*
garrigue à *Teucrium marum, Thymus catharinae* et *Helichrysum italicum* subsp. *microphyllum*

garrigue à *Teucrium polium* et *Thymus catharinae*
prairie à *Pteridium aquilinum*, *Carlina corymbosa* et *Asphodelus ramosus*
Forêt mixte de *Quercus ilex* et *Quercus pubescens*
maquis à *Arbutun unedo* et *Erica arborea*
garrigue à *Erica arborea* et *Thymus catharinae*
garrigue à *Genista corsica* et *Thymus catharinae*
garrigue à *Teucrium marum, Thymus catharinae* et *Helichrysum italicum* subsp. *microphyllum*

prairie à *Carlina corymbosa* et *Asphodelus ramosus*
Forêt de *Taxus baccata* et *Ilex aquifolium*
garrigue à *Genista corsica* et *Thymus catharinae*
garrigue à *Berberis aetnensis*
prairie à *Pteridium aquilinum, Carlina corymbosa* et *Asphodelus ramosus*
Formation à *Alnus glutinosa*
maquis à *Erica scoparia, Erica terminalis* et *Leucojum pulchellum*
prairie à *Brachypoodium rupestre et Pteridium aquilinum*
Formation à *Juniperus sibirica*
garrigue à *Berberis aetnensis*
garrigue à *Astragalus genargenteus*
prairie à *Brachypodium rupestre*

Flore par rapport aux différents facteurs analysés

A' suivre les espèces les plus intéressantes pour leur conservation en ce qui concerne leur structure de défense contre les animaux au pâturage et, à d'autres égards, celles plus importantes pour le broutage par les différentes espèces d'animaux, incendie, toxicité et comestibilité. Les espèces endémiques sont toujours indiquées par un astérisque. La com-

binaison de plusieurs caractères permet la plus grande capacité de défense et donc d'abondance. Par exemple, les fougères, en générale, sont refusées par tous les animaux ce qui permet à *Pteridium aquilinum* de coloniser, grâce à son réseau souterrain des rhizomes, de vastes zones après le passage du feu.

1) Espèces endémiques ou rares favorisées par les animaux qui les réfusent à cause de la présence de substances toxiques: *Arum italicum* Miller*, Astragalus genargenteus**, *Aquilegia barbaricina* Arrigoni & Nardi**, Aquilegia nugorensis* Arrig. & Nardi *, *Capsella bursa-pastoris* (L.) Medic.*, Daphne oleoides, D. gnidium* L.*, Datura stramonium* L.*, Delphinium pictum* Willd.**, D. staphisagria* L., *Digitalis purpurea, Dittrichia viscosa* (L.) W. Greuter*, Euphorbia insularis**, *E. semiperfoliata* Viv.**, E. spinosa* L.*, Helleborus argutifolius* Viv.**, Hyosciamus niger* L.*, Paeonia morisii**, *Pancratium illyricum**, *Ranunculus cymbalarifoius* Balbis ex Moris **, R. cordiger**, *R. platanifolius* L.*, Ruta corsica* DC.**, Scrophularia trifoliata* L.**, Senecio vulgaris* L.*, Verbascum conocarpum**, *V. pulverulentum* Vill.*, Thymelaea tartonraira* (L.) All.*, Vincetoxicum hirundinaria.*

2) Espèces refusées à cause de la présence de substances aromatiques: *Calamintha nepeta* (L.) Savi ssp. *glandulosa* (Req.) P.W. Ball, *Hypericum hircinum* L.**, Marrubium vulgare* L.*, Mentha aquatica* L.*, M. insularis**, *Stachys glutinosa* L.**, Tanacetum audiberti**, *Teucrium glaucum* (Jord. & Fourr.) Bég., *T. marum, T. massiliense, T. polium, Thymus catharinae**.

3) Espèces refusées ou difficiles à brouter à cause de la présence des épines - *Anthyllis hermanniae* L. ssp. *ichnusae* Brullo & Giusso **, Astragalus genargenteus**, *Berberis aetnensis**, *Carduus nutans* L.*, Carlina corymbosa, C. macrocephala* Moris**, Centaurea calcitrapa* L.*, Crataegus monogyna* Jacq.*, Echium italicum* L.*, Eryngium campestre* L.*, Genista corsica**, *G. pichisermolliana**, *Juniperus communis* L.*, J. oxycedrus, J. sibirica, Lamyropsis microcephala**, *Ononis spinosa* L.*, Ptilostemon **, Prunus prostrata, P. spinosa, Rosa pouzinii* Tratt.*, R. serafini* Viv.*, Urtica atrovirens* Réq. ex Loisel.*

4) Espèces qui trouvent refuge et sont protégées à l'intérieur les pulvines d'espèces épineuses: *Bunium alpinum* ssp. *corydalinum*, *Cerastium boisserianum* Greuter & Burdet **, Gagea sp. pl., Poa balbisii* Parl.**, Saponaria alsinoides* (Viv.) Viviani **, Silene nodulosa* Viv.**, Viola limbarae* (Merxm. & Lippert) Arrigoni**, V. riviniana* Reichenb.

5) Espèces géophytiques protégées par de bulbes ou rhizomes - *Allium parciflorum**, *Corydalis pumila* (Host) Reichenb.*, Ornithogalum corsicum**, *Bunium alpinum* ssp. *corydalinum, Colchicum gonarei**, *Crocus minimus**, *Gagea sp.pl., Orchis sp.pl., Platanthera algeriensis* Batt. & Trabut*, Romulea requienii* Ten.*

6) Espèces hémicryptophytiques protégées par des touffes – *Carex caryophyllea* Latourr. ssp. *insularis* (Christ ex Barbey) Arrigoni **, Festuca morisiana**, *Poa bulbosa* L., *P. balbisii** , *Plantago sarda**, *Sagina pilifera**, *Trisetaria bournofii**,

7) Espèces rupicoles protégées dans les rochers et les falaises: *Amelanchier ovalis, Arenaria balearica* L.**, Armeria sardoa**, *A. sardoa* subsp. *genargentea* Arrigo*ni* **, Asplenium septentrionale* (L.) Hoffm.*, Barbarea rupicola* Moris**, Dianthus siculus**, *Galium schmidii**, *Herniaria litardierei* (Gamis.) Greuter & Burdet **, Iberis integerrima* Moris**, Helichrysum saxatile* Moris**, Hieracium irginianum**, *Hypericum annulatum* Moris**, Hypochoeris robertia* Fiori*, Limonium morisianum**, *Plantago sarda**, *Potentilla crassinervia* Viv.**, P. corsica* Soleir. ex Lehman**, Rhamnus alpina* L.*, Ribes*

sandalioticum (Arrigoni) Arrigoni*, Rumex scutatus* L., *Saxifraga cervicornis*, *S. corsica* (Ser. ex Duby) Gren. & Godron*, *Sesleria barbaricina*(Arrigoni) Arrigoni*, *Sorbus aria, S. praemorsa*, *Stachys corsica* Pers.*.

8) Espèces favorisées par le feu grâce à la capacité de regéter drageons, posséder des sgraines thermo-résistant, organes souterrains - *Arbutus unedo, Asphodelus ramosus, Astragalus genargenteus, Carlina corymbosa, Cistus monspeliensis* L., *C. salviaefolius* L., *C. creticus* L., *Crocus minimus*, *Erica arborea, E. scoparia, Ferula communis, Festuca sp. pl.(*), Gagea sp. pl., Genista corsica*, *G. pichisermolliana*, *Lathysus* sp. pl., *Medicago sp.pl., Trifolium* sp. pl., *Lotus alpinus* (DC.) Ramond, *Poa* sp. pl. *(*), Pteridium aquilinum, Thapsia garganica, Thesium italicum* A. DC.*, *Echium anchusoides* Bacchetta, Brullo & Selvi,*, *Scorzonera callosa* Moris*, *Vicia glauca* C. Presl., *Vicia* sp. pl.

9)) Espèces d'intérêt pabulaire très cherchées par les animaux et généralement favorisée par le feu - *Aegilops geniculata* Roth, *Agrostis castellana* Boiss. & Reuter, *Agrostis pourretii* Willd., *Allium subhirsutum* L., *Alopecurus bulbosus* Gouan, *Amelanchier ovalis, Andryala integrifolia* L., *Anthyllis vulneraria* L., *Anthoxanthum odoratum* L., *Apium nodiflorum* (L.) Lag., *Arbutus unedo, Arrhenatherum sardoum**, *Asparagus acutifolius* L., *Avena barbata* Pott. ex Link, *Bromus hordeaceus* L., *B. sterilis* L., *Borago pygmaea* (DC.) Chater & W. Greuter*, *Brachypodium retusum* (Pers.) P. Beauv, *Carex caryophyllea* subsp. *insularis**, *Chenopodium bonus-henricus* L., *Clinopodium vulgare* L. ssp. *orientale* Bothmer, *Chondrilla juncea* L., *Crepis caespitosa* (Moris) Gren.*, *Cynosurus echinatus* L., *Dactylis glomerata, Echium anchusoides**, *Echium plantagineum* L., *Erica arborea, Erodium ciconium* (L.) L'Hér, *Erodium cicutarium* (L.) L'Hér, *Festuca morisiana**, *Fragaria vesca* L., *Genista aetnensis* (Biv.) DC.*, *Geranium molle* L., *G. robertianum* L., *Glyceria notata* Chevall., *Juncus effusus* L., *Holcus lanatus* L., *Ilex aquifolium, Hypochoeris radicata* L:, *Jasione montana* L., *Juncus inflexus* L., *Hedera helix* L., *Lactuca muralis* (L.) Gaertner, *Lathyrus aphaca* L., *L. cicera* L., *L. latifolius* L., *L. pratensis* L., *Lolium multiflorum* Lam., *L. perenne* L., *L. rigidum* Gaudin, *Lonicera cyrenaica**, *Lotus alpinus, Malva alcea* L., *M. sylvestris* L., *Medicago lupulina* L., *Mentha pulegium* L., *Oenanthe crocata* L., *O. fistulosa* L., *O. lisae* Moris*, *Onopordon illyricum* L., *Ornithopus compressus* L., *Phleum bertolonii* DC., *Phillyrea latifolia, Plantago major* L., *Poa angustifolia* L., *P. annua* L., *P. balbisii**, *P. compressa* L., *P. nemoralis* L., *P. pratensis* L., *P. trivialis* L., *Potentilla reptans* L., *Ranunculus cymbalarifolius**, *R. platanifolius, Reichardia picroides* (L.) Roth., *Rhamnus alpina* L., *Rubus ulmifolius* Schott, *Rumex pulcher* L., *R. hydrolapathum* L., *R. suffocatus* Moris ex Bertol.*, *Sanguisorba minor* Scop., *Scorzonera callosa**, *Silene vulgaris* (Moench) Garke, *S. latifolia* Poiret, *Smyrnium rotundifolium* L., *Sonchus oleraceus* L., *Sorbus aria, S. praemorsa**, *Teucrium chamaedrys* L., *Trifolium campestre* Schreb., *T. molinerii* Hornem, *T. ochroleucon* L., *T. nigrescens* Viv., *T. repens* L., *T. resupinatum* L., *T. subterraneum* L., *Trisetaria gracilis* (Moris) Banfi & Arrigoni, *Urospermum dalechampii* (L.) Scop. ex F.W. Schmidt, *Valeriana montana* L., *Vicia angustifolia* L., *V. cracca* L., *V. disperma* DC., *V. glauca* C. Presl., *V. lathyroides* L., *V. tenuifolia* Roth, *Viola dehnhardtii* Ten., *V. riviniana, Vulpia sicula* (C. Presl) Link.

10) Espèces de peu d'intérêt pour le pâturage en raison de leur très petite taille: *Aira caryophyllea* L., *Bellium bellidioides* L.*, *Erophila verna* (L.) Chevall., *Clypeola jonthlas-*

pii L.*, Erodium maritimum* L'Hér.*, Hornungia petraea* (L.) Reichenb.*, Moenchia erecta* (L.) P. Gaertner, B. Meyer & Scherb.*, Teesdalia coronopifolia* (J.P. Bergeret) Thell.*, Thlaspi brevistylum* (DC.) Mutel *, *Galium parisiense* L.*, Euphrasia genargentea* (Feoli) Diana Corrias**, Odontites corsicus* (Loisel.) G. Don fil. **, Parentucellia latifolia* (L.) Caruel*, Trifolium arvense* L.*, T. strictum* L.*, Veronica brevistyla* Moris*.

Conclusions

La présence des animaux herbivores à l'état libre, le pâturage et l'incendie dans la montagne du Gennargentu représentent un obstacle important pour la conservation des formations climaciques, mais, en même temps, ils constituent des facteurs très remarquables dans la sélection et la propagation de nombreuses espèces, qui ont un réflexe profond sur leur présence, abondance et répartition. D'autre part, par rapport aux animaux, les composés toxiques ou aromatiques, les épines, le type biologique et l'habitat, jouent un rôle clé dans la configuration de la phytodiversité du Gennargentu. De nombreuses espèces endémiques héliophiles, en particulier, ont avantage pour la présence des animaux et même des incendies, qui restaurent des conditions écologiques favorables à leur développement. Néanmoins, les pratiques traditionnelles ont subi une profonde transformation au cours des dernières décennies avec la disparition de la transhumance et la modification des règles de bonnes pratiques sur l'utilisation des terres de pâturage. Une plus grande attention à ces problèmes est souhaitable afin de comprendre mieux les dynamiques liées à un équilibre qui puisse concilier la protection et la conservation de la biodiversité et du paysage avec les différentes exigences de la pratique pastorale.

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Cuscuta campestris (*Cuscutaceae*) une holoparasite nouvelle et envahissante pour la flore de Tunisie

Abstract

El Mokni, R., Elaissi, A. & El Aouni, M. H.: *Cuscuta campestris* (*Cuscutaceae*) une holoparasite nouvelle et envahissante pour la flore de Tunisie. — Fl. Medit. 26: 179-189. 2016. — ISSN: 1120-4052 printed, 2240-4538 online.

The authors report the recent discovery in Tunisia of a new non-chlorophyll spermaphyte within the *Cuscutaceae*. The fields dodder or the devil's hair (*Cuscuta campestris*) originating from North America was observed, for the first time in 2010, in the north-west of Tunisia (in the Mogods).

Key words: xenophytes, alien flora, N-Africa.

Introduction

En Tunisie, les plantes holoparasites se limitent à quelques familles botaniques (Pottier-Alapetite 1981); les *Cuscutaceae* (*Cuscuta* L.), les *Cynomoriaceae* (*Cynomorium* Micheli), certaines *Orchidaceae* (*Limodorum* Boehmer (Labbé 1954) et *Neottia* Sw. (El Mokni & al. 2010) ; les *Orobanchaceae* (*Orobanche* L.) (Domina & al. 2013; El Mokni & al. 2015) et *Cistanche* Hoffm. et Link.) et les *Rafflesiaceae* (*Cytinus* L.). Elles sont toutes dépourvues de chlorophylle et dépendent de leurs hôtes pour leur nutrition carbonée et/ou minérale.

Le genre *Cuscuta* (cuscute) contient 180 espèces parasites obligatoires (Yuncker 1932; Mabberley 2008), réparties dans un large éventail d'habitats essentiellement dans les régions tempérées et subtropicales du monde. Des études récentes incluent aujourd'hui le genre *Cuscuta* dans la famille des *Convolvulaceae* (Stefanovic & al. 2002). D'autres auteurs l'ont traité dans une famille autonome, les *Cuscutaceae,* au sein de laquelle ils ont reconnu deux genres, *Cuscuta* et *Grammica*, en se basant sur l'aspect et la forme des stigmates (Swift 1996). Ce genre comprenait, dans la flore de Tunisie, 4 espèces (Pottier-Alapetite 1981; Le Floc'h & al. 2008 et Le Floc'h & al. 2010) à savoir, *Cuscuta epithymum* (L.) L., *C. nivea* M. A. Garcia, *C. palaestina* Boiss., et *C. planiflora* Ten. avec 3 sous-espèces (*C. palaestina* Boiss. subsp. *palaestina*, *C. planiflora* subsp. *godronii* (Des Moul) Kerguélen et *C. planiflora* subsp. *planiflora* (Des Moul) Kerguélen). Plus récemment,

Dobignard & Chatelain (2011), limitent la présence en Tunisie de 7 taxons (cinq espèces et deux sous-espèces) dont deux comme adventices. Aucun des travaux cités, ne parle de la présence de la cuscute champêtre sur le territoire tunisien et de la gamme d'hôtes qu'elle peut parasiter en Afrique du Nord.

La présence de *Cuscuta campestris* pourrait représenter une préoccupation indésirable pour les agriculteurs des régions infestées, du fait qu'elle provoque un effondrement général du métabolisme des plantes cultivées (suçant toutes les substances nutritives organiques et inorganiques). Des études sur les variétés résistantes à cette cuscute doivent être menées au plus tôt afin de lutter contre l'éventuelle menace de ce grave holoparasite. Des pertes sévères de récolte due à *Cuscuta* sont signalées pour 25 espèces cultivées dans 55 pays (Lanini & Kogan 2005). Les réductions de rendement dues à des espèces de *Cuscuta* sont de l'ordre de 60-65% chez le piment fort (*Capsicum frutescens* L.), 87% chez la lentille (*Lens culinaris* Mill.), 86% pour le pois chiche (*Cicer arietinum* L.), 72% chez la tomate (*Solanum lycopersicum* L.) et de 60-70% pour la luzerne (*Medicago sativa* L.) (Mishra 2009). En outre, cette mauvaise herbe parasite est devenue l'un des facteurs de contraintes importantes limitant la productivité des cultures dans diverses parties du monde (Farah & Al-Abdul Salam 2004) suite à sa grande résistance aux herbicides (Nadler-Hassar & Rubin 2003). L'ampleur de sa forte dissémination provient du fait qu'elle ne parasite pas uniquement les plantes cultivées mais aussi une multitude de plantes sauvages de différentes familles botaniques.

Le présent article constitue la première contribution qui évoque, jusqu'à présent, la présence réelle de la cuscute champêtre et de certaines de ses plantes hôtes spontanées sur le territoire tunisien.

Contexte de la découverte

Lors de prospections botaniques habituelles entretenues dans les zones limitrophes des formations forestières et préforestières du Nord-ouest de la Tunisie (Kroumirie & Mogods), zones connues pour leur richesse en messicoles, l'un des auteurs (R.E.M) se trouve devant des plages jaune-orange de filaments d'une cuscute étrange ! Des échantillons ont été ramassés et pris au laboratoire pour examination et identification précise.

La description des différentes parties de la plante a été basée sur des mesures morphométriques avec référence à certains travaux antérieurs, y compris ceux de Yuncker (1932), Jauzein (1995), García (2002), Costea & Tardif (2006), Fennane & al. (2007) et Wright & al. (2011).

Des observations subséquentes ont été poursuivies durant les années suivantes dans d'autres zones limitrophes ou plus éloignées (Tableau 1). Une culture de pomme de terre était gravement touchée par l'extension de cette cuscute en 2013, dans la région de Boussalem (Fig. 1.1).

