

P. Cuccuini, A. Stinca, R. Vallariello & A. Santangelo

The Libyan Collections of vascular plants by Fridiano Cavara: museological importance and holdings of nomenclatural types

Abstract

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The first description of Cavara Libyan collection in NAP is given, highlighting its relevance among the Libyan collection present in Italian Herbaria in terms of specimen number and diversity of genera represented.

The names of 19 taxa belonging to 9 families and described by Cavara, sometimes jointly with Trotter, or Grande, and by other botanists (Pampanini and Hackel) on material collected by Cavara, are here typified. Types previously designated by others are also listed and referenced. A new combination and status novus *Limonium hirtiflorum* (Cavara) Cuccuini is proposed

Key words: historical collections, nomenclature, taxonomy, Flora of Libya.

Introduction

Fridiano Cavara [*Mongardino (Bologna), 1857 – †Naples, 1929] started his research activities with cryptogams, especially fungi, at the University of Pavia (Rodio 1930). When, in 1906, he became Professor at Naples University and Director of the local Botanical Garden, he worked hard to make it a modern research institute fit to lend support to the colonial policy of the Italian Government (Catalano 1958). In 1918 the *Stazione sperimentale per le piante officinali* was founded within the Botanical Garden, dedicated exclusively to the cultivation of and research on medicinal plants. In this context, Cavara was appointed member of the Commission of Study for Tripolitania and Cyrenaica (Libya). In this position he undertook several expeditions to North Africa, alone or together with other colleagues from the University of Naples, such as Alessandro Trotter (1874-1967), Professor of Plant Pathology at the Agronomy Faculty of Portici (Naples), and Loreto Grande (1878-1965), curator of the Herbarium of the Botanical Institute of Naples. They were among the contributors to the project to investigate the flora and vegetation of the two regions of Libya occupied by Italy, Tripolitania and Cyrenaica (Cuccuini & al. 2015). In 1913 Cavara and Trotter investigated Tripolitania (Cavara & Trotter 1914). In

1922 and 1925 Cavara alone and in 1924 together with Grande investigated Cyrenaica (Cavara 1923; Cavara & Grande 1925; Cavara 1928).

In addition to his floristic contributions Cavara published an interesting paper on the Libyan vegetation (Cavara 1926). The herbarium materials of vascular plants from Libyan expeditions by Cavara were stored in *Herbarium Neapolitanum* (NAP) (Santangelo & al. 1995). Several specimens were also sent to Renato Pampanini for study purpose and are now stored in Natural History Museum of Florence University (FI) in Libyan Herbarium, currently included in *Herbarium Centrale Italicum* (Cuccuini & al. 2015). Materials collected with Trotter are stored also in *Herbarium Porticense* (PORUN), in the Trotter collection (De Natale 2007). Of course, there are also numerous collections distributed in several Herbaria related to Libyan cryptogams (Zanffognini 1914; Zodda 1914, 1926).

The aim of this work is to study the Libyan collections of vascular plants by Cavara to highlight their interest within the scope of the typification of taxa described for Libya, to give a first description of the materials stored, and to evaluate the contribution of Cavara's research to the knowledge of Libyan flora.

Materials and methods

The study of the collections focuses on the original materials related to taxa described by Cavara as result of the Libyan expeditions. Due to lack of knowledge about the Cavara Libyan collection preserved in NAP, a survey of all the bundles was carried out to allow the search of original material. Indeed, there is no original index of this collection and specimens still have not been catalogued (Santangelo & al. 1995). The collection consists of 114 bundles that are not originally ordered and numbered (Fig. 1a). A provisional numeration was provided in 2016 to allow a temporary translocation of the collection during the restructuring of the Herbarium room. One hundred and ten bundles are marked with the name "Cirenaica" and 4 with "Tripolitania". Specimens are not mounted and are kept in folders, individually or in more than one (from 1 to 4-5). In this case specimens are frequently separated by newspaper sheets. In other cases, the same method is used to separate more individuals of the same specimen bearing a single original label.

Finding the herbarium specimens is possible thanks to protruding labels, on which the name of the genera preserved in the folders are reported. All genera reported on the protruding labels was recorded to obtain data on represented families (according to Euro+Med 2006-) and genera. Information, for every bundle, about the estimated number of folders, the preservation status, the title of labels (if present), the name of collectors, the date of gathering and presence/absence of specimen arrangement were also recorded. Random sampling on number of specimens per folders was made to give quantitative data about material stored in the collection.

