

THE GENUS *ASTROLOBA* UITEWAAL.
(LILIACEAE)

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THE ENTITIES HERREI AND SPIRALIS

It was shown in the introductory survey, that these two entities were distinguished from the other members of the genus, by the great inflation of loosely packed parenchyma tissue on either side of the midribs of the outer tepals of the perianth.

Apart from the dubious herbarium specimen from Graaff Reinet, (Marloth 5112 in Herb. Marloth (PRE)), the known records for the entity spiralis are in the Little Karoo, from Ladismith and Barrydale to Oudtshoorn and De Rust, while the entity herrei has, to date, only been found in marginal karoid areas North of Uniondale, and near Prince Albert in the northern foothills of the Swartberg.

"Spiralis" was first described as a species by Linneus in the Species Plantarum (1753), but he did not mention the rugosity of the perianth in his description of the flowers until his publication of the Mantissa in 1771. "Herrei" was described as a species by Uitewaal in 1948. In 1950, Uitewaal published another new species of *Astroloba*, A. dodsoniana, which appears to be identical to his A. herrei. Uitewaal wrote "... it ("dodsoniana") is easily distinguished (from A. herrei) by its more erect, and more whitish leaves, which have only very inconspicuous lines on the back, and by its light margins and keel." The problem now is to determine the extent of the similarity between the entities spiralis and herrei.

VEGETATIVE CHARACTERS (See Figs. 57 and 58, and Plates 25 and 26.)

An examination of the introductory comparison of vegetative characters in the genus as a whole shows some similarity between the entities spiralis and smutsiana. In the field, it is often difficult to distinguish between non flowering populations of the two. It is the author's opinion, that in the past there was considerable confusion between plants of the two entities. A. spiralis was the first species in the genus to be described. Later Aiton in the first edition of the Hortus Kewensis described two varieties of A. spiralis, pentagona and imbricata, on the

grounds of leaf arrangement. Haworth in 1804 raised "pentagona" to specific level, without describing the flowers. An illustrated account of a flowering plant described as Aloe pentagona only appeared in 1811. It had a smooth perianth. While the identity of this particular plant is open to doubt, as it might have been a specimen either of what is now referred to by the present author as A. smutsiana or as A. hallii, it seems very likely that originally, non-flowering plants of the entities smutsiana and spiralis were taken to be one species. Later, plants of A. hallii and A. smutsiana, which, apart from the shape of the apex and the presence of tubercles, may look alike on account of similar coloration and the presence of vein lines, were also confused, resulting in a taxonomic muddle over the identity of the species A. pentagona.

The reader is asked to refer again to the introduction and to the survey of field populations in A. smutsiana to see how this compares with the entity spiralis in vegetative characters.

Leaf Arrangement (See Table 77)

In the entity spiralis, the spiral angle ranges from less than $10 - 30^{\circ}$ in most plants from Hoekplaas, South of the Swartberg, and $10 - 15^{\circ}$ in plants near Prince Albert in the northern foothills of the Swartberg.

The majority of plants in both samples of the entity herrei, have sub-erect leaves, but in most plants of the Prince Albert sample, the leaf apices follow the angle of the leaf with the stem or curve upward, while in the Hoekplaas sample they curve outward. One of the few reasons given by Uitewaal for the recognition of A. dodsoniana was the more erect position of the leaves, but, as is obvious, this is not a good taxonomic character.

In the entity spiralis, the majority of leaves from Calitzdorp are erect, the majority from Oudtshoorn sub-erect. All leaf apices in the Calitzdorp sample follow the angle of the leaf with the stem, while in nearly half of the plants from Oudtshoorn they curve outward.

Thus, while there is some variation in leaf arrangement between individual populations, the two entities, taken as a whole,

Locality. Class range of measurements. Total no. Range actual indiv. measurement

Locality.	SPIRAL ANGLE. Class interval 10°						Total no. indiv.	Range actual measurement
	0	10	20	30	40	50		
<u>SPIRALIS.</u>								
Calitzdorp R47	-	1	2	2	1	6	7	30
Oudtshoorn R7	1	6	3	6	1	17	0	33
<u>HERREI.</u>								
Hoekplaas R16	-	1	3	5	-	9	10	30
Prince Albert R46	-	5	5	-	-	10	10	15

Locality.	ANGLE OF LEAF WITH STEM. Class interval 20°					Total no. indiv.	Range actual measurement
	30 Erect	Sub-50 erect	Patent-70 erect	Patent.	40		
<u>SPIRALIS.</u>							
Calitzdorp R47	4	2	-	-	6	23	45
Oudtshoorn R7	3	15	-	-	18	25	50
<u>HERREI.</u>							
Hoekplaas R16	-	7	2	-	9	40	60
Prince Albert R46	-	10	-	-	10	35	45

Locality.	CURVATURE OF LEAF APICES.				Total no. indiv.	Range actual measurement
	u	f	o	6		
<u>SPIRALIS.</u>						
Calitzdorp R47	-	6	-	6	f	o
Oudtshoorn R7	1	10	7	18	u	-
<u>HERREI.</u>						
Hoekplaas R16	-	1	8	9	f	o
Prince Albert R46	5	4	1	10	u	-

Locality.	ANGLE OF LEAF APEX. Class interval 5°						Total no. indiv.	Range actual measurement
	10	15	20	25	30	40		
<u>SPIRALIS.</u>								
Calitzdorp R47	-	-	-	2	2	2	6	22
Oudtshoorn R7	-	-	9	8	6	-	23	18
<u>HERREI.</u>								
Hoekplaas R16	-	5	5	-	-	-	10	13
Prince Albert R46	1	8	2	-	-	-	11	9

Table 77 VARIATION IN APPEARANCE OF LEAFY SHOOT IN FIELD SAMPLES OF 'SPIRALIS' AND 'HERREI'.

(u = leaf apices curving upwards; f = leaf apices following the angle of the leaf with the stem; o = leaf apices curving outwards).

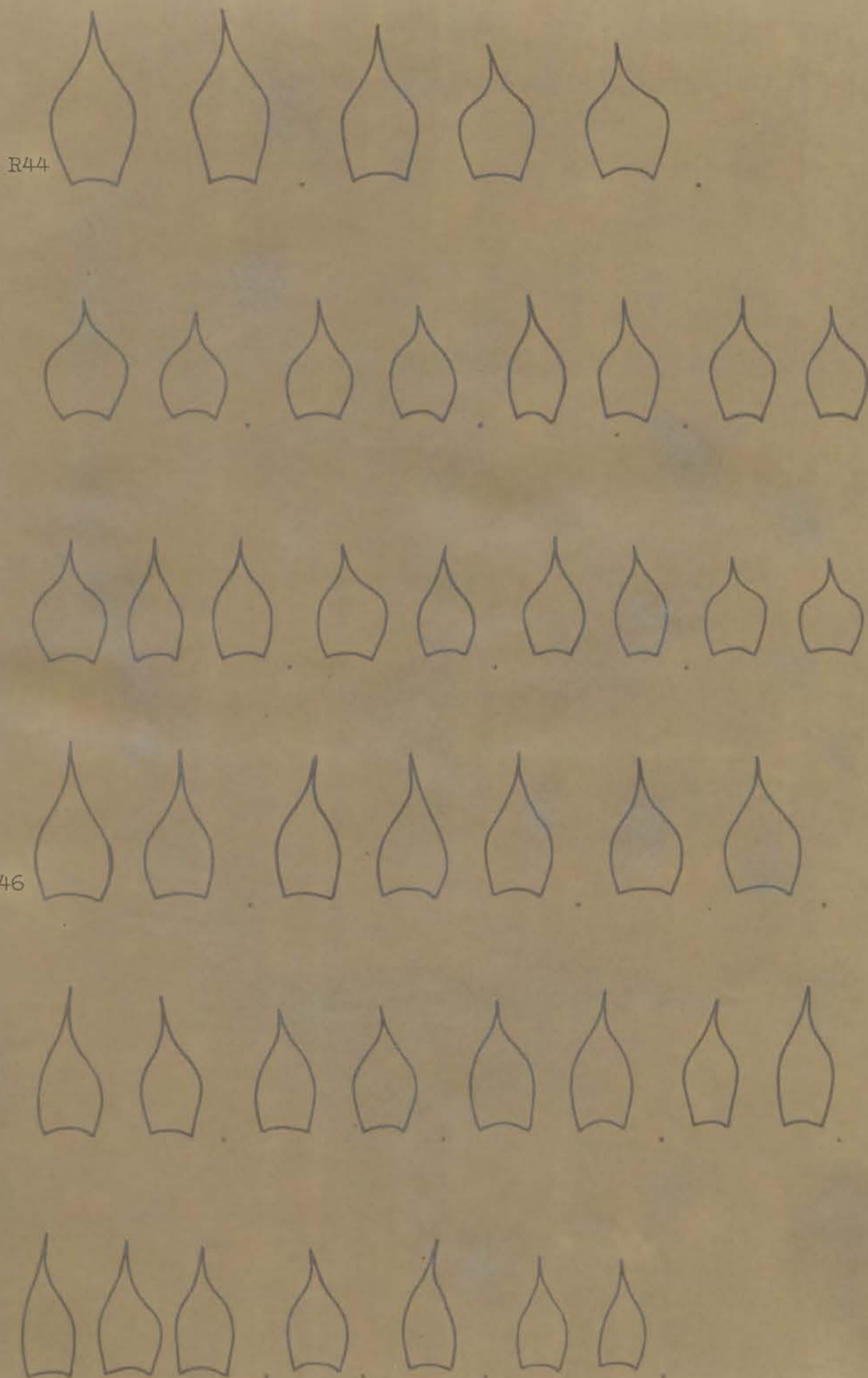


Fig. 57. Variation in leaf shape in population samples of the entity herrei. (Sheathing part of leaf base not shown, the dots indicate the number of leaves ^{shown} per plant).

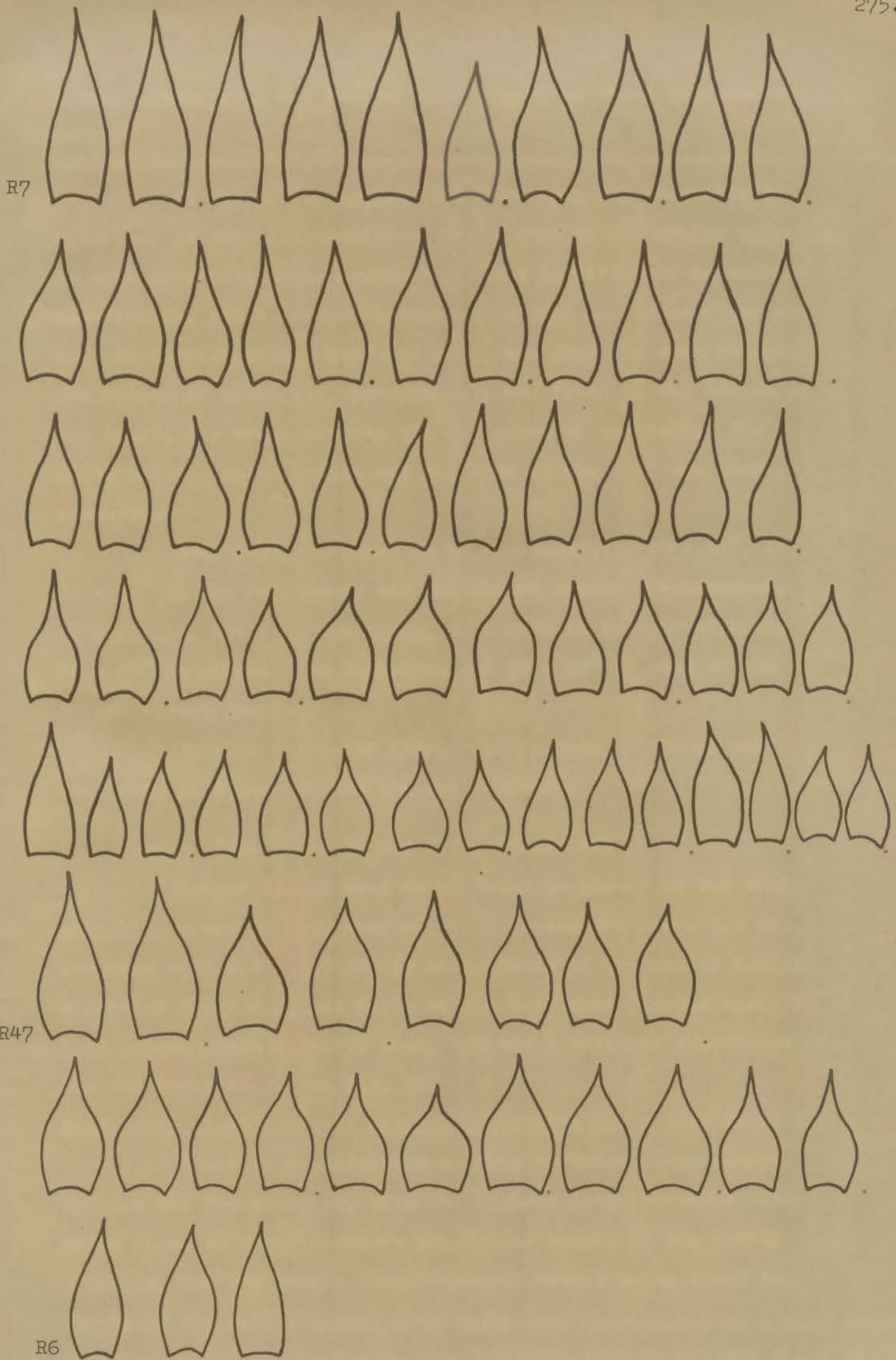


Fig.58. Variation in leaf shape in population samples of the entity spiralis. (Sheathing part of base not shown, the dots indicate the number of leaves shown for each plant.)

differ little from one another with regard to these characters.

Leaf apex (See Table 78)

In the entity herrei, the leaf apex may generally be described as narrowly acuminate, while that of the entity spiralis is more generally acute acuminate. This is difficult to express numerically, and a rather approximate method was devised for doing so. An imprint of the leaf was made, and from the apex an arc, the radius of which was approximately one fifth of the length of the leaf*, was drawn cutting the two sides of the leaf. The angle between these points and the apex of the leaf was then measured.

This angle is found to be approximately $20 - 35^\circ$, and $15 - 30^\circ$ in the Calitzdorp and Oudtshoorn samples respectively, of spiralis, while in the herrei specimens it is approximately $10 - 20^\circ$ in plants from Hoekplaas and $10 - 15^\circ$ in most of the Prince Albert sample.

In this character then, a difference, although not absolute, is found between the two entities.

Leaf length (See Table 79 and Figs. 57 and 58)

Longer leaves tend to be found in plants of the entity spiralis, where in both samples, most leaves are 2.0 - 3.0 cm, compared with 2.0 - 2.5 cm. in most plants of the entity herrei. A scatter diagram of the angle of the leaf apex plotted against leaf length gives a fairly good, but not a complete separation of the two entities. (See Fig. 59)

Leaf width at widest part and length-breadth ratio (See Table 79)

There is considerable overlap in these measurements between the two entities, with the highest length-breadth ratios being found in the Oudtshoorn population sample of the entity spiralis, and the lowest length-breadth ratios being found in plants of the entity herrei from Hoekplaas.

Position of widest part of leaf in relation to length. (See Table 79)

As has been seen previously, the longer the leaf, the

* If the leaf was 1.5 - 2.0 cm, the radius was 0.4 cm, if 2.0 - 2.5 cm, 0.5 cm, if 2.5 - 3.0 cm, 0.6 cm and so on.

Locality	Radius of arc.	Leaf length	Angle of apex.	Length- breadth ratio.
	cm.	cm.	°	
<u>SPIRALIS.</u>				
Oudtshoorn R47.	0.9	4.2	18	2.90
	0.8	3.7	19	2.82
	0.8	3.6	18	2.70
	0.7	3.5	19	2.60
	0.7	3.3	22	2.54
	0.6	3.0	23	1.95
	0.6	3.0	19	2.19
	0.6	3.0	27	2.19
	0.6	2.9	19	2.37
	0.6	2.9	20	2.37
	0.6	2.8	21	2.33
	0.6	2.8	26	2.33
	0.6	2.7	19	2.02
	0.5	2.5	19	2.44
	0.5	2.5	26	2.47
	0.5	2.4	27	1.96
	0.5	2.4	21	1.64
	0.5	2.4	26	2.00
	0.5	2.3	24	2.18
	0.5	2.2	22	2.00
	0.5	2.2	26	1.86
	0.5	2.2	25	1.86
	0.4	1.9	22	1.85
Calitzdorp R47.	0.7	3.4	22	2.41
	0.6	2.7	30	1.86
	0.6	2.6	33	1.71
	0.6	2.6	28	2.06
	0.5	2.5	25	1.92
	0.5	2.4	34	1.57
<u>HERREI.</u>				
Uniondale	0.7	3.2	14	2.03
Hoekplaas R16.	0.6	2.6	13	1.67
	0.5	2.3	14	1.80
	0.5	2.2	14	1.78
	0.5	2.2	16	1.96
	0.5	2.1	17	1.62
	0.5	2.1	15	1.68
	0.5	2.1	18	1.44
	0.5	2.1	17	1.87
	0.4	1.8	16	1.46
Prince Albert R46.	0.6	2.9	13	2.00
	0.6	2.7	9	2.08
	0.6	2.7	14	1.98
	0.5	2.5	15	2.42
	0.5	2.5	12	2.00
	0.5	2.5	13	1.75
	0.5	2.5	20	2.21
	0.5	2.4	18	2.40
	0.5	2.4	15	2.09
	0.5	2.3	14	1.76
	0.5	2.1	14	2.28

TABLE 78 Variation in angle of leaf apex constructed on a leaf print by drawing an arc from the leaf apex to cut the sides of the leaf below, and measuring the angle made by these three points. The radius of the arc depends upon the length of the leaf. This is shown for field specimens of 'spiralis' and 'herrei', together with the length-breadth ratio of the leaves.

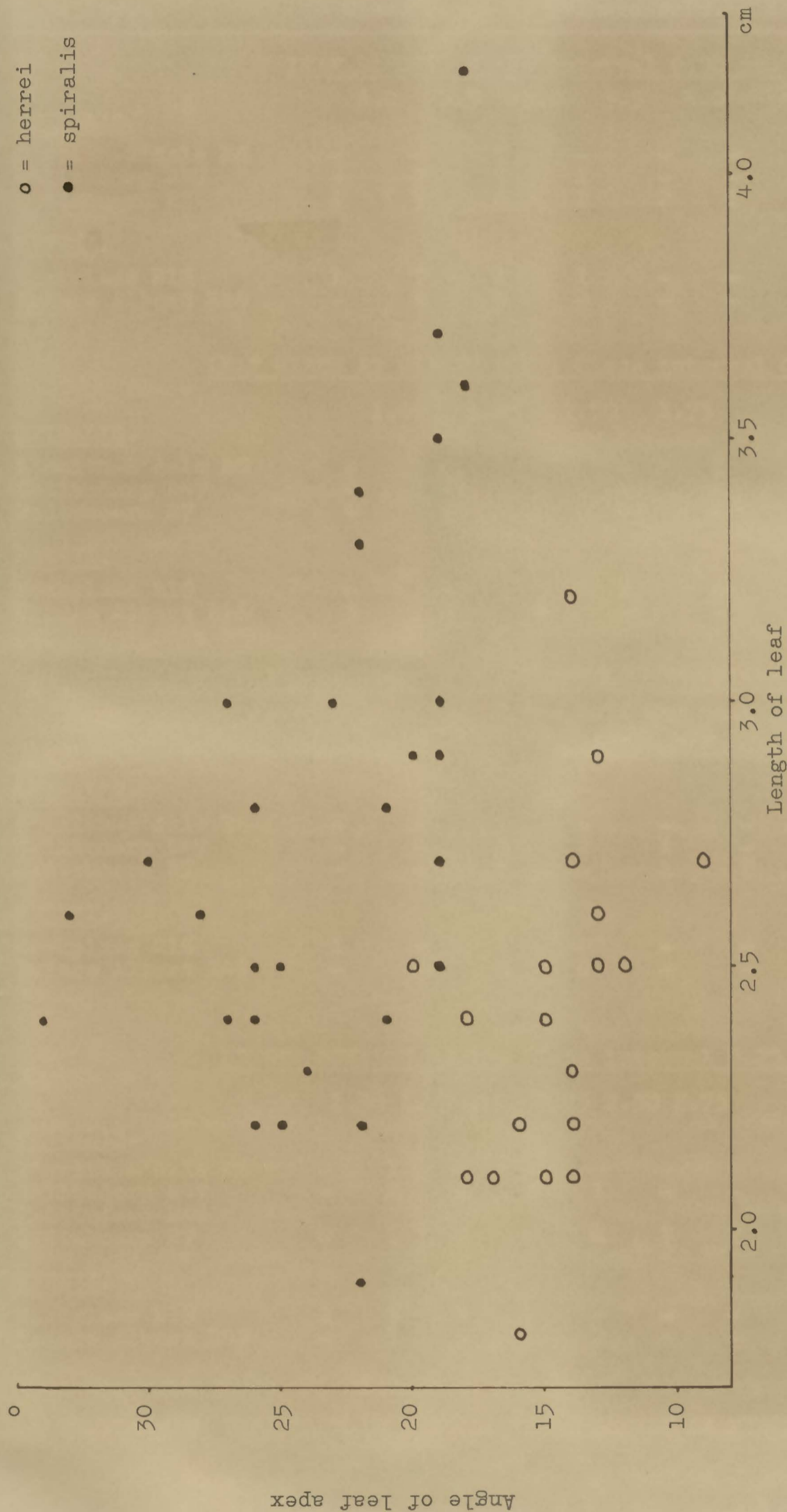


Fig.59. Variation in leaf length and in the angle of the leaf apex in the entities spiralis and herrei.

Locality.	Class range of measurements.						Total no. indiv.	Range actual measurements
	<u>LEAF LENGTH. Class interval 0.50 cm.</u>							
	2.0	2.5	3.0	3.5	4.0		cm.	
<u>SPIRALIS.</u>								
L'smith-B'dale R6	-	-	1	-	-	1	3.0	
Calitzdorp R47	-	2	3	1	-	6	2.4 - 3.4	
Oudtshoorn R7	1	9	8	2	2	23	1.9 - 4.2	
<u>HERREI.</u>								
Hoekplaas R16	1	7	1	1	-	10	1.8 - 3.2	
Prince Albert R46	-	8	3	-	-	11	2.1 - 2.9	
<u>LEAF WIDTH AT WIDEST PART. Class interval 0.25 cm.</u>								
	1.00	1.25	1.50	1.75			cm.	
<u>SPIRALIS.</u>								
L'smith-B'dale R6	-	-	-	-	1	1	1.7	
Calitzdorp R47	-	-	6	-	-	6	1.3 - 1.50	
Oudtshoorn R7	4	9	10	-	-	23	1.0 - 1.50	
<u>HERREI.</u>								
Hoekplaas R16	-	4	5	1	-	10	1.1 - 1.6	
Prince Albert R46	3	2	6	-	-	11	0.9 - 1.4	
<u>POSITION OF WIDEST PART OF LEAF w.r.t. MIDLENGTH. Class interval 0.25 cm.</u>								
	Above	0	Below half way mark				cm.	
			.25	.50	.75			
<u>SPIRALIS.</u>								
L'smith-B'dale R6	-	-	1	-	-	1	0.1bel*	
Calitzdorp R47	-	-	3	2	1	6	0.1bel-0.6be	
Oudtshoorn R7	-	-	4	16	1	23	0.2bel-0.9be	
<u>HERREI.</u>								
Hoekplaas R16	1	-	9	-	-	10	0.1ab - 0.2b	
Prince Albert R46	-	-	5	6	-	11	0.1bel-0.5be	
<u>LENGTH-BREADTH RATIO. Class interval 0.25</u>								
	1.50	1.75	2.00	2.25	2.50	2.75		
<u>SPIRALIS.</u>								
L'smith-B'dale R6	-	1	-	-	-	-	1 1.67	
Calitzdorp R47	-	2	2	1	1	-	6 1.57 - 2.41	
Calitzdorp-R46	-	-	-	-	-	-	-	
Oudtshoorn R7	-	1	7	4	6	3	23 1.64 - 2.90	
<u>HERREI.</u>								
Hoekplaas R16	2	3	4	1	-	-	10 1.44 - 2.03	
Prince Albert R46	-	1	4	4	2	-	11 1.75 - 2.42	

Table 79 VARIATION IN DIMENSIONS OF LEAVES IN FIELD POPULATIONS OF SPIRALIS AND HERREI.

*(ab = above midlength, bel = below midlength).

Locality.	Class range of measurements.				Total no. indiv.	Range actual measurement	
	.05	.10	.15	cm.			
<u>MUCRO LENGTH. Class interval 0.05 cm.</u>							
<u>SPIRALIS.</u>							
L'smith-B'dale R6	-	1	-	-	1	.10	
Calitzdorp R47	1	5	-	-	6	.06	-.08
Oudtshoorn R7	1	13	8	1	23	.04	-.16
<u>HERREI.</u>							
Hoekplaas R16	-	6	2	2	10	.08	-.18
Prince Albert R46	-	7	4	-	11	.07	-.13

Table 80 VARIATION IN MUCRO LENGTH IN FIELD SAMPLES OF
SPIRALIS AND HERREI.

further below the half way mark of the length does the widest part tend to be.

Mucro length. (See Table 80)

Here too, the difference between the two entities is slight, but the samples of the entity herrei have a slightly larger percentage of mucros more than 0.10 cm. long, than found in the samples of the entity spiralis.

In actual leaf dimensions then, apart from the angle of the leaf apex, there is little difference between the entities spiralis and herrei.

LEAF COLOUR AND VEIN LINES.

This has been described in the introduction. All the leaves of the entity herrei have fine vein lines running the entire length of the leaf on the underside, and these lines often appear as very fine longitudinal ridges. In the entity spiralis, on the other hand, vein lines are not always apparent, (they were present in 43% of the plants examined) and never appear as fine ridges. The reason for this is because in the entity herrei, the bundle caps are much larger and close to the epidermis than in the entity spiralis. (See Appendix Table 8). A scatter diagram of the vertical distance of the largest bundle cap from the ventral side of the leaf from the lower epidermis, plotted against the area of this cap, gave a good separation of the entities spiralis and herrei for the few specimens

THE ENTITY SPIRALIS.



A(X $1\frac{1}{8}$). Shoot of plant from Calitzdorp R7, showing white maculae on leaves which developed under cultivation at Kirstenbosch.

B(X $1\frac{1}{5}$)



C(X $1\frac{1}{8}$)

D(X 1)

Leafy shoots B and C from Oudtshoorn R7, D from Calitzdorp R47. (Scales approximate).

THE ENTITY HERREI.



Habit of plants from Hoekplaas in which the leaf apices curve outwards ($X \frac{4}{5}$).



Leafy shoots ($X 1\frac{1}{6}$): showing bundle cap lines and acute acuminate leaf apices.

(Scales approximate).

examined. (See Fig. 9).

Uitewaal gave as the other features by which A. dodsoniana differed from "herrei", the more whitish leaves and the very inconspicuous lines in the former. Again these are poor characters as they are so indefinite, and on these grounds, "dodsoniana" cannot be considered as a species distinct from the entity herrei.

Summary

Of all the vegetative characters, the ones in which there is a noticeable difference between the entities herrei and spiralis are the narrowly acuminate apices of the former, compared with the acute acuminate apices of the latter, and the very prominent bundle caps in the entity herrei. These two characters, render the two entities easily distinguishable in the field and lend support to their recognition as separate species. The leaves of the entity herrei dry with a series of very fine longitudinal ridges, this has never been the case in any specimens of the entity spiralis thus far examined.

The entity spiralis has in fact, more vegetative characters in common with A. smutsiana than with the entity herrei.

INFLORESCENCE CHARACTERS.

In this part of the survey, herbarium specimens are also included. Unfortunately the number of inflorescences of the entity herrei examined is rather few.

