

Unusual structural variation in the fruit of *Dasispermum suffruticosum* (Apiaceae): A new record of heteromorphic fruits in the family

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Dasispermum is a monotypic genus found on sand-dunes along much of the South African coast. *D. suffruticosum* is exceptionally polymorphic in the structure of the fruit, and major morphological differences are found between fruits from different plants, which are not obviously correlated with geographic and taxonomic patterns. The mericarps vary from homomorphic to heteromorphic, the latter being a relatively rare condition in the Apiaceae and the occurrence of both types in the same species has not been reported before. In both the heteromorphic and homomorphic types, wing configuration is already evident in the flowering stage.

Dasispermum is 'n monotipiese genus wat op sandduine langs die grootste deel van die Suid-Afrikaanse kuslyn voorkom. *D. suffruticosum* is besonder polimorfies in die vrugstruktuur, en groot morfologiese verskille kom voor tussen vrugte van verskillende plante, wat skynbaar nie gekorreleer is met geografiese en taksonomiese patrone nie. Die merikarpe varieer van homomorfies tot heteromorfies; laasgenoemde is 'n relatief skaars toestand in die Apiaceae en die voorkoms van beide tipes in dieselfde spesie is nog nie voorheen aangeteken nie. By beide die heteromorfiese en homomorfiese tipes is die vlerk-konfigurasie reeds sigbaar in die blomstadium.

Keywords: Apiaceae, *Dasispermum*, fruit wall structure, South Africa, taxonomy.

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Introduction

Dasispermum Raf. is a monotypic genus endemic to South Africa and comprises *D. suffruticosum* (Berg.) B.L. Burt. This species is found on coastal sand-dunes, with a known distribution from Isipingo in KwaZulu-Natal to Vredendal in the Western Cape Province (Figure 1). The plants resemble parsley, hence the common names 'wild parsley' and 'strandpietersielie'.

Historically, much emphasis has been placed on the structure of the mature fruit in the classification of taxa within the family Apiaceae. *Dasispermum* is reported to have mericarps with sub-equal wings (Sonder 1862). As part of a study to investigate the fruit structure of the African Apiaceae, two samples of *Dasispermum* were initially examined. Major differences were observed between them, one of the most striking relating to the wing symmetry. One type has homomorphic fruits, i.e. the wings of the two mericarps are exactly the same, so that the fruit is symmetrical about the commissural plane; the other has heteromorphic fruits, i.e. with the wings of the two mericarps dissimilar, so that the fruit is not symmetrical. The heteromorphic wing symmetry is also found in *Heteromorpha* Cham. & Schlecht. and is discussed

fully by Winter, van Wyk & Tilney (1993). Material was then obtained from a number of different localities, representing the full range of distribution of the genus, in an attempt to determine whether or not the structural differences of the fruit were correlated with any geographical or taxonomic patterns.

Materials and Methods

Flowers and fruits of various stages of maturity were collected *in situ* at a number of different localities and preserved in FAA. In some instances, three or more separate plants were sampled to investigate within-population variation. In order to represent more fully the geographical range of the species, fruits from herbarium specimens were also used. A list of voucher specimens is included in Table 1. The herbarium material was rehydrated and then placed in FAA for a minimum of 24 h. All the material was then treated according to the method of Feder & O'Brien (1968) for embedding in glycol methacrylate (GMA). However, a minimum of 24 h was used for the first two infiltrations in GMA and a minimum of 5 days for the third infiltration. The capsules containing the material and GMA were placed in an oven at 60°C for 24 h. Sections, about 5 µm thick, were cut using a Porter Blum ultramicrotome. The Periodic acid-Schiff/Toluidine blue staining method was used and photographs taken using a Leitz Wetzlar microscope and Ilford Pan F film.

Results and Discussion

Enormous variation in the morphology of the fruit was encountered (Figures 2 & 3c). At one extreme (Figure 2a), the two mericarps making up each fruit were homomorphic (disymmetric) whereas, at the other (Figure 3c), the mericarps were distinctly different (monosymmetric). This latter heteromorphic condition is relatively rare in the southern African members of the Apiaceae, being found in *Heteromorpha*, *Polemanniopsis* B.L. Burt and some species of *Annesorhiza* Cham. & Schlecht. However, the symmetry has not to date been seen to vary within a single species, as occurs in *D. suffruticosum*. The type of wing configuration is evident even in the flowering stage (Figure 3). Therefore, the ovaries have the same symmetry as the mature

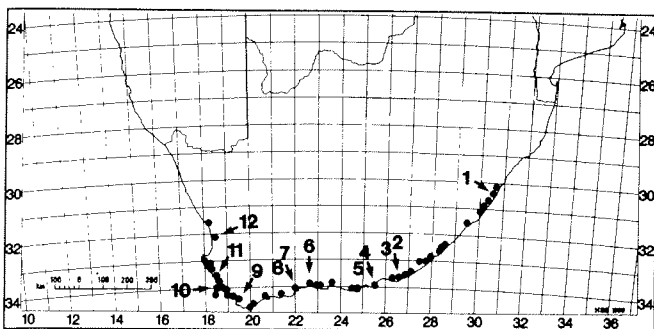


Figure 1 The known geographical distribution of *Dasispermum suffruticosum*, with arrows showing the collecting localities of material used in this study.