Moreover, the material collected in Tripolitania expedition of 1913 with Trotter stored in PORUN and the material sent to Renato Pampanini in FI were investigated. Therefore about 11,000 specimens were handled in NAP, 26 in PORUN and about 1000 in FI. Materials by Cavara were required to Herbaria K, MI, MSNM, PAD, PAL, PI, RO, TO and Virtual Herbaria were consulted too, in particular BM, F, FH, G, MPU, NY, P, PRC, S, W, WU (abbreviations according to Thiers 2020). To obtain the list of the

new taxa described by Cavara, all the names used by Cavara in the publications regarding Libyan vascular flora (Cavara & Trotter 1914; Cavara 1923; Cavara & Grande 1925; Cavara 1926, 1928) were checked.

Taxonomical and nomenclatural check and update of the obtained list was carried out through main Floras and floristic accounts of North Africa (Täckholm & Täckholm 1941; Maire & Weiller 1939; Maire 1942; Maire & al. 1952-1987; Täckholm & Drar 1950, 1954; Täckholm 1956; Quézel & Santa 1962, 1963; Boulos 1999, 2000, 2002, 2005; Le Floc'h & al. 2010; Dobignard & Chatelain 2010, 2011a, 2011b, 2012, 2013; Domina & El Mokni 2019) as well as through the Flora of Libya (Ali 1977; El Gadi 1977; Alavi 1983; Qaiser & Siddiqi 1984; Erteeb & Sherif 1985; Siddiqi 1985; Siddiqi & Sherif 1988) or taxonomic revisions of some taxa or general inventory (Bor 1948; De Wilde-Duyfjes 1976; Brullo 1978; Brullo & Furnari 1979; Greuter & al. 1984, 1986, 1989; Guittenneau 1990; Wiklund 1992; Greuter 2003; Greuter & Raab-Straube 2008)

The typification was carried out according to the International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) (Turland & al. 2018, hereafter ICN).

Organization of the herbarium collections

The Cavara Libyan collection in *Herbarium Neapolitanum* (NAP) includes more than 6,850 folders, for a total estimated number of about 10,700 specimens.

The overall collection's conservation status is mediocre but, apart from few exceptions, it is enough to allow the analysis of morphological characters of the specimens.

The carried-out survey of the collection showed that the collection never had a definitive arrangement. There are no differences among bundles named in different ways. All the bundles store specimens gathered in the different expeditions (*Missione agrologica per lo studio della Tripolitania*; *Missione scientifica in Cirenaica*), in addition to specimens received from other Institutions (*Flora Libyca exsiccata - Beguinot & Vaccari*). Together with specimens labelled with official label of the expedition or holding organization (Figs. 1b, 1c), several specimens with field labels are present (Figs. 1d, 1e).

Specimens were collected by Cavara, but also by Grande, Trotter, and by other contributors (e.g., Peglion, A. Maugini, H. Scaetta), mainly in the years corresponding to Cavara's expeditions (1913, 1922, 1924, 1925). Only few specimens were revised by other botanists, and among those Pampanini was the most represented.

The species names are not always reported on labels, but specimens are grouped based on genera and family. Frequently genera and families are arranged in taxonomic order in the bundles, but specimens of the same family and genera are also present in different bundles, clearly collected in different periods and localities. During the investigation a list, albeit provisional, of the genera preserved in Cavara Libyan collection was made (Electronic Supplementary File 1). Vascular plants are well represented, with a clear dominance of angiosperms families (88) compared to ferns (3) and gymnosperms (3). Two folders of Algae are also present, related to *Codium* and *Chara*, the latter at the time included in vascular cryptogams (Cuccuini 1997; Khan & Sarma 1984). Most represented families are *Asteraceae* (65 genera), *Poaceae* (52), *Fabaceae* (31), *Brassicaceae* (29) and *Apiaceae* (28).