Morphologie générale et caractéristiques botaniques de la cuscute observée

La cuscute récoltée est une phanérogame entièrement dépourvue de chlorophylle, parasitant dans son biotope un grand nombre de végétaux spontanés; le liseron tricolore

Tab. 1. Coordonnées géographiques et superficies approximatives des différentes zones de découverte de *Cuscuta campestris* en Tunisie septentrionale et méridionale durant la période 2010-2016, avec les principales plantes hôtes.

Année de Découverte	Région/Gouvernorat	Coordonnées			Superficie approximative Couverte par la cuscute (en m^2)	Principales plantes hôtes
		Latitude Nord	Longitude Est	Altitude (en m a.s.l.)		
2010	Béja-Sud Béja	36°44'46.78''	9°12'19.42''	160	82	- *Xanthium italicum* - *Convolvulus arvensis* - *Convolvulus tricolor* - *Daucus carota* aggr. - *Bupleurum lancifolium* - *Echallium elaterium* - *Senecio vlerioeus* aggr. - *Polygonum* sp. pl.
2011	Boussalem Jendouba	36°36'39.68''	8°58'28.22''	130	14	- *Xanthium italicum* - *Convolvulus arvensis* - *Solanum hyopericum* - *Solanum tuberosum*
2012	Mateur-Route Bazina Bizerte	37°01'38.91''	9°38'38.66''	30	18	- *Trifolium alexandrinum* - *Trigonella foenum-graecum*
2013	Jemmel-Route Ridèn Monastir	35°36'18.78''	10°44'19.11''	40	8	- *Medicago sativa* - *Setaria alhaerens* - *Amaranthus viridis* aggr.
2014	Mateur-Route Sejnane Bizerte	37°04'40.93''	9°34'49.99''	20	3	- *Anethum graveolens* - *Foeniculum vulgare*
	Plage Sidi Salem Bizerte	37°17'22.80''	9°52'27.21''	0	10	- *Xanthium italicum* - *Amaranthus* sp. pl. - *Echinochloa colona*
2015	Jilma Sidi Bouzid	35°21'37.85''	9°27'25.62''	350	23	- *Solanum hyopericum* - *Amaranthus* sp. pl.
2016	Mjaz El Bab Béja	36°38'18.87''	9°36'51.75''	50	66	- *Solanum hyopericum* - *Amaranthus* sp. pl.

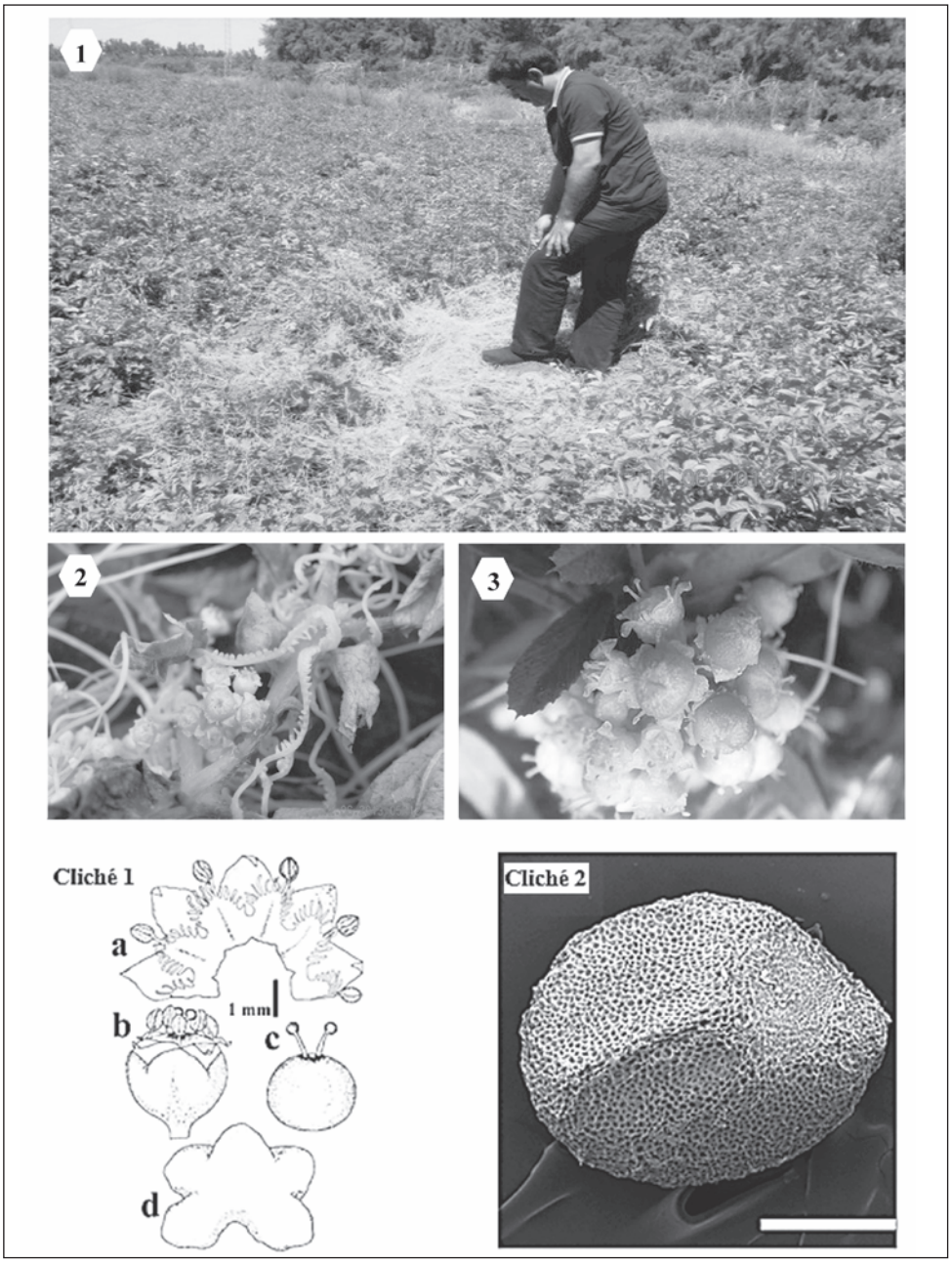

Fig. 1. **1.** Champ de culture maraichère infesté par la cuscute champêtre en 2013, à Boussalem (Jendouba); **2.** Détail des suçoirs de la cuscute champêtre; **3.** Inflorescence cymeuse avec des capsules surmontées de deux styles (Clichés de Ridha EL MOKNI). **Cliché 1.** Détails de différents verticilles de la fleur et capsule de la cuscute champêtre; **cliché 2.** Détail sur la forme et l'ornementation de la graine chez la cuscute champêtre (Clichés de Costea & Tardif 2006).

(*Convolvulus tricolor* L.), la buplèvre à feuilles en fer de lance (*Bupleurum lancifolium* Horn), la momordique cornichon d'âne (*Ecballium elaterium* (L.) Reich.), etc.

La plantule ne montre pas de Cotylédons. Les Premières feuilles sous forme de filaments volubiles blanchâtres ou jaunâtres de 3 à 7 cm de long, sans feuilles issus de la germination de la graine dans le sol. La plantule meurt si les filaments ne trouvent pas de plante hôte à laquelle se fixe par les suçoirs. Une fois la plante fixée et alimentée par la plante hôte, les racines du parasite disparaissent.

Au stade adulte, la plante prend l'aspect d'une plante herbacée, filamenteuse, volubile, aphylle, de taille indéfinie. Elle développe un important réseau de filaments très ramifiés qui entourent les tiges et recouvrent les plantes hôtes. Les racines sont présentes uniquement au stade plantule, avant la rencontre et la fixation sur l'hôte.

La tige cylindrique, pleine, filiforme de moins de 1 mm de diamètre, abondamment ramifiée, volubiles, glabre, jaune ou orangée clair, s'entortille en se nourrissant de la plante hôte par ses suçoirs. Le long de la tige, se trouvent régulièrement des groupes de 5 à 15 suçoirs (*haustorium*) alignés (Fig. 1.2). Ces suçoirs sont insérés dans les tissus de la plante hôte, jusqu'aux vaisseaux conducteurs à partir desquels ils récupèrent la sève élaborée. Les feuilles sont réduites à des écailles, longues de plus ou moins 2 mm, visibles seulement à l'extrémité des tiges. L'inflorescence cymeuse montre des glomérules denses, disposés régulièrement le long des tiges, comprenant peu ou de nombreuses fleurs, larges d'environ 1 cm. Les fleurs sont réduites, de 2 à 2,5 mm de diamètre, blanchâtres ou blanc verdâtre, portées par un pédicelle de moins de 2 mm de long (Fig. 1, cliché 1-b, Costea & Tardif 2006). Le calice est formé de 5 sépales ovales de 1 à 1,7 mm de long, soudés à la base, à lobes arrondis, imbriqués (Fig. 1, cliché 1-d). La corolle est campanulée, longue de plus ou moins 2 mm, à 5 lobes triangulaires, aigus, réfléchis, persistants (Fig. 1, cliché 1-a et 1-b), presque de même longueur que le tube. Présence de 5 écailles fixées au tiers inférieur du tube de la corolle, longues de 0,7 à 0,8 mm, dépassant le tube de la corolle et profondément frangées (Fig. 1, Cliché 1-a). Les 5 étamines sont aussi longues que les lobes de la corolle (Fig. 1, cliché 1-a, Costea & Tardif 2006). L'ovaire est globuleux, de 1 mm de diamètre, surmonté par un style bifide filiforme surmonté d'un stigmate globuleux (Fig. 1, cliché 1-c ; Fig. 1.3). La période de floraison commence en juin jusqu'au octobre. La pollinisation est entomophile et autogame. Le fruit est une capsule globuleuse à sommet déprimé s'ouvrant transversalement, débordant rapidement la corolle, de 3 mm de diamètre, à paroi mince, fragile, se creusant pendant la maturation d'un puits séparant les 2 styles. La capsule est de couleur brun clair à maturité, elle contient 3 à 4 graines et s'ouvre par une fente entre les bifurcations stylaires. La graine est ovoïde comprimée (Fig. 1, cliché 2, Costea & Tardif 2006), longue de 1 à 1,15 mm. La dissémination est barochore. Un nombre de Chromosomes chez cette espèce $n = 28$ chromosomes a été reporté aux États Unis (Fogelberg 1938) alors que $2n = 56$ a été reporté au Mexique (Ward 1984) et à Iran (Aryavand 1987). Il s'agit bien de la cuscute champêtre, *Cuscuta campestris* Yunck.

Origine et distribution de la cuscute champêtre

La cuscute champêtre (*Cuscuta campestris*) parasite indésirable originaire de l'Amérique du Nord (Canada, Mexico) s'est aujourd'hui largement propagée dans l'Ancien Monde, devenant l'espèce la plus répandue du genre sur la planète (Dawson &

al. 1994). Cette cuscute montre une distribution qui s'étend depuis la rive nord de la méditerranée (Royaume uni, Espagne, France, Danemark, Grèce, etc.), la partie européenne de la Russie et s'étendant à Taiwan, en Indonésie, en Australie et même en Afrique (Holm & al. 1997) où elle a une répartition plutôt méridionale jusqu'à ce qu'elle ait été inventoriée et photographiée pour la première fois en Tunisie en juin 2010. Très récemment, Kazi-Tani (2014) signale sa présence en Algérie.

Synonymie et syntaxonomie

Cuscuta campestris Yunck. = *C. arvensis* auct. non Beyr. ex Hook., *C. arvensis* var. *calycina* (Engelm.) Engelm., *C. arvensis* Fiori, *C. scandens* subsp. *cesattiana* (Bertol.) Greuter, *Grammica campestris* (Yunck.) Hadac & Chrtek.

Sur le plan syntaxonomique, l'espèce appartient à l'ordre de *Papaveretalia rhoeadis* Hüppe & Hofmeister 1990.

Découverte, envahissement et distribution actuelle de la cuscute champêtre en Tunisie

Le premier foyer d'infestation par la cuscute a été découvert en 2010 au gouvernorat de Béja (cf. Fig. 2). Depuis, des prospections annuelles nous ont permis de repérer d'autres foyers de cette plante holoparasite traduisant un haut degré d'envahissement essentiellement dans plusieurs zones à cultures maraichères (cf. Fig. 2). Les coordonnées géographiques de chaque site infesté nouvellement découvert sont regroupées dans le tableau 1. Aussi, une superficie approximative occupée par cette cuscute dans chaque foyer découvert a été calculée et toutes les plantes hôtes ont été inventoriées (Tableau 1).

Biologie et écologie

Cuscuta campestris est une liane annuelle parasite sans chlorophylle. Elle se multiplie principalement par graines, mais des fragments de tige pourvus de suçoirs peuvent être disséminés par les outils. Les graines peuvent rester viables dans le sol pendant 10 ans. Elles peuvent germer jusqu'à une profondeur de 15 mm. La plantule doit se fixer à une plante hôte dans les 5 jours qui suivent sa germination. L'extrémité de la jeune tige s'allonge de quelques centimètres et, par des mouvements circulaires, cherche à atteindre une tige de plante hôte. À ce moment elle l'entoure de 2 ou 3 spires et envoie plusieurs suçoirs dans les tissus conducteurs de l'hôte tandis que la partie inférieure de la plantule se dessèche.

L'extrémité de la tige s'allonge alors de façon rectiligne jusqu'à entrer en contact avec une autre tige hôte autour de laquelle elle s'entoure. Sur cette portion de tige libre se développe des rameaux latéraux, eux aussi à la recherche de tiges hôtes auxquelles se fixer (Dawson & al. 1994). De cette façon, un seul individu peut couvrir plusieurs mètres carrés de fins filaments orangés. Bien qu'il se développe normalement comme une annuelle, ses pousses peuvent rester en vie en hiver, et ses graines peuvent germer et infecter les plantes hôtes au printemps suivant (Wang & al. 2002).

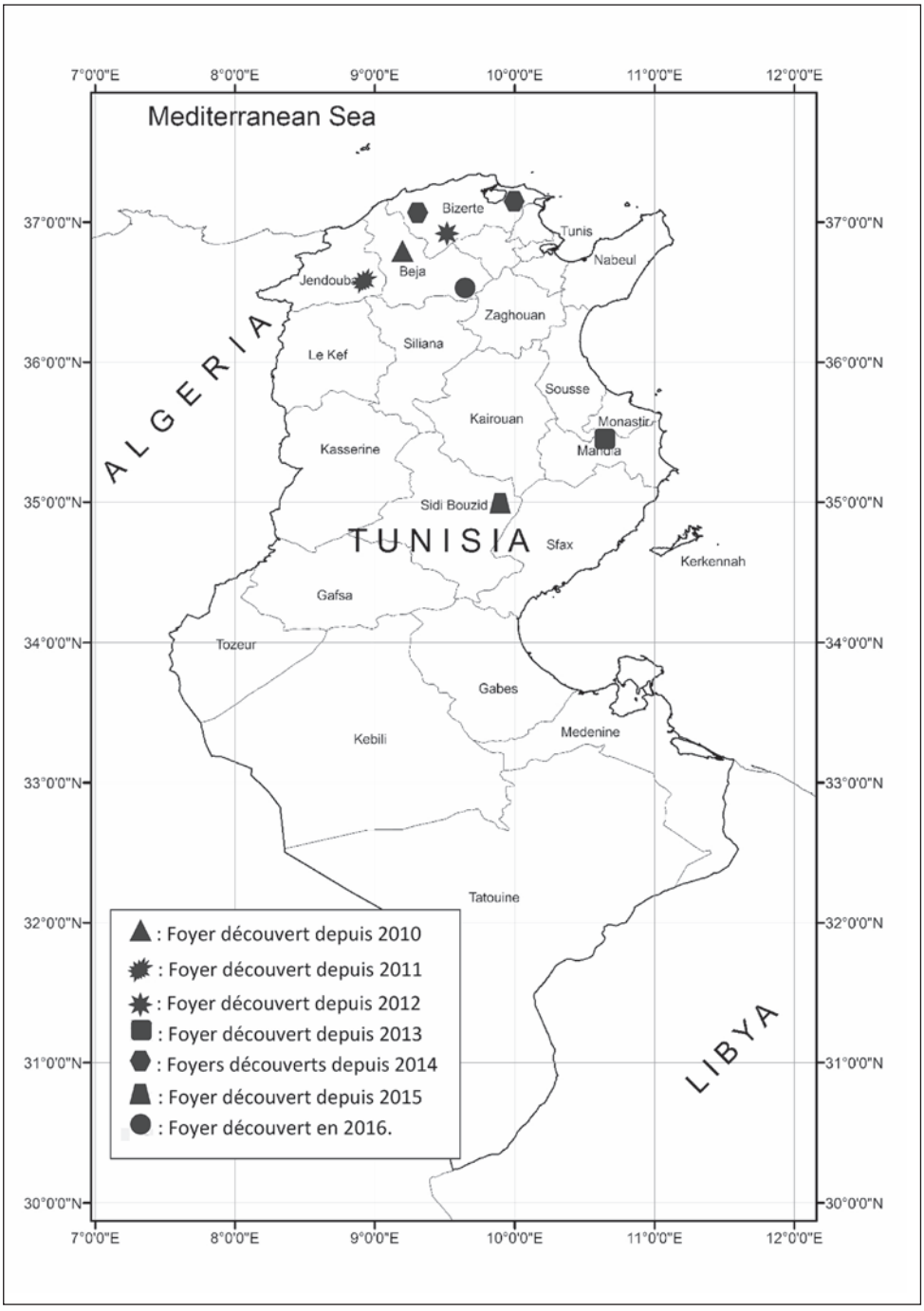

Fig. 2. Carte de localisation des foyers de découverte et d'extension de *Cuscuta campestris* en Tunisie septentrionale et centrale depuis 2010 jusqu'à 2016.

Il tire ses ressources entièrement de ses plantes hôtes, sévèrement réprimées et peuvent même aboutir à leur mort (Ashton & Santana 1976; Cooke & Black 1987; Dawson & al. 1994). Ce parasite a un large éventail d'espèces d'accueil (Yuncker 1932 ; Parker & al. 1984; Nemli 1986). Il s'attaque à certaines cultures horticoles, des légumineuses et aux herbes indésirables à feuilles larges, mais il est rare de le trouver sur les plantes ligneuses.

La cuscute champêtre préfère les territoires avec une humidité abondante. Les graines immatures germent plus vite que les adultes. Les semences de cuscute sont transportées par le vent, l'eau, les oiseaux, autres animaux et par l'homme au cours des travaux sur le terrain des machines et surtout pendant le transport des semences et la production agricole contenant des graines de cuscute. L'espèce est détruite par le gel dans les districts qui ont une fine couverture de neige en hiver. La vitesse d'envahissement et la nocivité de la mauvaise herbe dépend de la densité de la contamination sur des cultures touchées (Pilyugin 1953; Beilin 1967; Shatalov 1987).

Conclusion

La présence de *Cuscuta campestris* est confirmée sur le territoire tunisien où elle vient s'ajouter au groupe des plantes holoparasites. Son haut degré d'envahissement est remarquable surtout dans les cultures irriguées de la Tunisie septentrionale.

