

AN UPDATE OF THE GENUS *GAGEA* SALISB. (LILIACEAE) IN THE IBERIAN PENINSULA

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Summary. A new *Gagea* species from Spain and Morocco, *Gagea subtrigona* J.-M. Tison, is described; an overlooked species from the southern Iberian Peninsula, *Gagea lusitanica* A. Terrac., is cleared; an updated key to the Iberian species of the genus *Gagea* is provided.

Resumen. Se describe *Gagea subtrigona* J.-M. Tison, nueva especie de España y Marruecos, y se reconoce *Gagea lusitanica* A. Terrac., especie propia del Sur de la Península Ibérica. También se aporta una clave actualizada de las especies ibéricas del género *Gagea*.

INTRODUCTION

The taxonomy of the genus *Gagea* has been studied in the Iberian Peninsula by TERRACCIANO (1904a, 1904b, 1905a, 1905b) mainly on dried adult plants, then by BAYER & LÓPEZ (1988a, 1988b, 1989, 1991) including living plants with highly suitable results; during studies on the Moroccan species I published a small complement on the section *Didymobolbos* in southern Spain (TISON, 2004a). After ten years of investigations on Iberian *Gagea* including cultivation of many clones, two species previously quoted as exceptionally polymorphic, *G. algeriensis* Chabert and *G. elliptica* (A. Terrac.) Prain (TISON, 2004a, 2004b) proved to hide each one misappreciated taxon. The two cryptic species are described here, one of them as new. To summarize the current state of knowledge I propose an updated key of the *Gagea* species of this region.

RESULTS AND DISCUSSION

Gagea subtrigona* J.-M. Tison, *sp. nova

A *Gagea algeriensis* Chabert (= *G. wilczekii* Br.-Bl. & Maire) differt colore semper viridescente, juvenilibus et immaturis plantis bulbillorum gregem ferentibus, immaturis plantis plurifoliatis, florescentibus plantis rarissimis, folio basali primo plus aut minus canaliculato, inflorescentia saepe bulbillifera, pedicellis semper pilosis.

Similar to *Gagea algeriensis* Chabert (= *G. wilczekii* Br.-Bl. & Maire), but always greenish; juvenile and immature plants with a cluster of sister bulbils; immature plants with several leaves; flowering plants very rare; first basal leaf more or less canaliculate; inflorescence often bulbilliferous; pedicels always hairy.

Holotypus. SPAIN: *Gagea wilczekii* Br.-Bl. & Maire, Hs, **Alacant**: (Alcoi), Serra de Mariola, Bc. de Bocairent, 30SHY1388, 880 m, 11.3.2001, L. Serra 5702, A. Bort & L. Serra Cremades (VAL 193871), inferior plant (bulbilliferous) (Fig. 1, arrow).



Fig. 1. *Gagea subtrigona*, holotype (arrow).

Epitype: Fig. 2.

Other specimens examined.

Because its sporadic flowering and difficult recognition when dried, the species is very rare and inconspicuous in herbaria and we take into account only recent collections with anatomic study of leaves.

SPAIN. **Alacant**: (Alcoi), Serra de Mariola, Bc. de Bocairent, 30SHY1388, 880 m, 11.3.2001, *Serra 5702, Bort & Serra Cremades* (Herb. Serra n° 6231, transferred to VAL), superior plant (isotypus); (Alcoi), El Puig, 30SYH2182, 850 m, 17.3.1992, *Serra 2171* (Herb. Serra n° 2413); (Xixona), La Carresqueta, 30SHY1977, 1000 m, 17.3.1992, *Serra 2172* (Herb. Serra n° 2414); (Agres), Serra de Mariola, Molí Mató, 30SYH1494, 850 m, 10.4.2000, *Serra 5584, Laguna & Raeymaekers* (Herb. Serra n° 6109); (Confrides), Serra d'Aitana, pr. Cases d'Aitana, 30SYH3683, 1190 m, 20.3.2004, *Serra 6626 & al.* (Herb. Serra n° 7289); (Vall de Gallinera), pr. Tossal del Molló, 30SHY4198, 615 m, 20.3.2003, *Peris* (Herb. Serra n° 7516). **Albacete**: Robledo: col de la N322 à la sortie W de la ville, c. 1000 m, pelouses sèches sur calcaire, 18.3.2005 & *ex cultis* 29.3.2007, *Tison* (Hb. privé). **Córdoba**: Priego-de-Córdoba : plateau de Navazuelo, c. 800 m, pelouses rocailleuses très ouvertes sur gypse, 20.3.2005, *Tison* (Hb. privé). **Guadalajara**: Alcolea: voie express NII à 1,5 km à l'est du Puerto de Alcolea, c. 1100 m, biotopes secondaires très ouverts sur marnes, 10.4.2001, *Tison* (Hb. privé). **Jaén**: Cazorla: Puerto de las Palomas, c. 1300 m, pelouses rocailleuses sur calcaire, 18.3.2005, *Tison* (Hb. privé). **Málaga**: Ronda: entre le Puerto del Viento et la maison des gardes au N du C344, c. 1300 m, pelouse rocailleuse exp. N sur arête calcaire, 21.3.2001 & *ex cultis* 28.3.2005, *Tison* (Hb. privé); El Burgo: Puerto de las Abejas, c. 800 m, pelouses ouvertes et ± secondaires sur pentes calcaires, 22.3.2005, *Tison* (Hb. privé). **Valencia**: (Fontanars), Serra de la Solana, La Replana, 30SXH99, 940 m, 14.3.1992, *Serra Cremades* (Herb. Serra n° 2415); (Bocairent), Naixement del Vinalopó, 30SHY0688, 780 m, 20.3.2004, *Peris* (Herb. Serra n° 7517). MOROCCO. **Al-Hoceima**. Ajdir: col du Nador 1500 m, pente marneuse exp. S à végétation ouverte, ab. 2, 25.3.2001, *Tison* (Hb. privé). **Khenifra**. Aguelmous: près du Tizi-n-Tichka 2300 m, arête d'éboulis schisteux fins, 02.4.2001 & *ex cultis* 28.3.2005, *Tison* (Hb. privé). **Marrakech**. Mouldikht: Tizi-n-Test, c. 2300 m, pentes d'éboulis schisteux fins, 01.4.2001, *Tison* (Hb. privé). **Meknes**. Timhadite: Tizi-n-Tretten, c. 1900 m - doline non pâturée, 29.3.2001 & *ex cultis* 28.3.2005, *Tison* (Hb. privé).

