

**The Genus *Nigella* (*Ranunculaceae*) —
a Taxonomic Revision**

By

Michael Zohary, Jerusalem

(Received July 28, 1978, in revised form September 9, 1982)

Key Words: *Ranunculaceae*, *Nigella*, *N. arvensis* var. novae.—Taxonomic revision.

Abstract: The genus *Nigella*, burdened with about 80 or more binomials, consists of only 14 acceptable species. A key, notes on the nomenclature, and illustrations are provided. The most polymorphic species is *N. arvensis*; its races have long been subject to taxonomical controversy and are grouped here into 14 varieties: *N. arvensis* var. *anatolica*, var. *iranica*, and var. *simplicifolia* are described as new taxa.

Nigella is a small genus in the *Ranunculaceae*. Although revised several times, certain taxa of it have never been well understood, so that a striking number of misnomes and misidentifications still occur in many floras and herbaria. This is primarily due to the high degree of variability and polymorphism of *N. arvensis*, which at present is probably in full swing of differentiation and which has its centre of diversity mainly in the East Mediterranean countries.

Nigella has been variously divided into sections and subsections. Following TERRACIANO (1897-1898), we have adopted here the division of the genus into the following sections: sect. *Komaroffia* (1 sp.), sect. *Garidella* (2 spp.) and sect. *Nigella* (11 spp.). The sections are well delimited, but their diagnostic markers are not weighty enough for taxa higher than sections. Yet, some authors considered them as genera (LINNAEUS 1753; BOISSIER 1867; TUTIN 1964) or as subgenera (e.g. MEIKLE 1977).

Nigella was already well known to pre-Linnaean botanists and herbalists, so that LINNAEUS (1753) could record not less than six species of this genus under *Nigella* and one under *Garidella*. Additional species were described by SMITH in SIBTHORP & SMITH (1806), MARSCHALL VON BIEBERSTEIN (1808) and others. The first to review the genus was A. P.

DE CANDOLLE (1818); he recognized 11 species, 3 of which were new. In his *Prodromus* (1824) no additional species are recorded. SPENNER (1829) revised the genus and reduced the number of species to 8 (including those of *Garidella*). He was probably the first to consider *Garidella* as a section of *Nigella*.

In 1867, BOISSIER summarized the knowledge of the species confined to the area of his *Flora Orientalis*. He went on reducing some of the published binomials to varieties, including some described earlier by himself (BOISSIER 1841, 1846, 1856). In the nineties of the last century, two revisions of this genus were published—one by BRAND (1895–1896), and the other by TERRACCIANO (1897–1898), who was probably unaware of BRAND's revision. The former abounds in superfluous new and old binomials and varieties, and also in undue synonyms. Contrarily, TERRACCIANO's revision is very critical and easily applicable, but out-of-date.

Recently several species of the genus have been thoroughly treated in local floras, such as *Flora of USSR* by KRAŠENINNIKOV (1937), of *Armenia* by TAHTADZJAN (1954), “*Flora Europaea*” by TUTIN (1964), “*Flora of Turkey*” by DAVIS (1965), “*Flora Palaestina*” by ZOHARY (1966), *Flora of Lebanon and Syria* by MOUTERDE (1970) and “*Flora of Cyprus*” by MEIKLE (1977). In all these treatments no special attention was paid to the variability of *N. arvensis*, except in DAVIS (1965).

In 1970 a detailed study on the “*Rassenkreis*” of *N. arvensis* from the Aegean area has been published by STRID. This study tries to cast light on the most obscure and intricate part of section *Nigella*. It is based primarily on cytogenetical evidence and also on a few, reportedly consistent morphological markers. In itself, it presents a highly instructive biosystematic study of a group of blurred forms, usually included within a single species; not less than 12 taxa, species and subspecies, are recognized, but the reasons for their taxonomic ranking are not adequately argued. There is also little justification to conclude that “the conspicuous local differentiation appears to have taken place in the Aegean where some forms must be recognized as separate species. All forms occurring outside this area can probably be regarded as subspecies of *N. arvensis*”. Conventional taxonomists acquainted with the extremely polymorphic complex of *N. arvensis* all over the Middle Eastern and N. African countries, will certainly pay high credit to STRID's experimental approach and his meticulous efforts to clear up the cluster of forms around *N. arvensis* within the Aegean Islands.

They will, however, become bitterly frustrated when attempting to handle these taxa, in context with the bewildering array of other forms

of this species outside the area considered by STRID. Even within the Aegean area, STRID's taxa are difficult to distinguish, both in the herbarium and in the field. For further comments one should consult the remarks in my treatment of *N. arvensis* (on p. 81 ff.).

Taxonomic Position of *Nigella* and its Subdivision

In the latest edition of the "Syllabus der Pflanzenfamilien", BUCHHEIM (1964) creates a special subtribe within the *Caltheae*, the *Nigellinae*, which consist of three genera: *Nigella*, *Garidella* and *Komaroffia*. The only differential marker of this group is the 2-lipped nectary (= petal), consisting of a lower petaloid, bifid lip and an upper scale-like lip which conceals the nectar. This is, indeed, a particular feature in the family and as such acceptable as a taxonomic marker. But it occurs with only slight modification in all the three "genera". Therefore, the separation of *Garidella* and *Komaroffia* from *Nigella* on the basis of nectary differences is not justified.

Another possible differential character is the fruit form and the mode of its dehiscence. Both, *Komaroffia* and *Garidella*, have capsular fruits dehiscing along the ventral and dorsal suture of the carpels. Now, capsular fruits are found also in some species of *Nigella* s.str. (e.g., *N. damascena*, *N. sativa*, and, to some extent, also in *N. segetalis*); they also partly open on both the ventral and dorsal suture (e.g. *N. damascena*). It follows that fruit form and dehiscence also fail as differential markers between *Nigella* and the *Komaroffia*/*Garidella* group.

Komaroffia and *Garidella* therefore should remain within *Nigella* and ranked as sections at most. The present author thus follows SPENNER (1829), TERRACCIANO (1897-1898), KRAŠENINNIKOV (1937), TAHTADZJAN (1954) and BRAND (1895-1896, as to *Komaroffia*). No innovations have been introduced here in regard to the subsectional division of sect. *Nigella*.

Key to the Sections and Subsections

1. Sepals one fourth to one half as long as petals II. sect. *Garidella* (species nos. 2, 3)
— Sepals as long as or longer than petals 2
2. Sepals yellow. Carpels 5-20, compressed, folded. Seeds discoid III. sect. *Nigella* subsect. (C) *Nigellastrum* (species nos. 12-14)
— Sepals white or bluish. Carpels usually 2-10, not compressed. Seeds not discoid 3

3. Sepals elliptical, sessile, as long as petals. Nectaries (upper lip) scale-like, forming a tube with base of petals. Carpels 2-3, connate, hairy, tapering into short beaks. Flowers involucrate I. sect. *Komaroffia* (species no. 1)
- Sepals not as above. Petals 2-lipped, often clawed. Carpels glabrous, ending mostly in a beak at least half as long as carpels 4
4. Carpels united all along; fruit often inflated III. sect. *Nigella* subsect. (B) *Erobathos* (species nos. 10-11)
- Carpels united at most to three fourth of their length; fruit not inflated III. sect. *Nigella* subsect. (A) *Nigellaria* (species nos. 4-9)

Survey of Diagnostic Characters

The main diagnostic characters on the specific and infraspecific level are:

1) Shape of leaves and degree of their division. Entire leaves are not found even in *N. integrifolia*, except in one variety of *N. arvensis*. The division of the leaves ranges from 1- to 3-pinnatisect to unequally 3-lobed. Rarely is the blade of the upper leaves reduced to a single entire lobe. All this variation may occur within a single species (particularly in *N. arvensis*).

2) Involucration. In some species, such as *N. damascena*, *N. oxypetala*, *N. fumariifolia*, *N. stellaris* and *N. arvensis* var. *involucrata*, the uppermost leaves closely approach the flowers, forming a kind of involucre. This is a fairly consistent character, but there are various degrees of involucration in one and the same population.

3) Indumentum. Most of the taxa are glabrous in their vegetative organs; but in a few cases the indumentum of certain organs may be quite constant and diagnostic (e.g. in the leaves of *N. ciliaris* and *N. arvensis* var. *iranica* or in the petal hairs of *N. fumariifolia*).

4) Habit. The species of *Nigella* display predominantly erect, strictly or divaricately branching stems. The procumbent habit is rare but mostly constant (e.g. in *N. fumariifolia*, *N. stellaris* and in some coastal varieties of the *N. arvensis* complex).

5) Size, shape and colour of the calyx as well as the proportion between claw and limb length are sometimes good markers, both on specific and infraspecific levels.

6) Size of the petals as well as the shapes of the nectary scales (upper lips) and of the appendages of the lobes in the lower lips are useful sectional and specific characteristics.

7) The tip of the anther-connective, whether blunt, apiculate or aristate, is a quite reliable varietal marker.

8) Carpels. Their number, degree of connation and divergence in fruit, the proportion between the carpels and their beak, and their surface configuration (whether 1- or 3-nerved, smooth or tuberculate), are important for the demarcation of species and varieties.

9) Seeds may be flat, or triquetrous, smooth or tuberculate, all constant characters.

10) Chromosome numbers so far have been counted in *N. arvensis* (including many of its varieties and those subspecies and "species" dealt with by STRID 1965, 1970), *N. ciliaris*, *N. damascena*, *N. hispanica*, *N. nigellastrum*, *N. orientalis*, and *N. sativa*. All have $2n = 12$, except only *N. (Komaroffia) integrifolia* with $2n = 14$ (see PEREIRA 1942, FEDOROV 1969, and STRID 1970). Recent C-banding studies on chromosomes also have revealed structural differences between the karyotypes (GILOT-DELHALLE & al. 1976).

Key to the Species

1. Sepals not petaloid, one fourth to one half as long as petals 2
- Sepals petaloid, much longer than above..... 3
2. Claw of petals much longer than sepals; lower lip of petal limb broadly ovate, inconspicuously bifid..... 2) *N. unguicularis*
- Claw of petals not longer than sepals; lower lip of petal limb oblong, divided into oblong linear lobes..... 3) *N. nigellastrum*
- 3 (1). Sepals yellow. Seeds discoid 4
- Sepals white or bluish (rarely green). Seeds triquetrous..... 6
4. Sepals ciliate. Plant villose..... 14) *N. ciliaris*
- Sepals glabrous. Plant glabrescent or glabrous 5
5. Lower lip of petals shortly 2-fid. Carpels usually slightly longer than beaks..... 12) *N. orientalis*
- Lower lip of petals with 2 long filiform appendages. Carpels $1\frac{1}{2}$ -2 times as long as beaks..... 13) *N. oxypetala*
- 6 (3). Fruit inflated, capsule-like; carpels united to apex or nearly so 7
- Fruit not inflated, follicular; carpels united up to two thirds of their length 10
7. Capsule 8-12 mm long, hairy. Lower leaves entire, upper 3-sect. Petals as long as or a little shorter than the elliptical sepals, with a very short semitubular nectary scale 1) *N. integrifolia*
- Capsules and petals not as above..... 8

8. Capsules tuberculate, 1-5-celled. Flowers usually not involucrate 7) *N. sativa*
 — Capsules smooth, 10-celled. Flowers involucrate 9
 9. Lobes of lower petal lip ovate to oblong, twice as long as broad 10) *N. damascena*
 — Lobes of lower petal lip linear, 5 times as long as broad 11) *N. elata*
 10 (6). Flowers involucrate 11
 — Flowers not involucrate 13
 11. Beaks of carpels erect or somewhat spreading, usually less than 1.5 cm long. Carpels dehiscent. 5) *N. arvensis* var. *involucreata*
 — Beaks of carpels strongly divaricate-stellate, 1.5-4 cm long. Carpels not dehiscent 12
 12. Lower lip of petals abruptly narrowed into linear, clavate horns. Beaks of carpels 2-3 cm or more 8) *N. stellaris*
 — Lower lip of petals gradually narrowed at apex. Beaks of carpels shorter 9) *N. fumariifolia*
 13 (10). Carpels 2-3 times as long as beaks 6) *N. segetalis*
 — Carpels as long as or somewhat shorter or somewhat longer than beaks 14
 14. Back of carpel 1-nerved. Carpels 5-10 or more 4) *N. hispanica*
 — Back of carpel 3-nerved. Carpels 3-5 5) *N. arvensis*

Nigella

L., Sp. Pl. 534 (1753); BENTH. et HOOK., Gen Pl. 1/1, 8 (1962); PRANTL in ENGL. & PRANTL, Nat. Pflanzenfam. 3/2, 57 (1891); TERRACCIANO, Bull. Ort. Palermo 1, 139 (1897); BRAND, Helios 12, 182 (1895); DAVIS, Fl. Turk. 1, 98 (1965); ZOH. in ZOH. & FEINBR., Fl. Pal. 1, 191 (1966).

