Four structural characters in the genera Peucedanum, Ferula and Ferulago

Four structural characters in the genera Peucedanum, Ferula and Ferulago

For the first of them, I found the clue from Boissier applied to *Ferula* and *Peucedanum* (cf. Flora orientalis... 2: 983. 1872) "Hoc unico inflorescentiae charactere genus *Ferula* naturali modo a *Peucedano* fere eadem fructus structura donato distinguitur".

For the others, I took into account:

2. the most obvious for all the *Umbelliferae:* the laciniae of the leaves;
3. the most peculiar to *Ferulago:* the hypsophylls (involucres and involucels), with the purpose comparing *Peucedanum* and *Ferulago;*
4. the most overgrown in several *Ferula,* the leave sheaths, with the aim of comparing it with *Peucedanum.*

The many adjoined illustrations are presented together with the species' names, the designation inferred from the presence or absence of one or another of those characters, if that indeed can help in the generic delimitations and in the intergeneric relationships. The text of the legends is therefore complementary to this one. Here instead, it is hoped to argue the trends with geographical significance of those characters in the three genera, but with special attention to *Ferulago.*

Review of the first character: inflorescence form

The umbellulae are arranged in three Types in the 3 genera (somewhat simplified; see also in the legends of the illustrations for some intermediates).

Type I: from the main, robust stem, here and there several verticillated compound umbels arise; *Ferulago campestris* is an obvious European example.

Type II: the umbellulae are displayed by a more or less corymbiform panicle lacking a main axis; an Anatolian example, *Ferulago stellata* Boiss.

Type III: the whole inflorescence, with a main axis, ends in a constantly compound umbel fructiferous; lateral ascending umbels are as a rule not fructiferous or fruit much later. A Mediterranean example: *Ferulago lutea* (Poiret) Grande.

A) PEUCEDANUM

Of the samples available in Geneva Conservatoire, it could be said: the inflorescence Type I is rather rare and seems localized in centro-oriental Europe, Spain and Africa (see Fig. 1: 1-6). The Type II instead is fairly evenly distributed over the whole genus area (see Fig. 2: 1-15). The same seems true for Type III (see Fig. 3: 1-15). By the way, from a quick survey of the very rich collection of *Lomatium* in New York Botanical Garden Herbarium (Oct. 1974) confirmed by the scruting of the Geneva collections, I ascertained that all the *Lomatium* species would seem to have the Type III inflorescence. I was then very anxious to see if the Far North-East species of *Peucedanum* would show an increasing incidence of Type III inflorescence. That could have meant a geographical trend of this character, as it were a centrifugalisation toward the East (for my ideas about this topic for *Araliaceae,* see BERNARDI, 1975). But alas the *Peucedanum* samples to those regions are too poorly represented in Geneva for either confirmation or refutation of that hypothesized trend, leaving untouched the question, perhaps more nomenclatural than taxonomic, of *Lomatium* versus *Peucedanum.*

It is worth observing that some *Peucedanum* species have an inflorescence without a main axis but with a basipetous blooming, therefore of an intermediate Type: II toward III (see Fig. 4: 1-7). In *Ferulago,* on the

contrary, the intermediate forms of inflorescence are to be found between Types I and III. However, in both genera, those intermediate forms tend to the dominant form of inflorescence: the Types II and III in *Peucedanum;* the Type I in *Ferulago.*

B) FERULA

Here the main tendency is to Type I (see Fig. 5: 1-7). Frequently it is possible to observe a tall, straight floriferous stem attaining a size rare in the family. But, unlike *Peucedanum* where as a rule all the umbellulae bloom at the same time and fruit later, in *Ferula,* quoting again BOISSIER (1872: 983) "umbellis centralibus ramorum fertilibus saepius sessilibus vel brevius pedunculatis, lateralibus (sub umbrella centrali sitis) masculis vel polygamis". This means that throughout the inflorescence, on the verticillate lateral compound umbels and, on the top, one umbel will carry fruit while the others will remain sterile. All this approaches Type III, but here only, the top umbel is fertile. From the available evidence of Geneva samples and Korovin's beautiful monograph, it would seem that the true Type III is lacking in *Ferula.*

On the other hand, inflorescences of Type II, when they are present in *Ferula* species, take from it a fair amount of its generic facies. I believe that many species of *Ferula,* chiefly of the subg. *Peucedanoides,* would be better placed in *Peucedanum.* As the aim of this work is to order *Ferulago* clearly, I cannot enter into the problem of the hazy boundary between *Ferula* and *Peucedanum,* but I limit myself to giving an account of some *Ferula* species which, for a constellation of characters, e.g.: stature, small fruits, bracts both at the inflorescence base and throughout it, leaves sheaths and of course, inflorescence Type II, point straight to *Peucedanum;* they are: *Ferula canescens* (Ledeb.) Ledeb.; *F. caucasica* Korovin; *F. dshaudshamyr* (sic!) Korovin; *F. gracilis* (Ledeb.) Ledeb.; *F. involucrata* Korovin; *F. leucographa* Korovin; *F. microcarpa* Korovin; *F. sadleriana* Ledeb.; *F. sinaica* Boiss.; *F. syreitschikowii* Kos.-Pol (see Fig. 6).

This list surely is incomplete. The much-needed botanist (needed for more than a century) who will revise *Peucedanum* should take into account the fact that this genus is — in my opinion — hugely parasitized, in a taxonomic sense, by *Ferula.*

C) FERULAGO

In the "Conclusions" (p. 167), the reader can find the results of my research discussed at length, with the geographical implications.

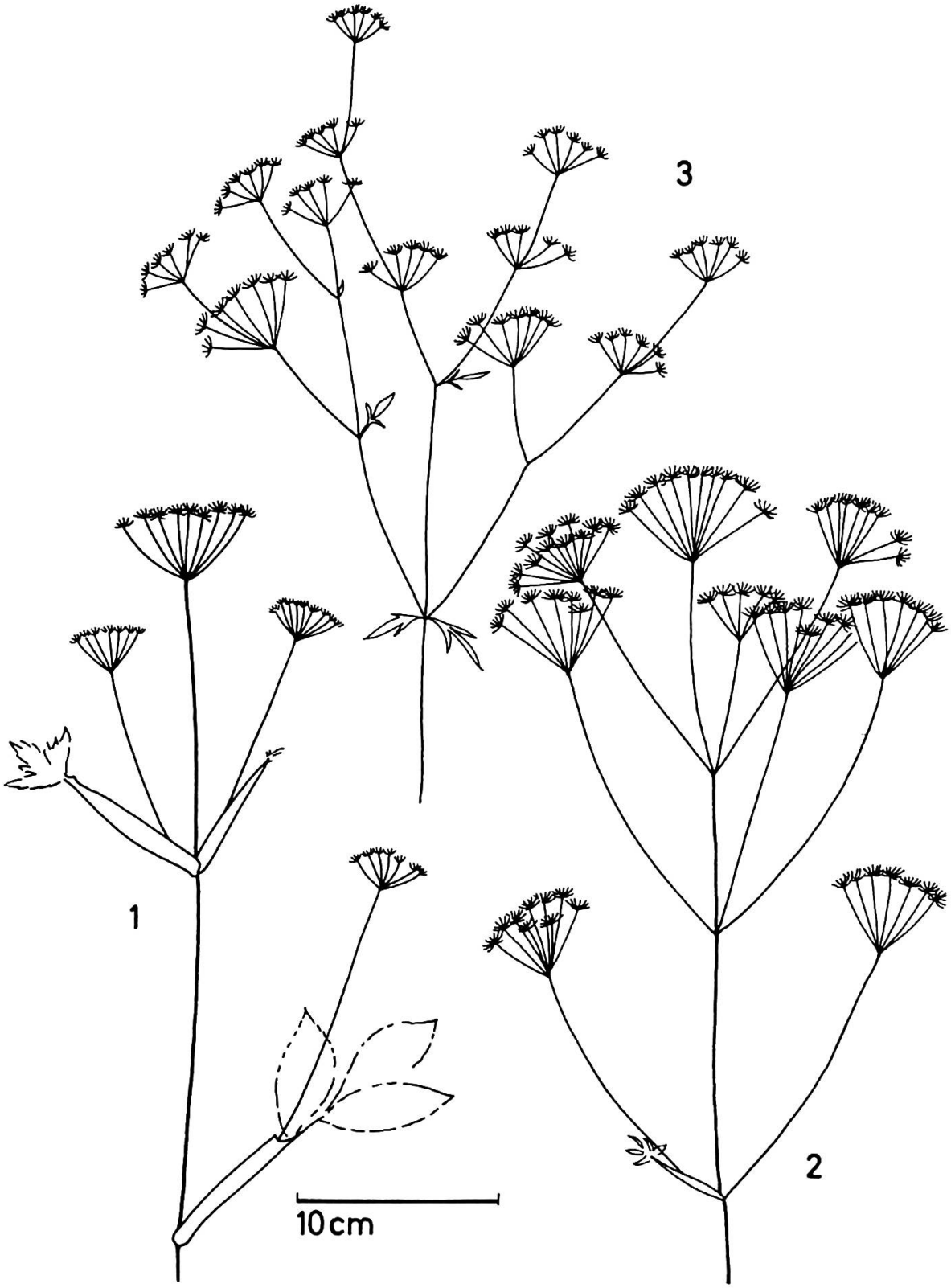
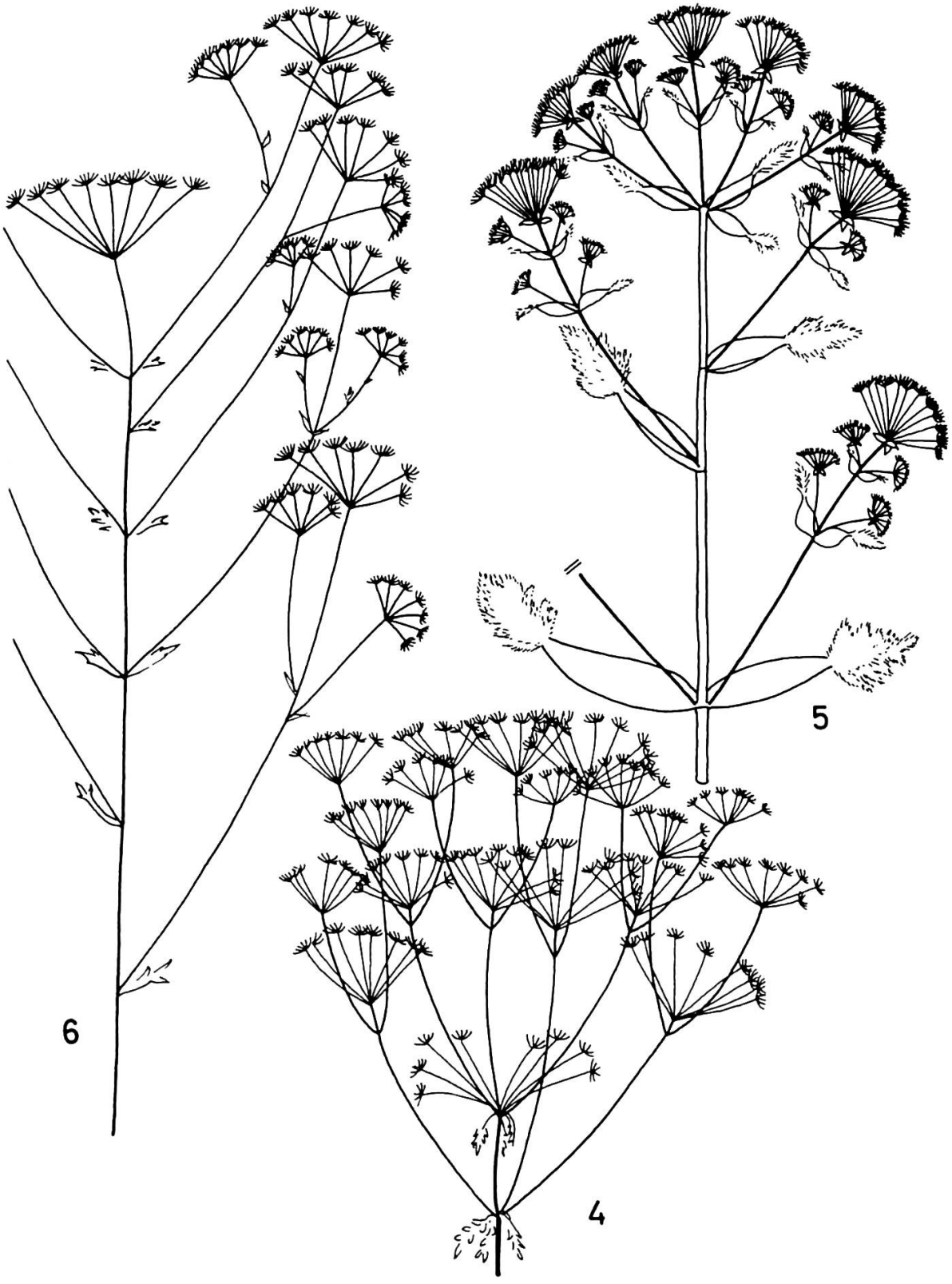


Fig. 1 (see explanation p. 26).