Peduncle and raceme length (See Table 81)

Peduncle length tends to be greater in the entity spiralis than in the entity herrei. Unfortunately many of the racemes of the entity herrei were damaged and it was not possible to obtain a fair comparison of raceme lengths in the two entities.

Thickness of peduncle (See Table 82)

There is an overlap in the width of the peduncle base between the majority of individuals of both entities, but there are a larger number of peduncles in the entity spiralis with narrower bases than are found in the entity herrei.

With regard to the width of the peduncle below the first pedicel, this tends to be broader in the entity herrei.

Locality. Class range of measurements. Total no. Range act
indiv. measurements

Locality.	PEDUNCLE LENGTH.							Total no. indiv.	Range act measurements	
	10	15	20	25	30	35	cm.			
<u>Field Specimens.</u>										
<u>SPIRALIS.</u>										
L'smith-B'dale R6	-	-	-	1	-	2	-	3	25	-
Calitzdorp R64	-	-	1	1	4	1	-	7	19	-
Oudtshoorn R68	-	-	2	2	11	4	5	24	16	-
<u>HERREI.</u>										
Hoekplaas R44	1	-	3	2	-	-	-	6	10	-
Prince Albert R46	-	-	4	4	2	-	-	10	18	-
<u>Herbarium Specimens.</u>										
<u>SPIRALIS.</u>										
Graaff Reinet ?	-	-	-	1	-	-	-	1	25	-
Oudtshoorn	-	-	1	5	1	2	-	9	19	-
De Rust	-	-	-	-	-	1	-	1	34	-
Little Karoo	-	-	1	-	-	-	-	1	16	-
<u>HERREI.</u>										
Prince Albert	-	-	-	1	-	-	-	1	22	-

Locality.	RACEME LENGTH.							Total no. indiv.	Range act measurements	
	10	15	20	25	30	35	cm.			
<u>Field Specimens.</u>										
<u>SPIRALIS.</u>										
L'smith-B'dale R6	1	-	1	1	-	-	-	3	8	-
Calitzdorp R64	1	3	1	2	-	-	-	7	10	-
Oudtshoorn R68	-	3	8	10	-	2	1	24	13	-
<u>HERREI.</u>										
Hoekplaas R44	1	2	1	-	1	-	-	5	9	-
Prince Albert R46	-	1	-	1	-	-	-	2	14	-
<u>Herbarium Specimens.</u>										
<u>SPIRALIS.</u>										
Graaff Reinet ?	-	1	-	-	-	-	-	1	14	-
Oudtshoorn	-	6	-	1	-	-	-	7	11	-
De Rust	-	-	-	1	-	-	-	1	21	-
Little Karoo	-	1	-	-	-	-	-	1	15	-
<u>HERREI.</u>										
Prince Albert	-	1	1	2	1	-	-	5	14	-

Class interval 5.0 cm

Table 81 VARIATION IN LENGTH OF PEDUNCLE AND RACEME IN
"SPIRALIS" AND "HERREI".

Locality. Class range of measurements. Total no. indiv. Range actual measurements

WIDTH PEDUNCLE BASE. Class interval 0.15 cm.								cm.
<u>SPIRALIS.</u>								
L'smith-B'dale R6	-	3	-	-	-	3	.28	- .35
Calitzdorp R64	-	-	3	-	-	3	.40	- .64
Oudtshoorn R68	-	13	10	1	-	24	.26	- .56
<u>HERREI.</u>								
Hoekplaas R44	-	-	5	1	-	6	.42	- .5
Prince Albert R46	-	1	7	2	-	10	.40	- .6

PEDUNCLE DIAM. BELOW RACEME. Class interval 0.10 cm.								cm.
		.10	.20	.30				
<u>SPIRALIS.</u>								
L'smith-B'dale R6	-	0	1	2	-	3	.14	- .2
Calitzdorp R64	-	0	1	2	-	3	.19	- .2
Oudtshoorn R68	-	0	17	7	-	24	.13	- .2
<u>HERREI.</u>								
Hoekplaas R44	-	0	-	6	-	6	.23	- .2
Prince Albert R46	-	0	2	8	1	11	.20	- .3

Table 82 VARIATION IN THICKNESS OF PEDUNCLE BASE IN FIELD SPECIMENS OF "SPIRALIS" AND "HERREI".

Branching of inflorescence and number of sterile bracts (See Tables 83 and 84)

Out of all field and herbarium specimens of both entities examined, only one branched inflorescence was found, in a specimen of the entity spiralis from Oudtshoorn, while unexpanded raceme buds in the axils of sterile bracts were found in a few specimens of the same entity from both Oudtshoorn and Calitzdorp. There was a slight difference in the number of sterile bracts between the two entities, this being 3 - 6 bracts in most of the samples of the entity spiralis, and 2 - 4 bracts in most of the samples of the entity herrei.

Sterile and fertile bracts (See Tables 85, 86, 87 and 88)

There is an overlap in the length of the bracts in the two entities, the fertile bracts of the entity herrei tending to be slightly longer.

As would be expected, the sterile and fertile bracts are also somewhat broader at the base in the entity herrei, where the peduncle is generally slightly thicker than in the entity spiralis.

Locality.	Indivs. with one or more branches to inflorescence.	Inflorescences unbranched but unexpanded raceme buds in axils of sterile bracts.	Total no. indiv.
<u>Field Specimens.</u>			
<u>SPIRALIS.</u>			
L'smith-B'dale R6	0	0	3
Calitzdorp R64	0	2	6
Oudtshoorn R68	1	2	24
<u>HERREI.</u>			
Hoekplaas R44	0	0	6
Prince Albert R46	0	0	10
<u>Herbarium Specimens.</u>			
<u>SPIRALIS.</u>			
Graaff Reinet ?	0	0	1
Oudtshoorn	0	0	8
De Rust	0	0	1
Little Karoo	0	0	1
<u>HERREI.</u>			
Prince Albert	0	0	2

Table 83 VARIATION IN DEGREE OF BRANCHING OF INFLORESCENCE IN
"SPIRALIS" AND "HERREI".

Locality	Class range of numbers				Total no. indiv.	Range in no. bracs
	1-2	3-4	5-6	7-8		
<u>Field Specimens.</u>						
<u>SPIRALIS.</u>						
L'smith-B'dale R6	-	-	1	2	3	5 -
Calitzdorp R64	-	2	4	1	7	4 -
Oudtshoorn R68	-	10	12	2	24	3 -
<u>HERREI.</u>						
Hoekplaas R44	2	3	1	-	6	1 -
Prince Albert R46	3	7	-	-	10	2 -
<u>Herbarium Specimens.</u>						
<u>SPIRALIS.</u>						
Graaff Reinet ?	-	1	-	-	1	4 -
Oudtshoorn	-	1	6	-	7	4 -
De Rust	-	-	-	1	1	7 -
Little Karoo	-	1	-	-	1	4 -
<u>HERREI.</u>						
Prince Albert	2	-	-	-	2	2

Table 84 VARIATION IN NUMBER OF STERILE BRACTS IN "SPIRALIS"
AND "HERREI".

Locality. Class range of measurements. Total no. Range actual indiv. measurements

	<u>LENGTH BASAL STERILE BRACT.</u>							cm.
	0.7	0.9	1.1	1.3				
<u>Field Specimens.</u>								
<u>SPIRALIS.</u>								
L'smith-B'dale R6	1	1	2	-	-	3	0.67 - 1.00	
Calitzdorp R64	-	4	1	-	-	5	0.77 - 0.95	
Oudtshoorn R68	7	7	5	1	1	21	0.52 - 1.40	
<u>HERREI.</u>								
Hoekplaas R44	1	3	2	-	-	6	0.70 - 1.00	
Prince Albert R46	1	6	3	-	-	10	0.70 - 1.10	
<u>Herbarium Specimens.</u>								
<u>SPIRALIS.</u>								
Graaff Reinet ?	-	-	-	-	1	1	1.40	
Oudtshoorn	-	3	2	-	-	5	0.75 - 1.00	
De Rust	-	-	1	-	-	1	1.10	
<u>HERREI.</u>								
Prince Albert	-	1	3	-	-	4	0.90 - 1.10	

	<u>LENGTH BASAL FERTILE BRACT.</u>							cm.
	0.4	0.6	0.8	1.0				
<u>Field Specimens.</u>								
<u>SPIRALIS.</u>								
L'smith-B'dale R6	-	1	-	-	-	1	0.57	
Calitzdorp R64	-	6	-	-	-	6	0.47 - 0.60	
Oudtshoorn R68	1	12	8	1	-	22	0.32 - 0.86	
<u>HERREI.</u>								
Hoekplaas R44	-	2	6	-	-	8	0.60 - 0.75	
Prince Albert R46	-	2	7	1	-	-	0.60 - 0.85	
<u>Herbarium Specimens.</u>								
<u>SPIRALIS.</u>								
Graaff Reinet ?	-	-	1	-	-	1	0.65	
Oudtshoorn	1	5	1	-	-	7	0.40 - 0.65	
De Rust	-	-	1	-	-	1	0.70	
Little Karoo	1	-	-	-	-	1	0.35	
<u>HERREI.</u>								
Prince Albert	-	-	6	2	1	9	0.70 - 1.10	

Class interval 0.20 cm.

Table 85 VARIATION IN LENGTHS OF BRACTS IN "SPIRALIS" AND "HERREI".

Locality. Class range of measurements. Total no. Range actual indiv. measurements

Locality.	BASIL WIDTH BASAL STERILE BRACT.					Total no. indiv.	Range actual measurements
	0.1	0.2	0.3	0.4	cm.		
<u>Field Specimens.</u>							
<u>SPIRALIS.</u>							
L'smith-B'dale R6	-	-	1	-	-	1	0.23
Calitzdorp R64	-	-	4	1	-	5	0.25 - 0.3
Oudtshoorn R68	-	3	13	5	-	21	0.20 - 0.4
<u>HERREI.</u>							
Hoekplaas R44	-	-	2	3	1	6	0.30 - 0.5
Prince Albert R46	-	-	4	3	3	10	0.28 - 0.5
<u>Herbarium Specimens.</u>							
<u>SPIRALIS.</u>							
Graaff Reinet ?	-	-	-	1	-	1	0.40
Oudtshoorn	-	2	2	-	-	4	0.20 - 0.3
De Rust	-	-	1	-	-	1	0.28
<u>HERREI.</u>							
Prince Albert	-	-	-	3	1	4	0.40 - 0.5

BASIL WIDTH BASAL FERTILE BRACT.

<u>Field Specimens.</u>							
<u>SPIRALIS.</u>							
L'smith-B'dale R6	-	-	1	-	-	1	0.23
Calitzdorp R64	-	2	3	1	-	6	0.18 - 0.3
Oudtshoorn R68	-	3	19	-	-	22	0.20 - 0.3
<u>HERREI.</u>							
Hoekplaas R44	-	-	3	4	1	8	0.30 - 0.4
Prince Albert R46	-	-	4	4	2	10	0.30 - 0.4
<u>Herbarium Specimens.</u>							
<u>SPIRALIS.</u>							
Graaff Reinet ?	-	1	-	-	-	1	0.20
Oudtshoorn	1	5	1	-	-	7	0.10 - 0.2
De Rust	-	-	1	-	-	1	0.25
Little Karoo	-	1	-	-	-	1	0.14
<u>HERREI.</u>							
Prince Albert	-	-	1	3	5	9	0.30 - 0.5

Class interval 0.10 cm.

Table 86 VARIATION IN BASAL WIDTH OF BRACTS IN 'SPIRALIS' AND 'HERREI'.

Locality. Class range of measurements. Total no. indiv. Range actual measurement

MIDDLE WIDTH BASAL STERILE BRACT.

	.05	.10	.15	.20	.25		cm.
<u>Field Specimens.</u>							
<u>SPIRALIS.</u>							
L'smith-B'dale R6	-	1	-	-	-	1	0.10
Calitzdorp R64	-	2	3	-	-	5	0.08 - 0.13
Oudtshoorn R68	1	16	4	-	-	21	0.05 - 0.15
<u>HERREI.</u>							
Hoekplaas R44	-	-	1	4	-	6	0.15 - 0.27
Prince Albert R46	-	-	6	4	-	10	0.14 - 0.20
<u>Herbarium Specimens.</u>							
<u>SPIRALIS.</u>							
Graaff Reinet ?	-	-	1	-	-	1	0.14
Oudtshoorn	-	4	-	-	-	4	0.06 - 0.10
De Rust	-	1	-	-	-	1	0.10
<u>HERREI.</u>							
Prince Albert	-	3	-	-	1	4	0.10 - 0.23

MIDDLE WIDTH BASAL FERTILE BRACT.

<u>Field Specimens.</u>							
<u>SPIRALIS.</u>							
L'smith-B'dale R6	-	1	-	-	-	1	0.10
Calitzdorp R64	2	3	-	-	1	6	0.05 - 0.23
Oudtshoorn R68	-	21	1	-	-	22	0.06 - 0.12
<u>HERREI.</u>							
Hoekplaas R44	-	1	3	3	1	8	0.10 - 0.24
Prince Albert R46	-	-	4	5	1	10	0.12 - 0.13
<u>Herbarium Specimens.</u>							
Graaff Reinet ?	1	-	-	-	-	1	0.04
Oudtshoorn	1	6	-	-	-	7	0.04 - 0.06
De Rust	-	1	-	-	-	1	0.07
Little Karoo	-	1	-	-	-	1	0.06
<u>HERREI.</u>							
Prince Albert	-	3	3	3	-	9	0.08 - 0.17

Class interval 0.05 cm.

Table 87 VARIATION IN WIDTH OF BRACTS TAKEN HALF WAY ALONG LENGTH OF BRACT IN "SPIRALIS" AND "HERREI."

Locality. Class range of measurements. Total no. Range actual indiv. measurements

LENGTH-BREADTH RATIO BASAL STERILE BRACT.

2.0 4.0 6.0 8.0 10.0 12.0 14.0

Field Specimens.

SPIRALIS.

L'smith-B'dale R6	-	-	-	1	-	-	-	-	1	6.70
Calitzdorp R64	-	-	-	3	-	2	-	-	5	6.00 - 11
Oudtshoorn R68	-	-	3	5	5	3	3	2	21	4.26 - 28

HERREI.

Hoekplaas R44	-	3	3	-	-	-	-	-	6	3.33 - 6
Prince Albert R46	-	3	4	3	-	-	-	-	10	3.50 - 10

Herbarium Specimens.

SPIRALIS.

Graaff Reinet ?	-	-	-	-	1	-	-	-	1	10.00
Oudtshoorn	-	-	-	-	2	1	1	-	-	9.00 - 12
De Rust	-	-	-	-	-	1	-	-	1	11.00

HERREI.

Prince Albert	-	1	-	-	1	2	-	-	4	3.91 - 11
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LENGTH-BREADTH RATIO BASAL FERTILE BRACT.

Field Specimens.

SPIRALIS.

L'smith-B'dale R6	-	-	1	-	-	-	-	-	1	5.70
Calitzdorp R64	-	1	2	-	1	2	-	-	6	2.08 - 11
Oudtshoorn R68	-	2	4	9	5	-	2	-	22	3.50 - 11

HERREI.

Hoekplaas R44	-	4	3	1	-	-	-	-	-	2.50 - 11
Prince Albert R46	-	4	5	1	-	-	-	-	10	3.33 - 11

Herbarium Specimens.

Graaff Reinet ?	-	-	-	-	-	-	-	1	1	16.25
Oudtshoorn	-	-	-	1	6	-	-	-	7	6.25 - 11
De Rust	-	-	-	-	1	-	-	-	1	10.00
Little Karoo	-	-	1	-	-	-	-	-	1	5.83

HERREI.

Prince Albert.	-	-	3	4	2	-	-	-	9	4.50 - 11
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Class interval 2.00

Table 88 VARIATION IN LENGTH-BREADTH RATIO OF BRACTS IN
"SPIRALIS" AND "HERREI".

Locality. Class range of measurements. Total no. indiv. Range actual measurements.

FLOWERING PEDICEL FROM BASE OF RACEME.

cm.

Field Specimens.

SPIRALIS.

L'smith-B'dale R6
 Callitzdorp R64
 Oudtshoorn R68

HERREI.

Hoekplaas R44
 Prince Albert R46

Herbarium Specimens.

SPIRALIS.

Graaff Reinet ?
 Oudtshoorn
 Little Karoo

HERREI.

Prince Albert

	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	
	-	2	1	-	-	-	-	-	3
	1	-	1	-	-	-	-	-	4
	3	9	-	-	-	-	-	-	12
	-	1	3	2	1	-	-	-	7
	-	-	3	5	1	-	-	-	9
	-	1	-	-	-	-	-	-	1
	1	5	1	-	-	-	-	-	7
	-	1	-	-	-	-	-	-	1
	-	-	-	2	1	2	-	-	6

Class interval 0.2 cm.

0.38 - 0.40
 0.17 - 0.80
 0.18 - 0.39
 0.35 - 0.95
 0.50 - 0.94
 0.25
 0.20 - 0.42
 0.22
 0.63 - 1.68

Table 89A VARIATION IN LENGTH OF PEDICEL IN 'SPIRALIS' AND 'HERREI'.

Locality. Class range of measurements. Total no. indiv. Range actual measurements.

FLOWERING PEDICEL FROM MIDDLE OF RACEME.

	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	
<u>Field Specimens.</u>										cm.
L'smith-B'dale R6	-	2	1	-	-	-	-	-	-	0.30 - 0.43
Callitzdorp R64	2	1	3	-	-	-	-	-	-	0.13 - 0.51
Oudtshoorn R68	17	7	-	-	-	-	-	-	-	0.14 - 0.38
<u>HERREI.</u>										
Hoekplaas R44	-	2	2	3	-	-	-	-	-	0.23 - 0.70
Prince Albert R46	-	-	6	1	-	-	-	-	-	0.47 - 0.64
<u>Herbarium Specimens.</u>										
<u>SPIRALIS.</u>										
Graaff Reinet ?	-	1	-	-	-	-	-	-	-	0.24
Oudtshoorn	1	6	-	-	-	-	-	-	-	0.20 - 0.31
De Rust	-	1	-	-	-	-	-	-	-	0.27
Little Karoo	1	-	-	-	-	-	-	-	-	0.12
<u>HERREI.</u>										
Prince Albert	-	1	2	-	2	1	-	-	-	0.39 - 1.10

FRUITING PEDICEL FROM BASE OF RACEME.

	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	
<u>Field Specimens.</u>										
<u>SPIRALIS.</u>										
Callitzdorp R64	1	1	1	1	-	-	-	-	-	0.20 - 0.82
Oudtshoorn R68	2	10	1	-	-	-	-	-	-	0.17 - 0.44
<u>HERREI.</u>										
Prince Albert	-	-	-	-	-	-	-	-	1	2.0
<u>Herbarium Specimens.</u>										
<u>SPIRALIS.</u>										
Oudtshoorn	-	3	-	-	-	-	-	-	-	0.30 - 0.39
De Rust	-	1	-	-	-	-	-	-	-	0.38

Class interval 0.2 cm.

The middle width of the lowest sterile and fertile bracts, taken at a point halfway along the bract length, also tends to be greater in the entity herrei than in the entity spiralis. This difference is more marked in the basal fertile bracts, where in the majority of the samples of the entity spiralis, the middle width is 0.10 cm. or less, compared with 0.10 - 0.20 cm. in the majority of the samples of the entity herrei.

Correspondingly, higher length-breadth ratios, calculated by dividing the length of the bracts by the middle width, are found in the entity spiralis.

Pedicel length (See Table 89A and B)

This tends to be somewhat longer in the entity herrei than in the entity spiralis, but again there is some overlap between the two. In the entity spiralis, the basal flowering pedicel is 0.2 - 0.4 cm. long in most flowering specimens from Oudtshoorn and the small sample from the Ladismith-Barrydale Karoo, but it is more variable in the Calitzdorp sample. In most of the flowering inflorescences of the entity herrei, the basal pedicel is 0.4 - 0.8 cm. in length. The length most of the pedicels from the middle of flowering racemes of the entity spiralis is 0.2 cm. or less in specimens from Oudtshoorn, and more variable in the Calitzdorp sample. In inflorescences of the entity herrei middle flowering pedicel length ranges from 0.2 - 0.8 cm. in plants from Hoekplaas, while most pedicels from the middle of flowering racemes from Prince Albert are 0.4 - 0.6 cm. in length.

Summary.

Thus in inflorescence characters, the differences between the entities spiralis and herrei are slight. In the entity spiralis, peduncles tend to be longer and more slender, pedicels tend to be shorter and bracts tend to be narrower and slightly shorter than in the entity herrei, but there is considerable overlap in these measurements between the two. There are local variations in these measurements in populations of the entity spiralis from Oudtshoorn and Calitzdorp.

PERIANTH CHARACTERS (See Plate 27).

Mention was made in the introduction of the fact that the inflated tissue on either side of the mid rib of the outer tepals is transversely rugose in the entity spiralis and smooth or undulating in the entity herrei.

This rugosity in the entity spiralis is very marked indeed, taking the form of transverse wrinkles, but in herbarium specimens, however, it is sometimes difficult to distinguish perianths of this entity from specimens of the entity herrei when the swollen part of the tepal is undulating in appearance in the latter.

Three types of perianth inflation were observed in the entity herrei. (See Fig. 60). In the first and second types the base of the perianth tube is either the same diameter as or slightly smaller than the middle diameter of the perianth tube. In the first type, (A. in the diagram), the inflations are very slightly undulating, while in the second type, (B. in the diagram), the inflations are smooth. In the third type, (C. in the diagram), the base of the perianth is larger than the middle of the tube and the inflations are very marked and smooth. In no instance, however, is the perianth of the entity herrei as wrinkled as that of the entity spiralis.

All three types of perianth were found in both populations of the entity herrei and their frequency is given in Table 90.

The colour of the perianth in both entities is very similar. The midribs of the tepals are greenish, often with a beige tinge, while the inflated tissue on either side is white and the lobes are a clear yellow, which may be bright or pale, but is never cream or white.

Position of lobes in the open flower. (See Fig. 61)

This is very similar in the two entities. In most cases, the anterior outer lobe is at an angle of $30 - 60^{\circ}$, and the outer laterals and inner petals are at an angle of 30° or less.

Dimensions of lobes. (See Fig. 61)

The outer and inner lobes of the entity spiralis tend to be narrower than those of the entity herrei, being in most cases

Fig.60. Variation in shape of perianth tube in the entity herrei.

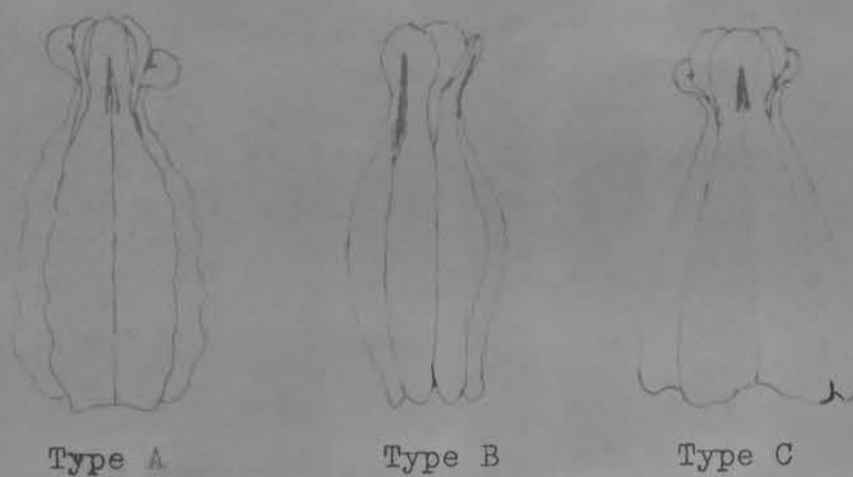
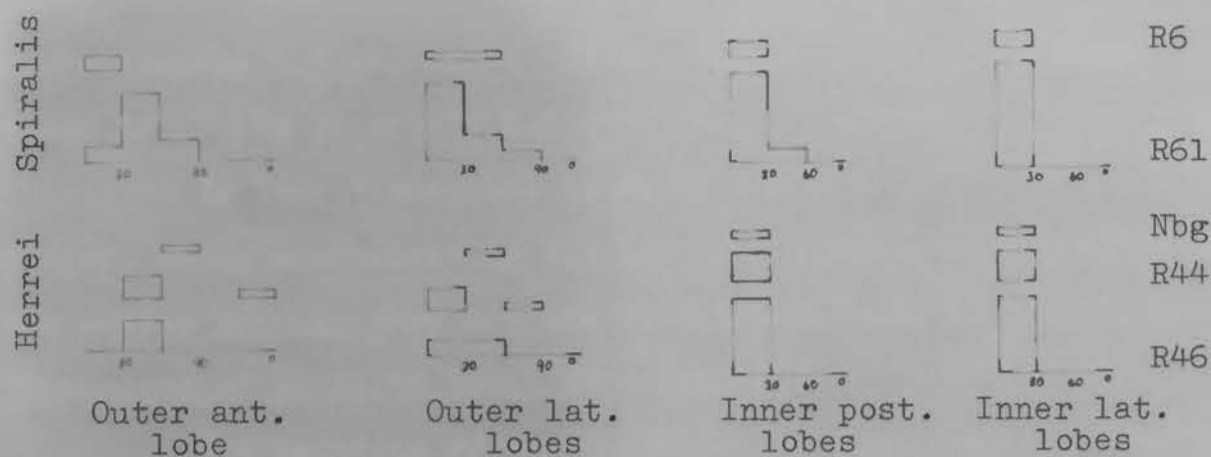


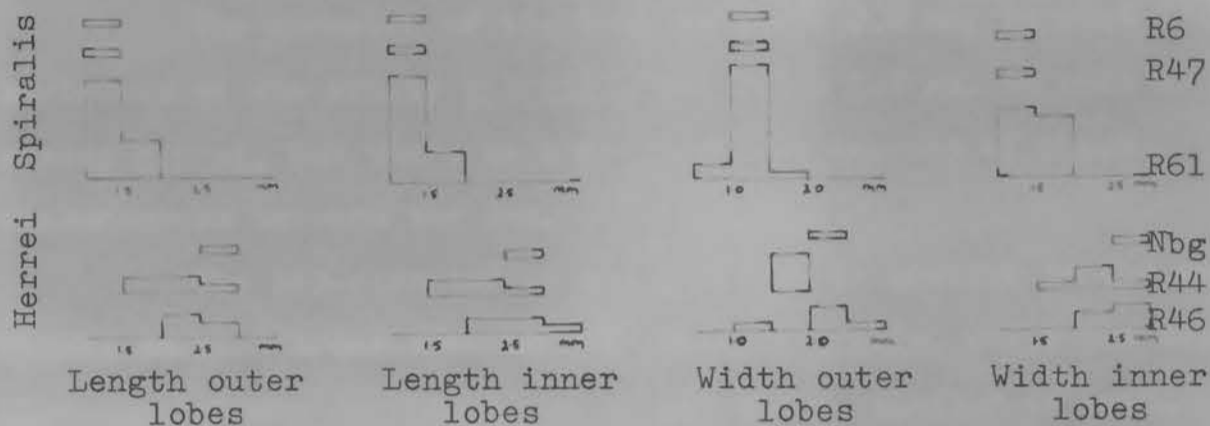
Table 90 Frequency of occurrence of perianth types in two population samples of the entity herrei.