Type Species: *N. arvensis* L., fide HUTCHINSON, Kew. Bull. 1923: 87. Annuals, erect or decumbent, glabrous or pubescent. Leaves alternate, mostly pinnatisect or ternate, rarely simple. Flowers hermaphrodite, solitary, at end of branches, actinomorphic, pink, white, bluish to yellow. Calyx of 5 sepals, often petaloid, persistent or caducous. Corolla of 5(-8) petals, often with bent claw and simple to 2-lipped nectariferous limb. Stamens many, first erect, then bent downwards. Ovary of 2-10 partly or entirely connate carpels often with conspicuous beak-like styles. Seeds angular or discoid.

Fourteen species, mainly in the Mediterranean and West Irano-Turanian countries; one species widely spread throughout the southern and central European countries.

I. Sect. *Komaroffia* (O. KTZE.) BRAND, Helios **13**, 12 (1895); TERRACC., Boll. Ort. Palermo **1**, 139 (1897).

Syn.: Genus *Komaroffia* O. KTZE., Act. Hort. Petr. **10**: 144 (1887).

Type Species: *K. diversifolia* (FRANCHET) O. KTZE.

Sepals ovate-oblong, somewhat longer than the deeply bifid white or pink petals. Nectary scale minute. Fruit a capsule of 2-3 short-beaked carpels, dehiscing along the dorsal sutures.

1) *Nigella integrifolia* REGEL, Bull. Soc. Imp. Nat. Mosc. **43**, 246 (1870); AITCHISON, Afgh. Delim., Trans. Linn. Soc. **2**, Ser. **3** (1), 30 (1888).

Type: Mogol-Tay, Tadžikistan (LE: holo!).

Syn.: *N. diversifolia* FRANCH., Ann. Sci. Nat. Bot. Ser. **6**, **15**, 220 (1883). ≡ *Komaroffia diversifolia* O. KTZE., Acta Hort. Petr. **10**, 144 (1887).—*N. bucharica* N. SCHIPCZ., Not. Syst. Herb. Petrop. **5**, 174 (1924).

Icon.: FRANCH., op. cit. t. 2 (1870); AITCH., op. cit. 3, t. 2 (1888).—Fig. 1.

Distr.: Iran, Afghanistan, Central Asia.—Area*: Irano-Turanian.

Selected Specimens. Afghanistan: Hai-Rud-Valley, AITCHISON (FI); Prov. Maimana 500 m, 1962, HEDGE & WENDELBO (E); Kabul, 2100 m, 1962, nos. 3111, 3594 (E). Uzbekistan: Buchar, Cholm, 1927, KORSCHINSKY (LE, type of *N. bucharica* SCHIPCZ.). "Turkestan: Bakdschuam" (?), 3000 ft., 1883, REGEL (FI). Kazakhstan: Hungersteppe, am linken Syr-Daria-Ufer, 1883, MUSA (FI). Tadžikistan: env. of the town Dushand Shin 1960 (E). Iran: 150 km N.W. of Mashhad, abandoned fields, 1962, ZOHARY & ORSHAN 9978 (HUIJ).

II. Sect. *Garidella* (L.) SPENN., Monogr. Gen. *Nigellae* ii (1829).

Syn.: Genus *Garidella* L., Sp. Pl. 425 (1753); BOISS., Fl. Or. **1**, p. 64 (1887). Subgen. *Garidella* (L.) BRAND (1895, p. 182).—MEIKLE, Fl. Cypr. **1** (1977).

Type Species: *G. nigellastrum* L. (fide HUTCHINSON, Kew Bull. **1923**, 87).

Sepals oblong, greenish, much shorter than the petals, deciduous. Nectary scale short, flattened. Fruit of 2-3 connate, short-beaked carpels, inflated, dehiscing along the dorsal sutures.

2) *Nigella unguicularis* (LAM.) SPENN., Monogr. *Nigella* 12 (1829); BRAND, Helios **12**, 182 (1895); TERRACC., Bull. Orto Palermo **1**, 143 (1897).

Type: Orient, MICHAUX (Herb. LAMARCK, P!).

Syn.: *Garidella unguicularis* LAM., Tabl. Encycl. t. 379f. 2 (1797); POIR., Encycl. Méth., Suppl. **2**, 709 (1812); DC., Reg. Veg. Syst. Nat. **1**, 325 (1817); BOISS., Fl. Or. **1**, 64 (1867); STRID, Bot. Notiser **122**, 330-332 (1969).

* Under Area, here and in the following, the phytogeographical element of the taxon is understood, according to ZOHARY (1973).

Icon.: LAM., loc. cit. (1797); ZOHARY (1966, t. 279).

Distr.: Crete, Cyprus, Turkey, Syria, Lebanon, Palestine, Iraq.—Area: E. Mediterranean.

Selected Specimens: Turkey: Aintab [Gaziantep], 1907, HARADJIAN 1343 (K); Hatay, between Kerhan [Kırıkhan] and Alexandretta [İskenderun], 1931, ZOHARY (HUI); env. of Elazığ, fallow field, 1160 m, 1963, ZOHARY 37622 (HUI). Syria: Selemie, 1933, EIG & ZOHARY (HUI); Harmal, 1934, Stud. Rer. Nat. (HUI); Jebel Druze, El Kefr, 1932, EIG & ZOHARY (HUI); Mt. Hermon, Shibba to Ein Jinna, 1924, EIG (HUI). Palestine: Judean Mts., env. of Jerusalem, 1934, EIG & FEINBRUN 107 (HUI). Cyprus: Kykko, 3300-4300 ft., 1913, HARADJIAN 949 (K). Iraq: Jebel Sinjar, 750 m, 1948, GILLET 11001 (K).

3) *Nigella nigellastrum* (L.) WILLK. in WILLK. & LANGE, Prodr. Fl. Hisp. 3, 963 (1880); BRAND 1895, p. 182; TERRACC. 1897, p. 141.

Type from S. France (Herb. Linn. 587/1).

Syn.: *N. garidella* SPENNER, Monogr. *Nigella*, 11 (1829);—*Garidella nigellastrum* L., Sp. Pl. 425 (1753); BOISS., Pl. Or. 1, 64 (1867).—*G. anethifolia* SALISB., Prodr. 374 (1796).—*G. nigelliformis* ST.-LAG., Ann. Soc. Bot. Lyon 7, 126 (1881).

Icon.: LAM., Tabl. Encycl. t. 379 f. 1 (1797); Bot. Mag. 31, 1266 (1810); Fl. URSS 7, t. 6 (1937).—Fig. 2.

Distr.: Spain, France, Switzerland, Greece, Crete, Crimea, Caucasus, Transcaucasia, Turkey, Iraq, Iran, Cyprus, Palestine.—Area: N. Mediterranean (W. Irano-Turanian).

Selected Specimens: Spain: Dilar, ad Granada, 3000-4000 m, 1895, PORTA & RIGO 12 (K). France: Aix, 1876, CARLIER 1077 (FI). Switzerland: Vaud, 1876, coll. ign. (FI). Greece: near Phanar 1931, s.n. (K). Turkey: Amanus Mts., ascent to Karaksu, 1932, EIG & ZOHARY (HUI); distr. Amasya, Amasia [Amasya], 1889, BORN-MÜLLER (E). Cyprus: St. Chrysostomo, 1889, PICHLER (FI). Iraq: Jebel Sinjar, 750 m, 1948, GILLET 11002 (K); Swara-Tuka, open oak scrub, 1955, ROBERTSON 219 (K). Caucasus: 1831, HOHENACKER (FI); Karabagh, SZOVITS 536 (K). Israel: N. Negev, 5 km W. of Beth-Kama, stony soil, 1981, DANIN 1816 (HUI).

III. Sect. *Nigella*

Type Species: *N. arvensis* L.

Syn.: Sect. *Eunigella* WILLK. in WILLK. & LANGE, Prodr. Fl. Hisp. 3, 963 (1800).—Sect. *Nigellaria* DC., Prodr. Syst. Nat. 1, 49 (1824).—Sect. *Git* BRAND (1896, p. 171).—Subgenus *Melanthium* BRAND (1895, p. 183) p. p.—Subsect. *Nigellaria* (DC.) TERRACC. (1898, pp. 20, 21) et Subsect. *Stellaris* TERRACC. (1898, pp. 21, 40).

Sepals longer than petals, stalked, persistent. Carpels 3-5(-10), partly or entirely connate, with a long beak, dehiscing on the ventral (and partly also on the dorsal) sutures or non-dehiscing.



Fig. 1



Fig. 2

Fig. 1. *N. integrifolia* REGEL; *a* sepals (various sizes); *b* petal with nectariferous scale at base; *c* stamens and ovary; *d* capsule. — $\times 0.5$; *a d* $\times 1.5$

Fig. 2. *N. nigellastrum* (L.) WILLK. & LGE.; *a* petal with bifid lower lip and scale-like upper lip; from Turkey (HUI). — $\times 0.5$; *a* $\times 4$

A) Subject. *Nigellaria* (DC.) TERRACC. (1898)

Sepals violet, pink to bluish, rarely white. Carpels united at most to three fourths of their length. Fruit not inflated (except in *N. sativa*). Seeds angular.

4) *Nigella hispanica* L., Sp. Pl. 752 (1753).

Type: The illustration, Fig. 9 (not Fig. 8!) in MORISON, Hist. **3**, t. 18 (1715) should be selected as lectotype.

1. Flowers medium-sized, 2.5-3.5(-4) cm across. Sepals pale pink with claw half as long as limb. Lobe of inner corolla lip shorter than the outer ones. Follicles smooth or very sparingly glandular. Styles erect-patulous. Lobes of leaves short and broad (c) var. *parviflora*
- Flowers larger, 4-7 cm across. Sepals bluish or deep violet. Lobes of inner corolla lip as long as those of the outer ones 2
2. Sepals sessile or subsessile. Carpels densely glandular (a) var. *hispanica*
- Sepals with claws one third as long as blade. Carpels smooth or sparsely glandular (b) var. *intermedia*

(a) var. *hispanica*. *N. hispanica* L., Sp. Pl. 534 (1753); DC., Reg. Veg. Syst. **1**, 328 (1817); SPENNER (1829, p. 9); WILLK. & LANGE, Prodr. Fl. Hisp. **3**, 964 (1880).

Syn.: *N. amoena* SALISB., Prodr., 374 (1796)—*N. polygyna* MOENCH, Method. Pl. Suppl., 111 (1802).—*N. fontanesii* HÜBER ex hort. Utrecht ad ann. 1873—*N. divaricata* WILLK. in WILLK. & LANGE, Prodr. Fl. Hisp. **3**, 964 (1880) et Suppl. 321 (1893) non BEAUPRÉ in DC., 329 (1817).—*N. hispanica* var. *genuina* COSS., Comp. Fl. Atl. **2**, 40 (1887)—*N. hispanica* α [subsp.] *normalis* TERRACC. (1898, p. 21).

Icon.: MORISON, Hist. **3**, t. 18, f. 9 (1715); Bot. Mag. **31**, t. 1265, f. 4 (1810).—Fig. 3.

Distr.: Portugal, Spain.—Area: N. W. Mediterranean. A segetal plant, probably derived from var. *intermedia*.

Selected Specimens: Portugal: Prov. Algarve (FI?). S. Spain: Sierra de Sacana, 1889, REVERCHON 710 (E); Granate Puebla de Don Federico 1890, PORTA & RIGO 257 (K); distr. Burgos 1960, DRESSER 503 (E).

(b) var. *intermedia* COSS., Not. Pl. Crit. 49 (1849); COSS., Comp. Fl. Atl. **2**, 41 (1887).

Type: In Algeria, COSSON (P: holo.; K: iso.).

Syn.: *N. hispanica* DESF., Fl. Atl. **1**, 430, t. 112 (1799).—*N. hispanica* var. *gaditana* SOLEIR ex NYMAN, Consp. Fl. Eur., 16 (1878), nom. nud.—*N. arvensis* var. *cossoniana* J. BALL, Spicil. Fl. Maroc., 308 (1878)—*N. arvensis* var.

glauescens LOJACONO, Fl. Sic. **1**, 59 (1888)—*N. hispanica* subsp. *atlantica* MURB., Lunds Univ. Arsskr. **33** (12), 3 (1897)—*N. hispanica* γ [subsp.] *intermedia* (COSS.) TERRACC. (1898, p. 23).

