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Revision of the genus *Asphodeline* (Liliaceae) — A new infrageneric classification

ERTAN TUZLACI

RÉSUMÉ

TUZLACI, E. (1987). Révision du genre *Asphodeline* (Liliaceae) — Une nouvelle classification infragénérique. *Candollea* 42: 559-576. En anglais, résumés français et anglais.

Un nouveau taxon infra-générique Sect. *Appendicigera* E. Tuzlaci est décrit dans le genre *Asphodeline* (Liliaceae). Les clés pour les espèces, les dessins originaux des caractères diagnostiques et la distribution générale de chaque taxon dans la Sect. *Asphodeline* et dans la Sect. *Appendicigera* sont aussi donnés.

ABSTRACT

TUZLACI, E. (1987). Revision of the genus *Asphodeline* (Liliaceae) — A new infrageneric classification. *Candollea* 42: 559-576. In English, French and English abstracts.

A new infrageneric taxon Sect. *Appendicigera* E. Tuzlaci is described in the genus *Asphodeline* (Liliaceae). In addition, the keys to the species, the original drawings of the diagnostic characters and the general distribution of each taxa in both Sect. *Asphodeline* and Sect. *Appendicigera* are presented.

Introduction

Asphodeline Reichb., a member of the Monocotyledons, is mostly accepted in *Liliaceae* L., although it is also considered in *Asphodelaceae* A. L. Jussieu by various taxonomists.

Asphodeline has fourteen species, distributed in the South-West Asia (mainly in the Middle-East countries) and the Mediterranean area. The genus is presented in Europe by three species which are *A. taurica*, *A. lutea* and *A. liburnica*. Except the last one, the others are the most widespread species of the genus. Only *A. lutea* has been recorded from the North-West Africa.

Historical view

The first described species of the genus *Asphodeline* is *A. lutea* and this species was published under the name of *Asphodelus luteus* by C. Linnaeus in 1753. Later a few more *Asphodeline* species have been described in the genus *Asphodelus* and all of them have been considered as *Asphodelus* species in various floristical and systematical publications. In 1830, the genus *Asphodeline* has been distinguished from the genus *Asphodelus* by its recurved tepals, unequal filaments and declined sexual organs by H. G. Reichenbach, based on the specimens of *Asphodelus luteus* and *A. liburnicus*.

The first comprehensive study on this genus was published by J. G. BAKER, in 1876. *Asphodeline* and the other related genera were revised in the same publication.

Two subgenera in *Asphodeline* were distinguished by Baker as indicated below:

1. Subgen. *Dorydium* (Salisb.) Baker: stems simple below the inflorescence. Stamens very unequal (*A. lutea*, *A. taurica*, *A. globifera*, *A. tenuior*, *A. liburnica*, *A. brevicaulis*, *A. ambigua*, *A. parviflora*, *A. damascena*, *A. balansae*, *A. prismatocarpa*, *A. rigidifolia*, *A. isthmocarpa*).
2. Subgen. *Dendrasphodeline* Baker: stems branched in the middle. Stamens subequal (*A. prolifera*).

Baker introduced the following new species (except *A. parviflora*, others had been named by J. Gay): *A. parviflora*, *A. globifera*, *A. prismatocarpa*, *A. balansae*, *A. isthmocarpa* and *A. ambigua*. Among them, only *A. globifera* and *A. prismatocarpa* are still the accepted species in the genus.

E. Boissier also revised the genus for the volume 5 of the "Flora Orientalis" (1884). Twelve *Asphodeline* species were grouped as yellow and white-flowered species. Except *A. ambigua*, all the species which were mentioned in Baker's revision, were included in his work.

Finally, a detailed study of the genus *Asphodeline* was realized between 1976 and 1982 by the author (TUZLACI, 1982). Its brief results have been represented in Davis' "Flora of Turkey" and in some other recent publications (TUZLACI, 1983, 1985; MATHEWS & TUZLACI, 1984).

Material

This taxonomic revision was based on the study of both living populations (in Turkey) and dried specimens kept in the several herbaria following as: AEF, ANK, ATA, BM, DUF, E, EGE, HUB, ISTE, ISTF, ISTO, K, MARE.

The morphological characters and the drawings were introduced in accordance with the living materials. Perigone colour, fleshy capsule shape and its measurements should be noted in the field because they change when dried.

Asphodeline Reichb., Fl. Germ. Excurs. 116 (1830)

Perennial, biennial, annual herbaceous, usually shortly rhizomatous, sometimes stoloniferous plants. Roots numerous, cylindrical, occasionally more or less fleshy. Stems erect or ascending, partially or throughout leafy or leaves only at base. Leaves numerous, green or glaucous, linear, tapering towards apex or setaceous, dilated with broad scarious margins at base. Inflorescence raceme or panicle. Bracts and bracteoles scarious. Pedicels jointed. Flowers numerous, in groups or rarely solitary on each node, hermaphrodite, zygomorphic in posture. Perigone concolor or bicolor, yellow, yellow-orange, white, pinkish white, white-pink; segments 3 + 3, outer 3 narrower than inner 3, connate at base, more or less recurved, longitudinally 1-veined. Stamens 3 + 3, unequal, outer 3 smaller than other 3, inserted in perigone tube. Filaments declinate-ascending, dilated at base, surrounding the ovary, shorter ones with or without an appendage. Anthers dorsifixed, intrors, outer 3 distinctly smaller than inner 3. Ovary superior, 3-celled with 2 ovules in each loculus. Style filiform, declinate-ascending. Stigma minutely 3-lobed. Fruit loculicidal capsule. Seeds 6, brownish or greyish black, triquetrous.

Sections

In this study, two sections are distinguished in the genus, mainly based on the structure of the outer (shorter) stamens. This classification is supported by the other additional characters of the plants (Table 1).

The diagnostic features of the both subgen. *Dorydium* and subgen. *Dendrasphodeline*, indicated by Baker, have not been adopted in the present infrageneric classification of *Asphodeline* for the similar branching (especially after destruction of the inflorescence) occurs just above the leafy part of the stem in the plants pertaining to both subgenera and the difference between the inner and outer stamens is naturally less distinct in *A. dendroides* (syn. *A. prolifera*) than in the

	<i>Sect. Asphodeline</i>	<i>Sect. Appendicigera</i>
<i>Root</i>	± Fleshy or rarely slender	Rigid, not fleshy
<i>Stem</i>	Erect or ascending, terete, striate or sulcate. Glabrous or puberulent, somewhat or throughout leafy.	Erect, terete or slightly angular. Glabrous, somewhat or throughout leafy or leaves only at base.
<i>Leaf</i>	Linear or setaceous, smooth, rough or minutely ciliate on scarios margins.	Linear, smooth on scarios margins.
<i>Inflorescence</i>	Usually lax or rarely ± dense.	Lax or dense.
<i>Bract</i>	Ovate, lanceolate, deltoid, acuminate or aristate at apex, glabrous or ciliate.	Ovate or lanceolate, usually acuminate or rarely aristate (in lower bracts) at apex, glabrous.
<i>Perigon</i>	Outer tepals concolor (yellow or white) or bicolor (orange-yellow or pink-white).	Outer tepals concolor (white).
<i>Stamens</i>	Outer (shorter) filaments without an appendage.	Outer (shorter) filaments appendiculate.
<i>Capsule</i>	Globose, oblong, cylindric, obovoid.	Globose, oblong, cylindric, obovoid, pyriform, obtrigonus, obprismatic, ovoid.

Tab. 1. — Morphological comparisons between *Sect. Asphodeline* and *Sect. Appendicigera*.

other species because it has the smallest flowers in the genus. However, *A. dendroides* which is a single annual species in the genus, needs further investigation especially from the point of the structure of the flower for adequate and living material had not been seen by the author during this study. Its taxonomic status may be better recognized after examining more material.