Locality	Type of perianth			Total number individuals
	A	B	C	
Hoekplaas R44	2	2	1	5
Prince Albert R46	4	2	1	7

POSITION OF LOBES IN OPEN FLOWER



DIMENSIONS OF PERIANTH LOBES



DIMENSIONS OF PERIANTH TUBE

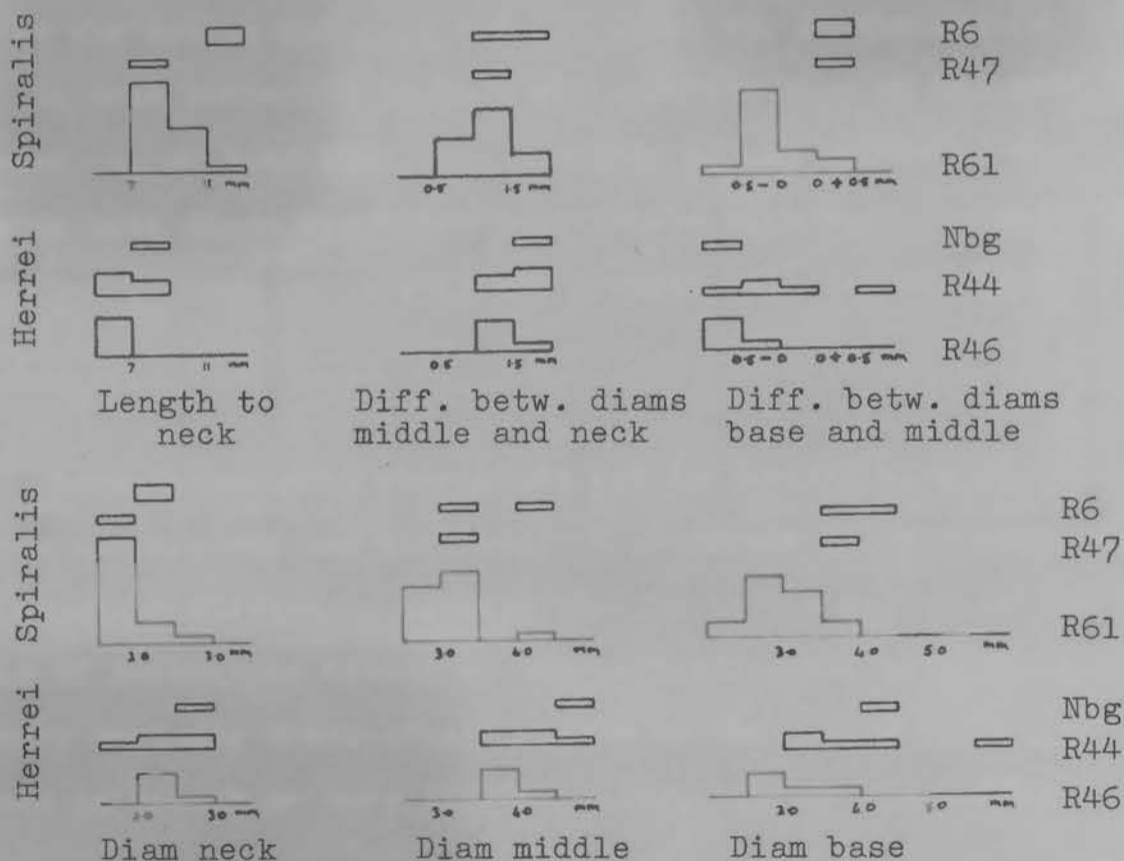


Fig.61. Variation in perianth characters in the entities spiralis and herrei.

approximately 1.5 mm. wide. In the entity herrei, the outer and inner lobes are generally 1.5 - 3.0 mm. in width.

In length too, the lobes of the entity spiralis tend to differ, being approximately 1.5 mm. long in most cases, while in the entity herrei, they are mostly 1.5 - 3.0 mm. in length.

Dimensions of perianth tube (See Fig. 61)

The majority of specimens of the entity herrei tend to have shorter perianth tubes than those of the entity spiralis.

The diameter of the neck is 1.5 - 2.0 mm. in most perianths of the entity spiralis, and 2.0 - 3.0 mm. in most of the entity herrei, but there is a considerable overlap of these measurements between the two.

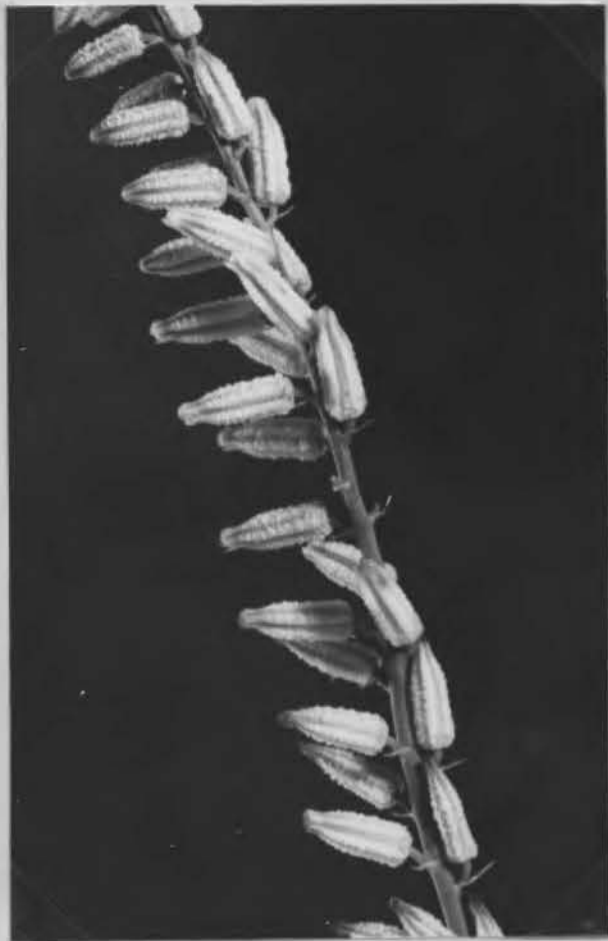
The mid-diameter of the perianth is greater in the entity herrei in most cases than in the entity spiralis, while the basal diameter is more variable, but on the whole, similar in both.

The difference between the diameter of the neck and the diameter of the middle of the perianth ranges from 0.5 - 2.0 mm. in the entity spiralis and 1.0 - 2.5 mm. in the entity herrei. In most perianths in both entities the base of the tube is the same as, or less than, the diameter of the middle of the tube and in both there are a few individuals with perianth tubes in which the basal diameter is slightly greater than the middle diameter.

Summary

Certain perianth characters are indicative of a difference between the two entities. A character which appears to show an absolute difference between the two is the nature of the inflation of parenchyma tissue of the perianth tube, this being always very markedly transversely rugose in the entity spiralis, as opposed to smooth or very slightly undulating in the entity herrei.

Other characters in which the entity herrei differs from the entity spiralis, but not completely, are the shorter tubes, the larger perianth lobes and the broader middle diameter of the perianth tube found in the majority of individuals.



Portion of an inflorescence of a specimen of the entity spiralis (X 1 approx.)



Types of perianth found in the entity herrei: in these examples the inflated tissue of the perianth tube is smooth.



A specimen of the entity herrei in which the tissue inflation of the perianth tube is undulating. As the flower withers, this tissue becomes flaccid and more wrinkled in appearance as seen in the flower on the right.

CHROMOSOME NUMBER

As has been mentioned, root squashes of plants of the entity spiralis gave a somatic chromosome count of $2n = 28$, while in root squashes of plants of the entity herrei the somatic number was $2n = 14$. Unfortunately it has not yet been possible to examine the meiotic behaviour in Pollen Mother Cell chromosomes of the entity spiralis to determine whether or not the plant is an auto- or an alle-polyploid.

CONCLUSION

In conclusion then, although the entities spiralis and herrei have in common the inflation of the outer tepals of the perianth, and have very similar inflorescence characters, their continued recognition as two distinct species seems justified, primarily on grounds of difference in chromosome number and on the difference in appearance of the inflated part of the perianth, this being far more rugose in the entity spiralis. Other characters in which the two differ, but which are more difficult to assess are the greater size and closer proximity to the epidermis of the bundle caps, and the more acuminate nature of the leaf apex in the entity herrei.

Accordingly these two entities are still referred to as Astroloba spiralis (L) Uitew. and Astroloba herrei Uitew.

A N I N T E R G E N E R I C H Y B R I D

between

ASTROLOBA RUGOSA AND HAWORTHIA MARGARITIFERA.

Haworth in his Supplementum of 1819 listed Apicra aspera, accompanied by the same description as in his Synopsis (1812), and two varieties thereof, α minor and β , "nearly twice as large". Following his account of this species is a description of a new species of Apicra - Apicra bicarinata with "cordate leaves with two keels ... scattered raised dark green tubercles on the under-surface and margins and keels frequently roughly tuberculata". There is no note as to the origin of this species, but there is a comment that this species is very similar to A.aspera, ("priori simillima..."), but nearly three times the size.

The account of leaf variation in populations of the species now referred to by the present author as A.rugosa showed that in all specimens, with one exception, leaf length ranged from 1.5 - 2.5 cm. In individual populations, most specimens had leaves either 1.5 - 2.0 cm, or 1.5 - 2.5 cm long.

The present author found a plant of unknown origin, labelled No. 7262, in the succulent collection at Kirstenbosch, with leaves 3.5 - 4.5 cm long, and numerous tubercles on the exposed part of the lower side, which did indeed resemble an enlarged specimen of A.rugosa. The flowers were actinomorphic and it seemed reasonable to recognise the plant as a specimen of A.bicarinata Haw.

There were also a number of herbarium specimens, (of which Hurling and Neil s.n., Nat. Bot. Gdns. 1942/28 (BOL) may be cited as representative), of plants resembling the plant No. 7262, collected by Hurling and Neil over several years from a locality four miles out of Montagu on the Baden road. These plants had been found growing with plants of A.rugosa and Haworthia margaritifera (L) Haw. Miss W. Barker, then working at the Bolus Herbarium, suggested that these plants were in fact hybrids between Haworthia margaritifera and Apicra aspera, as A.rugosa was then incorrectly known.

Subsequently the author found a number of plants which might be referred to as "bicarinata" in other succulent collections, all of unknown origin, save for specimens from Mr. H. Herre of Stellenbosch, which he said, he thought came from near Calitzdorp. To date, there are no known records of A.rugosa from this area. The author in a number of field trips in the area found only specimens of Astroloba spiralis (L.) Uitew. According to Mr. H. Hall of Kirstenbosch, the form Haworthia margaritifera which was found with A.rugosa and "bicarinata" is confined to the Western limits of the Little Karoo, and it has never been seen elsewhere by the present author.

A search of likely localities four miles out of Montagu on the Baden road, while producing numerous plants of A.rugosa, failed to reveal any plants of the suspected hybrid or Haworthia margaritifera.^{*} However, plants of A.rugosa, the suspected hybrid, and the form of Haworthia margaritifera concerned were found in the garden of a farmhouse in this area. The present owner did not know of their origins but it is indeed possible that they came from karoid areas nearby.

Eventually, thanks to the efforts of Mr. J. Stayner of the Karoo gardens, Worcester, plants of the putative hybrid and its suspected parents were found growing together near Montagu on a farm Rietvlei No. 2, in one of the dry karoid valleys running parallel to the Baden-Baden one. In all, two plants of "bicarinata" were discovered in the area, one growing under a bush closely associated with a clump of Astroloba rugosa, the other also under a bush, a foot away from a plant of Haworthia margaritifera. (See Plate 28.). Both A.rugosa and H.margaritifera were occasional under bushes in this area.

* Miss Barker described the plants of Haworthia as H.papillosa (Salm.) Haw., but they and similar plants have been identified by Mr. H. Hall of Kirstenbosch as H.margaritifera (L.) Haw. It seems to the present author that these two are probably a single species, but more field observations would be necessary to prove this. The nomenclature of the H.margaritifera complex is too confusing to allow the application of a varietal name to the plants concerned.



The Rietvlei No. 2 locality for the putative hybrid, X Astroworthia bicarinata. Above : Plants of X A. bicarinata growing next to plants of H. margaritifera; below : plants of X A. bicarinata growing next to plants of A. rugosa.

CYTOLOGICAL INVESTIGATION OF SUSPECTED HYBRID.

Root squashes of A.rugosa, H.margaritifera and of "bicarinata" plants from Riet Vlei No. 2, Mr. Malherbe of Robertson, and Kirstenbosch No. 7262, revealed in all cases, a haploid chromosome number of $n = 7$, with three short, and four long subterminal chromosomes, similar in appearance in all three. (See Plate 11).

Examination of chromosome pairing at metaphase of the first meiotic division in pollen mother cells showed complete pairing in the two preparations examined of A.rugosa from Rietvlei and H.margaritifera from the Kirstenbosch collection.

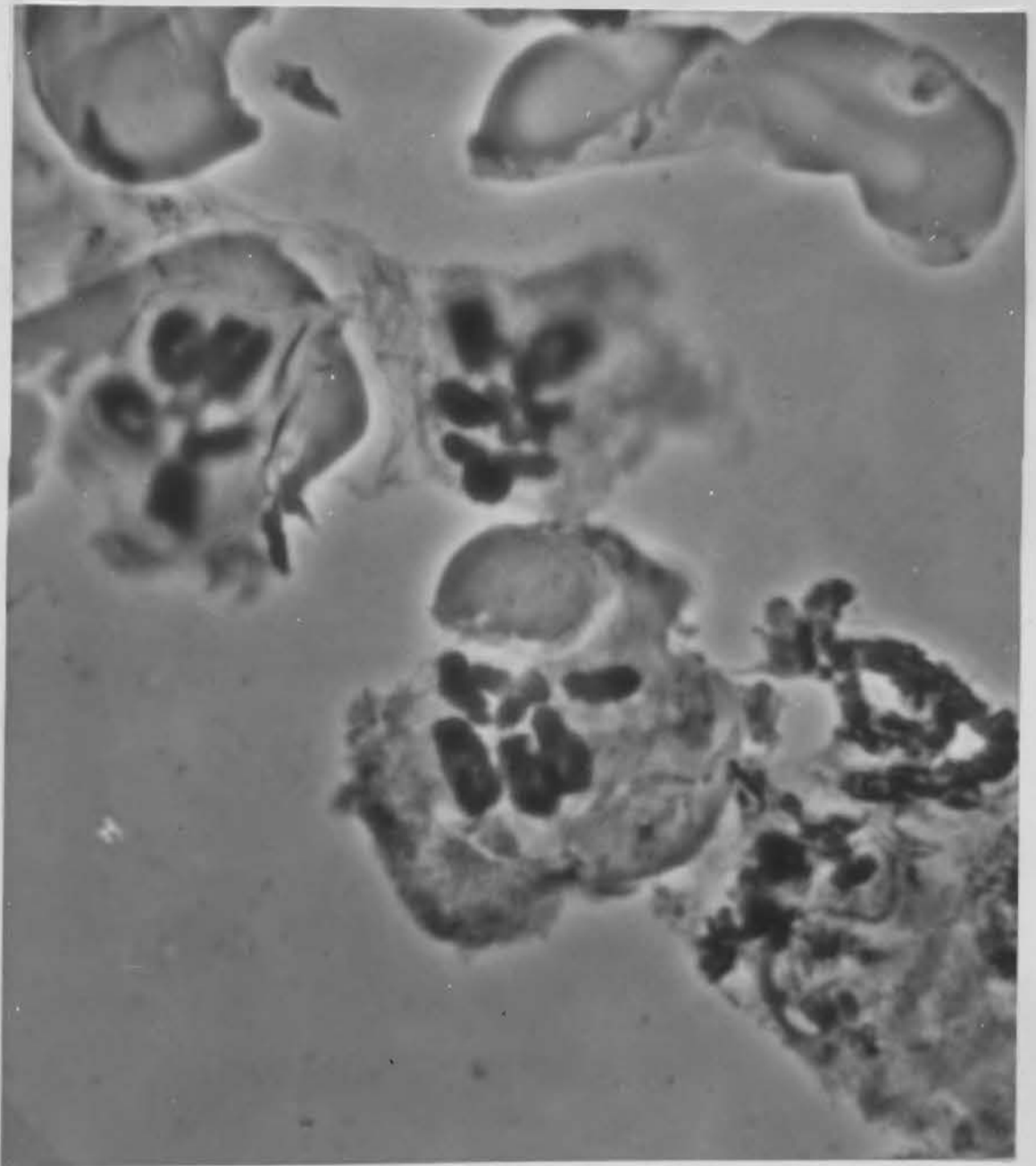
Pollen Mother Cell squashes from the "bicarinata" plant No. 7262 showed a complete lack of pairing between some of the long chromosomes in a few instances (See Plate 29 and Fig. 62). In one cell in which all long chromosomes showed complete pairing, there appeared to be lack of pairing between a pair of short chromosomes. Unfortunately at the time it was not possible to make a photographic record of this (See Fig. 63).

The number of cells in which the chromosome configurations were clearly visible at Metaphase I of meiosis in a P.M.C. squash of anthers from plant No. 7262, and the degree of lack of pairing is shown in Table 91.

Number of cells in which chromosome configuration visible at metaphase I	Complete pairing of chromosomes	Lack of pairing observed			Total no. cells in which incomplete pairing observed
		in one pair of short chromosomes	in one pair of long chromosomes	in two pairs of long chromosomes	
32	26	1	4	1	6

Table 91 SHOWING CHROMOSOME BEHAVIOUR IN METAPHASE I OF MEIOSIS IN P.M.C.'S OF "BICARINATA" No. 7262

In a preparation from the same inflorescence of slightly older anthers showing the end of Telophase I of meiosis, a number of cells had two large masses of nuclear material and one, rarely two, small masses of nuclear material. This was not seen at any stage in the



Pollen Mother cells of "bicarinata" plant No. 7262, at first Metaphase division of meiosis, one cell showing lack of pairing in one pair of long chromosomes.

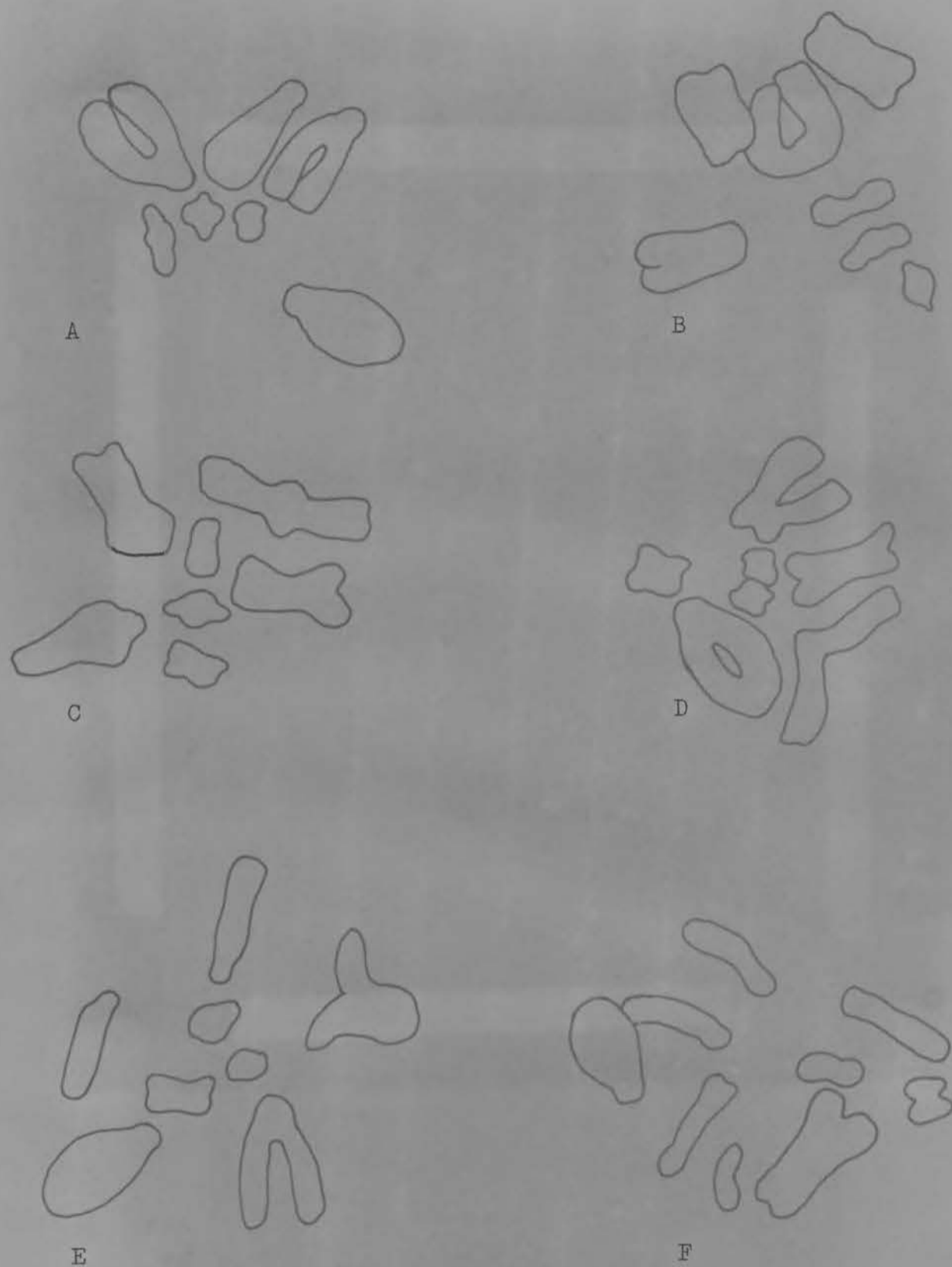


Fig.62. Showing chromosome configuration at first metaphase division of meiosis in pollen mother cells of "bicarinata" plant No. 7262. All chromosomes paired in A - D, two univalents in E, four univalents in F. In both cases, lack of pairing is in long chromosomes.

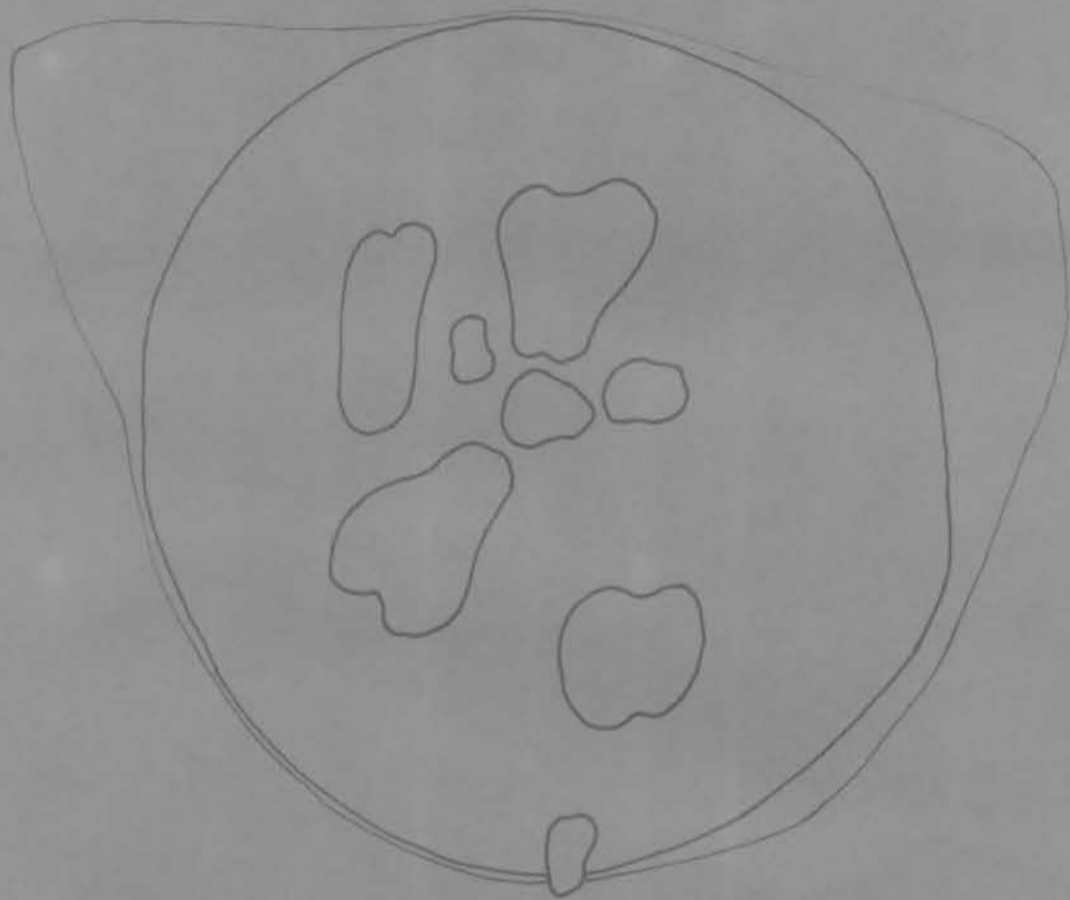


Fig.63. Pollen mother cell of "bicarinata" No. 7262 at first metaphase of meiosis, in which two short chromosomes appear as univalents.

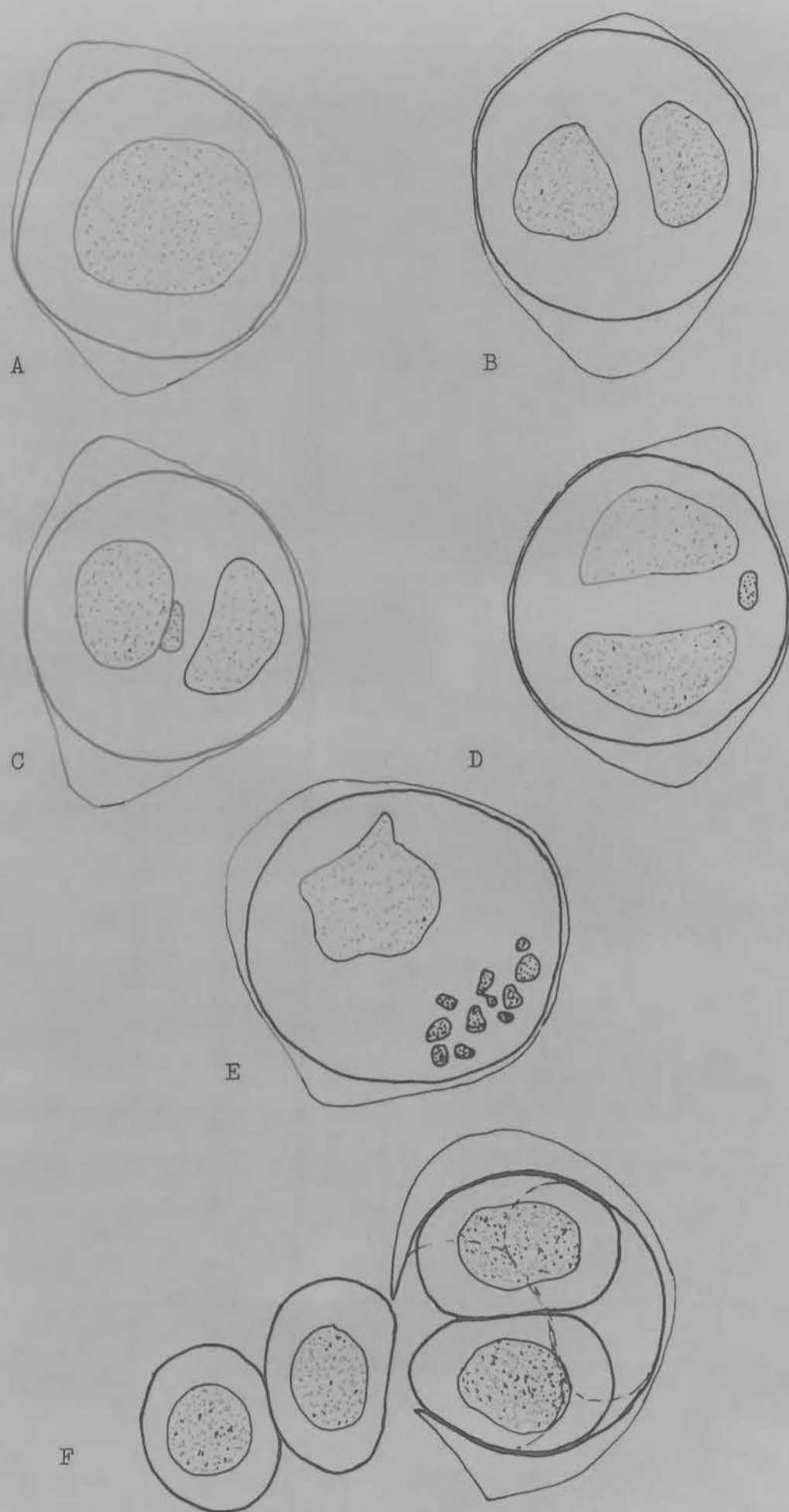


Fig.64. Pollen mother cells of "bicarinata" No. 7262.

