

NEW SPECIES OF *ALLIUM* SECT. MELANOCROMMYUM FROM THE EASTERN MEDITERRANEAN

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SUMMARY

Re-study of the molecular relationships in *Allium* sect. *Melanocrommyum* with a broader taxonomic sample confirms the results of Fritsch et al. (2010) and gives additional evidence that *Allium nigrum* L. s. lat. and *A. orientale* Boiss. s. lat. contain several only distantly related taxa. Three morphologically distinct entities occurring in Israel and adjacent territories are described as new species: *A. basalticum* Fragman & R.M. Fritsch formerly included in *A. nigrum*, *A. meronense* Fragman & R.M. Fritsch formerly treated as *A. asclepiadeum* Bornm., and *A. israeliticum* Fragman & R.M. Fritsch formerly subsumed under *A. orientale*. For nomenclatorial reasons, an epitype of *A. orientale* is designated. A distribution map and photographs of the new species are also presented.

INTRODUCTION

The botanical exploration of Near East dates back to the earliest phases of modern plant taxonomy. This area was repeatedly visited in the 19th century, and a large number of species were already mentioned in “Flora Orientalis” (Boissier 1882). These activities continued in the first decades of 20th century, more regional floras appeared, and a rather large “basal stock” of plant species became generally accepted as being distributed over the whole geographic area and beyond. In “Flora Palaestina” Kollmann (1986) has reviewed the knowledge on alliums of that time, among them were *A. nigrum* L. and *A. orientale* Boiss.

Kollmann's work was a breakthrough in understanding this exciting genus in Israel and its surroundings. However, recent molecular analyses presented evidence that some polymorphous *Allium* species (among them the above mentioned species) consist of infraspecific groups characterized by different phylogenetic history (Gurushidze et al. 2008, Fritsch et al. 2010). These taxa were monitored in the past years at the Jerusalem Botanical Gardens and distinct new morphological and ecological data supported the molecular ones. Therefore these groups may not constitute one natural species but represent different species. Investigation of additional material resulted in still more convincing and well separated groups often with very good bootstrap support (Gurushidze, unpubl., Fig. 1). Three well recognizable entities from Israel and its surroundings will be described below.

1. *ALLIUM NIGRUM* ALLIANCE

Allium nigrum L. and *A. multibulbosum* Jacq. were regarded as variants of one variable and widely distributed species over a long time. Only neotypification of *A. nigrum* to Cypriot plants (Seisums 1998, Brummitt 2000) set a clear decision about this taxon in a strict sense. Plants of the type location (Cyprus: 1-2 km NE of Lyso) are characterized by rose oblong tepals, rose filaments, and distinctly tri-sulcate, strongly coarse, dull, permanently green ovaries. Plants of *A. multibulbosum* own white to pinkish-carmine, oblong tepals, filaments of the same color as tepals, but rounded, narrowly hexasulcate, smooth and commonly glossy ovaries most often initially black and later becoming green (but some accessions are having permanently green ovaries). These taxa morphologically circumscribed above belong to well separated molecular groups (Fig. 1). Plants growing in the basalts of the Eastern Galilee and the Golan Heights of Israel are most similar to *A. multibulbosum* but differ by elliptic or obovate, white tepals, purplish suffused filaments, and purplish-black ovaries having six furrows (alternating wide and narrow ones, Figs. 3, 4). Formally they could be separated as infraspecific taxon of *A. multibulbosum*, because the morphological differences to *A. nigrum* s. str. are stronger. The latter owns unicolored, long-elliptic, pink tepals and permanently green, very coarse ovaries. However, the discussed plants from the basalts belong to another molecular clade. They form a distinct molecular group with *A. telavivense* Eig / *A. aschersonianum* Barbey as