Ecology. Open grasslands, rocky, gravelly or sandy places; more tolerant to mechanical instability than the neighbouring species; c. 500-1500 m in Spain, at least to 2300 m in Morocco. On disturbed ground the clusters of non-flowering plants with canaliculate, arched, dirty green leaves are easily mistaken for *Muscari neglectum* Ten.

Distribution. Spain: S.-E. quadrant, at least to Guadalajara; Morocco: at least Rif, Medium Atlas and Great Atlas.

Taxonomic remarks. *G. subtrigona* is an apomictic taxon: immature stage very long and bulbiferous, adult stage and seeds virtually absent, bulbils often sprouting unusually easily. Some bulbs produce an inflorescence once before death, but this inflorescence has an evident character of immaturity: it is sterile, usually few-flowered and often bulbiferous; hence, we can emphasize that both flowering and non-flowering old plants represent a similar immature stage and that this taxon actually never reaches the adult stage. Our cultivated lineages from Alcolea (Spain) and Ajdir (Morocco) regularly execute their complete ontogenic cycle to death without any flowering. The clones having a very thick first leaf look like bulbiferous *G. algeriensis* Chabert (= *G. wilczekii* Br.-Bl. and Maire: TISON, 2004b) and have been interpreted in this way (BAYER & LÓPEZ, 1988a; TISON, 2004b). However, although solitary bulbiferous plants may very exceptionally appear in natural populations of *G. algeriensis*, all our cultivated lineages of this species have a short immature stage (c. 2 years), a long flowering stage (3-5 years) and never produced sister bulbils for 10 years. In brief, *G. subtrigona* has normally no real adult stage and is regularly bulbiferous, while *G. algeriensis* has a long adult stage and its bulbiferous form can be considered as abnormal. Since every *Gagea* species has a strict ontogenetic sequence (LEVICHEV, 1999), the co-existence of such variations inside a single species is unlikely and allows to conclude to the existence of a cryptic species.

G. subtrigona indeed is in many respects intermediate between *G. algeriensis* and *G. lacaitae* A. Terrac. and likely results hybridogenous. The basal leaves are strongly variable depending on the clone, sometimes almost identical to those of *G. algeriensis*, sometimes rather similar to those of *G. dubia* A. Terrac. except the thickened keel and the two layers of vascular bundles, with all the intermediate possibilities (Fig. 3, 1c and 2c). To contrast with the polymorphism of the leaves, the ontogenetic sequence and the morphology of the subterranean organs are roughly constant.

Many investigated Spanish populations take in *G. subtrigona* and its two putative parental species growing together. *G. subtrigona*, still less-flowering than *G. lacaitae*, usually is completely unnoticed; however, it is often the most abundant among the three taxa, especially in very dry regions with poor soil (Albacete: BAYER & LÓPEZ, 1988a, sub *G. wilczekii*; from personal observations in Albacete, Jaén, Cuenca, Ciudad Real, Córdoba, Málaga). It apparently extends further to the north than *G. algeriensis*, to the province of Guadalajara (pers. Obs.), and is locally abundant in the province of Valencia where *G. algeriensis* is to be confirmed (P. Pablo Ferrer Gallego, pers. com.). On the contrary it seems less common in Morocco, probably reaching southernmost only the