Descriptions of the *Sect. Asphodeline* and *Sect. Appendicigera* are presented below. Furthermore, artificial keys, original morphological drawings and photographs are added to the text for the identification of the species in both section (Fig. 1-10; photo 1-2).

Sect. Asphodeline

Filamenta breviora inappendiculata ad apices. Tepala exteriora concoloria (lutea vel alba) vel bicoloria (extus aurantiaca, intus lutea vel extus pallide rosea intus alba). Plantae annuae vel perennes.

Key to species

1. Outer tepals white to pinkish white or bicolor (pink-white); inner tepals white to pinkish white; annual or perennial 2
- 1a. Outer tepals yellow or bicolor (orange-yellow); inner tepals yellow; perennial 3
2. Annual; perigone (5-)7-8 mm long **A. dendroides**
- 2a. Perennial; perigone 17-21(-25) mm long **A. tenuior** subsp. **tenuiflora**
3. Stems leafy throughout; inflorescence simple; bract large, ± ovate, 20-35(-40) × 7-15 mm; outer tepals concolor; capsule (10-)12-20 mm long **A. lutea**
- 3a. Stems somewhat leafy in lower part, rarely throughout; inflorescence simple or branched; bract shortly deltoid to lanceolate, 5-15(-25) × 2-6 mm; outer tepals concolor or bicolor; capsule 6-17 mm long 4
4. Capsule oblong to cylindrical or rarely subovoid, not umblicate at apex, (10-)12-17 mm long; pedicels ± equal to or shorter than capsules; outer tepals bicolor **A. baytopae**
- 4a. Capsule globose to obovoid, umblicate or not umblicate at apex, up to 9 mm long; pedicels 1-2(-3) times longer than capsules; outer tepals concolor or bicolor 5
5. Outer tepals bicolor or occasionally becoming concolor; leaves linear, more than 2 mm broad; pedicels spreading or recurved **A. brevicaulis**

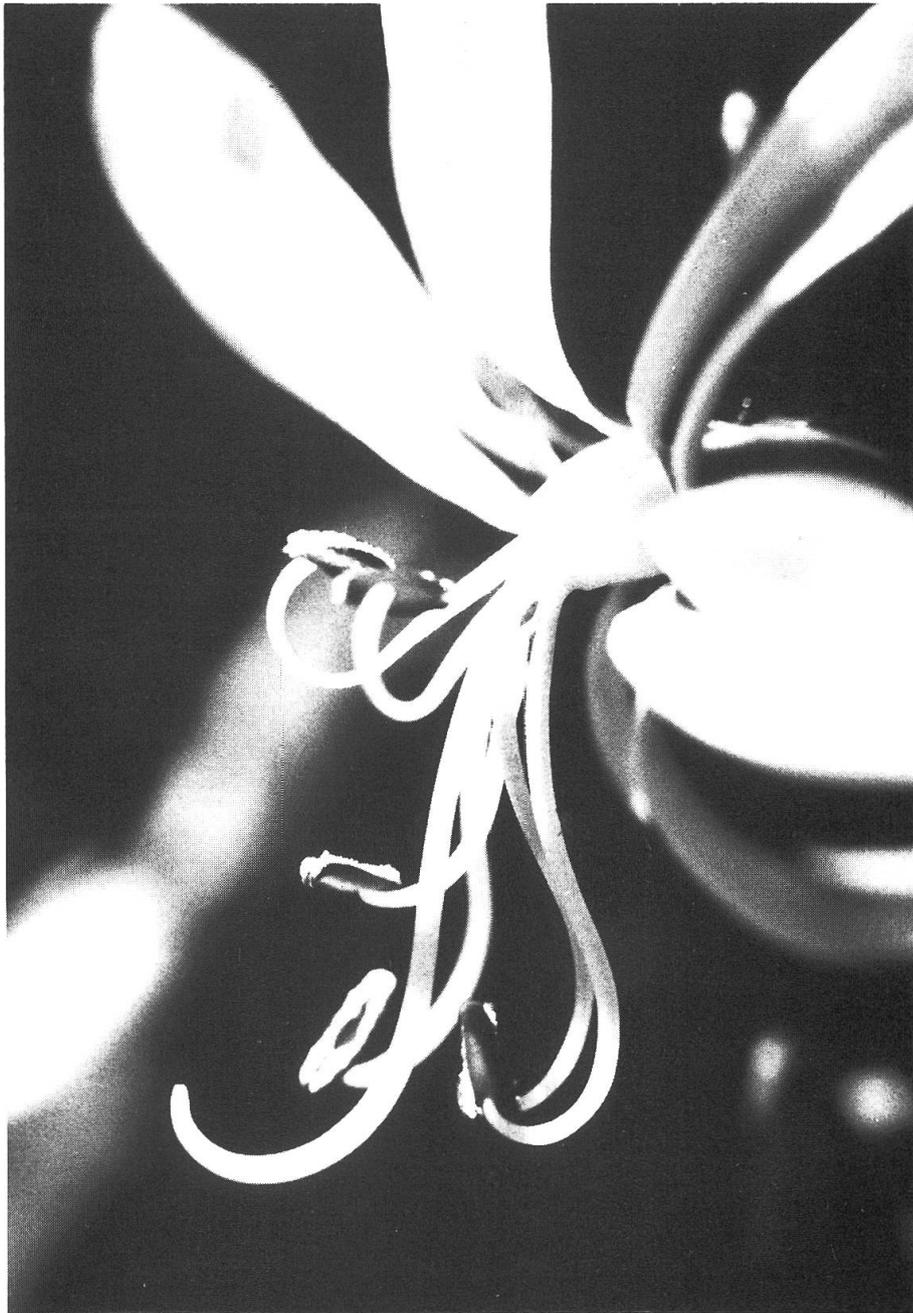


Photo 1. — *Asphodeline baytopae* (Sect. *Asphodeline*): sexual organs ($\times 5$).



Photo 2. — *Asphodelina damascena* subsp. *damascena* (Sect. *Appendicigera*); inflorescence ($\times 1$).

- 5a. Outer tepals concolor; leaves narrowly linear to setaceous, 1-2 mm broad; pedicels erect or spreading 6
6. Perigone (23-)25-35 mm long; roots \pm fleshy, up to 5 mm diam.; leaf base smooth on scarious margins; bract deltoid, shortly cuspidate at apex..... **A. liburnica**
- 6a. Perigone shorter, 15-20 mm long; roots slender, not fleshy; leaf base rough on scarious margins; bract deltoid to lanceolate, long cuspidate at apex **A. tenuior** subsp. **tenuior**

Distribution

- A. lutea* (L.) Reichb. — Algeria, Tunisia, Sicilia, Italy, Yugoslavia, Albania, Greece, Bulgaria, S.E. Romenia, Crimea, Caucasia, Turkey, Cyprus, Syria, Lebanon, Palestine.
- A. baytopae* E. Tuzlacı — Turkey, Syria, Cyprus(?).
- A. brevicaulis* (Bertol.) J. Gay ex Baker subsp. *brevicaulis* var. *brevicaulis* — Turkey, Iraq, Syria, Palestine, Iran(?).
- A. brevicaulis* (Bertol.) J. Gay ex Baker subsp. *brevicaulis* var. *edumea* (Zohary) E. Tuzlacı — Palestine, Syria, Iraq.
- A. brevicaulis* (Bertol.) J. Gay ex Baker subsp. *druzorum* Zohary — Palestine, Syria, Lebanon.
- A. liburnica* (Scop.) Reichb. — Italy, Yugoslavia, Albania, Greece, Crete, Bulgaria, European Turkey.
- A. tenuior* (Fischer) Ledeb. subsp. *tenuior* — Caucasia.
- A. tenuior* (Fischer) Ledeb. subsp. *tenuiflora* (C. Koch) E. Tuzlacı var. *tenuiflora* — Caucasia, Iran, Turkey.
- A. tenuior* (Fischer) Ledeb. subsp. *tenuiflora* (C. Koch) E. Tuzlacı var. *puberulenta* E. Tuzlacı — Turkey.
- A. dendroides* (Hoffm.) Woronow ex Grossh. — Caucasia, N.W. Iran, N.E. Turkey.