Elle a été introduite fort probablement à partir des semences de céréales et de légumineuses fourragères non convenablement purifiées importées des États-Unis, depuis fort longtemps. C'est une holoparasite caulinaire dont les capacités d'expansion territoriale sont incontestables. Son envahissement reste surtout étroitement lié à la présence de corridors biologiques (notamment fluviatiles) ou de certains vecteurs essentiellement anthropiques: les semences contaminées (speirochorie), le bétail ayant consommé des fourrages infestés, le matériel agricole et, en horticulture, les terreaux contaminés (cf. Lepoivre 2003). Nous assistons depuis 2010 à son extension progressive et sa banalisation dans les cultures maraichères et fourragères irriguées, de la Tunisie septentrionale et méridionale. Comme partout dans le monde (Kaiser & al. 2015), la cuscute champêtre se comporte en tant qu'holoparasite polyhôte.

Les mesures de contrôle doivent être utilisées avant la floraison. Il est nécessaire de bien séparer les graines de la culture principale des graines de cuscute. Cette cuscute est à détruire le long des routes de Mateur vers Béja et de Gbollat vers Mjez El-Bab, des bandes-frontières et dans les terres incultes (entre Mateur et Tabarka) au cours de la période de végétation. Les champs touchés par la cuscute doivent être semés pendant 3-4 ans par des cultures insensibles.

Si plusieurs espèces de cuscute ont montré des bienfaits, d'autres demeurent néfastes. Malgré la menace réelle qu'elle pèse pour les écosystèmes naturels et les cultures agricoles (Jayasinghe & al. 2004) ainsi que son impact négatif sur le métabolisme et la rentabilité des plantes cultivées et/ou spontanées, cette cuscute comme d'autres espèces de son genre pourraient être mieux valorisées pour leurs bienfaits dans les domaines médical, pharmacologique, ethnopharmacologique et phyto-thérapeutique

via certains de leurs métabolites secondaires (Azza & al. 1996; Ghule & al. 2011; Bahbehani 2014; Mehrbani & al. 2015).

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DCDB: an updated online database of chromosome numbers of tribe *Delphinieae* (*Ranunculaceae*)

Abstract

Bosch, M., Simon, J., López-Pujol, J. & Blanché, C.: DCDB: an updated online database of chromosome numbers of tribe *Delphinieae* (*Ranunculaceae*). — Fl. Medit. 26: 191-201. 2016. — ISSN: 1120-4052 printed, 2240-4538 online.

A new version of the earlier chromosome database of tribe *Delphinieae* is presented (v. 2.0, updated 23/4/2016 and available online at http://hdl.handle.net/2445/98702), after an accurate extensive literature and Internet survey, by adding the chromosome counts for the genera *Aconitum* L. [including *Gymnaconitum* (Stapf) Wei Wang & Z. D. Chen], *Delphinium* L. (including *Staphisagria* Spach), *Consolida* (DC.) S. F. Gray and *Aconitella* Spach, accumulated in the last 17 years.

A total number of 2598 reports are presented, belonging to 389 species and to a total of 467 taxa, and representing 44.5% of the total species number of the tribe (an increase of c. 137% compared with the 1097 reports gathered in the 1999 version). This increase is due both to chromosome research progress (analysed as counts/year) and an improved information capture system (including checking of populations location through Cyrillic alphabet, and Japanese and Chinese writing systems). Additionally, recent taxonomic advances, synonimization and new phylogenetic criteria have also been taken into account.

The main basic number $x = 8$ is found at 2*x*, 3x, 4*x*, 5*x*, 6*x*, and 8*x* ploidy levels, whereas x = 9 is much rarer. Polyploidy is more frequent in perennial taxa (*Aconitum* and *Delphinium* s. str.) whereas in annuals, disploidy (both increasing and decreasing) takes more importance and should be considered as a source of new evolutionary opportunities. The most frequent counts are $2n = 16$ and 32, but counts of $2n = 12$, 14, 17, 18, 20, 24, 26, 28, 30, 34, 40, 46, 48, 52, and 64 have also been recorded. In 20 species more than one different chromosome number has been reported and 81 species showed different ploidy levels.

The *Delphinieae* Chromosome Database (DCDB) provides the most complete current available information on chromosome numbers of *Delphinieae*, yearly updated, and aimed to be useful for general building of cytotaxonomical databases and for specific research ongoing projects of systematics of *Ranunculaceae*. It is based in MsAccess/MsExcel software, and includes three levels of taxonomic resolution (published name, database accepted name, and Plant List standard name), and the geographic origin of each count (country, and population when provided in the original source).

Key words: karyology, *Aconitum*, *Delphinium*, *Consolida*.

* Extended and enriched version of the poster presentation given at the XV Optima meeting in Montpellier, 6-11 June 2016.

Introduction

The tribe *Delphinieae* Warming is a large group within the *Ranunculaceae*, traditionally including four genera: *Aconitum* L., *Delphinium* L., *Consolida* (DC.) S. F. Gray, and *Aconitella* Spach. Recent advances in phylogeny (including nuclear and chloroplast DNA sequencing) proposed a better arrangement of previously recognized groups: *Aconitella* forms a clade embedded in *Consolida* whereas the wide *Consolida* is nested within *Delphinium* (Jabbour & Jenner 2011a, 2012), and *Staphisagria* J. Hill is restated as an independent genus (Jabbour & Jenner 2011b). More recently, the whole tribe *Delphinieae* has been confirmed as monophyletic within the subfamily *Ranunculoideae* after an analysis with multiple molecular markers (Cossard & al. 2016). However, as new major/medium taxonomic rearrangements seem still necessary/possible [i.e., recognizing a new subgenus for the *Delphinium anthriscifolium* group, looking for a new placement for *Aconitum fletcherianum* G. Taylor—its recent accommodation in a new sect. *Fletcherum* by Tamura (1996) or in a new subgenus *Tangutica* by Kadota (2001) are considered not definitive (see Hong & al. 2016)—or a clarified status of *Aconitum* subg. *Gymnaconitum* (Stapf) Rapaics, as well as some ongoing verification of the *D. staphisagria* group position, among others], a complete taxonomic framework is not fully established.

The tribe *Delphinieae* contains about 875 species primarily distributed in cold and temperate areas of the Northern Hemisphere (Greuter & al. 1989; Tamura 1995; the estimated total species number is reduced to 700 following Jabbour & Jenner 2012). Representatives are found in Africa, America, Asia, and Europe. The genus *Aconitum* and most species of *Delphinium* are perennials and geophytes. The remaining species of *Delphinium* and *Staphisagria* are annuals or biennials (including sect. *Delphinium*, sect. *Anthriscifolium* W. T. Wang and the entire formerly considered genera *Consolida* and *Aconitella*, which form a relatively small group of taxa mainly restricted to the Mediterranean and Irano-Turanian regions; Simon & al. 1999; Jabbour & Jenner 2011a). *Aconitum* (s. l.) traditionally included a single annual species, the Tibetan endemic *A. gymnandrum* Maxim.; in order to preserve the monophyly of *Aconitum*, Wang & al. (2013) removed this species from the genus and placed it within its own genus, *Gymnaconitum* (Stapf) Wei Wang & Z. D. Chen. In the present state of knowledge, thus, the tribe is composed by two large genera (*Aconitum*, *Delphinium*) and two minor ones (*Staphisagria* and *Gymnaconitum*) although new approaches are not unexpected in the near future. To be useful in the current situation, a three column system is provided to make easier the finding of a given searched name under the present version of the DCDB database.

Material and methods

Chromosome data have been gathered after an accurate review of published reports both on paper and electronic support. As far as possible, the original source has been directly checked out and is currently kept at our department, available upon request.

The collected data include the previous information presented in Simon & al. (1999) plus the results of the extensive search of reports published since 1999 to date, as well as the newly verified counts given in old publications. The current version of DCDB is updat-

ed up to April 23, 2016, just the day after the online publication of the significant paper of Hong & al. (2016) that comprised 60 new chromosome reports from 20 species of *Aconitum* subg. *Lycoctonum*, including a new basic number ($x = 6$; $2n = 12$). These very recent contributions have also been incorporated to the *Delphinieae* database.

DCDB is expected to be updated with a c. 1-year frequency.

The structure and composition of fields in the DCDB follows the system presented in Simon & al. (1999), with some modifications, as summarized below:

Published name – The scientific name under which the report has been published in the referenced source.

The Plant List name – Taxonomic standard given by *The Plant List* online platform (www.theplantlist.org), which is increasingly accepted by the botanical community as reference system since its launching in 2014. In the case of tribe *Delphinieae*, significant deviations from the published name have been detected, both by disagreements at low taxonomic ranks (i.e., subspecies and varieties recognized or not) and by changes at genus level (e.g., *Aconitella* or *Consolida* as separate genera or within a wide genus *Delphinium* s. l. resulting in different nomenclatural combinations). The conversion to the Plant List system will help browsing of *Delphinieae* chromosome database to non-specialist users but must be considered merely as an auxiliar indexation tool, and not a true consensus treatment.

Consensus name – For most taxa, the Plant List names are coincident with those adopted by the current compilation of chromosome databases called *Chromosome Counts Database* (CCDB, Rice & al. 2015), but not in all cases due to taxonomic different conceptions. In addition, a number of recently new proposed taxa are not recognized under CCDB standards [e.g., *Staphisagria macrocarpa* Spach—the name adopted by Jabbour & Jenner (2011b)—is listed under its classic basyonym *Delphinium staphisagria* L.]. Moreover, in certain groups our criteria on taxa delimitation are not fully coincident with those of the Jabbour & Jenner (2012) system nor with those of the Plant List, particularly regarding W Mediterranean or E Asian (Chinese, Japanese, Korean) species, for which treatments suggested by authors such as Kadota, Warnock, Hong or Wang (see full electronic version of DCDB) merit to be retained. In summary, while a stable and complete taxonomic system is not still available, a provisional working consensus list is needed and it is a third alternative to find a given report; following this DCDB provisional checklist, the number of recognized species is 875, and the total number of listed taxa is 1005. A supplementary and separate list includes published reports for *Delphinieae* of uncertain identity (mainly garden forms, induced mutants, artificial hybrids) and will be published in further updated versions.

Reports – The chromosome numbers are presented as published (n or $2n$). Very few reports are estimations of chromosome numbers from DNA values; when well established and fully documented, they have been also listed in DCDB (and noted in the "Observations" column).

Population, Country – In this 2016 version of our database, the effort of obtaining primary sources helped us to check the geographic origin of counts, otherwise in other compilations it can be only estimated from article titles (and only if the country or location is included in the title!). Now the origin has been established in terms of (i) population identification and (ii) country (state and, if possible substate or main geographic units).

This makes possible to identify the number of populations truly studied (in some cases, a single report in a given table of a standard database means, in fact, up to 60 analysed populations, which is informative of significant chromosome knowledge, for instance on variation levels of karyotype structure); when possible, the number of populations studied is provided (an independent line for each population) and the geographic origin (at country level and, when needed, substate entity) is given in the column.

Bibliographic reference – In abbreviated form. The complete citation is given in the "References" section.

Observations – A last column of open content is devoted to notes, remarks or observations of very different nature. They include, among others, precisions on the followed author for taxonomic criteria (if discrepancies concerning the consensus name exist), details on studied population identification or location, and comments on confidence of a given count (mainly coming from hybrids or garden forms).

Technically, the *Delphinieae* database is working in a Microsoft© environment (MsAccess and MsExcel). In further updates, a 3.0 version running over Dreamweaver© software will allow an easier browsing experience and will replace the current static interface.

Chromosome data provided by this DCDB database are available directly from the *Dipòsit Digital* (Digital Repository) of the Universitat de Barcelona in a complete format (http://hdl.handle.net/2445/98702). Simultaneously, DCDB will contribute to the resources of CCDB and will be searchable through the amount of data offered by this platform (http://ccdb.tau.ac.il/).

Results and discussion

A total number of 2598 reports have been gathered and included in the 2016 version of DCDB (listed in Appendix 1), belonging to 389 species (representing about 44.5% of the species of the tribe) and to a total of 467 taxa (46.7% of taxa). These figures mean an increase of c. 137% compared with the 1097 reports captured in the 1999 version.

The coverage degree of chromosome number knowledge varies from 39% (genus *Delphinium*) to 100% (genus *Gymnaconitum*) (Fig. 1).

Historical evolution of chromosomal knowledge in Delphinieae – The first chromosome reports recorded from *Delphinieae* are as old as the last quarter of the 19th century and belong to *Delphinium ajacis* L. [≡ *Consolida ajacis* (L.) Schur], an annual species widely used in gardening since long time ago, from which Guignard (1889) counted $n = 12$. This report was followed by the studies devoted to *Aconitum napellus* L. by Overton (1893, $2n = 24$ counts, trying to verify if the chromosome number was the same in all tissues) and, some years later, by Osterwalder (1898, $2n = 24$). In all three cases, the articles belong to the early days of cytology, and were oriented to the field of reproductive biology/embryology, at that time a part of an emerging plant physiology, although published in botanical journals from France, England or Germany (*Bulletin de la Societé Botanique de France*, *Annals of Botany*, or *Flora*). These counts date to even earlier than the commonly accepted putative discovery of a constant species-specific chromosome number by Strasburger (1910; *cf.* Peruzzi & Altinordu 2014).

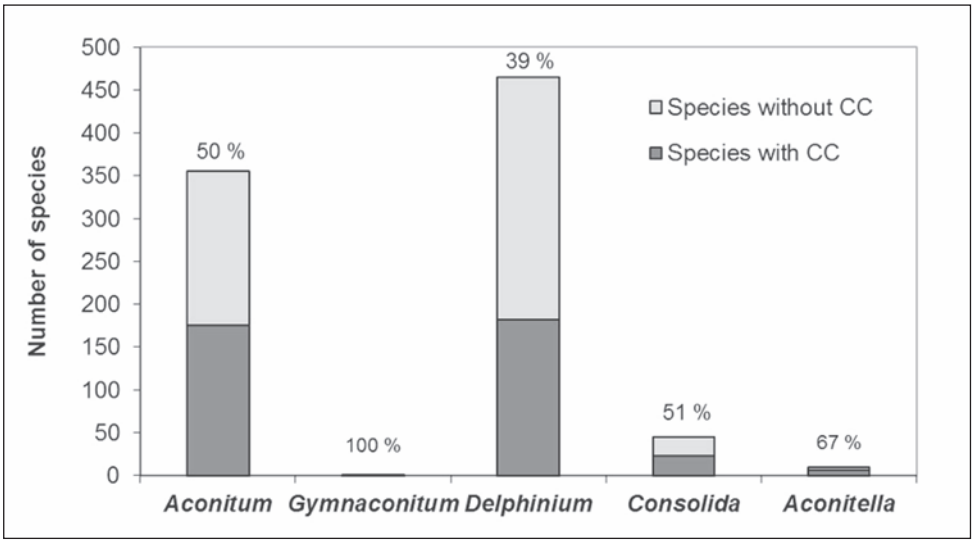

Fig. 1. Number and percentage of species counted per genus in the tribe *Delphinieae* (CC: chromosome count).

The contributions of these precursors were reviewed by Tjebbes (1927) who found the reports of $n = 12$ for *D. ajacis* as a wrong interpretation of V-shaped migrating chromosomes. He demonstrated $n = 8$ in his plates from pollen meiosis, helping to establish since then $x = 8$ as the main basic number, and a characteristic typical karyotype with a first long, submetacentric chromosome pair, for tribe *Delphinieae.*

Figure 2 depicts the evolution of the number of counts reported by year periods and gives us a good picture of the progression of chromosome number research in tribe *Delphinieae*, since the first historical report of Guignard more than 125 years ago. After a dramatic increase by the 1920–1940 authors, and some plain years around WWII, the line follows constantly upwards and has not reached the asymptotic profile yet, thus suggesting still active research in our days.

This increase is due both to chromosome research progress (analysed as counts/year) and an improved information capture system (including checking of populations location through Cyrillic alphabet, and Japanese and Chinese writing systems). Additionally, recent taxonomic advances, synonimization and new phylogenetic criteria have also been taken into account.

If we represent the number of yearly published articles along the same 1889–2016 period (Fig. 3), several major peaks can be identified, corresponding to the most productive authors and papers. Such most numerically significant contributions are those by Propach (1940, 61 counts), Lewis & al. (1951, 299 counts), Kadota (1987, 124 counts), Warnock (1995, 84 counts), Yang (2001, 32 counts), Yuan & Yang (2008, 93 counts), and the relevant contribution of Hong & al. (2016, 60 counts).

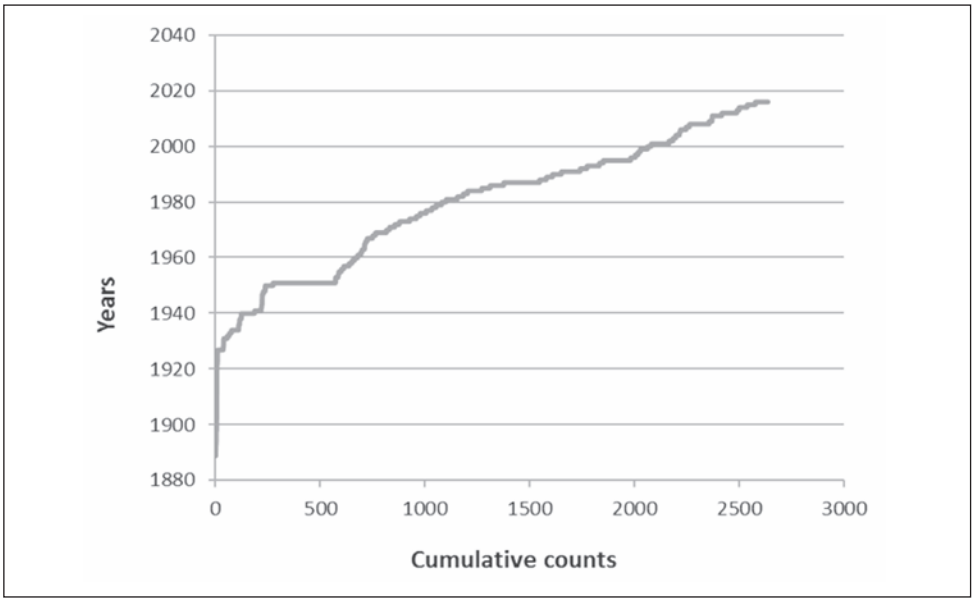

Fig. 2. Historical evolution of cumulative number of chromosome counts published on tribe *Delphinieae* (1889–2016) from data stored in DCDB.