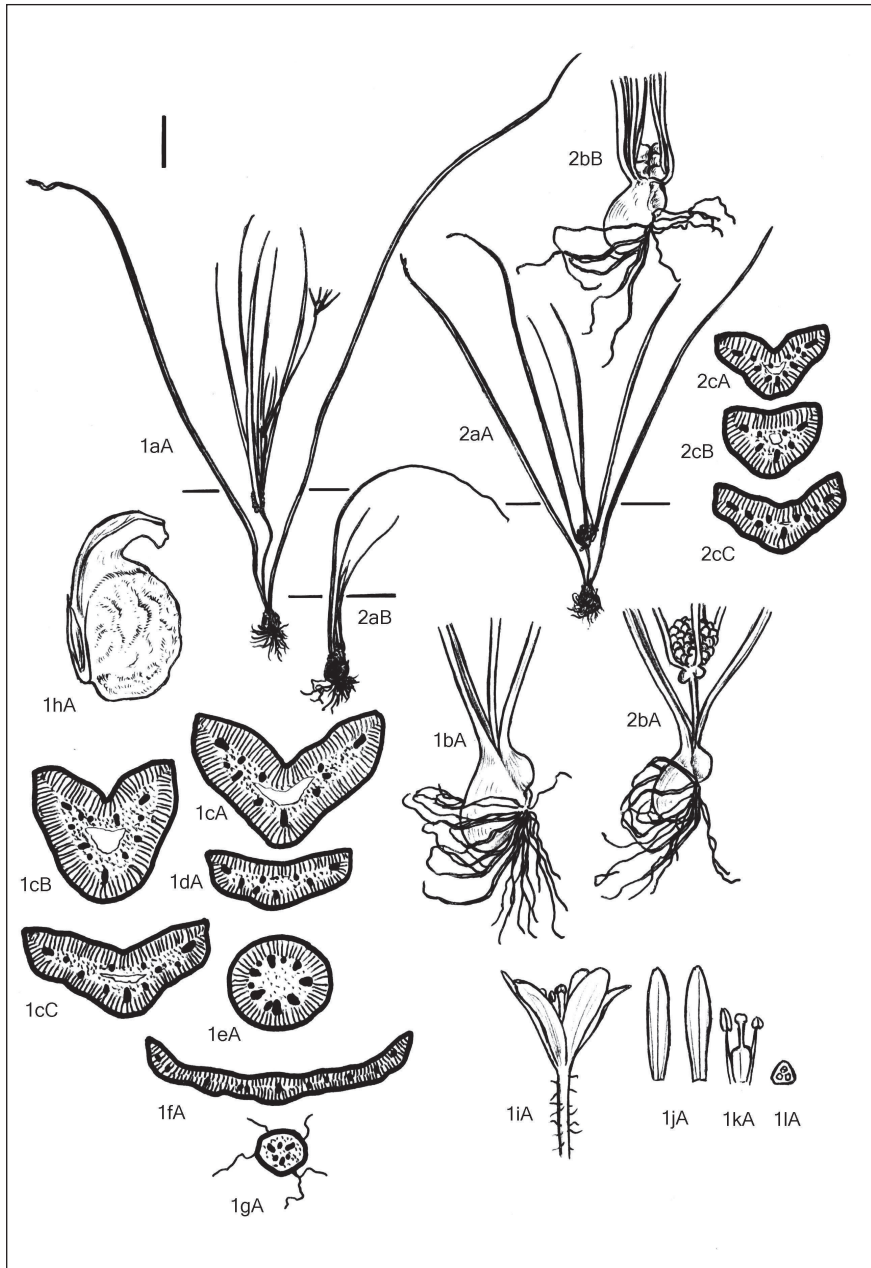


Fig. 2. *Gagea subtrigona*, Ronda (Málaga). A, B, C: three different clones in the same population. 1, adult stage; 2, immature stage. a, habitus; b, bulb and basis of the aerial parts; c, cross section of the first leaf; d, cross section of the second leaf; e, cross section of the peduncle; f, cross section of the first cauline leaf; g, cross section of a pedicel; h, basal bulbil in summer; i, flower; j, tepals (left: external; right: internal); k, androecium and gynoecium; l, cross section of the ovary. Scale bar: a, 2 cm; b, i-l, 0,5 cm; c-h, 1 mm.

Great Atlas, while *G. algeriensis* is present to Anti-Atlas (sub *G. cossoniana* Pascher: TISON, 2004b).

Whether *G. subtrigona* is better considered as an hybridogenous species or a simple hybrid is debatable. In my mind the second option should be unpleasant at least in the present state of knowledge. The taxon is very widespread and abundant and has been found several times without its putative parents. If we admit that both *G. algeriensis* and *G. lacaitae* and only them took place in its origin, which is not absolutely certain, it must be taken in mind that the taxa of the *G. granatellii* complex are often triploid (PERUZZI, 2003; PERUZZI & AQUARO, 2005; further data submitted, L. Peruzzi, pers. comm.) and that the Spanish populations of *G. lacaitae* always show a high percentage of pollinic abortion and almost never give viable seeds, which makes the hypothesis of numerous recent hybridizations very unlikely. As a matter of fact, the only good argument in consideration of an hybrid status is the high polymorphism of *G. subtrigona*, especially regarding the leaf anatomy. From my point of view this polymorphism does not allow to reject the specific status: I interpret this situation as an ancient introgressive phenomenon, as demonstrated for another hybridogenous taxon, *G. pomeranica* (Rüthe) Rüthe (PETERSON et al., 2004), usually treated as a good species.