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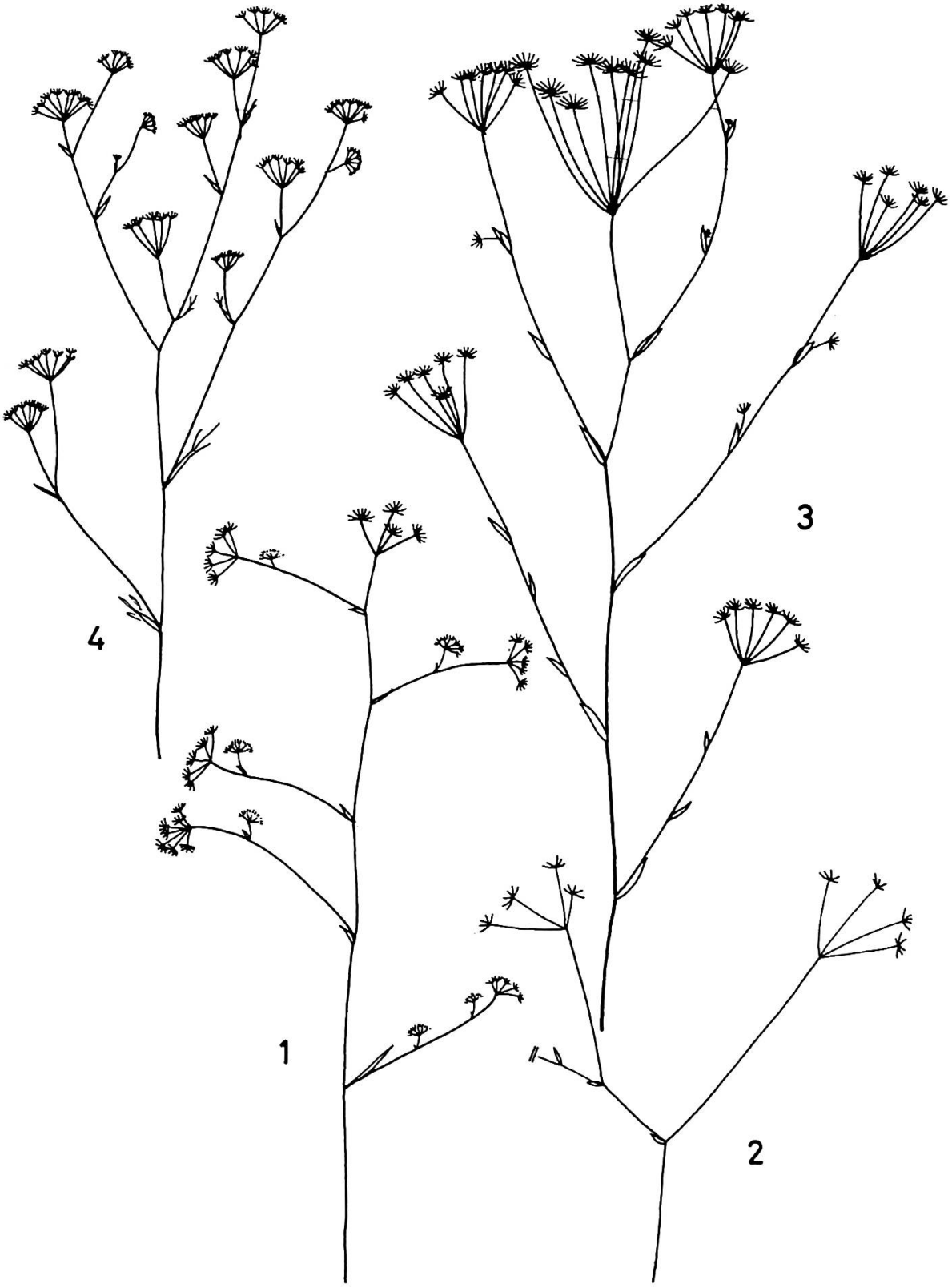

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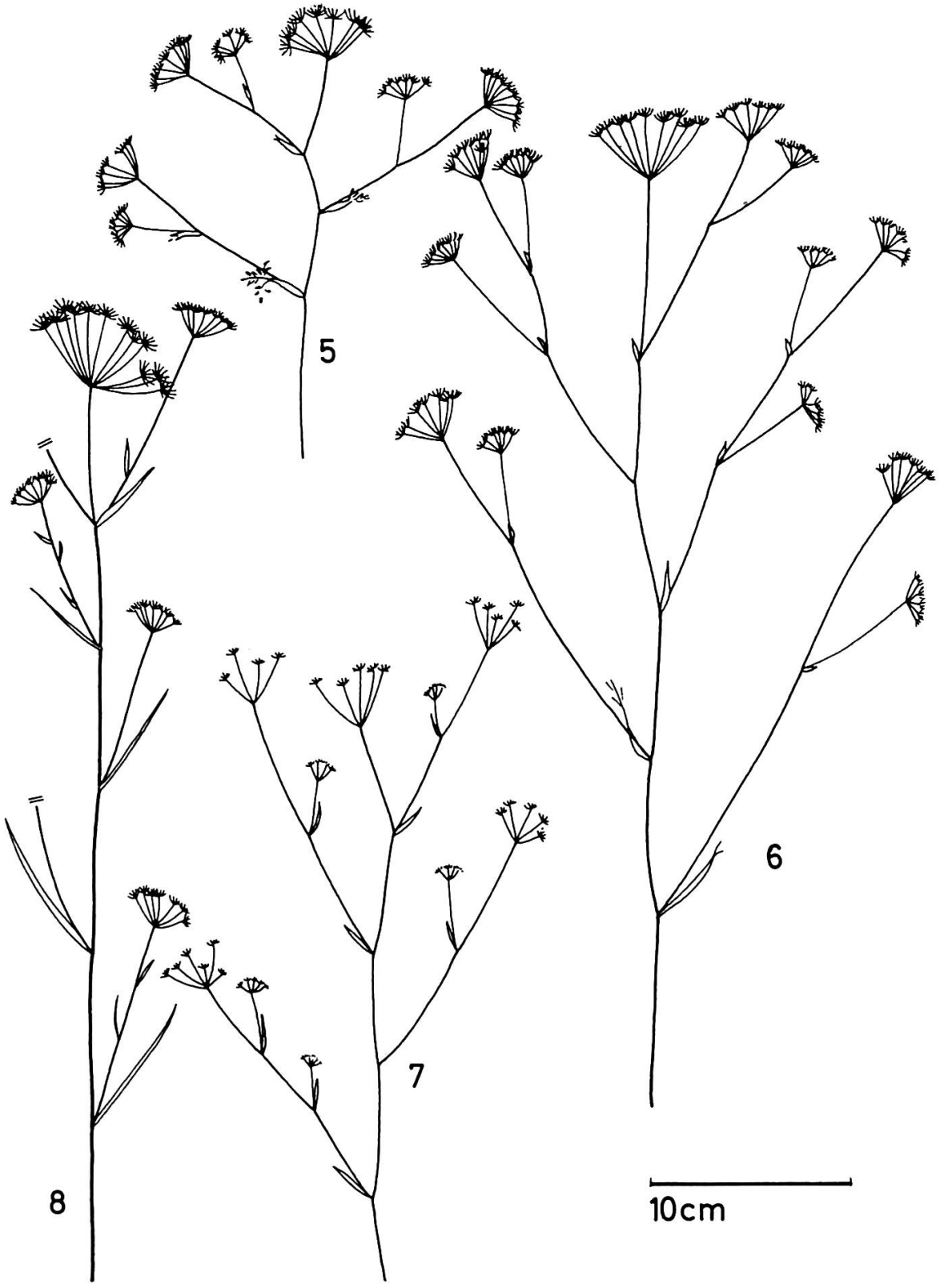

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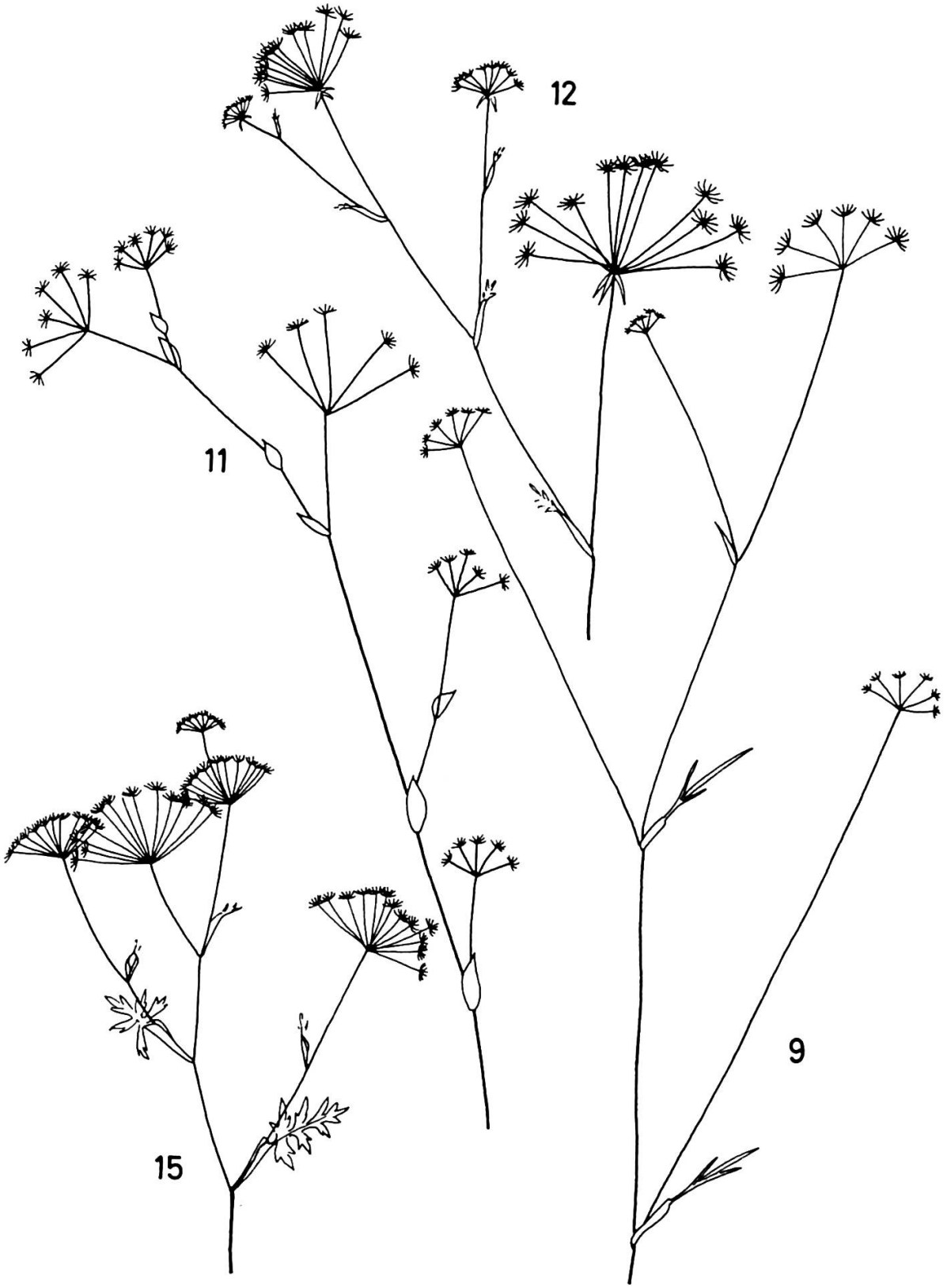

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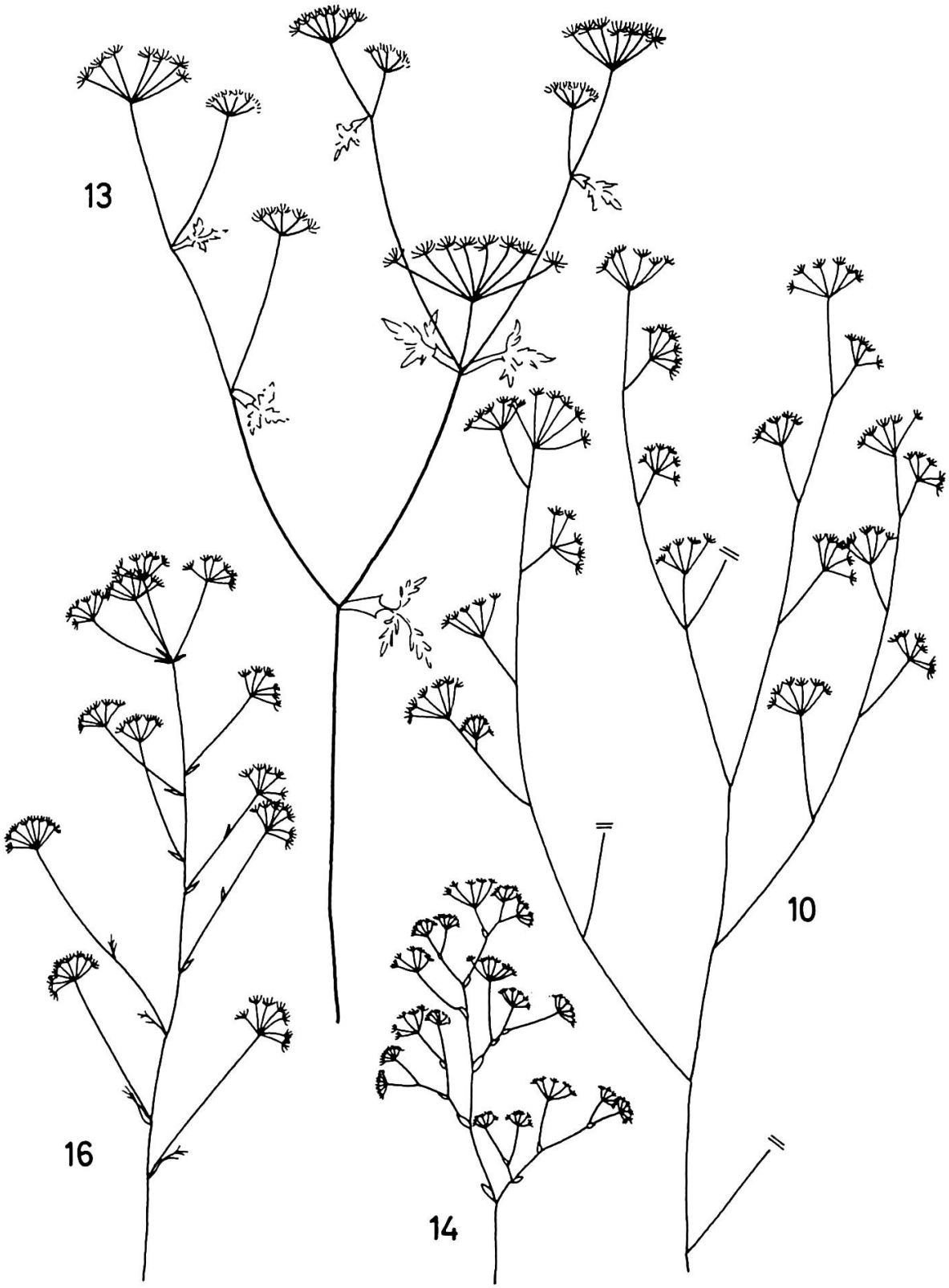

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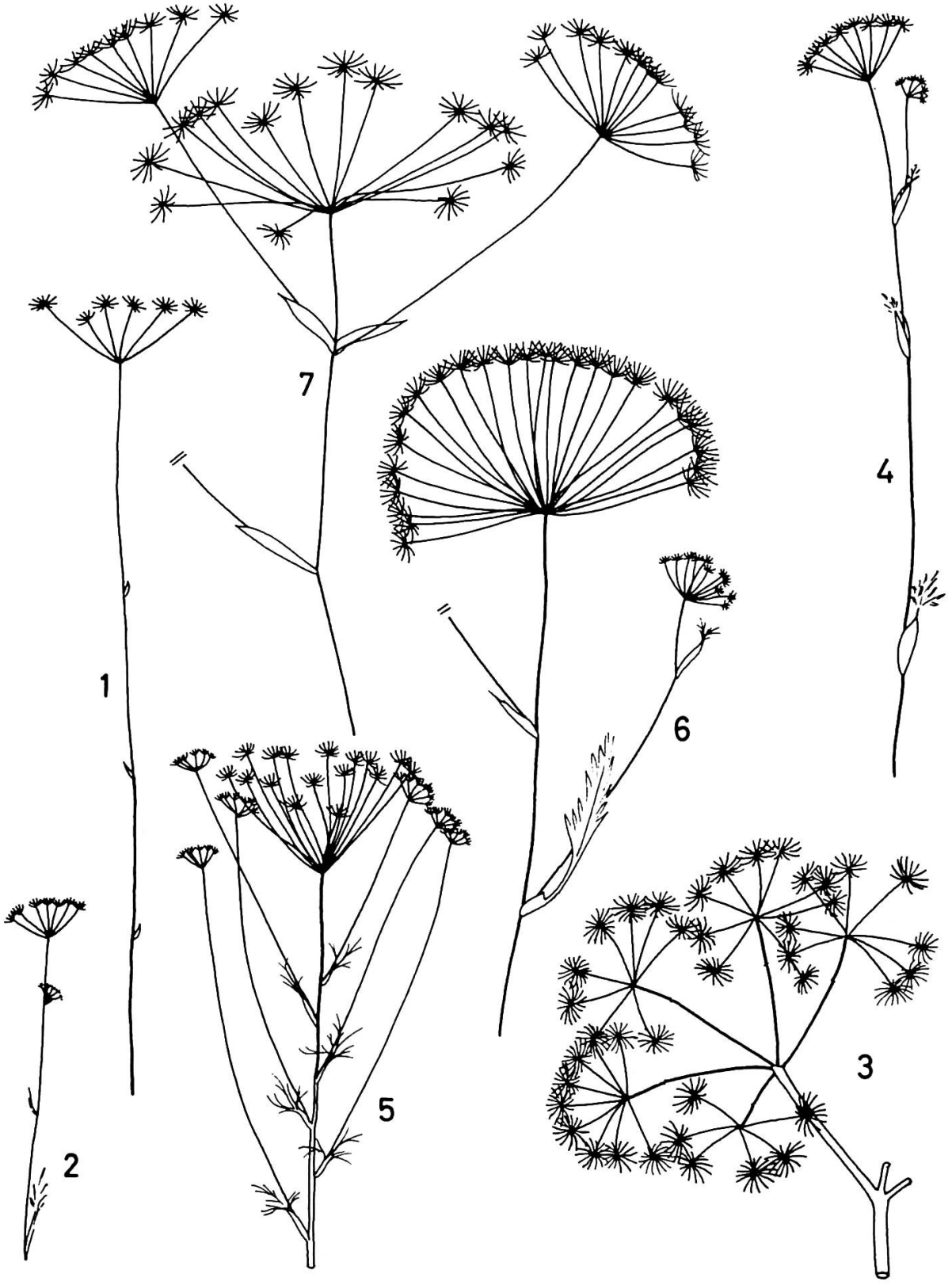