Sect. **Appendicigera** E. Tuzlacı, **sect. nov.**

Filamenta breviora appendiculata ad apices. Tepala exteriora concolor (alba). Plantae biennes vel perennes.

Filaments of the outer (shorter) stamens have a characteristic appendage below the anther (Fig. 2). This part may easily be distinguished by its yellow colour and enlarged structure over the pinkish or whitish, filiform filament. By the author, this appendage has been named as "Anther's Arm-chair" for its similar shape and its position. In the other section, the filaments of the outer stamens have a regular structure as the inner ones and their colour is white or pinkish white.

The colour of the perigone in this section shows homogeneity and it is white (usually pure white or occasionally pale pinkish white especially on the outer surface of the outer segments). On the other hand, in Sect. *Asphodeline*, the perigone has various colours, but yellow may be considered as the main colour.

The other remarkable differences between the sections are indicated in Table 1.

Sect. *Appendicigera* includes 8 species and totally 11 taxa. All of them occur in Turkey. Five of the species (*A. anatolica*, *A. rigidifolia*, *A. cilicica*, *A. prismatocarpa* and *A. peshmeniana*) are endemic (62%) and eight of the whole taxa (incl. endemic, three subspecies of *A. damascena*) are endemic (72.7%) in Turkey. In the meanwhile, they are also the important members of the vegetation of Turkey and most of them are found as abundant and widespread especially on the mountains and the steppes in the inner Anatolia. Therefore this section has its centre of distribution and diversity in Anatolia.

Key to species

1. Stems leafy throughout; inflorescence simple; perennial **A. taurica**
- 1a. Stems leafy only at base or in lower 1/4-7/10; inflorescence simple or branched; biennial or perennial 2
2. Capsule in various shape, but not globose 3
- 2a. Capsule \pm globose 4
3. Capsule \pm obprismatic, valves and intervals carinate, in cross section 6-angled in outline; inflorescence simple; lateral surfaces of seed equal to each other, semiovate
A. prismatocarpa
- 3a. Capsule oblong, cylindric, pyriform, obovoid, ovoid, obtrigonus, valves and intervals not carinate, in cross section rounded, trilobed or 3-angled in outline; inflorescence simple or branched; lateral surfaces of seed equal or unequal to each other, \pm triangular, semiovate or semicordate **A. damascena**
4. Capsule 6-9 mm diam. 5
- 4a. Capsule 12-18 mm diam. 6
5. Perennial; stems usually stout, leafy in lower 1/4-1/3; upper leaves usually deflected; inflorescence dense, simple; capsule (7-)8(-9) mm diam. **A. globifera**
- 5a. Biennial; stems slender, leafy at base; leaves rigid, spreading or erect; inflorescence lax, simple or branched; capsule 6-7 mm diam. **A. rigidifolia**
6. Stems leafy at base; capsule depressed at apex and base, in cross section 3 or 6-lobed in outline, 15-18 mm diam.; inflorescence dense, simple **A. peshmeniana**
- 6a. Stems leafy in lower 1/5-3/5; capsule depressed or undepressed, in cross section \pm rounded in outline, 13-14(-15) mm diam.; inflorescence lax, simple or branched 7
7. Stems leafy in lower 2/5-3/5; capsule \pm depressed at apex; anthers of inner stamens linear, 5-6 mm long **A. anatolica**
- 7a. Stems leafy in lower 1/5-1/3; capsule not depressed at apex, anthers of inner stamens linear-oblong, 3-4 mm long **A. cilicica**

Distribution

- A. taurica* (Pallas) Kunth — Albania, Yugoslavia(?), Greece, Bulgaria, Crimea, Caucasia, Turkey, Syria, Lebanon, Palestine.
- A. globifera* J. Gay ex Baker — Turkey, Lebanon, Syria(?).
- A. rigidifolia* (Boiss.) Baker — Turkey.
- A. cilicica* E. Tuzlacı — Turkey.
- A. peshmeniana* E. Tuzlacı — Turkey.
- A. anatolica* E. Tuzlacı — Turkey.
- A. damascena* (Boiss.) Baker subsp. *damascena* — Turkey, Syria, Lebanon(?).
- A. damascena* (Boiss.) Baker subsp. *ovoidea* E. Tuzlacı — Turkey.
- A. damascena* (Boiss.) Baker subsp. *gigantea* E. Tuzlacı — Turkey.
- A. damascena* (Boiss.) Baker subsp. *rugosa* E. Tuzlacı — Turkey.
- A. prismatocarpa* J. Gay ex Baker — Turkey.

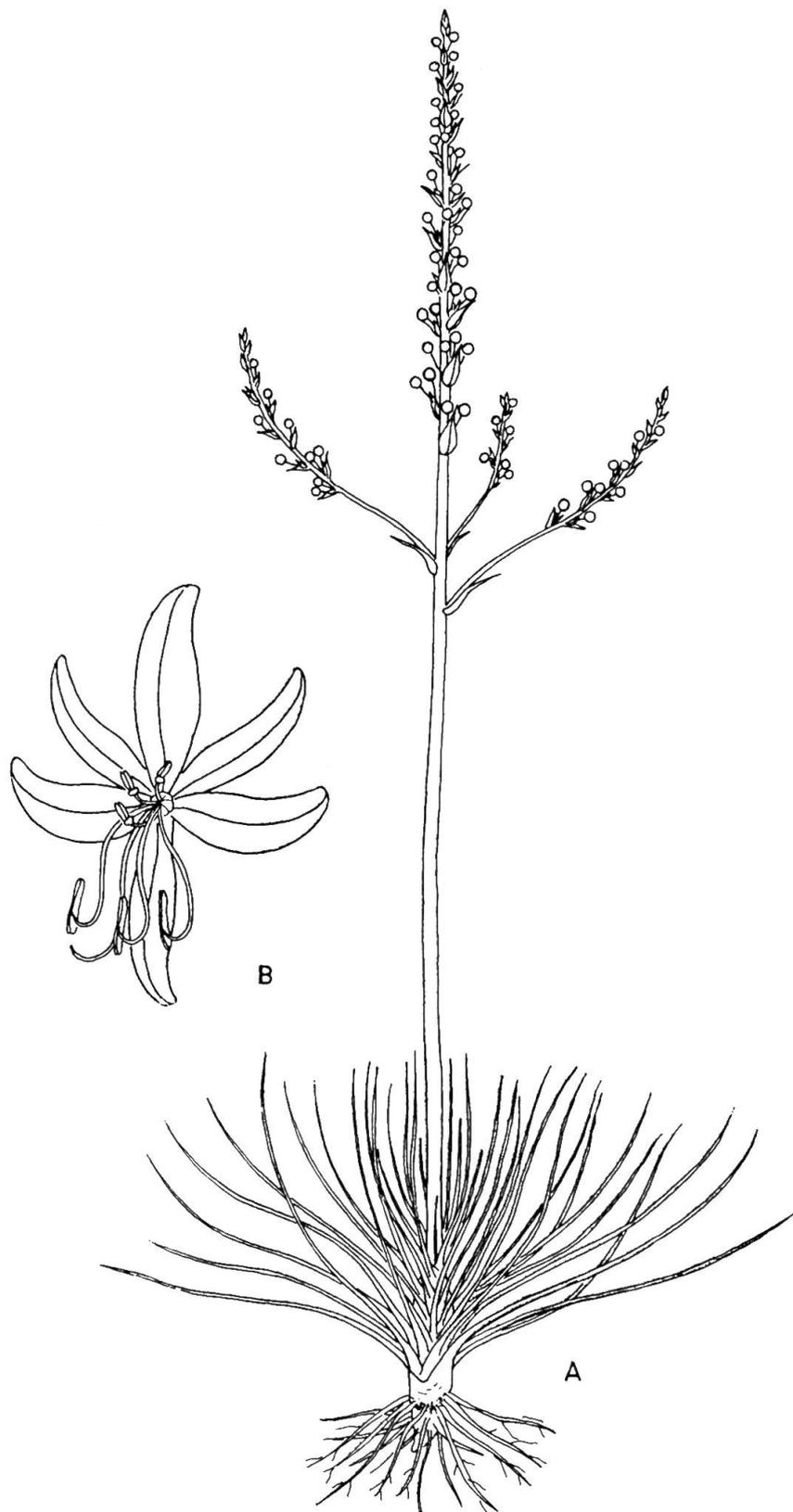


Fig. 1. — *Asphodeline rigidifolia*
A, habit ($\times 0.23$); B, flower ($\times 1.9$).