On some living plants the carinate basal leaves may lead to confusions with *G. dubia*, present in southern Spain and Morocco (TISON, 2002 [sub *G. maroccana* (A. Terrac.) Sennen & Mauricio], 2004a, 2004b) and northernmost at least to Sierra de Moncayo (J.-M. Tison, personal herbarium). *G. dubia*, however, is devoid of influence of *G. algeriensis*: it has thin, solid basal leaves with one layer of vascular bundles; its bulb is broadly ovate to subglobose while the bulb of *G. algeriensis* and *G. subtrigona* is more obliquely elongated. In addition *G. dubia* regularly produces complete inflorescences, has comparatively short and erect basal leaves, and usually grows at higher altitudes (1000-2300 m in Spain, at least to 2700 m in Morocco), commonly associated with *G. nevadensis* Boiss., but rarely with *G. algeriensis*, *G. lacaitae* or *G. subtrigona*.

According to its somewhat *dubia*-like habitus, to its reduced and irregular inflorescence, to its ecology (plant of foothills), *G. subtrigona* may fit the lectotype of *G. granatellii* subsp. *maroccana* A. Terrac. (Tanger, Schousboeh 1869: Tison, 2001). Following as close as possible Terracciano's descriptions and specimens I quoted numerous Moroccan populations of *G. dubia*, including *G. granatellii* subsp. *maroccana* in synonymy (TISON, 2004b); all undoubtedly belong to *G. dubia* with the possible exception of the lectotypical collection of *G. granatellii* subsp. *maroccana*. According to this, *G. maroccana* (A. Terrac.) Sennen & Mauricio might be a prioritary name for *G. subtrigona*. This synonymy, however, remains doubtful on account of the bad condition of Schousboeh's collection.

Gagea lusitanica A. Terrac., *Boll. Soc. Ortic. Mutuo Soc. Palermo*, 2 (3): 36 (1904)

Taxon intermediate between *Gagea elliptica* (A. Terrac.) Prain and *G. lacaitae* A. Terrac.; differs from the former in its bulbiferous juvenile and immature stages, its somewhat wider and flatter basal leaves having to 7 vascular bundles (vs. 3-5), its sometimes hairy pedicels and its rare and usually empty capsules; differs from the latter in its more elongated bulb, its usually more erect, much narrower basal leaves (1,5-3 mm at adult stage, vs. 3-5 mm in *G. lacaitae*) without adaxial additional vascular bundles, its more regular and plentiful flowering and its sometimes glabrous pedicels.

Lectotype (here designated). PORTUGAL. **Beira Baixa**. *Gagea polymorpha*, Monte Brito, Castello Branco, Junho de 1881, A.R. Da Cunha (LISU n° 8504!), left specimen (Fig. 3, arrow).

Four collections, all from the Castello Branco region, are quoted by Terraciano (1904a) in the protologue of *G. lusitanica*: one by Da Cunha (1881, LISU) and three by Daveau (1885, COI, G, MPU). All have been traced and can be considered as syntypes. The first collection (Da Cunha), which is in very good condition, is designated here as lectotypical; among the three plants of this collection, the most complete and well-presented one is chosen as lectotype.

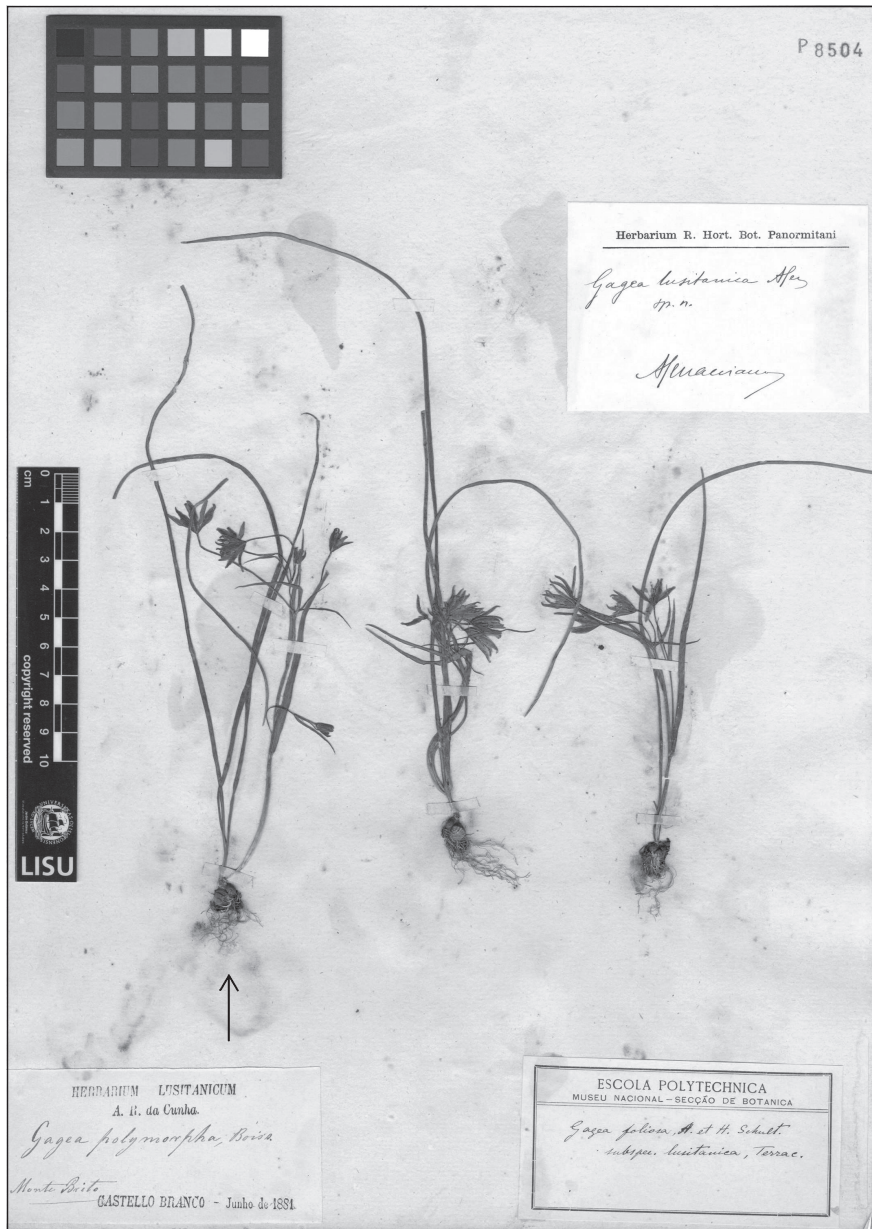
Epitype; Fig. 4.