A small part of specimens collected by Cavara is stored in the *Herbarium Porticense* (PORUN) which is part of the Botanical Museum "Orazio Comes" (De Natale 2007) at the Museum Center "Museums of Agricultural Sciences" of the University of Naples Federico



Fig. 1. a) Bundle of "Cavara Cirenaica" collection in NAP. The protruding labels with names of the genera are visible on the front; b) Institutional label in Cavara Libyan Collection in NAP, *Missione Scientifica in Cirenaica* (expedition in 1924, together with Loreto Grande) Cavara's handwriting; c) Cavara Libyan Collection in NAP, *Missione Agrologica per lo studio della Tripolitania* (expedition in 1913, together with Alessandro Trotter), Trotter's handwriting; d) Field label in Cavara Libyan Collection in NAP, Cavara's handwriting; e) Cavara Libyan Collection in NAP, Grande's handwriting.

II. The *exsiccata* are included in the Tripolitania Phanerogamic collection by Trotter, which is currently organized in 33 bundles with over 2300 sheets of mounted and accessioned plants arranged alphabetically by family (De Natale 2007; De Natale & Pollio 2012). Genera and infrageneric taxa are alphabetically ordered within families. However, there is no detailed and computerized catalogue for this collection. On each sheet there are one or more specimens of the same species collected in different locations. Each specimen has the original label handwritten by Trotter. In addition, almost all labels show the following printed words “*Missione agrologica per lo studio della Tripolitania*”.

As far as we know, only one official accession of Libyan materials from Neapolitan botanists is present in FI. It regards 40 specimens by Trotter, collected during the expedition in Tripolitania in 1914 (Trotter 1915). No records exist regarding materials sent directly by Cavara or Grande, despite the well documented working relationship with Pampanini (Cuccuini & al. 2015). A search for original material by Cavara, Cavara and Trotter or Cavara and Grande has been done in FI-HCI in ‘Africa’ and ‘Africa-Libya’ folders, if present, or generic ‘Foreign’ folders.

Catalogue

Hereafter all the taxa described by Cavara and other authors on material collected by him are reported. They are grouped per family and arranged alphabetically. The names of species and infraspecific taxa inside the families are arranged in alphabetical order too. Moreover, even some specimens related to 3 invalidly published names and 2 unpublished names are presented. The original material and nomenclatural types of the taxa are selected. If they have already been typified, bibliographical reference is given.

Legend of format. -

Geographical data: Cyrenaica, Tripolitania are shown in full only once for each taxon “Type” and in “Other original material”, and subsequently, at times, abbreviated as follows: Tripolitania = T.; Cyrenaica = C.

Herbarium: according to Thiers (2020) at the end of the entry, which may or may not include a bar code.

The format of each record is arranged under 5 fields (if all present):

New taxon: only the name of the new taxon is reported, without the name of the field. For the infraspecific taxa only the name of the Author of last epithet is given.

Accepted name (=): taxonomical and/or nomenclatural updating.

Type: selected type or Author of previous typification and related bibliographic reference.

Other original materials: other specimens (syntypes) gathered in localities corresponding with those reported in the protologues, kept in all consulted Herbaria.

Note: any nomenclatural, taxonomic or museological notes.

Alliaceae

Allium ampeloprasum var. *gracile* (‘*gracilis*’) Cavara (1928: 44) = ***Allium ampeloprasum*** L. (1773: 294) subsp ***ampeloprasum***. **Type:** Cirenaica: nei seminati a Guarscia, 4/04/1922, Cavara NAP (lectotype designated here). **Note:** De Wilde-Duyfjes (1976:

65) designated a different Type: "Libya, Cyrenaica, Uadi Derna, Bu Msafer, Cavara, s.n. (not seen)"; but this is not a specimen but refers to a locality based on Cavara's field notes, and has no standing.

Asteraceae

Carduncellus eriocephalus var. *glaucescens* Cavara, Cavara, (1928: 52) = *Carthamus eriocephalus* (Boiss.) Greuter, (2003: 53). **Type:** Cirenaica: Dune marine a nord della ridotta Tilgher (Agedabia), 28/04/1925, Cavara NAP (lectotype designated here); FI (FI003404 isolectotype).

Carduncellus eriocephalus var. *leucanthus* Cavara & Trotter, (1914: 153) = *Carthamus eriocephalus* (Boiss.) Greuter, (2003: 53). **Type:** Tripolitania: colline di Azizia (M. Bathus), F. Cavara NAP (lectotype designated here). **Other original material:** Tripolitania: pianura sotto M. Bathus, F. Cavara, NAP, PI.