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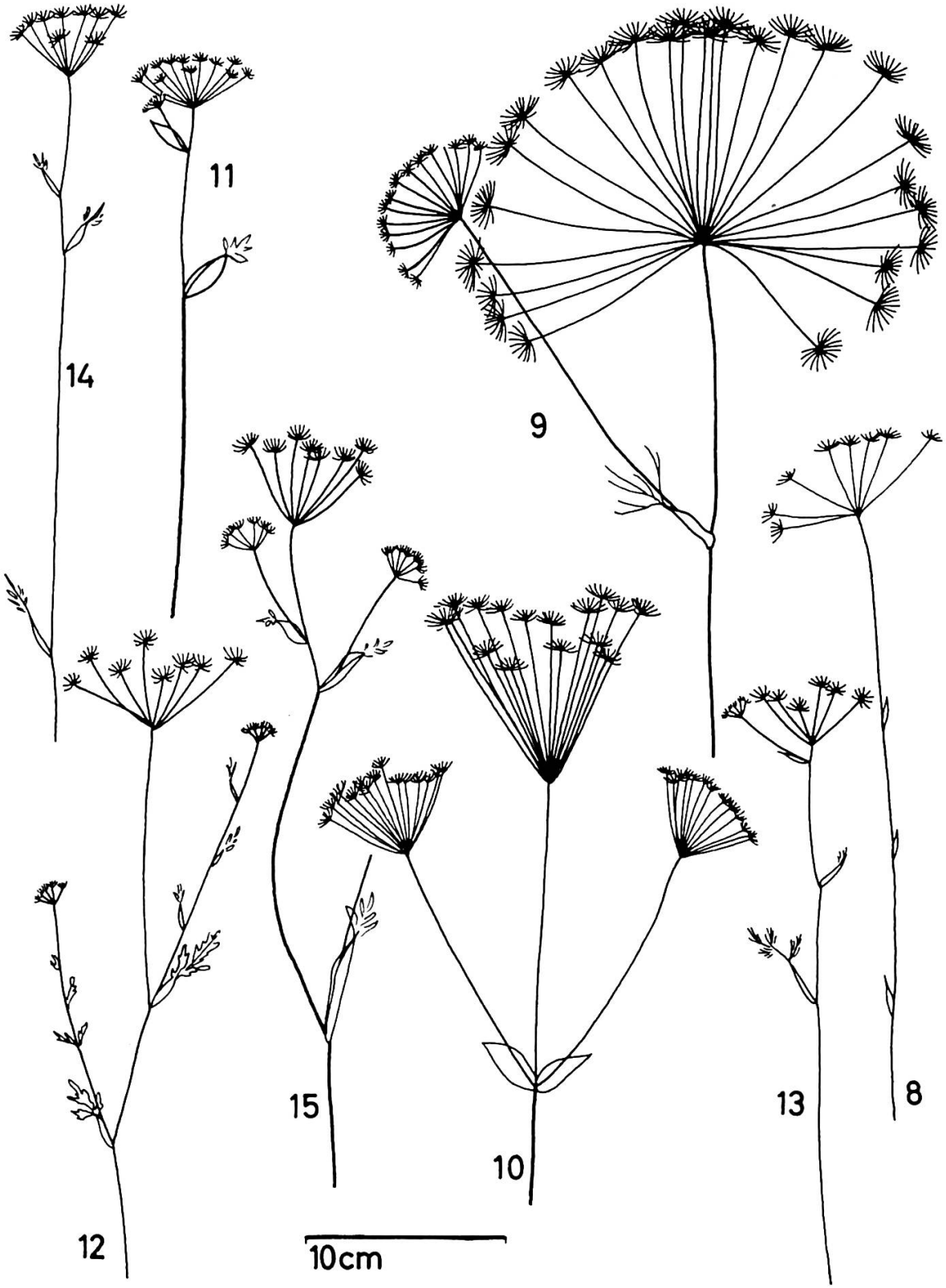

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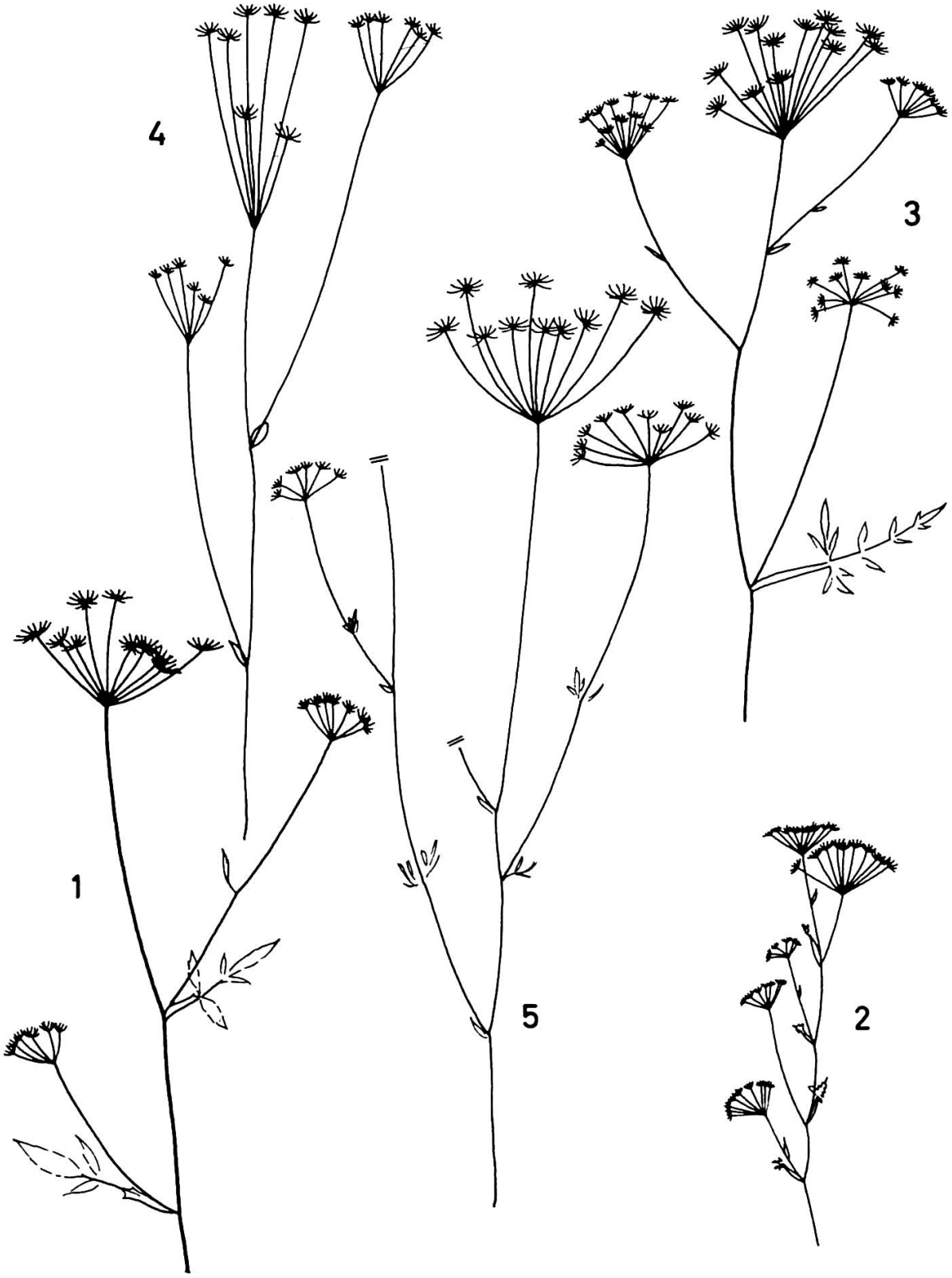

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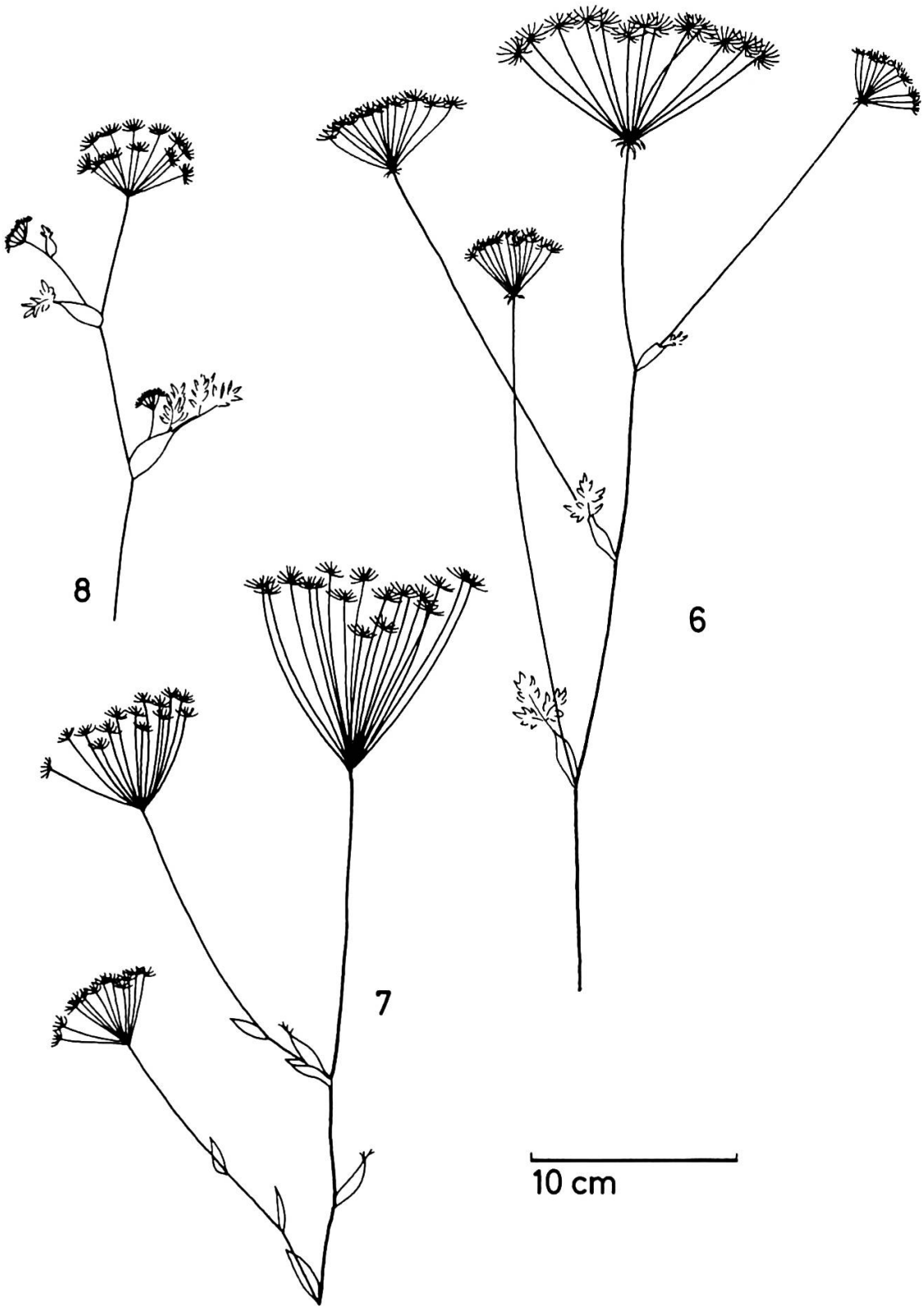


Fig. 4 (see explanation p. 26).

Fig. 1. — *Peucedanum.* Species with inflorescences of Type I. According to the evidence at hand, it seems that Type I is restricted to Europe and Africa, South of Sahara.

1. *P. hispanicum* (Boiss.) Endl. (Spain); **2.** *P. verticillare* (L.) Koch ex DC. (Europe); **3.** *P. welwitschii* (Endl.) Drude (West Trop. Africa); **4.** *P. elgonense* Wolff (West Trop. Africa); **5.** *P. kerstenii* Engler (West Trop. Africa); **6.** *P. wilmsianum* Wolff (South Africa).

Fig. 2. — *Peucedanum.* Species with inflorescences of Type II, present throughout the area of distribution of the genus. These 16 examples, although only a small portion of the species with this Type of inflorescence, do however show its ample variation.

1. *P. adae* Woronin (Caucasus); **2.** *P. alpinum* (Sieb. ex Schult.) Burtt & Davis (Crete and Anatolia); **3.** *P. arenarium* Waldst. & Kit. (East Europe); **4.** *P. angustisectum* C. Norman (South Africa). **5.** *P. baicalense* (Redow.) C. Koch (Siberia); **6.** *P. chryseum* (Boiss. & Heldr.) Chamberlain (Anatolia); **7.** *P. depauperatum* Boiss. & Balansa (Anatolia and Lebanon); **8.** *P. ferulaceum* Thunb. ex Sond. (South Africa); **9.** *P. lancifolium* Lange (Europe); **10.** *P. munbyi* Boiss. (North Africa); **11.** *P. neumayeri* Reichenb. (East Europe); **12.** *P. palustre* (L.) Moench (Europe); **13.** *P. petitianum* A. Rich. (East Africa); **14.** *P. polyscias* Boiss. (Iran); **15.** *P. terebinthaceum* Fischer ex DC. (Siberia); **16.** *P. venetum* (Sprengel) Koch (Europe).

Fig. 3. — *Peucedanum.* Species with inflorescences of Type III; they seem, from the available evidence, to be fewer than those of Type II, but as widespread. Lacking enough samples from the far North East, I could not verify if this Type is more frequent there than the Type II. The genus *Lomatium* of North America, surely closely akin to *Peucedanum*, seems to display only Type III.