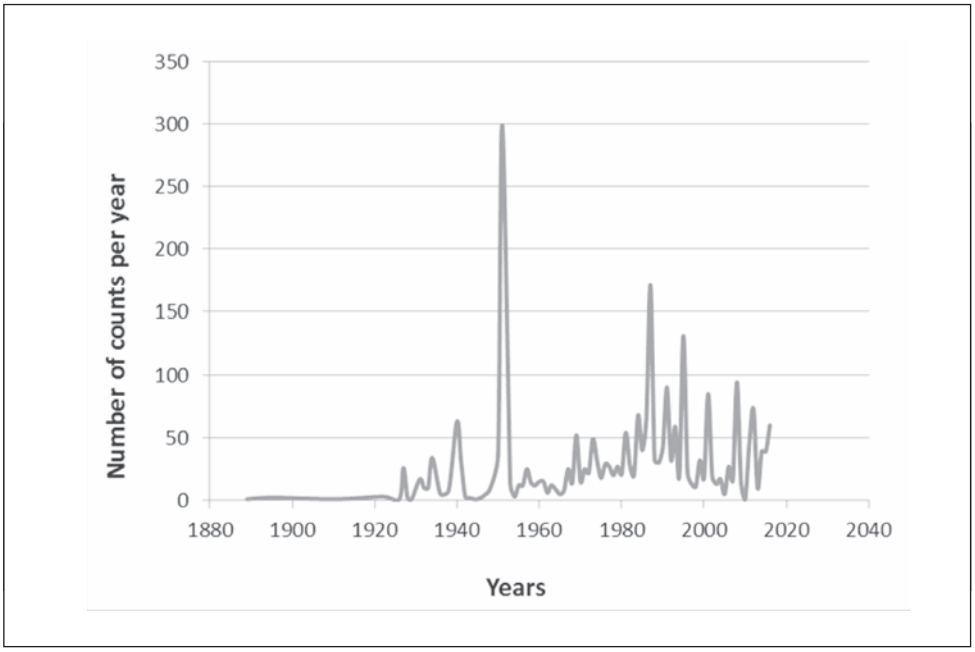

Fig. 3. Number of published papers containing chromosome counts per year in tribe *Delphinieae* (1889-2016) from data stored in DCDB. Peaks denote significant contributions (see text).

Geographic origin of chromosome counts – The geographic location of chromosome counts stored (Fig. 4) fits with the diversity of *Delphinieae* species in a given area together with the situation of the main research teams devoted to this study area: USA (18.8%), China (16%), Russia (13.9%), Japan (8.1%), and the Mediterranean Basin (12.6% including data from Catalan Countries, Spain, Morocco, Turkey, France, Greece, Italy, etc.) are the most represented regions in the DCDB records. Six percent of reports give no clear indication of origin—many of them on material from botanic gardens—and 1% needs to be confirmed.

Chromosome numbers, polyploidy and dysploidy – The number of chromosome counts reported for each listed species varies from one to more than 100, including both haploid and diploid counts. The most studied taxa are *Aconitum septentrionale* Koelle (117 counts), *Delphinium elatum* L. (67 counts), *Delphinium hansenii* (Greene) Greene (66 counts), and *Consolida ajacis* (L.) Schur (49 counts). The most frequent counts found in *Delphinieae* are $2n = 16$ and 32, but reports of $2n = 12$, 14, 17, 18, 20, 24, 26, 28, 30, 34, 40, 46, 48, 52, and 64 have also been recorded. In 20 species more than one different chromosome number have been reported; the species with more different chromosome numbers is *Aconitum palmatum* D. Don ($2n = 30$, 32, 46, 48, and 52).
The main basic number $x = 8$ is found at $2x$, $3x$, $4x$, $5x$, $6x$, and $8x$ ploidy levels, whereas $x = 6$, 7, 9, 10, and 13 are much rarer and reported for a reduced number of species (Table 1 and Figs. 5 and 6).

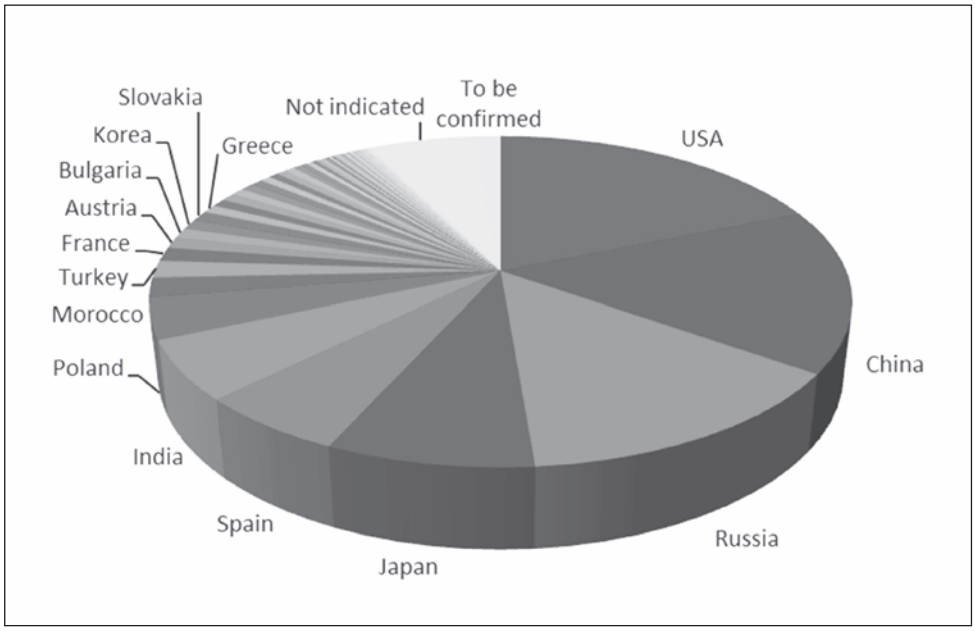

Fig. 4. Top-15 countries with more chromosome number reports of tribe *Delphinieae* from data stored in DCDB.

Table 1. Basic numbers and chromosome numbers in the tribe *Delphinieae* from data stored in DCDB.

GENUS	BASIC NUMBER (*x*)	CHROMOSOME NUMBER (2*n*)
Aconitum	6*, 8 , 9*, 10*, 13*	12, 16, 17, 18, 20, 24, 26, 28, 30, 32, 34, 40, 46, 48, 52, 64
Gymnaconitum	8	16
Delphinium	8, 9*, 10*	16, 18, 20, 24, 32, 48
Consolida	7*, 8, 9*, 10*	14, 16, 18, 20, 24
Aconitella	6*, 8, 9*	12, 16, 18

* uncommon

Polyploidy is more frequent in perennial taxa (*Aconitum* and *Delphinium* s. str.) but dysploidy (both increasing and decreasing) takes more importance (Figs. 5 and 6) in annuals and should be considered as a source of new evolutionary opportunities. Up to 81 species showed different ploidy levels.
B-chromosomes have been only found in *Aconitum* (in 17 species). Some rare numbers, especially in perennials, are coming from anomalous, experimental or ornamental plants and some other deviating counts are doubtful or coming from very old literature.

Concluding remarks – This compilation provides scientists interested in tribe *Delphinieae* convenient access to the chromosome numbers of species published to date, and contains updated information allowing direct consultation through the digital repository of the

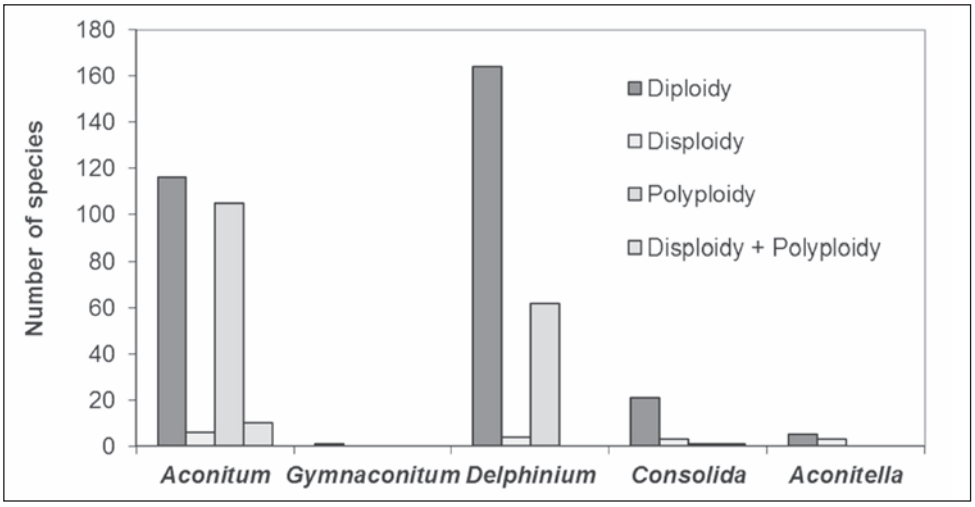

Fig. 5. Number of species with diploidy, dysploidy, polyploidy, or dysploidy + polyploidy per genus in the tribe *Delphinieae*.

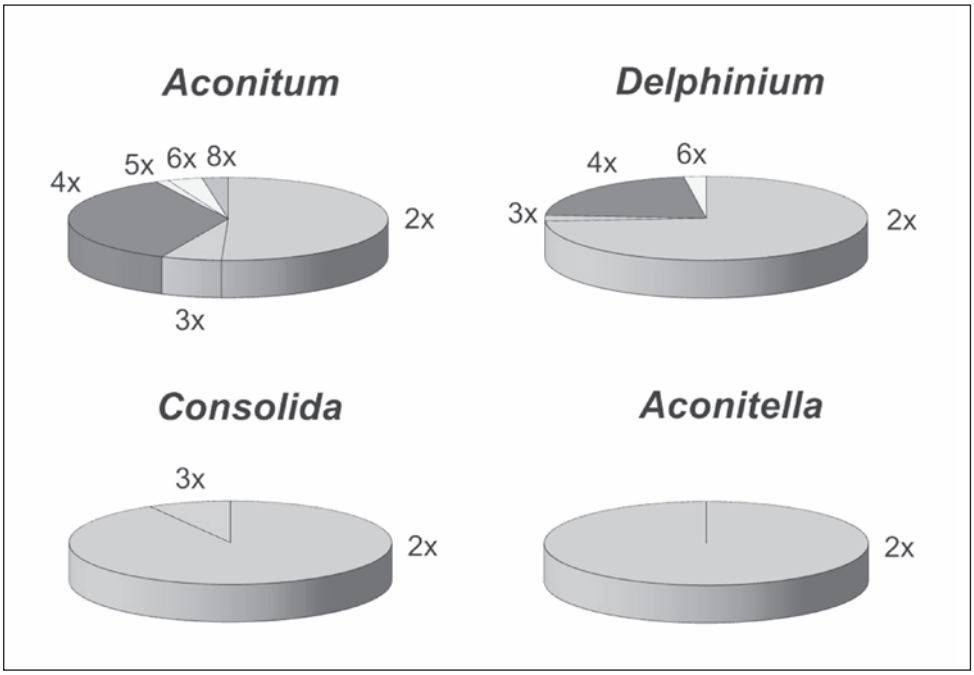

Fig. 6. Polyploidy levels per genus in the tribe *Delphinieae* (*Gymnaconitum* is not represented because it contains only one diploid species).

University of Barcelona. It places the tribe *Delphinieae*, with 2589 counts, within the taxonomic under-family level plant groups with available online chromosome database as the genus *Cardamine* (*Brassicaceae*, 2966 counts, Kučera & al. 2005), the genus *Hieracium* (*Compositae*, 356 records, Schuhwerk 1996) or the tribe *Alysseae* (*Brassicaceae*, 780 records, Spaniel & al. 2015).

The current state of knowledge is presented and the gaps that need further research are made evident. Although counts have been reported for about 44% of *Delphinieae* species, some of the single counts need confirmation, specially dysploid and rare numbers. The remaining 56% of species needs to be investigated. We hope this report will stimulate an interest in additional cytological and taxonomical studies that will contribute to elucidation of nature of the species in this large tribe. The online version of the DCDB data base containing the Chromosome counts in the tribe *Delphinieae* reported in the literature (1889–2016) with references is freely available under a CC BY-NC-ND 3.0 ES license at Dipòsit Digital de la Universitat de Barcelona [URI: http://hdl.handle.net/2445/98702]

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V. Vladimirov, V. Matevski, S. Bancheva, M. Delcheva, M. Kostadinovski & R. Ćušterevska

First report of *Erigeron sumatrensis* (*Asteraceae*) for the flora of the Republic of Macedonia

Abstract

Vladimirov, V., Matevski, V., Bancheva, S., Delcheva, M., Kostadinovski, M. & Ćušterevska, R.: First report of *Erigeron sumatrensis* (*Asteraceae*) for the flora of the Republic of Macedonia. — Fl. Medit. 26: 203-207. 2016. — ISSN: 1120-4052 printed, 2240-4538 online.

Erigeron sumatrensis (*Asteraceae*) is reported for the first time for the flora of the Republic of Macedonia. The taxon was recorded in several localities across the country. It seems, the species was introduced several decades ago, however, it remained unrecognized, mainly due to mis-identification with *E. bonariensis*. Brief morphological description, based on the material collected from Macedonia, and the habitat preferences of the species are provided. *Erigeron sumatrensis* has viable and persistent populations and should be regarded as naturalized in the Macedonian flora. The invasive behavior of the species is discussed briefly.

Key words: alien plants, *Conyza*, *Conyza sumatrensis*, Macedonian flora, xenophytes.

Introduction

Although the flora of the Republic of Macedonia is relatively well studied, ongoing research into the plant diversity of the county for the preparation of the critical national *Flora* continues to provide floristic novelties. Recently, four new taxa – *Andrachne telephioides* L., *Chorispora tenella* (Pallas) DC., *Nepeta parviflora* M. Bieb. and *Marrubium pestalozzae* Boiss. – were reported (Matevski 2016). During field studies within a bilateral Bulgarian-Macedonian project devoted to the taxonomic diversity in the families *Lamiaceae* and *Asteraceae*, a new alien species for the Macedonian flora was recorded next to a petrol station near the highway in Veles Municipality – *Erigeron sumatrensis* Retz. Later examination of the collection in the herbarium MKNH revealed the species had been recorded much earlier from several localities in the country but it was erroneously identified as *Conyza bonariensis* (L.) Cronquist.

The aim of this article is to report *Erigeron sumatrensis* (*Asteraceae*) as a new alien species to the flora of the Republic of Macedonia and to highlight its main distinguishing characters from morphologically similar taxa.

Material and methods

Plant material collected by the authors in the field as well as the material stored in the Herbarium (MKNH) of the Institute of Biology, Faculty of Natural Sciences and Mathematics in Skopje was investigated. Morphological characters were noted from the examined specimens and compared with those from relevant taxonomic literature (Marshall 1973; Davis & al. 1988; Wurzell 1988; Milović 2004; Vladimirov & Kuzmanov 2012). Data about the habitats of the species is based on the authors' personal observations. Plant nomenclature and taxonomy is consistent with Euro+Med Plant base (Greuter 2006-).

Results and discussion

Erigeron sumatrensis Retz., Observ. Bot. 5: 28 (1788) [syn.: *Conyza sumatrensis* (Retz.) E. Walker; *C. albida* Spreng.; *Erigeron albidus* (Spreng.) A. Gray].

Annual to biennial. Stems 50–180 cm, branched above, grayish-green, densely hairy, with two types of eglandular simple hairs – dense, appressed, pointing upward short hairs, and sparse, patent longer hairs. Leaves numerous, simple, alternate, 4–10 × 0.6–1.2 cm, elliptic-lanceolate to lanceolate, remotely dentate, lower petiolate, the uppermost sessile, pubescent. Synflorescence paniculate, rhombic in outline, many-flowered. Involucral bracts in 2–3 rows, linear-lanceolate, 3–5 mm long, densely pubescent, grayish-green. Ligulate florets numerous, female, in several rows, ligule shorter than 0.5 mm (inconspicuous); tubular florets few (ca. 15), hermaphrodite. Achenes obovate, compressed, 1–1.5 mm long, with a pappus of 4–5 mm long, pale-brownish hairs. Flowering June to November, fruiting July to November.

In the Macedonian flora, *E. sumatrensis* is morphologically most similar to two alien, congeneric species – *E. canadensis* L. and *E. bonariensis*. *Erigeron canadensis* differs from the other two species by having glabrous to subglabrous involucral bracts, green stem with sparse patent hairs, and conspicuous, 0.5–1 mm long whitish ligules. *Erigeron sumatrensis* differs from *E. bonariensis* in having rhombic in outline synflorescence, with side branches not exceeding the central branch (funnel-shaped in *E. bonariensis*, with side branches usually much overtopping the central branch), most peduncles 1–2 times longer than capitula in fruiting stage (peduncles 2–6 times longer than capitula in *E. bonariensis*), grayish-green involucral bracts (usually purple-tipped in *E. bonariensis*), receptacle 1.8–2.8 mm wide (2.6–3.9 mm wide in *E. bonariensis*) and pale-brownish pappus hairs (dirty-white in *E. bonariensis*).

Distribution in the Republic of Macedonia: – Skopje, in the city centre (near Sajmište), 20 Nov 1992, coll. V. Matevski; Skopje, Gazi Baba, 25 Sept 1999, coll. V. Matevski; Gradsko: Stobi, by a pathway, 140 m a. s. l., 30 Jun 1999, coll. V. Matevski; Star Dojran, Mrdaja, sandy places in front of Mlaz hotel, 22 Sept 1999, leg. V. Matevski; Star Dojran, Mrdaja, in front of Mlaz hotel, on the sands around the lake, 02 Dec 2000, leg. V. Matevski; Kočani, between Kočani town and Istibanja village, by the road, 375 m a. s. l., 41° 55′ 07″ N, 22° 29′ 30″ E, 15 Oct 2005, coll. V. Matevski & M. Kostadinovski; Makedonska Kamenica, between Istibanja village and Makedonska Kamenica, by the road, 389 m a. s. l., 41° 56′ 00″ N, 22° 30′ 50″ E, 15

Oct 2005, coll. V. Matevski & M. Kostadinovski; Veles: Gradsko, near the junction to Prilep, 167 m a. s. l., 41° 33′ 15″ N, 21° 57′ 30″ E, 06 Oct 2006, coll. V. Matevski; Veles: Dolno Kalaslari village, by a petrol station near Aleksandar Makedonski Highway [E-75(A1)], 187 m a. s. l., 41° 41′ 07″ N, 21° 49′ 59″ E, 21 Oct 2016, growing together with *E. canadensis* and *E. bonariensis*, *V. Vladimirov, M. Delcheva, S. Bancheva* (SOM) (Fig.1).

If not otherwise stated, the examined herbarium specimens have been stored in the Herbarium (MKNH) of the Institute of Biology, Faculty of Natural Sciences and Mathematics in Skopje and in the herbarium (SOM) of the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Sofia.

Apparently the species was introduced long ago, however, it remained unrecognized by *E. bonariensis*, mainly due to the lack of relevant taxonomic literature, e.g. in Cronquist (1976) only *E. canadensis* and *E. bonariensis* were included.

Distribution worldwide: – Native to South America. Introduced and naturalized to all continents except for Antarctica (Thébaud & Abbott 1995; Pruski & Sancho 2006). In the Balkan Peninsula, *E. sumatrensis* was recorded in almost all countries: Albania (Baltisberger & Lippert 1987), Bulgaria (Vladimirov 2009; Petrova & al. 2013), Croatia (Milović 2004), Greece (Danin 1976, 1983), Montenegro (Stešević & Petrović 2010, sub *Conyza albida*), Romania (Anastasiu & Memedemin 2012), Serbia (Niketić & Jovanović 2002; Vrbničanin & al. 2004), Slovenia (Poldini & Kaligarič 2000), Turkey-in-Europe (Davis & al. 1988: 161-162).