Carlina sicula var. *libyca* f. *longebracteata* Cavara (1928: 51) = *Carlina sicula* subsp. *mareotica* (Asch. & Schweinf.) Greuter, (2003: 52). **Type:** Cirenaica: Bir Sebil, nel gretto dell'Uadi, 21/04/1922, Cavara, NAP, lectotype designated by Meusel & Kästner (1994: 264). **Other original material:** C.: Uadi Bent (Derna), aprile 1922, Cavara, NAP.

Centaurea alexandrina f. *basiantha* Cavara (1928: 52) = *Centaurea alexandrina* Delile (1813: 280, t. 49, f. 3). **Type:** Cirenaica: Piana di Casr Gebeila sulla carovaniera Merg-Gerdes, 14/04/1925, Cavara, NAP (lectotype designated here); FI (FI003389 isolectotype). **Other original material:** pascoli di El Abiar, 25/03/1924, Cavara & Grande, NAP (2 specimens). **Note:** the lectotype comprises one folder, in which are present 2 individuals with only one institutional label.

Centaurea alexandrina f. *magnispina* Cavara (1928: 52) = *Centaurea alexandrina* Delile (1813: 280, t. 49, f. 3.). **Type:** Cirenaica: Uadi Derna, aprile 1922, Cavara, NAP (lectotype designated here). **Other original material:** Costoni dell'Uadi Derna, aprile 1922, Cavara, NAP. **Note:** the lectotype consists of two individuals separated by newspaper sheet with only one institutional label by Cavara.

Centaurea bimorpha f. *integrifolia* Cavara, (sub *C. dimorpha*) (1928: 52.) = *Centaurea bimorpha* Viv. (1824: 58. t. 24) **Type:** Cirenaica: Bengasi alla Berca, marzo 1922, Cavara, NAP (lectotype designated here). **Other original material:** Bengasi, al cimitero arabo, marzo 1922, Cavara, NAP; Bengasi, alla Giuliana, 27/3/1922, Cavara, NAP.

Centaurea cyrenaica var. *cavarae* Grande (1928: 52) = *Centaurea cyrenaica* Bég. & Vaccari (1912: 3) **Type:** Cirenaica: lungo la camionabile Merg-Sidi Cheila nei pratelli, 16/03/1922, Cavara NAP (lectotype designated here). **Other original material:** Uadi Derna, 8/4/1922, Cavara, NAP; rupi sull'Uadi Derna, 8/04/1922, Cavara, FI. **Note:** Grande recognized the new taxon after its gathering. He added the name of the new varietas on the original labels by Cavara and put in the sheet the labels with the new name and its description. That information (in *schedulae herbarii libyci* by Grande) is published in Cavara (1928). The lectotype consists of 3 individuals put together in one folder.

Cynara cardunculus var. *elata* Cavara (1923:12-13) = *Cynara cyrenaica* Maire & Weiller (1939: 286). **Type:** Cirenaica: sulle rupi dell'Uadi Sambar (Cirene), aprile 1922, Cavara, NAP, sh. 1, (lectotype designated here); isolectotype, sh. 2, NAP. **Note:** recent floras include it in *Cynara cardunculus* subsp. *cardunculus* (Dobignard & Chatelain 2011, 2: 254). Wiklund (1992) in her revision of genus *Cynara* assumed that Cavara's

taxa could be referred to the endemic *Cynara cyrenaica* based on the description and provenance of specimens reported in Cavara (1923), even without seeing the type. The lectotype is in a poor state of preservation, but the diagnostic characters in the protologue are recognizable. In fact, both the basal leaves and the bracts of the flower heads are present (the upper ones assembled in a small envelope conserved on the sheet). Besides the adiachally green leaves and small capitula, the involucral bracts allow to refer the specimen to *C. cyrenaica*. The specimen “Uadi Derna, 1922, Cavara”, cited in the protologue, *non vidi*.

Caprifoliaceae

Lonicera persica var. *occidentalis* Pamp. (1928: 581-582) = *Lonicera nummulariifolia* subsp. *occidentalis* (Pamp.) Brullo & Furnari (1979: 171). **Type:** Cirenaica, Cirene: Mattan Borgu, nei boschetti presso la Ridotta, 04/1922, Cavara (sub *L. biflora* Desf.), (lectotype, FI, by Cuccuini & al. 2015: 62). Isolectotype NAP. **Other original material:** C.: Derna, Uadi Chersa, nei boschetti della macchia, 04/1922, Cavara, NAP, FI; C.: Uadi El Kuf, sulla via nuova tra Merg e Messa, 24/04/1922, Cavara, NAP; C: Nei pressi dell’Uadi Surrak, 06/1919, Maugini, FI; Cirene: Uadi El Kuf, 24/04/1922, Maugini, FI; C.: Cirene: Ghegab, 03/1923, Casilli, FI.