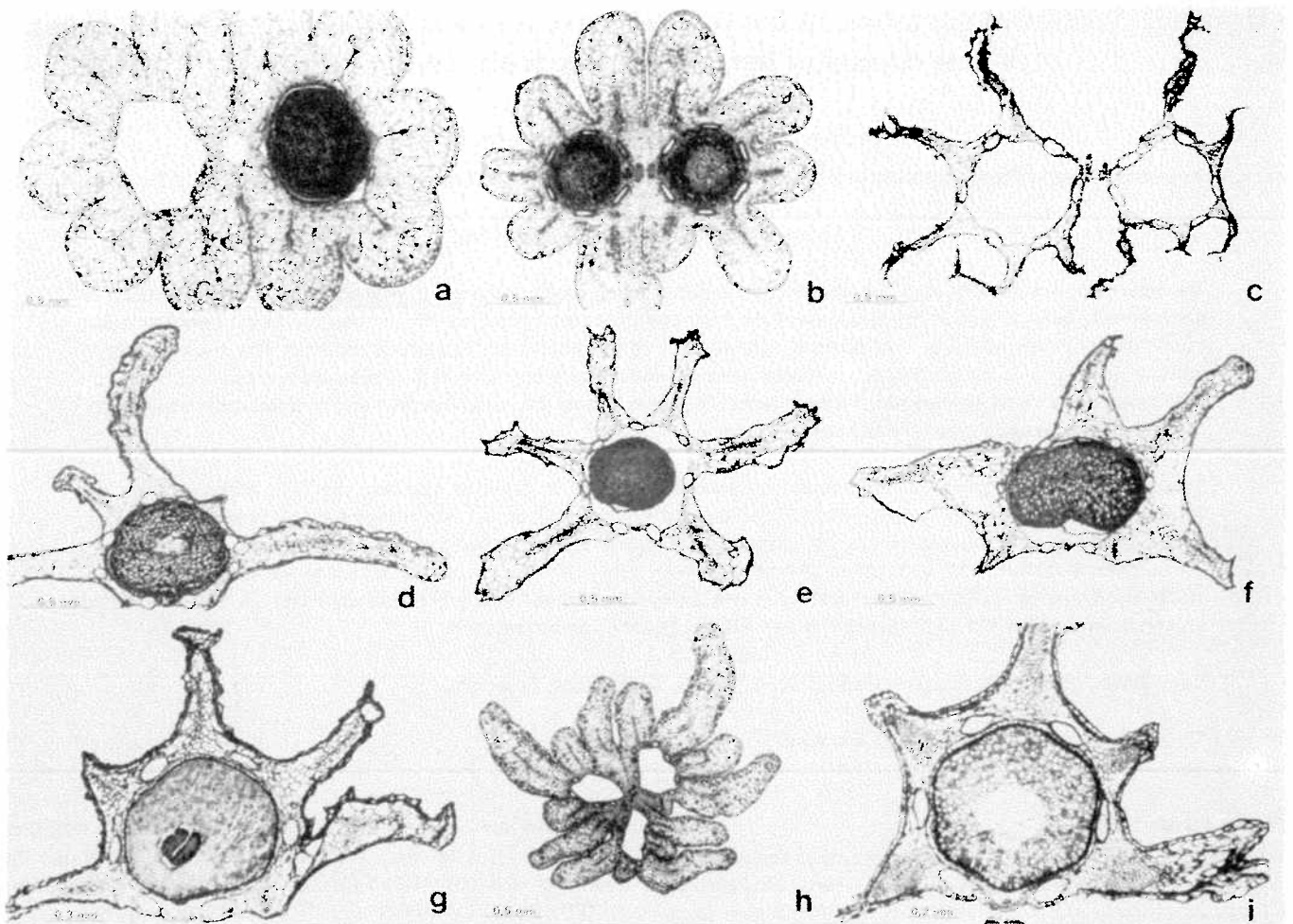


Figure 2 Variation in flowers and fruits of *Dasispermum suffruticosum* from various localities, as seen in transverse section. a, Homomorphic; large wings with small vascular bundles (older fruit from *Winter 78*). b, Slightly heteromorphic (young fruit from *Van Wyk s.n.*). c, Exceptionally thin-winged (older fruit from *Van Wyk s.n.*). d, Variable wing length (mature mericarp from *Arnold 1170*). e, Six-winged (mature mericarp from *Retief 1196*). f, Asymmetrical mericarp (mature mericarp from *Arnold 1170*). g, Narrow wings with large vascular bundles (almost mature mericarp from *Van Wyk s.n.*). h, ovary with three carpels (flower from *Tilney 204*). i, Small wings with large vascular bundles (mature mericarp from *Taylor 9876*). (Localities and herbaria are listed in Table 1).