It is worth observing that the species 3, 7, and 10 point to Type I, while the species 5, 12, and 15 to Type II. Ninth and tenth examples show inflorescences structurally of Type II, but as these are basipetous, they become blurred with Type III.

In *Ferulago*, on the other hand, the types of inflorescences are more sharply defined, with very few species whose inflorescences show a mingling of two different types.

1. *P. capillaceum* Thunb. (South Africa); **2.** *P. falcaria* Turcz. (Central Asia); **3.** *P. fraxinifolium* Hiern (East Trop. Africa); **4.** *P. friesiorum* Wolff (East Trop. Africa); **5.** *P. galbanum* Bentham & Hooker (South Africa); **6.** *P. isetense* Sprengel ex Schult. (Siberia); **7.** *P. longifolium* Waldst. & Kit. (East Europe); **8.** *P. magalismontanum* Sond. in Harv. (South Africa); **9.** *P. multiradiatum* Drude (South Africa); **10.** *P. ostruthium* (L.) Koch (Europe); **11.** *P. praeruptorum* Dunn (China); **12.** *P. rigidum* Bunge (China); **13.** *P. salinum* Pall. ex Sprengel (Siberia); **14.** *P. vaginatum* Ledeb. (Siberia); **15.** *P. volkensii* Engler (East Trop. Africa).

Fig. 4. — *Peucedanum.* Species with inflorescences clearly built on Type II, but usually with only one fertile umbel; as a rule, that fruiting umbel is terminal either at the beginning or becomes so by differentiate growing, thus approaching Type III.

1. *P. aegopodioides* (Boiss.) Vandas (Anatolia and Balkans); **2.** *P. deltoideum* Makino (Japan); **3.** *P. latifolium* DC. (Caucasus to Europe); **4.** *P. meisnerianum* McOwan ex Engler (South Africa); **5.** *P. muriculatum* Welw. ex Hiern (West Trop. Africa); **6.** *P. oreoselinum* (L.) Moench (Europe); **7.** *P. stenocarpum* Boiss. & Reuter (Spain); **8.** *P. ubadakense* Makino (Japan).

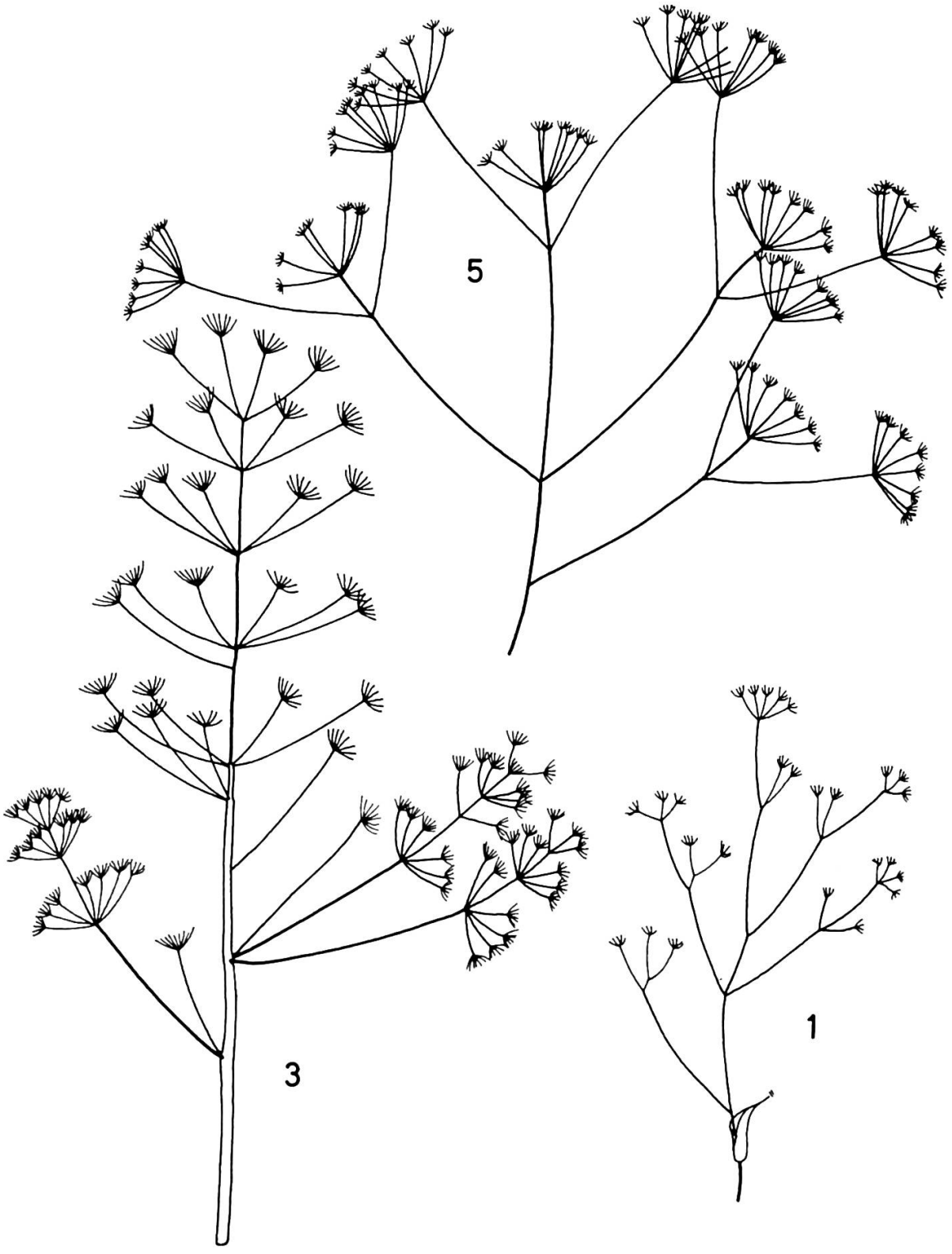
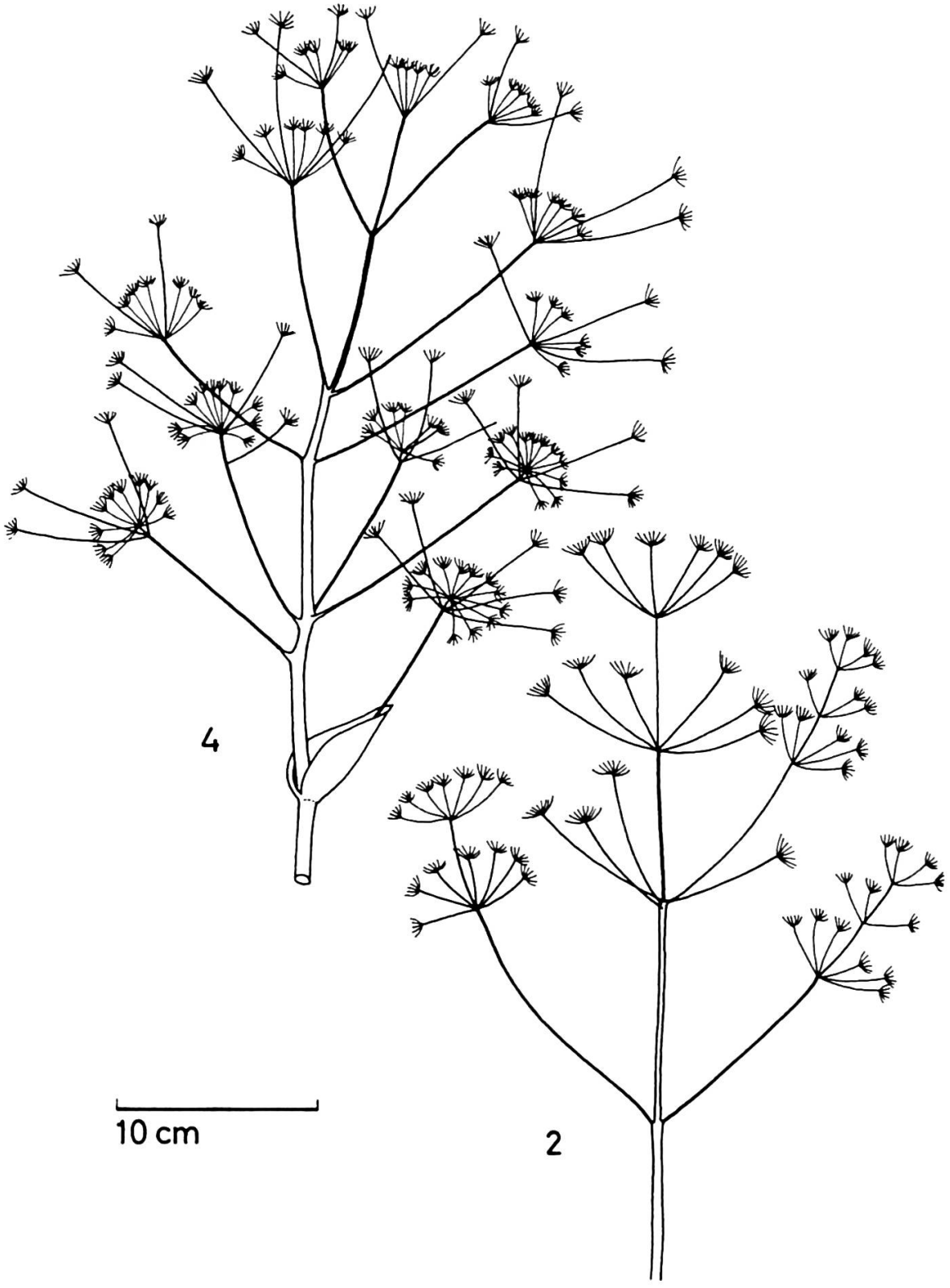


Fig. 5 (see explanation p. 37).



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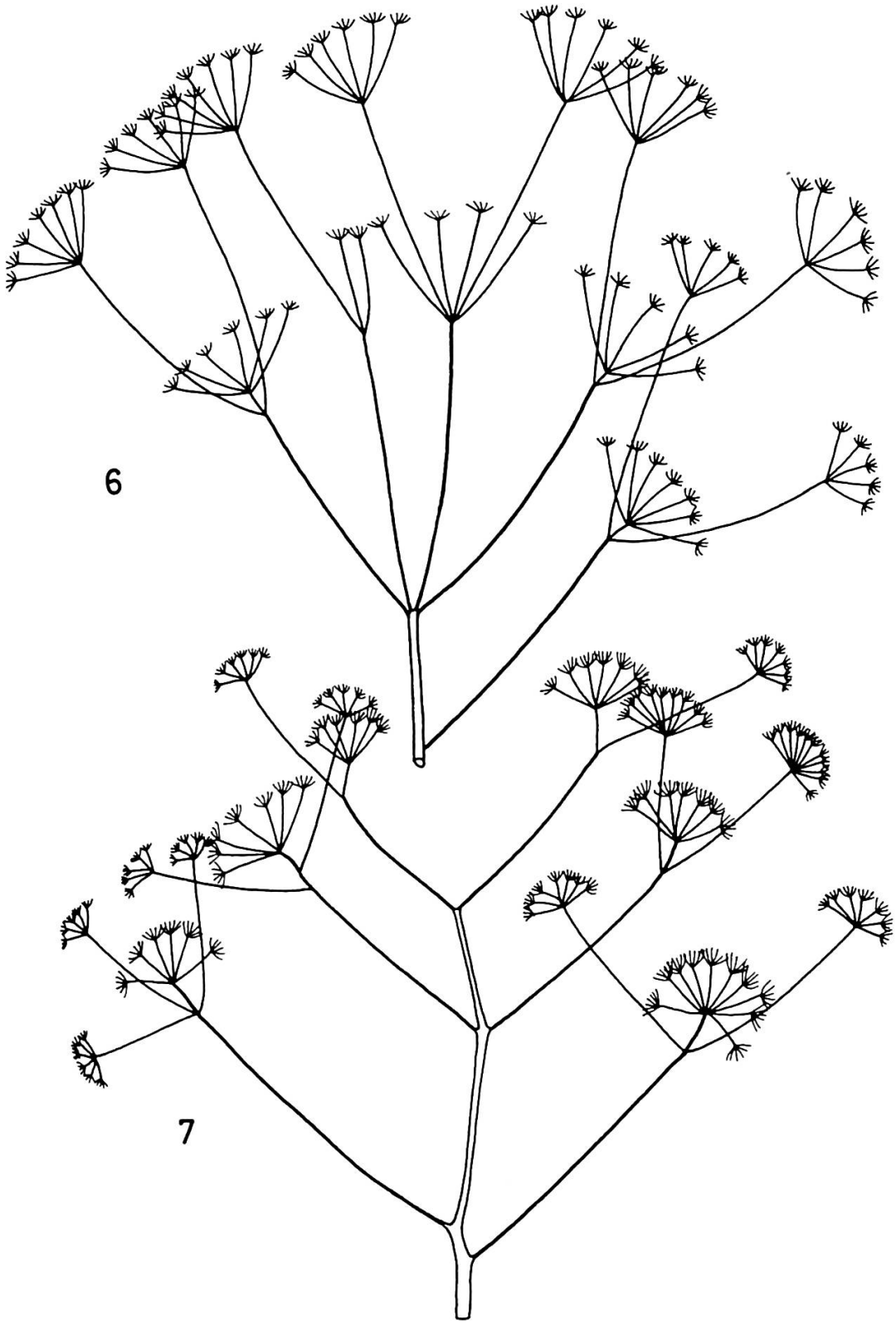

