

# THE TAXONOMIC SEPARATION OF THE CYTOLOGICAL RACES OF *KOHLRAUSCHIA PROLIFERA* (L.) KUNTH *SENSU LATO*

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## INTRODUCTION

It has been realised for some considerable time that *Kohlruschia prolifera* (L.) Kunth contains both diploid and tetraploid plants (Blackburn, 1933, Böcher *et al.*, 1953, 1955). The cytotypes appear to have different distributions, the more widespread diploid being replaced in W.S.W. Europe by the tetraploid. Because of the close morphological similarity between the cytotypes, and the difficulty of separating them, *K. prolifera* has come to be widely referred to in the literature as an example of the phenomenon of semi-cryptic polyploidy (cf. Heywood, 1958, Larsen, 1960). In the course of a revision of the whole genus, we have had occasion to make a detailed study of the *K. prolifera* group, as a result of which it has become apparent that not only can the diploid and tetraploid races be separated fairly satisfactorily on the basis of their seed-coat morphology, but the differences had been recognised precisely many years previously.

Although it has usually been assumed that the tetraploids have arisen from the diploids by autopolyploidy, the morphological evidence suggests that another diploid species, *K. velutina* (Guss.) Reichb., is involved and that the tetraploid has been formed as a result of allopolyploidy between it and diploid *K. prolifera*.

## TYPIFICATION OF *K. PROLIFERA*

This species was based on *Dianthus prolifer* L., *Sp. Pl.*, 410 (1753). Typification has proved difficult since there is no positive evidence that the specimen of *Dianthus prolifer* in the Linnean Herbarium has a claim to being selected as a lectotype. The sheet does not bear the *Species Plantarum* number normally found on those of species described in the first edition. If, however, the specimen is accepted as authentic there is no reason to suppose that it is other than diploid *Kohlruschia prolifera*, although in the absence of seeds it cannot be identified with certainty. The synonyms and distribution given by Linnaeus could apply to either the diploid or tetraploid species. This kind of situation arises occasionally with the typification of species in polyploid groups where the various species may be separated from one another by micro-characters which are not available for examination in the type material. In such cases the wisest course is to accept a typification which does not upset the traditional interpretation of the species, unless there is strong evidence to the contrary. Accordingly the name *K. prolifera* (L.) Kunth is accepted here for the diploid species which occurs in most countries of Europe and to a small extent in N.W. Africa and Anatolia.

## THE IDENTITY OF *DIANTHUS NANTEULLII* BURNAT

During the investigation of the genus it was necessary to account for *Dianthus nanteullii* Burnat which was published in *Flore des Alpes Maritimes*, 1: 221-222 (1892) with a full description based on 38 specimens from various localities at Cannes and Agay. The leaf sheaths are described by Burnat as 'aussi larges que longues' and the seeds are described in considerable detail: 'absolutely intermediate between the two preceding species [*D. prolifer* and *D. velutinus*] in dimensions and shape: more convex dorsally than in

*D. velutinus*, and less hollow-concave than in the latter, the outer surface striate-tuberculous, with tubercles similar to those of *D. velutinus*, but much closer together and less projecting.<sup>7</sup>

Burnat considered the species (apart from the rare presence of glandular hairs) intermediate between *D. prolifer* and *D. velutinus*, but Nanteuil thought that a hybrid origin was unlikely in view of the commonness of the new form in the vicinity of Cannes while only one specimen of *D. velutinus* was seen. *D. prolifer* did not on the other hand appear to be less abundant although it flowered later. He gave the following times of maturity of the first seeds :

<i>velutinus</i>	20th May
intermediate	1st June
<i>prolifer</i>	25th June

Time of flowering needs further investigation both in the field and in cultivation, but *D. velutinus* does appear in the light of later observations to be the earliest of the three to flower (cf. Böcher *et al.*, 1953).