Other specimens examined.

PORTUGAL. **Beira Baixa**. Castello Branco, juin 1885, Daveau (COI, G, MPU) [syntyp]. SPAIN. **Cádiz**. Grazalema: à l'est du Puerto de las Palomas, c. 1250 m, pelouse embroussaillée, 21.3.2005, Tison (Hb. privé). **Granada**. Loja: N321 au pied de la montagne de Los Infernos, c. 900 m, vires herbeuses sur escarpements calcaires, 19.3.2005, Tison (Hb. privé). **Málaga**. Monda (Málaga), UF35, 22.3.79, Diez & Zarazaga (MGC 5510); Laguna de Fuente Piedra (Málaga), UG41, 06.3.76, Asensi & Garretas (MGC 9026); Málaga, Álora, El Sabinal, La Medionda, 04.02.89, Bootillo (MGC 31611 & 42267); Málaga: Ronda, prox. Cortijo de la Planilla (entre las piedras de una era), erizos, calizas, 730 m s.m., UF0867, 05.3.89, Montilla (MGC 40552); Málaga: Sierra de las Nieves, Tolox, Ampigal de Tolox, 03.4.2003, Cabezudo (MGC 55158); Atajate: route de Benadalid v. 700 m, pelouses embroussaillées sur éminences, 21.3.2005, Tison (Hb. privé); Ronda: versant ouest du Puerto del Viento v. 1100 m, broussailles sur pente calcaire exp. W, 21.3.2001, Tison (Hb. privé).

Ecology. Known only on rocky meadows over limestone, at 600-1200 m s.m.

Distribution. Spain: Andalucía (at least provinces of Granada, Málaga and Cádiz); Portugal?



Taxonomic remarks. I found several Andalusian populations conspicuously agreeing with the syntypes of *G. lusitanica* and not with other taxa. This plant was quoted as a critical bulbiferous form of *G. cf. elliptica* in previous papers (TISON, 2004a, 2004b), a rather troubling hypothesis considering the normally constant ontogenic cycle of every *Gagea* species (I.G. Levichev, pers. com.). The cultivation through several years confirmed the total absence of bulbiferous stage in *G. elliptica*, its regularity in *G. lusitanica*, and the existence of further distinctive features suggesting an influence of *G. lacaitae* in *G. lusitanica*. The two taxa often grow together (for example at Ronda, Atajate, Grazalema) and this situation brings the differences in light: in addition to the elements quoted above, *G. lusitanica* blooms c. 10-15 days before *G. elliptica* on the same place, is somewhat shorter and stouter than the latter, and usually does not give viable seeds. According to its probable hybrid origin, *G. lusitanica* is rather polymorphic: depending on the lineage, the basal leaves are more or less broad (Fig. 4, 1c), the cluster of bulbils at immature stage is sessile or pedunculate (Fig. 4, 2a), the pedicels are glabrous or hairy (Fig. 4, 1i), but no evident correlation is visible among these variations.

G. lusitanica seems very close to *G. polymorpha*, a cryptic taxon known only around Granada. Although *G. polymorpha* was supposed intermediate between *G. durieui* and *G. elliptica* (TISON, 2004a), it is more probably intermediate between *G. durieui* and *G. lusitanica* according to its slightly hairy pedicels. The only constant difference between *G. polymorpha* and *G. lusitanica* is the anatomy of the adult basal leaves: semicylindrical with U- or V-arranged vascular bundles in *G. polymorpha*, flat with plane-arranged vascular bundles in *G. lusitanica*. Some narrow-leaved specimens of the latter, especially at the Eastern part of the area, appear very close to the former.

Despite its name and type locality, the presence of *G. lusitanica* in Portugal is to be confirmed today. The labels of the type collections are unlikely and may be due to mixtures of herbarium parts. The region of Castelo Branco includes only plains and low siliceous mountains less than 1000 m high; "Monte Brito" quoted by Da Cunha is a small hill c. 6 km north-east of the city, where *Gagea* can hardly flower later than mid-April, while the labels of the type collections quote June. The only *Gagea* I found in this region was *G. soleirolii* F.W. Schultz, blooming in March and rather common down to the foothills.