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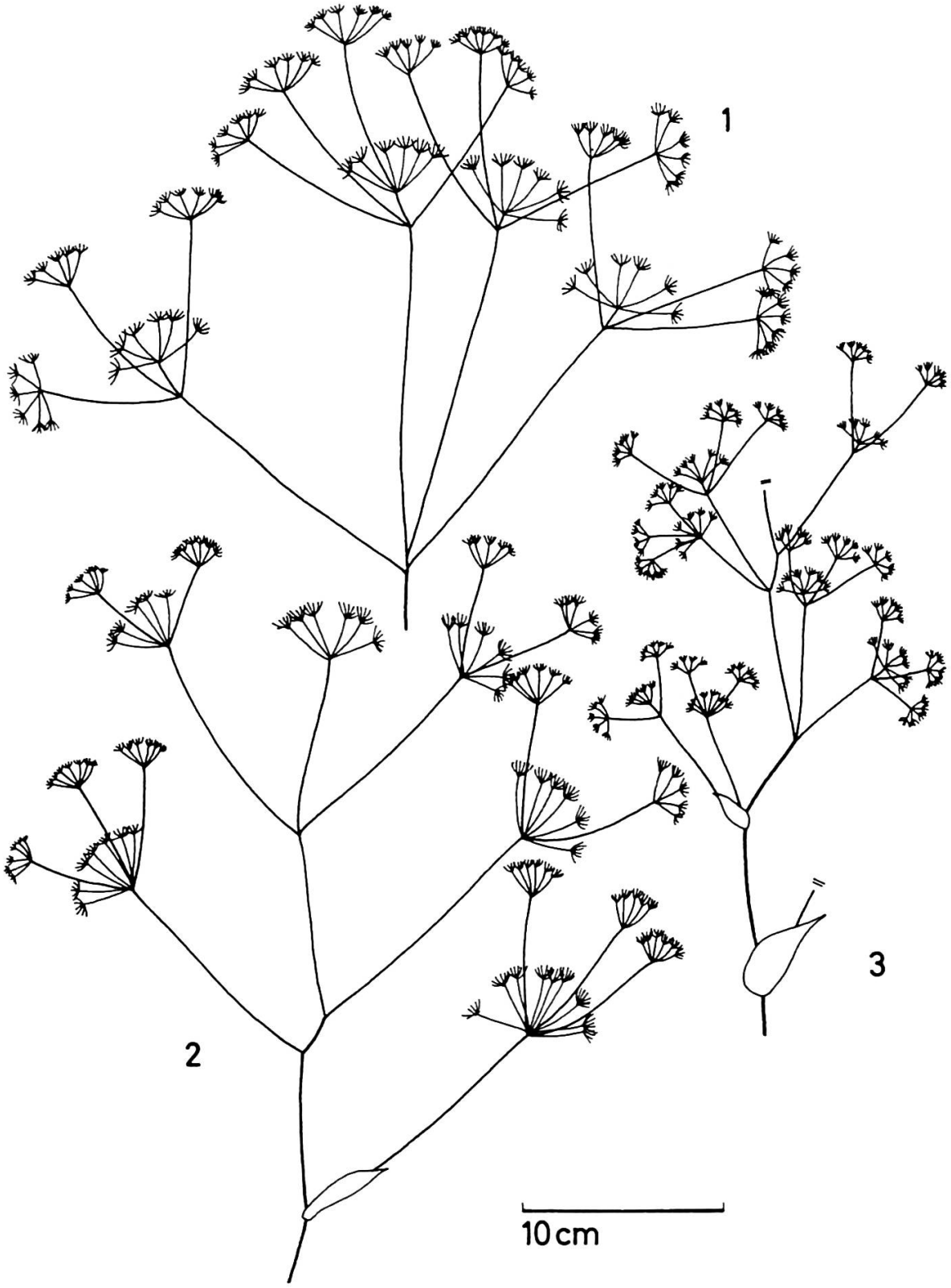
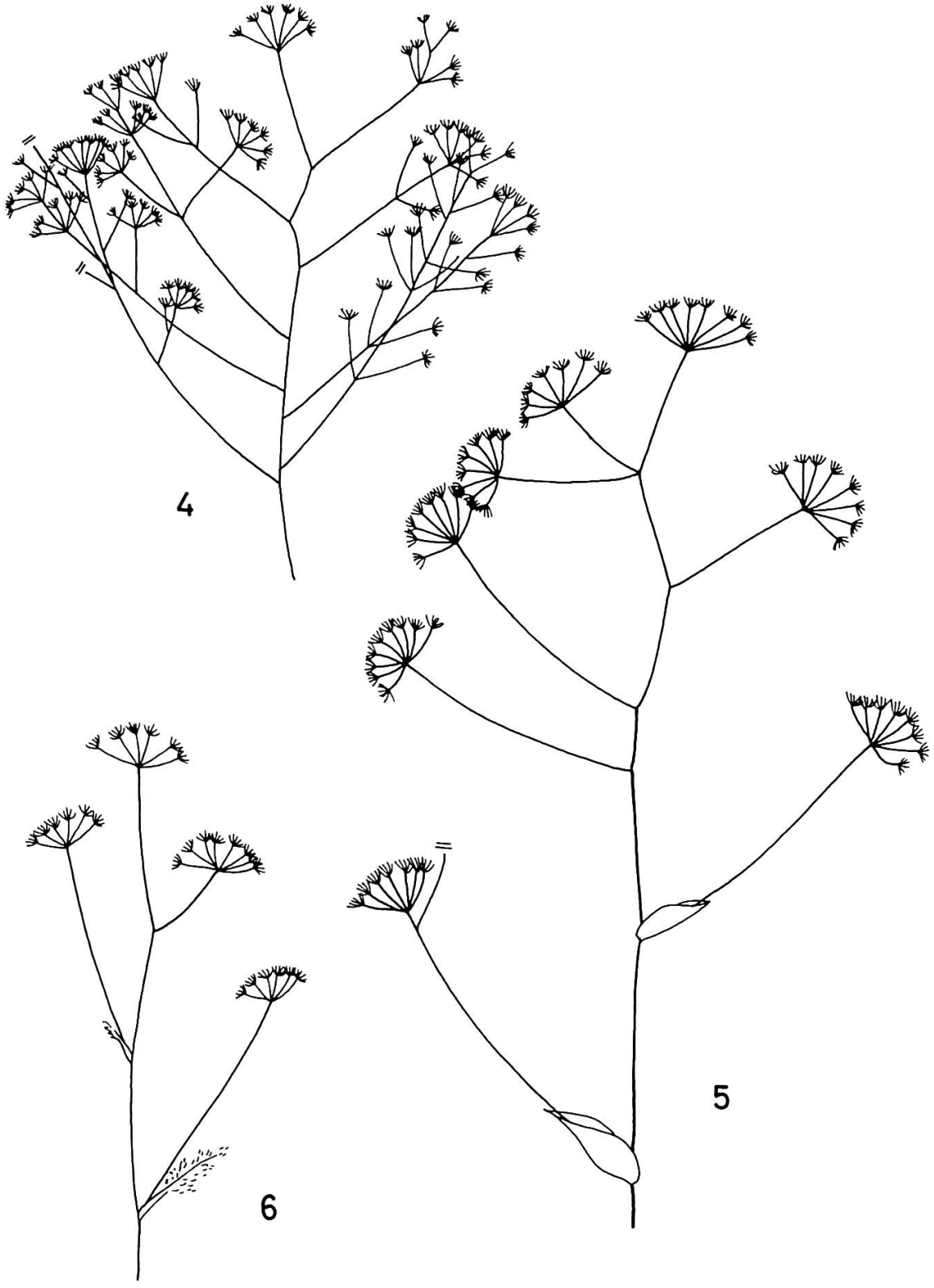


Fig. 6 (see explanation p. 37).



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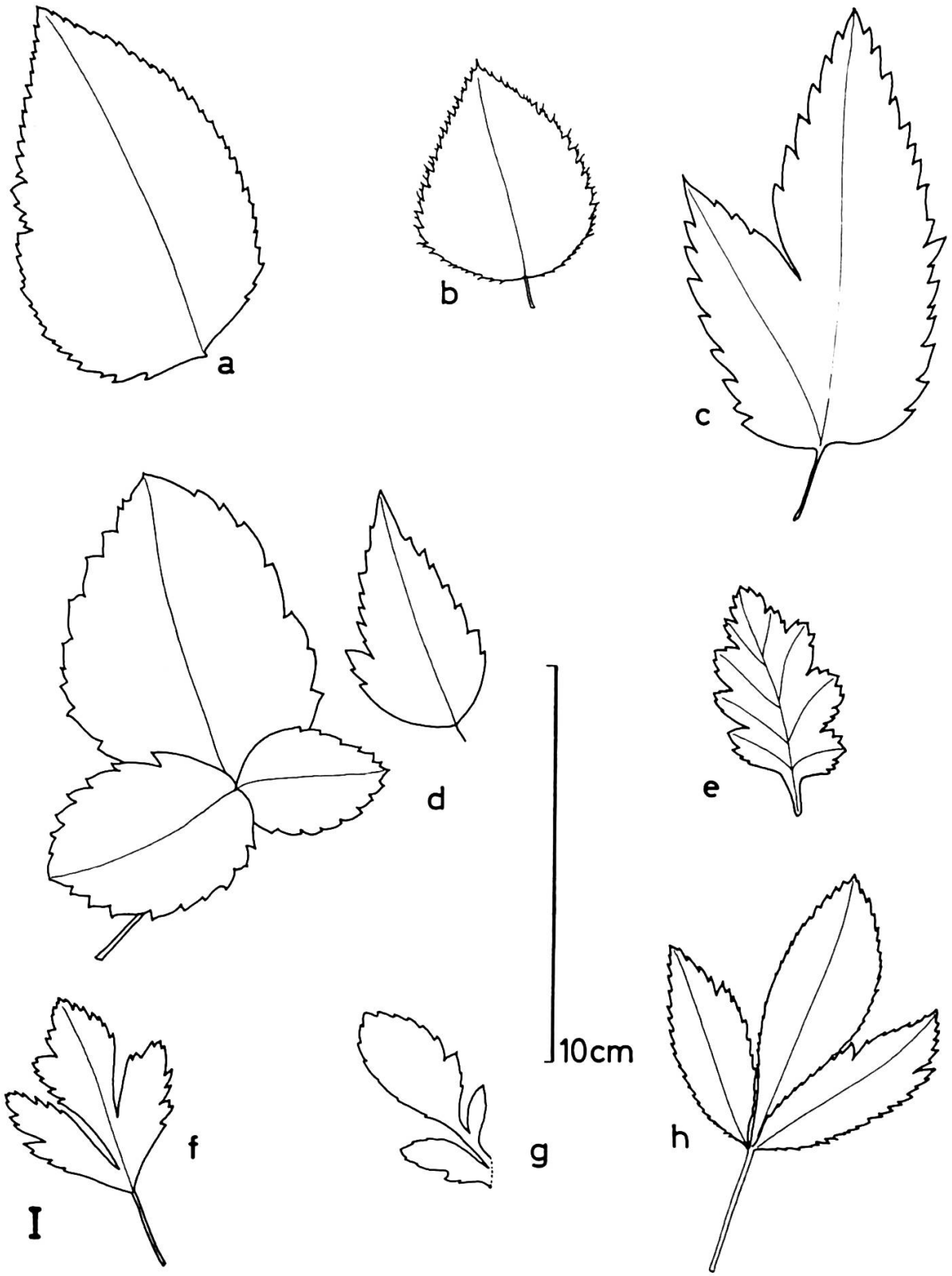

Fig. 7 (see explanation p. 37).

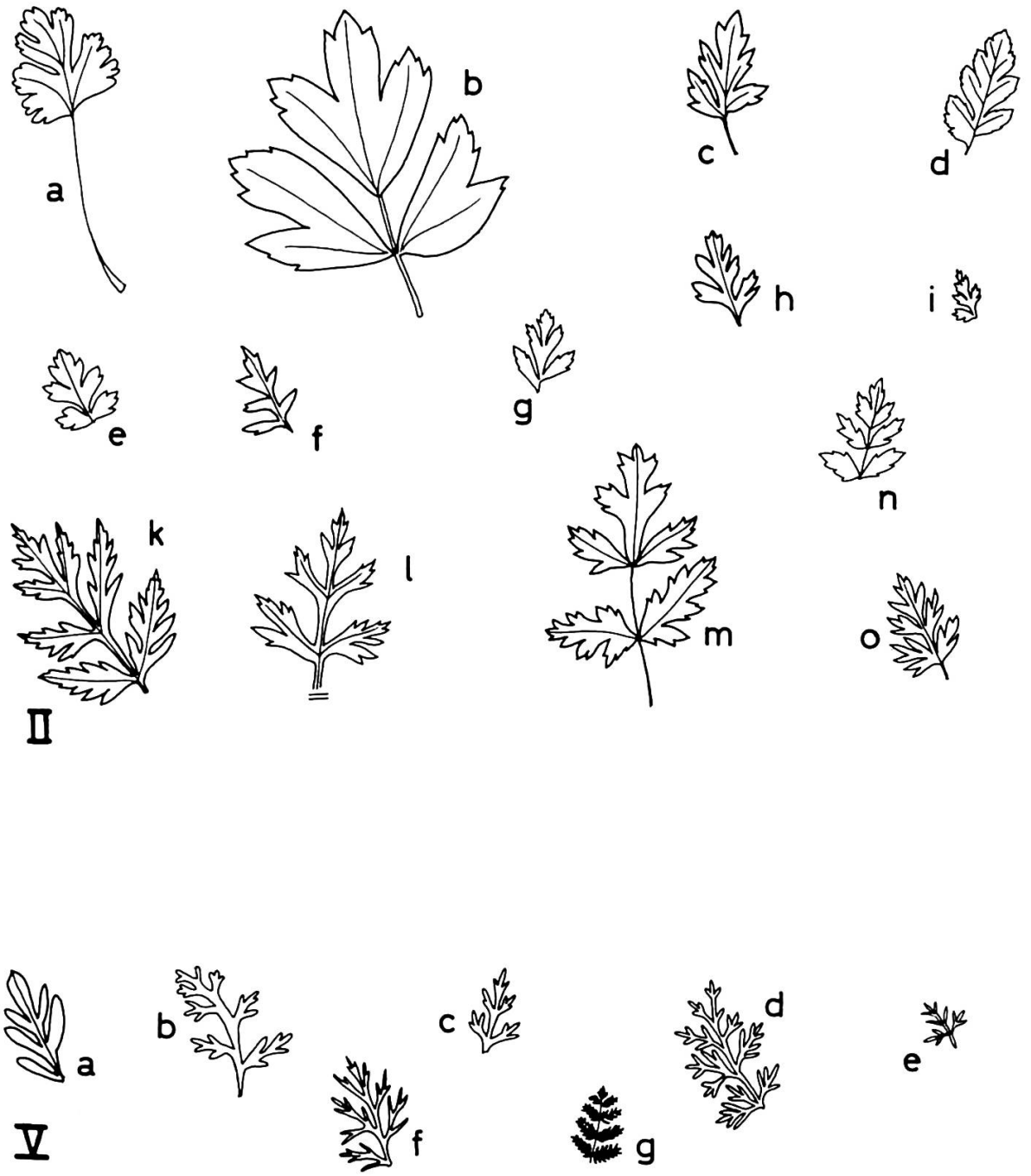

Fig. 7 (see explanation p. 37).