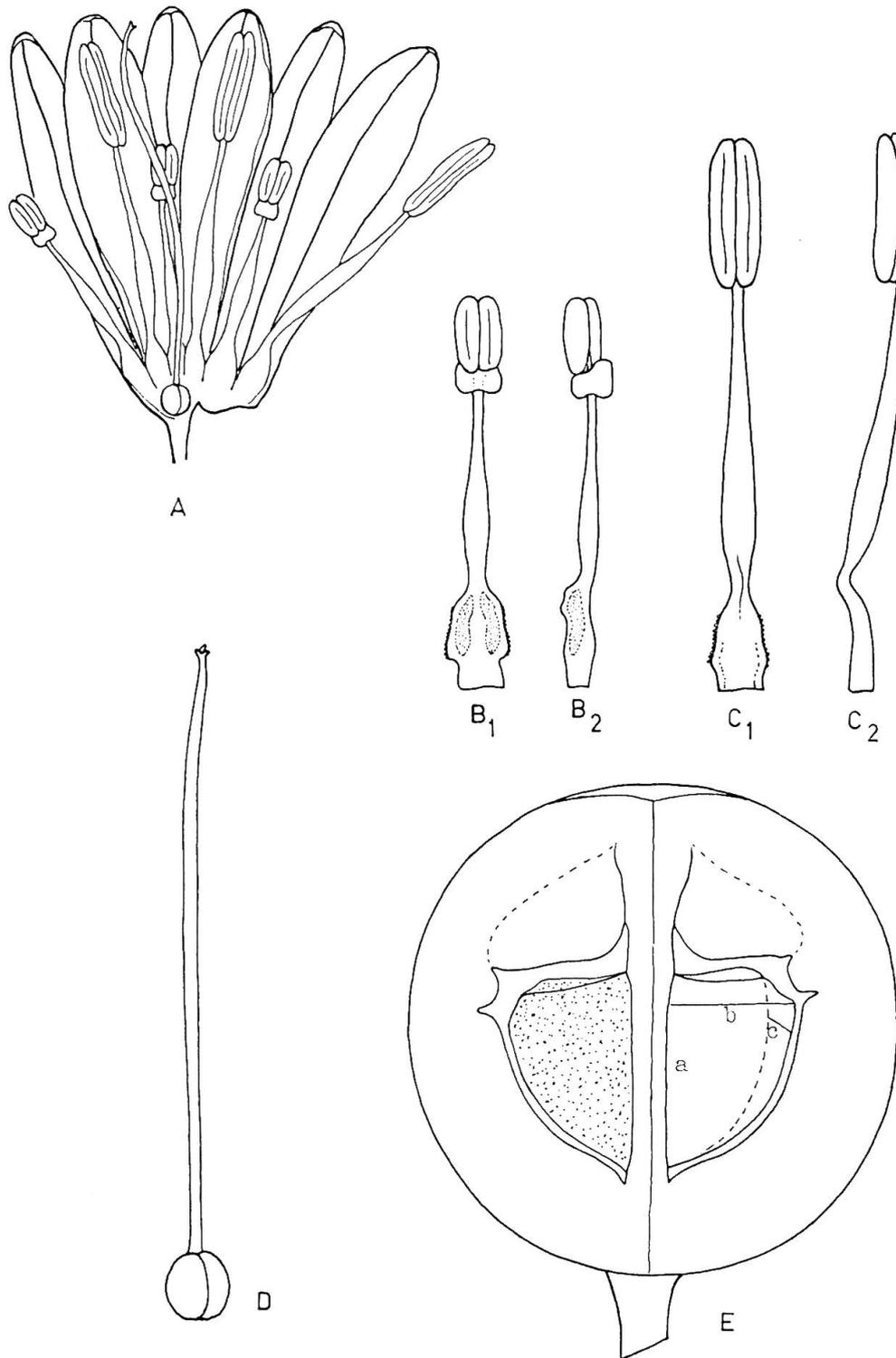


Fig. 2. — Structure of flower and fruit of *Asphodeline*.
A, inside of flower (*A. rigidifolia* $\times 2.8$); **B**, **C**, stamens (*A. rigidifolia* $\times 4.7$); **B1** (front), **B2** (profile) outer stamen; **C1** (front), **C2** (profile) inner stamens; **D**, pistil (*A. rigidifolia* $\times 4.7$); **E**, vertical section of capsule (*A. cilicica* $\times 4.7$); **a**, seed length; **b**, seed width; **c**, seed thickness.