Further examination of large numbers of individuals by Nanteuil failed to reveal any transitional forms. This is confirmed by our own comparative studies on a wide range of material from diverse provenances.

It is interesting to note that, although Burnat appears to have been the first to publish a description of this species, there are two older sheets in the Kew Herbarium from the Pyrenees which have manuscript names and extensive and accurate descriptions appended.

#### KOHLRAUSCHIA VELUTINA (GUSS.) REICHB.

The third taxon involved in this complex, *K. velutina*, is characterized by its long leaf sheaths (at least twice as long as broad) and by its strongly tuberculate seeds. The epithet *velutina* refers to the dense glandular-tomentose indumentum which is usually found on some of the internodes in the middle part of the stem. This character is not, however, constant and forms with glabrous stems occur which have in the past been confused with *K. prolifera*, especially in Italy, Sicily and Sardinia.

*K. velutina* is diploid (Böcher *et al.* 1953, 1955) and is regarded by some writers, such as Briquet (1910), as only subspecifically distinct from *K. prolifera*. It is widely distributed in the Mediterranean region from Portugal and Spain to Turkey and Palestine. The karyotype has, however, been shown to be quite distinctive (Böcher *et al.*, *loc. cit.*) as discussed below.

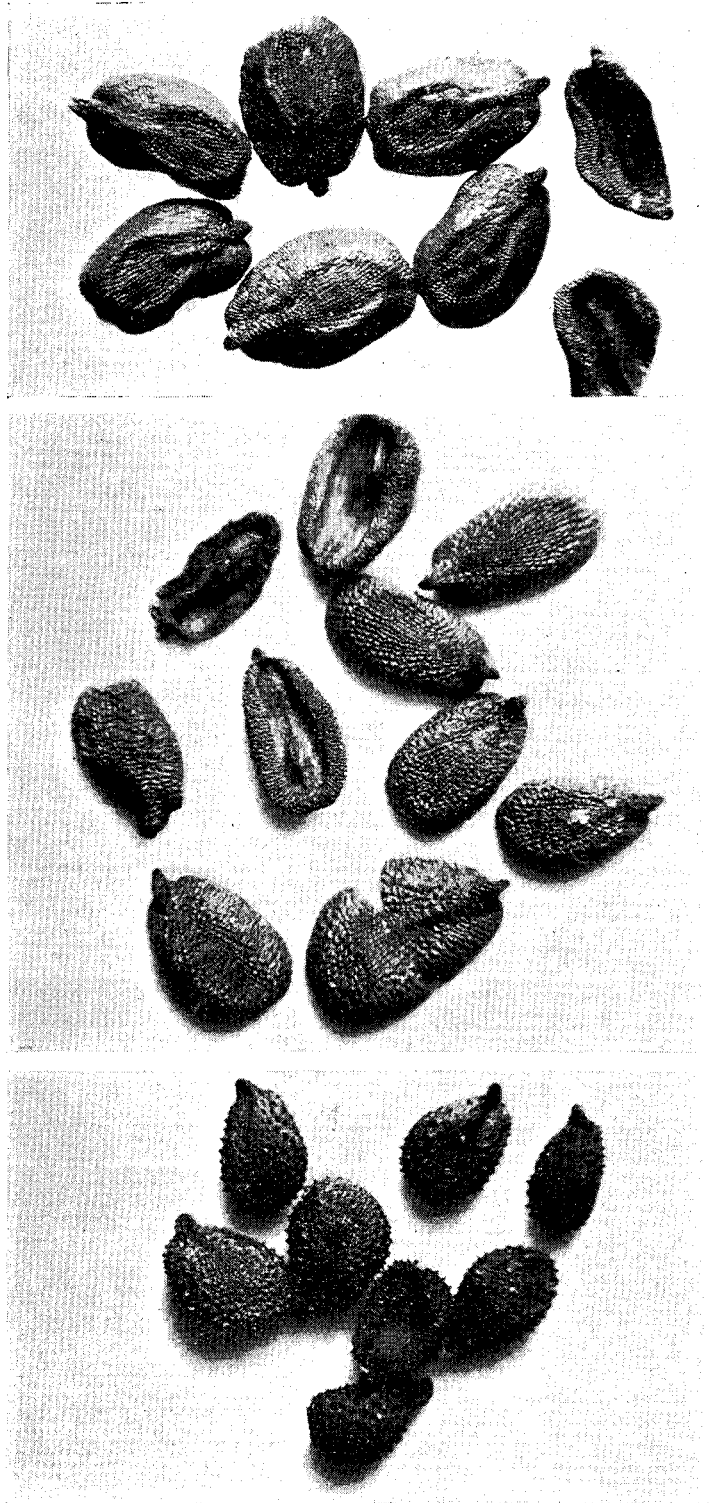
#### TAXONOMIC COMPARISONS

The accompanying table sets out the differences between the three units. From this it will be seen that several characters can be employed to separate them, with *K. nanteuilii* occupying an intermediate position. Of these characters, however, the only constant and reliable ones are those of the seed testa.

TABLE 1

	<i>K. prolifera</i>	<i>K. nanteuilii</i>	<i>K. velutina</i>
<i>Internodes</i> (middle part of stem)	Glabrous	Glabrous to tomentose	Densely glandular-tomentose, rarely glabrous