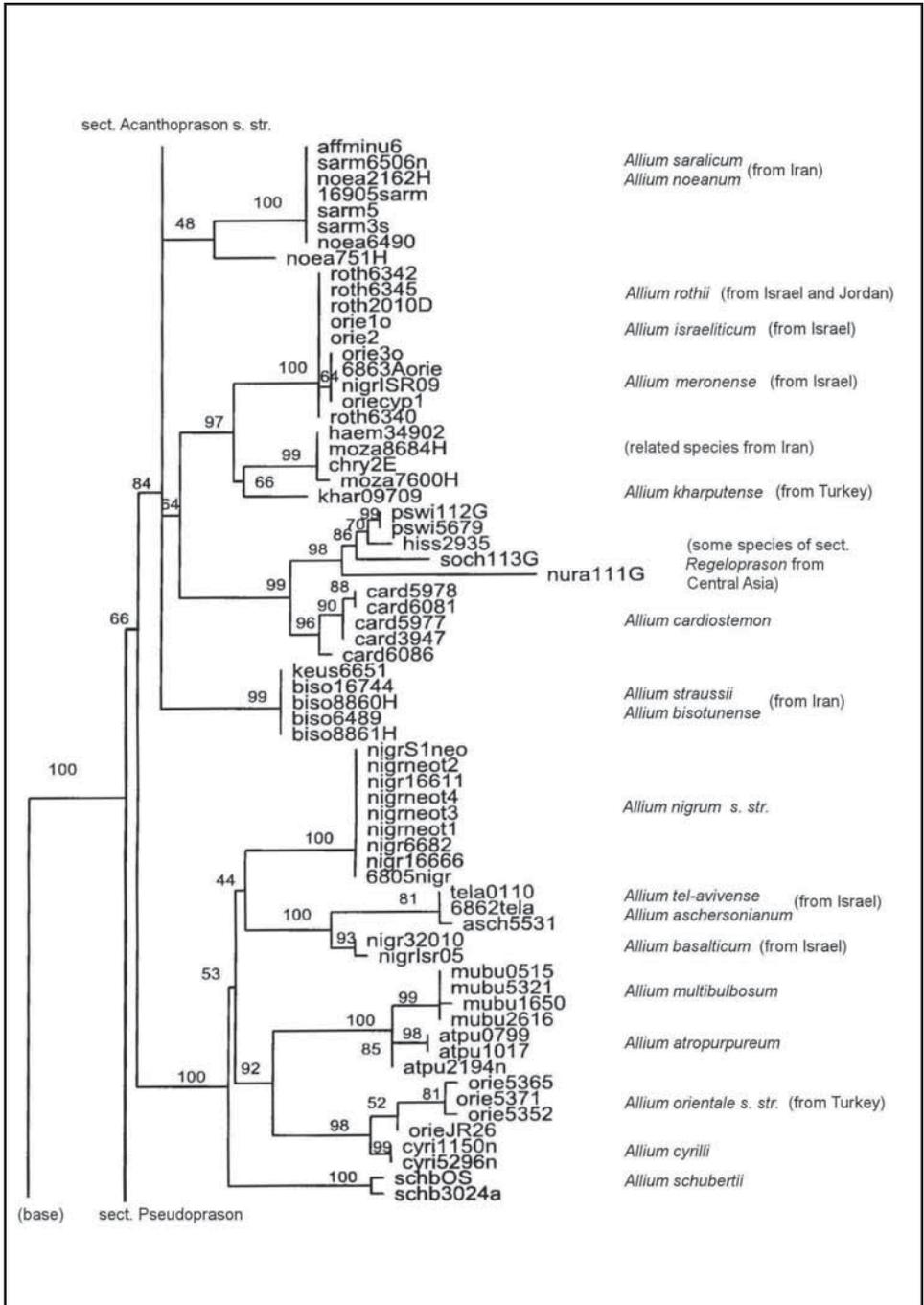


Fig. 1. RAxML dendrogram with bootstrap data of sect. *Melanocrommyum* (section of an unpublished analysis of Internal Transcribed Spacer (ITS) sequences, for inclusion of some taxa of sect. *Regeloprason* and *A. schubertii* see discussion in Fritsch et al. 2010).

sister, which is sister to *A. nigrum* s. str. and still more distantly positioned from *A. multibulosum* (Fig. 1).

Another sister of the discussed plants from the basalts is the only investigated accession of *A. dumetorum* Feinbr. & Szel. (Gurushidze unpubl., not shown in Fig. 1), occurring in chalky soil only in Nahal Yagur at the northern Mt. Carmel in Israel. The flowers of this taxon (Fig. 4) are so similar to those of *A. nigrum* that it has been treated as synonym of *A. nigrum* in “Flora Palaestina” (Kollmann, 1986). Nevertheless, our preliminary data support to accept *A. dumetorum* as a separate species, probably a sibling of *A. nigrum* s. str. These remarkable morphological differences among molecular sisters strongly support to recognize also the discussed plants from the basalts of the eastern Galilee and Golan Heights as a separate species newly described here:

Allium basalticum Fragman & R.M. Fritsch, **sp. nov.**

- *Allium nigrum* auct. Israel., p.p., Fig. 2.

Holotype: Israel. Golan Heights, Gamla. 04.1977 leg. Y. Kaplan (HUI no. 6206)

Diagnosis: Differt ab *Allio multibuloso* tepalis albis ellipticis vel obovatis, filamentis purpureo-suffusis et ovariis angulosis alternatim anguste et late hexasulcatis.