Icon.: DESF., Icon. Fl. Arl. t. 112 (1798).

Distr.: Portugal, S. Spain, Morocco, Algeria, Tunisia, Sicily.—Area: S. W. Mediterranean. Occurs both in segetal and primary habitats; probably the ancestor of var. *hispanica*.

Selected Specimens. Morocco: Sisi Abdalla, 1928, JAHANDIEZ 405 (E). Algeria: Oran, 1906, FAURE (E); Kabylie, Kerrata, 1898, BOCE 241 (E); Sable de la Calle, 1841, DURJEU 6 (P). Tunisia: Maklar, 1897, MURBECK 1 (K, isotype of subsp. *atlantica* MURB.); Le Kef, 1937, ESPINA 3126 (HUJ). Sicily: Girgenti [Agrigento] ai Maccalabi (s. col.), 1897, 858 (K).

(c) var. *parviflora* COSS., Not. Pl. Crit. 49 (1849); COSS., Comp. Fl. Atl. **2**, 41 (1887).

Type: In Pyreneis Hispan. loco dicto Seo Urgel, BOURGEOU 569 (P: lectotype!).

Syn. *N. gallica* JORDAN, Pug. **1**, 3 (1852); LLOYD & FOUC., Fl. Ouest. France **13** (1886).—*N. hispanica* LOISEL., Fl. Gall. **1**, 321 (1806); MUTEL, Fl. France **1**, 29 (1834).—*N. hispanica* [subsp.] *confusa* SALL. ex NYMAN, Consp. Fl. Eur., 16 (1878).—*N. divaricata* sensu WILLK. in WILLK. & LANGE, Prodr. Fl. Hisp. **3**, 964 (1880), non BEAUPRÉ, p. p.—*N. hispanica* “forme” [= proles] *gallica* (JORD.) ROUY & FOUC., Fl. France **1**, 21 (1893)—*N. hispanica* β [subsp.] *gallica* (JORD.) TERRACC. (1898, p. 23).

Icon.: COSTE, Fl. France **1**, 48 (1901).

Distr.: Portugal, N. and Central Spain, S. and W. France.—Area: N. W. Mediterranean.

Selected Specimens: Portugal: Alto Douro, 1955, FERNANDEZ 5659 (HUJ). Spain: Castelnauary Urgel (FI); Figueras, champs Font del Sock, 1912, BILLOT 706 bis (FI).

Although we have not seen the specimens referred to by BRAND (1895–1896) as three new varieties (var. *divaricata*, var. *algeriensis* and var. *cossoniana*) of *N. gallica*, we do not believe that there is any justification to add more infraspecific taxa to the already accepted ones, which are scarcely discernible from one another. From the description it seems that the above varieties by BRAND should all be included within var. *parviflora*.

5. *Nigella arvensis* L., Sp. Pl. 534 (1753).

Lectotype: “Ingolstadii, Basileae et in Bohemia”, Herb. BURS. **VII** (1): no. 118 (UPS), fide STRID (1970, p. 28).

N. arvensis represents the most difficult groups in the genus due to its intricate polymorphism and plasticity. The author has examined

several hundred specimens; after a meticulous study, he is inclined to distinguish only the following 14 varieties. Most of them have been already previously considered by TERRACCIANO (1897—1898), BRAND (1895—1896), BOISSIER (1867) and others.

The following key includes all the infraspecific taxa, so far known to the present author, that make up the extremely polymorphic *N. arvensis* and among them also all the taxa recorded by STRID (1970), namely the 3 new species (*N. icarica*, *N. carpatha* and *N. stricta*) described by him, the 2 species (*N. degenii* and *N. doerfleri*) described by VIERHAPPER (1926) and 6 subspecies described or recorded by STRID.

STRID (1970) sees in *N. arvensis* a species complex, the taxa of which form a "Rassenkreis" with intermediates and in his own words: "The continuous morphological variation in *N. arvensis* probably corresponds to a cline with respect to genetic constitutional similarity. The end members of this chain of forms give rise to sterile hybrids, while interjacent populations form fertile hybrids" (p. 131), or elsewhere (p. 25) "such a Rassenkreis is interesting from an evolutionary point of view but annoying to the practical taxonomist, presenting him with virtually insolvable problems".

The difficulties lie in the hardly discernible morphological markers. Accordingly, it is not surprising that sharp-eyed taxonomists, such as TERRACCIANO, BOISSIER, and others, did not find in the Aegean material taxa different from those occurring elsewhere, while STRID described or accepted in the material of this area 5 species. Other taxonomists too, such as RECHINGER (1943 a, b, 1961), GREUTER & al. (1967), TUTIN (1964), MEIKLE (1977), DAVIS (1965), did have difficulties with these taxa and were hesitant to accept some of them. This is shown in STRID's historical review (p. 15) and in the synonyms of the various taxa recorded by him.

The author of this revision has examined specimens named by STRID (including type material) in various European herbaria and has failed to find morphological differences weightly enough to separate the Aegean plants taxonomically from the other known varieties of *N. arvensis*.

STRID (1970) also admits that his Aegaeen taxa are cytogenetically close; they are karyotypically similar, and 10 out of the 12 under concern are cross-compatible. Moreover, STRID's reluctance as to their taxonomic rank is obvious from his statement that "extensive experimental studies would be needed to explore the full range of variability in *N. arvensis*". In the very limited Flora Palaestina area, for instance, not less than three subspecies and seven varieties were recognized (ZOHARY 1966, p. 73).



Fig. 3

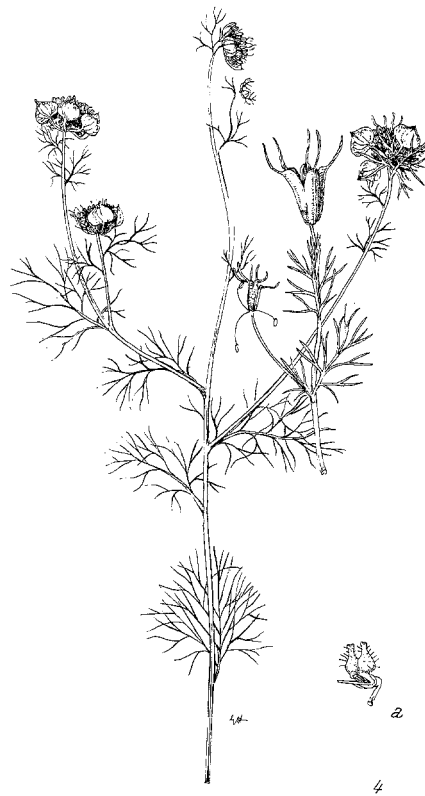


Fig. 4

Fig. 3. *N. hispanica* L. var. *hispanica*; a petal; from Spain (HUI). — $\times 0.5$;
a $\times 2$

Fig. 4. *N. arvensis* L. var. *arvensis*; a petal; from Ukraine (HUI). — $\times 0.5$;
a $\times 2$

All these facts lead the present author to include STRID's "micro"-taxa within the frame of the known *N. arvensis* varieties. In the synonymy they have been marked with (p) (= provisional) to designate their special status. This procedure should be regarded a means to settle the discordance between experimentally obtained taxa and those based on traditional morphological markers alone. Such "conflicts" probably occur in all the cases where parts of a genus are studied experimentally, while the rest is still conventionally named.

The variety concept is applied here in the sense of NORDENSTAM (1968) to designate morphologically deviating populations whose status

is still uncertain. A similar opinion in the defence of the variety is also expressed by BÖCHER (1967). More morphological, genetical and ecological studies are required before a subdivision into eco-geographical subspecies is justified.

1. Carpels glabrous, smooth (rarely very sparsely tuberculate) 2
- Carpels tuberculate 7
2. Green, erect, richly leafy plants. All leaves 2-3-pinnatisect into linear-lanceolate to filiform divergent lobes. Sepals pale blue, 7-10 mm across. Mostly weeds in corn fields of C. and S. Europe (a) var. *arvensis*
- Plants mostly glaucous and not as above 3
3. Stemless or with short (5-15 cm) decumbent or ascending stems or branches. All leaves, including the uppermost ones, divided into 3 short unequal lobes. Capsule usually short, up to 1.5 cm long. Littoral E. Mediterranean plants. (j) var. *microcarpa*
- Erect, non-littoral plants. Leaves different 4
4. Carpels 3-5; follicular parts 0.8-1.2 cm long, connate to 1/3-1/2 of their length; beaks and free parts of follicles widely spreading in fruit. Flowers 1.2-1.5 cm across. Poorly branching W. Irano-Turanian plants with upper leaves 3-sect into unequal linear to filiform lobes. (k) var. *assyriaca*
- Not as above 5
5. Leaves lanceolate, 3-6 cm long, entire, all undivided. Iraq (o) var. *simplicifolia*
- All or most of the leaves 1-3-ternatisect or pinnatisect 6
6. Anthers aristate. Appendages of petal lobes incurved. Carpels 9-12 mm long. Low, sparsely branching plants from the Negev desert (h) var. *beershevensis*
- Anthers blunt or apiculate. Appendages of petal lobes straight. Carpels 5-6, up to 20 mm long. Fairly tall (30-50 cm), divaricately branching W. Mediterranean plants (b) var. *glaucescens*
- 7 (1). Flowers involucrate by the upper leaves. E. Mediterranean plants (g) var. *involucrata*
- Flowers not involucrate 8
8. Upper parts of carpels and their beaks strongly diverging in fruit. W. Irano-Turanian plants 9
- Carpels and fruits erect or slightly diverging in fruit. Mostly E. Mediterranean plants 12

9. Carpels connate to $1/3-1/2$ of their length; beak 1-2 times as long as carpel. Erect, sparsely branching, glabrous plants with upper leaves 3-sect into linear to filiform lobes, the middle one 2-4 cm long. (k) var. *assyriaca*
 — Not as above 9
10. Leaves strongly asperulous-pubescent, all or the uppermost only, 3-sect into oblanceolate, 6-12 mm long lobes, the terminal lobe larger. W. Iran..... (n) var. *iranica*
 — Leaves glabrous or slightly scabrous..... 11
11. Stem leaves (including the uppermost ones) 2-3-ternatisect into filiform, 8-15 mm long, green lobes. Carpels 2-5, transversally wrinkled. Flowers 2-2.5 cm across. Sepals broad ovate, 8-10 mm across. Appendages of lower petal lobes as long as or shorter than lobe. Anatolia (l) var. *anatolica*
 — Stem leaves (including the uppermost ones) 3-sect into unequal, linear to filiform, partly over 2 cm long lobes. Lower lip of petal with appendages up to twice as long as lobe. Syria and Iraq (m) var. *longicornis*
- 12 (8). Littoral decumbent or stemless, or strongly divaricate, short-stemmed plants; leaves thick or somewhat leathery or succulent 13
 — Non-littoral plants with erect, richly or moderately branching stems 14
13. Leaves, at least the uppermost ones, long-elliptical, entire, up to 1.3 cm broad..... (i) var. *palaestina*
 — All stem leaves including the uppermost ones 3-sect or pinnatifid with laciniae much less broad than above..... (j) var. *microcarpa*
- 14 (12). Branching from base with 5-20 erect stems. Leaves 3-sect into linear-lanceolate lobes. Appendage of lobes of lower petal lip broadly ovate, as broad as long. Carpels sometimes sparingly tuberculate. Negev desert (f) var. *multicaulis*
 — Not as above 15
15. Uppermost stem leaves simple, rarely 3-sect and then the terminal lobes 2-4 times as long as the lateral ones. Flowers 2-2.5 cm across. Sepals bluish. Anthers almost blunt. Erect, little branching plants of the coastal sandy plains of Palestine and Lebanon (d) var. *mutica*
 — Upper and uppermost leaves always 3-sect into cuneate or linear-filiform laciniae. Plants also different otherwise 16

16. Flowers whitish, up to 1.5 cm across. Sepals elliptical, about 3-5 mm broad. Appendages of lobes of lower petal lip filiform, 0.3-0.5 mm thick. Anthers blunt. Sandy deserts of the Negev ..
 (e) var. *negevensis*
- Flowers bluish-white, 2-2.5 cm across. Sepals broadly ovate, cordate at base, 7-8 mm wide. Appendages of petals linear. Anthers aristate. Mainly E. Mediterranean and W. Irano-Turanian (c) var. *glauca*

(a) var. *arvensis*. *N. arvensis* L., Sp. Pl. 534 (1753); KOCH, Synopsis. ed. 2, 22 (1843); BRAND, Helios 12, 189 (1895).