<i>Leaf sheaths</i>	Broader than long to about as long as broad	1-2 times as long as broad	At least twice as long as broad
<i>Width of Petal limb</i>	2-3.5 mm	2-3 mm	1.2-2.5 (- 3) mm
<i>Inner bracts</i>	Obtuse	Obtuse or mucronate	Mucronate
<i>Seed size</i>	1.3-1.9 mm	1.2-1.9 mm	1-1.3 (- 1.4) mm
<i>Testa pattern</i>	Reticulate (Plate 6a)	Tuberculate (Plate 6b)	Tuberculate to papillose (Plate 6c)

PLATE 6



a. (top) *K. prolifera* (København 3325), b. (middle) *K. nanteuillii* (København 3248)  
c. (bottom) *K. velutina* (København 3303)

The details of the seed testa are shown in Plate 5. The characteristic pattern of each species is easily appreciated by using a low-power dissecting microscope, although with a little practice an ordinary  $\times 10$  hand-lens is adequate. Through the courtesy of Professor T. W. Böcher and Dr. Kai Larsen we have been able to examine specimens and seeds from spontaneous plants grown in Copenhagen whose chromosomes have been counted by them. This material is listed below :

<i>Origin</i>	<i>Culture No.</i> (København)	<i>Origin</i>	<i>Culture No.</i> (København)
<i>nanteuillii</i> 2n = 60		POLAND	
CHANNEL ISLANDS		Tomice, distr. Poznan	3324
Jersey, St. Ouens Bay	3248	Poznan	3365
Jersey, Quenvais	3249	SWEDEN	
FRANCE		Øland	2963
Béziers	1733	Gotland	2878
Port Vendres	1715	DENMARK	
MADEIRA	3111	Kregme	2282
SPAIN		FRANCE	
Soria	3321	Mt. Louis above La Cassagne	1696
PORTUGAL		Luchon	1627
Coimbra	2483	Bouleternère	1700
CANARY ISLANDS		SWITZERLAND	
Gran Canaria	37, 38	Hort. Bot. Lausaniensis	663
Tenerife	36		
<i>prolifera</i> 2n = 30		<i>velutina</i> 2n = 30	
HUNGARY		PORTUGAL	
Budapest	3325	Sacavem	3303
SPAIN		BELGIUM	
Lloret de Mar, Barcelona	3323	Hort. Bot. Antwerpen	913

In all cases the correlation between chromosome number and seed testa type has been confirmed in the *prolifera-nanteuillii* pair. Similarly, the cultivated material of *K. velutina* has its characteristic testa configuration and the expected chromosome number of  $2n = 30$ .