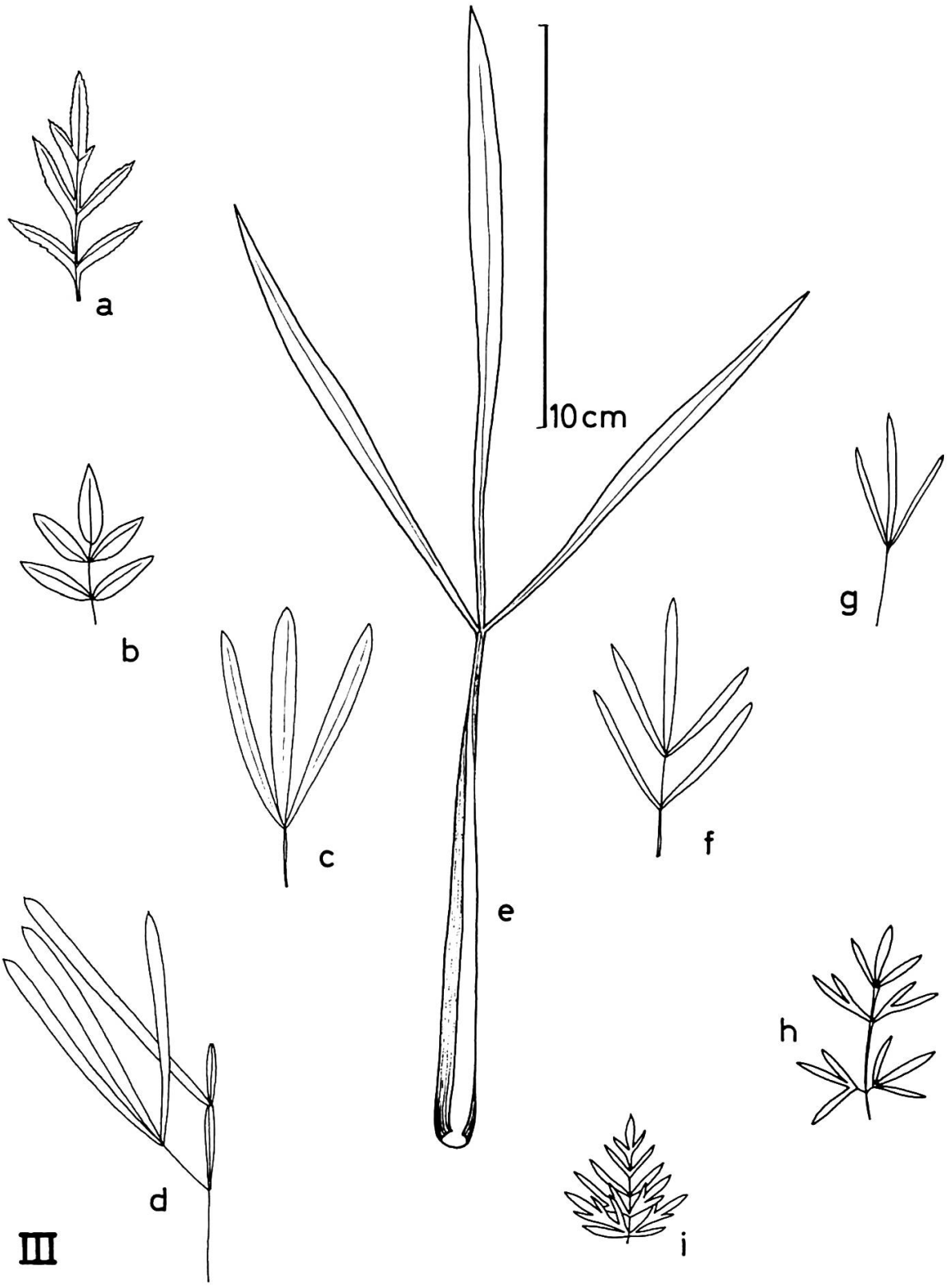

Fig. 7 (see explanation p. 37).

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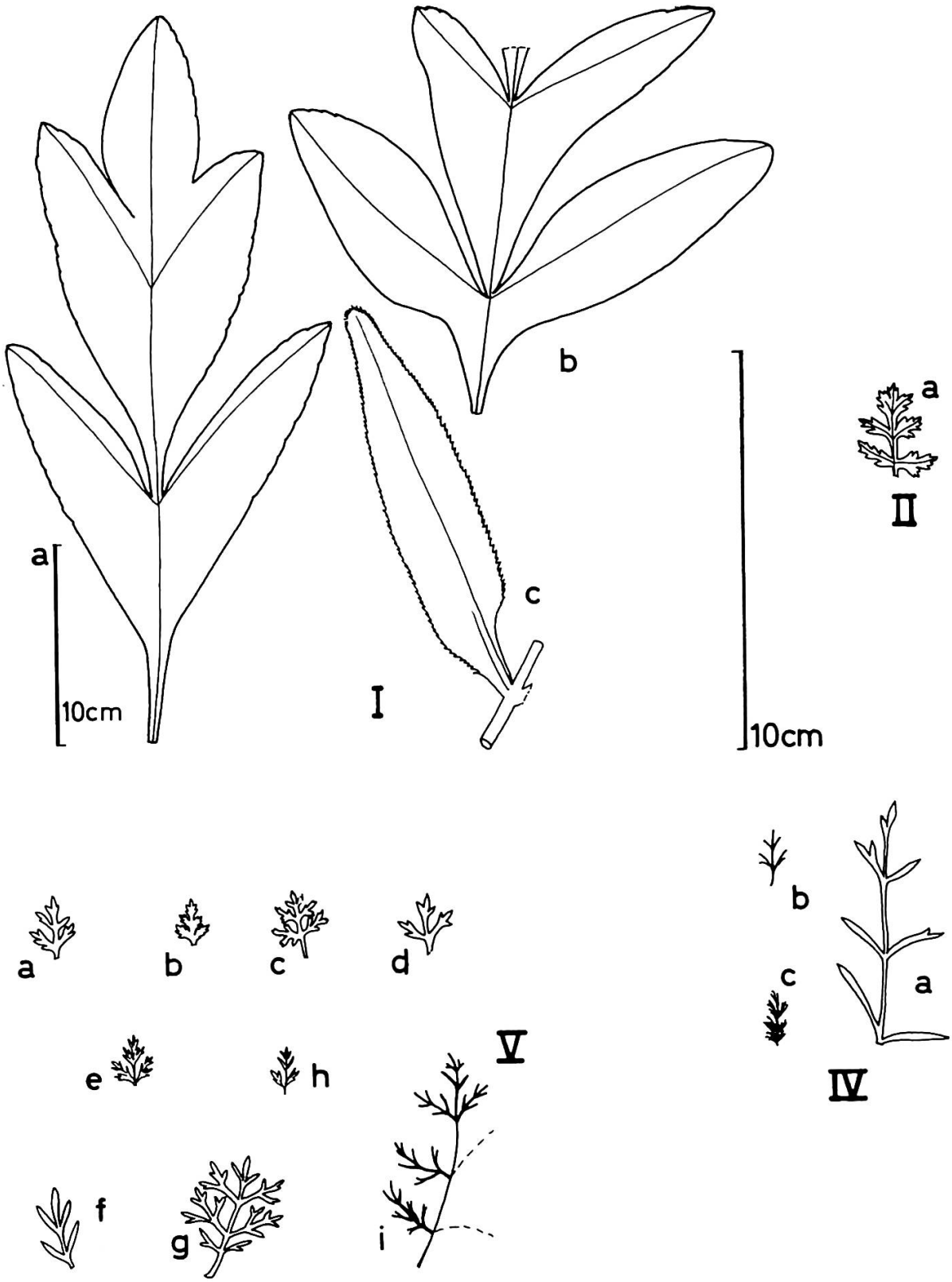

Fig. 8 (see explanation p. 38).

Fig. 5. — *Ferula.* Species with inflorescences of Type I. *Ferula blanchei* Boiss. appears to be the best example of an erect and verticillate inflorescence. The botanical samples of very great size of *Ferula* species are more often than not deceptive and misleading, being as a rule fragmentary or too young.

1. *F. microcolea* Boiss. (Iran); **2.** *F. heuffelii* Griseb. ex Heuf. (East Europe); **3.** *F. blanchei* Boiss. (Syria, Irak, Palestine); **4.** *F. elaeochytris* Korovin (Anatolia and Syria); **5.** *F. barbeyi* Post (Syria, Irak); **6.** *F. szowitziana* DC. (Central Asia, Anatolia, Iran); **7.** *F. ovina* (Boiss.) Boiss. (Central Asia to Pakistan).

Fig. 6. — *Ferula.* Species with inflorescences of a Type intermediate between I and II (Nos. 1-2-3), with others (Nos. 4-5-6) gradually approaching Type II.

1. *F. rigidula* DC. (Caucasus, Iran); **2.** *F. sadleriana* Ledeb. (East Europe); **3.** *F. hermonis* DC. (Anatolia and Syria); **4.** *F. caspica* Bieb. (Central Asia, Anatolia and East Europe); **5.** *F. ceratophylla* Regel & Schmalh. (Central Asia); **6.** *F. canescens* Ledeb. (Central Asia).

Fig. 7. — *Peucedanum,* laciniae or terminal part of leaves. This genus shows a very rich spectrum of foliar forms: almost all types of leaves in the family! The subdivision of the foliar forms into six theoretical types indicated by roman numerals, notwithstanding the natural fact that they intermix (notably Type II tends toward Type V and Type IV toward Type VI) helps to a certain extend to visualize the three genera better (see also Fig. 9).

Type I and Type II are much more widespread and variable than in *Ferula,* but are lacking in *Ferulago.* Type III is peculiar to *Peucedanum.*

Type I. — **a)** *P. hispanicum* (Boiss.) Endl. (Spain); **b)** *P. fraxinifolium* Hiern (East Trop. Africa); **c)** *P. aegopodioides* (Boiss.) Vandas (Anatolia and Balkans); **d)** *P. verticillare* (L.) Koch ex DC. (Europe); **e)** *P. pastinacaefolium* Boiss. & Hohen. (Iran); **f)** *P. galbanum* Bentham & Hooker (South Africa); **g)** *P. muriculatum* Welw. ex Hiern (West Trop. Africa); **h)** *P. ostruthium* (L.) Koch (Europe).

Type II. — **a)** *P. alpinum* (Sieb. ex Schult.) Burtt & Davis (Anatolia and Creta); **b)** *P. japonicum* Thunb. (Japan); **c)** *P. oreoselinum* (L.) Moench (Europe); **d)** *P. petitianum* A. Rich. (East Trop. Africa); **e)** *P. achaicum* Halácsy (Greece); **f)** *P. meisnerianum* McOwan ex Engler (South Africa); **g)** *P. magalismontanum* Sond. in Harv. (South Africa); **h)** *P. munbyi* Boiss. (North Africa); **i)** *P. baicalense* (Redow.) C. Koch (Siberia); **k)** *P. terebinthaceum* Fischer ex DC. (Siberia); **l)** *P. deltoideum* Makino (Japan); **m)** *P. wilmsianum* Wolff (South Africa); **n)** *P. volkensii* Engler (East Trop. Africa); **o)** *P. adae* Woronin (Caucasus).

Type III. — **a)** *P. latifolium* (Bieb.) DC. (Europe); **b)** *P. capense* Sond. (South Africa); **c)** *P. coriaceum* Reichenb. (Europe); **d)** *P. officinale* L. (Europe); **e)** *P. graminifolium* Boiss. (Anatolia); **f)** *P. lancifolium* Lange (Europe); **g)** *P. ruthenicum* Bieb. (Anatolia and East Europe); **h)** *P. arenarium* Waldst. & Kit. (East Europe); **i)** *P. vaginatum* Ledeb. (Siberia).

Type IV. — **a)** *P. vittijugum* Boiss. (Balkans); **b)** *P. salinum* Pallas ex Sprengel (Siberia); **c)** *P. ferulaceum* Thunb. ex Sond. (South Africa); **d)** *P. angustisectum* (Engler) Norman (West Trop. Africa); **e)** *P. stenocarpum* Boiss. & Reuter (Spain); **f)** *P. longifolium* Waldst. & Kit. (East Europe); **g)** *P. paniculatum* Loisel. (Corsica and Sardinia); **h)** *P. capillaceum* Thunb. (South Africa).

Type V. — **a)** *P. obtusifolium* Sibth. & Sm. (Anatolia and Greece); **b)** *P. palimbioides* Boiss. (Anatolia); **c)** *P. paucifolium* Ledeb. (Caucasus and Iran); **d)** *P. chryseum* (Boiss. & Heldr.) Chamberlain (Anatolia); **e)** *P. friesiorum* Wolff (East Trop. Africa); **f)** *P. isetense* Sprengel ex Schultes (Siberia); **g)** *P. kerstenii* Engler (East Trop. Africa).

Type VI. — **a)** *P. petiolare* Boiss. (Iran); **b)** *P. cupulare* Boiss. (Iran); **c)** *P. sclerophyllum* Boiss. & Hausskn. (Iran); **d)** *P. polyscias* Boiss. (Iran).

Fig. 8. — *Ferula*, laciniae or terminal part of leaves.

They are sorted into Types as in *Peucedanum*, but Type III and Type VI are lacking and Type II seems very rare. The large foliar segments of Type I (the best known and most widespread example being *Ferula assa-foetida* L.) do not depend in any case on a moister climate, since the species with this foliar type grow in desert or semi-desert conditions where other *Ferula* species with foliar Type IV and Type V also thrive (together with *Peucedanum* and *Ferulago* species with Type VI). The foliar types of *Ferulago* are not presented here, but in "visiting cards" accompanying every species, the foliar laciniae are sketched to the same scale. Most of the species of *Ferulago* have foliar of Type IV and V.

Type I. — **a)** *F. assa-foetida* L. (Central Asia, Iran to West Pakistan); **b)** *F. diversivittata* Regel & Schmalh. (Central Asia and Iran); **c)** *F. jaeschkeana* Vatke (Central Asia to North India).

Type II. — **a)** *F. szowitziana* DC. (Central Asia, Anatolia, Iran).

Type IV. — **a)** *F. ceratophylla* Regel & Schmalh. (Central Asia, Anatolia and Iran); **b)** *F. rigidula* DC. (Caucasus, Iran); **c)** *F. hermonis* Boiss. (Anatolia and Syria).

Type V. — **a)** *F. heuffelii* Griseb. ex Heuf. (East Europe); **b)** *F. barbeyi* Post (Syria, Irak); **c)** *F. macrocolea* Boiss. (Iran); **d)** *F. caspica* Bieb. (Central Asia, Anatolia and East Europe); **e)** *F. canescens* Ledeb. (Central Asia); **f)** *F. sadleriana* Ledeb. (East Europe); **g)** *F. sinaica* Boiss. (Palestine and North Arabia); **h)** *F. microcolea* Boiss. (Iran); **i)** *F. ovina* Boiss. (Central Asia, Iran, Irak to West Pakistan).

Review of the second character: laciniae of the leaves

I have divided the laciniae of the leaves into six types; some are of course linked by almost imperceptible forms to others, as is so often the case in "rebus naturalibus". Nevertheless, it is hoped that the many illustrations (Fig. 7, 8) will render almost superfluous all verbal disquisition. *Peucedanum* is endowed with all six types; it is worthy of note that the third one is lacking in *Ferula* and *Ferulago*. The uncommon Type VI is distinctive of the § *Junceae* Boiss. The author of the "Flora orientalis" thus magistrally outlined that section: "Folia in lacinias rigidas cylindricas petioliformes secta (BOISSIER, 1872: 1014). *Ferula* has neither the third nor the sixth Types of laciniae.