Syn.: *N. doliata* PALL. ex BIEB., Fl. Taur.-Cauc. 2, 16 (1808).—*N. divaricata* BEAUPRÉ ex DC., Reg. Veg. Syst. 1, 329 (1817) quoad pl. Tauriae, sensu GRISEBACH, Spic. Fl. Rum. & Bithyn. 1, 317 (1843).—*N. foeniculacea* DC., Reg. Veg. Syst. 1, 328 (1817).—*N. tuberculata* GRISEB., Spic. Fl. Rum. & Bithyn. 1, 318 (1843).—*N. agrestis* PRESL, Delic. Prag. 225 (1882).—*N. arvensis* α [var.] *typica* BOISS., Fl. Or. 1, 66 (1867).—*N. arvensis* β [var.] *verruculosa* BECK, Fl. Nieder-Oesterr. 1, 398 (1890).—*N. arvensis* α [subsp.] *normalis* TERRACC., Bull. Ort. Bot. Palermo 2, 31 (1898).—*N. arvensis* subsp. *arvensis*: TUTIN, Fl. Europ. 1, 209 (1964).

Icon.: RCHB. 4, t. 120, f. 4735 (1840); LAM., Tabl. Encycl. 1, t. 488, f. 1 (1793).—Fig. 4.

Distr.: Central, Southern and Eastern Europe.—Area: N. Mediterranean-Pontic-Central-European.

Selected Specimens: Germany: Hessen, HOHENACKER 300 (E). Austria: bei Döbling (Vienna), 1897, KREBS (E). Czechoslovakia: Weisskirchen, 1909, MALOCH 451 (E). Poland: Raclavice, 1954, JASZIEWICZ (BM). S. Russia: Odessa 1893, KULIKOVSKY 114 (E); Crimea, 12 km N. of Simpheropol, 1898, DESOUCHET (MPU). Hungary: Erisi et Iris, Csepel, 1871, SONKLAR (E). Bulgaria: Ad Sados, 1899, STRIBRNY (E). France: près Lyon, GUINAND 1869 (P); Paris 1958, ROUX (P). Yugoslavia: Vranjano, 1895, ADAMOVIĆ (E). Greece: Epirus, 1889, BALDACCIO (E).

This variety is most common in the northern Mediterranean countries and in southern, eastern and central Europe. It is almost exclusively segetal and possibly has been derived from wild *N. African* or S. W. Asian varieties confined to primary habitats, sharing with var. *arvensis* smooth carpels, long apiculate anthers, etc. A similar situation is found in the segetal Atlantic *N. hispanica* var. *hispanica*. In S. W. Europe hybridisation probably occurs between such populations of *N. hispanica* and *N. arvensis*. In S. E. Europe intermediate forms are found between var. *arvensis* and the highly complex var. *glauca*.

(b) var. *glaucescens* GUSS., Pl. Rar. 216 (1826) et Fl. Sic. Prodr. 2, 34 (1828).

Type: Calabria, GUSSONE (FI, n. v.).

Syn.: *N. divaricata* MORIS, Fl. Sard. **1**, 54 (1837).—*N. catanae* TEN., Fl. Neap. Syll. App. **5**, 14 (1842).—*N. divaricata* BEAUPRÉ ex DC. (1818) sensu GUSS., Fl. Sic. Syn. **2**, 30 (1845).

Icon.: DELESS., Icon. **1**, t. 46 (1821); GUSS., Fl. Sic., t. 260 (1828).

Distr.: Morocco, Algeria, Tripolitania, Italy (also recorded by TERRACCIANO from Sardinia and Sicily).—Area: W. Mediterranean.

Selected Specimens: Morocco: Bir Rashid in segetibus, 1913, PITARD 2921 (K). Algeria: Hautes Plateaux Oranais, env. de Bedeau, 1100 m, 1934, FAURE (HUIJ). Tunisia: in collibus Zayhonan, 1852, KRALIK s. n. (K). Italy: in agro Ticinense, GRAVES (K).

This variety probably intercrosses with *N. hispanica* var. *intermedia* and varies accordingly.

The name *N. divaricata* BEAUPRÉ is here reluctantly added as a synonym because the herbarium specimen denoted "Tauria, BEAUPRÉ in Herb. DC., Genève" which should be considered as the type specimen, can hardly be separated from var. *arvensis*, which is fairly common in the Crimea. The other two specimens, mounted with the former on the same sheet, came both from Egypt, are very different, and one of them is named *N. laevis* DELILE (DC. 1817). Confusingly, the Crimea specimen disagrees sharply with the illustration cited by DELESSERT and the short description given in DC. (1817). No doubt, that both were prepared from a typical specimen of the true var. *glaucescens* GUSS. BOISSIER (Fl. Or. **1**, 66, 1867) was the first to reduce *N. divaricata* BEAUPRÉ to a variety. But his var. *divaricata* is very broadly conceived, it includes specimens belonging to var. *arvensis*, var. *palaestina* ZOH., var. *glauca* BOISS. and var. *microcarpa* BOISS. The true var. *glaucescens* does not occur in the region of the Flora Orientalis.

(c) var. *glauca* (SCHKUHR) BOISS., Fl. Or. **1**, 66 (1867).

Type: Turkey, Armenia, CALVERT (K: lectotype selected by DAVIS 1965).

Syn.: *N. glauca* SCHKUHR, **2**, Bot. Hdb. 92 (1808) p. p.; WALLR., Linnaea **14**, 587 (1840).—*N. huthii* BRAND, Helios **12**, 191 (1895).—(p)¹ *N. degenii* VIERH., Mag. Bot. Lapok **25**, 148 (1926); STRID, Op. Bot. **28**, 51 (1970).—(p) *N. doerfleri* VIERH., Magyar Bot. Lapok **25**, 147 (1926); STRID, Op. Bot. **28**, 53.—*N. arvensis* β [subsp.] *glauca* (BOISS.) TERRACC., op. cit. 36 (1898), p. p. (excl. var. *glaucescens*).—*N. arvensis* subsp. *tuberculata* (GRISEB.) BORNM. var. *tuberculata* BORNM., Verh. Zool.-Bot. Ges. Wien, **48**, 457 (1898). ≡ *N. arvensis* subsp. *glauca* (BOISS.) TERRACC., STRID 1970, p. 38.—(p) *N. icarica* STRID 1970, p.

¹ See explanation on p. 83.

48.—(p) *N. degenii* subsp. *barbro* STRID 1970, p. 58 (p.).—(p) *N. degenii* subsp. *jenny* STRID 1970, p. 60.—(p) *N. degenii* subsp. *minor* STRID 1970, p. 61.—(p) *N. stricta* STRID 1970, p. 63.—(p) *N. carpatha* STRID, p. 49.

Icon.: In STRID (1970) several drawings of STRID's taxa cited above.

Distr.: Caucasus, Crimea, Greece, Aegean Islands, Anatolia, Cyprus, Iran, Iraq, Syria, Lebanon, Tunisia, Algeria.—Area: E. Mediterranean-W. Irano-Turanian.

Selected Specimens: Caucasus: Castalinia Gori, 1881, BROTHERS (BM). Armenia: pr. pag. Buhagiar, 1929, SCHELKOVNIKOV et KARA-MUZZA s.n. (Hort. Bot. Arm.). Greece: 1917, KOLLEY & KENCH s.n. (BM); Macedonia, Great Caraburum about 4 miles S. of Salonika, s.d. (BM); Dodekanisos, insula Liadi, RECHINGER 7785 (W); Anidhros, RECHINGER 5246 (W, under *N. doerfleri* VIERH.); insula Naxos ad pagum Apiranthos 1932, RECHINGER 2246 (W); ins. Tino, Tuntas, RECHINGER (under *N. aegaea* VIERH., and *N. degenii* VIERH. subsp. *barbro* STRID); Samos, W. of Tigani 1964, GATHORNE-HARDY 812 (E). Turkey: Anatolia: W. of Muğla, DUDLEY D. 35441 (K); Cappadocia, Caesarea [Kayseri], BALANSA 1861 (P, ad var. *assyriacam* spectans); Taurus cataonicus, 1865, s.d. (P); Kalecik, 1929, BORNMÜLLER 13686 (G); env. of Aksaray, 1953, H. BIRAND & M. ZOHARY 2793 (HUI); Pamphylia: Vilayet Antalya, between Alanya and Gazipaşa, 4. 6. 1950, A. HUBER-MORATH 10398 (HUI). Syria: Antilebanon, Wadi el Hazir, GOMBAULT 2121 (P). Lebanon: Beirut 1876, POST 95 (BM); Lattakia 1846, REUTER (G). Iran: Ghilan, AUCHER-ELOY 4022 (P, BM); Khuzestan, S. of Haft Tape, WRIGHT 428-106 (K). Iraq: distr. Kirkuk 1957, RECHINGER 9280 (W). Tunisia: Sfax, 1854, ESPINA (P). Algeria: Autours de Dyelfa, 1854, REBOUD (G).

As is seen from the synonymy, it is this variety, into which 4 of the species and their subspecies described or accepted by STRID have been included as provisional synonyms. The specimens cited indicate the wide distribution of this taxon as compared with the area studied by STRID.

(d) var. *mutica* BORNM., Verh. Zool.-Bot. Ges. Wien **48**, 547 (1898) (sub subsp. *tuberculata*).

Type: Israel: Jaffa, 1925, BORNMÜLLER (B: lecto.).

Syn.: *N. arvensis* var. *submutica* BORNM., Verh. Zool.-Bot. Ges. Wien **48**, 547 (1898).—*N. arvensis* L. subsp. *tuberculata* (GRISEB.) BORNM. var. *mutica* BORNM. (op. cit.).

Icon.: ZOHARY (1966, t. 280, sub *N. arvensi*).

Distr.: Turkey, Lebanon, Israel.—Area: E. Mediterranean.

Selected Specimens: S. Turkey: Alanya, 1947, DAVIS 14486 (K). Lebanon: Saïda, 1854, GAILLARDOT 546 (K). Israel: Sharon Plain, Even Jehuda, 1951, ZOHARY & AMDURSKY s.n. (K).

(e) var. *negevensis* ZOH. in ZOH. & FEINBR., Fl. Palaest. **1**, 194 (1966) sub subsp. *tuberculata*.

Type: Israel: Negev, Mishor Yemin (Tureiba), sands of Neogene sandstone, 1957, M. ZOHARY & Y. WASEL 842 (HUI: holo!).

Distr.: Endemic to Israel; limited to above desert district.—Area: Saharo-Arabian.

This variety is readily distinguished from var. *mutica* by smaller flowers and fruits, whitish sepals, slender stems and branches, and filiform leaf lobes.

(f) var. *multicaulis* ZOH. in ZOH. & FEINBR., Fl. Palaest. **1**, 194 (1966) sub subsp. *tuberculata*.

Type: W. Negev, env. of Wadi Sheneq (Nahal Habsor), sandy loess soil, 1949, M. ZOHARY & G. ORSHAN 837 (HUJ: holo!).

Syn.: $\equiv$ *N. deserti* var. *latilabris* ZOH., Palest. J. Bot. Jerusalem Ser., **2**, 154 (1941).

Distr.: Endemic to Israel.—Area: E. Mediterranean-Saharo-Arabian.

Selected Specimens: Israel: Coastal Negev, inter Nuckl et Gaza, E. BOISSIER (G); N. Negev, about 10 km south of Beersheba, sandy soil, 1928, A. EIG & M. ZOHARY 835 (HUJ).

This variety differs from all other varieties of *N. arvensis* by its many green, erect stems, its whitish-green flower colour and its very broad petal appendages.

(g) var. *involutrata* BOISS., Fl. Or. **1**, 66 (1867).

Type: Greece: Attica, HELDREICH 1673 (lecto.: K!).

Syn.: *N. arvensis* γ [subsp.] *involutrata* TERRACC., 1898, p. 38.—*N. aristata* SM. in SIBTH. & SM., Fl. Gr. Prodr. **1**, 373 (1806).—*N. arvensis* subsp. *aristata* (SM.) NYMAN, Consp. Fl. Eur. **17** (1878); TUTIN, Fl. Eur. **1**, 209 (1964); STRID, Op. Bot. **28**, 34 (1970).—*N. huthii* var. *aristata* (SM.) BRAND in Helios **12**, 192 (1895), comb. illeg.—*N. aristata* subsp. *rechingeri* TUTIN, Bot. Jahrb. **80**, 322 (1961).—*N. arvensis* subsp. *rechingeri* (TUTIN) TUTIN, Feddes Repert. **70**, 5 (1964).