Cyperaceae

Carex divisa f. *pumila* Cavara (1928: 43) = *Carex divisa* Huds., (1762: 348) **Type:** Cirenaica: Cirene ne’ prati umidi, 7/4/22, Cavara, NAP (lectotype designated here). **Other original material:** siti erbosi secchi a Gubba, 13/3/1924, Cavara & L. Grande, NAP; in herbidis siccis! presso la macchia di Gubba, 15/3/1924, Cavara & L. Grande, NAP.

Fabaceae

Argyrolobium uniflorum f. *compacta* Cavara (1928: 45) = *Argyrolobium uniflorum* (Decne.) Jaub. & Spach, (1843: 45). **Type:** Cirenaica: dune a Nord-ovest di Agedabia, aprile 1925, Cavara, NAP (lectotype designated here). **Note:** specimen: sebka di Zuetina, 1925, Cavara, *non vidi*.

Dorycnium rectum var. *glaber* Cavara & Trotter (1914: 147) = *Dorycnium rectum* (L.) Ser. De Candolle (1825: 208). **Type:** Tripolitania: lungo il vallone di Ain Mimuna presso Casr Garian, 17/5/1913, Trotter, PORUN (lectotype designated here). **Note:** the lectotype consists of several stems, severely damaged on the upper parts. Diagnostic characters are however clearly visible.

Lathyrus cicera f. *contracta* Cavara (1928: 47) = *Lathyrus cicera* L., (1753: 730). **Type:** Cirenaica: nei pascoli di el Abiar, 25/3/1924, Cavara & Grande, (sub. *L. cicera*), NAP (lectotype designated here). **Other original material:** scarso ad El-Abiar, 25 /3/1924, Cavara & Grande, NAP. **Note:** In the protologue the date of gathering is 1922, but no specimens collected in El-Abiar during the expedition of 1922 are present. Instead, all the specimens are collected in the expedition of 1924 with Grande, as documented both by institutional label (Cavara’s handwriting) and the field’s ones (Grande’s handwriting). Moreover, the diagnostic characters, that perfectly agree with the protologue, are written in pencil on the institutional label by Cavara. Therefore, we suppose that the published date is reported for mistake, and we select the specimen with institutional

label as lectotype.

Lupinus hirsutus var. *micranthus* f. *leucotrichus* Cavara (1928: 45) = ***Lupinus micranthus*** Guss. (1828: 400). **Type:** Cirenaica: Bassa macchia. Merg sulla strada per Tolmetta, 11/04/1925, F. Cavara, NAP (lectotype designated here).

Geraniaceae

Erodium hirtum var. *cyrenaicum* Pamp. (1931: 295) = ***Erodium cyrenaicum*** (Pamp.) Guitt. (1990: 76). **Type:** [Libia], Cirenaica, Derna: primo gradino dell'altipiano e al sommo, gennaio-febbraio 1912, leg. Longa (FI, lectotype FI003779, by Cuccuini & Nepi in Boccone 27(2): 88. 2015). Isolectotype FI, (FI003778) (the 2nd specimen kept on the top of sheet with lectotype). **Other original materials:** Cirenaica: Derna al faro, 18/3/1924, F. Cavara & L. Grande, NAP; Uadi Bent, 1922, Cavara. *non vidi*.

Lamiaceae

Thymus capitatus f. *albiflorus* Cavara & Trotter (1914: 151) = ***Coridothymus capitatus*** (L.) Reichenb. f. (1857: 161). **Type:** Tripolitania: rupestri presso Fondouc Ngasa lungo l'Uadi, 8/05/1913, "flore albo", Trotter, PORUN (lectotype designated here). Isolectotype PORUN.