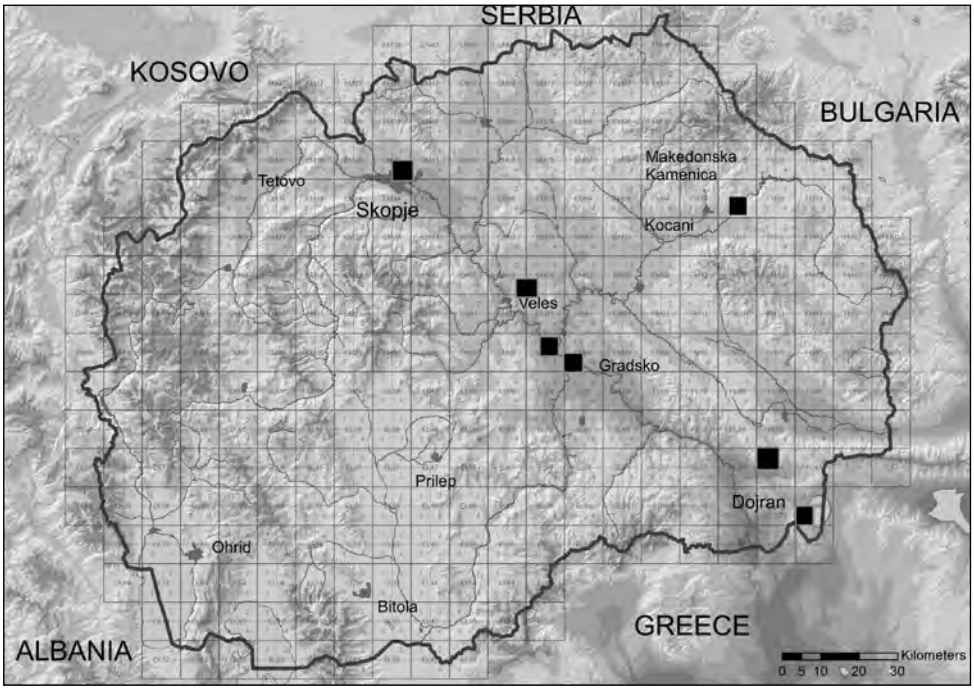

Fig. 1. Distribution of *Erigeron sumatrensis* in the Republic of Macedonia.

Habitat preferences: – *Erigeron sumatrensis* grows in open, sunny to partly shaded places, mainly in disturbed or man-made habitats – road embankments, railroad tracks, urban areas, waste lands, arable land, row crops, vineyards and orchards. In many of these sites, *E. sumatrensis* grows together with *E. canadensis* and/or *E. bonariensis*, and in these cases it usually reaches the biggest size of the three species.

Invasiveness: – The observed populations of the species in Macedonia are viable and persistent, not dependent on further introductions or maintenance by humans, which suggests that the species should be regarded as naturalized in the Macedonian flora in the sense of Richardson & al. (2000). Invasive behavior of the species has been reported for some of the neighbouring countries, e.g. for Bulgaria (Vladimirov 2009; Petrova & al. 2013). In fact, *E. sumatrensis* and *E. canadensis* are considered the most widespread species throughout the world (Thébaud & Abbott 1995) included the small Mediterranean islands (Celesti-Grapow & al. 2016). Each specimen of the taxon produces an enormous amount of seeds which are very easily dispersed by wind. This, as well as other reproductive traits, e.g. autonomous seed production, versatile mating system of self- and cross-pollination, generalized pollination system, high germination rate (Hao & al. 2009), make the species a very efficient colonizer in open, disturbed or free of vegetation places. However, the species is less competitive than native plants if the disturbance of the ground is discontinued. Therefore, *E. sumatrensis* is not or very rarely seen in most of the well preserved natural habitats, e.g. grasslands. However, it may become invasive in natural sparsely vegetated habitats. The species is an important and highly aggressive weed in agricultural land.

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Vladimir Vladimirov & Malina Delcheva

First record of the alien *Diplachne fascicularis* (*Poaceae*) in Bulgaria

Abstract

Vladimirov, V. & Delcheva, M.: First record of the alien *Diplachne fascicularis* (*Poaceae*) in Bulgaria. — Fl. Medit. 26: 209-214. 2016. — ISSN: 1120-4052 printed, 2240-4538 online.

Diplachne fascicularis (*Poaceae*), a taxon native to North and South America, is reported for the first time as an alien species for the flora of Bulgaria and of the Balkan Peninsula. It was recorded in rice fields in Central Bulgaria, in the Thracian Lowland floristic region. Brief morphological description is provided based on the material collected from the Bulgarian localities. This species grows in damp to wet places at the margins of rice fields and is already rather abundant. Distinguishing characters from the morphologically most similar native species (*Cleistogenes serotina* and *C. bulgarica*) have been highlighted. The invasiveness and spreading potential of the species have been discussed based on personal observations and data from the literature.

Key words: *Diplachne fusca* s.l., *Gramineae*, *Leptochloa*, rice fields, weeds, xenophytes.

Introduction

During the past decade the alien species of vascular plants in the Bulgarian flora received particular attention in floristic studies. Poorly studied regions and habitats of Bulgaria, e.g. roadsides, railroads, harbour areas, river banks, urban areas, were explored and this resulted in the discovery of numerous floristic novelties: *Ambrosia trifida* (Stoyanov & al. 2014), *Clematis tibetana* (Vladimirov & al. 2014a), *Epilobium adenocaulon* (Kalníková & Palpurina 2015), *Euphorbia prostrata* (Vladimirov & al. 2014b), *Lepidium virginicum* (Stoyanov & Vladimirov 2015), *Oenothera glazioviana* (Kalníková & Palpurina 2015), *Solanum elaeagnifolium* (Vladimirov & al. 2015) are among the most significant examples.

The aim of this article is to report for the first time the occurrence of *Diplachne fascicularis* (*Poaceae*) in Bulgaria.

Material and methods

Plant material was collected in rice-fields in Southern Bulgaria. Herbarium specimens were deposited in the herbarium (SOM) of the Institute of Biodiversity and Ecosystem Research. Morphological characters were noted from the gathered herbarium specimens

and compared with the data from relevant literature (Snow 2003; Stace 2010). Data about the habitat and populations of the species are based on personal observations.

Results and discussion

Diplachne fascicularis (Lam.) P. Beauv., Ess. Agrostogr.: 81, 160, pl. 16, f. 9. 1812 [syn. *Festuca fascicularis* Lam., *Leptochloa fascicularis* (Lam.) A. Gray, *Leptochloa fusca* subsp. *fascicularis* (Lam.) N. Snow, *Diplachne fusca* subsp. *fascicularis* (Lam.) P. M. Peterson & N. Snow] (Figs. 1-2).

Annual. Stems 70–100 cm, somewhat compressed, usually branched, erecto-patent to suberect, with hollow internodes. Sheaths scabrid to subglabrous; ligules 2–8 mm, membranous, becoming lacerate at maturity; leaf blades 15–45 × 0.3–0.8 cm, scabrid, the uppermost exceeding the panicle. Panicle partly enclosed in the uppermost leaf sheath, 10–60 cm long, with 10–25 branches; branches 4–12 cm long, erecto-patent to suberect. Spikelets subsessile (peduncle 0.4–0.6 mm), 6–11 mm long, 5–11-flowered; lower glume ca. 2–2.5 mm, lanceolate, upper glume ca. 4 mm, elliptic; lemmas lanceolate, 3-veined, with silky hairs at base and along the margin in the lower half, bifid at apex, with 0.5–2.5 mm long apical awn arising from the notch, midrib keeled, usually scabrid.

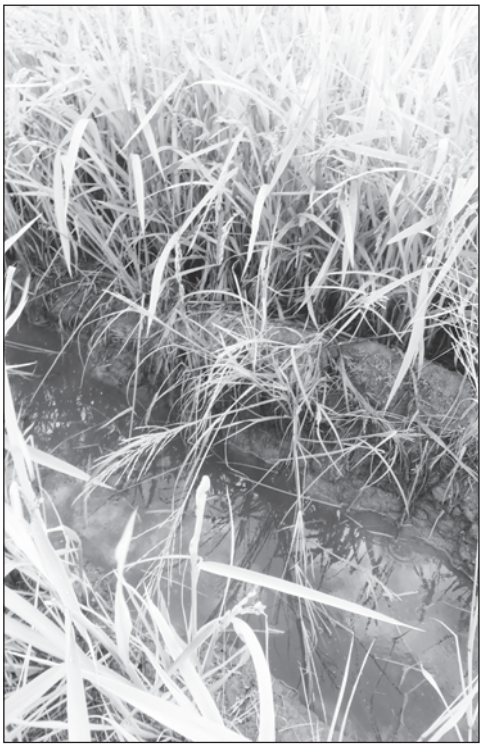

Fig. 1. *Diplachne fascicularis* – habitus.

Fig. 2. *Diplachne fascicularis* – panicle.

Flowering August – September, fruiting October – November.

The taxonomic position of *D. fascicularis* is not resolved yet. Here, specific rank has been accepted for consistency with the Euro+Med treatment (Valdés & Scholz 2009). However, other taxonomic sources as well as recent molecular studies suggest the subspecific rank may be more appropriate – *Diplachne fusca* subsp. *fascisularis* (Peterson & al. 2015; Verloove 2016) or *Leptochloa fusca* subsp. *fascicularis* (Snow 1998, 2003).

In the Bulgarian flora, the species is morphologically close to *Cleistogenes serotina* (L.) Keng and *C. bulgarica* (Bornm.) Keng. *Diplachne fascisularis* differs from both species of *Cleistogenes* by the annual biological behavior (*C. serotina* and *C. bulgarica* are both herbaceous caespitose perennials), membranous ligule becoming lacerate at maturity (ligule a ciliate rim in the other two species), much longer panicle – 10–60 cm (usually 4–10 cm long in both species of *Cleistogenes*), spikelets of 5–11 florets (of 2–5 florets in the other two species) (cf. Kožuharov 1963; Tutin 1980). Also the habitat preferences of the species are very different – *C. bulgarica* and *C. serotina* grow in dry stony grasslands, whereas *Diplachne fascicularis* is a weed in rice-fields.

Distribution in Bulgaria: – Thracian Lowland floristic region (Fig. 3): ca. 2.5 km North of Tsalapitsa village, margin of a rice field along the road to Saedinenie town, 190 m a. s. l., 42.209332° N, 24.562244° E, 12 Oct 2016, *V. Vladimirov & M. Delcheva* (SOM 173164, 173165); ca. 3 km North of Tsalapitsa village, margin of a rice field along the road to Saedinenie town, 194 m a. s. l., 42.214107° N, 24.559780° E, 11 Nov 2016, *V. Vladimirov & M. Delcheva* (SOM 173166); *loc. ibid.*, 195 m a. s. l., 42.223843° N, 24.555600° E, 11 Nov 2016, *V. Vladimirov & M. Delcheva* (SOM); ca. 3.5 km W-SW of Saedinenie town along the road to Pishtigovo village, margin of a rice field, 208 m a. s. l., 42.252014° N, 24.501905° E, 11 Nov 2016, *V. Vladimirov & M. Delcheva* (SOM).

Distribution worldwide: – Native to parts of North and South America: from Southern British Columbia and Ontario in the USA to Argentina. Introduced to Asia and Europe (http://emonocot.org/taxon/urn:kew.org:wcs:taxon:474908). In Europe, reported as an alien in Spain and Portugal (Valdés & Scholz 2009; Osca 2013; Valdés 2015) and Italy (Romani & Tabacchi 2000; Celesti-Grapow & al. 2009, 2010). Recently introduced to Turkey, where it adapted to rice fields and became an important weed in many regions of the country (Altop & al. 2015). A rare casual in Belgium, first recorded as a wool alien (Verloove 2016), and in the Czech Republic (Kubát & al. 2002; Pyšek & al. 2012). Apparently, this is the first report of the species for the Balkan Peninsula.

Habitats and spreading potential: – In Bulgaria the species has been recorded only in and at the margins of rice fields. The species is already rather abundant at the margins of the rice fields, producing a large amount of seeds which fall down on the ground. Personal observation on the management practices of rice fields suggest that seeds of all species growing there are transported by the running water, and especially by the machineries used for land cultivation – large amounts of mud containing all fallen seeds of the weedy species stick to the tyres of the machines and are transported all around. It is perhaps only a matter of time that seeds of *D. fascicularis* are moved to the irrigation channels and other suitable

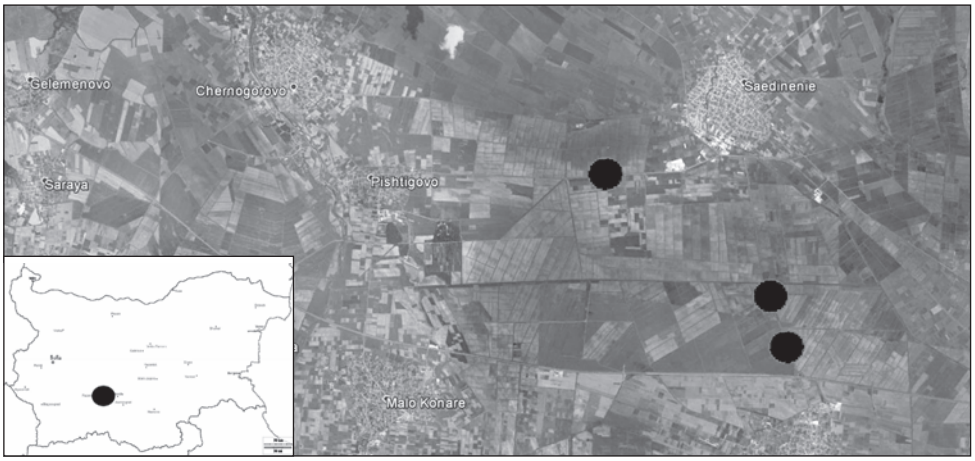

Fig. 3. Distribution map of *Diplachne fascicularis* in Bulgaria.

wet habitats nearby. An increase of the presence of *D. fascicularis* in rice fields over the past few years was reported for the region of Valencia, Spain (Osca 2013). Seed trade is pointed as the main pathway for the introduction and spread of the species in Spain (Del Monte & Cortés 2000) and Italy (Romani & Tabacchi 2000).

Diplachne fascisularis is an important weed in cereal crops, especially rice fields, regarded in Southern Europe as a species with a maximum spreading potential and maximum score for weediness, moderately easy to control (Weber & Gut 2005).

Other alien species around the rice fields were observed too, e.g. *Erigeron canadensis* L., *E. sumatrensis* Retz. (very abundant), *E. bonariensis* L., *Bidens frondosus* L., *Xanthium italicum* Moretti.

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Mediterranean plant karyological data – 26

edited by G. Kamari, C. Blanché & S. Siljak-Yakovlev

Abstract

Kamari, G., Blanché, C. & Siljak-Yakovlev, S. (eds): Mediterranean plant karyological data – 26. — Fl. Medit. 26: 215-239. 2016. — ISSN: 1120-4052 printed, 2240-4538 online.

This is the twenty-six of a series of karyological data from Mediterranean area, peri-Alpine communities and the Atlantic Islands, in English or French language. It comprises contributions on 25 taxa: *Cyclamen*, *Matthiola*, *Ornithogalum* and *Scilla* from Cyprus by P. Bareka, E. Christou & G. Kamari (Nos 1868-1871); *Lilium* from Turkey by B. Gürdal, S. Demirci, N. Özhatay & E. Kaya (Nos 1872-1880); *Centaurea*, *Campanula*, *Clinopodium* and *Silene* from Greece by Ch. Kyriakopoulos, P. Bareka & G. Kamari (Nos 1881-1884); *Aconitum* from France, Morocco and Spain by J. Molero, A. M. Rovira, M. Bosch, J. Simon & C. Blanché (Nos 1885-1902).

During the OPTIMA Meeting held in Montpellier (6-11 June 2016), the Commission of Karyosystematics agreed to change the current name of the column "Mediterranean Chromosome Number Reports" in Flora Mediterranea for a most comprehensive title recognizing the true scope of the contributions usually published (which include, karyotype analysis, evolutionary consequences, bibliographic critical review, as well as biogeographical considerations, taxonomic remarks etc., derived from chromosome studies). The new title for the series is: "Mediterranea plant karyological data" (MPKD) and thus the next issues will be named accordingly. The Commission also decided the addition of the titles of single contributions to valorize the work of the contributors.

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P. Bareka, E. Christou & G. Kamari

Karyology of some plant taxa from Cyprus

Abstract

Bareka, P., Christou, E. & Kamari, G. 2016: Karyology of some plant taxa from Cyprus [In Kamari, G., Blanché, C. & Siljak-Yakovlev, S. (eds), Mediterranean plant karyological data - 26]. – Fl. Medit. 26: 216-219. doi: 10.7320/FlMedit26.216

The chromosome number, karyotype morphology and geographical distribution of some plant taxa from the indigenous flora of Cyprus are presented, along with comments concerning their IUCN status, whenever appropriate. Karyotype microphotographs for all taxa are provided and their karyotype morphology is discussed.

1868. ***Cyclamen cyprium*** Unger & Kotschy **—** 2*n* = 30 (Fig. 1A).

Cy: Close to the monastery of Agia Moni, 34° 90' N, 32° 62' E, alt. ca 1000 m, 17 Feb 2009, *E. Christou & P. Christou E67CY* (UPA).

Cyclamen cyprium is an endemic species of Cyprus that grows in rocky places, near lakes, streams and woodlands of pine and cedar, at an altitude of 300-1200 m.

The chromosome number 2*n* = 30 found here, agrees with previous reports by Vogt & Aparicio (1999) from a population derived from the region of Paphos. Earlier studies (Haan & Doorenbos 1951; Legro 1959 and Lepper 1964) also report the same chromosome number from cultivated material of unknown origin.

The karyotype is symmetrical consisting of mostly metacentric and submetacentric chromosomes, varying in size from 5.07 to 3.04 μm. In the present study, we observed the presence of at least two chromosomes pairs bearing satellites.

1869. ***Matthiola tricuspidata*** (L.) R. Br. **—** 2*n* = 14 (Fig. 1B).

Cy: Limassol, Akrotiri Bay, 34° 70′ N, 33° 09′ E, alt. 0-3 m, 4 Apr 2009, *E. Christou & P. Christou, E63CY* (UPA).

Matthiola tricuspidata, is a mediterranean ammophilus species that is located on sandy beaches and primary dunes near the sea level.

The somatic chromosome number of 2*n* = 14, counted here is in accordance with previous reports from Italy (Cela Renzoni 1969; Brullo & Pavone 1977) and Greece (Miège & Greuter 1973; Runemark 2000). However, Vogt & Aparicio (1999) report the chromosome number 2*n* = 16 in material derived from a Cypriot population close to Larnaca.

The karyotype studied here consists of mostly metacentric (m) chromosomes, which vary in size between 2.90 and 1.61 μm.