The *Gagea* taxa in Portugal are probably few-numerous (TERRACCIANO, 1905b) and remain poorly known. The only unquestionable species are *G. soleirolii*, widespread and locally common, *G. bohemica* (Zauschner) Schultes and Schultes f., probably rare (BAYER & LÓPEZ, 1991) and *G. pratensis* (Pers.) Dumort., very rare and/or underestimated (absent in TERRACCIANO, 1905b; sub *G. nova* Samp. ex Miranda: MIRANDA LOPES, 1929-1930; sub *G. pratensis* subsp. *nova* Samp.: COI!). *G. elliptica* and *G. lacaitae*, the putative parental

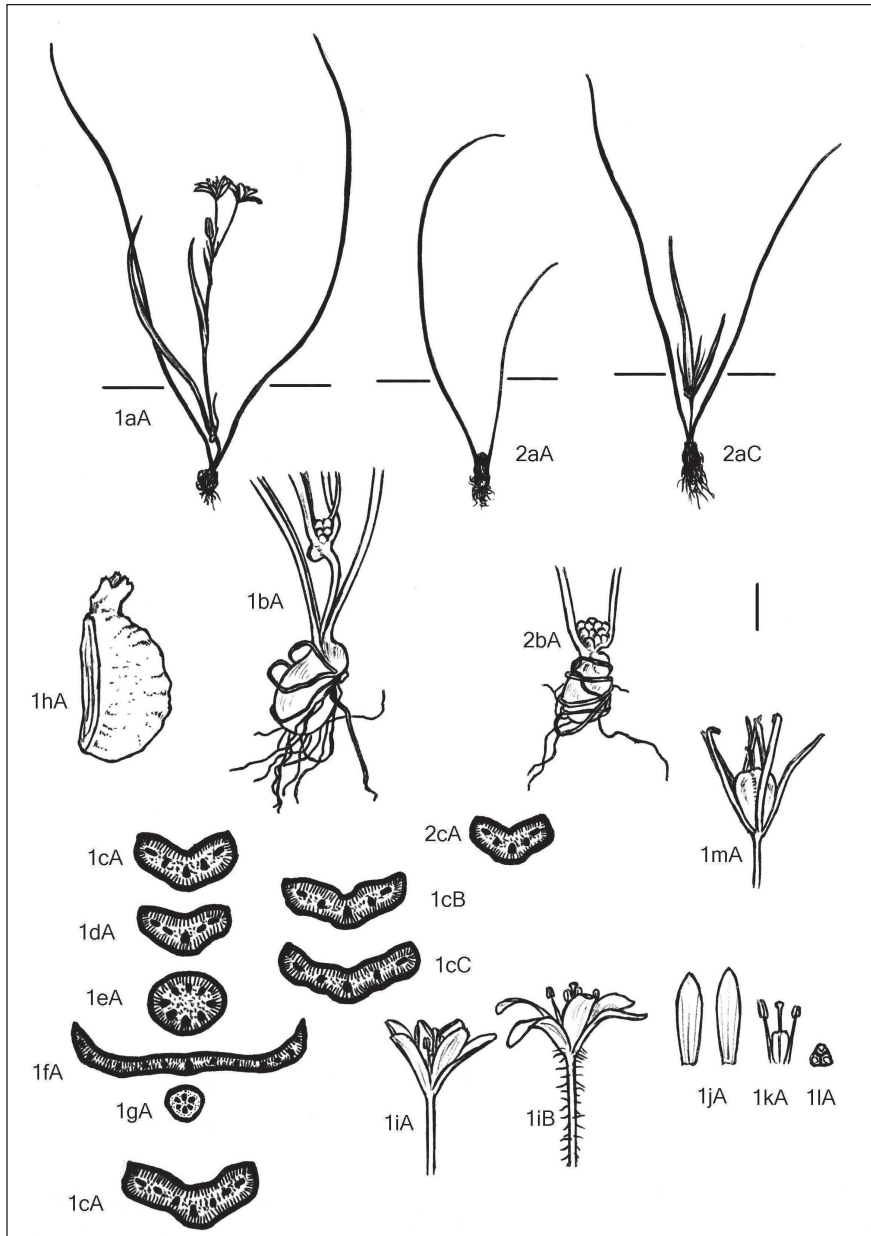


Fig. 4. *Gagea lusitanica*, A, Loja (Granada); B, Atajate (Málaga); C, Grazalema (Cádiz). 1, adult stage; 2, immature stage. a, habitus; b, bulb and basis of the aerial parts; c, cross section of the first leaf; d, cross section of the second leaf; e, cross section of the peduncle; f, cross section of the first cauline leaf; g, cross section of a pedicel; h, basal bulbil in summer; i, flower; j, tepals (left: external; right: internal); k, androecium and gynoecium; l, cross section of the ovary; m, pod (empty). Scale bar: a, 2 cm; b, i-m, 0,5 cm; c-h, 1 mm.

species of *G. lusitanica*, are present in south-west Spain, the former almost to the Guadiana river (BAYER & LÓPEZ, 1991), but there is no available information about their real presence on the Portuguese territory.