A before first meiotic division; B at first telophase of meiosis; C and D at same stage, but with two nuclei and an additional mass of smaller nuclear material; E at same stage as B after colchicine treatment; F liberation of pollen grains.

division of P.M.C.'s in A.rugosa and H.margaritifera. It seems reasonable to suggest that these small masses of nuclear material arise as the result of lack of pairing of one or more pairs of chromosomes at meiotic metaphase I. (See Fig. 64).

Treatment with colchicine, where the anthers were placed in a 0.01% solution of colchicine for three hours before placing in fixative, resulted in P.M.C.'s with a varying number of masses of nuclear material of irregular size at the stage when Telophase I of meiosis should have been completed. (See Fig. 64).

In the only good preparation of anthers from flowers of plants of "bicarinata" from Rietvlei, the P.M.C.'s were found to be at the stage of Telophase I of meiosis. Again some cells were observed to have one or two small masses of nuclear material in addition to two large nuclei. This is taken as evidence of lack of pairing in at least one of the pairs of chromosomes in some of the P.M.C. cells of this plant too.

The occasional lack of pairing in Metaphase I of meiosis between certain complementary chromosomes is indicative of a slight dissimilarity in the two chromosome complements of a cell. Such evidence is contributory towards the determination of the hybrid origin of the plant in question. (See Goodspeed 1954).

Apart from the recreation of the hybrid, the above is the only direct evidence in favour of "bicarinata" being a hybrid.

A comparison of vegetative and inflorescence characters does provide circumstantial evidence in further support of this. Plants of unknown origin from various succulent collections are included in this comparison. In the text they are designated as follows:-

Kirstenbosch No. 7262;
 from the Karoo Gardens, R70;
 from Mr. B. Carp, R71;
 from Mr. Malherbe, R72; and
 from Mr. H. Herre, R73.

Locality	Class range of measurements.					Total no. indiv.	Range actual measurement
	<u>SPIRAL ANGLE. Class interval 10°</u>						
	0°	10°	20°	30°	40°		o
	<u>HAWORTHIA MARGARITIFERA</u>						
Rietvlei R50b	-	-	-	1	2	-	3 30 - 40
	<u>"ASTROWORTHIA BICARINATA."</u>						
Rietvlei R50	-	1	1	-	-	-	2 10 - 18
K'bosch 7262	-	-	-	-	-	-	-
Karoo Gdn's R70	-	1	-	-	-	-	1 8
Ex. B. Carp R71	-	-	1	-	-	-	1 13
Ex. Malherbe R72	-	-	-	-	-	Irreg.	1 Irregular
Ex. H. Heme R73	-	1	-	-	-	Irreg.	1 Irregular
	<u>ASTROLOBA RUGOSA</u>						
Rietvlei R50a	-	3	1	-	-	-	4 1 - 13
Montagu Area. R17,19,20, 23.	1	10	3	2	-	-	16 0 - 25
	<u>ANGLE OF LEAF WITH STEM. Class interval 20°</u>						
	30°		50°				
	<u>HAWORTHIA MARGARITIFERA</u>						
Rietvlei R50b	3		-		-	3	20 - 30
	<u>"ASTROWORTHIA BICARINATA"</u>						
Rietvlei R50	-		3		-	3	40 - 50
Karoo Gdns R70	-		1		-	1	35 - 40
Ex B. Carp R71	1		-		-	1	25
Ex Malherbe R72	-		1		-	1	40
Ex H. Heme R73	-		2		-	2	30 - 50
	<u>ASTROLOBA RUGOSA</u>						
Rietvlei R50a	-		4		-	4	40 - 50
Montagu Area R17,19,20, 23	-		15		1	16	40 - 60

TABLE 92 Variation in spiral angle and angle of leaf with stem in field and garden specimens of H. margaritifera the suspected hybrid and A. rugosa.

Locality.	Class range of measurements.							Total no. indiv.	Range of measurements.
<u>Curvature of leaf apices*</u>									
	u			f				o	
<u>HAWORTHIA MARGARITIFERA</u>									
Rietvlei R50b	3			-				-	3 u
<u>"ASTROWORTHIA BICARINATA"</u>									
Rietvlei R50	-			2				-	2 f
Karoo Gdn's R70	1			-				-	1 u
Ex B. Carp R71	-			-				1	1 o
Ex Malherbe R72	-			1				-	1 f
Ex H. Heme R73	-			1				1	2 f - o
<u>ASTROLOBA RUGOSA</u>									
Rietvlei R50a	-			2				2	4 f - o
Montagu Area R17,19, 20,23	-			2				14	16 f - o
<u>Greatest width leaf. Class interval 0.25 cm.</u>									
	1.25	1.50	1.75	2.00	2.25	2.50	2.75		cm.
<u>HAWORTHIA MARGARITIFERA</u>									
Rietvlei R50b	-	-	1	-	1	1	-	-	3 1.6 - 2.0
<u>"ASTROWORTHIA BICARINATA"</u>									
Baden-Baden R58	-	-	2	-	-	-	-	-	2 1.7
Rietvlei R50	-	-	-	2	-	-	-	-	2 2.0
Hort K'bosch 7262	-	-	-	-	1	1	-	-	2 2.2 - 2.4
Karoo Gdn's R70	-	-	-	-	-	-	-	1	1 2.8
Ex B. Carp R71	-	-	-	-	1	-	-	-	1 2.1
Ex Malherbe R72	-	-	-	1	-	-	-	-	1 1.8
Ex H. Heme R73	-	-	-	1	1	-	-	-	2 2.0 - 2.2
<u>ASTROLOBA RUGOSA</u>									
Rietvlei R50a	1	2	1	-	-	-	-	-	4 1.2 - 1.4
Baden Rd R18	1	3	3	-	-	-	-	-	7 1.2 - 1.4
Montagu Area R17,19, 20,23	2	17	7	1	-	-	-	-	27 1.1 - 1.3

TABLE 93. Variation in Curvature of leaf apices and greatest leaf width in field and garden specimens of H. margaritifera, the suspected hybrid and A. rugosa.

*(u = leaf apices curving upward, f = leaf apices following the angle of the leaf with the stem, o = leaf apices curving outward.)

Total no. Range actual indiv. measurements.

Locality. Class range of measurements.

Leaf length. Class interval 0.50 cm.

Locality	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	cm.	Total no. indiv.	Range actual measurements.
Rietvlei R50b	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	5.3 - 9.0	3	
	<u>HAWORTHIA MARGARITIFERA</u>																	
	"ASTROWORTHIA BICARINATA"																	
Baden-Baden R58	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	3.9 - 4.0	2	
Rietvlei R50	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	3.5 - 4.6	2	
Hort. K'bosch 7262	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	3.7 - 4.5	2	
Karoo Gdn's R70	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	5.1	1	
Ex B. Carp R71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.3	1	
Ex Malherbe R72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.4	1	
Ex H. Heme R73	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	3.9 - 4.6	2	
	<u>ASTROLOBA RUGOSA</u>																	
Rietvlei R50a	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0 - 2.4	4	
Baden Rd. R18	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7 - 2.2	7	
Montagu Area R17,19,20,23	1	18	8	-	-	-	-	-	-	-	-	-	-	-	-	1.4 - 2.5	27	

Length-breadth ratio. Class interval 0.25 cm.

Locality	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	Total no. indiv.	Range actual measurements.
Rietvlei R50b	-	-	-	-	-	-	1	-	-	-	1	-	3	2.70 - 3.96
	<u>HAWORTHIA MARGARITIFERA</u>													
	"ASTROWORTHIA BICARINATA"													
Baden-Baden R58	-	-	-	-	-	1	-	-	-	-	-	-	2	2.29 - 2.59
Rietvlei R50	-	-	1	-	-	-	-	-	-	-	-	-	2	1.75 - 2.28
Hort K'bosch 7262	-	-	1	-	-	-	-	-	-	-	-	-	2	1.68 - 1.96
Karoo Gdn's R70	-	-	-	-	-	-	-	-	-	-	-	-	1	1.82
Ex B. Carp R71	-	-	-	-	-	-	-	-	-	-	-	-	1	1.56
Ex Malherbe R72	-	-	-	-	-	-	-	-	-	-	-	-	1	1.89
Ex H. Heme R73	-	-	-	-	1	-	-	-	-	-	-	-	2	1.95 - 2.24
	<u>ASTROLOBA RUGOSA</u>													
Rietvlei R50a	1	2	3	2	1	-	-	-	-	-	-	-	4	1.43 - 1.83
Baden-Baden R18	-	-	-	-	-	-	-	-	-	-	-	-	7	1.06 - 1.67
Montagu Area R17,19,20,23	-	7	12	8	-	-	-	-	-	-	-	-	27	

Locality.	Class range of measurements.											Total no. indiv.	Range actual measurements.	
	Above	0	0	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00			2.25
Rietvlei R50b	-	-	-	-	-	-	1	-	1	-	-	1	3	1.2bel - 2.5 bel
	<u>HAWORTHIA MARGARITIFERA</u>													
	<u>"ASTROWORTHIA BICARINATA"</u>													
Baden-Baden R58	-	-	-	-	1	-	-	-	-	-	-	-	2	0.7bel - 0.8bel
Rietvlei R50	-	-	-	1	1	-	-	-	-	-	-	-	2	0.3bel - 0.6bel
Hort K'bosch 7262	-	-	-	2	-	-	-	-	-	-	-	-	2	0.5bel
Karoo Gdn's R70	-	-	-	-	1	-	-	-	-	-	-	-	1	0.7bel
Ex B. Carp. R71	-	-	-	-	-	-	-	-	-	-	-	-	1	0.1bel
Ex. Malherbe R72	-	-	-	-	-	-	-	-	-	-	-	-	1	0.1bel
Ex H. Heme R73	-	-	-	-	2	-	-	-	-	-	-	-	2	0.7bel - 0.6bel
	<u>ASTROLOBA RUGOSA.</u>													
Rietvlei R50a	-	2	2	-	-	-	-	-	-	-	-	-	4	0.0 - 0.1bel
Baden Rd. R18	3	3	1	-	-	-	-	-	-	-	-	-	7	0.1 ab - 0.1bel
Montagu Area R17,19,20,23	7	10	9	1	-	-	-	-	-	-	-	-	27	0.1 ab - 0.3bel

Class interval 0.25 cm.

TABLE 95 Variation in position of widest part of leaf in relation to mid length in field and garden specimens of H. margaritifera, the suspected hybrid and A. rugosa.
(ab = above midlength, bel = below midlength).



B X $\frac{3}{4}$



A X $1\frac{1}{4}$



C X 1

Leafy shoots of *A. rugosa* (A); *Astroworthia bicarinata* (B) and *H. margaritifera* (C) (Scales approximate).

Locality.	Class range of measurements.			Total no. indiv.	Range actual measurements	cm.
	.05	.10	.15			
	<u>HAWORTHIA MARGARITIFERA</u>					
Rietvlei R50b	-	1	2	3	.10	-
	<u>"ASTROWORTHIA BICARINATA"</u>					
Baden-Baden R58	-	2	-	2	.10	-
Rietvlei R50	-	2	-	2	.08	-
Hort. K'bosch 7262	-	1	1	2	.08	-
Karoo Gdn's R70	-	1	-	1	.09	-
Ex B. Carp. R71	1	-	-	1	.03	-
Ex Malherbe R72	-	1	-	1	.07	-
Ex H. Heme R73	-	2	-	2	.08	-
	<u>ASTROLOBA RUGOSA</u>					
Rietvlei R50a	3	1	-	4	.05	-
Baden Rd. R18	3	4	-	7	.04	-
Montagu Area R17,19,20,23	13	13	-	26	.04	-

Class interval 0.05 cm.

Table 96 VARIATION IN MUCRO LENGTH IN FIELD AND GARDEN SPECIMENS OF H. MARGARITIFERA, THE SUSPECTED HYBRID, AND A. RUGOSA.

COMPARISON OF VEGETATIVE CHARACTERS. (See Plates 30 and 31).

In growth habit, plants of H.margaritifera are acaulescent, the leaves forming a five farious rosette, while in both A.rugosa, as is typical in the genus Astroloba, and in "bicarinata" the plants are caulescent.

Leaf arrangement. (See Tables 92, 93)

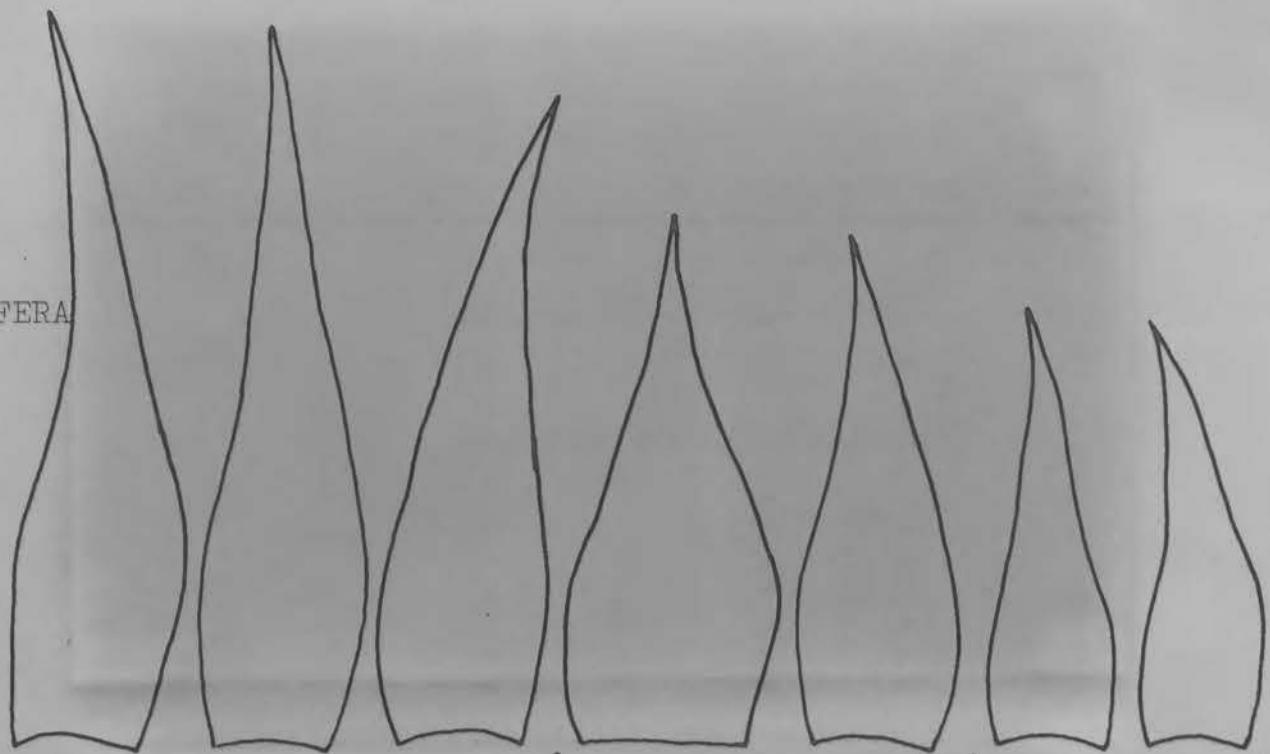
H.margaritifera has somewhat imbricate, erect leaves, the apices of which curve upward, while A.rugosa has leaves more regularly five ranked and sub-erect, the apices of which follow the angle of the leaf with the stem, or, more frequently, curve outwards slightly. In "bicarinata", the spiral angle is $0 - 20^{\circ}$, the leaves are sub-erect in all cases save in R71, where they are erect, and the leaf apices follow the angle of the leaf or curve outward, except in R70, where they curve upward.

Leaf size and shape. (See Tables 93, 94, 95 and 96, and Plate 65)

H.margaritifera has leaves varying in length from 5 to 9 cm, and in width from 1.50 - 2.50 cm, while in A.rugosa, leaf length varies from 1.5 - 2.5 cm, and leaf width from 1.25 - 1.75 cm, being 1.25 - 1.50 cm in most cases. In "bicarinata", leaf length is

HAWORTHIA
MARGARITIFERA

R50B

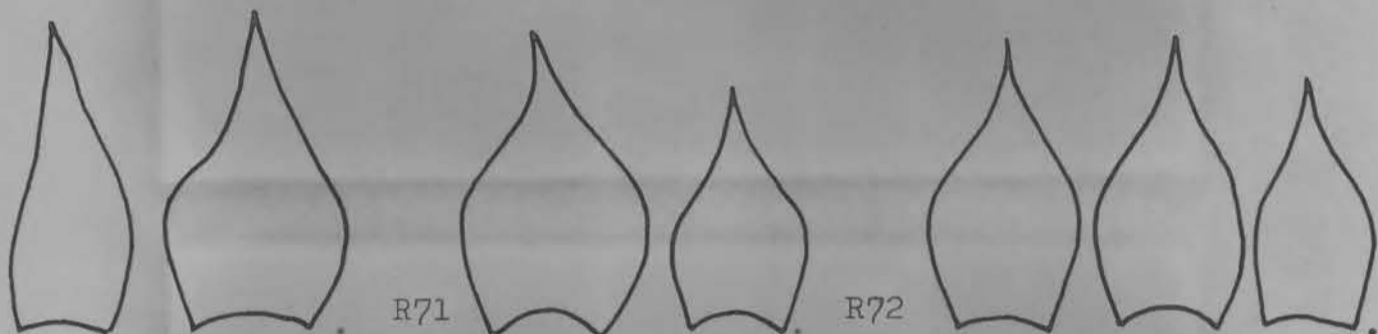
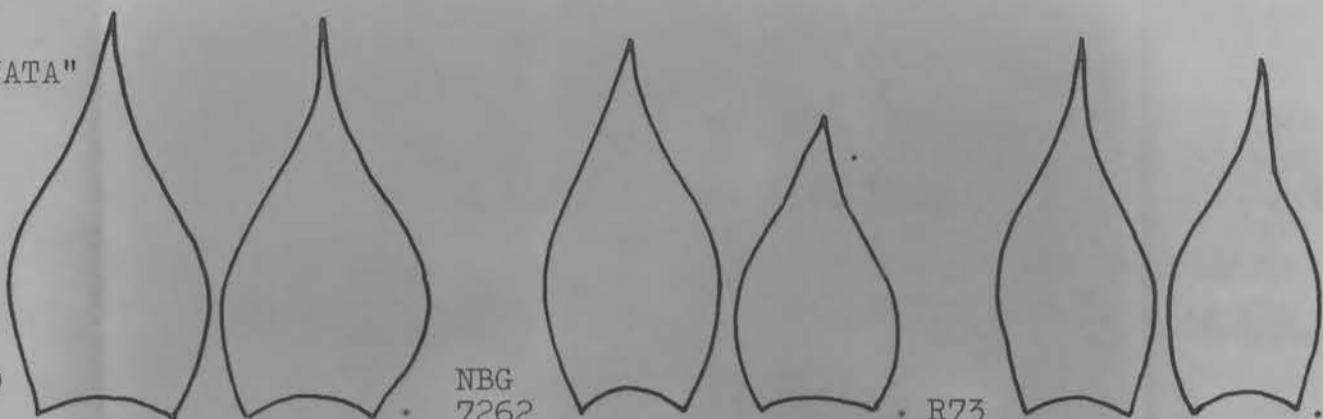


"BICARINATA"

R70

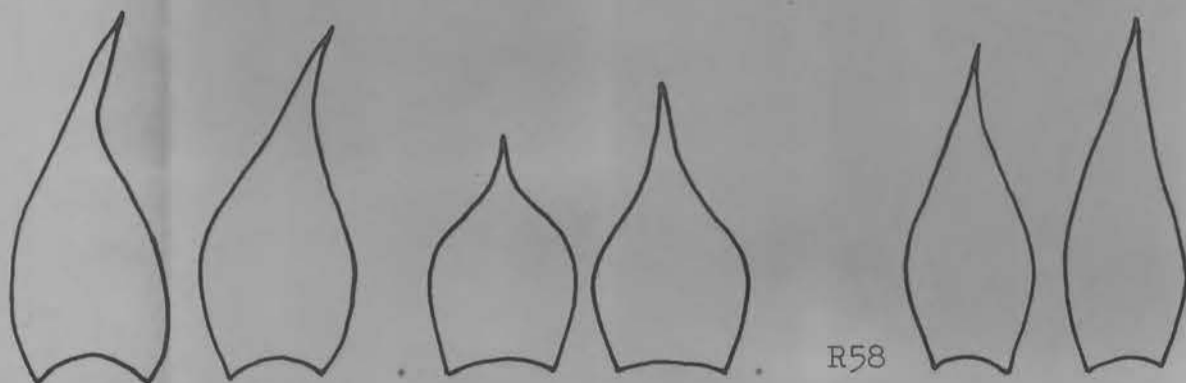
NBG
7262

R73



R50

R58



ASTROLOBA
RUGOSA

R50A

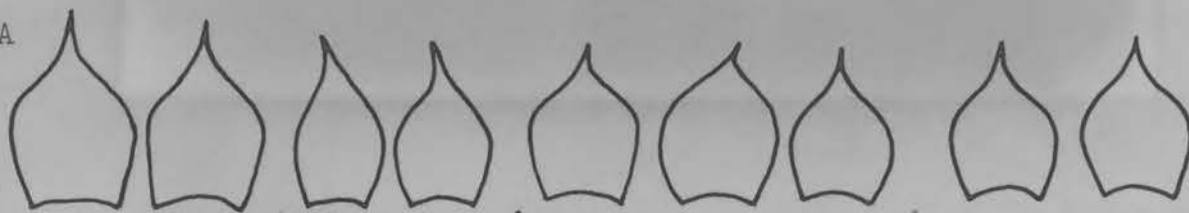


Fig.65. Variation in leaf shape in *Haworthia margaritifera*, "*bicarinata*", and *Astroloba rugosa*. (Sheathing part of leaf base excluded, dots indicate the number of leaves shown for each plant.)



A X 1½



B X 1



C X 1

A : Comparison of leaves of X Astroworthia bicarinata with leaf of A. rugosa (on right). Note double keel in right hand leaf of X A. bicarinata. B : Range of leaves in H. margaritifera; C : Range of leaves in X A. bicarinata. All leaves seen in ventral view.

3.0 - 5.0 cm, leaf width 1.50 - 3.0 cm. The narrowest leaves are thus found in H.margaritifera, with a length-breadth ratio of 2.50 - 4.00 in the specimens observed, while those of A.rugosa are considerably broader, with a length-breadth ratio of 1.00 - 1.75 in the great majority of cases. Length-breadth ratios in "bicarinata" range from 1.50 - 2.75.

The widest part of the leaf is 1.00 - 2.50 cm below the longitudinal half-way mark in H.margaritifera, and at the half-way mark or a few mm. above or below it in A.rugosa. In "bicarinata", the widest part of the leaf is at the half-way mark or up to 1.00 cm. below it.

The longest mucros are found in H.margaritifera, where in the specimens observed, they range from .10 - .13 cm in length. In A.rugosa, measurements range from .04 - .08 cm, while in "bicarinata" mucros range in length from .03 - .12 cm.

Thus in leaf arrangement and in the dimensions of the leaves, "bicarinata" is intermediate in character to H.margaritifera and A.rugosa.

Leaf Tubercles. (See Tables 97 and 98)

The largest and most prominent tubercles from the undersides of the leaves are found in H.margaritifera, where in diameter they range from 0.9 - 2.1 mm, and in height from 0.7 - 1.5 mm. In A.rugosa tubercle diameter and tubercle height both range from 0.1 - 0.3 mm. In "bicarinata", tubercles from the lower sides of the leaves vary from 0.1 - 0.7 mm in height, and from 0.3 - 0.5 in diameter, with the exception of No. 7262, which has the smallest, least prominent tubercles, (0.1 - 0.3 mm high and 0.1 - 0.3 mm wide), and R73, where the tubercle diameter ranges from 0.1 - 0.7 mm.

There is a slight tendency for the tubercles of the margins and keels to be smaller and less prominent, but the pattern of variation for all three is on the whole the same.

In H.margaritifera, the tubercles may be fairly evenly scattered, several sometimes merging together to form a larger compound tubercle of irregular shape, or they may be aggregated into transverse bands, 2.0 - 4.0 mm apart. These bands are not very well defined. The

Locality.	Class range of measurements.								Total no. plants.
	0.1	0.3	0.5	0.7	0.9	1.1	1.3	1.5	
<u>Tubercles from underside of leaf.</u>									
<u>HAWORTHIA MARGARITIFERA.</u>									
Rietvlei R50b	-	-	-	-	2	3	2	2	3
<u>"ASTROWORTHIA BICARINATA"</u>									
Rietvlei R50	-	-	2	-	-	-	-	-	2
Hort. K'bosch No.7262	-	2	-	-	-	-	-	-	2
Karoo Gdns. R70	-	-	1	-	-	-	-	-	1
Ex. B. Carp R71	-	-	1	-	-	-	-	-	1
Ex. Malherbe R72	-	-	1	-	-	-	-	-	1
Ex. H. Herre R73	-	1	1	1	-	-	-	-	2
<u>ASTROLOBA RUGOSA.</u>									
Rietvlei R50a	-	4	-	-	-	-	-	-	4
Baden Rd. R18	-	7	-	-	-	-	-	-	7
Montagu dist. R17,19, 20,23	-	27	-	-	-	-	-	-	27
<u>Tubercles of margins and keels.</u>									
<u>HAWORTHIA MARGARITIFERA.</u>									
Rietvlei R50b	-	-	-	1	3	2	1	-	3
<u>"ASTROWORTHIA BICARINATA"</u>									
Rietvlei R50	-	-	2	-	-	-	-	-	2
Hort K'bosch No.7262	1	1	-	-	-	-	-	-	2
Karoo Gdns R70	-	-	1	-	-	-	-	-	1
Ex. B. Carp R71	-	-	1	-	-	-	-	-	1
Ex. Malherbe R72	-	1	-	-	-	-	-	-	1
Ex. H. Herre R73	-	2	-	-	-	-	-	-	2
<u>ASTROLOBA RUGOSA.</u>									
Rietvlei R50a	1	3	-	-	-	-	-	-	4
Baden Rd. R18	1	6	-	-	-	-	-	-	7
Montagu dist. R17,19, 20,23	10	17	3	-	-	-	-	-	27

Class interval 0.20 mm.

Table 97 VARIATION IN HEIGHT OF TUBERCLES IN H. MARGARITIFERA,
THE SUSPECTED HYBRID AND A. RUGOSA.

(These Tables compiled in the same way as in the A. foliolosa).
complex.

Locality.	Class range of measurements.											Total no. plants.
	0.1	0.3	0.5	0.7	0.9	1.1	1.3	1.5	1.7	1.9	2.1	
Rietvlei R50b Rietvlei R50b	-	-	-	-	-	3	2	1	1	1	1	3
Rietvlei R50 Hort. K'bosch No. 7262 Karoo Gdns R70 Ex. B. Carp R71 Ex. Malherbe R72 Ex. H. Herre R73	-	2	1	1	1	1	1	-	-	-	-	2 2 1 1 1 2
Rietvlei R50a Baden Rd. R18 Montagu Dist R17,19,20,23	1	4	7	27	-	-	-	-	-	-	-	4 7 27
Rietvlei R50b	-	-	-	-	1	3	1	1	1	1	1	3
Rietvlei R50 Hort. K'bosch No. 7262 Karoo Gdns. R70 Ex. B. Carp R71 Ex. Malherbe R72 Ex. H. Herre R73	-	1	1	1	1	1	1	1	1	1	1	2 2 1 1 1 2
Rietvlei R50a Baden Rd. R18 Montagu Dist. R17,19,20,23	1	4	7	25	-	-	-	-	-	-	-	4 7 25

Tubercles from underside of leaf.

HAWORTHIA MARGARITIFERA.

"ASTROWORTHIA BICARINATA."

ASTROLOBA RUGOSA.