Description: Bulbs 2-3cm long and 2.5-4cm in diameter, 15-30cm deep, depressed ovate, outer tunics grayish. Scape straight, cylindrical, 25-60cm long, 6-8mm in diameter, smooth, dull green, glaucous bloom. Leaves 3-5, lanceolate, 30-50cm long, (1) 2-5cm wide at about $\frac{1}{4}$ of length, initially rather stiff upright, later more or less recurved, tapering into a long narrowly-triangular tip, margin smooth; green, with glaucous bloom. Spathe very shortly beaked, splitting into 3-5 deflexed valves, during anthesis valves \pm stellate, scarious. Inflorescences broadly fasciculate to semi-globose, dense, many-flowered, 6-10cm in diameter; pedicels straight, green, rather thick. Flowers bowl-shaped star-like. Tepals elliptic to obovate, concave, 6-8mm long, 4.5-6mm wide, basally very shortly connate one among another and with filaments, obtuse; white with conspicuous green median vein. Filaments narrowly triangular, somewhat fleshy, $\frac{1}{2}$ - $\frac{2}{3}$ as long as tepals, inner filaments 1.5 times wider than outer ones, obliquely forward directed; basally pinkish-carmine fading toward the tip. Anthers oblong with spreading lower end, 1.5-2mm long, pale yellow. Ovaries depressed-globose six-angled (with 3 wide and 3 narrow furrows), 3-4mm

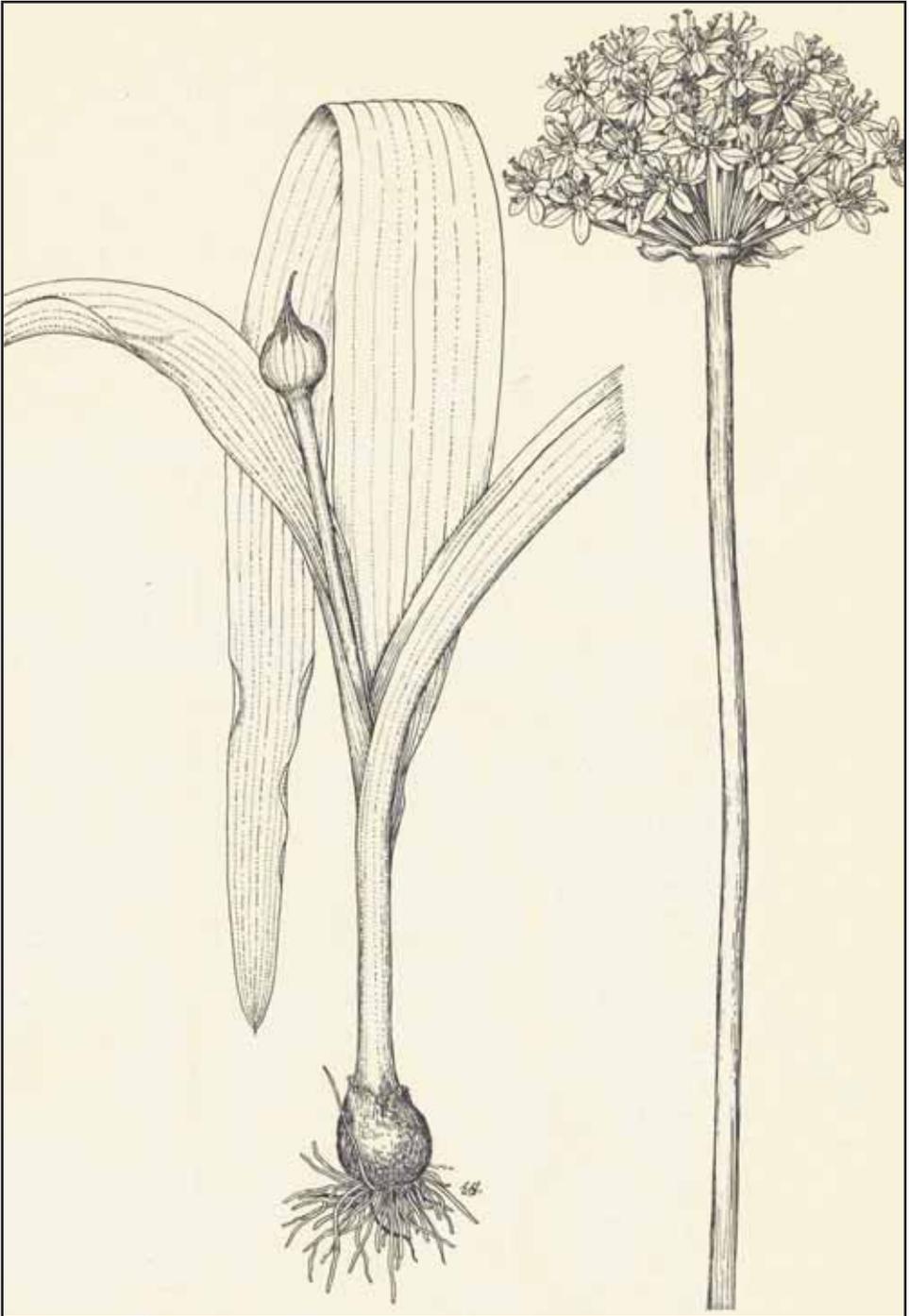


Fig. 2. Drawing of *A. basalticum* (Naomi Feinbrun-Dothan, *Flora Palaestina IV*, Plates, Jerusalem; The Israeli Academy of Sciences and Humanities, 1986, plate 131).