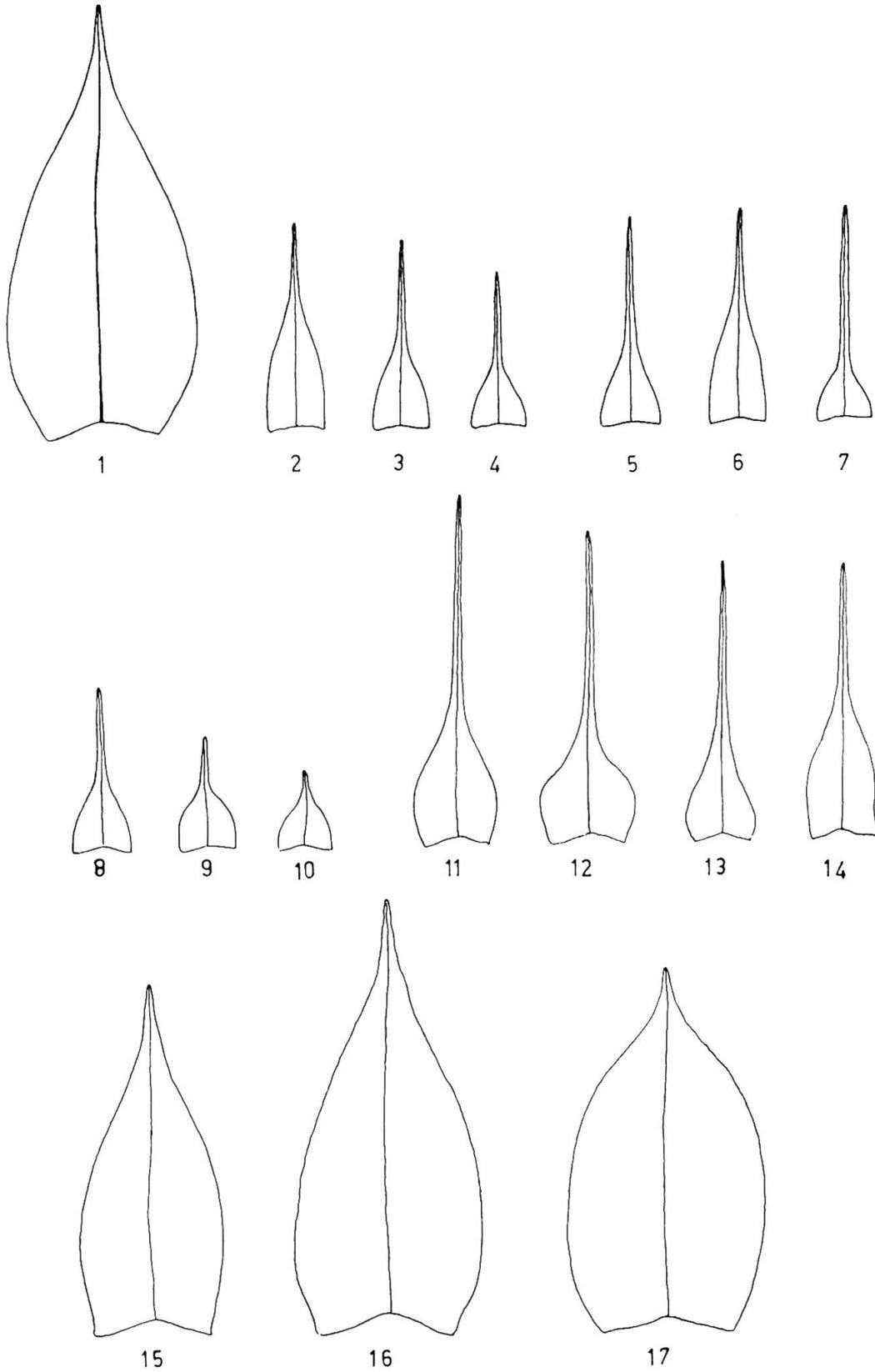


Fig. 3. — *Asphodeline* bracts.

1, *A. lutea*; 2-4, *A. baytopae*; 5-7, *A. brevicaulis* subsp. *brevicaulis* var. *brevicaulis*; 8-10, *A. liburnica*; 11-14, *A. tenuior* subsp. *tenuiflora*; 15, *A. rigidifolia*; 16, *A. globifera*; 17, *A. taurica* ($\times 1.9$).

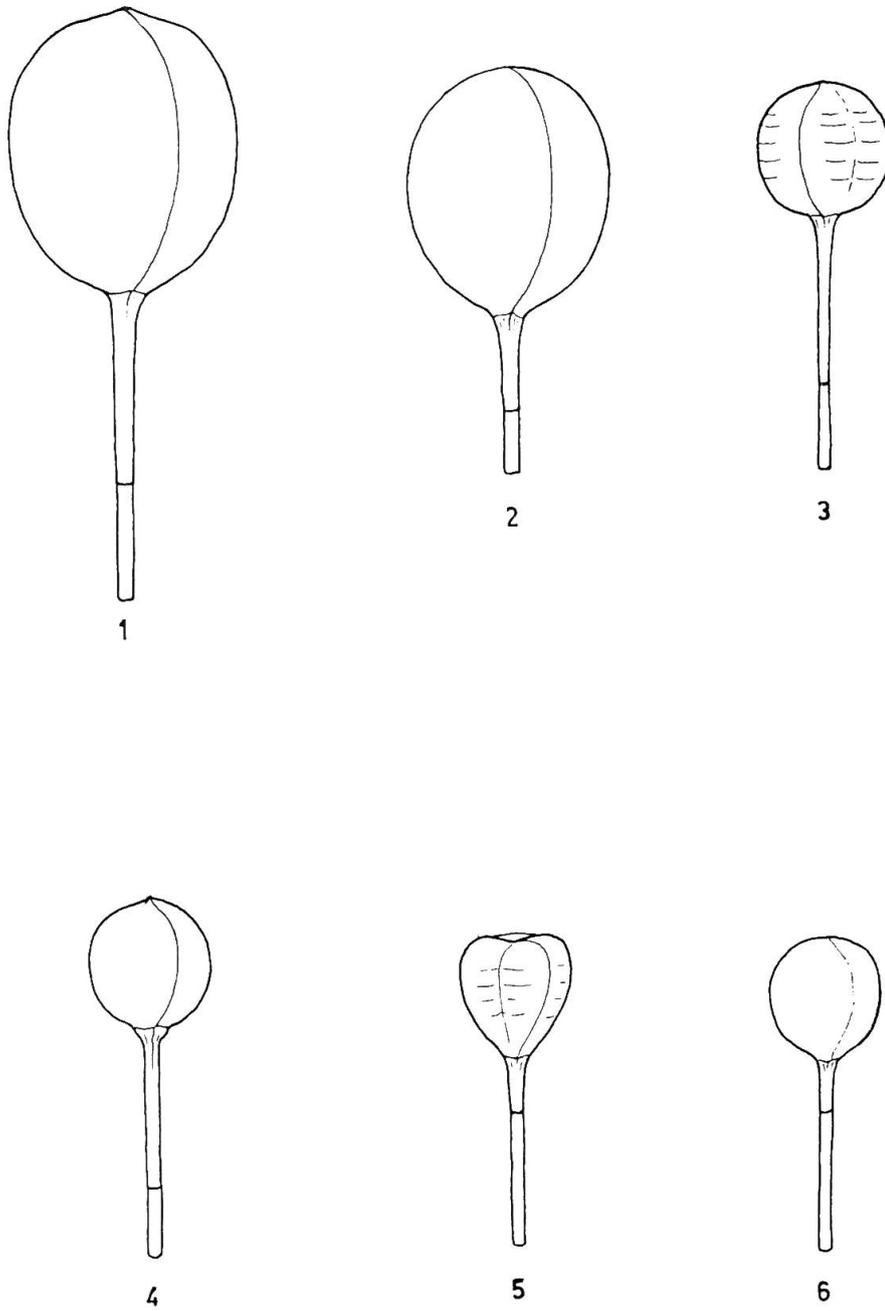


Fig. 4. — *Asphodeline* capsules (I): 1, *A. lutea*; 2, *A. baytopae*; 3, *A. brevicaulis* subsp. *brevicaulis* var. *brevicaulis*; 4, *A. liburnica*; 5-6, *A. tenuior* subsp. *tenuiflora* ($\times 1.9$).