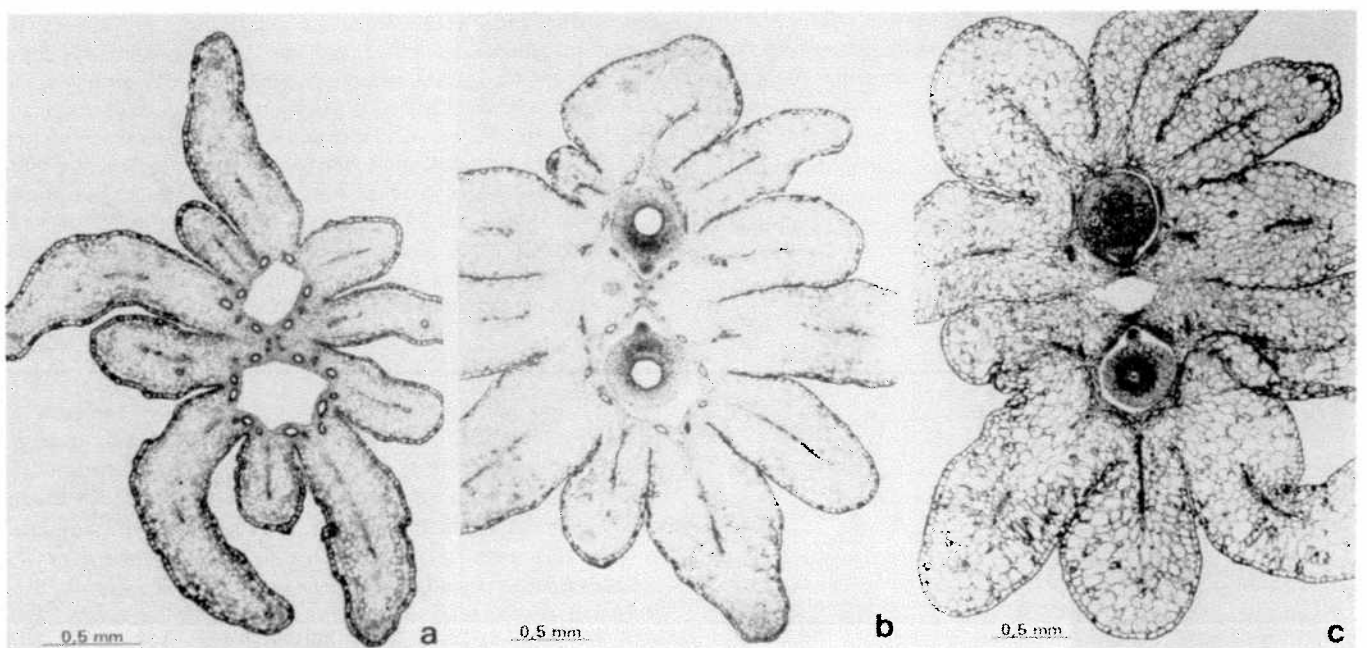


Figure 3 Transverse sections showing fruit development in fruits with strongly heteromorphic mericarps (*Tilney 204*, Boggomsbaai). a, ovary; b, young fruit; c, almost-mature fruit.

Table 1 Wing symmetry of the ovary and fruit of *Dasispermum suffruticosum* at various localities (arranged from east to west, see Figure 1) along the South African coast. Voucher specimens and materials that were investigated are also listed