Fig. 3. Inflorescence of *A. basalticum*, plant cultivated in the Jerusalem Botanical Gardens.



Fig. 4. Inflorescence of *A. dumetorum*, plant from the type location – N. Israel, Mt. Carmel, N.Yagur. (photograph by Y. Marta)



Fig. 5. Group of *A. basalticum*, plants cultivated in the Jerusalem Botanical Gardens.

long, 4-5mm in diameter, surface smooth, glossy; initially blackish purple, later changing to green. Style narrowly conical, 2-4mm long, pinkish; stigma dot-like, whitish. Capsule three-sided conical, c. 8mm long and in diameter, glossy.

Illustration: Plate 13 C as *A. nigrum*, in: Allium Crop Science: Recent Advances, eds. H.D. Rabinovich & L. Currah, CABI Publishing, Wallingford, 2002.

Paratypes: Israel, Lower Galilee, Ramat Sirin, 23.04.1967 leg. U. Eliav (HUJ no. **6164**); Israel, South Golan Heights, near Ramat Magshimim, 09.04.1998, leg. O. Cohen (HUJ no. **98-7507**); Israel, Golan Heights, Upper Wadi Taibe, 24.04.1973, leg. A. Shmida (HUJ); Israel, Golan Heights, Sanbar, 16.04.1969. leg. Maryam (HUJ).

Phenology: The first strong rains occur usually during November. Since the plant's bulb is located rather deep in clayish alluvial soil, it takes several strong rain storms for the water to reach the bulbs and awake them from summer dormancy. As soon as this happens, leaf sprouting takes place and one can see them above ground in December. In February and only then one can see the bud inflorescence above ground. Blooming takes place in mid-March to early April, but occasionally starts earlier in early March and finishes later in late April. Fruits develop and become dry during May, seeds are dispersed in June.

Geographic distribution, habitats and ecology: The species grows primarily in volcanic basalt soils in herbaceous vegetation, mainly among perennial Poaceae and Asteraceae species as well as many other geophytes, such as *Anemone coronaria*, *Asphodeline lutea*, *Narcissus tazetta* and even *Allium schubertii*. These habitats are often inundated in winter, but always completely dry in summer. It grows also in disturbed secondary habitats, primarily in agricultural fields. In such places, especially west of the Jordan Rift Valley, it is not really known what was the primary habitat and whether *A. basalticum* inhabited it in historical time. The largest populations are known from the southern Golan Heights in deep heavy soils; smaller populations are found also in central and eastern Golan Heights as well as west of the Jordan Rift Valley in the Lower Galilee and Jezreel Valley (Fig. 13). In the latter two districts it is almost extinct due to modern agriculture practices (deep plowing and use of pesticides), and is today only known from a handful of sites. The species is also identified in old collections from Lebanon on the Beirut-Damascus road and near the northern Lebanese

border with Syria, in both cases growing in agricultural fields. We assume that the plant occurs sporadically in Lebanon and Syria, since traditionally managed fields are common. Additional surveys are needed to confirm this.
Chorotype: East Mediterranean.

2. *ALLIUM ASCLEPIADEUM* ALLIANCE

Morphologically different plants of the Higher Upper Galilee characterized by pure white tepals and shorter filament bearing basally a distinct purple ring-like zone (Figs. 6, 7) were formerly treated as *A. asclepiadeum* Bornm. and later included in *A. nigrum* (Kollmann, 1986). They are indeed most similar to this and other closely related Turkish species. However, *A. asclepiadeum* differs by undulate leaf laminae, milky-white, soon reflexed, oblong tepals with rounded base, and filaments about half as long as tepals, and differs from the very close *A. nemrutdaghense* Kit Tan & Sorger additionally by still longer, uncolored filaments. *Allium karamanoglu* Koyuncu et Kollmann is a more slender plant having narrower (up to 15mm wide) and shorter leaves, a poorer and much denser inflorescence, long acute, basally rounded tepals, completely crème or blackish filaments with black anthers, and a black ovary.

The taxon growing in Upper Galilee is not positioned near Turkish species in the molecular tree (Fig. 1; *A. kharputense* is the closest relative available for molecular analysis) but among taxa growing in Israel, Jordan, and Cyprus. This position as well as its distribution and habitat (Fig. 8) underline its recognition as a new species:

Allium meronense Fragman & R.M. Fritsch, **sp. nov.**

- *Allium nigrum* auctt., *A. asclepiadeum* auctt. non Bornm.

Holotype: Israel. Upper Galilee, Mt. Meron. 03.04.1984 leg. N. Bar-Shai (HUJ no. **6160**).

Diagnosis: Differt ab *Allio asclepiadeo* staturis validis foliis canaliculatis stricto recurvatis, tepalis rhomboideo-lanceolatis basi triangulari-stipitatis, filamentis tertiis partis vel quadrantis longitudine tepalorum, ovariis nigrescenti-purpureo maculatis et stylis albescentis.