Icon.: SIBTH. et SM., Fl. Graeca **6**, 510 (1827).

Distr.: Greece, Yugoslavia, Turkey, Syria.—Area: E. Mediterranean.

Selected Specimens: Greece: Attica, 1673, HELDREICH (K, lecto.), Larissa, 1885, HAUSSKN. (JE); insula Euboea, Hagios Dimitrios, 1958, RECHINGER 19017 (G); also seen from the Cyclades, Samos and other Aegean islands. Yugoslavia: Dalmatia, 1868, PICHLER 23 (BM). Turkey: Muğla, DAVIS 13580 (E). Lebanon: Bir Hassan, 1929, GOMBAULT 617 (P).

Very similar to var. *glauca* but flowers involucre by the uppermost leaves. BOISSIER (1867), well familiar with the Greek plants of *N. aristata*, has not accepted this taxon but as a variety. He probably rejected the epithet *aristata* because aristate anthers occur also in other forms of *N. arvensis*, while involucre is a rather constant character

within *N. arvensis*. This view was also accepted by TERRACCIANO (1897-1898) and by DAVIS (1965). TUTIN has changed his mind three times as to the taxonomic value of this taxon (see synonyms above).

I have seen specimens of var. *glauca* that clearly intergrade with other varieties in their poorly developed involucre, the configuration of their carpels and the length of their anther apex.

For example: Yugoslavia: Dalmatia, in arvis Salonam [Split], RICHTER 92 (G, P). Greece: Thessalia, Pelion, s.d. (G). Aegaea: Insula Mikonos 1901, HELDREICH 1601 (G, type of *N. degenii* VIERH. subsp. *barbro* STRID); Cyclades, HELDREICH (P); Samos, FORSYTH-MAJOR 619 (E, type of *N. huthii* BRAND); Samos, BARBEY 619 (P, named as subsp. *glauca* by STRID); Kos, RECHINGER 8033 (W). Turkey: Lydia, 1842, BOISSIER (G); Bozdağ, 1950, DAVIS 18168. Syria: Damascus, 1837, AUCHER-ELOY 96 (G).

These intermediates support our view, already expressed by BOISSIER, DAVIS and others, to consider *N. aristata* only as a variety (var. *involutrata*) of *N. arvensis*, close to var. *glauca*. STRID (1870) has excluded most of the above cited specimens from his subsp. *aristata* and refers them to *N. degenii* and to some of his other subspecies.

(h) var. *beershevensis* ZOH. in ZOH. & FEINBR., Fl. Pal. 1, 193 (1966) sub subsp. *arvensi*.

Type: Israel, N. Negev, 20 km N. W. of Beersheva, ZOHARY and WASEL 875 (H.U.J. holo.).

Distr.: Endemic to Israel.—Area: Saharo-Arabian.

Selected Specimens: Israel: 4 km south of Beersheva, loess soil, 1928, A. EIG, M. ZOHARY & N. FEINBRUN 879 (H.U.J.).

(i) var. *palaestina* (ZOH.) ZOH. & FEINBR., Fl. Palaest. 1, 194 (1966) sub subsp. *divaricata*.

Type: Sharon Plain, sandy coast, 1956, ZOHARY & WASEL 898 (H.U.J. holo.).

Syn.: *N. arvensis* var. *divaricata* (BEAUPRÉ) BOISS., Fl. Or. 1, 66 (1967) p. p. quoad plant. joppensem (nom. ambiguum). ≡ *N. divaricata* var. *palaestina* ZOH., Pal. J. Bot. Jerusalem Ser., 2, 153, f. 2 (1941).

Distr.: S. Turkey, Lebanon, Israel.—Area: E. Mediterranean.

Selected Specimens: Turkey: Prov. Muğla: Datça Marmaris, 1962, DUDLEY 35441 (K). Lebanon: Beirut, 1881, PEYRON 939 (G). Palestine: Sharon Plain, Natanya, elevated sea shore 1938, EIG, ZOHARY & GRIZI (H.U.J.).—Fairly common all along the elevated coast line of Israel. I have seen specimens from Rhodos (e.g. 1879, E. BOURGEAU, K) which approach very much both var. *palaestina* and var. *microcarpa*.

This variety is very striking by its low stem, its divaricate branches and especially by its broad, rather leathery scabrous, entire upper

leaves, reaching a width of 1 cm. The lower leaves are often pinnatisect or trifid and their terminal lobe is much broader and longer than the other. Var. *palaestina* is confined to the coastal line where it stands the action of wind and sea water spray.

(j) var. *microcarpa* BOISS., Fl. Or. **1**, 66 (1867). (err. *macrocarpa*).

Type: In Creta prope Cydoniam, HELDREICH (K: lectotype).

Syn.: = *N. arvensis* subsp. *divaricata* var. *daucifolia* ZOH. in ZOH. & FEINER., Fl. Pal. **1**, 194 (1966).—*N. cretensis* STEVEN, Bull. Soc. Imp. Nat. Mosc. **29**, 282 (1856).—*N. arvensis* var. *cretensis* REVERCH., Pl. Exsicc. 1884.—*N. taubertii* BRAND in Helios **13**, p. 192 (1895).—*N. arvensis* subsp. *taubertii* (BRAND) MAIRE, Fl. Afrique Nord **11**, 40 (1964).—*N. arvensis* subsp. *brevifolia* STRID, Opera Bot. **28**, 44 (1970).—*N. arvensis* var. *tauricola* DAVIS, Fl. Turk. **1**, 102 (1964).

Distr.: Aegean Islands, Turkey, Israel, Egypt, Libya, Tunisia, Sicily.—Area: E. Mediterranean.

Selected Specimens: Greece: Rodhos: Bord de champs 1870, BOURGEAU (G, ad var. *glauca* spectans); Chios: Pelmaion, 1939, PLATT 364 (K); Cyclados: Suphrania, 1935, RECHINGER 7620 (G). Crete: Kissamos, 1884, REVERCHON 216 (K, E, type of *N. arvensis* subsp. *brevifolia* STRID l.c.). Turkey: Antalya, between Elmali to Antalya, steppe forest of *Juniperus excelsa*, 1200 m, 1971, SHMIDA et LEV-ARI. Palestine: Galilee Coast, Rosh-Haniqra, 1956, ZOHARY & WASEL 917 (HJ); Ashkelon, 1956, ZOHARY & WASEL 914 (HJ). Egypt: Herb. OLIVIER, 1882, (G-DC, G); Ramleh, 1871, DU PARQUET 476 (BM); San Stephania bei Alexandria, O. KAISER, 1912 (G); El-Arish, 1925, ZOHARY (HJ); Mandara, 1877, LETOURNEUX (MPU). Libya: Plain of Al Marj, 1922, HORTERT (BM); Valée de Zordes, 1875, DAVEAU (P, type of *N. taubertii* BRAND); Tripoli, 1913, VACCARI 102 (FI). Tunisia: HUET DE PAVILLON (K).

This variety is rather heterogenous consisting both of stemless plants with long, decumbent branches and erect or ascending caulescent middle-sized plants. Their capsules vary from $\pm$ smooth to densely tuberculate, but the small size of the fruits (name!) is very striking. Transitions occur towards var. *palaestina* and var. *glauca* and need further study. The polymorphism of var. *microcarpa* may be due to the diversity of conditions prevailing in its insular and littoral habitats.

(k) var. *assyriaca* (BOISS.) ZOH., comb. nov.

Type: In deserto Assyriae, AUCHER-ELOY 48 (G: lecto. K, BM).

Syn.: $\equiv$ *N. deserti* var. *assyriaca* BOISS., Ann. Sci. Nat. Bot. Sér. 2, **16**, 359 (1841). $\equiv$ *N. assyriaca* (BOISS.) BOISS., Fl. Or. **1**, 67 (1867); BRAND, Monogr. Helios **13**, 27 (1895).—*N. deserti* BOISS., Ann. Sci. Nat. Bot., sér. 2, **16**, 359 (1841); Fl. Or. **1**, 67 (1867).—*N. deserti* var. *arabica* BOISS., Ann. Sci. Nat. Bot., sér. 2, **16**, 359 (1841).—*N. arvensis* var. *caudata* BOISS., Fl. Or. **1**, 66 (1867). $\equiv$ *N.*

deserti α [subsp.] *normalis* TERRACC. et β [subsp.] *assyriaca* TERRACC., (1898, p. 42, 43). $\equiv$ *N. arvensis* subsp. *arvensis* var. *arabica* (BOISS.) ZOH. in ZOH. & FEINBR., Fl. Palaest. **1**, 193 (1966).

Distr.: Turkey, Syria, Iraq, Israel, Sinai.—Area: W. Irano-Turanian.

Selected Specimens: Turkey: in agris circa Aintab [Gaziantep], HAUSSKN. (G); inter Orfa [Urfa] et Suerek [Siverek], KOTSCHY 344 (G, lectotype of var. *caudata* BOISS.). Iraq: Khanaqin, 26. 5. 1932, B. P. UVAROV 14 (HUJ); inter Mosul et Zako, 1957, RECHINGER 10637 (W). Iran: Dizful, 1851, LOFTUS (BM). Syria: Syrian Desert, Bezariah near Palmyra, 1900, POST (BM); Mayodina, 1946, BROWN s. n. Israel: Negev, 3-4 km S. of Beersheba, on the way to Asluj, 320 m, 23. 5. 1935, M. ZOHARY & N. FEINBRUN 87 (HUJ); Judean Desert, Wadi Farah, 1934, EIG, ZOHARY & FEINBRUN 980 (HUJ). Sinai: Desert de l'Isthm Aegypt, Wadi Maghara, 1920, TONTAN (MPU).

Var. *assyriaca* is only one member of a whole complex of forms characterized by strongly divergent, long-caudate fruiting follicles. Its taxonomy is still rather obscure and deserves further studies. The following four varieties (l)-(o) are very close to var. *assyriaca* in regard to the above mentioned fruit character, but differ considerably in other markers.

(l) var. *anatolica* ZOH., var. nova

Type: N. E. Turkey: vilayet Sivas, environs of Suşehri, *Artemisia* steppe, 860 m, 1963, ZOHARY 67950 (HUJ: holo.!).

Planta laeta viridis, 20-30 cm alta. Caules erecti vel ascendentes, divaricato-ramosi. Folia asperulo-hirta, omnia tripinnatisecta, laciniis filiformibus, 1-2 cm longis. Flores nudi, majores, 2-3 cm diametro. Sepala alba, apice cyanoidea, late ovata, basi cordata, longe stipitata. Antherae aristatae. Labia exteriora petalorum in lacinias breves producta. Carpella 5, laevis vel saepe tuberculata, trinervia, 15 mm longa, ad tertiam partem connata; partes carpellorum liberae valde divergentes, stylis quam carpella aequilongis.

This variety differs from the others by short and shaggy linear leaflets, whitish sepals with claws almost as long as limbs, and linear and mostly smooth carpels.

Distr.: Turkey.—Area: W. Irano-Turanian.

Specimens Seen: Turkey: C. Anatolia, 10 km N of Ankara, 1962, M. & D. ZOHARY 85 (HUJ); district Elazığ, 14 km N of village Pestek, 1963, ORSHAN & PLITTMANN 472-232 (HUJ).

(m) var. *longicornis* (ZOH.) TOWNSEND, Taxon **16**, 467 (1976).

Type: Syria, Hauran, Tel Chihane (near Chaboo), EIG & ZOHARY (HUJ).

Syn.: *N. assyriaca* var. *longicornis* ZOH., Pal. J. Bot. Jerusalem Ser., **2**, 154 (1941).

Distr.: Syria, Iraq.—Area: W. Irano-Turanian.

Specimens Seen: Syria: Antilebanon, env. of the village Jerejir, 1932, EIG, FEINBRUN & ZOHARY (H.U.J.). Iraq: 6 km W of Tel Afar, 1948, GILLET 11168 (K); 36 km E of Samarra, 1957, RAVI 20377 (K); Erbil, 1893, BORNMÜLLER 830 (K).

Differs from var. *assyriaca* mainly by its very long appendages of the lower petal limb. The leaves are pinnately divided into very long, filiform to linear and crowded lobes.