Tubercles of margins and keels.

HAWORTHIA MARGARITIFERA.

"ASTROWORTHIA BICARINATA."

ASTROLOBA RUGOSA.

Class interval 0.2 mm.

TABLE 98 Variation in diameter of tubercles in H. Margaritifera, the suspected hybrid, and A. RUGOSA.

tubercles of the margins and keels are not smooth round protuberances, often having the appearance of a molar tooth.

In A.rugosa, as has been mentioned, the tubercles are fairly evenly distributed, ranging in density from about 5 per sq. 4 mm to 30 per sq. 4 mm, and tending to be arranged in poorly defined longitudinal groups of up to 6 tubercles.

In "bicarinata", the tubercles are also fairly evenly distributed, sometimes a few are aggregated into small irregularly shaped groups, and in some specimens, into longitudinal groups of up to 6 tubercles. Occasionally in both A.rugosa and "bicarinata", a few tubercles occur on the dorsal side of the leaf.

Thus in the nature of the leaf tubercles too, plants of "bicarinata" are intermediate in character between A.rugosa and H.margaritifera.

At this stage a comment on the epithet "bicarinata" is in place. Mention has been made elsewhere that in any one entity of the genus Astroloba, a few plants may be found with two keels on the underside of the leaf. This is no less the case in "bicarinata", where some double keeled leaves were observed on the shoots of No. 7262. In heavily tubercled leaves such as found in H.margaritifera and "bicarinata", the keel is not always apparent. Because it describes a condition by no means always present the name "bicarinata" is somewhat misleading.

In colour, the leaves of H.margaritifera and "bicarinata" are similar to those of A.rugosa, but the tubercles of H.margaritifera are always whitish, while in "bicarinata", they are more frequently concolorous or paler.

A note on leaf anatomy.

It has been mentioned that the outer walls of the epidermal cells from the upper part of the leaf are frequently papillate in A.rugosa. This is also the case in H.margaritifera and in "bicarinata". (See Fig. 8)

Summary.

From the foregoing it is clear that the vegetative characters of the plants referred to as "bicarinata" are intermediate between those of H.margaritifera and A.rugosa.

COMPARISON OF INFLORESCENCE CHARACTERS. (See Tables 99 - 106)

Pedicel and raceme lengths, and numbers of sterile bracts per peduncle, are very similar in all three, but, while no specimens of A.rugosa were found with branched inflorescences or unexpanded axillary raceme buds, all inflorescences examined of H.margaritifera were branched. In this connection it is of interest to note that in some specimens of H.margaritifera the axillary racemes branched again. All plants of "bicarinata" had branched inflorescences, or if not, unexpanded raceme buds in the axils of the sterile bracts.

The stoutest peduncles, 0.45 - 1.00 cm in diameter, at the base and 0.20 - 0.40 cm below the main raceme, are found in H.margaritifera. In A.rugosa, most of the Montagu specimens are 0.30 mm or less wide at the base, (with the exception of those from Baden-Baden, half of which are 0.30 - 0.45 cm in width), while the diameter of the peduncle below the raceme ranges from 0.10 - 0.30 cm, being 0.10 - 0.20 cm in most cases. In "bicarinata", peduncle bases range from 0.30 - 0.75 cm in width, while the diameter below the raceme is 0.10 - 0.30 cm with the exception of half the peduncles of No. 7262, which are thicker.

The length of the lowest sterile bract ranges from 0.6 - 1.0 cm, in all the H.margaritifera specimens examined, while most basal sterile bracts in A.rugosa are 0.40 - 0.6 cm. long. In the "bicarinata" inflorescences, basal sterile bract lengths of 0.40 - 1.05 cm are found, the longest occurring in No. 7262.

Basal fertile bract length ranges from 0.3 - 0.6 cm in H.margaritifera; from less than 0.3 to 0.5 cm, but with most bracts 0.3 - 0.4 cm long, in A.rugosa, and from less than 0.3 to 0.6 cm in all specimens of "bicarinata", except those of No. 7262, which are longer.

Sterile bracts with the greatest basal width tend to be found in inflorescences with the stoutest racemes, and in H.margaritifera, sterile bract bases range from 0.3 - 0.7 cm in width, while in "bicarinata" they are 0.2 - 0.7 cm wide, and in most inflorescences of A.rugosa, 0.2 - 0.3 cm wide.

Total no. Range actual indiv. measurements.

Class range of measurements.

Locality.	Peduncle length.										cm.		
	5	10	15	20	25	30	35	40	45	50			
Ex. Hort K'bosch	-	-	-	-	-	1	-	1	2	-	4	29	41
Baden-Baden R58	-	-	1	2	-	1	-	-	-	-	4	13	27
Rietvlei R50	-	-	2	-	1	1	-	-	-	-	4	14	27
Hort K'bosch 7262	-	-	-	2	3	1	-	1	-	-	7	19	36
Karoo Gdn's R70	-	-	1	-	1	-	-	-	-	-	2	12	24
Ex. B. Carp R71	-	-	-	1	1	-	-	-	-	-	2	19	25
Ex. H. Heme R73	-	-	-	1	1	1	-	-	-	-	4	17	33
Baden-Baden R59, 18, 17	-	-	1	3	8	3	3	-	-	-	18	14	34
Montagu Area R19, 20, 23, Nbg	-	-	4	3	9	4	1	-	-	-	22	12	43
Ex Hort K'bosch	-	-	1	1	-	-	-	1	-	-	3	14	38
Baden-Baden R58	-	-	3	3	2	-	-	-	-	-	5	17	23
Rietvlei R50	-	-	2	1	-	1	-	-	-	-	4	13	26
Hort K'bosch 7262	-	-	-	5	1	-	-	-	-	-	6	16	21
Karoo Gdn's R70	-	-	-	1	-	-	1	-	-	-	2	18	33
Ex. B. Carp R71	1	1	-	-	-	-	-	-	-	-	2	4	8
Ex. H. Heme R73	-	-	3	-	-	-	-	-	-	-	-	12	15
Baden-Baden R59, 18, 17	-	4	6	6	1	-	-	-	-	-	17	9	22
Montagu Area R19, 20, 23, Nbg	1	10	5	3	-	2	-	-	-	-	22	9	27

TABLE 99 Variation in peduncle and raceme length in field and garden specimens of H. margaritifera, the suspected hybrid, and A. rugosa.

Degree of Branching of Inflorescences.

Locality	Indivs. with one or more branches to inflorescences	Indivs. with no branches, but unexpanded raceme buds in axils of sterile bracts	Total no. indiv.
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HAWORTHIA MARGARITIFERA

Ex. Hort K'bosch	4	0	4
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"ASTROWORTHIA BICARINATA"

Baden-Baden R58	4	0	5
Rietvlei R50	2	2	4
Hort K'bosch 7262	2	3	8
Karoo G'dns	0	1	2
Ex. B. Carp	0	2	2
Ex. H. Heme	2	2	4

ASTROLOBA RUGOSA

Baden-Baden R59,18	0	0	19
Montagu Dist R17,19,20,23 Nbg	0	0	22

Number of Sterile bracts

Locality	Class range of numbers	Total no. indiv.	Range actual no. bracts.
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HAWORTHIA MARGARITIFERA

Ex. Hort K'bosch	- 2 2	4	3 - 5
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"ASTROWORTHIA BICARINATA"

Baden-Baden R58	- 4 1	5	3 - 5
Rietvlei R50	- 4 -	4	3 - 4
Hort K'bosch 7262	- 7 -	7	3 - 4
Karoo Gdn's	- 1 1	2	3 - 5
Ex. B. Carp	- 2 -	2	3 - 4
Ex. H. Heme	1 3 -	4	2 - 4

ASTROLOBA RUGOSA

Baden-Baden R59,18	6 13	19	2 - 4
Montagu dist. R17,19,20,23 nbg	5 17	22	2 - 4

TABLE 100 Variation in degree of branching and number of sterile bracts in field and garden specimens of H. margaritifera, the suspected hybrid, and A. rugosa.

Locality. Class range of measurements. Total no. Range actual indiv. measurements

Width of base of peduncle. Class interval 0.15 cm.

0.30 0.45 0.60 0.75 0.90 cm.

HAWORTHIA MARGARITIFERA

Ex. Hort K'bosch - 1 - 1 1 1 4 0.45 - 0.

"ASTROWORTHIA BICARINATA"

Baden-Baden R58 - - 3 1 - - 4 0.52 - 0.
 Rietvlei R50 - 3 1 - - - 4 0.36 - 0.
 Hort K'bosch 7262 - - 6 1 - - 7 0.47 - 0.
 Karoo Gdn's R70 - - 2 - - - 2 0.48 - 0.
 Ex. B. Carp R71 - 1 1 - - - 2 0.39 - 0.
 Ex. H. Herre R73 - 1 1 - - - 2 0.38 - 0.

ASTROLOBA RUGOSA

Baden-Baden R59,18,17 8 9 - - - - 17 0.22 - 0.
 Montagu Area R19,20,
 23 Nbg 19 3 - - - - 22 0.23 - 0.

Width of peduncle below main raceme. Class interval 0.10 cm.

0.10 0.20 0.30 0.40

HAWORTHIA MARGARITIFERA

Ex. Hort K'bosch - - 2 2 - - 4 0.27 - 0.

"ASTROWORTHIA BICARINATA"

Baden-Baden R58 - 4 2 - - - 2 0.16 - 0.
 Rietvlei R50 - - 4 - - - 4 0.22 - 0.
 Hort K'bosch 7262 - - 3 4 - - 7 0.25 - 0.
 Karoo Gdn's R70 - - 2 - - - 2 0.25 - 0.
 Ex. B. Carp R71 - - 2 - - - 2 0.21 - 0.
 Ex. H. Herre R73 - 2 2 - - - 4 0.20 - 0.

ASTROLOBA RUGOSA.

Baden-Baden R59,18,17 - 14 3 - - - 17 0.14 - 0.
 Montagu Area R19,20,
 23, Nbg - 14 8 - - - 22 0.14 - 0.

TABLE 101 Variation in thickness of peduncle in field and garden specimens of H. margaritifera, the suspected hybrid and A. rugosa.

Locality. Class range of measurements. Total no. Range act
indiv. measurements

Length basal sterile bract. Class interval 0.20 cm.

	0.4	0.6	0.8	1.0	1.2		cm.
<u>HAWORTHIA MARGARITIFERA</u>							
Ex. Hort K'bosch	-	-	2	2	-	-	4 0.70 - 0
<u>"ASTROWORTHIA BICARINATA"</u>							
Baden-Baden R58	-	1	4	-	-	-	5 0.60 - 0
Rietvlei R50	1	2	-	1	-	-	4 0.40 - 0
Hort. K'bosch 7262	-	-	1	5	1	-	7 0.80 - 1
Karoo Gdn's R70	-	1	-	-	-	-	1 0.47
Ex. B. Carp R71	-	2	-	-	-	-	2 0.60
Ex. H. Herre R73	-	1	2	1	-	-	2 0.53 - 0
<u>ASTROLOBA RUGOSA</u>							
Baden-Baden R59,18,17	1	7	-	-	-	-	8 0.40 - 0
Montagu Area R19,20, 23, Nbg	-	3	1	-	-	-	4 0.47 - 0

Length basal fertile bract. Class interval 0.10 cm.

	0.3	0.4	0.5	0.6	0.7	0.8	
<u>HAWORTHIA MARGARITIFERA</u>							
Ex. Hort K'bosch	-	1	2	1	-	-	4 0.34 - 0
<u>"ASTROWORTHIA BICARINATA"</u>							
Baden-Baden R58	-	2	4	-	-	-	6 0.36 - 0
Rietvlei R50	-	-	4	-	-	-	4 0.43 - 0
Hort K'bosch 7262	-	-	-	-	2	3	1 6 0.70 - 0
Karoo Gdn's R70	1	-	-	-	-	-	1 0.24
Ex. B. Carp. R71	-	2	-	-	-	-	2 0.33 - 0
Ex. H. Herre R73	-	-	2	2	-	-	4 0.43 - 0
<u>ASTROLOBA RUGOSA</u>							
Baden-Baden R59,18,17	7	10	2	-	-	-	19 0.30 - 0

TABLE 102 in
Variation-bract length in field and garden specimens
of H. margaritifera, the suspected hybrid and A. rugosa

Locality. Class range of measurements. Total no. indiv. Range actual measurements

Width base of basal sterile bract. Class interval 0.10 cm.

	0.2	0.3	0.4	0.5	0.6		cm.
<u>HAWORTHIA MARGARITIFERA.</u>							
Ex. Hort. K'bosch	-	-	1	1	1	1	4 0.40 - 0.70
<u>"ASTROWORTHIA BICARINATA"</u>							
Baden-Baden R58	-	1	2	1	1	-	5 0.28 - 0.60
Rietvlei R50	-	-	3	-	-	1	4 0.35 - 0.63
Hort. K'bosch 7262	-	-	-	2	2	3	7 0.46 - 0.70
Karoo Gdn's R70	-	-	1	-	-	-	1 0.35
Ex. B. Carp. R71	-	-	-	2	-	-	2 0.45
Ex. H. Herre R73	-	1	1	2	-	-	4 0.30 - 0.50
<u>ASTROLOBA RUGOSA</u>							
Baden-Baden R59,18,17	1	6	1	-	-	-	8 0.18 - 0.36
Montagu Area R19,20, 23, Nbg	1	3	-	-	-	-	4 0.20 - 0.27

Width base of basal fertile bract. Class interval 0.10 cm.

	<u>HAWORTHIA MARGARITIFERA</u>						cm.
Ex. Hort K'bosch	-	2	1	1	-	-	4 0.28 - 0.45
<u>"ASTROWORTHIA BICARINATA"</u>							
Baden-Baden R58	-	6	-	-	-	-	6 0.28 - 0.30
Rietvlei R50	-	2	1	1	-	-	4 0.30 - 0.43
Hort. K'bosch 7262	-	-	-	5	1	-	6 0.43 - 0.60
Karoo Gdn's R70	-	1	-	-	-	-	1 0.30
Ex. B. Carp. R71	-	-	2	-	-	-	2 0.38 - 0.40
Ex. H. Herre R73	-	1	3	-	-	-	4 0.30 - 0.35
<u>ASTROLOBA RUGOSA</u>							
Baden-Baden R59,18,17	4	6	-	-	-	-	10 0.20 - 0.25
Montagu Area R19,20, 23, Nbg	2	3	-	-	-	-	5 0.20 - 0.30

TABLE 103 Variation in basal width of bracts in field and garden specimens of H. margaritifera, the suspected hybrid and A. rugosa.

Locality	Class range of measurements.				Total no. indiv.	Range actual measurements
	.05	.10	.15	.20		
<u>Basal sterile bract.</u>						
	<u>HAWORTHIA MARGARITIFERA</u>					cm.
Ex. Hort K'bosch	-	2	-	-	2	0.07 - 0.08
<u>"ASTROWORTHIA BICARINATA"</u>						
Baden-Baden R58	-	-	-	3	3	0.18 - 0.20
Rietvlei R50	-	1	1	-	2	0.07 - 0.13
Hort K'bosch 7262	-	-	-	5	6	0.16 - 0.23
Karoo Gdn's R70	-	1	-	-	1	0.10
Ex. B. Carp R71	-	-	2	-	2	0.13 - 0.15
Ex. H. Heme R73	-	1	1	-	2	0.10 - 0.15
<u>ASTROLOBA RUGOSA</u>						
Baden-Baden R59,18,17	-	4	3	-	8	0.06 - 0.23
Montagu Area R19,20,23 Nbg	-	1	3	-	4	0.08 - 0.12
<u>Basal fertile bract.</u>						
<u>HAWORTHIA MARGARITIFERA</u>						
Ex. Hort K'bosch	1	1	-	-	2	0.05 - 0.07
<u>"ASTROWORTHIA BICARINATA"</u>						
Baden-Baden R58	-	-	1	3	4	0.15 - 0.20
Rietvlei R50	-	1	-	1	2	0.10 - 0.18
Hort K'bosch 7262	-	-	2	1	5	0.15 - 0.23
Karoo Gdns R70	-	1	-	-	1	0.10
Ex. B. Carp R71	-	-	-	2	2	0.16 - 0.17
Ex. H. Heme R73	-	-	2	-	2	0.12 - 0.13
<u>ASTROLOBA RUGOSA</u>						
Baden-Baden R59,18,17	-	7	3	-	10	0.07 - 0.12
Montagu Area R19,20,23 Nbg	-	2	3	-	5	0.08 - 0.13

TABLE 104 Variation in width of bracts taken half way along length of bract in field and garden specimens of H. margaritifera, the suspected hybrid and A. rugosa.

Locality.	Class range of measurements.						Total no. indiv.	Range actual measurements	
<u>Basal Sterile Bract.</u>									
	2	4	6	8	10	12			
<u>HAWORTHIA MARGARITIFERA</u>									
Ex. Hort. K'bosch	-	-	-	-	1	-	1	2	8.75 -12.14
<u>"ASTROWORTHIA BICARINATA"</u>									
Baden-Baden R58	-	2	1	-	-	-	-	3	3.33 - 4.16
Rietvlei R50	-	-	-	1	-	1	-	2	4.61 -11.85
Hort. K'bosch 7262	-	1	3	;	-	-	-	5	4.00 - 6.56
Karoo Gdn's R70	-	-	1	-	-	-	-	1	4.70
Ex. B. Carp R71	-	1	1	-	-	-	-	2	4.00 - 4.61
Ex. H. Herre R73	-	-	2	-	-	-	-	2	5.00 - 5.30
<u>ASTROLOBA RUGOSA</u>									
Baden-Baden R59,18,17	1	2	4	-	1	-	-	8	1.82 - 9.16
Montagu Area R19,20, 23, Nbg	-	-	4	-	-	-	-	4	4.33 - 5.87
<u>Basal Fertile Bract.</u>									
<u>HAWORTHIA MARGARITIFERA</u>									
Ex. Hort. K'bosch	-	-	-	-	2	-	-	2	8.57 -10.00
<u>"ASTROWORTHIA BICARINATA"</u>									
Baden-Baden R58	-	4	-	-	-	-	-	4	2.11 - 2.66
Rietvlei R50	-	1	1	-	-	-	-	2	2.72 - 4.50
Hort. K'bosch 7262	-	3	2	-	-	-	-	5	3.04 - 5.40
Karoo Gdn's R70	-	1	-	-	-	-	-	1	2.40
Ex. B. Carp. R71	1	1	-	-	-	-	-	2	1.94 - 2.18
Ex. H. Herre R73	-	2	-	-	-	-	-	-	
<u>ASTROLOBA RUGOSA</u>									
Baden-Baden R59,18,17	-	7	3	-	-	-	-	10	2.50 - 5.71
Montagu Area R19,20, 23 Nbg.	-	4	1	-	-	-	-	5	4.33 - 5.87

Class interval 0.20

TABLE 105 Variation in the length-breadth ratio of bracts in field and garden specimens of H. margaritifera, the suspected hybrid and A. rugosa.

Locality.	Class range of measurements.				Total no. indiv.	Range actual measurements
	0.2	0.4	0.6	0.8		
<u>Length flowering pedicel from base of raceme.</u>						
						cm.
<u>HAWORTHIA MARGARITIFERA</u>						
Ex. Hort K'bosch	-	1	2	-	3	0.32 - 0.6
<u>"ASTROWORTHIA BICARINATA"</u>						
Baden-Baden R58	-	-	3	-	4	0.48 - 0.9
Rietvlei R50	-	-	1	2	3	0.48 - 0.6
Hort. K'bosch 7262	-	6	-	-	6	0.30 - 0.4
Karoo Gdn's R70	-	-	2	-	2	0.45 - 0.5
Ex. B. Carp R71	-	-	2	-	2	0.45 - 0.4
Ex. H. Herre R73	-	1	2	1	4	0.39 - 0.6
<u>ASTROLOBA RUGOSA</u>						
Baden-Baden R59,18,17	-	2	9	7	18	0.40 - 0.8
Montagu Area R19,20, 23 Nbg.	-	3	9	7	19	0.32 - 0.8
<u>Length flowering pedicel from middle of raceme.</u>						
						cm.
<u>HAWORTHIA MARGARITIFERA</u>						
Ex. Hort. K'bosch	-	1	1	-	2	0.50 - 0.5
<u>"ASTROWORTHIA BICARINATA"</u>						
Baden-Baden R58	-	1	1	-	2	0.43 - 0.5
Rietvlei R50	-	3	1	-	4	0.32 - 0.5
Hort. K'bosch 7262	4	1	-	-	5	0.26 - 0.3
Karoo Gdn's R70	-	2	-	-	2	0.40 - 0.4
Ex. B. Carp. R71	-	2	-	-	2	0.38 - 0.4
Ex. H. Herre R73	-	3	-	-	3	0.37 - 0.4
<u>ASTROLOBA RUGOSA</u>						
Baden-Baden R59,18,17	1	11	3	-	16	0.30 - 0.9
Montagu Area R19,20, 23, Nbg.	2	13	2	1	18	0.30 - 0.7
<u>Length fruiting pedicel from base of raceme.</u>						
						cm.
<u>HAWORTHIA MARGARITIFERA</u>						
Ex. Hort. K'bosch	-	-	-	1	1	0.61
<u>"ASTROWORTHIA BICARINATA"</u>						
Baden-Baden R58	-	-	1	1	2	0.42 - 0.6
<u>ASTROLOBA RUGOSA</u>						
Baden-Baden R59,18, 7	-	-	-	-	1	0.89
Montagu Dist Nbg.	-	-	2	-	2	0.52 - 0.5

Class interval 0.20 cm.

TABLE 106 Variation in pedicel length in field and garden specimens of H. margaritifera, the suspected hybrid and A. rugosa.

There is less difference in the width of the base of the lowest fertile bract. This ranges from 0.2 - 0.5 in H.margaritifera, from 0.2 - 0.3 in A.rugosa and from 0.2 - 0.4 in all specimens of "bicarinata", except for a single specimen from Rietvlei, and all basal fertile bracts of No. 7262, which have a greater basal width.

With regard to the length-breadth ratios of the bracts, (the value for the breadth being taken half-way along the length of the bract), the samples for H.margaritifera are, unfortunately, small. In both specimens of this species, the length-breadth ratio of the lowest sterile and fertile bracts exceeds 8.0. In A.rugosa, the length-breadth ratio of the sterile bracts is somewhat variable, with a length-breadth ratio of 4.0 - 6.0 in most specimens, while the length-breadth ratio in most basal fertile bracts is 2.0 - 4.0. A similar pattern is observed in "bicarinata".

The length of basal flowering pedicels ranges from 0.3 - 0.6 cm in the H.margaritifera specimens examined, and from 0.2 - 0.8 cm, with most specimens 0.6 - 0.8 cm long, in A.rugosa. In "bicarinata" basal pedicels are 0.3 - 1.0 cm long, most being 0.4 - 0.6 cm in length, with the exception of No. 7262, where the basal flowering pedicels are shorter. Most flowering pedicels from the middle of the raceme are 0.3 - 0.5 cm long in all three, again with the exception of No. 7262, where they are shorter.

Mention should be made of the fact that peduncle and raceme axes, and pedicels are reddish brown or a glaucous green in A.rugosa, while in H.margaritifera and in "bicarinata" they are reddish brown in colour.

Summary.

Thus in inflorescence characters too, "bicarinata" is intermediate between H.margaritifera and A.rugosa, although the difference with regard to these between the two suspected parent species is, apart from branching of inflorescences slight. It is of interest to note how the "bicarinata" specimen No. 7262 differs from the other plants of "bicarinata" in thickness of peduncle below raceme, bract dimensions and pedicel length.

COMPARISON OF PERIANTH CHARACTERS. (See Figs. 66 and 67)

In the introductory survey, mention was made of the fact that the feature of a strongly bilabiate flower typical of the genus *Haworthia*, was not as marked in species such as *H. margaritifera*. In colour too, the flowers of *H. margaritifera* and the other species of *Haworthia* with less bilabiate perianths differ from the very bilabiate species. In the latter, the central vein of each tepal is a beige or glaucous green, the rest of the tepal including the lobes a glistening white. In *H. margaritifera*, on the other hand, the tubular part of the perianth has a faint yellowish beige tinge which becomes a glaucous reddish brown - green towards the base. The lobes are yellowish cream or cream, and the V of the vein endings is often slightly reddish brown.

The colour of the perianth of *A. rugosa* has already been described.

The colours of the perianth of "*bicarinata*" vary from those of *H. margaritifera* to those of *A. rugosa*. Flowers from the plant R73 had in some instances the outer tepals slightly inflated on either side of the midrib, as was observed in certain specimens of *A. rugosa*. The plant No. 7262 did differ slightly in the colour of the perianth, in that the veins of the tepals were green and the rest of the tepal including the lobes, white. Sometimes the white part of the perianth tube did have a pale beige tinge.

As previously, variation in perianth dimensions for *H. margaritifera*, *A. rugosa* and the suspected hybrid are shown in a series of histograms.

With regard to the position of the lobes in the open flower, it can be seen that the least open lobes are found in *A. rugosa*, the most open in *H. margaritifera* with those of "*bicarinata*" intermediate. As mentioned before, *A. rugosa* characteristically has all the inner lobes at an angle of 30° or less. This was not observed in any of the few *H. margaritifera* flowers examined, but in "*bicarinata*" is found to be the case for the inner posterior lobe of two flowers, and for the inner lateral lobes of about half the samples.

Lobe length, although short for the genus *Haworthia*, is longest in *H. margaritifera*, ranging from 2.0 - 3.0 mm for the outer lobes

and 2.5 - 3.5 mm for the inner lobes. It is shortest, 1.0 - 2.0 mm for outer and inner lobes in A.rugosa, and intermediate in flowers of "bicarinata". Here, outer and inner lobes range from 1.5 - 2.5 mm, the inner in most cases being a little longer.

In width, the outer lobes of H.margaritifera tend to be similar to those of A.rugosa, which are 1.0 - 1.5 mm in most cases. In "bicarinata", however, outer perianth lobes range from 1.0 - 2.0 mm in width.

The inner lobes of both H.margaritifera and A.rugosa are slightly wider than the outer, being 1.5 - 2.00 mm in most cases. In most of the "bicarinata" samples, the inner lobes are 1.5 - 2.00 mm wide, except for specimens from Rietvlei, in which the lobes are 2.0 - 2.5 mm in width, and the flowers of No. 7262, where width of the inner perianth lobes varies from 2.0 - 3.5 mm.

The length of the perianth tube varies from 9 - mm in the few specimens of H.margaritifera which were examined, to 7 - 11 mm in most flowers of A.rugosa and "bicarinata".

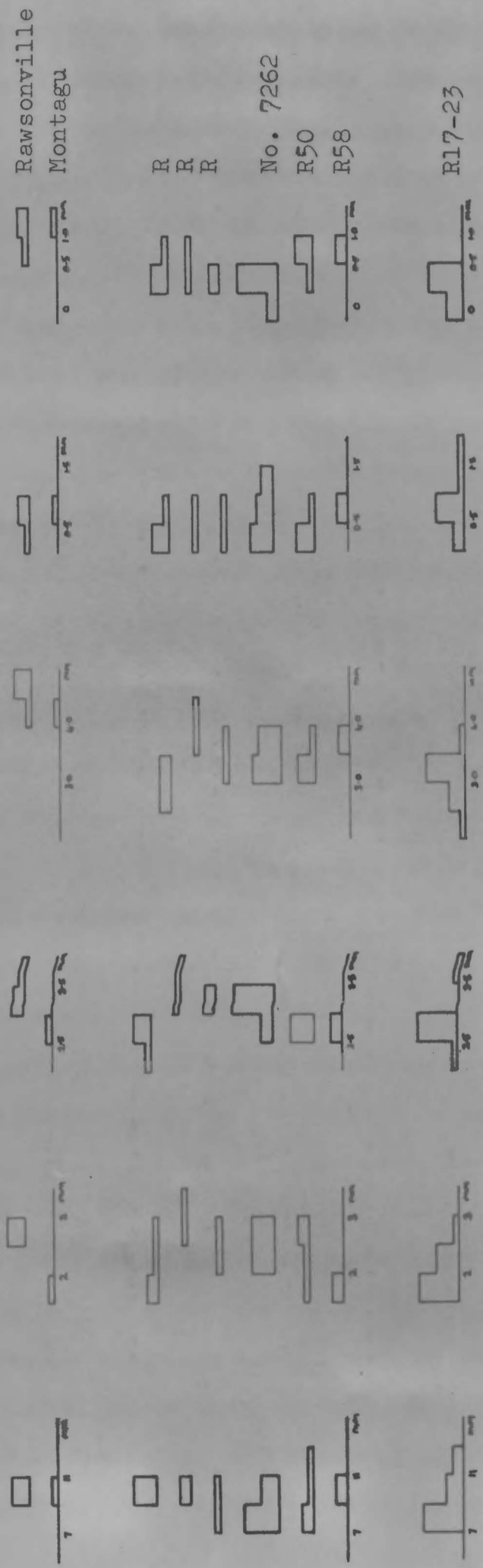
In all three, the neck of the perianth tube ranges from 1.5 - 3.0 mm, but it is most constricted, 1.5 - 2.5 mm, in specimens of A.rugosa.