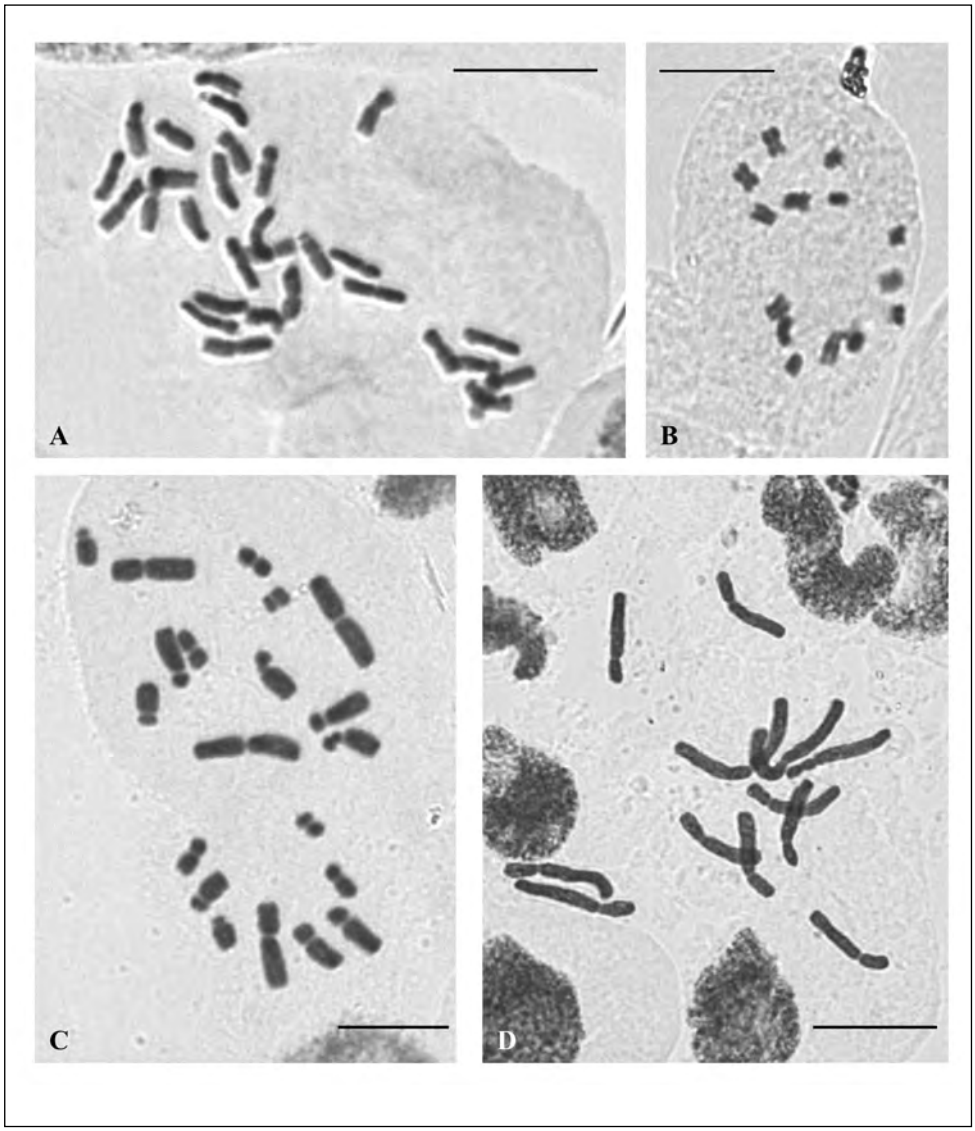

Fig. 1. Microphotographs of somatic metaphase plates of: **A,** *Cyclamen cyprium*, 2*n* = 30; **B,** *Matthiola tricuspidata*, 2*n* = 14; **C,** *Ornithogalum chionophylum,* 2*n* = 20 and **D,** *Scilla morrisii*, 2*n* = 12. – Scale bars = 10 μm.

1870. *Ornithogalum chionophilum* Holmboe **—** 2*n* = 20 (Fig. 1C).

Cy: Agios Nikolaos forest, 35° 05' N, 32° 02' E, alt. ca 700 m, 6 Apr 2008, *E. Christou & P. Christou*, *E4CY* (UPA).

Ornithogalum chionophylum is an endemic species of Cyprus distributed in Akamas area, at the forest of Agios Nikolaos as well as the Troodos mountains. It prefers moist soil, usually near streams, riverbanks or in shaded areas of *Pinus nigra* J.F. Arnold forests.

The chromosome number $2n = 20$ of the population studied is in accordance with previous reports by Garbari & al. (1988) and Stedje & Ovstedal (1991). Additionally, the chromosome number of $2n = 24$ is also reported for this taxon by Gennaiou-Della (2000) in material from another population of Cyprus.

The karyotype is asymmetrical consisting of $2n = 10m + 2sm + 2sm/st + 6st = 20$ chromosomes. The fourth in size chromosome pair is characterized by the presence of a secondary constriction on the short arm of the homologues, while the size of the chromosomes ranges from 10.25 to 2.21 μm.

1871. *Scilla morrisii* Meikle **—** $2n = 12$ (Fig. 1D).

Cy: Close to the monastery of Agia Moni, 34° 90' N, 32° 62' E, 6 Apr 2008, *E. Christou & P. Christou*, *E4CY* (UPA).

Scilla morrisii is an endemic species of Cyprus found in moist, shaded crevices and banks, often under *Quercus infectoria* subsp. *veneris* (A. Kern.) Meikle and *Pistacia terebinthus* L. The species has been characterized as Endangered (EN), according to the *Red Data Book of the flora of Cyprus*, since it is threatened by habitat loss caused by the expansion of agricultural areas, road construction, internal factors (inbreeding and low densities) and by predators, while its total population on the island amounts to 1000 individuals (Della & al. 2007).

The chromosome number $2n = 12$ is in accordance with previous reports by Greilhuber & Speta (1989); Gennaiou-Della (2000) and Speta (2011), under *Othocallis morrisiii* (Meikle) Speta from other localities of the island.

The symmetrical karyotype consists of $2n = 2m + 8sm + 2sm\text{-}SAT = 12$ large chromosomes ranging in size from 22.96 to 11.94 μm. The shortest in size chromosome pair bears small spherical satellites. Additionally, secondary constrictions are observed in the middle of the shorter arms of the third in size chromosome pair.

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B. Gürdal, S. Demirci, N. Özhatay & E. Kaya

Chromosome numbers of 9 taxa of *Lilium* (*Liliaceae*) from Turkey

Abstract

Gürdal, B., Demirci, S., Özhatay, N. & Kaya, E. 2016: Chromosome numbers of 9 taxa of *Lilium* (*Liliaceae*) from Turkey [In Kamari, G., Blanché, C. & Siljak-Yakovlev, S. (eds), Mediterranean plant karyological data - 26]. – Fl. Medit. 26: 220-223. doi: 10.7320/FlMedit26.220

In the present study the chromosome number of 9 *Lilium* taxa from Tukish populations is given. For three of them the somatic number is given for the first time. Additionally, the presence of B chromosomes has been observed for *Lilium kesselringianum, Lilium ponticum* var. *artvinense* and *Lilium szovitsianum*, while a new chromosome number for *Lilium candidum* is reported.

Introduction

This report is based on the specimens collected during the Geophyte Project (110G007), carried out in the Atatürk Horticultural Central Research Institute (Yalova). Plant specimens were collected from nature and planted in the geophytes research garden in Yalova. Actively growing root tips used for the chromosome counts were collected from the garden. The methods followed standard chromosome counting procedure in ISTE (Koçyiğit & Bona 2013). As a result, chromosome number of 9 taxa are counted, 3 of them are reported for the first time in this study.

1872. *Lilium akkusianum* R. Gämperle — 2*n* = 24 + 0-1B.

Tu: Tokat; Erbaa, Madenli Köyü, Armudun altı mevkii, 1147 m, 15 Apr 2008 (Hort. coll. no: L6001).
— Tokat; Erbaa, Gökal Köyü, Çermik Mahallesi, orman açıklıkları, 1358 m, 02 Jul 2008 (ISTE 93709).

Lilium akkussianum is an endemic species described from N Anatolia (Gamperle 1998). The chromosome number is reported for the first time.

1873. *Lilium armenum* Grossh. — 2*n* = 24.

Tu: Ardahan; Damaldan Arap Mezarlarına, Üçdere ağaçlandırma, 1800-1900 m, 15 Jul 2009 (Hort. coll. no: L7506).

Lilium armenum was reported as 2*n* = 24 in the literature (Kudriashova 1969). Our result is in accordance to the previous study.

1874. *Lilium candidum* L. — 2*n* = 24, 32.

Tu: Muğla; Marmaris, İçmeler-Bayırköy yolu, İçmeler üstü, 241 m, 14 Mar 2008 (Hort. coll. no: L4805).

The somatic number of *Lilium candidum* 2*n* = 24 has been previously reported (Smyth & al. 1989; Agnieszka & al. 2005). In the present study 2*n* = 24, as well as 2*n* = 32 chromosomes are counted.

1875. *Lilium ciliatum* P.H. Davis — 2*n* = 24.

Tu: Trabzon; Maçka, Bekçiler Köyü civarı eski yol üzeri, 1657 m, 13 Jul 2007 (Hort. coll. no: L6107).

Lilium ciliatum is an endemic species from Turkey. The chromosome number reported here, 2*n* = 24, is in accordance with a previous report (Özdemir 2003).

1876. *Lilium kesselringianum* Miscz. — 2*n* = 24 + 0-2B

Tu: Artvin; Sahara, Yalnızçam dağı, Şavşat, 2185 m, 12 Sept 2006 (Hort. coll. no: L0801).

In the literature, the chromosome number of *Lilium kesselringianum* is reported as 2*n* = 24 (Kudriashova 1969; Zakharyeva & Makushenko 1969). In this study, the somatic number is the same, while 0-2B chromosomes are observed.

1877. *Lilium martagon* L. — 2*n* = 24.

Tu: İstanbul; Belgrat Ormanları, Atatürk Arboretumu, 100 m, 05 Jun 2005 (Hort. coll. no: L3401).

The chromosome number of 2*n* = 24 + 0-2B for *Lilium martagon* is also reported in the literature (Holub & al. 1972; Murin & al. 1980; Strid & Franzen 1981; Malakhova & Markova 1994).

1878. *Lilium ponticum* K. Koch — 2*n* = 24.

Tu: Trabzon; Çaykara, Karaçamdan Soğanlıya çıkış yolu, 1959 m, 15 Apr 2006 (Hort. coll. no: L6101).

The chromosome number of *Lilium ponticum* is reported for the first time in this study.

1879. *Lilium ponticum* var. *artvinense* (Miscz.) P.H. Davis & D.M. Hend. — $2n = 24 + 0\text{-}3B$.

Tu: Artvin; Kafkasordan-Madene giderken yol üzeri, 1701 m, 13 Apr 2006 (Hort. coll. no: L0803).

The chromosome number reported here is counted for the first time and B chromosomes are observed.

1880. *Lilium szovitsianum* Fisch. & Avé-Lall. — $2n = 24 + 0\text{-}1B$.

Tu: Ardahan; Çıldır, Kenarbel Köyü, Aktaş Gölü, Ercan mevkii, 1975 m, 30 Aug 2007 (Hort. coll. no: L7505).

The chromosome number $2n = 24$ for *Lilium szovitsianum* has already been given (Kudriashova 1969). In this study, we observed the presence of a B chromosome in some metaphase plates.

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Ch. Kyriakopoulos, P. Bareka & G. Kamari

Karyological data of some endemic taxa from Mt Taigetos, Greece

Abstract

Kyriakopoulos, Ch., Bareka, P. & Kamari, G. 2016: Karyological data of some endemic taxa from Mt Taigetos, Greece [In Kamari, G., Blanché, C. & Siljak-Yakovlev, S. (eds), Mediterranean plant karyological data - 26]. – Fl. Medit. 26: 224-228. doi: 10.7320/FlMedit26.224

In the present study, the chromosome number and the karyotype of 4 endemic taxa from populations of Mt Taigetos are given. For *Campanula papillosa* and *Clinopodium taygeteum* the somatic number is given to our knowledge for the first time. The geographical distribution and the conservation status of the threatened taxa are also discussed.

1881. *Centaurea athoa* subsp. *parnonia* (Halácsy) E. Gamal-Eldin & Wagenitz — $2n = 2x = 20$ (Fig. 1A).

Gr: Peloponnisos, Nomos Lakonias, Mt Taigetos, at the way from Maganiari to EOS refuge, limestone, open place between *Pinus nigra-Abies cephalonica* forest, 36° 57' N, 22° 23' E, alt. 1300 m, 5 Jul 2014, *Ch. Kyriakopoulos& G. Kofinas 2052* (UPA).

Centaurea athoa belongs to sect. *Acrocentron* (Cass.) DC. (Wagenitz & Gamal-Eldin 1985) and it is divided into two subspecies. The typical one occurs at Athos peninsula and in W & S Anatolia (Gamal-Eldin & Wagenitz 1991), while subsp. *parnonia* (≡ *Centaurea parnonia* Halácsy) is an endemic taxon occurring in S & SE Peloponnisos, mostly at the middle-upper altitudinal range of Mts Taigetos and Parnon respectively (Gamal-Eldin & Wagenitz 1991).

The chromosome number of the population studied is $2n = 2x = 20$ and agrees with previous reports by Routsi (1993) and Routsi & Georgiadis (1994, 1999), under the name *C. rupestris* subsp. *parnonia*. The same chromosome number is also given for the typical subspecies in material from Greece (Strid 1986; Routsi & Georgiadis 1994, 1999) and Turkey (Uysal & al. 2009).

1882. *Campanula papillosa* Halácsy — $2n = 32$ (Fig. 1B).

Gr: Peloponnisos, Nomos Lakonias, Mt Taigetos, at the summit area of Profitis Ilias called Megala Zonaria, limestone slopes, 37° 57' N, 22° 21' E, alt. 1900 m, 22 Jun 2008, *Ch. Kyriakopoulos & N. Turland 755a* (UPA).

Campanula papillosa is a local endemic species of S Peloponnisos, which occurs on the higher altitudes of Mt Taigetos. It was found for the first time by Maire & Petitmengin

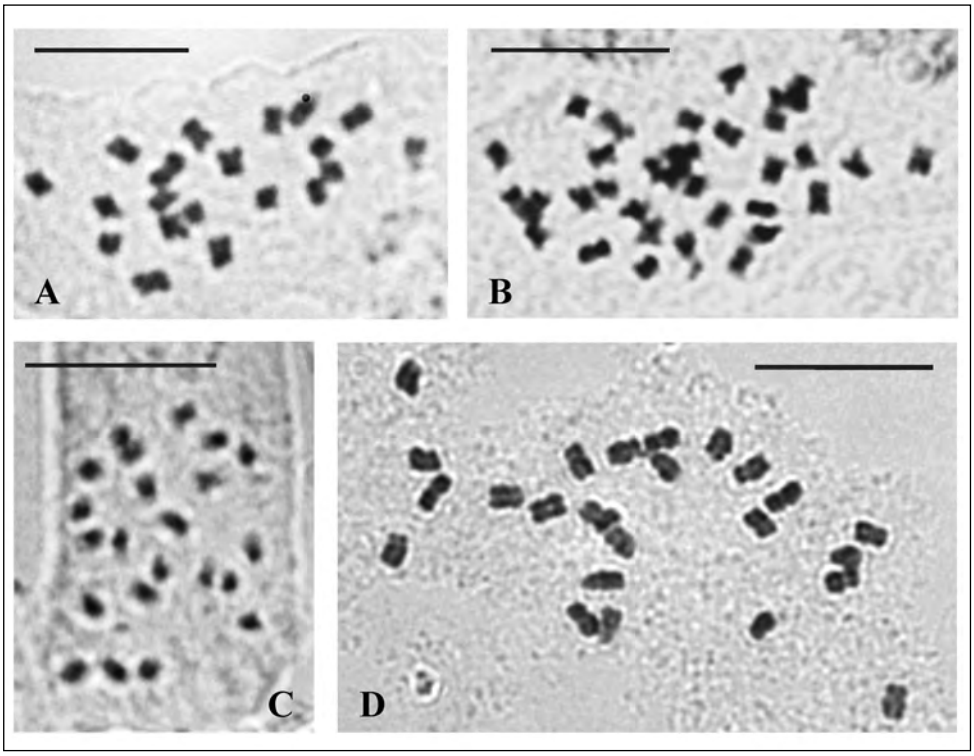

Fig. 1. Microphotograph of mitotic metaphase plates of: **A.** *Centaurea athoa* subsp. *parnonia*, 2*n* = 20; **B.** *Campanula papillosa*, 2*n* = 32; **C.** *Clinopodium taygeteum*, 2*n* = 22; **D.** *Silene gigantea* subsp. *hellenica*, 2*n* = 24. – Scale bars = 10 μm.

(1906) and described by Halácsy (1908). It is a little-known and rarely collected species of the genus *Campanula* with few references (Hartving 1991; Tan & Iatroú 2001) and to our knowledge its collection by the first author in 2008, is its rediscovery after 102 years. It is a relict species, categorized as Critically Endangered (CR) by Kyriakopoulos & al. 2009, because of its limited distribution area and very small population size, which was considered not to exceed 100 individuals.

To our knowledge, the chromosome number 2*n* = 32 and the karyotype of *Campanula papillosa* are given here for the first time.

1883. *Clinopodium taygeteum* (P.H. Davis) Bräuchler — 2*n* = 22 (Fig. 1C).

Gr: Peloponnisos, Nomos Messinias, Mt Taigetos, on the vertical NE slopes of Tsuga summit of Mt Xerovouna, in the north part of Taigetos ridge, 37° 06’ N, 22° 18’ E, alt. 1750 m, 1 Jul 2007, *Ch. Kyriakopoulos 561*(UPA). – Fig. 1C.

— Peloponnisos, Nomos Messinias, Mt Taigetos, place called Neraidovrahos, on the vertical slopes of Pirgaki summit of Mt Xerovouna, in the north part of Taigetos ridge, 37° 07' N, 22° 17' E, alt. 1650 m, 5 Aug 2007, *Ch. Kyriakopoulos 673* (UPA).
— Peloponnisos, Nomos Lakonias, Mt Taigetos, at the E slopes between the summits Sidirokastro and Anonimi, Pentadactilos ridge, 37° 02.554' N, 22° 19.036' E, alt. 1950 m, 17 Jun 2015, *Ch. Kyriakopoulos 2233* (UPA).

Clinopodium taygeteum (P.H. Davis) Bräuchler (≡ *Micromeria taygetea* P. H. Davis) is an endemic species of S Peloponnisos, which grows exclusively on limestone rock crevices and stony slopes, at the higher altitudes of the main summits Tsuga (1782 m) and Pirgaki (1731 m) of Mt Xerovouna, in the north part of Taigetos ridge. The species is included in the *Red Data Book of Rare and Threatened Plants of Greece* (Phitos & al. 2009) as Endangered (EN) by Kyriakopoulos & Kamari (2009).

The closest relative of this isolated taxon is *Clinopodium caricum* (P.H. Davis) Bräuchler & Heubl (≡ *Micromeria carica* P. H. Davis), which occurs in SW Anatolia (Τουρκία) (Burtt & Davis 1949). Davis collected *C. taygeteum* for first time in 1938 at the place above Tripi in Mt Xerovouna in Northern Taigetos. Recently, the first author also found *C. taygeteum* (*Kyriakopoulos 2233*, UPA) in the main ridge of Mt Taigetos called Pentadactilos, c. 15 km southern of its *locus classicus*.

To our knowledge, the chromosome number $2n = 22$ and the karyotype of *Clinopodium taygeteum* are given here for the first time.

1884. *Silene gigantea* subsp. *hellenica* Greuter — $2n = 24$ (Fig. 1D).

Gr: Peloponnisos, Nomos Lakonias, Mt Taigetos, at the gorge Langada, 37° 05' N, 22° 19' E, alt. 600 m, 23 Jun 2013, *Ch. Kyriakopoulos 1528* (UPA).