Description: Bulbs 1.5-3cm long and in diameter, ± ovate. Scape flexuous or ascendent, 10-20 (- 25)cm long obconical c. 4-5mm in diameter near base, c. 6-7mm below inflorescence, smooth, dull green, purplish flushed near base, with glaucous bloom. Leaves 2-3 (4), triangular-lanceolate,



Fig. 6. Inflorescence of *A. meronense* (tepals narrow), N. Israel – Mt. Meron.



Fig. 7. Inflorescence of *A. meronense* (tepals ovate), N. Israel – Mt. Meron.



Fig. 8. Group of *A. meronense* plants, N. Israel – Mt. Meron.

tapering into a triangular hooded tip, canaliculate, thickish, recurved, 20-30cm long, near base 3-4cm wide, dull green, basally outside and on veins purplish flushed, with glaucous bloom. Spathe shortly beaked, splitting into 3-5 persistent acute valves, finally semi-reflexed, membranous, translucent yellowish-brown with brown veins. Inflorescence initially fasciculate later semi-globose, multiflorous, semi-dense, (3-) 4-6 (-7) cm in diameter; pedicels wire-like thin, ascending, green. Flowers bowl-shaped star-like. Tepals lanceolate to ovate, 7-9mm long, free near base, tapering towards base and the \pm triangular, obtuse or subacute, often with plicate tip; initially patent, after anthesis \pm deflexed and crumbled; pure white, median vein narrow, greenish. Filaments triangular, $\frac{1}{4}$ - $\frac{1}{3}$ ($\frac{2}{5}$) as long as tepals, basally shortly connate, inner filaments 1.5 times wider than outer ones, obliquely forward directed; white, with a distinct purple ring-like zone near the base. Anthers pale yellow, oblong, c. 1.5mm long. Ovary depressed globose-six-angled, 3-4mm in diameter, 2-3mm long, smooth, glossy; green, in anthesis blackish or with many black spots. Style cylindrical, 1-2mm long, whitish, with a dot-like, white stigma. Capsule depressed-globose with six furrows, c. 6mm in diameter, widely opening.

Paratypes: Israel, Upper Galilee, Mt. Meron. 01.05.1967. leg. D. Pery (HUJ no. **6165**); Israel, Upper Galilee, Mt. Meron - near top of the mountain. 02.04.1958. leg. N. Feinbrun (HUJ no. **6170**); Israel, Upper Galilee, Mt. Meron - maquis. 12.04.1965. leg. F. Kollmann (HUJ no. **6171**).

Illustrations: Illustrated flora of Lebanon, under *A. asclepiadeum* (Tohme and Tohme, 2007).

Phenology: The plant sprouts after the first strong rains during November. Leaves can be seen in December. In Early March one can see the bud inflorescence above ground. Blooming takes place in late March to April, but occasionally it starts earlier in early March and finishes later in early May. Fruit is developing during May becoming dry in early June; seeds are dispersed in June-July.

Geographic distribution, habitats and ecology: The plant was found in the Upper Galilee. It grows in open sunny patches with herbaceous vegetation at edges of *Quercus calliprinos* maquis on terra-rossa soil within hard limestones and on basalt soil within basalt rocks. Its distribution range is detailed in the Red Data Book (Shmida et al 2011) - 23 sites are approved from Mt. Meron area and eastwards to Mt. Cna'an, Kerem Ben Zimra, Dalton plateau and Malkia, all at altitudes between 700 and 1100m (Fig.

13). An important collection from South Lebanon (road between Marjayun and Kaukaba, 1947, G **8768**) and a photograph in the Illustrated Flora of Lebanon (Tohme & Tohme, 2007) confirm that this species occurs in Lebanon. Further study is needed to see how much north this species occurs. Chorotype: East Mediterranean.

3. *ALLIUM ORIENTALE* ALLIANCE

In the original description (Diagn. pl. orient. sér. 1, 13:25, 1854), *A. orientale* was characterized as having sub-undulate, plane, canaliculated-plicate, thickish leaves shorter than the scape, pedicels which are 3 times longer than the white or pale red flowers, filaments slightly shorter than the tepals, and ovate and nearly smooth ovaries and capsules. Seven vouchers from Asia Minor, Syria, Mesopotamia, and the Arabian Desert were mentioned. Later in “Flora Orientalis” (vol. 5:282 f., 1882), Boissier changed the description. He did not mention the flatness and relative length of the leaves but the leaf number as 2-6, mentioned white or red tepals becoming flaccid or sub-reflexed after anthesis, filaments $\frac{1}{4}$ shorter than tepals, and omitted the characters of anthers, ovary and capsules. Thus this name became applicable to rather different plants (vouchers from Cyprus, Palestine, and more places in Asia Minor were also added) including those having red spots at the base of filaments and others with very broad leaves which were explicitly mentioned in “Flora Orientalis”. De Wilde-Duyfjes (1976) included even *A. gayi* Boiss., *A. aschersonianum* Barbey, and *A. telavivense* Eig. However, such a broad concept is not at all supported by molecular data. As Fig. 1 shows, material of *A. orientale* s. lat. from southern Turkey is only very distantly related to plants from Israel also named *A. orientale*. *Allium aschersonianum* and *A. telavivense* occupy likewise separate positions. Thus also the Turkish and the Israel plants belong to different species, but which of them must correctly be named *A. orientale*?