Plumbaginaceae

Statice pruinosa var. *hirtiflora* Cavara (1928: 49) ≡ ***Limonium hirtiflorum*** (Cavara) Cuccuini comb. et stat. nov. **Type:** Cirenaica: Costoni aridi di Porto Bardia, 21/02/1924, F. Cavara, FI (lectotype designated by G. Domina in Cuccuini & al. (2016) as *S. pruinosa* var. *hirtiflora* Cavara & Grande), NAP, Isolectotypes (4 specimens). **Note:** the taxonomic position of this taxon is critical (see Brullo 1978; Qaiser & Siddiqi, 1984; Dobignard & Chatelain 2013). Nevertheless, the characters considered by Qaiser & Siddiqi (1984), the only ones among those indicated by the various authors that are constantly present (short hairiness of the bracts and of the calyx), together with the distribution and ecology of the taxon are different from those of the typical specie. Therefore the new name and combination are here proposed.

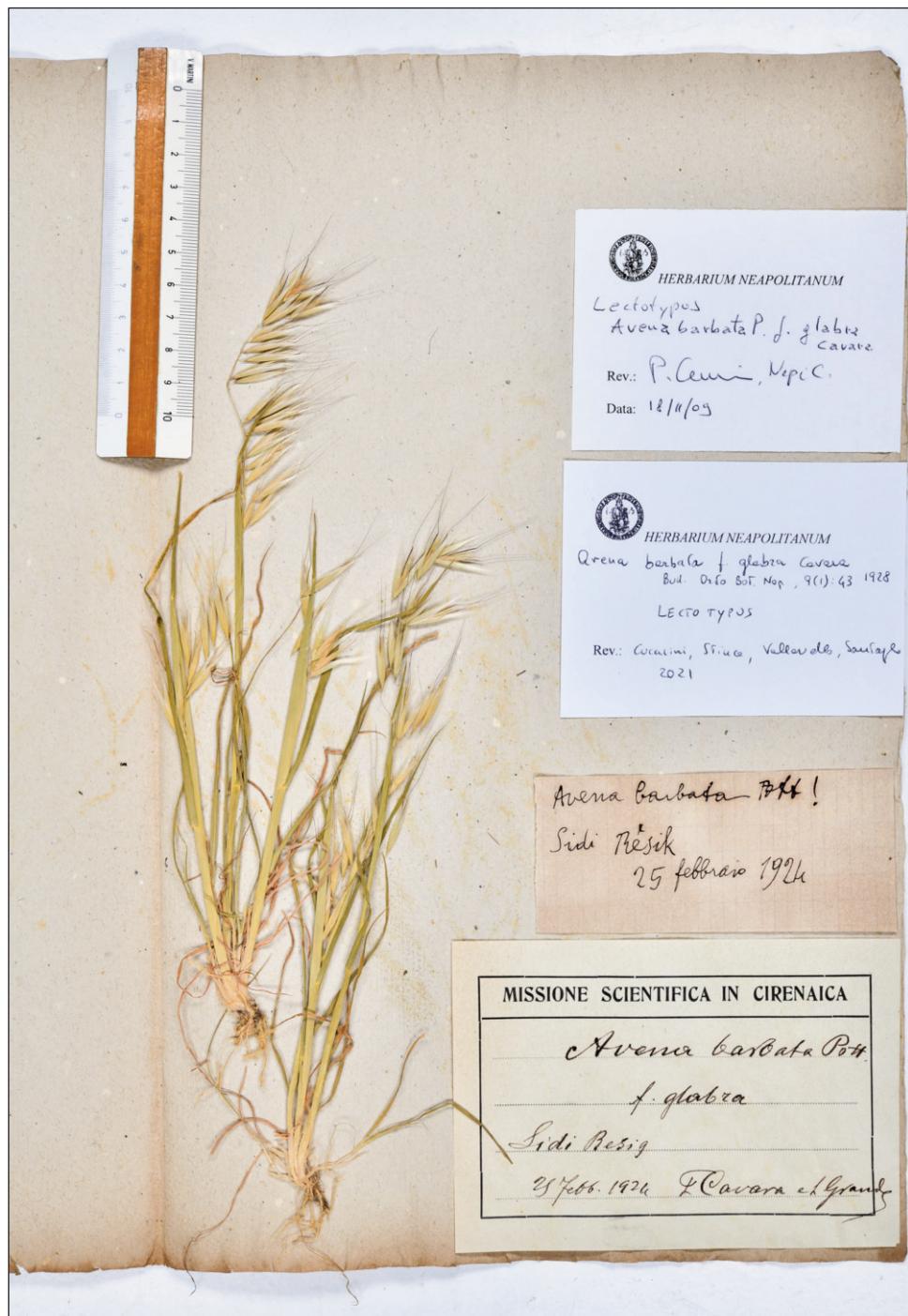
Poaceae

Avena barbata f. *glabra* Cavara (1928: 43) = ***Avena barbata*** Pott ex Link, (1799: 315) [in Ref. see Link]. **Type:** Cirenaica: Sidi Resig, 25/02/1924, (Marmarica), Cavara e Grande, NAP (lectotype designated here, Fig. 2).