Silene gigantea (L) L. is a perennial species endemic to the Balkan Peninsula, western Asia and Cyprus. It is divided into three subspecies; subsp. *gigantea*, subsp. *rhodopea* (Janka) Greuter and subsp. *helllenica* Greuter (Greuter 1995, 1997).

Silene gigantea subsp. *hellenica* is growing from central to west Sterea Ellas (Parnassos and Giona), NW Evia, Peloponnisos (Mts Taigetos, Parnonas, Chelmos, Kyllini and Gerania) on the low-mid altitudes of them (Greuter 1997). Recently, Du Pasquier & al. (2015) mentioned that the distribution of *S. gigantea* subsp. *hellenica* can be extended to Turkey, however, according to the authors a more detailed study is necessary in order to clarify the taxonomic status of the Turkish populations.

The chromosome number found here is $2n = 24$. The same chromosome number is given for *Silene gigantea* s.l. by Degraeve (1980); Ghazanfar (1983); Strid & Andersson (1985); Montmollin (1986) and Runemark (1996).

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J. Molero, A. M. Rovira, M. Bosch, J. Simon & C. Blanché

Karyological study of the genus *Aconitum* (*Ranunculacae*) in the W Mediterranean Area

Abstract
Molero, J., Rovira, A. M., Bosch, M., Simon, J. & Blanché, C. 2016: Karyological study of the genus *Aconitum* (*Ranunculacae*) in the W Mediterranean Area [In Kamari, G., Blanché, C. & Siljak-Yakovlev, S. (eds), Mediterranean plant karyological data - 26]. – Fl. Medit. 26: 229-239. doi: 10.7320/FlMedit26.229

A karyological study of 38 populations belonging to 8 taxa of the genus *Aconitum* (*Ranunculaceae*) from the W Mediterranean Area is presented here. Karyotype microphotographs and corresponding idiograms for all taxa are provided and their karyotype morphology is discussed.

1885. *Aconitum anthora* L. — 2*n* = 32.

Ga: Pyrénées Orientales, Vall d'Eina, meadow, 42° 26' 39'' N 2° 06' 55'' E, alt. 2000 m, 20 Aug 1994, *M. Bosch* (BCN 4712).
Hs: Girona, Alta Garrotxa, Bassegoda peak, rocky scree, 42° 18' 46'' N 2° 37' 51'' E, alt. 1370 m, 22 Aug 1985, *J. Molero & A. Rovira* (BCN 4718).
— Huesca, Lanuza, dam in the gorge of Portet, 42° 45' 32'' N 0° 17' 42'' W, alt. 1900 m, 28 Jul 1994, *A. Salvador & J. Vicens* (BCN 4711) – Figs 1A & 3A.
— Lleida, Llebreta Lake, Aigües Tortes-Sant Maurici, 42° 33' 02'' N 0° 53' 27'' E, alt. 1750 m, 30 Aug 1994, *J. Simon & M. Bosch* (BCN 4714). – Figs 1B & 3B.
— Lleida, Vall d'Aran, above Arrós, ravine of Varradós, cottage of les Artiguetes to Salt del Pish, grasslands and wet meadows, 42° 46' 36'' N 0° 50' 05'' E, alt. 1500 m, 3 Sept 1992, *J. Molero & A. Rovira* (BCN 14360).

The five surveyed populations (Central & E Pyrenees) share the same chromosome number 2*n* = 4x = 32 (Figs 1A-1B), as previously reported in the few studies available from the Iberian Peninsula (Picos de Europa, Díez & al. 1984) and French Pyrenees (Küpfer 1974; Baltisberger & Utelli 2001) and in accordance with the previous counts known from European origin (Bosch & al. 2016).

The haploid idiograms (Pyrenean populations, Figs 3A-3B) are quite similar, with the formula 2*n* = 13 sm + 3st = 16 chromosomes, slightly differing (length of long arm of pair II) from those reported by Seitz & al. (1972) from the Jura massif (Ch). Some variation in number and position of satellites is detected: pair XIV (Pyrenees, present paper), pair V (Slovenia, Seitz & al. 1972), pairs XIV and XV (Jura, Seitz & al. 1972), as also observed in *A. lycoctonum* and particularly in the *A. napellus*-group (Figs. 3 & 4). Chromosome size and total karyotype length in *A. anthora* are clearly shorter than in the remaining groups, even considering the tetraploid condition (and thus losses and deletions), also detected by

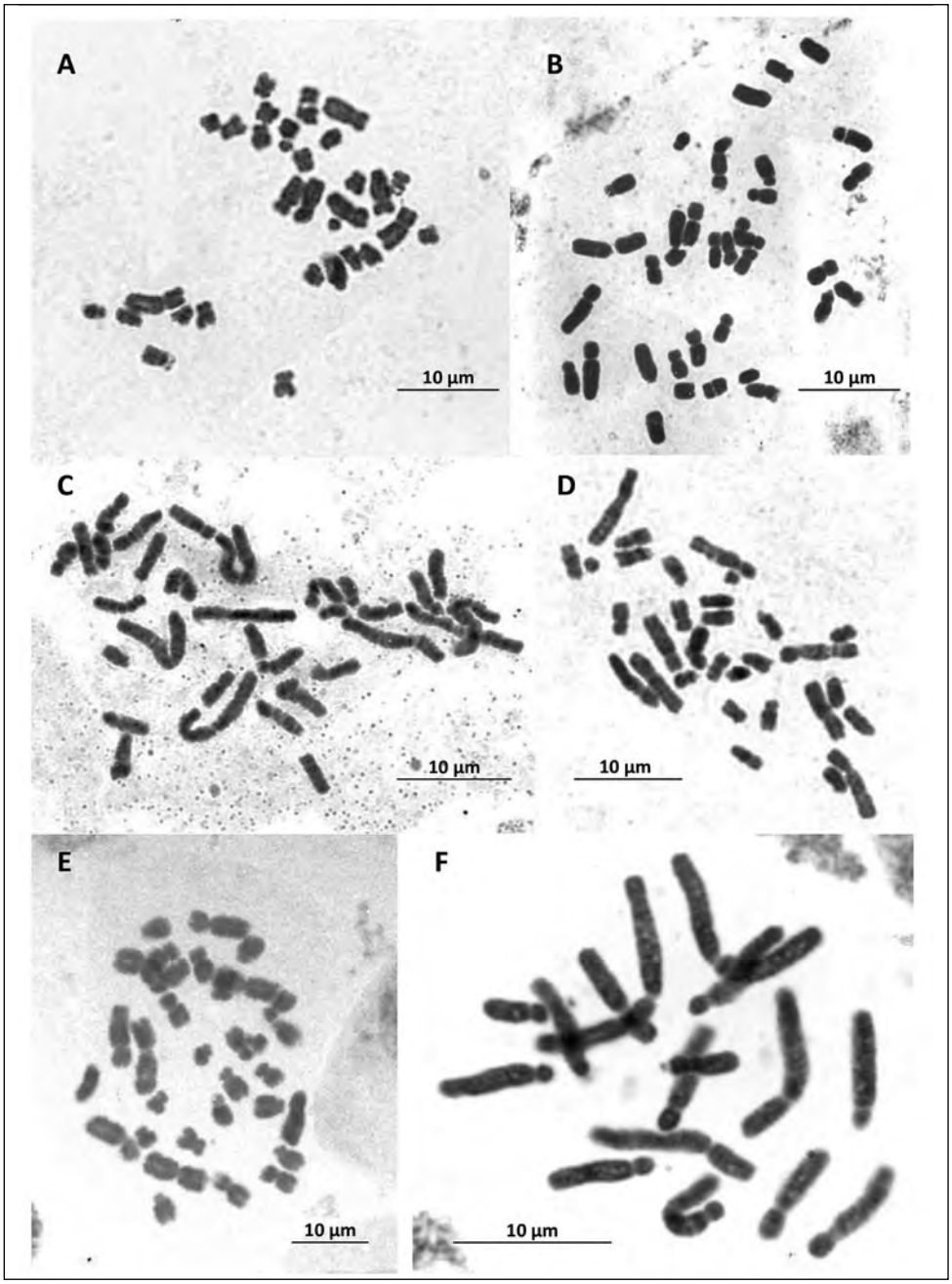

Fig. 1. Microphotographs of somatic metaphase plates of: A-B, *A. antora*, 2*n* = 32: A, Lanuza (Hs: Huesca) & B, Llebreta Lake (Hs: Lleida); C-E, *A. burnatii*, 2*n* = 32: C, Authion (Ga: Alpes Maritimes), D, La Hoya de la Mora (Hs: Granada) & E, Peña Oroel (Hs: Huesca); F, *A. lycoctonum*, 2*n* = 16, Sierra Nevada (Hs: Granada).

Schafer & La Cour (1934) and Kočková (2012), this last one from DNA values. Seitz & al. (*l.c.*) considered *A. anthora* as an old taxon originated by autopoliploidy from a diploid Asiatic ancestor; it has been placed by Jabbour & Jenner (2012) in a clade of relatively old divergence.

1886. *Aconitum burnatii* Gáyer subsp. *burnatii* — 2*n* = 32.

Ga: Alpes Maritimes, Madone de Fenestre, meadow near a stream, 44° 05' 41'' N 7° 21' 30'' E, alt. 1910 m, 17 Sept 1993, *M. Bosch, J. Simon & J. Vicens* (BCN 14362). – Fig. 3C.
— Alpes Maritimes, Circuit d'Authion, gaunt ravine, 44° 00' 07'' N 7° 25' 49'' E, alt. 1900 m, 17 Sept 1993, *M. Bosch, J. Simon & J. Vicens* (BCN 14361). – Figs 1C & 3D.
Hs: Granada, Sierra Nevada, Laguna de las Yeguas, source of a creek, 37° 03' 32'' N 3° 22' 50'' W, alt. 2800 m, 27 Jun 1983, *C. Benedí, C. Blanché, J. Molero, J. Molero-Mesa & J. Vallès* (BCN). – Fig. 3E.
— Granada, Sierra Nevada, Hoya de la Mora, under the university refugee, 37° 05' 34'' N 3° 23' 09'' W, alt. 2500 m, 14 May 1986, *J. Molero* (BCN 4725). – Figs 1D & 3F.
— Huesca, Jaca, Peña Oroel, under "Faixa Paco", 42° 31' 12'' N 0° 31' 47'' W, alt. 1630 m, 1 Oct 1992, *J. Molero & A. Rovira* (BCN 14359). – Figs 1E & 3G.

Our results included the first reports for W Mediterranean populations (Pyrenees, Sierra Nevada) of this taxon, with 2*n* = 4x = 32 chromosomes (Figs 1C to 1F). The only previously known European references come from Maritime Alps populations (Ga, It) under the name *A. divergens* subsp. *burnatii* (Gáyer) W. Seitz with indications of 2*n* = 32 (Seitz 1969).

Also for the first time, five haploid idiograms belonging to *A. burnatii* subsp. *burnatii* are presented (Figs 3C to 3G), with karyotype structure corresponding to the *A. napellus* s.l.- type defined by Seitz (1969). These idiograms show minor differences in several pair ratios, whereas it seems relevant that the Iberian populations of *A. burnatii* (and also of the *A. napellus* grex) constantly bear the pair II shorter than pair I. The significance of variation in the II pair of chromosomes in tribe *Delphinieae* has been discussed in Blanché & al. (1997). Satellite positions are shared by Maritime Alps and Pre-Pyrenees populations (pair XI), whereas in Sierra Nevada karyotypes they appear in pair XIII.

1887. *Aconitum lycoctonum* L. subsp. *lycoctonum* — 2*n* = 16.

Hs: Ávila, Puerto de Mijares, near the edge of a stream, 40° 19' 52'' N 4° 48' 48'' W, alt. 1570 m, 11 Oct 1986, *J. Molero* (BCN).
— Granada, Sierra Nevada, near Parador Nacional to Veleta peak, 37° 05' 11'' N 3° 22' 25'' W, alt. 2500 m, 14 May 1986, *J. Molero* (BCN). – Figs 1F & 3H.
— Guadalajara, Montejo de la Sierra, 41° 04' 01'' N 3° 31' 50'' W, alt. 1200 m, 3 Aug 1985, *C. Benedí & J. Molero* (BCN). – Fig. 3I.
— Huesca, Benasque, near Llosás, meadow, 42° 36' 34'' N 0° 30' 21'' E, 1 Aug 1993, alt. 2200 m, *M. Bosch & J. Simon* (BCN 14358).

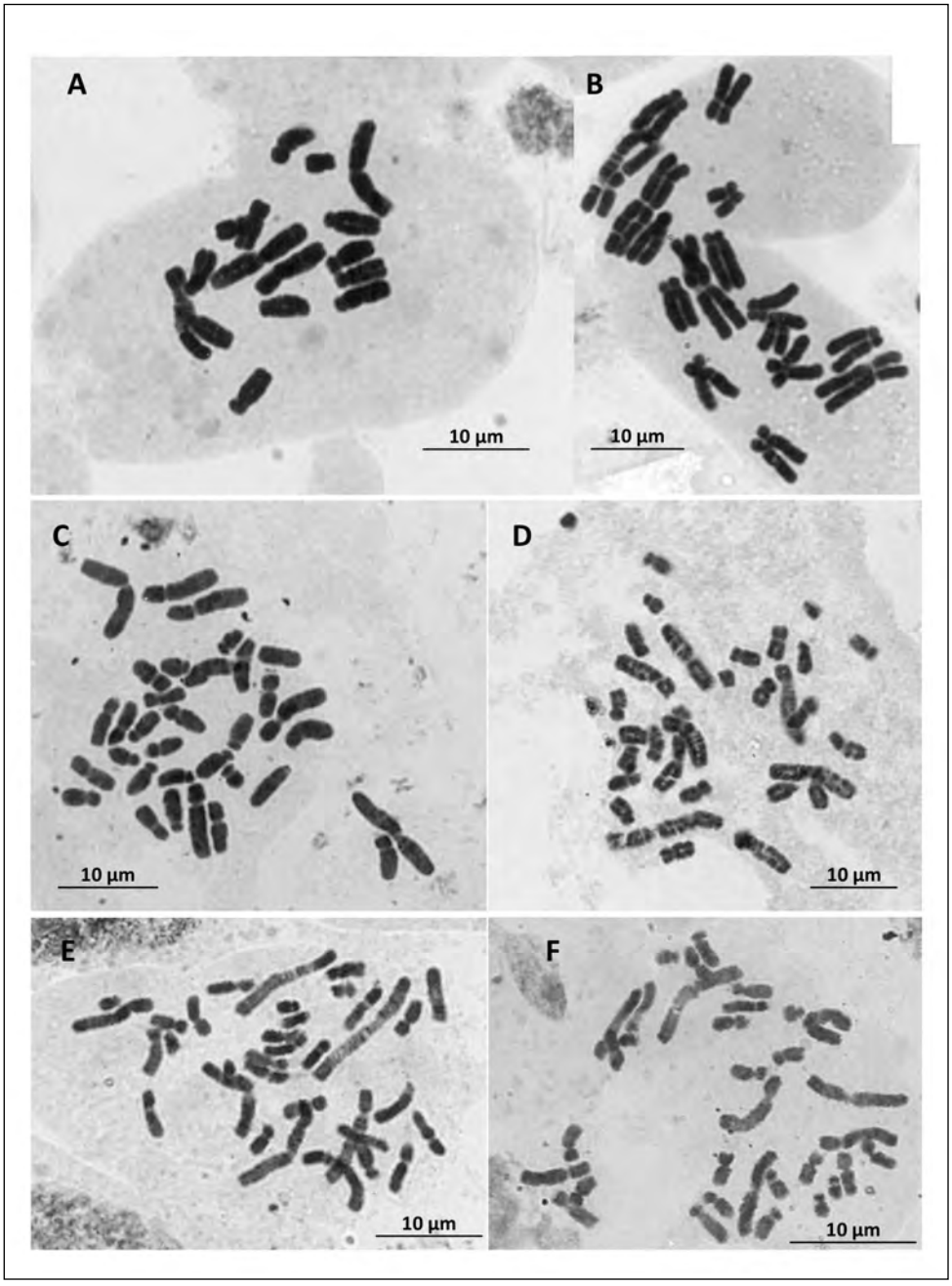

Fig. 2. Microphotographs of somatic metaphase plates of: A-B, *A. lycoctonum* subsp. *lycoctonum*, 2*n* = 16: A, Moncayo (Hs: Huesca) & B, Oukaimeden (Ma: Haut Atlas); C-D, *A. napellus* subsp. *castellanum*, 2*n* = 32: C, Laguna del Marquesado (Hs: Cuenca) & D, Las Honfrias (Hs: Salamanca); E-F, *A. napellus* subsp. *vulgare*, 2*n* = 32: E, Lago Enol (Hs: Oviedo) & F, Moncayo (Hs: Huesca).

— León, Cofiñal, 43° 01' 48" N 5° 15' 58" W, alt. 1200 m, 19 Jul 1984, *F. Llamas* (BCN 4874).
— Oviedo, Puerto de Veguerada, between calcareous rocks, 43° 02' 38" N 5° 29' 41" W, alt. 1500 m, 1 Jun 1994, *C. Blanché & J. Simon* (BCN). – Fig. 3J.
— Soria, Sierra Cebollera, forest trail over Molinos de Razón, granitic scree in birch clearings, 41° 58' 23" N 2° 35' 15" W, alt. 1300 m, 16 Aug 1983, *J. Molero & A. Rovira* (BCN 4863).
— Zaragoza, Moncayo, Beratón, ravine slope, on stony and rich in humus ground near to *A. napellus*, 41° 43' 17" N 1° 48' 18" W, alt. 1480 m, 2 Jul 1995, *J. Molero* & *A. Rovira* (BCN 4766). – Figs 2A & 3K.
Ma: Haut Atlas, Oukaimeden peak, margin of a stream, 31° 11' 48" N 7° 50' 02" W, alt. 2700 m, 20 Jun 1994, *J. Molero, A. Rovira, C. Blanché, M. Bosch & J. Simon* (BCN). – Figs 2B & 3L.

The nine studied populations from Spain and Morocco presented $2n = 2x = 16$ chromosomes (Fig. 1F and Figs 2A-2B), as reported from many sources (Bosch & al. 2016). The previously known numbers from *A. lycoctonum* Iberian populations –although published under several alternative nomenclatural combinations– are also $2n = 16$ (Küpfer 1974; Löve & Kjellquist 1974; Baltisberger & Charpin 1989; Baltisberger & Utelli 2001 and Castroviejo & al. 2003) as well as the North African ones (Galland 1988).

Only diploid cytotypes have been reported for *A. lycoctonum*, apart from a rare and old report of a triploid ($2n = 24$, Delay 1947). However, poliploidy has been documented in tetraploid and hexaploid Chinese species of *Aconitum* subgen. *Lycoctonum* (Yuan & Yang 2006; Hong & al. 2016): $2n = 32$ in *A. angustius* W.T. Wang, *A. brevicalcaratum* (Finet & Gagnep) Diels, *A. crassifolium* Hand.-Mazz., *A. chrysotrihum* W.T. Wang, and *A. rilongense* Kadota, and $2n = 48$ in *A. apetalum* (Huth) B. Fedtsch ex Stein. The most deviant chromosome count in subgen. *Lycoctonum* is the very recently published $2n = 12$ from *A. fletcherianum* G.Taylor, with a karyotype showing deep and significant chromosome rearrangements (Hong & al. 2016), representing the first report of this chromosome number in the genus *Aconitum*.