The middle diameter of the perianth tube too, is least in the majority of A.rugosa specimens where it is 2.5 - 3.0 mm. In "bicarinata", the mid diameter is 2.5 - 3.5 mm in most flowers, while in H.margaritifera it varies from 2.5 - 4.0 mm.

The basal diameter of the perianth tube is broadest in H.margaritifera, where it is 4.0 - 5.0 mm. In A.rugosa it is 3.0 - 3.5 mm in most flowers, and 3.0 - 4.0 mm in most specimens of "bicarinata", slightly narrower bases being found in flowers of R73.

The difference between the diameters of the middle and the neck of the perianth tubes does not vary much in the three, but the difference between basal and mid diameter of the perianth tube is more variable. This is greatest in H.margaritifera, being 0.5 - 1.5 mm. In "bicarinata" the difference between basal and mid diameter varies from 0 - 1.0 mm.

H. marg.
"bicarinata"
A. rugosa



Rawsonville
Montagu

R
R
R
No. 7262
R50
R58

R17-23

Diff between
diams base
and middle

Diff. between
diams middle
and neck

Diam. base

Diam. middle

Diam. neck

Length to
neck

Fig.66. Variation in shape of perianth tube in H. margaritifera, "bicarinata" and A. rugosa.

Fig.67. Variation in position of lobes in the open flower and in the dimensions of the lobes in H. margaritifera, "bicarinata" and A. rugosa.

H. marg.

"bicarinata"

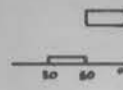
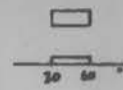
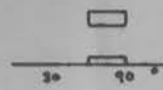
A. rugosa

H. marg.

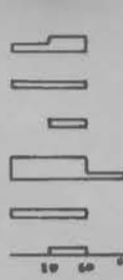
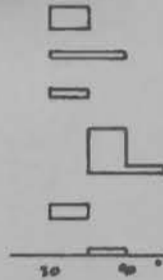
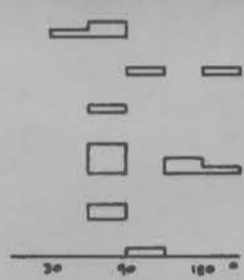
"bicarinata"

A. rugosa

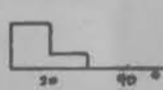
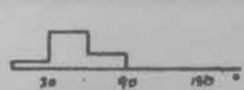
POSITION OF LOBES IN OPEN FLOWER



Rawsonville
Montagu



R
R
R
No. 7262
R50
R58



R17-23

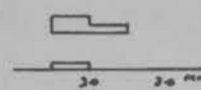
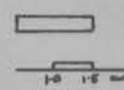
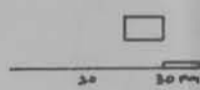
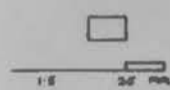
Angle of outer ant. lobe

Angle of outer lat. lobes

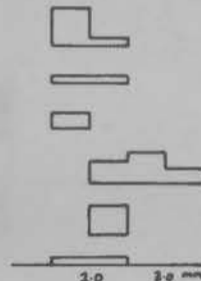
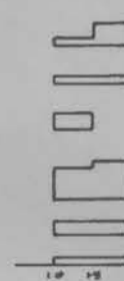
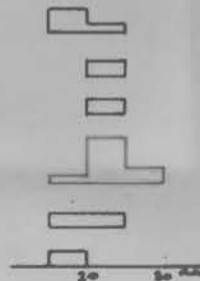
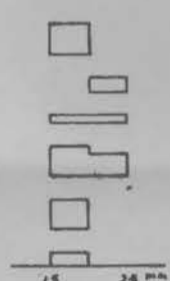
Angle of inner post. lobe

Angle of inner lat. lobes

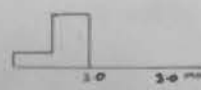
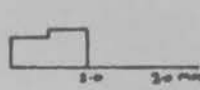
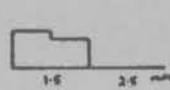
DIMENSIONS OF LOBES



Montagu
Rawsonville



R
R
R
No. 7262
R50
R58



R17-23

Length outer lobes

Length inner lobes

Width outer lobes

Width inner lobes



Showing the shape of the perianth in specimens of H. margaritifera.
(X 1)



A.



B.

A and B: portions of inflorescences of "bicarinata" (X 1 approx). A, from the Karoo gardens, Worcester, R70; B, from Rietvlei No. 2, R50.

Showing the perianth in a specimen of A. rugosa
(X 1 approx.)



SUMMARY.

From the foregoing, "bicarinata" is shown to have perianth characters intermediate between those of H.margaritifera and A.rugosa. It is of interest to note the differences in perianth character between plant No. 7262 and the other samples designated as "bicarinata".

CONCLUSION.

In conclusion, from the evidence of behaviour of the chromosomes in meiotic Metaphase I in P.M.C.'s, from the fact that "bicarinata" has vegetative, and floral characters intermediate between H.margaritifera and A.rugosa, and from the fact that all three have been found in the field growing in close proximity, it seems reasonable to consider the plants described as "bicarinata" as intergeneric hybrids between Haworthia margaritifera (L.) Haw. and Astroloba rugosa sp. nov. Roberts.

To date, there has been no valid description of a hybrid genus involving the genera Astroloba and Haworthia. Von Poellnitz (1943) mentioned the name "Apworthia" for such a genus, but included no diagnosis, so his name is invalid. He combined the old generic name Apicra with Haworthia.

The present author accordingly proposes the name x Astroworthia for intergeneric hybrids between Astroloba and Haworthia. Consequently, the hybrid in question is referred to as x Astroworthia bicarinata (Haw.) Roberts comb. nov.

A REVIEW OF THE TAXONOMIC LITERATURE ON THE GENUS ASTROLOBA.

Introduction:

Before embarking on a review of the subject, a comment on the difficulties encountered in dealing with taxonomic literature on *Astroloba* is appropriate.

Most of the species have been described from specimens in private succulent collections, the descriptions in most cases being based on a single plant. No records of herbarium type specimens have so far come to notice, and, except for a few cases, the type descriptions are unaccompanied by illustrations.

Although succulent collectors have, from the earliest days been in literary contact with one another, a study of the literature shows a lack of consistency and some confusion in the interpretation of certain species.

In a genus such as *Astroloba* where the facies of the constituent species is so similar, this is not surprising. A short Latin diagnosis without an illustration may easily apply to more than one species.

Except for Baker (1881, 1896) and Berger (1908), who, writing monographs on large sections of the Liliaceae, could not possibly approach the problem critically, most of the recent literature on *Astroloba* has been the work of amateur succulent enthusiasts, none of whom have seen the species in the field, or made population studies.

Early authors attached great importance to leaf arrangement; whether the leaves were in five straight rows, in five spirally twisted rows or imbricate. Since this varies from stem to stem and indeed occasionally on the same stem, it cannot be of primary taxonomic significance.

Taxonomic History of the genus:

The earliest known account of a species of *Astroloba* appears in Commelin's *Praeludia* (1703), as an "African aloe, erect, rotund with small rigid pointed leaves" which was given to the medical garden at Amsterdam by Daniel des Maretes, and "has produced

no flowers or seeds". The accompanying illustration is a poor one, making identification of the plant in question impossible.

In his Species Plantarum, ⁽¹⁷⁵³⁾ Linnæus described one species of *Astroloba*, *Aloe spiralis*, "with ovate acuminate, five ranked imbricate leaves" and "sessile ovate crenate flowers, the inner segments connivent".

Haworth (1804) was the author of the first monograph on the Aloe. He divided the group into *Grandiflorae*, *Curviflorae* and *Parviflorae*, the latter section including species today recognised as belonging to the genera *Haworthia* and *Astroloba*. It should be noted that Haworth placed many plants in these groups without having seen their flowers.

The *Parviflorae* were divided into the *Acaules* and the *Rigidae*, and including all the then known species pertaining to *Astroloba*, described from living plants in Haworth's collection.

Haworth's comments (1804 p.23) on variability in aloes: "...a predominant, but I believe an erroneous idea, that few of them are truly and originally distinct; but fluctuating and inconsistent if raised from seed", and on "the utter impracticability of their ever appearing in a 'hortus siccus', at least in any cognizable shape" are of some interest.

Duval (1809) separated the Genus *Haworthia* from *Aloe* on account of a bilabiate perianth: "Calyx petaloideus, rectus, superne revolutus in duo labia".

Willdenow (1811) unaware of Duval's new genus, established the genus *Apicra* from *Aloe* on the same grounds: "Corolla Monopetala limbo sexpartito bilabiato ... Diese Gattung ist durch den besondern Bau der Blumenkrone von den eigentlichen Aloë Arten beim ersten Blick zu unterscheiden,". The name *Apicra* was chosen because the sap of these plants was not bitter like that of species of *Aloe*, and the genus was divided into *Acaules* and *Caulescentes*, the latter including six species recognised today as species or components of species of *Astroloba*. For three of these, *A. imbricata*, *A. pentagona* and *A. bullulata*, (sensu Willd.) the references cited include good illustrations of actinomorphic perianths. Thus *Apicra* Willd. 1811 and *Haworthia* Duval 1809 are synonymous.

Haworth (1812) included Duval's genus in his *Synopsis*, dividing *Haworthia* into several sections including "Caulescentes erecte corollis cylindricis sub-erectis; limbo sub-regulari. An genus proprium?" The five species in this section are all components of the genus *Astroloba* as construed at present.

Haworth's Supplement (1819) contained the genus *Haworthia* as previously and, "*Apicra*. Willd. - *Aloë aliorum*" with "... perigonius petaloideus cylindricus, limbus regularis patulus, laciniis brevibus". He had not seen Willdenow's original description (loc.cit. p.50) and had misapplied the name *Apicra* to a new perfectly valid genus.

This mistake was perpetuated by subsequent authors, notably Baker and Berger who, while citing the genus as *Apicra* Willd. distinguished it from *Haworthia* on the grounds of short equal spreading perianth segments as opposed to a bilabiate condition.

Mention must here be made of Salm-Dyk's Monograph (1836-1863) in which he retained the old concept of the genus *Aloe*, as he had done previously in his Catalogue (1817). The genus was divided into *Grandiflorae* and *Parviflorae*, and the two groups of the latter "*limbo bilabiato*" and "*limbo regulari*" were equated with "*Haworthia* Duval" and "*Apicra* Haw".

Stearn (1936) proposed the conservation of the generic name *Apicra* Haw, suggesting "*A. pentagona* (Haw) Haw." as a lectotype on the grounds that: "*Apicra* Willd. (1811) is a synonym of *Haworthia* Duval (1809). In defining *Apicra* as a genus with a regular perianth unlike *Haworthia*, Haworth was really founding a new genus for which no alternative name exists". Technically, Haworth cited the epithet as "*Apicra* Willd."; as is shown elsewhere the interpretation of "*Apicra pentagona* (Haw.)" Haw. is a matter of some confusion.

It would have been far better to reject the name *Apicra* altogether, and substitute a new one. This was eventually done by Uitewaal (1947), who proposed the new and now accepted name of *Astroloba*, (Greek astron = star, lobos = lobe). However, for the type Uitewaal put forward the same species as had Stearn, an unwise

choice, because of the confusion in the application of this epithet.

Taxonomic History of the different Species.

In view of the confusion arising from misinterpretation of specific diagnoses, accounts of the literature for the different species are given in some detail.

Species are dealt with individually or in their related groups. This has resulted in some repetition, but it is felt that for the sake of clarity, this is necessary.

[Faint, illegible text, likely bleed-through from the reverse side of the page.]

Although leaf arrangement is not of primary significance, the individual angle tends to be lower, 0-10°, in most plants of "lilia" than in "pulsilla" and "pulsilla" where it is more variable ranging from 0-30°.

Leaf length in field specimens of "lilia" ranges from 2.5 - 4.5 cm., while in field specimens of "pulsilla" and "pulsilla" leaf length was 1.5 - 3.5 cm., very rarely 4.0 cm. - 4.5 cm. - 5.0 cm. in specimens of "lilia" and 1.5 - 2.5 cm. and 2.5 - 3.5 cm. in specimens of "pulsilla" and "pulsilla" respectively.

The presence of inter-nodal hairs and the presence of axillary hairs were observed in field specimens of "pulsilla", while axillary hairs were absent and inter-nodal hairs were present in "lilia". The length of the lowest inter-nodal hairs was 0.2 - 0.4 mm. in specimens of "pulsilla" and 0.3 - 0.5 mm. in most specimens of "lilia".

ASTROLOBA SPIRALIS (L) Uitew. AND THE CONFUSION ARISING OUT OF
THE INTERPRETATION OF ALOE PENTAGONA (Ait) Haw.

The author has shown that in her opinion the entities referred to as "spiralis", "smutsiana" and "hallii" should be treated as distinct species. While "spiralis" differs from "smutsiana" in perianth characters and chromosome number, in vegetative characters the two are very similar, so that it is often difficult to identify plants of either when they are not in flower.

"Hallii" has a smooth perianth in common with "smutsiana" and striations on the leaf underside which are sometimes found in plants of "smutsiana". However, many plants of "hallii" have tuberculate or spotted leaves in the field, which has never been observed in field populations of either "hallii" or "spiralis", although under cultivation a few plants of both did develop white blotches which were not raised. "Hallii" differs further from "smutsiana" in the keeled marginate nature of the leaf apices, never to date observed in the latter.

Although leaf arrangement is not of primary significance, the spiral angle tends to be lower, 0-10°, in most plants of "hallii" than in "smutsiana" and "spiralis" where it is more variable ranging from 0-30°.

Leaf length in field specimens of "hallii" ranges from 2.5 - 4.5 cm., while in field specimens of "smutsiana" and "spiralis" leaf length was 1.5 - 3.5 cm, very rarely 4.0 cm. Length-breadth ratios are 1.72 - 3.14 in plants examined of "hallii" and 1.30 - 2.30, and 1.57 - 2.90 in plants examined of "smutsiana" and "spiralis" respectively.

No branched inflorescences and only one peduncle with unexpanded axillary raceme buds were found in field specimens of "smutsiana", while branched inflorescences were occasional and unexpanded axillary raceme buds more frequent in "hallii". The length of the lowest flowering pedicels was 0.2 - 0.4 cm in most specimens of "smutsiana" and 0.3 - 0.6 cm in most specimens of "hallii".

A review of the relevant taxonomic literature^{and one herbarium specimen} shows that at the time of the publication of Salm-Dyk's monograph (1836-1863), all three species were cultivated in Europe. Such a review also shows that extreme confusion existed over the identity of "hallii" and "smutsiana", and that in all likelihood, non-flowering material of "smutsiana" and "spiralis" was also confused.

In the following survey, the present author will show that the epithet "spiralis", as devised by Linnéus, may be readily applied to field specimens, so that this species may be referred to as Astroloba spiralis (L.) Uitew. With regard to the other two species, however, the present author will show that the nomenclature and applications thereof have been so confused that there has been no other choice but to select two completely new names for these two, which are accordingly referred to as Astroloba hallii Roberts sp. nov. and Astroloba smutsiana Roberts sp. nov.

Finally, before embarking upon what must be one of the most knotty taxonomic problems it was ever any taxonomist's task to unravel, it must be noted that under cultivation, succulent plants often become very turgid, and may look somewhat different from plants in the field. The development of white blotches on the leaves of some plants of A. spiralis and A. smutsiana under cultivation has already been mentioned.

It should also be noted here, apropos of the confusion over past nomenclature of all three, that photographs were seen of plants from green houses at Kew and Lucerne, labelled as "Apicra pentagona". These most resembled plants of either A. spiralis or A. smutsiana, as did actual leaves sent from the Kew plants.

Aloe spiralis, a plant with "sessile* ovate crenate flowers, the inner segments connivent (and) ovate acuminate five-ranked imbricate leaves" was the first species of Astroloba to be described, by Linnéus (1753). Amongst the references cited, including Linnéus (1737, 1748) and Van Royen (1740), were two

*Linnéus' use of the word sessile is rather loose. Save for some plants of A. foliolosa sub. sp. robusta Roberts, the flowers in Astroloba are all pedicellate.

works with illustrations of the plants described. One was Commelin's *Praeludia* (1703) with the poor illustration of a leafy shoot, the other, Dillenius' *Hortus Elthamensis* (1732). The latter has an excellent illustration depicting a plant with five-farious patent erect imbricate leaves and a spike of flowers, the perianth tubes of which are rugose on their outer surfaces. The plant of this illustration is readily associated with plants collected in the Little Karoo near Oudtshoorn, Calitzdorp and Ladismith. As before mentioned, the identity of the plant of Commelin's illustration is uncertain.

Linneus' *Hortus Upsaliensis* (1748) was unobtainable, but in the *Hortus Cliffortianus* (1737), he described the plant as an "Aloe with ovate acuminate leaves, which are imbricate and five ranked about the stem ... Plant covered with leaves so it is almost round. Scape erect rarely branched, flowers sessile, nearly erect, ovate with small limbs". As references he cited Commelin, Dillenius and Boerhaave's *Index* (1720).

Dillenius described the flowers as "..... monopetalous, tube entire, striate rough and crisp ... with six short yellow segments, the outer three larger, somewhat expanded, the edges slightly crenate, the inner segments smaller connivent and not crenate". In the last paragraph he made the interesting comment that other of these species were said to be in Holland "differentia vero non satis mihi liquet". He cited one reference, Boerhaave's *Index* which give only Commelin's descriptive phrase.

While the word "crena" means a rounded tooth or notch, in view of Dillenius' use of the word, and the glossary of terms in the Lichfield edition (1782) of the *Systema Vegetabilium*, it seems that by "floribus crenatis" Linneus was referring to the notched condition of the margins of the perianth lobes and not the rugosity of the corolla tube described and illustrated by Dillenius. (In the glossary of the Lichfield edition, the term "notched" is placed under the section "margin" and its Latin equivalent is given as "crenatum: the margin cut into nicks, without any reference to the extremities").

Featherly (1954) defines the word crenate as being "said of a margin with rounded or blunt teeth". While the

perianth lobes of *Astroloba* flowers are often minutely notched, this is not a prominent character, and it is very surprising that Linneus should have noted it and not the rugosity of the perianth tube in his first account of *Aloe spiralis*, if he had in fact seen flowering material.

Although Linneus' account of *Aloe spiralis* in the *Species Plantarum* of 1753 makes no mention of a rugose perianth, because Dillenius' description of such a flower is cited, *Aloe spiralis* L. has to be identified as a plant with a rugose perianth.

There are no extant records of a Linnéan specimen of *Aloe spiralis* L., and it is very possible that when writing the *Species Plantarum* Linneus had not seen flowering material of the plant he described as *A. spiralis*, and had simply quoted an inaccurately made summary of Dillenius' description from the *Hortus Cliffortianus*. That Linneus must have seen vegetative material of what is now called *Astroloba* seems evident in view of his earlier references of 1737 and 1748. That these may have been plants other than *A. spiralis* is not unlikely.

However, in a note on *Aloe spiralis* in the *Observationes* of his *Mantissa* (1771), Linneus changed the description from "sessile flowers" to "spicate muricate flowers". In the same account the leaves are, for the first time, described with "tricarinate apices". In the Lichfield glossary "murex'd", with the Latin equivalent "muricatus", is placed in the section "surface" and is given as "sprinkled with awl-shaped points". Also in the *Observationes*, Linneus wrote that the leaf arrangement of *Aloe spiralis* was "six farious (not five farious) imbricate".

All *Astrolobas* have a leaf arrangement in multiples of five but this error was perpetuated in a number of subsequent accounts, including Houttyn (1773-1783), and Persoon's edition of the *Systema Vegetabilium* (1797), while Gmelin in his edition of the *Systema Naturae* (1796) described the leaf arrangement as octofarious and omitted an account of the flower altogether. He cited an unobtainable reference "Knorr del nat l.t.A.6".* Thunberg (1785-1794) writing of *Aloe spiralis* did not include an account of

* Presumably Knorr, G.W. (1766-67). *Deliciae Naturae Selectae* etc. (2nd ed. 1778).

the flower and also described the leaves as "imbricate octofariis". The Lichfield edition of the *Systema Vegetabilium* included a description of the flowers as in the *Mantissa* but omitted any account of leaf arrangement.

Mention must be made of the account of *Aloe spiralis* in the eighth edition of *Millers Garden Dictionary* (1768) in which was noted a much larger "seminal variety" with thicker leaves and longer pedicels raised from seed". The only references cited were Linneus (1753) and Commelin (1703). There was no account of the floral morphology apart from Linneus' epithet "oval crenated flowers".

In 1789 appeared the first edition of the *Hortus Kewensis* by William Aiton. Apart from listing two new varieties of *Aloe spiralis* based on leaf arrangement : α *imbricata* "imbricated spiral Aloe" and β *pentagona* "5-sided spiral aloe", he added nothing to supplement previous descriptions, only noting that the species flowered in June and July and was cultivated in 1732 by James Sherard. As references, apart from the *Species Plantarum**, Aiton cited Thunberg (1785) quoting "foliis octofarius ovatis" and Dillenius (1732), making no mention of a rugose perianth. As has been shown, the leaf arrangement in *A. spiralis* varies from a spiral angle of 0° to one of 30° , so that on grounds of the description alone, α *imbricata* and β *pentagona* cannot be recognised as valid varieties. To the best of the author's knowledge, there are no known herbarium specimens or drawings of specimens of these two varieties.

Both Aiton's new varieties were included in Willdenow's edition of the *Species Plantarum* (1799). Here epithets for *Aloe spiralis* from all available literature were listed.

The grouping of the references listed is of significance and for this reason they are given below in full:-

* The Edition of the *Species Plantarum* cited by Aiton is a later one as he refers to p. 459. The author has seen no edition of the *Species Plantarum* other than the first but since the second *Holmiae* 1762-63) and third (*Vindobonae* 1764) editions were published before the *Mantissa* and *Observationes* (1771) it has been assumed that the description of *Aloe spiralis* in the edition cited by Aiton is unchanged.

"16. ALOE Spiralis.

A. sub caulescens, foliis imbricatis octofariis ovatis, floribus racemosis recurvis. Thunb. Diss. n. 14. Thunb. prod 61.

A. floribus spicatis ovatis muricatis crenatis : segmentis interioribus conniventibus. Mill. dict. n. 12. Knorr del. 1. tab. A.6.

α imbricata foliis spiraliter imbricatis. Ait. Kew. 1 p. 471

A. foliis caulinis sexfariis ovatis mucronatis. Syst. Veg. 278*.

A. foliis ovatis acuminatis cauliniis quinquefariam imbricatis. Hort. Cliff. 132. Hort. Ups. 87. Roy lugdb. 23.

A. africana erecta rotunda folio parvo et in acumen acutissimum exeunte. Dill. elth. 16 t 13 f. 14. Comm. prael. 83 t 32.

β pentagona, foliis imbricatis. Ait. l.c. Houttyn Lin. Pfl. Syst. 6. p. 344. Spiral förmige Aloe W. Habitat in Africae campestribus.

Folia ovato subulata, mucronato-spinosa, apice tricarinata, sexfariam imbricata. Mant. 368."

Taken at its face value, one must assume that the term "muricatis" applies to the perianth of the species as a whole, as the flowers of the type are listed as "ovatis muricatis crenatis", while the Hortus Elthamensis (l.c.) is quoted for var imbricata, and the Mantissa (l.c.) for var pentagona, both references alluding to muricate flowers. In the Houttyn reference (l.c.) only the colour of the flowers, and not their texture or shape is described.

The edition of Miller's Dictionary cited by Willdenow must be later than the Eighth edition which makes no mention of

*Presumably this refers to J.A. Murray's Edition of 1774.

a muricate flower for Aloe spiralis*. A glance at the leaf arrangement in the references cited by Willdenow shows the terms octofarious, sexfarious, quinquefarious and spirally imbricate. Houttyn (l.c.) quoting Linneus in the Mantissa, described the leaves of Aloe spiralis as being in "sechs Reihen am Stengel" while the reference is here placed under β pentagona after the phrase "foliis quinquefarium imbricatis". The whole account and citation of references is thoroughly contradictory and in no way clarifies the position regarding the identification of the two varieties, or justifies their recognition.

The next illustrated account of Aloe spiralis appeared in the Plantes Grasses of De Candolle (1799) where the leaves are described as "imbricate octofariis", and the perianth tube as "transversely rugose on the outside". The drawing is poor and the perianth not well shown, but the specimen may also be readily associated with specimens collected in the Little Karoo, both in character and size. De Candolle cited the specimen as "Aloe spiralis imbricata. Ait. Kew. 1. p.471. n. 12 var. α " but made no mention at all of var β pentagona nor did he describe it elsewhere. Amongst other references included by De Candolle were Lamarck 1783: "Aloes cylindrique" var α ** (where the leaves were described as having "somewhat reddish

* The Catalogues of the libraries at Kew and the British Museum of natural history give the following publications of the Gardners Dictionary after 1768.

1771 The Abridgement of the Gardners dictionary ... Sixth Edition, London (B.M. & Kew)

1785 Dictionnaire des Jardiniers ... traduit de l'anglais, etc. Paris, 8 vols. (Kew)

1790 Supplement ... par M. de Chazelles, Paris (Metz), 2 vols. (Kew).

1794 The Gardners Dictionary Ed. 7 revised and altered Dublin (Kew)

1807 The Gardners' and Botanists' Dictionary by T. Martyn. London 1807. 2 vols. (B.M. & Kew)

Only the 1768 Edition, listed as the Eighth edition has been seen by the present author.

** Var β is now a species of Haworthia.

spices" but an account of the nature of the perianth was omitted); and "Aloe perfoliata non spinosa". Wein. Phyt. Icon. 72 (1737-1745) next to which is De Candolle's comment : "b. pessime"; and Millers Dictionary.

Haworth (1804) raised Aiton's two varieties to specific level and, contrary to Article 52 of the present day International Rules, gave the name spiralis to a completely new species.

Aloe imbricata (Ait.) Haw. was described "with multifarious somewhat erect smooth unspotted leaves and a straight stem ... A. spiralis α imbricata Willd. Sp. Pl. 2 : 191, Ait. Kew 1 : 471, Aloe africana erecta rotunda Commel. Prael. t 32, Dill. Elth. t 13.f.14; Aloe spiralis Plantes Crasses : 55".

Aloe pentagona (Ait.) Haw. was described "with five-farious patent smooth green leaves below occasionally spotted, stem a little straight very rarely sub twisted ... A. spiralis β pentagona Willd. Sp. Pl. 2 : 191, Ait. Kew. 1 : 471."

The name Aloe spiralis Haw. non L. was then given to what Haworth considered to be a totally new species: "With spirally quinquefarious, patent-smooth green leaves, below obscurely spotted; "... the plant so much twisted so as to make the ... leaves seem multifarious". He commented : "it is very much like Aloe pentagona but somewhat larger".

It is the nature of the leaf arrangement, and the spotting on the leaf undersurfaces that has been used to distinguish these three species, not the floral characters, of which there is no mention.