Key to the Iberian species of the genus *Gagea*

G. luberonensis J.M. Tison was cited in Sierra Nevada (TISON, 2004a), but this population requires further study: it may belong to a narrow-leaved variant of *G. dubia* or to an undescribed intermediate between *G. bohémica* and *G. dubia* and was not cultivated in good condition so far.

Juvenile stage is here understood as at least two years before flowering (the smaller sterile plants); immature stage as one year before flowering (the biggest sterile plants, sometimes with a rudimentary sterile inflorescence); adult stage as flowering stage. Basal bulbil is the bulbil joint to the bulb, usually unique each year, except (in appearance) in *G. lutea* and *G. reverchonii*; sister bulbils are those at the top of the bulb or on the peduncle; cauline bulbils are the sister bulbils on the peduncle. Peduncle is the part of the “stem” between the bulb and the inflorescence. Indument on the pedicels is considered hairy when it is formed by more or less sparse hairs, the pedicels appearing green; villose when formed by dense hairs, the pedicels appearing greyish.

1. Peduncle and pedicels sharply angled. Seeds with a conspicuous caruncle (Sect. **Gagea**)..... 2
1. Peduncle and pedicels terete or very bluntly angled. Seeds without conspicuous caruncle 5
2. Pedicels straight or ascending even when fruiting. Young bulb completely exerted from the tunic of the ancient one. One basal bulbil at every stage. Basal leaf not broadened beyond the middle (continental Spain, except semi-arid regions, mainly in the mountains; N. Portugal) **G. pratensis** (Pers.) Dumort.
2. Pedicels deflexed at least when fruiting. Young bulb more or less included in the tunic of the ancient one. One cluster of basal bulbils at immature stage, no bulbils at adult stage. Basal leaf usually more or less broadened beyond the middle..... 3
3. Bulb tunics clear brown to greyish. Basal leaf to 15 mm wide, strongly broadened beyond the middle, with a tubulate apical cusp. Fruiting (fertile) pedicels deflexed just under the flower. Tepals greenish outside (Pyrenees, Cantabric Mts.)..... **G. lutea** (L.) Ker-Gawler

3. Bulb tunic dark brown to blackish. Basal leaf to 7 mm wide, few or sometimes not broadened beyond the middle, with a conical apical cusp. Fruiting (fertile) pedicels deflexed from the basis or the middle. Tepals often becoming reddish outside (Mountains of E. Spain, from E. Pyrenees to Sierras Béticas) **G. reverchonii** Degen
[*G. burnatii* A. Terrac., *G. lutea* subsp. *orosiae* P. Montserrat]
4. First basal leaf subcylindrical and broadly hollow. First cauline leaf of flowering plants hollow in its distal 1/4-1/2 (Sect. **Fistulosae** (Pascher) Davlianidze) (Pyrenees, Cantabric Mts.)
..... **G. fragifera** (Vill.) E. Bayer & G. López
[*G. liotardii* (Sternb.) Sch. & Sch. f., *G. fistulosa* auct.]
4. First basal leaf not subcylindrical and/or not broadly hollow. First cauline leaf solid (Section **Didymobulbos** (K. Koch) Boiss.)..... 5
5. Basal leaves of immature and flowering plants with 5-9 U-arranged vascular bundles distinctly closer to the abaxial side than to the adaxial one. Pedicels with very short (max. 1 mm) straight hairs often extending to the base of the peduncle. Pedicels usually spreading after flowering (E. Pyrenees, probably naturalized; to be confirmed elsewhere)
.....**G. villosa** (M. Bieb.) Sweet [*G. arvensis* Dumort.]
5. Basal leaves not as above. Pedicels glabrous or with rather long (to 2 mm or more), often flexuose hairs never extending to the peduncle. Pedicels erect at 0-45° after flowering..... 6
6. First basal leaf of adult and immature plants becoming somewhat hollow, with 7-13 vascular bundles arranged in a ring or in 2 layers spaced at least at the medium part. Second basal leaf of adult plants often distinctly smaller and thinner than the first one, sometimes lacking..... 7
6. First basal leaves of adult and immature plants solid, with 3-11 vascular bundles arranged in 1 layer (sometimes duplicate at the medium part) or with 3 V-arranged bundles. Second basal leaf of adult plants similar to the first one..... 8
7. Flowering plants without bulbils normally > 30% of the population, often > 50%. Juvenile and immature plants normally having no sister bulbils and one leaf. First basal leaf compressed-subtrihedral. Pedicels often hairy only at the top, sometimes entirely glabrous or entirely hairy (E., C., S.E. and S. Pain) **G. algeriensis** Chabert
[*G. wilczekii* Br.-Bl. & Maire]