Catapodium tubulosum f. *simplex* Cavara & Trotter (1914: 142) = ***Castellia tuberculosa*** (Moris) Bor (1948: 90). **Type:** Tripolitania: presso Uadi Ngasa (Homs), 3/04/1913, Trotter, PORUN, (lectotype designated here, the plant on the top left of the sheet). **Note:** The lectotype is mounted on the same sheet with two samples of the typical form.

Cutandia divaricata var. *laxiflora* Hackel in litt., Cavara & Trotter (1914: 142) = ***Cutandia divaricata*** (Desf.) Benth. (1881: 118). **Type:** Tripolitania: steppa presso l'Uadi el Madernel Tarhouna, 13/05/1913, Trotter, PORUN (lectotype designated here, plant on the left of the sheet).

Phalaris minor var. *integra* f. *phaeosperma* Cavara (1928: 42) = ***Phalaris minor*** Retz., (1783: iii. 8). **Type:** Cirenaica: nei coltivati alla fattoria Zorda (Merg), 11/04/1925,

Fig. 2. Lectotype of *Avena barbata* f. *glabra* Cavara here designated.

Cavara, NAP (lectotype designated here). **Other original material:** Cirenaica: Piana di Casr Gebeila presso Got es Sas, 13/04/1925, leg. Cavara, NAP; sulla strada di Got es Sas, 13/04/1925, leg. Cavara, NAP.

Trisetum macrochaetum var. *pilosum* Cavara (1928: 43) = *Trisetaria macrochaeta* (Boiss) Maire, (1942: 92). **Type:** Cirenaica: Piana di Feteja (Derna), 19/03/ 1924, Cavara e Grande, “*differt a Tris. macrochaetum, cui affinis, glumellis pilosis, ac setulis crebris farcto*”, NAP (lectotype designated here).

Invalidly published names

Atractylis prolifera var. *albiflora* Cavara, Bull. Orto Bot. Regia Univ. Napoli, (1928: 51).
Nomen nudum.

Cirsium syriacum var. *albiflorum* Cavara, Bull. Orto Bot. Regia Univ. Napoli, (1928: 51).
Nomen nudum.

Note: these names invalidly published by Cavara were used by Pampanini (1931), who correctly indicated that these taxa were merely a *nomen nudum* without adding any description. Also today these names, are wrongly listed as validly published taxa in several floras (Dobignard & Chatelain 2011a; Alavi 1983).

Hedypnois polymorpha var. *tubaeformis* f. *intermedia* Cavara, Bocconeia 27(2): 51. 2015.
Nomen inval.

Unpublished material

“*Hedypnois polymorpha* var. *tubaeformis* f. *nana* Cavara” (in herb. NAP, Sched.)
 “*Hedypnois polymorpha* var. *tubaeformis* f. *acaulis* Cavara” (in herb. NAP., Sched.)

Conclusions

This research has highlighted the structure of the Libyan collection by Fridiano Cavara kept in the *Herbarium Neapolitanum* (NAP). It is probably the second Libyan collection for historic importance, after FI, among the Italian Herbaria.

The survey conducted in the main Italian and foreign Herbaria clearly show the lack of distribution of Libyan phanerogamic collections in the face of a large presence of other collections by Cavara related to Fungi or other Italian collections. This is probably because Cavara studied the Libyan collection at the end of his career. He died in 1929, one year after the last contribution related to his research on Libyan Flora (Cavara 1928).

Nevertheless, these collections were very fruitful from the scientific point of view as attested by both bibliographical research and this study. The materials from Cyrenaica collected by Cavara resulted in the publication of several interesting records for the Libyan flora: 126 taxa (Fungi, Bryophyte, Lichen, Phanerogams) new for Cyrenaica and Libya and 26 new described taxa (7 Fungi, 1 Lichen, 18 Phanerogams), as reported by Pampanini (1931). The expedition to Tripolitania led to publication of a list of 161 taxa (Cavara & Trotter 1914), among which 72 new for Libyan flora and 4 for Africa. Five new taxa were described thanks to this expedition.