Ferulago presents only the fourth, fifth and sixth Types. The sixth Type is peculiar to species of the § *Anisotaenia,* which have few vittae and a restricted geographical distribution, almost the same as that of the § *Junceae* of *Peucedanum.*

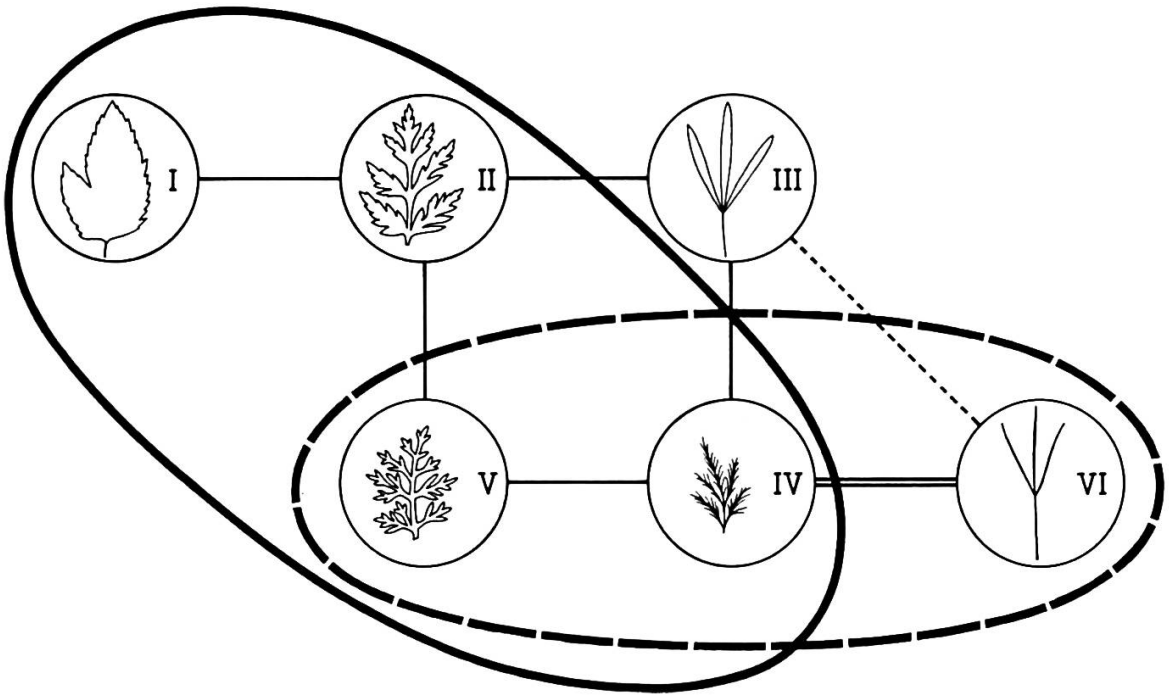

Fig. 9. — The six simplified Types of laciniae in *Peucedanum.*

The four Types in the ellipse surrounded by a solid line are present in *Ferula* (the Type II seems however very rare). The three Types (IV, V, VI) in the ellipse surrounded by a dated line are only to be found in *Ferulago.* The type VI is encountered exclusively in the § *Anisotaenia* of *Ferulago* and § *Junceae* of *Peucedanum.* The largest number of species of both sections are in Iran.

Review of the third character: hypsophylls

The three genera in respect to this character show great differences, that is to say:

a) *Peucedanum.* — There are species lacking hypsophylls completely; others lacking of involucres nevertheless have the involucels; there are species with both.

b) *Ferula* on the whole is destitute of them. In some rare instances, the involucels are present, but scanty on the same verticil, but lacking under umbellulae of the same sample and usually decidous; therefore they do not represent any reliable character, but a sort of "lusus naturae".

c) *Ferulago,* on the other hand, always possesses involucres and involucels.

Peucedanum thus appears as the middle term between the "no" of *Ferula* and the unconditional "yes" of *Ferulago.* Owing to the fact that in this genus, the form of the involucres (as a rule, the involucels have a similar but reduced form) stands out as very valuable in characterising the species, I searched for similar evidence in *Peucedanum.* The material at my disposal was far from complete, but I found a few interesting trends, namely:

1. Species with neither involucres nor involucels are scattered on the three continents. For instance, we find:

In Africa: *Peucedanum aculeatum* Engler; *P. capense* Sond.; *P. fraxinifolium* Hiern; *P. galbanum* (L.) Bentham & Hooker; *P. hypoleucum* (Sond.) Bentham & Hooker; *P. megalismontanum* Sond.; *P. petitianum* A. Rich.; *P. zenkeri* Engler; *P. zeyheri* Sond.

In Asia: *P. aegopodioides* (Boiss.) Vandas (also in Europe); *P. alpinum* Burtt & Davis; *P. latifolium* (Bieb.) DC.; *P. ramosissimum* Dietr.; *P. salinum* Pallas; *P. vaginatum* Ledeb.

In Europe: *P. achaicum* Halácsy; *P. coriaceum* Reichenb.; *P. officinale* L.; *P. paniculatum* Loisel.; *P. paucifolium* Ledeb.; *P. verticillare* (L.) Koch ex DC.

2. When present, the hypsophylls are divided into three types by shape (in the same manner as in *Ferulago*):

Type I: lineate, without apparent veins;

Type II: oblong, with few, but easily visible veins;

Type III: deltoid, often cochleariform and (or) acuminate with a rich network of veins.

For the first type of hypsophyll, rather few species also present involucres: most of them possess only the involucels. From this evidence, it seems that this hypsophyll type is very rare in African species.

Referring to the *Peucedanum* species with hypsophylls of Type II, there are a fair number of species with both involucres and involucels and fewer with only involucels.

In the first case, we can ascribe:

— *Peucedanum adae* Woronin from Caucasus; *P. ferulaceum* Thunb. (South Africa); *P. kerstenii* Engler (East Trop. Africa); *P. oreoselinum* (L.) Moench (Europe); *P. triternatum* Eckl. & Zeyh. (South Africa); *P. wilmsianum* Wolff (South Africa), etc.

In the second instance (no involucres):

— *Peucedanum deltoideum* Makino (Korea); *P. depauperatum* Boiss. & Balansa (Asia minor); *P. neumayeri* (Viv.) Reichenb. fil. (Europe); *P. volkensii* Engler (East Africa).

In the first case, with the exception of the Caucasian *P. adae,* all the other species are found in western Caucasus and not in Asia.

Among the species with deltoid hypsophylls, there are almost the same number of species with and without involucres.

In the first instance (both involucres and involucels):

— *Peucedanum alsaticum* L. (Europe); *P. aucheri* Boiss. (Iran);[1] *P. isetense* Sprengel (East Europe and Siberia);[2] *P. pastinacaefolium* Boiss. & Hohen. (Iran); *P. palustre* (L.) Moench (Europe); *P. polyscias* Boiss. (Iran); *P. venetum* (Sprengel) Koch (Europe).

In the second instance we have:

— *Peucedanum arenarium* Waldst. & Kit (Europe); *P. baicalense* (Redow.) C. Koch (Asia); *P. japonicum* Thunb. (Asia); *P. meisnerianum* MacOwan ex Engler (South Africa); *P. mumbyi* Boiss. (North Africa) (sometimes with involucres); *P. obtusifolium* Sibth. & Sm. (East Europe and Asia minor); *P. rigidum* Bunge (Asia).[3]

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[1]As it appears from the specimens *Aucher 4630, 4635* and *Stock 951* indicated in "Flora orientalis...", excluding the others; from the samples in "Flora orientalis Herbarium" (G-BOIS), it seems to me a spurious species.

[2]To be found in "Flora SSSR" 16: 238 (1950) as *Aulacospermum isetense* (Sprengel) Schischkin: with the best of intentions I cannot see the "ubi consistam" of *Aulacospermum* in respect to *Peucedanum.*

[3]In "Iconographia Cormophytorum Sinicorum" 2: 1093, No. 3916 (1972) [no author's name] it is possible to read "*Ferula borealis* Kuan", which, following the index, would take the place of *Peucedanum rigidum* Bunge. I think that the contrary is right and that *Ferula borealis* Kuan can be taken to be a synonym of *P. rigidum.*

In sum, *Peucedanum* displays this character in a rich fashion with seven possibilities, namely: three types of hypsophylls for both involucres and involucels; three types for the involucels only, or a complete lack of bracteal apparatus.

Some more or less distinct geographical inferences are indicated. It might be worth using this character, perhaps as the most subordinate, in the systematics of this large genus.

Review of the fourth character: leaves sheaths

Here, *Ferulago* plays no role, since its leave sheaths present very small growth, or none. In *Peucedanum* and *Ferula,* on the other hand, this character shows a very large variation, from species in which leave sheaths are almost obsolete, to others in which this character is very noticeable. The illustrations (Fig. 10: 1-33) all to the same scale, are eloquent.

Ferula indeed, in several instances, is more peculiar than *Peucedanum.* AITCHINSON (1888: 67, tab. 18) affords one illustration of the most spectacular example of the supposed *Ferula oopoda* Boiss. (but by KOROVIN, 1947: 67, named *Ferula badghysi* Korovin, from Afghanistan). Aitchinson wrote "In the present specimens the larger of these sheaths is at least six inches across, and the largest, observed lower on the stem, was at least a foot across; and they more nearly resemble a bowl or cup than an egg". In *Ferula* then, this character is developed to its greatest extent. I am not inclined to believe that it is dependent on semi-desert conditions or other ecological reasons. Other *Umbelliferae* in quite different ecological surroundings, as for instance *Angelica ursina* (Rupr.) Maxim. from Kamtchatka and the more western *A. archangelica* L. and *A. sylvestris* L. display some leave sheaths almost as large as the aforementioned *Ferula badghysi.* As this is then genetic character, in my opinion at least, it would be interesting to discover its possible correlation with other characters and to ascertain if some geographical trend exists in the distribution of the oversized leave sheaths in *Peucedanum* and *Ferula*. But this is far from our narrow mole-hill *Ferulago*.

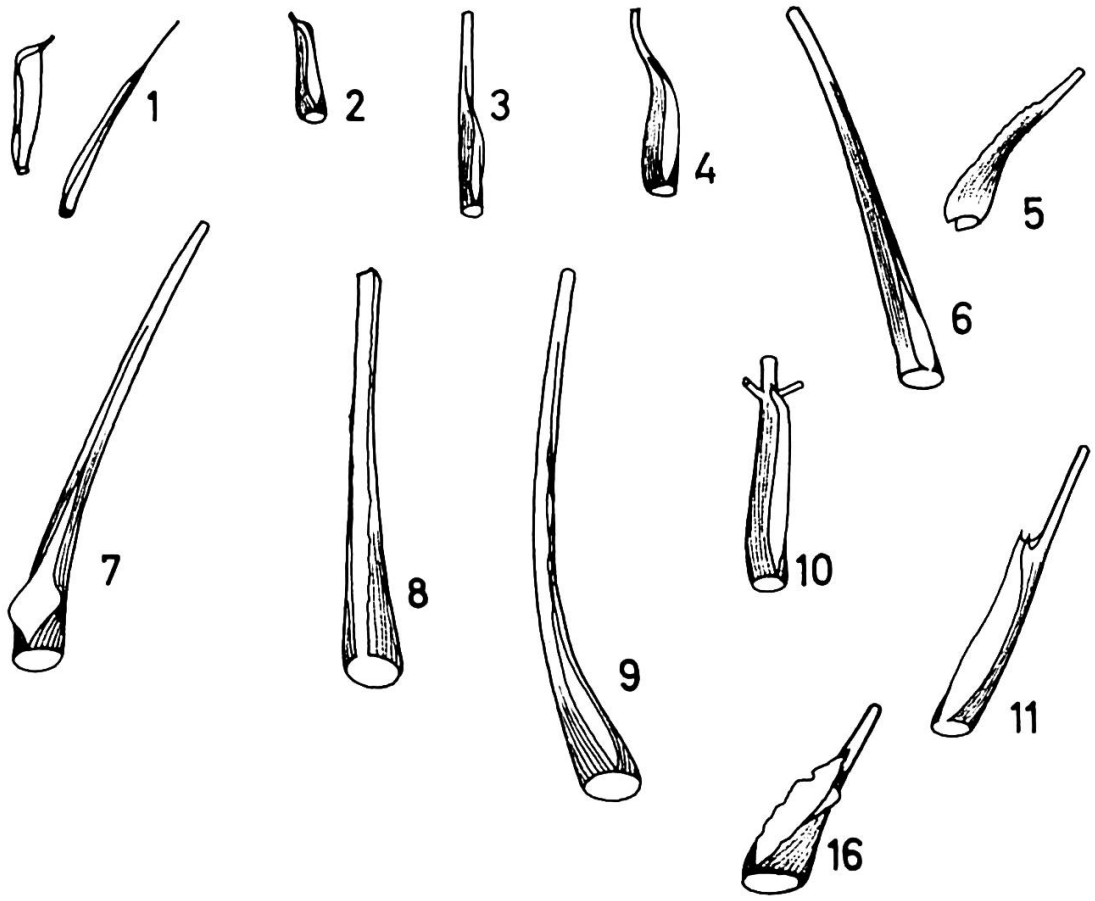

Fig. 10 (see also the following two pages). — Sheaths of the leaves in *Peucedanum* (Nos. 1 to 21) and in *Ferula* (Nos. 22 to 33). In the sixth to the ninth examples, it is only the petiole base which surrounds the stem, the rest of it becomes more or less canaliculate. Number 10 *(Peucedanum ferulaceum)* is homologous, in reduced scale, to number 26 *(Ferula sinaica*, suspected by me to be a *Peucedanum)* and also to number 28. The same is true to numbers 21 and 27. The examples 29 to 33 demonstrate the huge growth of the sheaths in *Ferula*.

1. *P. salinum* Pall. ex Sprengel (Siberia); **2.** *P. rigidum* Bunge (China); **3.** *P. vaginatum* Ledeb. (Siberia); **4.** *P. oreoselinum* (L.) Moench (Europe); **5.** *P. lancifolium* Lange (Europe); **6.** *P. latifolium* DC. (Europe); **7.** *P. ostruthium* (L.) Koch (Europe); **8.** *P. alsaticum* L. (Europe); **9.** *P. officinale* L. (Europe); **10.** *P. ferulaceum* Thunb. ex Sond. (South Africa); **11.** *P. paniculatum* Loisel. (Corsica and Sardinia); **12.** *P. cervaria* (L.) Lapeyr. (Europe); **13.** *P. stenocarpum* Boiss. & Reuter (Spain; **14.** *P. hispanicum* (Boiss.) Endl. (Spain); **15.** *P. obtusifolium* Sibth. & Sm. (Anatolia and Greece); **16.** *P. multiradiatum* Drude (South Africa); **17.** *P. ubadakense* Makino (Japan); **18.** *P. galbanum* Bentham & Hooker (South Africa); **19.** *P. volkensii* Engler (East Trop. Africa); **20.** *P. arenarium* Waldst. & Kit. (East Europe); **21.** *P. verticillare* (L.) Koch ex DC. (Europe); **22.** *F. canescens* Ledeb. (Central Asia); **23.** *F. barbeyi* Post (Syria); **24.** *F. microcolea* Boiss. (Iran); **25.** *F. sadleriana* Ledeb. (East Europe); **26.** *F. sinaica* Boiss. (Palestine, North Arabia); **27.** *F. eleaeochytris* Korovin (Anatolia and Syria); **28.** *F. rigidula* DC. (Caucasus, Iran); **29.** *F. ceratophylla* Regel & Schmalh. (Central Asia); **30.** *F. jaeschkeana* Vatke (Central Asia, Iran to North India); **31.** *F. hermonis* Boiss. (Anatolia and Syria); **32.** *F. ovina* Boiss. (Central Asia, Iran to West Pakistan); **33.** *F. macrocolea* Boiss. (Iran).