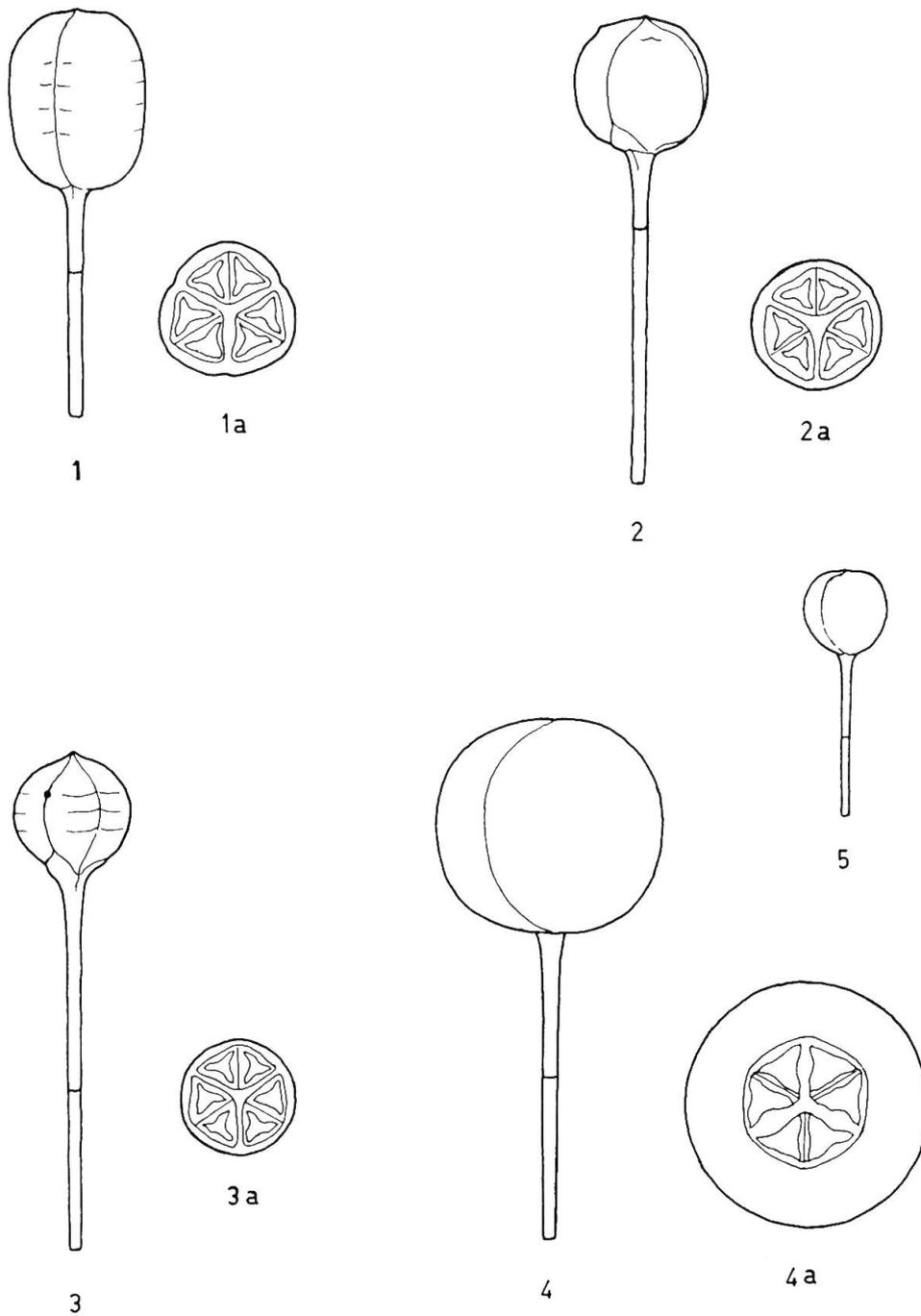


Fig. 5. — *Asphodeline* capsules (II): 1, *A. taurica* (1a, median cross-section); 2, *A. globifera* (2a, median cross-section); 3, *A. rigidifolia* (3a, median cross-section); 4, *A. cilicica* (4a, median cross-section); 5, *A. dendroides* ($\times 1.9$).

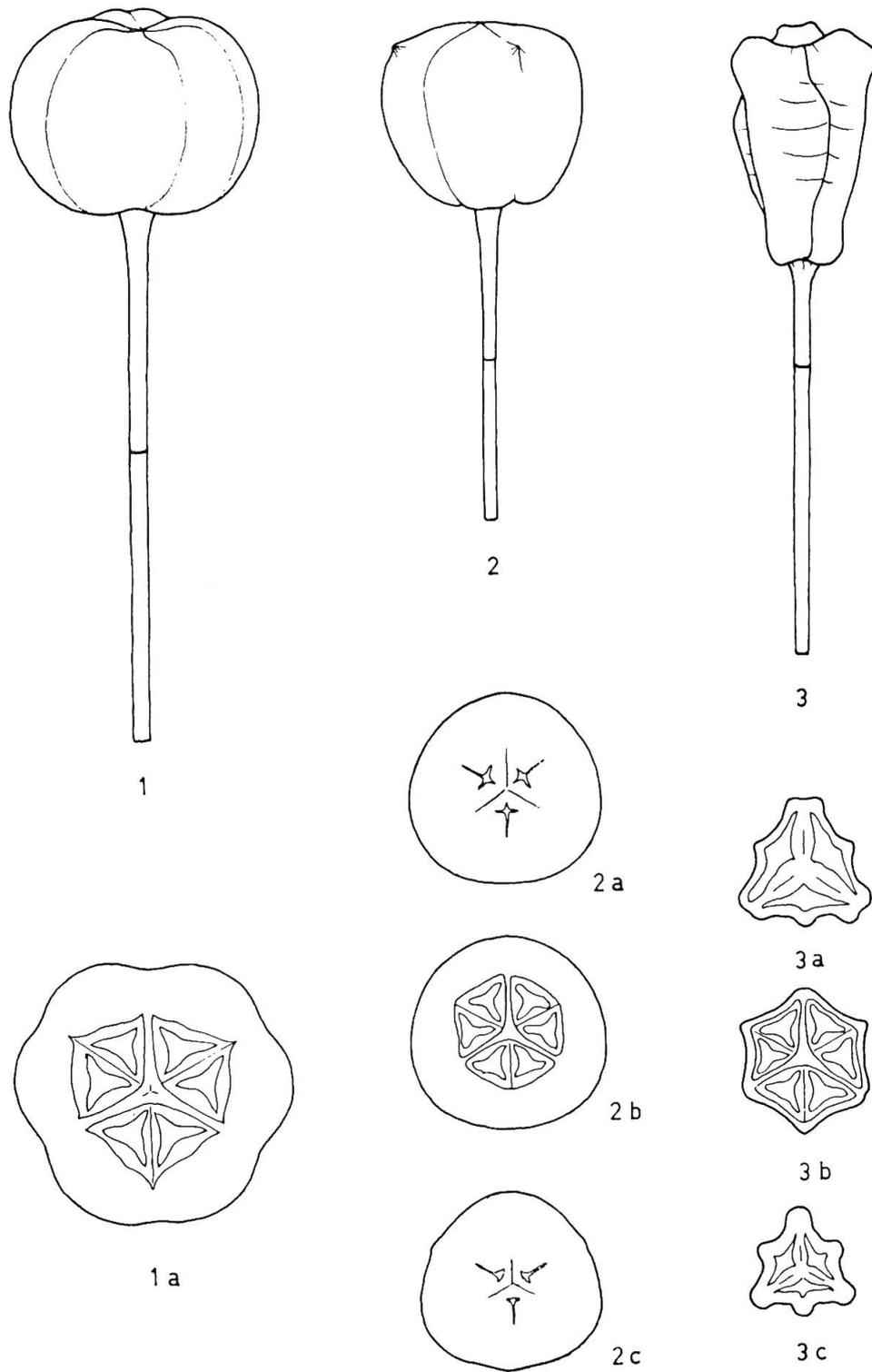


Fig. 6. — *Asphodeline* capsules (III): *A. peshmeniana* (1a, median cross-section); 2, *A. anatolica* (2a, apical cross-section; 2b, median cross-section; 2c, basal cross-section); 3, *A. prismatocarpa* (3a, apical cross-section; 3b, median cross-section; 3c, basal cross-section) ($\times 1.9$).