Considering only the new phanerogamic taxa in Cavara's and Cavara and Trotter's collections, we listed them alphabetically in a catalogue that includes all the specimens stored in the Herbaria NAP, PORUN, FI, PI.

The catalogue includes 51 specimens of original collections used by Cavara and other authors to study 23 new taxa. In the present work nineteen names have been typified, while the reference of the typification for the others is reported. In more detail, the original collection encompasses 22 lectotypes, 9 isolectotypes, 20 other materials of original collection. The herbaria in which they are stored are reported in Table 1. Moreover, 3 invalidly published names and 2 unpublished (*herbarium sched.*) names are listed, the latter to make them available for citations in further research.

Among the authors of the taxa we find Cavara, in some cases together with Trotter, Grande, and also the scientists who received the Libyan material by Cavara for study purpose, like Pampanini or Hackel. Regarding the collaboration with Trotter, it is interesting to note that the two botanists, while participating in the same expedition and publishing together the result of their research, kept their collections separate, as clearly reported in the published floristic list (Cavara & Trotter 1914). Only 7-8% of the specimens were collected by both botanists. Very different was the collaboration with Grande in the expedition of 1924, during which 75% of the specimens were collected by the two botanists (Cavara & Grande 1925).

From the results of this study, we can argue that Cavara was certainly a passionate researcher of the Libyan flora but, although he was a pioneer among the Italian scholars, he could not devote as much time as he would have liked to this topic. It is a fact, however, that both at the time and today the main Italian researchers of North African flora such as Pampanini and Béguinot (Pampanini 1914, 1931; Béguinot & Vaccari 1912a, 1912b, 1913a, 1913b, 1914) considered almost all taxa named by him, recognizing their validity, sometimes recombining them in various ways. Among the foreign scholars, it was certainly Maire with his collaborators (Maire & al. 1952-1987) to mention the taxa he described - more than the half - often recognizing their validity. This is the case of *Lupinus hirsutus* var. *micranthus* f. *leucotrichus* Cavara, recognised as valid in another form (*status novus*) by Quézel (Maire & Quézel 1987), or *Statice pruinosa* var. *hirtiflora* Cavara, moved to

Table 1. Different type material of new taxa in Libyan collections by Cavara kept in the consulted Herbaria.

Herbaria	Lectotypes no.	Isolectotypes no.	Other original exsiccata no.
NAP	16	6	17
PORUN	4	1	-
FI	2	2	2
PI	-	-	1

genus *Limonium*, reported in one of the last Egyptian Flora (Täckholm 1956) and in the only Flora of Lybia (Qaiser & Siddichi 1984) and as *Limonium hirtiflorum* (Cavara) Cuccuini comb. et stat. nov. in the present study. Moreover, the taxonomic revision of *Cynara cardunculus* var. *elata* in this work allowed the correct placement of the taxon, confirming the proposal by Wiklund (1992). Finally, it is useful to remember the positive opinion on Cavara's work by Arabian scholars (Saaed & al. 2019) who recently have attempted a scientific assessment of the contribution of various botanists to the study of Libyan flora and vegetation. They cite "The Flora of Libya" (Cavara 1926) as the first attempt of approaching the definition of the Libyan vegetation and underline the importance of the collections by Cavara. The present research highlights the relevance of the Libyan collection of Cavara in NAP, but it represents only a first contribution to its knowledge. Only a complete and accurate study of the collection will allow its definitive reorganization and revaluation.

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Addresses of the authors:

Piero Cuccuini¹, Annalisa Santangelo^{2*}, Roberta Vallariello² & Adriano Stinca³,
¹The University Museum System, Natural History Museum, Botany, Via G. La Pira
4, 50125 Firenze, Italy. Email: piero.cuccuini@unifi.it

²Department of Biology, University of Naples Federico II, Via Foria 223, 80139,
Naples, Italy. E-mails: santange@unina.it; roberta.vallariello@unina.it

³Department of Environmental Biological and Pharmaceutical Sciences and
Technologies, University of Campania Luigi Vanvitelli, Via A. Vivaldi, 43, 81100
Caserta, Italy. E-mail: adriano.stinca@unicampania.it

*Corresponding author.