The answer seems easy, because de Wilde-Duyfjes (1976:200) designated the sheet “Cilicia Aucher 2188” housed at G as lectotype. However, search for this lectotype at G gave an unforeseen result: Two sheets bear the cited label but present different plants, and none of these sheets bears a notice by de Wilde-Duyfjes. Therefore an epitype must be chosen:

Allium orientale Boiss., Diagn. pl. orient. sér. 1, 13:25, 1854.

Epitype: Here designated, housed in G-Boiss. The sheet labeled “Cilicia Aucher 2188” containing two scapes with inflorescences, one bulb part with two undulate, 1-2cm wide, shortly attenuate leaves, and an extra part of a bulb.

A second sheet at G with an identical label contains one complete plant and a second plant without bulb having very narrow leaves (picture available via <http://www.ville-ge.ch/musinfo/bd/cjb/chg/index.php?lang=en>). These plants represent probably shade forms having grown in the shadow of bushes or among dense grasses. The characters of this epitype agree well to the protologue as well as to the description in “Flora of Turkey” (Kollmann 1984:203) for Turkish plants when characters of reddish, pink, or lilac-pink flowering plants are ignored. There Kollmann (l.c.) also mentioned the differences between Turkish *A. orientale* plants and those from Palestine; we share her observations. The plants we collected in southern Turkey own rather flat, 1-4cm wide, undulate leaves adpressed to the soil, rather thick, gleaming white, (long-) elliptic, obtuse tepals with a green median vein, triangular white filaments about $\frac{3}{4}$ as long as the tepals, and depressed-globose, slightly furrowed, glossy ovaries becoming blackish when in full anthesis and again green afterwards. The plants we studied from Israel and its surroundings differ by recurved, canaliculated, gradually attenuate leaves (Fig. 11), translucent white, \pm narrowly ovate, acute tepals only slightly longer than the long-triangular, whitish filaments, and glossy, permanently green ovaries (Fig. 10). They are here described as a new species:

Allium israeliticum Fragman & R.M. Fritsch, **sp. nov.**

- *A. orientale* auct. (Fig. 9).

Holotype: **Israel**. Judean foothills, Zakariya to Bet Guvrin. 20.03.1952, leg. G. Orshansky (HUJ no. **18283**).

Diagnosis: Differt ab *Allio orientale* turcico foliis canaliculatis paulatim attenuatis recurvatis, tepalis translucentis acutis et ovariis permanente viridibus.

Description: Bulbs subovate, 2-3cm long, 1.5-2.5cm in diameter. Leaves 2-6 (10), thickish, recurved, canaliculated, gradually attenuate, 0.8-2.5cm wide, 15-30cm long, smooth, lower side with distinct longitudinal ribs, glaucous. Scape 15-25 (40)cm long, flexuous, terete, narrowly conical widest below the

inflorescence, green, upper part often brownish suffused. Spathe paper-like, whitish-brownish with brown veins, as long as the pedicels, incompletely split into 3-4 acute, finally deflexed valves. Inflorescence fasciculate, finally often semi-globose, dense, 10-50-flowered. Pedicels thickish, slightly incurved, 1.5-2 times of tepal length. Flowers cup-shaped star-like. Tepals translucent white, \pm narrowly ovate, acute, 6-8mm long, 1.5-2 (inner tepals 2.5)mm wide, median vein greenish (Fig. 10, 12). Filaments only slightly shorter than tepals, narrowly triangular, whitish, with yellow anthers. Ovaries depressed-globose with shallow furrows, c. 3mm in diameter, glossy, permanently green. Style slightly conical, 3-5mm long, whitish, with a white punctiform stigma. Capsule depressed-globose, three-angled, 6-8mm long and in diameter, widely opening, valves broad-elliptic.

Illustrations: Flowers of the East Mediterranean (Fragman et al 2001) opposite p. 292 under *Allium orientale*.

Paratypes: Israel, north Negev, 10 km west of Arad, 19.03.1967, leg. A. Danin (HUI no. **6256**); Israel, Mt. Gilboa above Ein Harod, 21.02.1924, leg. M. Zohary (HUI no. **6228**); Israel, El Hama, 13.03.1945, leg. N. Feinbrun (HUI no. **6288**); Jordan, near Amman, 14.04.1929, leg. A. Eig & M. Zohary (HUI no. **6290**)

Phenology: The plant sprouts after the first strong rains during November. Leaves can be seen in December, and in February the bud inflorescence is visible above ground. Blooming takes place in March, but occasionally it starts earlier in late February and finishes later in early April. Fruits develop and become dry during April-May, seeds are dispersed in May-June.