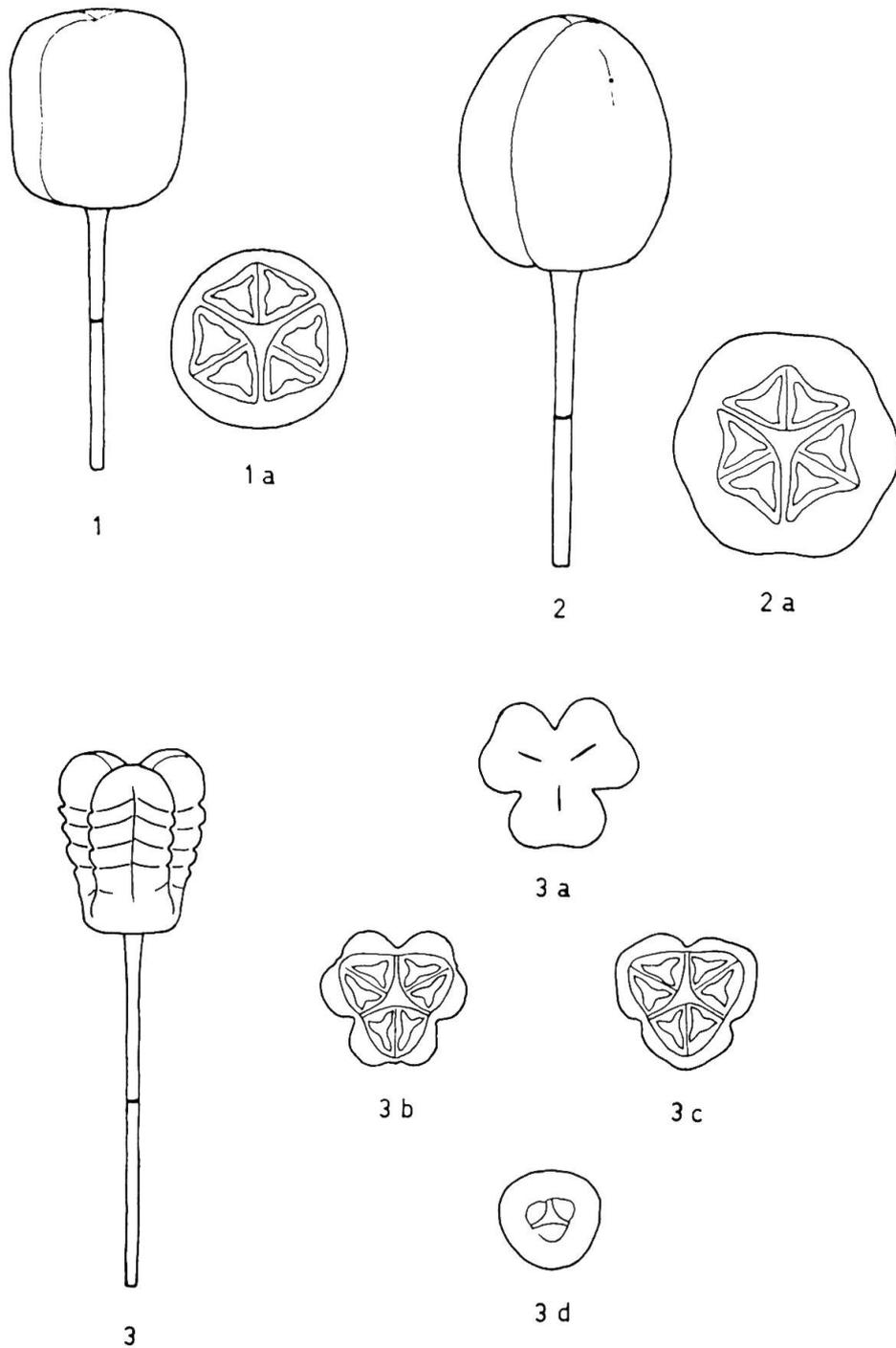


Fig. 7. — Capsules of *Asphodeline damascena*. 1, subsp. *gigantea* (1a, median cross-section); 2, subsp. *ovoidea* (2a, median cross-section); 3, subsp. *rugosa* (3a, apical cross-section; 3b, median cross-section; 3c, basal cross-section) ($\times 1.9$).

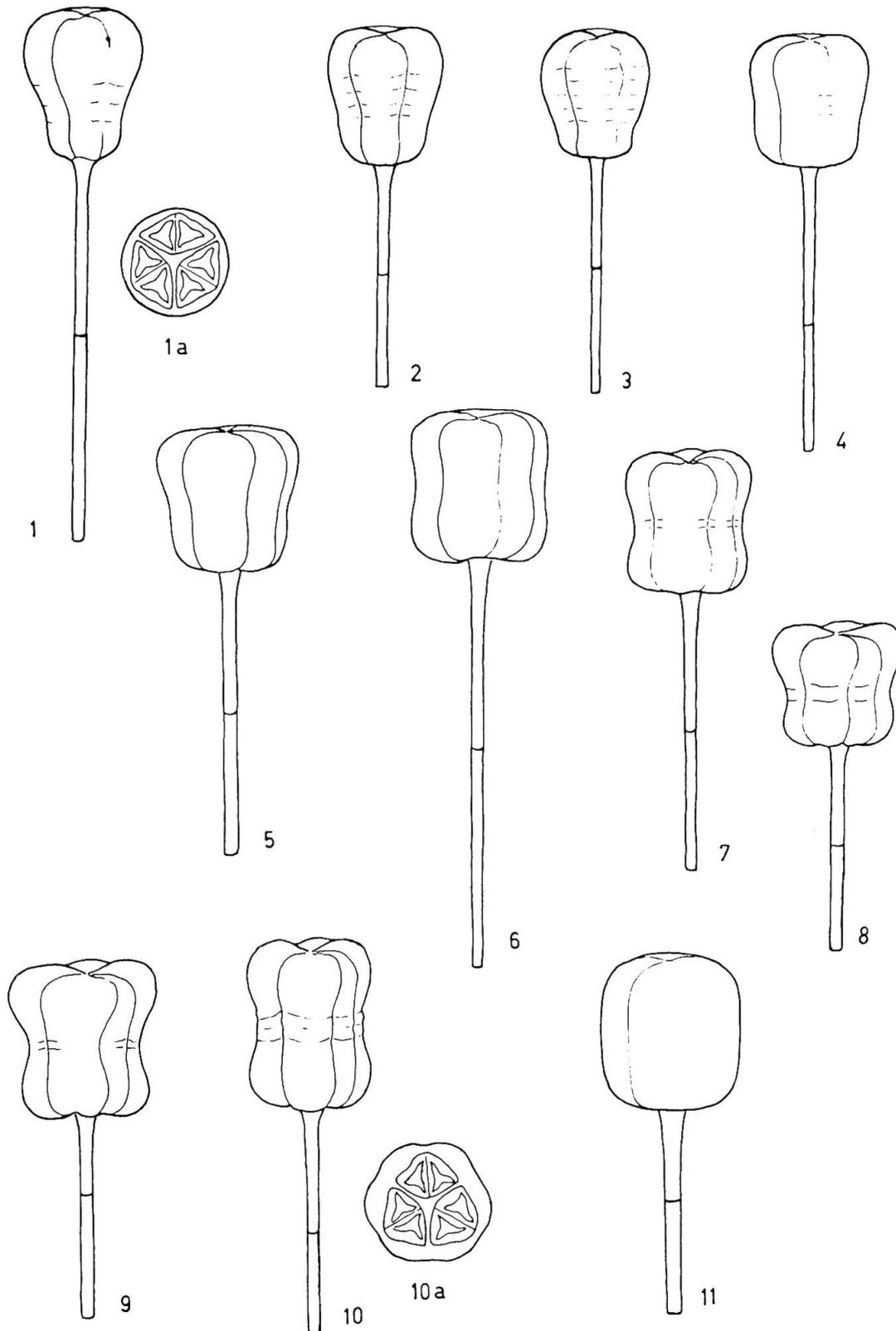


Fig. 8. — Capsule forms of *Asphodeline damascena* subsp. *damascena* (I). Localities (in Turkey); 1, Adana: Gülek pass (1a, median cross-section); 2, Arslanköy; 3, Zonguldak: Safranbolu; 4, Konya-Beyşehir; 5, İçel: Sertavul pass-Mut; 6, Konya: Bolkar Da.; 7-8, Adana: Pozantı; 9, Niğde: Çamardı; 10, Kayseri: Yahyalı (10a, median cross-section); 11, Ankara: Çandır ($\times 1.9$).