In view of the fallibility of the other characters used to separate the units, the seed testa pattern alone appears to be constantly correlated with level of polyploidy in the diploid-tetraploid *prolifera* pair. In cases such as these it is important that the constancy of the polyploid markers be checked over a wide range of material (Heywood, 1960, Heywood and Walker, 1961). We feel that the correlation is now well established in this group; moreover, examination of testas has been made of seed from extensive collections of herbarium material which on other characters and distributional grounds agree with determinations as *K. prolifera*, *K. nanteuillii* and *K. velutina*. Again the correlation has been satisfactory and no breakdown between the testa pattern differences has been noted. It is proposed therefore that the tetraploid form of *K. prolifera* be recognised as a separate species and the appropriate combination is made below :

***Kohlruschia nanteuillii*** (Burnat) P. W. Ball & Heywood, *comb. nov.* *Dianthus nanteuillii* Burnat, Fl. Alpes Marit., 1 : 221 (1892); *Tunica prolifera* proles *T. nanteuillii* Rouy & Fouc., Fl. Fr. 3 : 160 (1896); *Tunica nanteuillii* Gürke, Pl. Eur. 2 : 338 (1903); *Tunica prolifera* var. *nanteuillii* Briquet, Prodr. Fl. Corse 1 : 569 (1910).

Distribution : *British Isles*. V.c. 10, Isle of Wight; 11, S. Hants; 13, W. Sussex; 15, E. Kent (introduced); 28, W. Norfolk (introduced); Channel Islands, France, Corsica, Sardinia, Spain, Portugal, Morocco, Madeira, Canary Islands.

KOHLRAUSCHIA PROLIFERA (L.) Kunth occurs as a rare alien in the British Isles. Specimens have been seen from v.c. 14, E. Sussex, and v.c. 28, W. Norfolk, and it may also be found elsewhere.

#### THE ORIGIN OF *K. NANTEUILII*

It is suggested by Böcher *et al.* (1953) that the tetraploid race probably arose by autopolyploidy from diploid *K. prolifera*. As pointed out above, the morphological evidence does not lend support to this view since *K. nanteuilii* is intermediate in most characters between diploid *K. prolifera* and *K. velutina*. It seems possible therefore that *K. nanteuilii* may be an allotetraploid derived from the other two species. The strains of *K. velutina* examined cytologically by Böcher *et al.* were distinct from diploid *K. prolifera* in possessing a pair of very short chromosomes. If our theory is correct, an examination of the karyotype of *K. nanteuilii* may provide confirmation, since it should possess the short chromosome pair. Plants are being cultivated for this purpose.

#### DISCUSSION

The taxonomic recognition of polyploid races showing slight morphological divergence is a subject which has provoked considerable controversy (*cf.* Heywood, 1960; Löve, 1960). When no single morphological character can be detected which allows a constant separation to be made between polyploid races, it is doubtful if nomenclatural recognition serves any useful purpose. Similarly, when the characters proposed to distinguish the polyplotypes can be appreciated only by a specialist, it is of little value to recognise them as separate species knowing that the possibilities of correct identification by a non-specialist are slender (*cf.* Heywood, 1960, p. 183).

In this case, however, one morphological character, seed testa-pattern, which can be easily appreciated, appears to be constantly correlated with level of ploidy; other characters (as noted in Table 1) are satisfactory in a fair percentage of cases; and the geographical distribution of the diploid and tetraploid races is clearly distinct. There are, in addition, a number of physiological differences, although these need further investigation. These factors, as well as the probable allopolyploid origin of the tetraploid, seem to us to favour specific recognition. The close taxonomic similarity of the three species *K. prolifera*, *K. nanteuilii* and *K. velutina* could then be indicated in practice by grouping them in a species aggregate.

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