Geographic distribution habitats and ecology: The plant is found in Israel, the Palestinian Territories and Jordan (Fig. 13). It grows in diverse habitats, mainly in *Sarcopoterium spinosum* batha and also in other open habitats such as herbaceous pastures, in fallow fields and sandy plains. It prefers calcareous soils, but is also found in basalt, loessial and sandy soils. It is especially common in the transition zone between the Mediterranean region and the desert, an area with average annual rainfall of 200-400mm stretching southwards from the Lake of Galilee area in the north to eastern Lower Galilee, eastern Samaria, eastern Judea, Judean foothills, the southern coastal plain and northern Negev. It is rare in the Upper Galilee, Menashe Hills, Sharon, Moav in Jordan, and Jezreel Valley. Further studies are needed to confirm if this species occurs also in the arid parts of Syria.

Chorotype: East Mediterranean (W. Irano-Turanian).

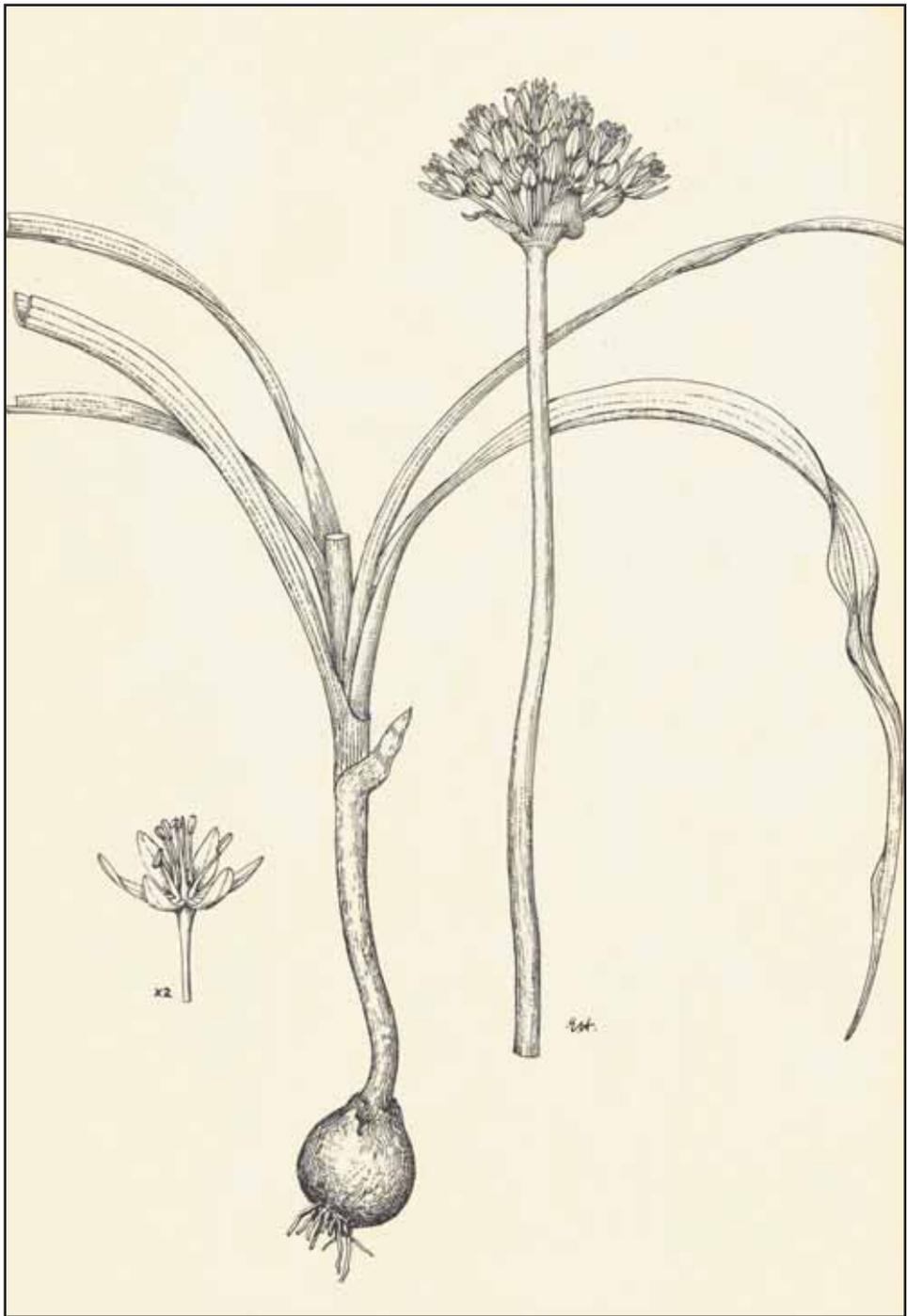


Fig. 9. Drawing of *A. israeliticum* (Naomi Feinbrun-Dothan, *Flora Palaestina IV*, Plates, Jerusalem; The Israeli Academy of Sciences and Humanities, 1986, plate 134).