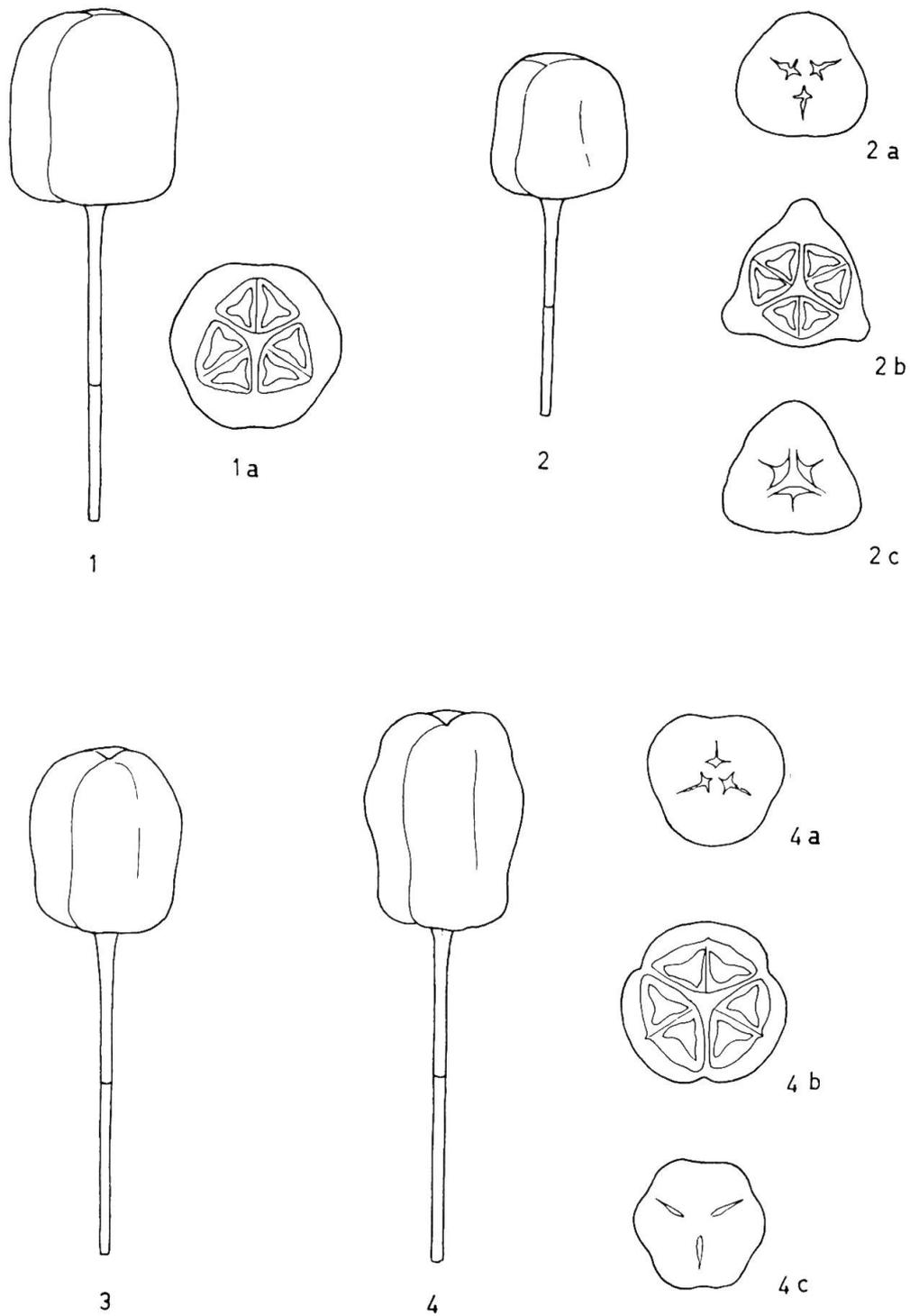


Fig. 9. — Capsule forms of *Asphodeline damascena* subsp. *damascena* (II). Localities (in Turkey); 1, Ankara: Çayırhan (1a, median cross-section); 2, Ankara: Kırıkkale-Elmadağ (2a, apical cross-section; 2b, median cross-section; 2c, basal cross-section); 3-4, Çankırı: Ilgaz (4a, apical cross-section; 4b, median cross-section; 4c, basal cross-section) ($\times 1.9$).

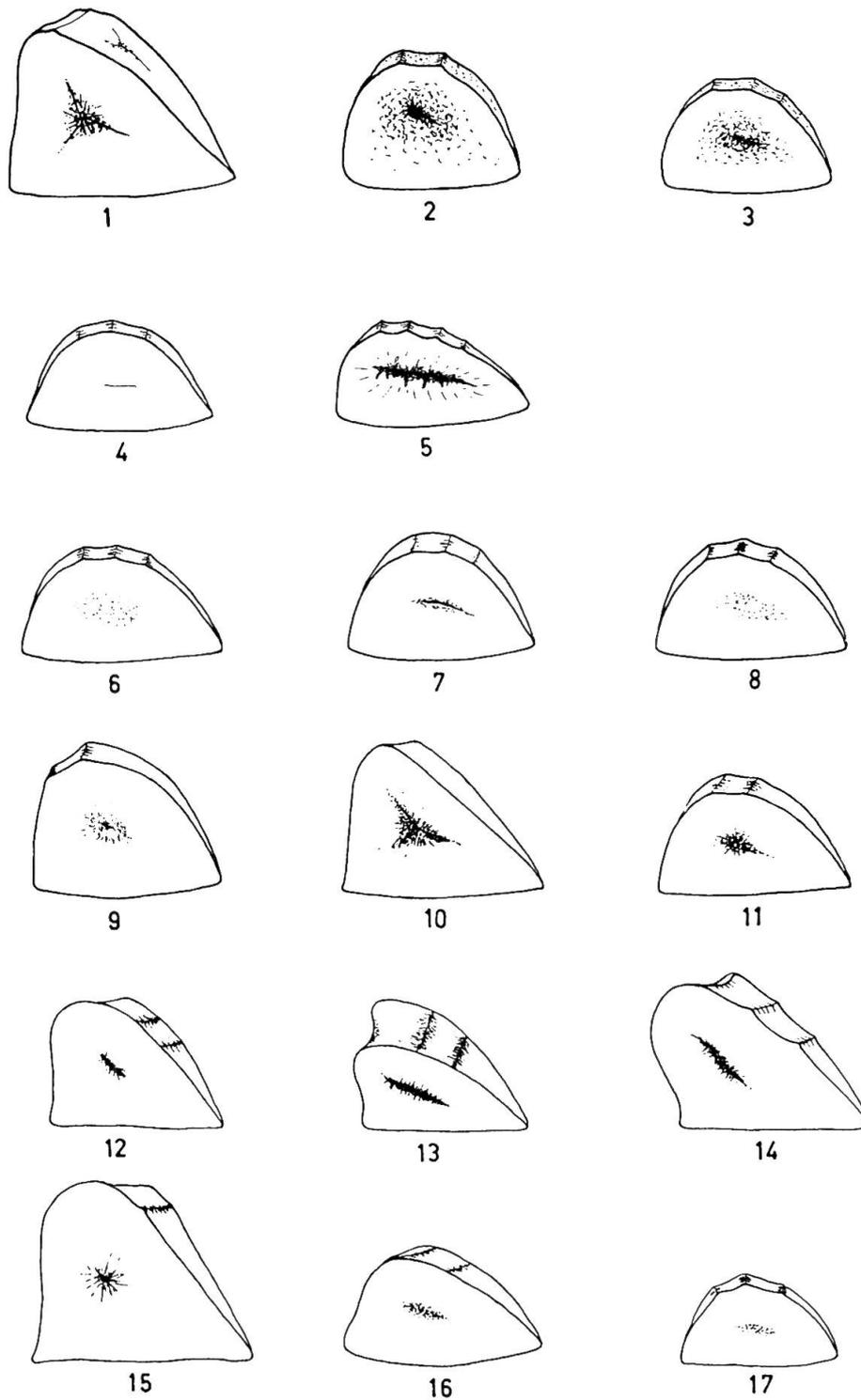


Fig. 10. — *Asphodeline* seeds: 1, *A. lutea*; 2, *A. baytopae*; 3, *A. brevicaulis* subsp. *brevicaulis* var. *brevicaulis*; 4, *A. liburnica*; 5, *A. tenuior* subsp. *tenuiflora*; 6, *A. taurica*; 7, *A. globifera*; 8, *A. rigidifolia*; 9, *A. cilicica*; 10, *A. peshmeniana*; 11, *A. anatolica*; 12, *A. damascena* subsp. *damascena*; 13, *A. damascena* subsp. *rugosa*; 14, *A. damascena* subsp. *gigantea*; 15, *A. damascena* subsp. *ovoidea*; 16, *A. prismatocarpa*; 17, *A. dendroides* ($\times 4.7$).

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