We obtained the haploid idiogram for four Iberian populations and one from Morocco (Figs 3H to 3L). This taxon shows a very stable karyotype structure in its whole southern distribution area, from Romania to the Moroccan Atlas, in coincidence with that published by Seitz & al. (1972), exhibiting a common chromosome formula ($2n = 2m + 6sm + 8st = 16$ chromosomes). Minor differences in arm lengths of pairs II and VI should be noted, as well as the number of satellite pairs (one, VII or mainly VIII in Iberian and Moroccan populations, *vs* two, VII and VIII in the Romanian one). The characteristic relatively longer short arm of pair V found in *A. lycoctonum* (both subsp. *lycoctonum* Figs 3H to 3L and subsp. *ranunculifolium*, Figs 4A-4B) has been also reported from Chinese diploid species of this subgenus (Yuan & Yang 2006; Hong & al. 2016).

1888. *Aconitum lycoctonum* subsp. *ranunculifolium* (Rchb.) Schinz & R. Keller — $2n = 16$.

Hs Girona, Vallter, over Setcases, megaphorbic communities on the bed of the valley, 42° 44' 21" N 2° 16' 30" E, alt. 1800 m, 22 Aug 1985, *J. Molero* (BCN 4762).
— Huesca, Peña Montañesa, 42° 30' 00" N 0° 12' 20" E, alt. 1500 m, 12 Aug 1985, *J.*

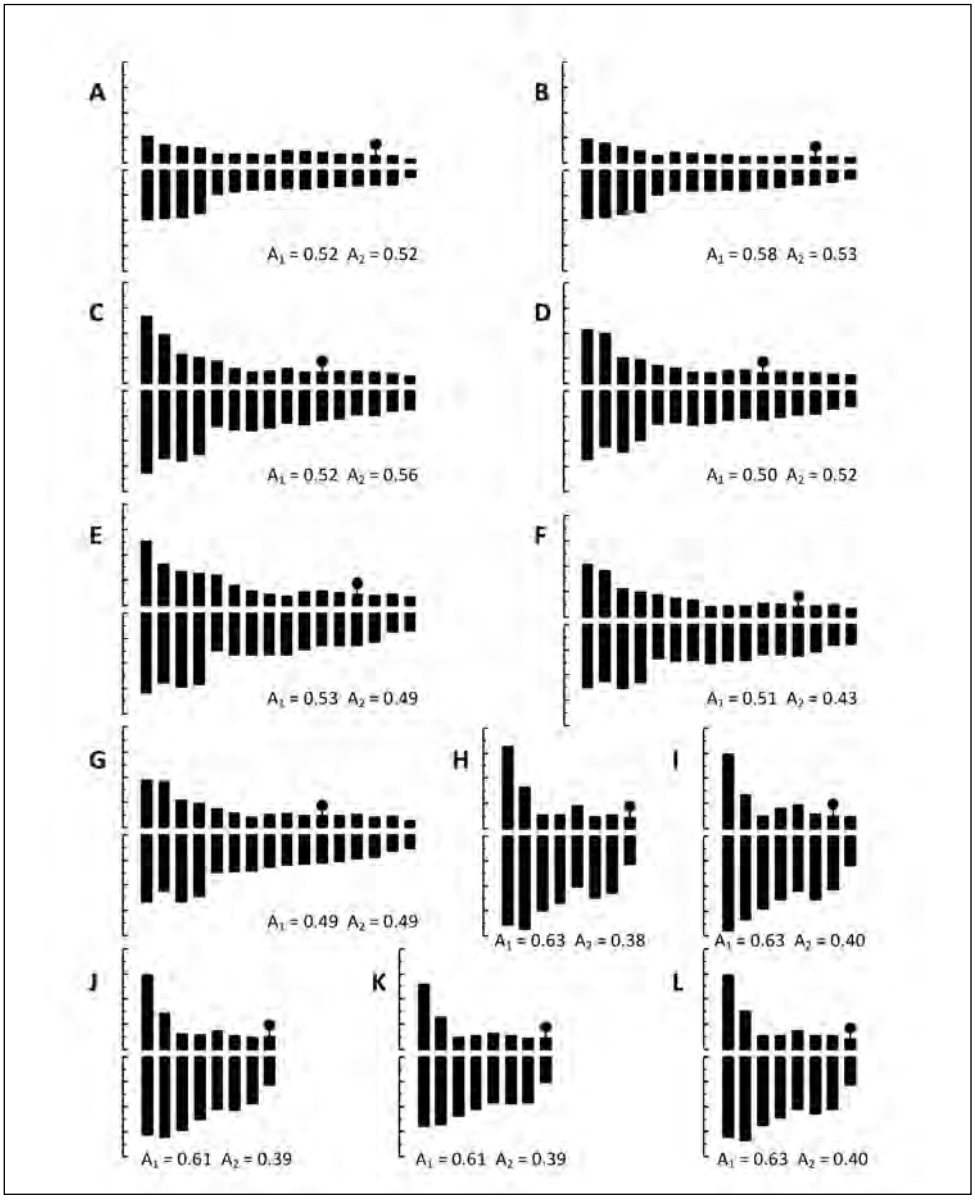

Fig. 3. Haploid idiograms obtained by measuring at least 5 good mitotic metaphases, 3 hours after pretreatment with colchicine 0.05 %. Asymmetry indices A1 and A2 are calculated following Romero (1986). A-B, *A. antora*: A, Lanuza (Hs: Huesca) & B, Llebreta Lake (Hs: Lleida); C-G, *A. burnatii*: C, Madone de Fenestre (Ga: Alpes Maritimes), D, Authion (Ga: Alpes Maritimes), E, Laguna de las Yeguas (Hs: Granada), F, La Hoya de la Mora (Hs: Granada) & G, Peña Oroel (Hs: Huesca); H-L, *A. lycoctonum* subsp. *lycoctonum*: H, Sierra Nevada (Hs: Granada), I, Montejo de la Sierra (Hs: Guadalajara), J, Puerto de Veguerada (Hs: Oviedo), K, Moncayo (Hs: Soria) & L, Oukaimeden (Ma: Haut Atlas). – Scale bars = 8+8 µm.

Molero (BCN). – Fig. 4B.
— Lleida, Vall d'Aran, Viella tunnel, Vall del Nere, 42° 39' 20'' N 0° 44' 47'' E, alt. 1600 m, 27 Jul 1994, *J. Simon & M. Bosch* (BCN 4759). – Fig. 4A.

Three Iberian populations (from Catalonia and Aragon) are reported here for the first time, showing diploid cytotypes of $2n = 2x = 16$. Only few and old chromosome data, coincident, are available for this taxon in Europe: Lovka & al. (1971) from Slovenia and Seitz & al. (1972) from Italy (S Tyrol). Some authors (Akeroyd & Chater 1993) place this taxon under the synonymy of *A. lycoctonum*; we follow the criteria of Seitz & al. (1972), confirmed by Molero & Blanché (1986).

Two haploid idiograms (from Central Pyrenees and Pre-Pyrenees) are presented (Figs 4A-4B). Karyotype structure is nearly identical between the two studied populations and the Iberian populations of subsp. *lycoctonum* ($2n = 2m + 6sm + 8st = 16$ chromosomes). Minor variation in subsp. *ranunculifolium* refers to arms ratios (at the border of sm and st limits) and satellites presence: in pair VIII in Vall de Nera population, absent in Peña Montañesa.

1899. *Aconitum napellus* subsp. *castellanum* Molero & C. Blanché — $2n = 32$.

Hs: Cuenca, Laguna del Marquesado, peaty soil, 40° 10' 40'' N 1° 40' 17'' W, alt. 1400 m, 12 Oct 1986, *J. Molero* (BCN 4682). – Figs 2C & 4D.
— Salamanca, Linares de Riofrío, Las Honfrias, in *castanetis* with *Pteridium aquilinum-Quercus pyrenaica*, near river, 40° 34' 59'' N 5° 58' 03'' W, alt. 1200 m, 19 Aug 1985, *C. Blanché & R. Ferrer* (BCN 4685). – Figs 2D & 4E.

The somatic number of $2n = 4x = 32$ chromosomes (Figs 2C-2D), is given here for the first time for this endemism of the Centre of the Iberian Peninsula (Molero & Blanché 1986), not differing from the remaining subspecies of the polymorphic complex of *A. napellus* s.l. (Bosch & al. 2016).

The karyotype structure of the two studied populations (Figs 4D-4E) is analogous to the basic model described by Seitz (1969) for the subspecies of *Aconitum* grex. *napellus* found in Europe (Akeroyd & Chater 1993), with some polymorphism at population level in subsp. *castellanum*: in arm ratio (pairs VI, XII, XV) and number of sat-chromosomes: two in Cuenca (VII and XII) *vs.* a single one (VII) in Salamanca.

1900. *Aconitum napellus* subsp. *lusitanicum* Rouy — $2n = 32$.

Hs: Ávila, Puerto Mijares, near the edge of a stream, 40° 19' 58'' N 4° 48' 44'' W, alt. 1680 m, 11 Oct 1986, *J. Molero* (BCN 4691).
— Guadalajara, Montejo de la Sierra, 41° 04' 01'' N 3° 31' 50'' W, alt. 1200 m, 3 Aug 1985, *C. Benedí & J. Molero* (BCN 4690).
— León, La Uña, margin river near Lario, 43° 03' 26'' N 5° 07' 57'' W, alt. 1200 m, 17 Aug 1985, *C. Blanché & R. Ferrer* (BCN 4735).

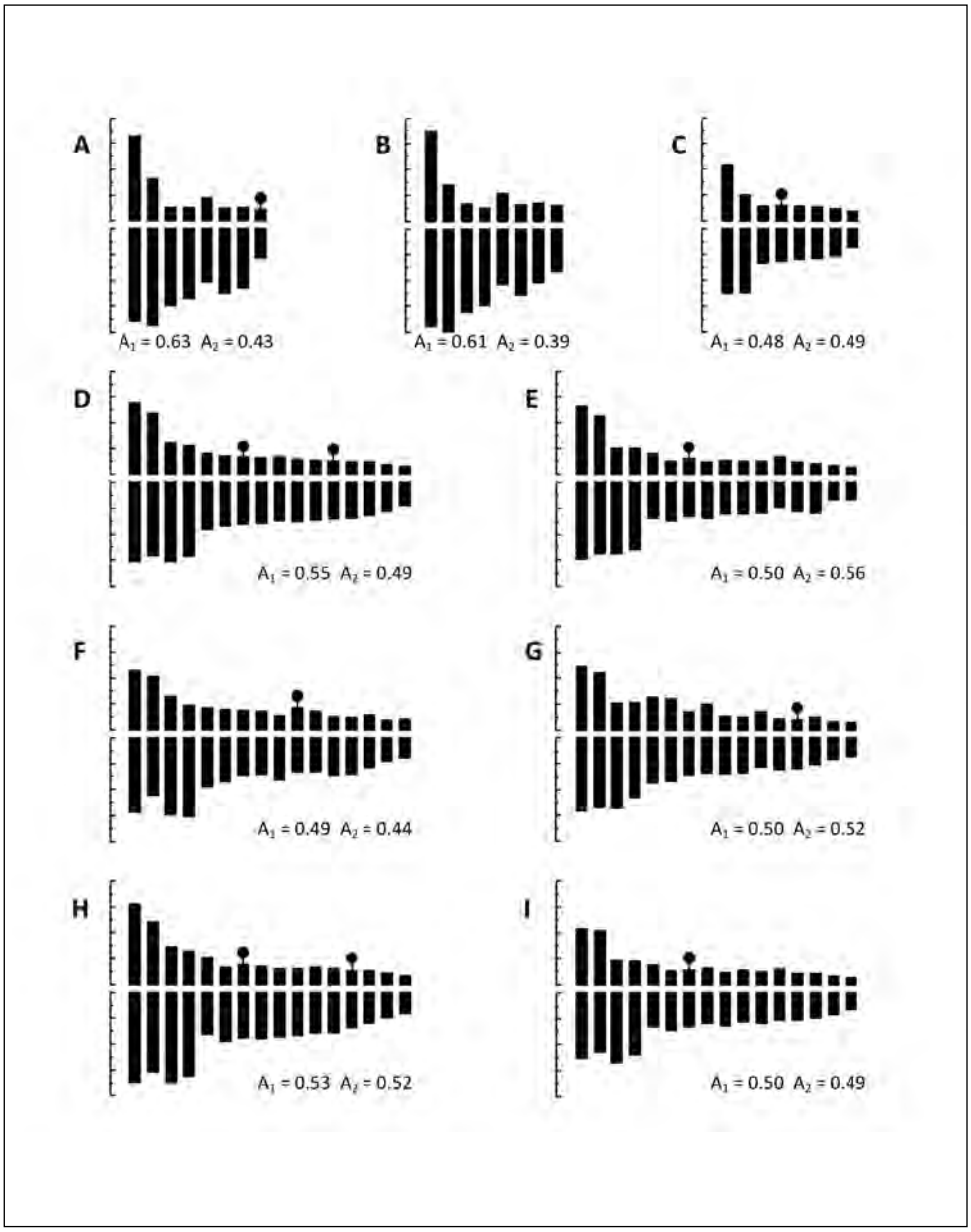

Fig.4. Haploid idiograms obtained by measuring at least 5 good mitotic metaphases, 3 hours after pre-treatment with colchicine 0.05 %. Asymmetry indices A1 and A2 are calculated following Romero (1986). A-B, *A. lycoctonum* subsp. *ranunculifolium*: A, Vall del Nere (Hs: Lleida) & B, Peña Montañesa (Hs: Huesca); C, *A. variegatum* subsp. *pyrenaicum*, Espelunguère (Ga: Pyrénées Atlantiques); D-E, *A. napellus* subsp. *castellanum*: D, Laguna del Marquesado (Hs: Cuenca) & E, Las Honfrias (Hs: Salamanca); F-I, *A. napellus* subsp. *vulgare*: F, Valdegobia (HS: Álava), G, Valle de Ordesa (Hs: Huesca), H, Lago Enol (Hs: Oviedo) & I, Moncayo (Hs: Soria). – Scale bars = 8+8 µm.

— León, Villasecino, meadow near a creek, 42° 57’ 03’’ N 6° 01’ 36’’ W, alt. 1200 m, 17 Jul 1984, *J. Molero & C. Blanché* (BCN 4736).
— Palencia, a creek near Areños, 42° 59’ 57’’ N 4° 29’ 34’’ W, alt. 1130 m, 15 Aug 1985, *C. Blanché & R. Ferrer* (BCN 4741).
— Zamora, Alcorcillo, near Alcañices, alder forest, 41° 42’ 39’’ N 6° 22’ 10’’ W, alt. 600 m, 31 May 1994, *C. Blanché & J. Simon* (BCN).

First absolute records for the six Iberian populations of this taxon, where we obtained the somatic number $2n = 4x = 32$. This result agrees with the counts reported by Seitz (1969) from several populations coming from Germany, Austria and N. France identified as *A. napellus* subsp. *neomontanum* (Wulfen) Gáyer, a non-priority synonym of the same taxon.

1901. *Aconitum napellus* subsp. *vulgare* (DC.) Rouy & Fouc. — $2n = 32$.

Ga: Pyrénées Orientales, Vall d’Eina, orri de baix, grassland near a creek, 42° 26’ 38’’ N 2° 06’ 56’’ E, alt. 1980 m, 18 Jul 1994, *M. Bosch & J. Simon* (BCN 4732).
Hs: Álava, Valdegovia, 42° 50’ 55’’ N 3° 04’ 24’’ W, alt. 600 m, 13 Oct 1985, *B. Fdez. de Betoño* & *J. A. Alejandre* (Alejandre Personal Herbarium). – Fig. 4F.
— Barcelona, Pedraforca, scree, 42° 14’ 13’’ N 1° 42’ 16’’ E, alt. 2300 m, 22 Sept 1985, *C. Blanché* (BCN 4740).
— Girona, Vallter, over Setcases, near ski station, 42° 25’ 30’’ N 2° 15’ 50’’ E, alt. 2000 m, 14 Sept 1983, *J. Molero & A. Rovira* (BCN 4752).
— Huesca, Valle de Ordesa, 42° 38’ 06’’ N 0° 00’ 48’’ W, alt. 1700 m, 23 Jul 1992, *J. Vicens, M. Bosch & J. Simon* (BCN). – Fig. 4G.
— Oviedo, Picos de Europa, Covadonga, Lago Enol, to Mirador del Rey, slits and meadows, 43° 16’ 19’’ N 4° 59’ 15’’ W, alt.1100 m, 2 Jun 1994, *C. Blanché & J. Simon* (BCN). – Figs 2E & 4H.
— Zaragoza, Moncayo, Beratón, ravine slope, on stony and rich in humus ground near to *A. lycoctonum*, 41° 43’ 17’’ N 1° 48’ 18’’ W, alt. 1400 m, 2 Jul 1995, *J. Molero* (BCN). – Figs 2F & 4I.

The obtained number for the seven studied populations is $2n = 4x = 32$ chromosomes (Figs 2E- 2F), in agreement with the numerous previous counts (Bosch & al. 2016). They are the first ones from the Iberian Peninsula. Some reports for *A. napellus* s.l. gave the somatic number $2n = 24$ for this taxon, coming from very old reports (Bosch & al. 2016) or obtained from plants growing in botanical gardens; they probably belong to hybrids, as the example of *A. napellus* x *A. variegatum* cited by Seitz (1969).

We are also giving the haploid idiograms from four Iberian populations (Cantabric Mts, Pyrenees and Iberian System) (Figs 4F to 4I). The idiograms mainly match with the general model of *A. napellus* s.l. karyotypes proposed by Seitz (1969), with slight divergences in arm ratios (particularly pairs IV, V and VI) and distribution of satellites (either in pairs VII, X o XIII). The basic chromosome formula is $2n = 3m + 13m (2m + 14sm) = 16$ chromosomes.

1902. *Aconitum variegatum* L. subsp. *pyrenaicum* Vivant in **Vivant & Delay** — 2*n* = 16.

Ga: Pyrénées Atlantiques, Vallée d'Aspe, Espelunguère, near Ibón de Estanés, megaphorbic communities in limestone foot cliff, 42° 48' 21'' N 0° 35' 15'' W, alt. 1650 m, 6 Oct 1995, *J. Molero, P. Montserrat & L. Villar* (BCN 4754). – Fig. 4C.

Poorly known E Pyrenean endemic, we studied a population located very close to that published by Vivant & Delay (1980), with the same result, 2*n* = 2x = 16 chromosomes.

Chromosome formula is 2*n* = 2m + 14sm = 16 chromosomes. The Fig. 4C shows the idiogram of *A. variegatum* subsp. *pyrenaicum*, with karyotype structure (except for the absence of satellite in pair III of the Pyrenean population) mainly sharing the data given by Seitz (1969) and Seitz & al. (1972) from alpine German and Austrian populations of *A. variegatum* subsp. *variegatum*. All the reports belonging to subsp. *variegatum* (from Central Europe, Alps and Balkans) give 2*n* = 16 (Bosch & al. 2016), although some old counts indicate 2*n* = 24 (Langlet 1927, Delay 1947).

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