Fig. 10. Inflorescence of *A. israeliticum*, S. Israel - Pura Nature Reserve.



Fig. 12. Inflorescence of *A. israeliticum*, N. Israel, Ramot Menashe. (photograph by Y. Marta).

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Photographs by Ori Fragman-Sapir unless otherwise stated.



Fig. 11. *Allium israeliticum* in a semidesert herbaceous pasture, S. Israel, Tel Krayot.

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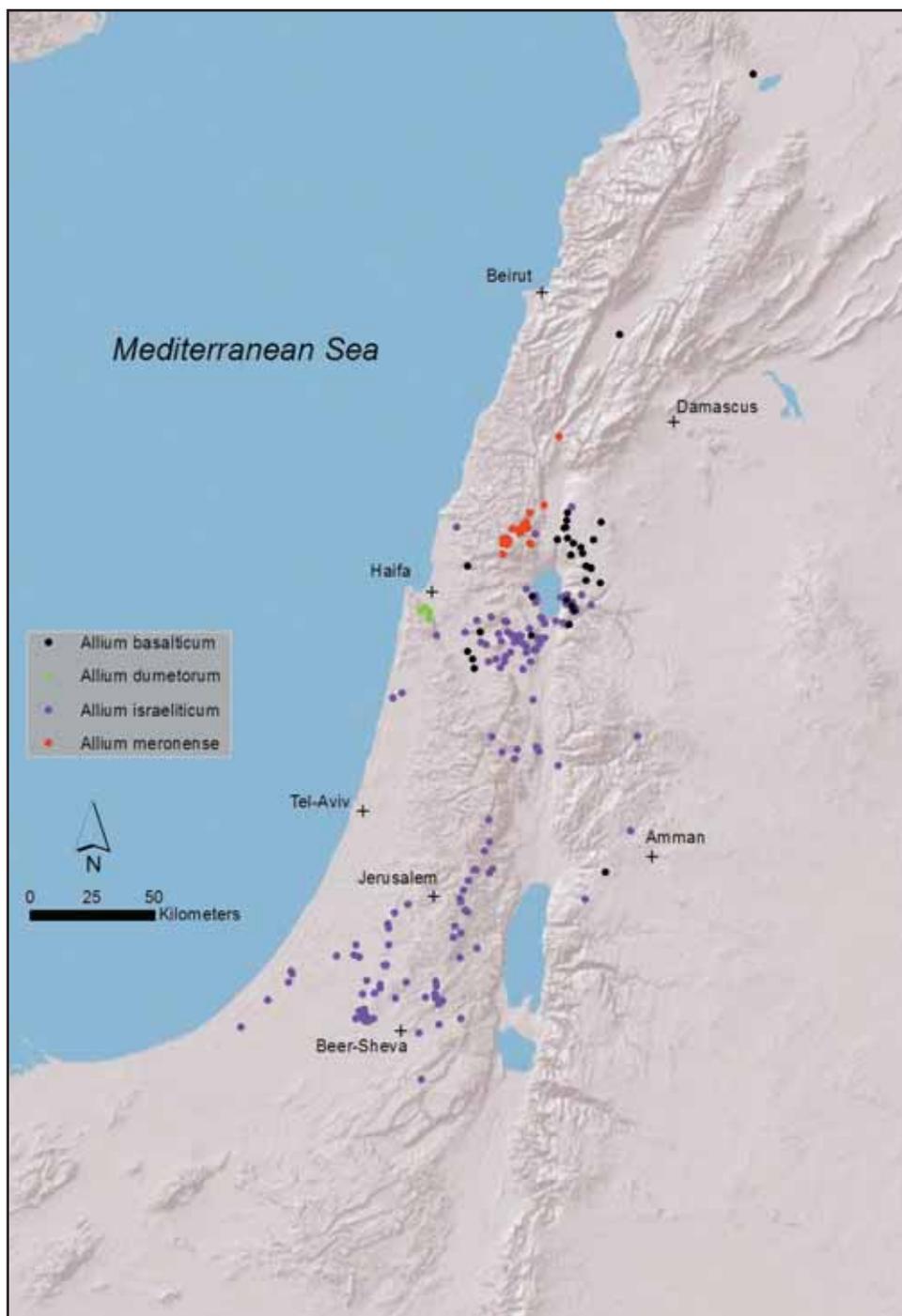


Fig. 13. Distribution map, based on Rotem Data-Base (Shmida, 2000), herbaria HUJ, G and B, and author's observations.