This is the first account in which the term "obsolete maculatis" is used to describe the upper portion of the leaf undersurface. The term maculate implies merely a spotting or blotching and does not indicate that these spots or blotches were slightly raised. As mentioned, occasional plants of A. spiralis L. and A. smutsiana sp. nov. have been observed, under cultivation, but not as yet in the field, to develop small white blotches on the leaf undersurface and these have so far never become raised or tuberculate.

Willdenow's account (1799 of Aloe spiralis and its two varieties implied that all had crenate perianths, and one is compelled, at this stage, to assume that Haworth followed Willdenow's interpretation, although he did cite Dillenius (1732), the only reference mentioning a rugose perianth, under Aloe imbricata. Thus Aloe imbricata (Ait.) Haw. may be regarded as a synonym of Aloe spiralis L. (in the original sense), and therefore superfluous, while at this stage, Aloe pentagona (Ait.) Haw. appears to differ from A. imbricata (Ait.) Haw. only in insignificant characters. The name Aloe spiralis Haw. is, by modern rules, invalid, but the species might, on account of size and maculate leaves, be identified as a specimen of A. hallii, however there is no definite proof of this.

The first illustration of a plant under the name "Aloe pentagona Aiton" appeared in Jacquin's *Fragmenta* (1809). Apart from citation of authors, no references are given. The specimen described as Aloe pentagona is shown with a branched inflorescence, the flowers of which have a smooth perianth, with creamy yellow spreading lobes, (the epithet "flavescentibus" is used in describing these). The leaves are "imbricate in five series, spreading ... broadly lanceolate, acuminate, pointed, rigid, thick, fleshy, entire ... smooth ..." and about 3.5 cm. in length. There is no mention of any spots on the leaf undersurface as given in Haworth's description of this species. The association of this specimen with plants collected in the field is open to considerable doubt. It could be identified either as a very large plant of A. smutsiana sp. nov. or a non-tuberculate form of A. hallii sp. nov. The inflorescence (here described as single or branched) is more frequently branched in A. hallii than in A. smutsiana, but in the former species there are always, on any one plant, leaves with fine vein lines towards the apex of the leaf undersurface, and this is not mentioned in this text. Lines are shown on the leaf undersurface in the illustration, but these appear to be simply lines of shading. The leaf apex itself is "keeled marginate" in A. hallii and "true marginate" in A. smutsiana. The drawing is insufficiently clear to show

the leaf apex in any great detail. The suggestion, that it is more probably a poor illustration of a specimen of A. hallii is made with considerable hesitation, this being supported by the yellow tinge to the perianth lobes.

Aloe spiralis L. is also described by Jacquin, and here, because of the rugose nature of the perianth, there can be no doubt as to the identification of the specimen in the illustration. The leaves are given as "densely imbricate ... in no order ... lanceolate acuminate ... smooth, dark green", and about 3.5 cm. long. The inflorescence is described as single or branched, the perianth lobes "flavescent", although the yellow here is a much deeper colour than in the illustration of Aloe pentagona.

In Willdenow's *Bemerkungen* (1811), were included Apicra imbricata: (Aloe imbricata Haworth (1804); Aloe spiralis Willd. (1799, 1809); De Candolle (1799); Jacquin (1809); Aloe africana erecta rotunda, etc., Commelinus (1703) and Dillenius (1732)); Apicra spiralis: (Aloe spiralis Haworth (1804) and *Species Plantarum* ed. 2 (1762-63)), and Apicra pentagona (Aloe pentagona Haworth (1804), Jacquin (1809) and Willdenow (1799)).

Apart from Apicra imbricata ("corollis transversim rugosis") there are however, no floral descriptions. The descriptions of leaf arrangement and leaf character are similar to those of Haworth (1804) save for a few additions in Apicra spiralis: "foliis ... ovatis, apice trigonis".

Below the description of Apicra spiralis, Willdenow noted that according to Haworth, this was the true Aloe spiralis of Linneus which he had never found under cultivation, and that it looked very much like Apicra pentagona but the stem was more twisted, the leaves broader and often in straight rows. It should be noted that in this work, Willdenow cited *Species Plantarum* ed. 2 as a reference for Apicra spiralis.

A photograph of a herbarium specimen with inflorescence: "Apicra pentagona ... Willd. *Mag.* (1811) ... p.273 *Hort. Bot.* (See Plate 33) Berol. W" (Willdenow No. 6794 *Mus. Bot. Berol.*) was available. The inflorescence is branched, the corolla tubes smooth and the leaves have a few tubercles on their undersurface. Willdenow's

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Leafy shoot of A. hallii (X14). A few white maculae visible on some of the leaves, keeled marginate apices visible in apical leaves. The leaves will dry with the darker bundle cap lines forming prominent ridges.



Leafy shoot of the herbarium specimen "Apicra pentagona" Willdenow No. 6794 from the Botanical Museum Berlin. Keeled marginate apices visible in some leaves, leaves have dried with the bundle cap lines forming a series of longitudinal ridges, and a few tubercles are present which roughly correspond to the bundle cap ridges. (X 14).

description of 1811, however, did not describe the spots on the undersurface of the leaf as raised, which they are in this herbarium specimen. The tubercles and the size and nature of the leaf apices make this plant readily identifiable with plants collected near Koup and in the Northern foothills of the Swartberg, and described by the author as A. hallii sp. nov.

In the same year the second edition of the Hortus Kewensis, edited by W.T. Aiton, was published. Here Aloe spiralis "corollis transversim rugosis subsessilibus", (Aloe spiralis Decandolle (1799), Aloe spiralis α imbricata Willdenow (1799) and Millers' Garden Dictionary Edition 1, are cited as references), and Aloe pentagona "folius quinquefarium ... laeviusculis, corollis pedunculatis non rugosis", (with Aloe pentagona Haworth (1804), and Aloe spiralis β pentagona Willdenow (1799) listed as references) are described. According to this edition both species were cultivated in 1731 by Mr. Phillip Miller (cf the historic note in the first edition of the Hortus Kewensis (1789)).

Also in 1811, Ker published an illustrated account of Aloe pentagona in the Botanical magazine. As references Haworth (1804) and A. spiralis β pentagona Aiton (1789) and Willdenow (1799) "exclusa passim var α " were cited. Ker was the first author to write "We have been induced to consider the present plant as specifically distinct from Aloe spiralis not so much by the difference in the arrangement and expansion of the leaves, as by the total absence of the transverse wrinkles, so remarkable in the corolla of the latter". The specimen depicted had been sent to Kew by Haworth.

The leaves are described as "ovate-acuminate ... dark green, smooth or with very minute raised points (elevato-punctulatis) ... with the topmost ones smaller and now marked below with a few white tubercles not particularly raised (parum salientibus)".

The Lichfield edition(1782) gives "punctatum" as meaning "spinkled with hollow points", Featherly (1954) as "marked with dots, depressions or translucent glands" so the phrase "elevato-punctulatis" is somewhat confusing. All leaves of

species of *Astroloba* do in fact have extremely minute depressions over the leaf above the stomatal apertures, but what Ker was describing is not quite clear. It is interesting that in the plant described, it is only the topmost leaves that are maculate.

The inflorescence is described as branched, and from the drawing, the lowest fertile bract is in length about 0.4 cm and the lowest pedicel about 0.8 cm. The perianth is described as "columnar-tubulosa", and the flowers in the illustration are larger and less constricted at the throat than those in the Jacquin work.

The leaf apices are poorly shown, and the leaves are very turgid so that the lower ones lie horizontal, but, apart from this and the long pedicels, it seems best to associate this plant with plants collected in the Ladismith-Barrydale Karoo, and in the Northern foothills of the Swartberg, and described as *A. smutsiana* sp. nov. The fact that only the upper leaves of the plant are spotted, the size of the inflorescence in the illustration and the cream lobes of the flowers are the grounds for this tentative association.

Haworth, in his Synopsis (1812) under the generic name *Haworthia* Duval included *H. spiralis*, *H. pentagona* and *H. imbricata* and added a fourth new species *Haworthia spirella*, "... with leaves spirally five farious, patent, lanceolate-acuminate, smooth palely green, somewhat bicarinate (subbicarinulatis) towards the apex; below apically with the slight keels sparsely spotted, the margins a little rough ... This is very similar to the preceding (*H. spiralis*) but is three times smaller, with narrower bicarinate leaves, the little keels with spots regularly marked". From this description, it is impossible to associate *H. spirella* with field specimens - it could be a small plant of either *A. hallii* or *A. smutsiana*.

This appears to be the first account in which the term "keel" is used in a description of the shape of the leaf towards the apex in cross section. Previously the matter was omitted, or the leaves were described as plane on the upper face, convex below; or the apex was described as being triangular, or

tricarinnate (Linneus 1771). For the other three species apart from "foliis ... apicem versus carina semilaterali"* for H. spiralis, the descriptions are similar to those in his "New Arrangement" (1804). Below the description of H. pentagona is the rather obscure observation that "for twenty five years this plant with me has never become spiral but constantly produced its imbricated leaves in five rows. Nevertheless I have seen one plant which seems the same (and larger than spirella) that did produce them somewhat spirally ... From imbricata this and the two preceding species will be considered abundantly distinct; except indeed by such Botanists as still prefer to reduce sections into species, instead of grouping species into sections".

This time, Haworth described the flowers of H. imbricata as "Corollis rugosis" and commented: "Spiralis is a name now hardly tenable for a plant which has nothing spiral about it, and which moreover Linneus seems to have so named, from having confounded it with at least one or more, which might be spiral. The first edition of Hortus Kewensis divided these by the sub-specific names of imbricata and spiralis**and, as it is the practice of Botanists, when named varieties are elevated to the rank of species, to adopt their sub-specific names for specific ones; I have followed this rule ... I had also another plant ... for the name spiralis ... which may have been the very one Linneus had in view when he formed the name spiralis, or if not it, he may have had spirella or perhaps both: for his knowledge of these plants at that time, (unless he had seen their smooth flowers), would hardly have prompted him to make even varieties of them. Be this as it may, I have called the large spiral species spiralis; and have continued it".

This is the first mention of the nature of the perianth of H. spiralis and H. spirella sensu Haworth. It is strange that, despite the illustration in the Botanical Magazine, Haworth did not comment on the flowers of H. pentagona.

* Cf keeled marginate apex of A. hallii?

** It seems that spiralis is a misprint and should read pentagona.

As a point of interest the dates of introduction into and flowering months under cultivation as given by Haworth are listed : for H. spiralis, before 1790, Aug. Sept.; for H. spirella, before 1808, Aug.; and for H. pentagona and H. imbricata 1731, June. July. (See fig. 17 for a comparison of flowering times in A. hallii, A. smutsiana and A. spiralis sensu the present author).

In 1812, the Botanical Magazine contained a well illustrated account of Aloe spiralis L. taken from a plant from Haworth's green house, with the observation that it flowered in August, but not as readily as Aloe pentagona.

In his Supplementum (1819) Haworth, now using the generic name "Apicra Willd.", divided Apicra pentagona into two varieties, α with the leaves always five farious and β torta, with the leaves "most often strongly spirally five farious". He observed that var β flourished at Kew but not var α - "the leaves of β are certainly diverse in shape and colour and also in substance. Perhaps a distinct (propria) species. Both varieties differ sufficiently from H. spiralis nobis which is twice as large or more and H. spirella nobis which is twice as small and distinct. β , is described from memory only but immediately after being seen."

Meanwhile Haworth had been in correspondence with Prince Salm-Dyk who, in his catalogue (1817), included Aloe imbricata Haw, Aloe spirella Haw. and Aloe pentagona with variety β spiralis (Haw) Salm-Dyk, all of which he had growing in his garden.

In 1821, Haworth included a note on Apicra pentagona in the Additamenta of his Revisiones, in which he described a var β torulosa of this species : "A. (spongy-flowered pentagonal) with sub-quinquefarious pale smooth green leaves, below sparsely spotted; the corolla with spongy torulose angles". Since he had already described var β torta in the Supplementum (1819) this was probably intended to be var γ . The plant in question was sent to him by Salm-Dyk earlier in the year.

The original Latin word "torus" meant a "protuberance" or "bulge", and why Haworth considered this a variety of A. pentagona is a mystery, since he commented that he had only heard of or seen a spongy corolla in A. imbricata and Aletride farinosa L, the

perianth of his "*Apicra pentagona* Nob. l.c. (*Aloe pentagona* Bot. Magaz. 1338)" being smooth. According to him, this variety *torulosa* differed from *A. imbricata* in size and length. It is possible that var *torulosa* could have been a specimen of *A. spiralis* L. which Haworth identified as a variety of *A. pentagona* on account of its leaf arrangement, or it may possibly have been a hybrid between *A. spiralis* and some other species.

One feels that Haworth, although a prolific writer on the Aloinae, did not really grasp the fact that there might be variation of vegetative characters within a single species, and in the *Astroloba* group at any rate, he was not a good judge of the characters delimiting the different species.

Sprengel (1825) included "*Aloe imbricata* Haw.", (citing as a reference "*A. spiralis* Cand.") and "*A. spiralis*" (citing as a reference "*A. pentagona* Jacque. Haw., *spirella* Haw.") The description of the former is similar to that of Haworth; the latter is described as "Caulescent, tortuous with five-farious patent spiral smooth leaves; below occasionally spotted". Was this species intended to be the same as the *spiralis* of Haworth?

The Schultz's (1829) listed *Aloe imbricata* Haw.; *Aloe quinqueangularis* which they raised to specific level from Haworth's *Apicra pentagona* β *torulosa* of 1821; *A. spirella* Haw.; *A. spiralis* Haw. and *A. pentagona* Haw. By modern rules of nomenclature, if a variety is raised to specific level, then the varietal name is adopted as a specific one if not already in use in a particular genus. *Aloe quinqueangularis* Schultes should therefore be referred to as *Aloe torulosa* (Haw.) Schultes.

Below the account of *A. spiralis* they mentioned that Salz-Dyk had a specimen named "*A. spiralis*", sent by Haworth "*a pentagona nonnisi foliis magis spiralibus diversum*"; while below the description of *A. pentagona* is the comment: "*Jacquini planta haud ita paucis ab illa in Bot. Mag. abluere videtur.*", the leaves of the former being lanceolate, acuminate and smooth on their under surface, while those of the latter were ovate acuminate, the under surfaces of the upper ones having a few whitish tubercles.

They quoted Salm-Dyk as saying of A. spirella :
 "... corolla hexagona cylindrica, angulis laevibus. Folia
 longiora magisque, quam in imbricata; hanc inter et pentagona
 media ..."

Salm-Dyk's Monograph (1836-1863) contained illustrated
 accounts of Aloe imbricata Haw., A. spirella Haw., A. spirella β
quinqueangularis nob., A. pentagona Haw., and A. spiralis Haw.
 Although Salm-Dyk corresponded with Haworth, there is no
 evidence that he obtained any of these plants from Haworth.

Aloe imbricata is described with "perianthium ...
 verruculatum, verrucis spongiosis albis ad angulos crenulato-
 confluentibus validis, ... laciniae ... flavidae ..." Here
 "crenulato-rugosis" appears to apply to the outer surface of
 the perianth tube rather than the margins of the lobes.
 Salm-Dyk made the observation: "Linnaei Al. spiralis, cujus
 flores crenatos dicit, absque dubio huc referenda est".

Aloe spirella is now described with "perianthium
 ad angulos albidum, spogiose sub torulosum, laeviusculum nec
 rugosum ... laciniae ... alboviridulae". The tissue on either
 side of the midrib of the three outer tepals of the perianth
 tube is sometimes very slightly inflated in A. rugosa, but
 only in A. spiralis L and A. herrei Uitew. is this very marked
 and rugose. The illustration of the flower of A. spirella in
 the Monograph does not show a spongy perianth at all and the lobes,
 which are always a bright yellow in A. spiralis, are here described
 as a whitish green. Indeed, from the illustration the specimen
 appears most to approximate A. smutsiana. An observation follows
 the description to the effect that this species differs from its
 allies in its lower stature, and smaller, crowded, very patent
 multifarious leaves, and that the perianth tube, "oculo amato",
 appears sub torulose at the angles; "sed non est rugosis aut
 crenulatus, ut in A. imbricata".

The illustration of A. spirella β quinqueangularis
 Nob. (which Salm-Dyk considered to be equal to A. pentagona β
torulosa Haw.) shows a perianth with pale yellow lobes, but which
 is definitely rugose despite the note that "... Flores, perianthium

... ut in specie." Salm-Dyk made the observation that for the very reason that the angles of the perianth tube were torulose he considered it to resemble A. spirella and had therefore judged it to be a variety of this species. It seems likely that the plant of the illustration is a hybrid, possibly between A. spiralis and A. smutsiana which could account for the slight degree of rugosity of the perianth. Both plants in the illustration have a few white spots on the under surface, described in the text as "punctis prominulis albis adspersa". If the plant described by Haworth as Apicra pentagona var torulosa was indeed from the same stock as that of the Salm-Dyk illustration, then its association with an illustration is established, and its possible identity deduced.

Technically, Aloe spirella β quinqueangularis Salm-Dyk should in any case be referred to as Aloe spirella β torulosa (Haw.) Salm-Dyk, and the Sdultes were the first to use the epithet "quinqueangularis".

Below Salm-Dyk's account of A. pentagona (Ait.) Haw. is the observation that this species differed from the preceding species, (A. imbricata, A. spirella and A. spirella β quinqueangularis) in the exact "five-fariousness" of the leaves. Var torta (Haworth, 1819) "... non constans et vegetationes solum casus est,...." The illustration, save for the tubercles, most resembles a large very turgid specimen of A. smutsiana.

The description of Aloe spiralis adds nothing to previous accounts, except that the length of the leaf is given as 5.0 cm, (approximately), and the flowers are described as "brevissime pedicellati", as opposed to "breve pedicellati" or "pedicellati" for the preceding species. Salm-Dyk observed that this plant first described by Haworth and unknown to other Botanists, was closest to A. pentagona from which it differed in size and the spirally twisted ranks of leaves. The illustration shows a perianth which is more inflated at the base than the preceding species and born on a very short pedicel. The leaves are quite densely spotted on the under surface, and in the detailed drawing of the top part of one leaf the artist has painted them in very approximate longitudinal rows and included a few longitudinal

white lines, but the exact nature of the apex is not clearly shown. It is indeed difficult to correlate this specimen with any plants collected in the field.

Kunth (1843), apart from maintaining A. pentagona β torta Haw. adopted Salm-Dyk's treatment of this section of the Aloe.

Baker (1881) recognised Apicra imbricata Haw. as a synonym of Aloe spiralis L. and reverted to the older, valid name.

Baker described Apicra pentagona Willd. as having leaves with one or two keels on the under surface and a few scattered white tubercles, an inflorescence often branching and a smooth perianth. He listed three varieties of this species, firstly var spirella, which was smaller than the type with more deltoid leaves, and incorporated H. spirella Haw. and Aloe spirella

β quinqueangularis Salm-Dyk; and next, a new variety, var Wildenovii Baker which was larger than the type, and incorporated Aloe spiralis Haw. non. L. There is a misquoted reference here: "Salm-Dyk, Aloe, Sect. 1. fig 3", which should of course read: "... fig. 5". Included as the third variety of A. pentagona was var bullulata, formerly Aloe bullulata Jacq. but this misplacement is dealt with elsewhere. The flowers of the varieties were not described in this or in his next work on the Aloinae.

As has been shown, there is a good deal of similarity between the species identified by the present author as A. bullulata and A. hallii, and also, more superficially between A. hallii and A. smutsiana. One may reasonably consider that the species described by Baker as A. pentagona included all three. Apart from Baker's variety bullulata, however, one can suggest, only on grounds of size, which is insufficient evidence, that the type and var Wildenovii were probably specimens of A. hallii, and spirella was probably included in plants of A. smutsiana.

It is of great interest to note that in the introduction to this Synopsis, Baker mentioned that "a large number of Cape species have been discovered and imported, mainly by Mr. Thos. Cooper of Redhill, who travelled through the colony from 1858 to 1862 collecting for the late Mr. Wilson Saunders and the Royal Horticultural Society ... Very few of the Cape species

which have ever been imported have been lost; ..."

In the Flora Capensis (1896-97), Baker enlarged upon the plants described. Apicra pentagona and its varieties, and A. spiralis were described from living cultivated plants, their South African localities being unknown. The leaves of A. pentagona were now described "with two obscure keels". There is some discrepancy in the descriptions of pedicels and fertile bracts for A. spiralis and A. pentagona. In Baker's Synopsis (1881), both species were described with "lanceolate deltoid bracts and pedicels .4 - .6 cm. long, while in the Flora Capensis, A. spiralis was described very short pedicels and ovate lanceolate bracts and A. pentagona with ovate bracts and pedicels as before!

Baker's key to the species of Apicra in the Flora Capensis was based entirely on leaf arrangement. An extract incorporating the above species is given below :-

"Leaves arranged in five straight or spirally twisted rows:
 Leaves lanceolate deltoid (1) pentagona

 Leaves multifarious, the spirals quite obliterated
 Perianth rugose* (2) spiralis"

Berger (1908) maintained spirella and Willdenovii as sub species of A. pentagona, and of the perianth of spirella he wrote "ad angulos sub torulosus, sed laevis non rugosis". He described the leaves as being light green, sometimes reddish, obliquely keeled or sometimes bicarinate on the underside, with "punctis tuberculisve paucis albidis vix conspicuis irregulariter adpersa ...", and the inflorescence as simple or branched. Both A. pentagona and A. spiralis were mentioned as flowering in the old gardens of La Mortola, but no herbarium material of either was cited.

His key is more comprehensive than Bakers:

* This is actually printed "Perianth smooth" but it is an obvious misprint.

"A Folia dorso † verrucosa vel papillosa.

.....
 B Folia dorso epapilloso, saepius inconspicue maculata,
 maculis parvis cartilagineis sed haud prominulis.

a Folia siccatione sulco-striata, nervis elevatis.

Perigonium extus verrucosum 5 A. spiralis

Perigonium extus laeve

1. Folia lanceolata deltoideo 6 A. pentagona

1. Folia stricte quinquefaria, interdum
 seriebus leviter tortis.

+ Folio ca 40 mm. long and 15 mm. wide* typica

++ Folia ca 50 mm. long and 20 mm. wide Willdenovii

2. Folia spiraliter sub quinquefaria, ca
 25 mm. longa spirella

Again the descriptions do not enable one to associate the varieties with certainty with either A. hallii or A. smutsiana. Berger restored A. bullulata to specific level. In his description he describes the leaf apices as "keeled marginate", and below is the comment that this species is well distinct from "A. pentagona Willd."

It may well be that the plants Berger described as "pentagona" were in fact all members of the species described by the present author as A. smutsiana. He included a poor illustration of "A. pentagona", which is shown with a few spots on the leaf undersurface and most resembles a very turgid, rather large, narrow leaved specimen of A. smutsiana.

The most recent person to write on the genus, Uitewaal, did not clarify matters. He published an account of the genus in Succulenta during the years 1936 - 1939, but it was not possible to obtain the issues in which A. pentagona was described. His key to the genus is however again based on leaf arrangement and shape and the relevant portion is given below:

* Berger gave the leaf width as measured at the base.

.....
 "Leaves with the lower side unspotted or with single slightly raised flecks:

- A. Leaves in 5 straight rows or slightly spiralled.
 o leaves lanceolate deltoid pentagona
- B. Leaves spirally 5 farious or imbricate
 o perianth rugose, leaves more or less erect. spiralis
 oo perianth smooth (slightly torulose in pentagona
 var spirella) older leaves more or less horizontal.
- 1) Plants 5 - 7.5 cm. in diam.
 a. leaves lanceolate deltoid pentagona var spiralis
-

In his revision of the nomenclature (1947), Uitewaal took "Astroloba pentagona (Haw.) comb. nov. Uitew. syn. Aloe pentagona Haw." as the type species, a poor choice. Apart from the wrong citation, as Aiton was the author of the epithet "pentagona", the identity of Aloe pentagona (Ait.) Haw. as has been shown, is not at all certain. Under A. pentagona, Uitewaal listed three varieties, var spiralis from Aloe spiralis Haw, and including Baker's var Wildenovii; var spirella from Haworthia spirella Haw. and lastly var torulosa from Apicra pentagona β torulosa Haw.

Jacobsen followed this arrangement in the new edition of his Handbook of Succulent Plants (1960).

A short summary of the relevant stages in the taxonomic history of the plants described variously by the epithets "pentagona" and "spirella" is now given.

The epithet "pentagona" was first used by Aiton (1789) to describe a variety of A. spiralis L. The grounds for recognition of this variety were based solely on leaf arrangement, which in view of the present knowledge of the genus, is a character which, taken on its own, is certainly not one of sufficient significance to be used even in the delimitation of varieties.

Willdenow included A. spiralis var pentagona Aiton in his species Plantarum (1799), and his citation of references

implied that it had a rugose perianth. Haworth (1804) raised this variety to specific level, citing both Aiton (1789) and Willdenow (1799) as references. Since he made no mention of perianth characters, Haworth gave no grounds to justify his recognition of A. pentagona as a species distinct from Aloe spiralis L.

The first illustration of a plant described as Aloe pentagona Haw. appeared in Jacquin's *Fragmenta* of 1809. The plant was shown to have a smooth perianth which at once separated it from A. spiralis L., which Haworth's and Aiton's descriptions had failed to do, their accounts being based solely on leaf characters.

The association of the plant of this illustration with field specimens is open to doubt. It could be a specimen of what the present author has described as A. smutsiana sp. nov. or of A. hallii sp. nov., the evidence being slightly more in favour of the latter.

The next illustration of a plant described as Aloe pentagona appeared in the *Botanical Magazine* of 1811, and again the association of this plant with field specimens is open to doubt, but it appears to be more probably a specimen of A. smutsiana.

The earliest known, and probably only herbarium specimen of a plant described as Aloe pentagona during this time, comes from Willdenow's collection in the Berlin Museum. This specimen, Willdenow No. 6794, has all the characteristics of what the present author has described as A. hallii sp. nov.! In 1811, Willdenow had also included an account of Aloe pentagona in his "Bemerkungen über die Gattung Aloe", which shed no light on the identity of this species.

Salm-Dyk's illustration of Aloe pentagona in his *Monograph* (1836-1864) appears to be that of a large specimen of A. smutsiana. Baker (1881 & 1896-97) probably included elements of both A. smutsiana and A. hallii in his concept of A. pentagona, for he listed as a variety of this species, A. bullulata Jacq. which is somewhat similar to A. hallii.

Berger (1908), on the other hand, appears to have confined his concept of A. pentagona solely to plants resembling A. smutsiana.

Thus, apart from the fact that none of the original descriptions by Aiton (1789) and Haworth (1804), give any grounds for the recognition of A. pentagona as a species distinct from A. spiralis L, there would appear to have been some confusion over the application of the epithet, plants of both A. smutsiana and A. hallii being referred to as A. pentagona.

In 1812, Haworth described a new species, Haworthia spirella, and again the poor description makes association with field specimens difficult. The first illustration of a plant described as Aloe spirella Haw. appeared in Salm-Dyk's Monograph (1836-1863), at least twenty years later. The plant in the illustration may be readily identified with A. smutsiana.

Both Baker (l.c.) and Berger (l.c.) reduced Aloe spirella (Haw.) Salm-Dyk to a variety of A. pentagona.

It is quite obvious that in the past specimens of A. smutsiana and of A. hallii have been confused.

There are no type herbarium specimens of Aloe pentagona Haw. or Haworthia spirella Haw. and no evidence that the plants described by subsequent authors in the past as "pentagona" or "spirella" were the same plants as, or off-shoots of, the original specimens described by Aiton and Haworth. The similar facies of all species of the genus could easily result in confusion of interpretation of sparse specific epithets.

If the plant described as Aloe pentagona by Haworth could be definitely associated with plants described by the present author as Astroloba hallii sp. nov., then the grounds for associating Haworthia spirella Haw. with plants described by the present author as Astroloba smutsiana sp. nov. would be very good, and there would be no need for a new name. However, it is just as likely that Haworth's original description of Aloe pentagona Haw. was applied to a plant of what the present author has called Astroloba smutsiana.