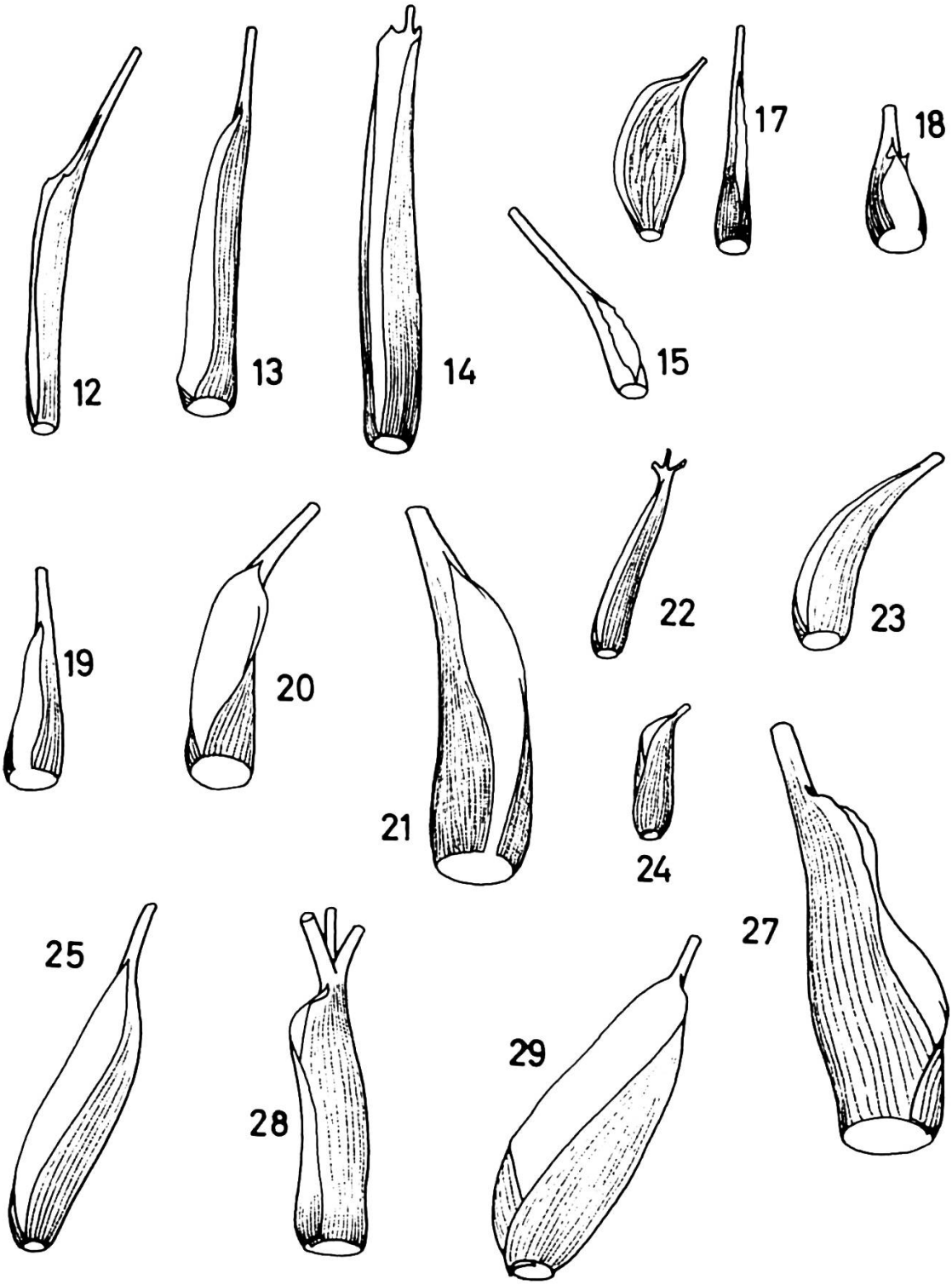

Fig. 10.

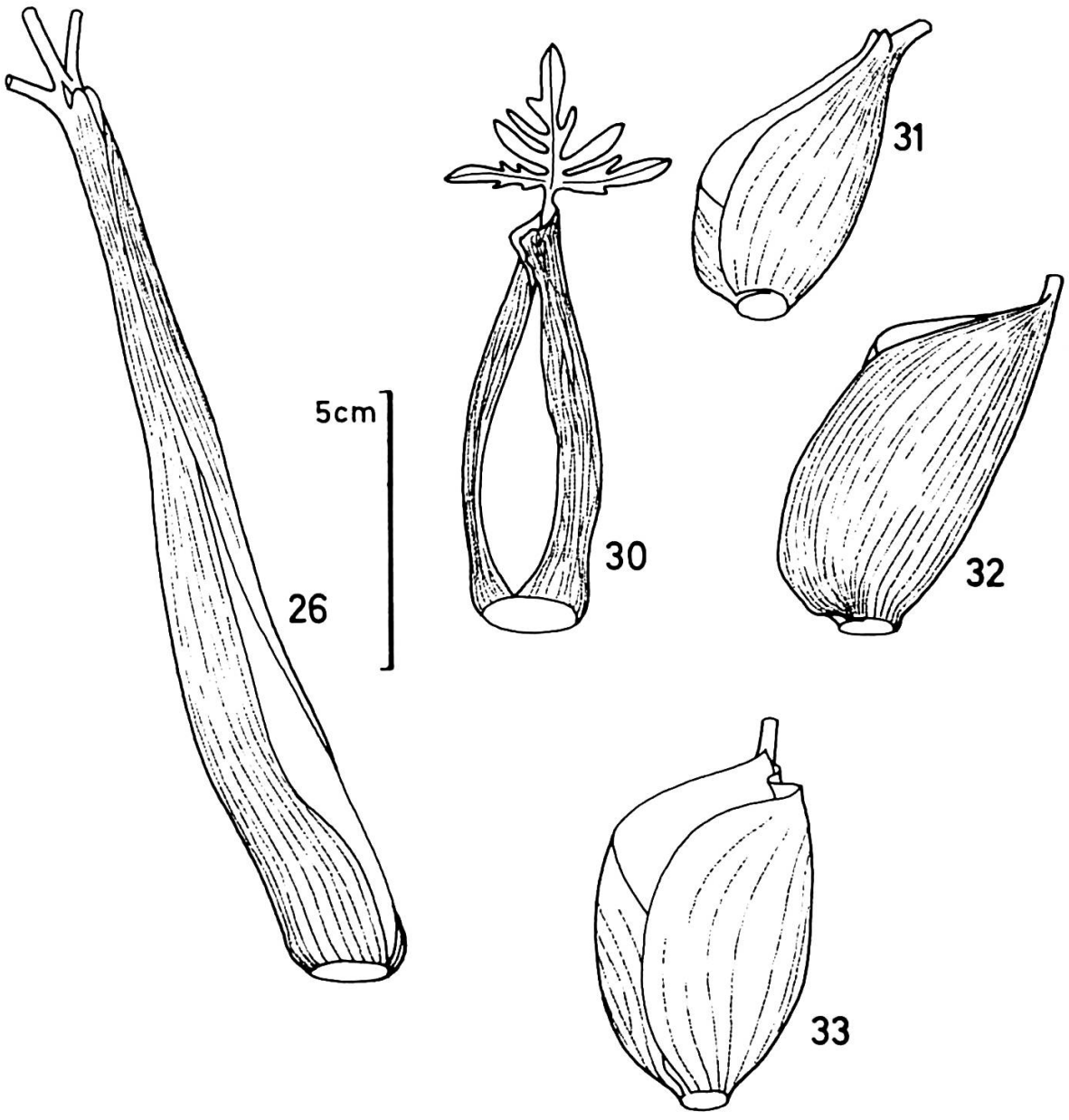

Fig. 10.

Fig. 11. — Distribution area of *Ferulago*, completely shadowed by those of both *Ferula* and *Peucedanum*.

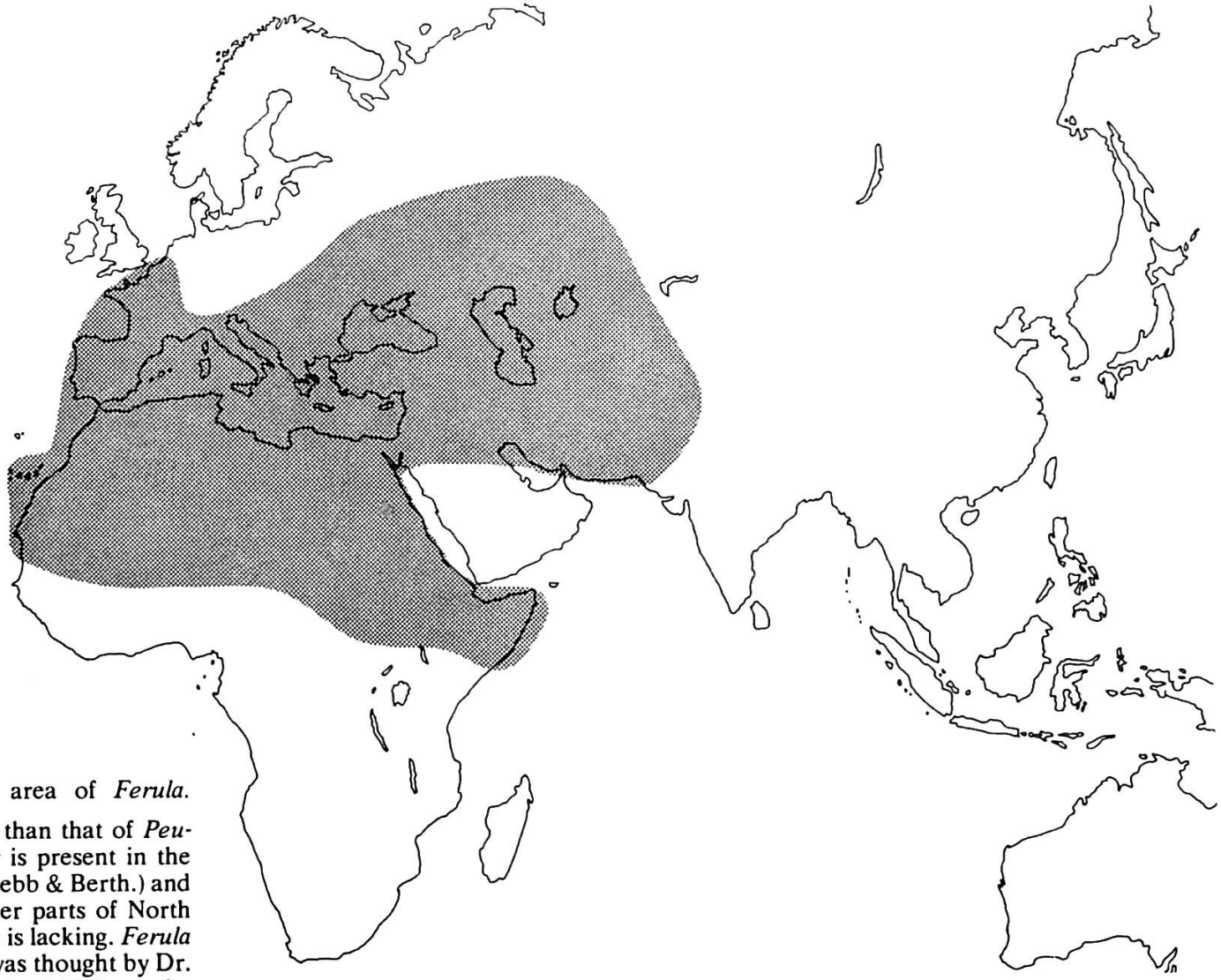

Fig. 12. — Distribution area of *Ferula*. This is noticeably smaller than that of *Peucedanum*. *Ferula* however is present in the Canary Islands (*F. linkii* Webb & Berth.) and (fide auctorum) in the drier parts of North Africa where *Peucedanum* is lacking. *Ferula linkii*, on the other hand, was thought by Dr. R. Maire (in sched., herb. MPU) to be present in North Africa but as subsp. of *Ferula communis* L.

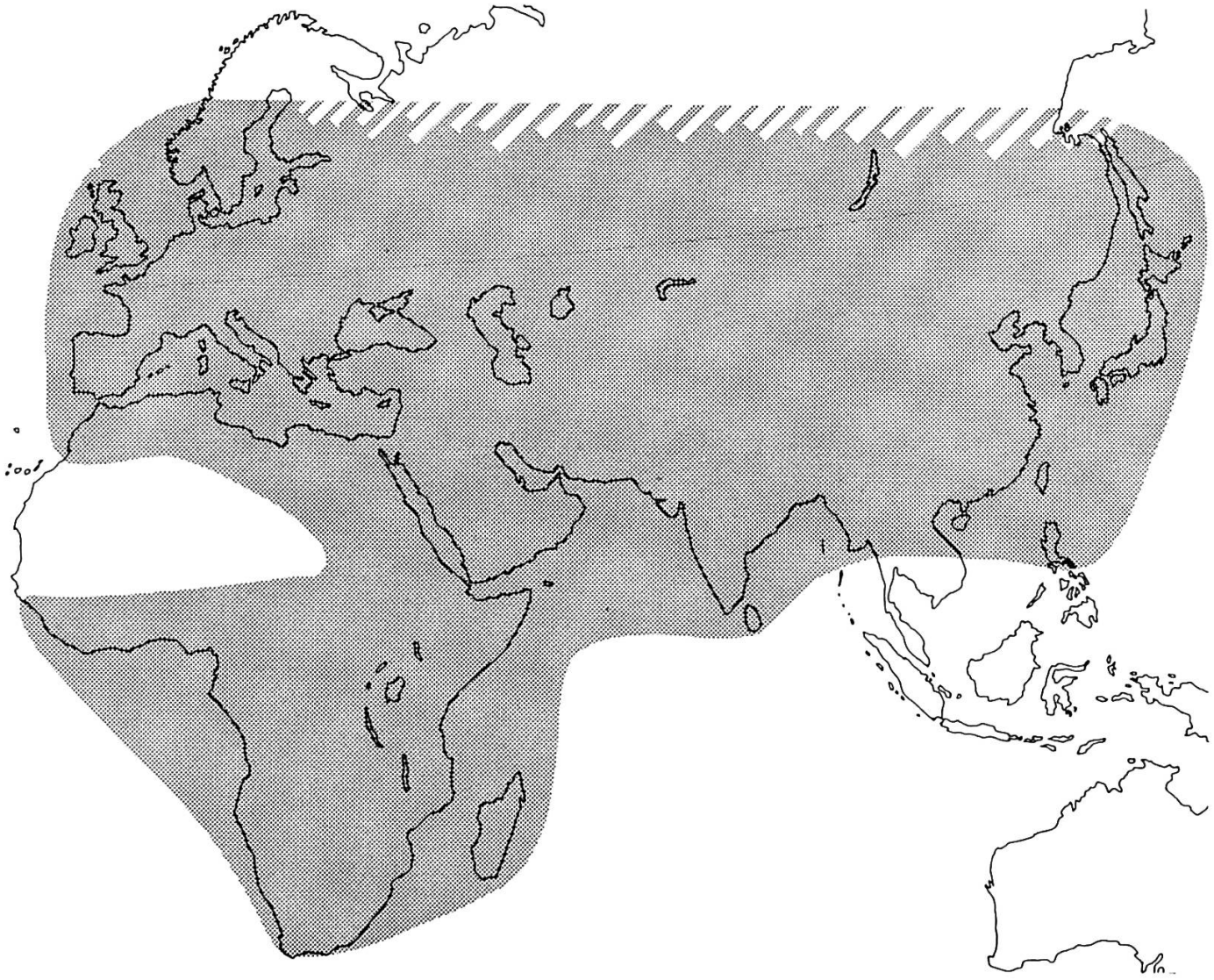

Fig. 13. — Distribution area of *Peucedanum*, as considered in DRUDE (1898) but excluding *Lomatium* Raf. These three generic areas are of course highly diagrammatic. In *Peucedanum* the northern borders are especially vague according to the available evidence and in the HIROE & CONSTANCE statement (see p. 11).