(n) var. *iranica* ZOH., var. nova

Type: W. Iran: Zahub to Karand, 1240 m, 1965, DANIN, BAUM & PLITMANN 65-152 (H.U.J.: holo.).

Planta glaucescens, 15-25 cm alta, a basi ramosa. Caules numerosi. Folia asperulo-hispidula, pinnatifida vel trisecta; lobi oblongi, 1-2 cm longi, terminalis quam laterales multo latior et longior. Flores 2.5 cm diametro. Sepala aureo-alba, rhomboideo-ovata, longe stipitata. Antherae longe apiculatae. Lacinae loborum petalorum longissimae, filiformae. Carpella 5, etiam inter nervos tuberculata, ad tertiam partem connata, demum valde divergentia, stylis quam carpella aequilongis.

Differs from var. *longicornis* with which it shares the very long petal lobes, by its oblong, somewhat hairy leaflets and its not aristate anthers.

Distr.: Endemic to W. Iran.—Area: W. Irano-Turanian.

Specimens Seen: W. Iran: about 80 km E of Kermānshāh on the road to Hamadan, 1965, DANIN & PLITMANN 26387 (H.U.J.).

(o) var. *simplicifolia* ZOH., var. nova

Type: Iraq: 25 km S.E. of Mandali, 1957, ALI EL RAVI 20709 (K: holo.).

Planta viridis, 20-25 cm alta, divericatim ramosissima. Folia indivisa, linearia, lanceolata, usque ad 5 cm longa et 0.8-1 cm lata, glabra. Flores circa 2 cm diametro. Sepala late ovata, albido-lurida, longe stipitata. Lacinae loborum labii petalorum exteriorum cornutae. Antherae brevissime apiculatae. Carpella 3-5, glabra, infra medium coalita. Styli valde divergentes, carpellis aequilongi.

This variety—known only from the type collection—is very near var. *assyriaca* and the only differential character are the undivided long and relatively broad green leaves.

Distr.: Endemic to Iraq.—Area: W. Irano-Turanian.

6) *Nigella segetalis* MARSCH. BIEB., Fl. Taur. Cauc. **2**, 16 (1808); BOISS., Fl. Or. **1**, 65 (1867).

Type: [Crimea:] In Tauriae agris, MARSCHALL VON BIEBERSTEIN (LE, n.v.).

Two varieties—both mostly weedy—can be distinguished: The local var. *armena* differs from the wide-spread var. *segetalis* by more setaceous leaf segments, less divaricately branching stems, larger flowers, more cylindrical capsules, and beaks one third as long as follicles, divaricately spreading and circinate at apex. Also, the surface of the capsule is more delicately tuberculate, and the angles of the triquetrous seeds are sharper. As separation of the two taxa is sometimes doubtful, further studies are required.

(a) var. *segetalis*.

Syn.: *N. sativa* var. *cretica* DC., Reg. Veg. Syst. **1**, 330 (1818).—*N. foeniculacea* SPENNER, Monogr. **9** (1829), non DC. (1818).—*N. bicolor* BOISS. et HELDR. in BOISS., Diagn. ser. **1**, **7**, 7 (1846).—*N. segetalis* α [subsp.] *normalis* TERRACC. (1898, p. 26).

Icon.: BIEB., Cent. Pl. Rar. Ross. **1**, t. 25 (1829).—Fig. 5.

Distr.: Crimea, Turkey, Iran, Caucasus.—Area: W. Irano-Turanian.

Selected Specimens: Crimea: Burundul, 1896, CALLIER 282 (E). Turkey: Paphlagonia, Tossia [Tosya], 1892, SENTENIS 4159 (W); Konia [Konya], in campis, 1845, HELDREICH (type of *N. bicolor* BOISS. et HELDR.); prov. Erzurum, between Horasan and Pasinler, 1700 m, 1957, DAVIS 29422 (E); Tuz Gölü, 1953, BIRAND & ZOHARY 3533 (HUJ). Iran: Env. of Urmia, 1916, SCHELKOVNIKOV 100-16 (W).

(b) var. *armena* (STEV.) BOISS., Fl. Or. **1**, 65 (1867).

Type: in Armenia Rossica, (LE, n.v.).

Syn.: *N. verrucosa* C. KOCH, Linnaea **15**, 246 (1841).—*N. foeniculacea* LEDEB., Fl. Ross. **1**, 736 (1842), p. p. (non DC.). = *N. armena* STEV., Bull. Soc. Nat. Mosc. **2**, 274 (1848). = *N. segetalis* β [subsp.] *armena* (STEV.) TERRACC. (1898, p. 26).

Icon.: Tahtadžjan, Flora Armeniae **1**, t. 36 (1954).

Distr.: Endemic in Armenia.—Area of species: W. Irano-Turanian.

Specimens Seen: Armenia: Erivan, 1956, TAER (K).

7) *Nigella sativa* L., Sp. Pl. 534 (1753).

Type from Egypt and Crete (Herb. Linn. 700/2, 4!).

(a) var. *sativa*.

Syn.: *N. cretica* MILL., Gard. Diet. **4** (1768) fide DAVIS, Fl. Turkey **1**, 103 (1965).—*N. indica* ROXB. ex FLEMM, J. Bot. **4**, 203 (1814).—*N. sativa* var. *indica* (ROXB.) DC., Reg. Syst. Veg. **1**, 328 (1818).—*N. sativa* α [subsp.] *normalis* TERRACC. (1898, p. 27).

Icon.: SIBTH. et SM., Fl. Graeca, t. 511 (1825).—Fig. 10.

Distr.: Grown in many countries of the temperate regions.

Selected Specimens: USSR, Ukraina: Prov. Kiev, pr. oppid. Uman, cult., 2991 (K). Iran: Prov. Khorassan in valle fluvii Atrek in agris incultis, 1937, RECHINGER 1801 (K). Iraq: NNW of Kulba 1957, RAVI 21123 (K). Cyprus: Supra Lapithos, 1880, SINTENIS & RIGO 619 (K). Further specimens from Pakistan, Turkey, Syria, Israel, Germany, France, probably all cultivated.

Cultivated throughout for its aromatic seeds, used to flavour bread etc. Var. *sativa* is extremely variable and has been divided into an array of cultivars.

(b) var. *hispidula* BOISS., Ann. Sci. Nat. Bot. Ser. 2, 16, 360 (1841).

Type: in Cilicia, ca. Mersina [Mersin], 1855, BALANSA 627 (G!).

Syn.: *N. truncata* Viv., Dec. Aeg. 6 (1831).—*N. sativa* var. *brachyloba* BOISS., Fl. Or. 1, (1867).—*N. sativa* ♂ [subsp.] *hispidula* (BOISS.) TERRACC. (1898, p. 30).

Icon.: Viv., op. cit. t. 2, f. 1.

Distr.: Egypt, Turkey, Afghanistan; elsewhere cultivated.—Area: N. E. Mediterranean.

Specimens Seen: Egypt: Spontaneo nei contorni di Alexandria (FI). Afghanistan: GRIFFITH 38 a (K).

Plants much more hairy and shaggy, stems more strictly branched, lobes of leaves shorter and denser, flowers smaller, and capsule more densely tuberculate than in the typical variety.

While DAVIS (1965, p. 103) does not accept var. *hispidula* because of transitions towards the cultivated form, TERRACCIANO, BRAND, and the present author justify BOISSIER's attitude who writes "haec vere spontanea et typus speciei esse videtur." Although it is fairly difficult to delineate these varieties, they should be kept apart as one (a) is almost exclusively a cultivated taxon or an escapee, while the other (b) is probably the wild form and the progenitor of the cultivar, though probably itself sometimes cultivated. However, studies on the taxonomy and the relationships between the wild and the cultivated forms are badly needed.

8) *Nigella stellaris* BOISS., Diagn. ser. 1, 8, 8 (1849); WALPERS, *Nigella*, Ann. Bot. Syst. 2, 11 (1851); BRAND, Helios 12, 186 (1895); HOLMBOE, Veg. Cyprus: 78 (1914).

Type: [S. Turkey] in cultis montis Cassii [J. Akra] in regione inferiore inter Cassab [Yayladağı] et Suadiyeh, VI 1846, BOISSIER (K!) (fide DAVIS 1965).

Syn.: *N. cilicica* BOISS. et BAL. in BOISS., Diagn. ser. 2, 5, 11 (1856).—*N. fumariifolia* α [subsp.] *stellaris* (BOISS.) TERRACC. (1898, p. 41).

Icon.: HOLMBOE, Stud. Veg. Cyprus 78, t. 19 (1914). — Fig. 6.



Fig. 5



Fig. 6

Fig. 5. *N. segetalis* L.; a petal; from Turkey (HUI). $\times 0.5$; a $\times 2$

Fig. 6. *N. stellaris* Boiss.; a petal; from Cilicia (HUI). — $\times 0.5$; a $\times 2$

Distr.: S. Turkey, Syria.—Area: N.E. Mediterranean.

Selected Specimens: S. Turkey: Cilicia, plain of Tarsus, 1896, SIEHE 135 (G); Taurus, Bulgardagh [Bolkar dağları], 1859, KOTSCHY 259 (G); prope Adana, 1952, DAVIS 19648; Amanus, Route de Beylan [Belen], 1932, DELBES (HUI). Syria: Mt. Nussairiy [Jabal el Ansariye], Bahamra, 1909, HARADJIAN 2683 (G, E).

Contrary to TERRACCIANO (1898), this is regarded as a well defined species though very near to *N. fumariifolia*, as has been already argued by HOLMBOE (1914). It is limited to the coastal regions of S. Anatolia and N. Syria, where it appears as a continental vicariad of the insular *N. fumariifolia*.

In the two species the gynoecium develops into an indehiscent capsule which apparently displays a synaptospermic mode of dispersal. The stellate, strongly divergent beaks of the carpels probably form a serious obstacle to long-distance dispersal.

9) *Nigella fumariifolia* KOTSCHY in UNG. et KOTSCHY, Ins. Cyp. 319 (1865); BOISS., Fl. Or. **1**, 66 (1867); BRAND, op. cit. **12**, 186 (1895).

Type: Cyprus, in valle prope Carium ad Episcopi, KOTSCHY 655, 741 (K! BM).

Syn.: *N. fumariifolia* var. *cassica* BRAND, loc. cit.—*N. fumariifolia* α [subsp.] *normalis* TERRACC., Boll. Ort. Bot. Palermo **2**, 40 (1898).

Icon.: HOLMBOE, Stud. Veg. Cyprus 78, t. 19 (1954).—Fig. 7.

Distr.: Cyprus, Crete, Karpathos, Kasos, Rodhos and probably other Aegean islands.—Area: N. E. Mediterranean.

Selected Specimens: Cyprus: Bei St. Chrysostome, 1889, RICHTER s.n. (G); Kyrenne, carob land, 1949, LASEY 744 (K); St. Hilarion 1941, DAVIS 3618 (BM); Crete: Distr. Sitia, 1942, RECHINGER 12674 (G); Kasos, 1886, FORSVTH 884 (G); Rhodhos: near Castelloso, 1948, GOULINY (K).

B) Subsect. *Erobathos* (DC.) ZOH., stat. nov.

Syn.: Sect. *Erobathos* (*Erobatos*) DC., Prodr. Syst. Nat. **1**, 49 (1824).—Genus *Erobatos* SPACH, Hist. Veg. Phan. **7**, 301 (1839).—Subgenus *Nigellina* BRAND, Helios **13**, 171 (1896), pro max. parte.

Flowers involucrate. Sepals bluish. Carpels $\pm$ fully united into a 10-celled inflated capsule, the outer 5 cells seedless. Seeds angular.

10) *Nigella damascena* L., Sp. Pl. 534 (1753); BOISS., Fl. Or. **1**, 68 (1867).

Type: "inter segetes Europae australis" (Hb. Linn. 700/1).

Syn.: *N. multifida* GATERAU, Fl. Montaub. 100 (1789).—*N. coerulea* LAM., Fl. Fr. **3**, 312 (1793).—*N. involucreta* MOENCH, Method. Pl. 314 (1794).—*N. elegans* SALISE., Prodr. 374 (1796).—*N. pygmaea* PERSOON, Ench. **2**, 85 (1807).—*N. coarctata* GMEL. ex DC., Regn. Syst. Veg. **1**, 331 (1817).—*N. bourgaei* JORDAN, Pug. **2** (1852).—*N. damascena* var. *minor* BOISS., Voy. Bot. **1**, 11 (1839).—*N. damascena* β [subsp.] *minor* (BOISS.) TERRACC., Boll. Ort. Bot. Palermo **1**, 149 (1897).—*N. damascena* α [subsp.] *normalis* TERRACC., 1897, p. 149.—*Erobathos damascenum* SPACH, Hist. Veg. Phan. **7**, 302 (1839).—*Erobathos coarctatus* (GMEL.) SPACH, op. cit. **7**, 304 (1839).