7. Flowering plants without bulbils normally < 1% of the population, often absent. Juvenile and immature plants normally having one sessile (rarely pedunculate) cluster of sister bulbils, many of them having several leaves; first basal leaf subtriangular to deeply canalculated. Pedicels entirely hairy (E., C., S.E. and S. Spain) **G. subtrigona** J.-M. Tison
8. Basal leaves of flowering plants subcylindrical, semicylindrical or bluntly trihedral, with 3(-5) vascular bundles, never exceeding 1,5 mm wide 9
8. Basal leaves of flowering plants flat or V-plicate, with (3-)5-11 vascular bundles, often exceeding 1,5 mm wide 12
9. Basal leaves of immature and flowering plants subcylindrical. Pedicels glabrous. Tepals usually 5-10 mm long (semi arid regions of S.E. Spain; Balears, except Menorca)..... **G. durieui** Parl.
[*G. iberica* A. Terrac.]
9. Basal leaves of immature and flowering (not juvenile) plants distinctly flattened or canalculated on the upper side. Pedicels often hairy or villose. Tepals usually 8-16 mm long 10
10. Basal leaves normally twisted in S, less than 1 mm wide on the biggest plants. Most pedicels shorter than or as long as the flower. Immature plants with (sometimes without) a very small cluster of bulbils usually sessile and hidden in the tunics of the bulb. Tepals more or less spatulate, obtuse (continental Spain, mostly mountains in the S., and N. Portugal)
..... **G. bohémica** (Zauschner) Sch. & Sch. f.
[*G. saxatilis* (Mert. & Koch) Sch. & Sch. f.]
10. Basal leaves normally straight or slightly curved, often to 1,5 mm wide on the biggest plants. Most pedicels much longer than the flower. Immature plants with a rather big cluster of bulbils often pedunculate and always conspicuous (when uprooted). Tepals broadly lanceolate, subacute 11
11. Inflorescence cymose with alternate leaves. Peduncle usually more or less elongated over the ground level. Pedicels sparsely hairy or sometimes glabrous. Flowering plants usually numerous (hills over 400 m s.m. S. Spain: Granada and Málaga prov.) **G. polymorpha** Boiss.
11. Inflorescence pseudo-umbellate with opposite or verticillate leaves. Peduncle often underground. Pedicels densely villose. Flowering plants very rare (usually 0-2 each year in the whole Balearic population) (thermomediterranean garigues at c. 100 m s.m. Mallorca, very rare and endangered)..... **G. mauritanica** Durieu

12. Pedicels glabrous. Sister bulbils absent or present..... 13
12. Pedicels hairy or villose. Sister bulbils always present, at least on immature plants 16
13. Sister bulbils absent. Basal leaves of flowering plants 1-2 mm wide. Buds erect, horizontal or nodding..... 14
13. Sister bulbil(s) present on immature and first-year-flowering plants. Basal leaves of flowering plants 1,5-4 mm wide. Buds erect 15
14. Buds erect to horizontal. Bulb narrowly oblong. Plant slender, 10-30 cm (hills and low mountains to 1700 m S. and S. W.-S. Spain; S. Portugal) **G. elliptica** (A. Terrac.) D. Prain
[*G. foliosa* subsp. *elliptica* A. Terrac.]
14. Buds normally nodding. Bulb broadly ovate. Plant rather stout, 3-15 cm (mainly mountains to 2800 m, down to the foothills in Atlantic regions. N., N.-W., C., W. Spain and Portugal; an isolated population in Sierra Nevada)..... **G. soleirolii** F.W. Schultz
[*G. nevadensis* auct.]
15. Immature plants with a single big sister bulbil at the top of the bulb, in addition to the basal bulbil (in appearance 3 unequal bulbs aggregated). First-year-flowering plants with a single cauline bulbil (high mountains to 2600 m. S. Spain, mainly Sierras Béticas) **G. nevadensis** Boiss.
15. Immature plants with a sessile or shortly pedunculate cluster of sister bulbils at the top of the bulb. First-year-flowering plants usually with 1-2 clusters of cauline bulbils (hills and low mountains to 1200 m. S. Spain (Andalucía); S. Portugal ?)..... **G. lusitanica** A. Terrac.
16. Basal leaves of immature and flowering plants usually with additional adaxial vascular bundles at the medium part. First cauline leaf usually inserted underground. Basal leaves flat. Cauline bulbils present on some flowering plants (hills and low mountains to 1800 m) 17
16. Basal leaves without additional adaxial vascular bundles. First cauline leaf usually inserted above ground..... 18
17. Plant light green or yellowish-green. First basal leaf without loose central parenchyma. Inflorescence elongated or branched with often alternate leaves (except if strongly bulbilliferous and reduced). Tepals obovate, obtuse (widespread in the mediterranean part of Spain except baleares)
..... **G. lacitae** A. Terrac.

17. Plant dark green; first basal leaf with a narrow layer of loose central parenchyma, inflorescence umbellate with usually subopposite to verticillate leaves. Tepals ovate, subacute to acuminate (to be confirmed in Spain, close to the border in the French E. Pyrenees: Banyuls)
 **G. granatellii** (Parl.) Parl.
18. Basal leaves carinate, usually V-shaped in section (except sometimes in old plants). Pedicels strongly villose. Immature plants with a sessile or (rarely) shortly pedunculate cluster of sister bulbils at the top of the bulb. Usually all flowering plants without bulbils (mountains of E. and S.E. Spain)
 **G. dubia** A. Terrac.
18. Basal leaves flat to slightly canaliculate. Pedicels sparsely hairy. Immature plants with a basal bulbil and a single big sister bulbil at the top of the bulb, or with sessile or shortly pedunculate cluster of sister bulbils at the top of the bulb. Usually some flowering plants with at least one cauline bulbil 15

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