Locality	Voucher specimens	Flower	Young fruit	Older fruit	Mature fruit	Fruit wing symmetry		
						homo- morphic Fig. 2a	slightly hetero- morphic Fig. 2b	hetero- morphic Fig. 3
1. Pennington	<i>Nicholas 1729</i> (PRE)				+		+	
2. Kasuka								
plant 1	<i>Arnold 1170</i> (PRE)				+		+	+
plant 2	<i>Tilney 206</i> (JRAU)	+	+				+	
3. Dias Cross	<i>Retief 1196</i> (PRE)				+	+		
4. Port Elizabeth	<i>Van Wyk s.n.</i> (JRAU)	+	+	+			+	
5. Seaview								
plant 1	<i>Winter & Tilney 153</i> (JRAU)	+	+			+		
plant 2	<i>Winter & Tilney 153</i> (JRAU)	+	+			+		
plant 3	<i>Winter & Tilney 153</i> (JRAU)	+	+			+		
6. Wilderness								
plant 1	<i>Winter & Tilney 167</i> (JRAU)	+	+		+	+		
plant 2	<i>Winter & Tilney 167</i> (JRAU)	+	+		+		+	
plant 3	<i>Winter & Tilney 167</i> (JRAU)	+	+		+		+	
7. Kleinbrakrivier	<i>Du Plessis 14</i> (PRE)				+			+
8. Boggomsbaai								
plant 1	<i>Tilney 204</i> (JRAU)	+	+	+				+
plant 2	<i>Tilney 204</i> (JRAU)	+	+					+
plant 3	<i>Tilney 204</i> (JRAU)	+						+
plant 4	<i>Tilney 204</i> (JRAU)	+						+
plant 5	<i>Tilney 204</i> (JRAU)	+						+
9. Hermanus	<i>Taylor 9876</i> (PRE)				+		+	
10. Noordhoek	<i>Winter 78</i> (JRAU)	+	+	+		+		
11. Milnerton								
plant 1	<i>Winter et al. 179</i> (JRAU)	+	+			+		
plant 2	<i>Winter et al. 179</i> (JRAU)	+	+			+		
plant 3	<i>Winter et al. 179</i> (JRAU)	+	+				+	
plant 4	<i>Winter et al. 179</i> (JRAU)	+	+			+		
12. Ysterfontein	<i>Reyneke 32</i> (PRE)				+	+		

fruit, indicating that the homomorphic or heteromorphic condition is established prior to the development of the fruit. This corresponds with observations on the ontogeny of the other southern African heteromorphic taxa (Winter, van Wyk & Tilney 1993; van Wyk & Tilney 1994). These taxa can, nevertheless, be distinguished from *D. suffruticosum*. In both *Heteromorpha* and *Polemanniopsis*, the distinction between sepaline wings and petaline ribs is always pronounced, with the sepaline wings being at least twice as long as the petaline ribs. Moreover, *Heteromorpha* has relatively narrow wings with vascular bundles that are considerably smaller than those of *Dasispermum* (Winter, van Wyk &

Tilney 1993). The absence of vittae (oil canals) in *Polemanniopsis* readily distinguishes this genus from the others (Burt 1988). In the heteromorphic species of *Annesorhiza*, the wings are composed almost entirely of lignified cells which represent a greater proportion than is found in *Dasispermum* (van Wyk & Tilney 1994).

In addition to the considerable variation in symmetry, other differences such as the size of the wings and the size of the vascular bundles were observed. The exceptional variability of the fruits is illustrated in Figure 2. Note, for example, the short, thick wings and minute vascular bundles in Figure 2a, and in contrast, the nar-

row wings and large vascular bundles in Figure 2g and 2i. Some of these differences probably relate to the developmental stage at which the fruit starts to dry out, with consequent shrinking. An example of this type of variation can be seen in the fruits in Figure 2b, 2c and 2g, which all came from a single plant. However, within populations, the fruits are relatively uniform (see Table 1) and in terms of symmetry, distinctly heteromorphic fruits do not occur at the same locality as homomorphic fruits.

Conclusions

In *Dasispermum* the mericarps comprising each fruit vary from homomorphic to the relatively rare heteromorphic condition. In the strongly heteromorphic and homomorphic types, the wing configuration is already evident in the ovary of the flowers. Fully mature fruits often differ in the size of vascular bundles and in the length and thickness of the wings. Different plants within the same population were found to be relatively uniform in terms of the fruit wing symmetry. The variation in fruit structure is not obviously correlated with geographic and taxonomic patterns. The function of these interesting characters would make a fasci-

nating study, e.g. adaptation to saline environment, buoyancy and flotation characters, and wind distribution.

Acknowledgements

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References

- BURTT, B.L. 1988. A new shrubby genus of African Umbelliferae. *Notes R. bot. Gdn Edinb.* 45: 493–501.
- FEDER, N. & O'BRIEN, T.P. 1968. Plant microtechnique: some principles and new methods. *Am. J. Bot.* 55: 123–142.
- SONDER, O.W. 1862. Umbelliferae. In: *Flora capensis*, eds H.W. Harvey & O.W. Sonder, Vol. 2, pp. 524–567. Hodges & Smith, Dublin.
- VAN WYK, B-E. & TILNEY, P.M. 1994. The taxonomic value of fruit wall structure in the genus *Annesorhiza* (Apiaceae). *S. Afr. J. Bot.* 60: 240–244.
- WINTER, P.J.D., VAN WYK, B-E. & TILNEY, P.M. 1993. The morphology and development of the fruit of *Heteromorpha* (Apiaceae). *S. Afr. J. Bot.* 59: 336–341.