Icon.: REICHENB., Ic. Fl. Germ. **4**, 120, f. 4737 (1840); LAM., Tabl. Encycl. **4**, t. 488 (1798); Bot. Mag. t. 22.—Fig. 8.

Distr.: Widely cultivated as an ornamental, but probably spontaneous in Turkey and Crete.—Area: Mediterranean.



Fig. 7

Fig. 8

Fig. 7. *N. fumariifolia* KOTSCHY; a petal; from Kyrenia (H.U.J.). — $\times 0.5$; a $\times 2$

Fig. 8. *N. damascena* L.; a petal; b capsule; from France, Montpellier (H.U.J.). — $\times 0.5$; a $\times 2$, b $\times 0.5$

Selected Specimens: Portugal: Algarve, 1959, stud. biol. 273 (H.U.J.). Spain: Catalonia occ., Les Borges Blanques, 1933, FONT QUER (H.U.J.). France: Montpellier, 1931, EIG (H.U.J.). Italy: Liguria, Val Polcevara, 1907, CANNEVA (H.U.J.); Sardinia: Platamona Sorso, 1959, CHIAPPINI (FI); Sicily: Palermo in campis, 1903, ROSS 403 (FI). Switzerland: In ruderalis (data illegible) (K). Yugoslavia: Rovigno [Croatia: Istra, Rovinj], 1928, BOJKO (H.U.J.). Bulgaria: Pčelina, 1958, RADENKOVA 541 (H.U.J.). Crete: S. E. foothills of Levka Ori, ORSHAN 10505-3 (H.U.J.). Cyprus: Kyrenia range 1948, KENNEDY 1649 (K). Morocco: Berkane, 1929, FAURE (H.U.J.). Further specimens from Turkey and several other European and N. African countries, mostly cultivated or escapees.

Specimens named var. *minor* do not constitute a distinct variety because the flowers vary gradually in size from about 4 cm in typical forms to about 1 cm. Both, extremes and intermediates occur together.

11) *Nigella elata* BOISS., Diagn. ser. **1**, **1**: 66 (1843) et Fl. Or. **1**, 68 (1867).

Type: [Turkey: prov. Manisa:] in dumosis montis Mesogis inter Derwend et Alascher ad basin Tmoli prope Sardes, VII. 1842, BOISSIER (G, lecto).

Syn.: *N. intermedia* C. KOCH, Linnaea **19**, 48 (1847).—*N. taurica* STEV., Bull. Soc. Nat. Mosc. **29**, 283 (1856).—*N. bithynica* AZN., Bull. Soc. Bot. Fr. **44**, 165 (1897).—*N. damascena* β [subsp.] *elata* (BOISS.) TERRACC. (1897, p. 153).

Icon.: KERNER, Pflanzenleb. **2**, 401 (1913).—Fig. 9.

Distr.: Bulgaria, Greece, Turkey.—Area: N. E. Mediterranean.

Selected Specimens: Greece: Macedonia, Kruša Balkan, Paprat distr. 1918, RUSSEL 64 (K). Bulgaria: S. of Ivajlovgrad, 1959, KOJOCHANOV (K). Turkey: Ephesus, stony ground, 1962, ZOHARY 2179 (HUJ); Phrygia, Sultandagh [Sultan dağı], 1899, BORNMÜLLER 4028 (MPU); Constantinopol [İstanbul], AZNAVOUR 4452 (type material of *N. bithynica*, E).

C) Subsect. *Nigellastrum* (DC.) ZOH., stat. nov.

Syn.: Sect. *Nigellastrum* (FABRICIUS) DC., Reg. Veg. Syst. **1**, 326 (1817).—Gen. *Nigellastrum* HEIST. ex FABRICIUS, Enum. Meth. Pl. Helmst. ed. 2, 273 (1763); MOENCH, Meth. 312 (1794).

Sepals yellow. Carpels 5-15, connate at base. Seeds flattened, orbicular.

12) *Nigella orientalis* L., Sp. Pl. 534 (1753); BOISS., Fl. Or. **1**, 69 (1867); BRAND, op. cit. **12**, 184 (1895); TERRACC., 1897, p. 144.

Type from Aleppo [Haleb] (Herb. Linn. 700/8).

Syn.: *Nigellastrum flavum* MOENCH, Meth. Pl. 312 (1794), nom. illeg.—*Nigellastrum orientale* SPACH, Hist. Veg. Phan. **7**, 311 (1839).

Icon.: GAERTN., Fruct. et Sem. **2**, t. 18, f. 10 (1790); Bot. Mag. **31**, t. 1264 (1810).—Fig. 11.

Distr.: Caucasus, Crimea, Turkey, N. Iran, Iraq, Syria; often weedy.—Area: N. E. Mediterranean W. Irano-Turanian.

Selected Specimens: Caucasus: HOHENACKER, ex. herb. Petropolit. (FI). Armenia: Karabag, 1829, SZOVITS 215 (K); Iberia, WILHELM 55 (K). Turkey: Distr. Amasya, 1963, PLITMANN 97014 (HUJ); Siirt, 1966, DAVIS 4312 (K). Syria: Muslemie, 1931, ZOHARY 200 (HUJ); Jebel Druz, 1931, ZOHARY (HUJ). Iran: Inter Teheran et Tabriz, 1859, Herb. Bungeanum (K). Iraq: Kurdistan, Mosul, 1841, KOTSCHY 59 (K).

BRAND (1895, p. 184), records a var. *microcarpa* (not seen by the present author). It deviates from the typical form by involucrate flowers, 2-5 follicles and 4-5 times smaller seeds. It was found in Iran, Shirvan, by BOISSIER and in Amasya, Anatolia, by BORNMÜLLER. Both, BOISSIER (1867) and DAVIS (1965) do not consider it as a distinct taxon.

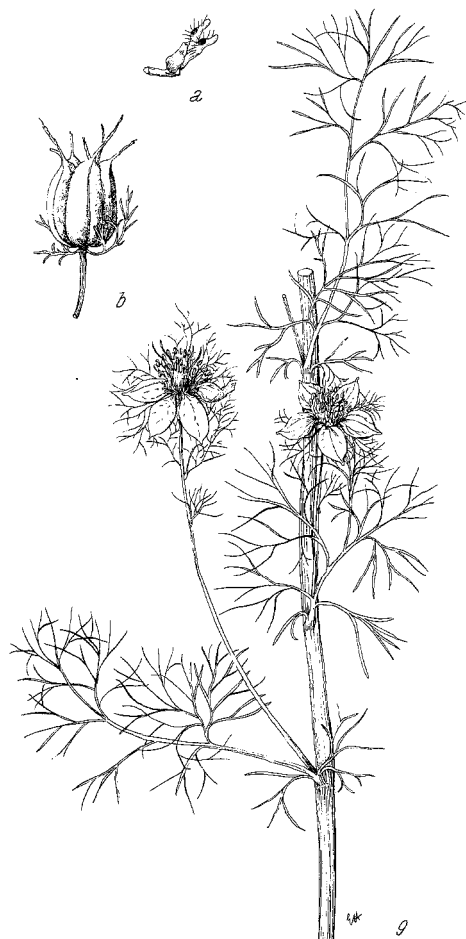


Fig. 9

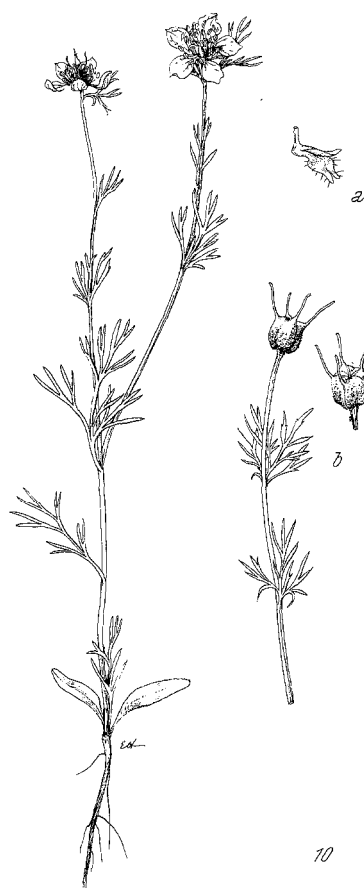


Fig. 10

Fig. 9. *N. elata* Boiss.; *a* petal; *b* capsule; from Turkey (H.U.J.). — $\times 0.5$; *a* $\times 2$, *b* $\times 0.5$

Fig. 10. *N. sativa* L.; *a* petal; *b* fruiting branch and capsule; (origin not marked). — $\times 0.5$; *a* $\times 2$, *b* $\times 0.5$

13) *Nigella oxypetala* Boiss., Ann. Sci. Nat. Bot. Sér. **2**, 357 (1841) et Fl. Or. **1** (1867).

Type: [Turkey:] Cappadocia orientalis, AUCHER 51 (G: lecto., K).

Syn.: *N. noeana* Boiss., Diagn. ser. **2**, **1**, 9 (1853).—*N. oxypetala* var. *tenuifolia* Boiss., Fl. Or. **1**, 70 (1867).—*N. oxypetala* var. *noeana* (Boiss.) Boiss., Fl. Or. **1**, 70 (1867).—*N. oxypetala* var. *persica* (Boiss.) BRAND, Helios **12**, p. 185

(1895).—*N. oxypetala* var. *typica* BRAND, *Helios* **12**, 185 (1895).—*N. oxypetala* α [subsp.] *normalis* TERRACC. (1897, p. 145).—*N. persica* BOISS., *Ann. Sci. Nat. Bot. Sér.* **2**, 16, 358 (1941).—*N. latisepta* P. H. DAVIS, *Not. Roy. Bot. Gard. Edinb.* **26**, 168 (1965).—*N. lancifolia* HUB.-MOR., *Bauhinia* **3**, 311 (1967).

Icon.: TAHTADZJAN, *Fl. Armenia* **1**, 141, t. 38 (1954); RECHINGER, *Rel. Sam.*, in *Ark. Bot. Ser.* **2**, 5 (1), t. 8 (1959) as *N. noeana*.—Fig. 12.

Distr.: Caucasus, Transcaucasia, Crimea, Turkey, N. Iran, Iraq, Syria.—Area: N. E. Mediterranean W. Irano-Turanian.

Specimens Seen: Iran: AUCHER-ELOY 4021 (G, type of *N. persica* BOISS.); Āzarbaijān: N. W. of Mahābād, 1962, FURSE 3311 (K). Turkey: Kayseri, 1250 m, BALLS 1127 a (E, type of *N. latisepta*); Lydia: Gume-Dagh, BORNMÜLLER 1902 (K); between Malatya and Elazığ, 1963, ZOHARY 272126 (HJ); Beyşehir, 1937, REESE s.n. (HJ); distr. Van, between Ahlat and Adilçevir, 1964, ZOHARY & PLITMANN 2163-20 (HJ); 21 km N. of Karaman, Feldrand, ca. 1000 m, 9. VI. 1966, SORGER (Herb. SORGER, type of *N. lancifolia* HUB.-MOR.). Soviet Armenia: 21 km N. of Erivan, 1919, GROSSHEIM (BM). Syria: in agris collinis pr. Aleppum [Haleb], 1841, KOTSCHY 216 (BM). Lebanon: pr. Bludan, 1855, KOTSCHY 77 (BM).

Within this species there are gradual transitions between narrow-lobed (var. *tenuifolia* = *N. persica* BOISS.), broad-lobed (var. *latisepta* DAVIS) and lanceolate-lobed forms with larger middle lobes (*N. lancifolia* HUB.-MOR.). This variability of leaves is fairly common also in some other species (especially in *N. arvensis*). I have seen many specimens of *N. oxypetala* from South Anatolia (including material of *N. latisepta* P. H. DAVIS and of *N. lancifolia* HUBER-MORATH). Not only the leaves vary here, but also other characteristics such as degree of flower involucre, number of follicles per fruit, follicle length, beak length (0.8-2 cm), degree of its circination, etc. These characters are not linked together but are variously combined, even within one and the same population. It is, therefore, impossible to split this group into varieties the less so into species.

14) *Nigella ciliaris* DC., *Reg. Syst. Veg.* **1**: 327 (1817) et *Prodr.* **1**, 49 (1824); BOISS., *Fl. Or.* **1**, 70 (1867); BRAND, **12**, 184 (1895).

Type: [Lebanon] "in oriente prope Barut" [Beirut], LABILLARDIERE (FI-WEBB: holo; K: photo).

Syn.: *N. oxypetala* α [subsp.] *ciliaris* TERRACC. (1897, p. 146).

Icon.: DELESS., *Icon.* t. 45 (1821); ZOHARY, *Fl. Palaest.* **1**, t. 281 (1966).

Distr.: Cyprus, Syria, Lebanon, Israel, Jordan.—Area: S. E. Mediterranean.

Selected Specimens: Syria: Jebel Druz, Sueda [Es Suweidiya], 1931, ZOHARY 101 (HJ); Homs, 1931, ZOHARY 152 (HJ); Mts. Nussairiy [Jebel el Ansariye], Bahamra, 1901, HARADJIAN 2682 (K). Lebanon: pr. Tyrum, GAILLARDOT (E); Beirut, Post 18 (FI). Israel: Upper Galilee, 1954, ZOHARY 820 (HJ); Judean Mts., Tel Gath, GINZBURG 66 (HJ).



Fig. 11. *N. orientalis* L.; a petal; b fruiting branch; (origin not marked). — $\times 0.5$; a $\times 2$; b $\times 0.5$

Fig. 12. *N. oxypetala* Boiss.; a petal; from Turkey (HUI). — $\times 0.5$; a $\times 2$

Species dubiae

Nigella corniculata DC., is described by DC., *Regn. Syst. Veg.* **1**, 326 (1818) and in *Prodr. Regn. Veg.* **1**, 49 (1824) as follows: Sepals strongly spreading, tapering at base, acuminate, hairy at back and ciliate. Petals small, 2-lipped, with nectariferous foveolate claws. Follicles 3-5, glabrous, connate at base, diverging at last, with reflexed tips. No data are recorded as to its locality. BOISSIER, *Fl. Or.* **1**, 70, adds: "Species dubia, olim in hort. Paris, culta et quam in herb. DESF. non reperire potui verosimiliter ex Oriente omnium specierum sectionis patria oriunda." A specimen bearing this name, perhaps handwritten by DE CANDOLLE, I have seen in MPU; it is most probably *N. orientalis* L.

Conclusions

1) The present revision aims at a taxonomic survey of the genus *Nigella* which has not been studied, in its entirety, since the critical and well-balanced treatment by TERRACCIANO (1897-1898). A subdivision into three sections (formerly considered by some as independent genera) is recommended. Out of the 80 or more binomials hitherto published in *Nigella*, only 14 are retained. The meticulous biosystematic study by STRID (1970) concerns only the Aegean representatives of the *N. arvensis* "Rassenkreis". STRID's concept of numerous microspecies and subspecies is difficult to use in other areas of the polymorphic group. At present, therefore, only 14 varieties of *N. arvensis* s.l. are recognized.

2) The most important diagnostic character is the structure of the nectariferous petals; their differentiation reflects evolutionary progress within the genus: Sect. *Komaroffia* occupies the most primitive position in this respect with its scale-like or somewhat semitubular upper petal lip. In sect. *Garidella* this structure is more advanced, while it is highly elaborated in sect. *Nigella*.

3) Nectaries, dichogamy, and the successive movements of stamens and styles make the flower of *Nigella* sect. *Nigella* well adapted to cross pollination (e.g. KNUTH 1898, KUGLER 1955). Still, self-pollination occurs in *N. damascena*, *N. fumariifolia*, *N. doerfleri* and *N. stricta* STRID (1969 a, 1970). Nothing is known about the pollination of the *Komaroffia*/*Garidella* group (STRID 1969 a). In flower structure *N. nigellastrum* seems to be much closer to *N. integrifolia* than to the other sect. *Garidella* species *N. unguicularis* whose connivent petal blades form a roof-like structure not paralleled in other species of *Nigella*.

4) Other important evolutionary changes affect the fruit form, but they are not linked to changes in petal shape. Therefore, the most elaborate fruit form—the capsule—has originated independently in various groups (sect. *Komaroffia*, sect. *Garidella* and in some species of sect. *Nigella*, e.g. *N. damascena*). An interesting aspect of fruit evolution is the tangential division of the carpels in *N. damascena*. This results in a ten-celled fruit, with five cells bearing seeds. This is quite a deviation from the prevailing fruit form of the genus. Carpobiologically most remarkable are *N. stellaris* and *N. fumariifolia*. In both the capsule never dehisces but becomes detached from the plant as a whole (synaptospermous dispersal).

5) The geographical distribution of *Nigella* is Mediterranean-W. Irano-Turanian, with the maximum species concentration in the E.

Mediterrano-W. Irano-Turanian borderland. As in other genera, its primary differentiation centre presumably was in the arid and semiarid parts of S. W. Asia, from where it has radiated to the West. Some species which grow in S. W. Asia in primary habitats occur elsewhere as segetal or cultivated plants (e.g. *N. arvensis* var. *arvensis*, *N. segetalis*, *N. sativa*).

The author wishes to convey his cordial thanks to the directors and keepers of the herbaria of the following institutions: B, BM, E, FI, G, G-BOISSIER, HBG, JE, K, LE, LINN, MPU, P, S, W, Z.

I wish to express my sincere thanks to Prof. F. EHRENDORFER and Dr. W. GUTERMANN for reading of the manuscript and for their valuable remarks. To the artist, Mrs. ESTHER HUBER, my cordial thanks are given for all the drawings attached to this revision. To Mrs. STEFANIA GRIZI the author is deeply indebted for typing and indexing the manuscript and otherwise devoted help.

References

- BÖCHER, T. W., 1967: Continuous variation and taxonomy. — *Taxon* **16**, 255—258.
- BOISSIER, E., 1841: *Plantae Aucherianae Orientales*. — *Ann. Sci. Nat.*, ser. **2**, 357—359.
- 1846: *Diagnoses Plantarum Orientalium Novarum*, ser. **1**, 7, 66. — Lipsiae: B. Herrmann.
- 1856: *ibidem*, ser. **2**, 5, 11. — Lipsiae: B. Herrmann.
- 1867: *Flora Orientalis* **1**, 64—70. — Basileae & Genevae.
- BRAND, A., 1895—1896: *Monographie der Gattung Nigella*. — *Helios* (Berlin) **12**, 182—197 (1895); **13**, 8—10, 171—174 (1896).
- BUCHHEIM, G., 1964: *Ranunculales*. — In MELCHIOR, H., (Ed.): *A. ENGLER'S Syllabus der Pflanzenfamilien* **2**, 131—147. — Berlin-Nikolassee: Gebr. Borntraeger.
- DAVIS, P. H., 1965: *Nigella*. — In DAVIS, P. H., (Ed.): *Flora of Turkey and the East Aegean Islands* **1**, 98—105. — Edinburgh: Univ. Press.
- DE CANDOLLE, A. P., 1817: *Regni vegetabilis systema naturalis* **1**, 325—333. — Parisiis.
- 1824: *Prodromus Systematics Naturalis Regni Vegetabilis* **1**, 48—50. — Parisiis.
- EHRENDORFER, F., 1968: Geographical and ecological aspects of infraspecific differentiation. In HEYWOOD, V. H., (Ed.): *Modern Methods in Plant Taxonomy*, pp. 261—296. — New York & London.
- FEDOROV, A. N. A., (Ed.), 1969: *Hromosomnye čisla cvetkovykh rastenij*. — Leningrad: "Nauka".
- GILLOT-DELHALLE, J., DEGRAVE, N., MOUTSCHEN, J., 1976: Cytotaxonomic investigation of the genus *Nigella* (*Helleboreae*) with C-banding techniques. — *Caryologia* **29**, 139—154.
- GREUTER, W., RECHINGER, K. H., 1967: *Flora der Insel Kythera*. — *Boissiera* **13**, 1—206.
- GUSSONE, G., 1828: *Florae siculae prodromus* **2**. — Neapoli.
- HALÁCSY, E. v., 1901: *Conspectus Florae Graecae* **1**. — Lipsiae.

- HOLMBOE, J., 1914: Studies on the vegetation of Cyprus. — *Bergens Mus. Skr.*, nov. ser., **1**(2).
- KRAŠENINNIKOV, I. M., 1937: *Nigella*. — In KOMAROV, V. L., (Ed.): *Flora URSS* **7**, 62—72. — Moskva-Leningrad.
- KNUTH, P., 1898: *Handbuch der Blütenbiologie* **2**. — Leipzig.
- KUGLER, H., 1953: *Einführung in die Blütenökologie*. — Stuttgart.
- LINNAEUS, C., 1753: *Species plantarum* **1**, 425. — Holmiae.
- MAIRE, R., 1964: *Flore de l'Afrique du Nord*, **9**, 35—44. — Paris.
- MARSHALL VON BIEBERSTEIN, F. A., 1808: *Flora Taurico-Caucasica* **2**, 16. — Charkoviae.
- MEIKLE, R. D., 1954: A survey of the flora of Chios. — *Kew Bull.* **1**, 85—200.
- 1977: *Flora of Cyprus* **1**, 60—64. — Kew.
- MOUTERDE, P., 1970: *Nouvelle Flore du Liban et de la Syrie* **2**, 5—11. — Beyrouth.
- NORDENSTAM, B., 1968: The genus *Euryops*. Part I, Taxonomy. — *Opera Bot.* **20**.
- PEREIRA, A. DE L., 1942: Contribuição ao conhecimento cariológico do género *Nigella* L. — *Bol. Soc. Brot. ser.* **2**, **16**, 5—40.
- RECHINGER, K. H., 1943 a: *Flora Aegaea*. — *Denkschr. Akad. Wiss. Wien, Math.-Nat. Kl.* **105** (1).
- 1943 b: *Neue Beiträge zur Flora von Kreta*. — *Denkschr. Akad. Wiss. Wien, Math.-Nat. Kl.* **105** (2/1).
- 1961: *Die Flora von Euboea*. — *Bot. Jahrb.* **80**, 294—382, 383—465.
- SCHKUHR, CH., 1808: *Botanisches Handbuch* **2**, 92. — Wittenberg.
- SIBTHORP, J., SMITH, J. E., 1806: *Florae Graecae Prodrum* **1**. — Londoni.
- SPENNER, L., 1829: *Monographia generis Nigellae*. — Friburg.
- STRID, A., 1965: Studies in the Aegean Flora VII. Chromosome morphology in the *Nigella arvensis* complex. — *Bot. Notiser* **118**, 139—165.
- 1969: *Garidella unguicularis*. — *Bot. Notiser* **122**, 330—332.
- 1969 a: Evolutionary trends in the breeding system of *Nigella*. — *Bot. Notiser* **122**, 380—397.
- 1970: Studies in the Aegean Flora XVI. Biosystematics of the *Nigella arvensis* complex. — *Opera Botanica* **28**. — Lund.
- TAHTADŽJAN, A. L., 1954: *Flora Armenii* **1**, 128—134. — Erevan.
- TERRACCIANO, A., 1897—1898: Revisione monographica della species del genere *Nigella*. — *Boll. Ort. Bot. Palermo* **1**, 122—153 (1897); **2**, 19—43 (1898).
- TUTIN, T. G., 1964: *Nigella*. — In TUTIN, T. G., & al. (Eds.): *Flora Europaea* **1**, 209—210. — Cambridge: Univ. Press.
- VIERHAPPER, F., 1926: Zwei neue *Nigella*-Arten aus der Verwandtschaft der *N. arvensis* L. — *Magyar. Bot. Lapok* **25**, 146—150.
- WASEL, Y., 1959: Ecotypical variation in *Nigella arvensis* L. — *Evolution* **13**, 469—475.
- WALPERS, W. G., 1842, 1845—1846: *Nigella*. — *Repert. Bot. Syst.* **1** (1), 41 (1842); **2** (5), 741 (1843). — Leipzig.
- ZOHARY, M., 1941: Taxonomical studies in the Flora of Palestine and neighbouring countries. — *Palest. J. Bot. Jerusalem Ser.* **2**: 152.
- 1966: *Flora Palaestina* **1**, 190—195. — Jerusalem: Israel Acad. Sciences and Humanities.
- 1973: *Geobotanical Foundations of the Middle East* **1 + 2**. — *Geobotanica selecta* (Ed.: R. TUXEN) **3**. — Stuttgart: G. Fischer; Amsterdam: Swets & Zeitlinger.