Because there is no evidence as to the nature of the

original Aloe pentagona Haw., and because of the subsequent confusion over the application of this epithet, it is the strong opinion of the present author that, to avoid further confusion, the epithet "pentagona" should be abandoned altogether in the genus Astroloba. Accordingly the specific epithet hallii is proposed for plants of Astroloba which resemble the Willdenow herbarium specimen "Apicra pentagona". This name is after Mr. H. Hall of Kirstenbosch who first brought living plants of this species to the notice of the present author. (See Plate 33).

If Haworth, on the other hand intended his Aloe pentagona to apply to plants described by the present author as A. smutsiana then Aloe pentagona Haw. and Haworthia spirella Haw. as illustrated by Salm-Dyk are synonymous. Indeed Baker (l.c.) and Berger (l.c.) reduced Haworth's spirella to a variety of A. pentagona.

The present author feels most strongly that if the specific epithet "pentagona" is to be abolished in the genus Astroloba, then so must the epithet "spirella" be abandoned. Accordingly the specific epithet smutsiana is proposed for all plants of Astroloba which resemble Salm-Dyk's illustration of Aloe spirella (Haw.) Salm-Dyk. This is in honour of General Smuts, as it was the Smuts Memorial Foundation which gave the financial assistance necessary for this research.

The identity of the species Haworth described as Aloe spiralis in 1804 is still open to doubt, the only evidence as to its identity being that it was "very much like Aloe pentagona but somewhat larger" and later, (1812), that it was three times larger than H. spirella. The only illustration of Aloe spiralis sensu Haw. appeared in Salm-Dyk's Monograph (l.c.). It is difficult to associate the plant in the illustration with either A. hallii or A. smutsiana.

Baker (l.c.) replaced the incorrect epithet spiralis Haw. by the epithet "Willdenovii" and reduced this species to a variety of A. pentagona, and this arrangement was maintained by Berger (l.c.).

In neither A. hallii nor A. smutsiana is there any grounds for recognition of sub specific categories based on size. Further, since the nature of the original Aloe spiralis sensu Haw. is open to doubt, it is best to abandon the varietal epithet "Willdenovii" Baker as well.

This species is difficult to culture and will not long remain alive in Europe. Aloe spiralis listed as species number 27 follows after A. unguis, No. 24, A. virens No. 25, and A. tortuosus No. 26, all species described with trifoliate leaves. Aloe foliolosa, described with multifoliate leaves is listed as number 28, while the other members of the section were described with trifoliate or five-foliate leaves are listed as numbers 29 to 31.

Willdenow (1811) repeated his arrangement when describing these as species of Aloë in his Description, and also (1811) in the second edition of the Florae Sibiricae also described the leaf arrangement of the plant Aloe spiralis as trifoliate.

In his synopsis, Swartz (1812) referred A. spiralis to Sarcocolla in the section Cylindropuntia "... Sarcocolla bilobata...". Together with other species recognized today as independent members of the genus Sarcocolla. In this work Swartz gave A. virens the English epithet "smooth triangular", and A. spiralis the epithet "rough triangular". All species recognized today as members of the section with trifoliate, five-foliate or multifoliate leaves were placed in the section Cylindropuntia "... Sarcocolla ... with sub-erect lobes."

Rafinesque (1817) in his Catalogue also listed Aloe spiralis with trifoliate leaves except species now recognized as belonging to Sarcocolla in a separate section from plants now recognized as members of Sarcocolla.

As has been shown, no species of Sarcocolla have trifoliate leaves and without question the plant described as A. spiralis by Swartz could only be placed in the genus Sarcocolla probably somewhere near S. virens and S. virens, which would appear to be

ASTROLOBA ASPERA (Haw.) Uitew. AND ASTROLOBA RUGOSA sp. nov. Roberts.

Haworth (1804) in his "New Arrangement of the Genus Aloe" included in the Division Parviflorae, Section Rigidae, a new species Aloe aspera, "... with trifarious orbiculate-ovate acuminate leaves ... below markedly tuberculate ... Cape of Good Hope. Masson. This species is difficult to culture and will not long remain alive in Europe". Aloe aspera, listed as species number 27 follows after A. anomala, No. 24, A. viscosa No. 25, and A. tortuosa No. 26, all species described with trifarious leaves. Aloe foliolosa, described with multifarious leaves is listed as number 28, while the other members of Astroloba then described with multifarious or five farious leaves are listed as numbers 20 to 23.

Willdenow (1811) repeated this arrangement when describing these as species of Apicra in his Bemerkungen, and Aiton (1811) in the second edition of the Hortus Kewensis also described the leaf arrangement of the plant Aloe aspera as trifarious.

In his synopsis, Haworth (1812) referred A. aspera to Haworthia, in the Section Caulescentes "... corolla bilabiate...", together with other species recognised today as caulescent members of the genus Haworthia. In this work Haworth gave H. viscosa the English epithet "smooth triangular", and H. aspera the epithet "rough triangular". All species recognised today as members of Astroloba with imbricate, five farious or multifarious leaves were placed in the Section Caulescentes ... "corolla ... with sub-erect lobes."

Salm-Dyk (1817) in his Catalogue also listed Aloe aspera with trifarious leaves amongst species now recognised as belonging to Haworthia in a separate section from plants now recognised as members of Astroloba.

As has been shown, no species of Astroloba have trifarious leaves and without question the plant described as A. aspera by Haworth would today be placed in the genus Haworthia probably somewhere near H. nigra and H. viscosa, which would appear to be

similar in size and habit. The flowers of both H. nigra and H. viscosa are strongly bilabiate.

In 1818 Haworth received from Prince Salm-Dyk a description of an inflorescence purporting to be that of the plant described as A. aspera. In this illustration the perianth was shown to be actinomorphic. Obviously the flowers came from a plant belonging to the genus now called Astroloba.

It is evident that the plant with trifarious leaves described by Haworth as A. aspera, must have been very similar in appearance to the plant of Salm-Dyk's which produced actinomorphic flowers.

It is from this that the confusion arose over the application of the epithet "aspera". Salm-Dyk had either never seen the plant described as 'aspera' by Haworth when he listed it "with trifarious leaves" in his Catalogue, or, he had plants of both what are now described as rugosa and what Haworth described as aspera, and had not examined them carefully to see the differences in leaf arrangement, or he had only plants of rugosa but again had not paid attention to the leaf arrangement, simply quoting Haworth's description.

The present author collected a plant near Waterford in the Eastern Cape, which, apart from its trifarious leaf arrangement, resembled very closely in vegetative characters plants of Astroloba rugosa sp. nov. Roberts. The flowers of this specimen which was identified by Mr. Hall of Kirstenbosch as a form of Haworthia nigra (Haw.) Bak. were markedly bilabiate, resembling those of H. viscosa. (See Plate 34).

As a result of Salm-Dyk's communication, Haworth (1819) included the plant described as aspera as a species of Apicra in his Supplementum. He now described the adult leaves as "sub irregularly spirally trifarious" and included a description of the flower taken from Salm-Dyk's letter. He mentioned two varieties, α minor "sent by Van Marum in 1818", and β , "nearly twice as large ... growing at Kew".

At this stage, presumably, Haworth had not seen the flowers of these varieties and one must therefore consider them

HAWORTHIA NIGRA (Haworth) ^{Baker.} ~~Uitewaal.~~ Plants from near Waterford.

Below: Leafy shoot (X $1\frac{1}{5}$); apart from the much darker green coloration, trifarious leaf arrangement, and the slightly denser tuberculation, superficially, this species resembles A. rugosa.



Right: Part of inflorescence (X 1 approx), the flowers are strongly bilabiate.



Leafy shoot viewed from above showing trifarious leaf arrangement.



H. nigra was in fact, originally described by Haworth as a species of Apicra, "intermediate between A. foliolosa and A. aspera." (Haworth in Phil. Mag. and Jour. Lond. Edin. and Dublin 1824:302 (1824)). The original Aloe aspera Haworth was probably a plant similar to H. nigra, if not in fact, actually a specimen of it.

as varieties of a species of *Haworthia*, although in his *Revisiones*, Haworth (1821) did comment that he did not possess var α , "neque (nisi parvam) β , ab. *Illust. Pr. de Salm-Dyk*". Here he also suggested that perhaps these two should be considered as separate species "ob tuberculorum nervorum differentiam".

In the field, in a single population of *Astroloba rugosa*, leaf length may range from 1.5 - 2.5 cm. and there is no justification for the recognition of varieties based upon size in this species, while in *H. nigra*, size is more variable. If the plant described as var. β was not a species of *Haworthia*, it is possible that it might have been a specimen of the intergeneric hybrid, *Astroworthia bicarinata* (Haw.) Roberts.

Sprengel (1825) and the Schultes (1829) both described *Aloe aspera* as having trifarious leaves.

Salm-Dyk (1836-1863) in his Monograph, however, described the leaves of *Aloe aspera* Haw as "spirally five ranked, 6-7 lin. long and wide ... with rough concolorous tubercles". The inflorescence was described as unbranched, with a "dirty pink" peduncle, and bracts three times shorter than the pedicels; the perianth as "obclavate-tubular, terete hexagonal, pale dirty pink, with regular open lobes". He mentioned that the plant was brought to England by Masson in 1795. However, apart from noting that Haworth's var. *major* was unknown to him, Salm-Dyk made no comment on the discrepancies in his present and all previous accounts of leaf arrangement.

All subsequent authors have incorrectly used Haworth's epithet "aspera" as pertaining to plants with five farious leaf arrangement and agreeing with Salm-Dyk's description of *Aloe aspera*. For this reason the present author proposes that the specific epithet "rugosa" be used instead and the species be described as *Astroloba rugosa* sp. nov. Roberts.

The variety β of "aspera" was included by Baker in his *Synopsis* (1881) and in the *Flora Capensis*, and it is of interest to examine his account. He described the leaf arrangement of "*Apicra aspera*" as multifarious, with the diameter of the leafy stem 2.5 cm., leaf length and width 1.3 - 1.8 cm. tubercles concolorous, inflorescence simple and pedicels 0.6 - 0.8 cm. long,

while "var β major Haw." was described with a leafy stem 5.0 cm. in diameter, leaf length 2.0 - 2.5 cm, leaf width 1.7 cm, tubercles concolorous or white, inflorescence occasionally branched and pedicels 0.3 - 0.4 cm. long. In the Synopsis, he noted that the perianth in the species had obscurely bilabiate lobes, while in the Flora Capensis he did not describe the inflorescence of the variety. These appear to be accounts of living plants growing at Kew.

The fact that the inflorescence of var. major was described as occasionally branched suggests that this particular plant might well have been a small form of the Haworthia margaritifera X Astroloba rugosa hybrid.

Berger (1908), described the leaves of "Apicra aspera" as spirally five ranked, 1.2 - 1.4 cm. long and wide, and the pedicels as 0.5 - 0.7 mm. in length, with no mention of whether or not branching occurred in the inflorescence. He commented that he had not seen "var major", and cited as herbarium specimens: "Springbokkeel" (Drege 8655), and Marloth n. 4216. As mentioned earlier, the present author found no specimens of A. rugosa beyond the Montagu-Ladismith-Barrydale karoo and the northern foothills of the Swartberg. Apart from a dubious Marloth specimen from Graaff Reinet, the Drege specimen is the only known record for A. rugosa beyond this area, if indeed it is a reliable record.

"Astroloba aspera var major" was included in Uitewaal's revision of the nomenclature of Haworthia and Apicra (1947), but no description was given.

Apart from Baker's account of 1881 there is no clue as to what "var major" might be and, in view of the fact that leaf length in rugosa varies from 1.5 - 2.5 cm in individual field populations, there is no course but to abandon this variety for Astroloba rugosa.

THE TAXONOMIC HISTORY OF A. BULLULATA (JACQ.) UITEW. AND THE
CONFUSION OVER THE IDENTIFICATION OF THIS SPECIES AND
A. BICARINATA (HAW.) UITEW.

Aloe bullulata was first described by Jacquin in his *Fragmenta* (1809). This description, accompanied by an illustration is one of the more comprehensive and useful type descriptions of a species in the genus *Astroloba*.

The plant described by Jacquin was grown from seed sent from the Cape by "Schollio"*, and flowered in May and June. A summary of Jacquin's description follows.

In the juvenile stages the leaves are five ranked, becoming imbricate later on, "so that below it resembles Aloe pentagona and above Aloe spiralis". The stem is about a foot high, the leaves are rigid and ovate acuminate, the largest being about 5 cm. long and tubercled on the underside. The inflorescence is racemose, the flowers "vix bilabiatae", with a green perianth tube and short ovate patent lobes which are yellow with a green stripe. In the accompanying illustration, the leaf apices, while not shown with any clarity as keeled marginate, are broadly acuminate, and there are a variable number of fairly large discrete tubercles on the leaf underside, which in one leaf in particular, are arranged in rough transverse rows.

There is no doubt about associating this species with plants collected in the Ceres-Sutherland Karoo and near Matjesfontein. None of the specimens collected had a leaf length of 5 cm., but this is a difference which is probably attributable to cultivation.

Willdenow (1811) included the species as Apicra bullulata in his *Bemerkungen* and it was listed in Salm-Dyk's catalogue (1817).

Haworth (1819) described Apicra bullulata the "blistered" *Apicra*, in his *Supplementum*, with "spirally five farious imbricate, ovate acuminate leaves and below a few dark green tubercles. He commented that this species had "affinities with Aloe

* Could this be F.A. Scholler (1718-1785) author of *Flora Barbiensis*?

spiralis* nob. Synopsis succ.(1812) in the frequent rough very hard tubercles of the margins and keels".

In his Supplementum, Haworth also included a new species, Apicra bicarinata: "with submultifarious cordate leaves, very hard and green, bicarinate; with scattered dark green raised tubercles below : with margins and keels frequently very roughly tuberculate". This description was followed by the comment that this species was very similar to "Apicra aspera", but "easily distinguished by being nearly three times as large, with a more intense colour and very hard irregularly roughly tuberculate margins and keels".

Although Haworth's species A. aspera has been shown to have been a species of Haworthia, it was obviously very similar in appearance to the species of Astroloba interpreted by Salm-Dyk as A. aspera Haw. The only plants in the field, which the present author has found to fit Haworth's description of "very similar to A. aspera, but ... nearly three times as large", are plants of the suspected hybrid between A. rugosa and H. margaritifera. A. bullulata and A. hallii, the other members of the genus with tuberculate leaves are very different in appearance. It is unlikely that Haworth would have described either of them as similar to A. aspera, or, if his A. bicarinata had in fact been a specimen of A. bullulata Jacq., that he would have failed to comment on its similarity to this species.

The Schultes (1829) and Kunth (1843) listed both bullulata and bicarinata as Aloes. It is of great interest that Salm-Dyk did not include Aloe bullulata or A. bicarinata in his Monograph, although he did mention that Aloe spirella "is easily separated from its relatives and especially A. bullulata".

Baker (1881) in his Synopsis, described bullulata as a variety of Apicra pentagona** , from which it differed in the

* Haworthia spiralis was described "with patent ovate-acuminate leaves ... keeled on one side towards the apex ... below a few scattered spots". (Synopsis: 97 (1812)).

** Baker described the leaves of "Apicra pentagona (Haw.) Willd" as lanceolate deltoid, regularly five farious, 3.2-3.8 cm. long and 1.3-1.7 cm. broad, bright green, the margins scabrous .. with a few white tubercles scattered on the under surface."

spirally twisted leaf arrangement and in the frequent tubercles on the under surface, a poor distinction. It could be debated whether or not Baker was in fact describing plants of A. bullulata Jacq., but taken at its face value one must assume he was.

As has been shown, there has been considerable confusion over the identity of "Apicra pentagona", while there is a good deal of similarity between the species identified as A. bullulata and A. hallii by the present author. The fact that Baker did include bullulata in the species "pentagona" may be considered as further evidence that he was also including plants described by the present author as A. hallii sp. nov. in this complex. All his descriptions of "pentagona" and its varieties were evidently taken from living plants.

Baker also included an account of Apicra bicarinata Haw. He described the leaves as bikeeled, densely multifarious, lanceolate deltoid, 2-3 cm. long, about 1.2 cm. wide, with copious prominent whitish tubercles on the under-surface, which may be in rough transverse and vertical lines ... "cf. A. aspera the large variety". He noted a drawing at Kew in 1818 of a specimen sent by Dr. Macrell and mentioned a plant of A. bicarinata he himself had seen collected by Cooper in the Orange Free State. One must doubt the accuracy of this locality.

In the Flora Capensis (1896), Baker mentioned that his description was taken from a drawing of Haworth's type made at Kew in 1818 and that the locality in South Africa was unknown. To date this painting has not been traced.

Bullulata was again listed as a variety of "A. pentagona" in the above-mentioned work.

Berger (1908) restored the specific status of what he considered to be A. bullulata. He described the leaves as imbricate, open, 3 cm. long and 1.3 cm. wide*, "ovate lanceolate acute, bright or pale green, below very oblique and acutely keeled, keel from above margin forming, with a few tubercles a little raised ... often brownish towards the margins and keels,

* In his account of "A. pentagona" Berger gives the measurement of leaf width at the base. He does not indicate where the measurement of leaf width was taken in any other species described.

and terminating in a short sub-sharp mucro". Below is the observation that the flowers are yellowish "with green lines". He cited a specimen "S. Cape Marloth n. 4201", and noted that plants were sent to Kew in 1818 by Dr. MacKrell. He also mentioned an aquatint of this plant in the herbarium, which the present author has been unable to trace. Since these plants were sent to Kew in 1818, it is highly unlikely that they were in any way connected with the original plant of A. bullulata described by Jacquin.

This is the first mention in any description of what the present author has termed a keeled marginate apex. Below his account is the comment that this species is well distinct from "pentagona Willd.", and that the leaves have the keel on the right side. Obviously Berger did not handle sufficient material of this genus to appreciate that the side of the leaf on which the keel is situated may vary even on one plant.

Berger also included an account of Apicra bicarinata Haw. where he described the leaves as "ovate deltoid, 2 cm. long and 1.5 cm. wide, shortly acuminate, bright green ... below obliquely keeled (or bikeeled?*) , with white tubercles on the under surface arranged roughly in transverse series, towards the margins and keels denticulate-rough". Below is the note that this species was brought to Kew in 1818 by Dr. Mackrell, and that there was a water colour of the plant at Kew.** Berger mentioned that Marloth had in a letter reported a record for A. bicarinata from Graaff Reinet. This locality must be viewed with some doubt. Berger commented that the species had more affinity with A. bullulata than with A. aspera; and that the plant in the picture at Kew had unicarinate not bicarinate leaves. He finally made the most important observation that the "keels ... simulate above a false margin".

A rather poor illustration of the plant described as "bicarinata" accompanies this account, in which the transverse grouping of the leaf tubercles is not shown, but the leaf apices

* The question mark is Berger's.

** To date untraceable by the present author.

are shown as curving slightly to one side. The species described by Berger as A. bicarinata, although smaller than is typical, is obviously also A. bullulata Jacq. on the ground of the broad leaves, the keeled marginate apices, the way the apices curve to one side and the grouping of the tubercles into transverse bands.

Berger's account of two water colours at Kew of plants collected in 1818 by Dr. MacKrell, one purporting to be an illustration of the type of Haworth's A. bicarinata, presents a problem. Neither of Berger's descriptions of A. bullulata or A. bicarinata, nor his comments on the water colours, could be said to apply to a plant resembling A. aspera Haw. but three times the size. Baker mentions only one water colour at Kew, that of A. bicarinata, from which, according to his note in the *Flora Capensis* (l.c.), he made his description. He however, described the leaves as "obscurely bikeeled".

Were there perhaps three paintings at Kew? In his original description Haworth (1819) apart from noting that the plant grew at Kew, made no mention of any water colour.

Baker's interpretation of A. bicarinata is problematical. His description and comments could certainly apply to the present author's interpretation of A. bicarinata Haw., but cannot be so considered if he was in fact referring to one of the water colours mentioned by Berger, for it seems most reasonable to consider A. bullulata and A. bicarinata sensu Berger as synonymous with A. bullulata Jacq.

It does seem unlikely that the plants in the water colours described by Berger, with unicarinate leaves were the same as that described by Haworth as A. bicarinata, with two keels.

Berger also included an account of a new species, Apicra skinneri, which he obtained from Mr. W. Skinner of Thornton Heath. His description of this species follows: "Leaves densely spiral ... erect patent, the older patent, 3 - 4 cm long, and 2.0 - 2.3 cm wide, widely ovate deltoid, acute and terminating in a sub pungent mucro, coriaceous ... bright green, the upper surface

with a few scattered tubercles, more rarely smooth below ... obliquely keeled or bikeeled, sometimes the second keel simulating a margin from above, with numerous subconcolorous or whitish tubercles, scattered or in transverse or longitudinal series ... flowers unseen". Below is the comment that this plant has definite affinities with A. bullulata, but is robuster, the leaf wider, more tuberculate and patent. It is odd that Berger did not include an illustration of his new species.

This description most closely agrees with plants of the A. rugosa X H. margaritifera hybrid, where the upper surfaces of the leaves are often tuberculate, and the tubercles are far more numerous than in A. bullulata or A. hallii. The author has never seen leaves in which the apex is sometimes of the sort described above, but in most cases, the keel in mature leaves is very indistinct on account of the degree of tuberculation, and sometimes the apex is very narrowly acute - acuminate as seen in specimens from Rietvlei and the collection of Mr. B. Carp. It seems most reasonable to consider Apicra skinneri Berger as a synonym of Apicra bicarinata Haw.

Berger's key to these three species and "aspera" is given below:-

- A. Leaves \dagger verrucose or papillose on the back.
- a) Leaves subrotund, dorsally semiglobose, convex keeled towards the apex, keel straight A. aspera
- b) Leaves greatly deltoid below acutely obliquely keeled. Keel above often forming a false margin.
- α Leaves 30-40 mm. long.
- i) Leaves deltoid \dagger 13 mm. wide few tubercles A. bullulata
- ii) Leaves ovate-deltoid 20-33 mm. wide numerous tubercles A. skinneri
- β Leaves 20 mm. long, tubercles numerous more conspicuous, sub irregularly distributed A. bicarinata

Marloth (1915) included a short description and an illustration of a flowering specimen of Apicra bullulata Jacq. from Verlaten Kloof at the Northern limits of the Ceres Sutherland Karoo. The shape of the leaf apex, the typical tuberculation pattern and the colour of the flowers are well shown.

Dr. Karl van Poellnitz (1930) described a new species, Apicra egregia, collected by a Mrs. van der Bijl near Oudtshoorn. His account is given as follows: "leaves 1.7 cm long, 1.5 cm wide at the base, strictly five farious or rarely sub-spirally five ranked, patent erect, ovate deltoid, towards the apex obliquely curved and a little in-curved, ending in a sharp brownish mucro, glaucous, dark green ... below obliquely keeled or rarely a little bikeeled and ornamented with shining green tubercles not regularly transversely seriate, single or a few congregated together ..."

He commented that this species differed from A. bicarinata Haw. especially in the glaucous-green leaves, which are very green below, with fewer tubercles not ornamented in transverse series.

It is evident that von Poellnitz was comparing his new species with the "bicarinata" of Berger's description. Apart from the size of the leaf, von Poellnitz' rather general account might apply to small plants of either A. hallii or A. bullulata. The fact that the leaves were described as ovate deltoid, obliquely curved and a little in-curved towards the apex might be considered to correspond more with A. bullulata than with A. hallii, but on the other hand the colour of the leaves was described as glaucous, (which in the field at any rate, rarely applies to A. bullulata), and the tubercles were described as not being in transverse series, although this latter character is not always constant in A. bullulata. Von Poellnitz did not describe the apex as keeled marginate, nor mention the green vein lines on the under surface of the leaf typical of hallii.

Jacobsen (1935) in the first English edition of his book on succulent plants included an account of Apicra egregia in which the leaves were described as "sharply keeled to one side ... bluish green, often reddish, with a few green longitudinal

* He used the emphatic word "haud"

stripes on the back, margins and keel rough cartilagenous". The accompanying photograph is very indistinct and could be of a plant of A. smutsiana or of A. hallii, both of which have characteristic green vein lines. The fact that the leaves were described as sharply keeled on one side, probably applies more to A. hallii than A. smutsiana.

An illustrated magazine article of von Poellnitz which appeared in 1937, clarified the identity of his Apicra egregia. The photograph of "Apicra egregia von P." is in fact of a plant readily associated with plants collected in the Ceres Sutherland Karoo. Apicra egregia von P. is thus a synonym of Apicra bullulata (Jacq.) Haw. In the photograph, a slight tendency for the tubercles to aggregate in transverse series is shown. In this description of the species, von Poellnitz described the arrangement of tubercles as "not or scarcely somewhat confluent, not or scarcely arranged in crosslines". He quoted Jacobsen's (l.c.) description of leaves with longitudinal green stripes and commented: "I do not understand this!" At least he had not confused plants of his "egregia" with plants of A. hallii.

Uitewaal (1938) in his series of articles on the genus Apicra in Succulenta, wrote an account of Apicra bullulata (Jacq.) Haw., A. skinneri Berger and A. egregia von Poellnitz. The specimen he described as A. bullulata came from a private collection, that he called A. skinnerii was sent from Winton nurseries, S. Africa under the name "Apicra Neillii", while the plant called A. egregia was collected by H. Herre from Verlaten Kloof and sent under the name A. bullulata.

Needless to say the plant referred to as "A. egregia" by Uitewaal, of which there is a photograph, is in fact a specimen of Apicra bullulata (Haw.) Jac. Uitewaal commented that von Poellnitz had written to him saying that, after visiting Jacobsen's succulent collection at Kiel, he felt that his A. egregia was identical with A. bicarinata Haw, but he had not investigated the matter further.

There are also photographs of the plants referred to as bullulata and skinnerii. There is little difference between them,

both resembling plants of the suspected H. margaritifera X A. rugosa hybrid. Both therefore should be referred to by the epithet bicarinata Haw. It is very likely that the plant sent from Winton nurseries was one of those collected by Hurling and Neil from 1928-1931 along the Baden road near Montagu. (See page 300).

It is a reflection of Uitewaal's lack of understanding of the species of this genus that he should consider the two plants referred to by him as bullulata and skinneri as two separate species, and yet dismiss lightly the great difference between the specimen he called A. bullulata and that illustrated as such by Jacquin, by saying that Jacquin's drawing was "te schematisch"!

It is of interest to note Uitewaal's suggestion that figure 2 of Section One of Salm-Dyk's monograph, which is missing, was intended to be an illustration of Aloe bullulata.

In his revision of the nomenclature of Apicra, Uitewaal (1947) listed A. bullulata Jacq., A. skinneri Berger, A. bicarinata Haw and A. egregia Poelln. all as species of Astroloba. Apart from the synonyms Skinnerii and egregia, there is little doubt that his interpretations of what constituted the A. bullulata and A. bicarinata differed from those of the original authors.

ASTROLOBA HERREI UITEW. AND A. DODSONIANA UITEW.

A new species of *Astroloba* *A. herrei* was described by Uitewaal in (1948), characterised by an ovate corolla in which the outer tepals are greatly inflated on either side of the midrib. Unfortunately it was not possible to obtain the original description, but from a later account with good photographs in *Succulenta* (1950), it appears that the original description of the perianth was not very satisfactory, and Uitewaal does not appear to have mentioned any similarity between the corolla of this species and that of *A. spiralis* (L) Uitew.

The species was described from plants collected by Mr. H. Herre of Stellenbosch near Uniondale and a collecting number (Stellenb. No. 5703) is given.

The photographs in the *Succulenta* account agree well with specimens found in the field near Uniondale and Prince Albert, and *Astroloba herrei* Uitew. is beyond doubt a good species.

In 1950 however, Uitewaal published a new species *Astroloba dodsoniana* described from a plant sent from a private collection in California! The photographs of the plant and a drawing of the flower also agree with plants in the populations of *A. herrei* found near Uniondale and Prince Albert! *Astroloba dodsoniana* Uitew. is unquestionably a synonym of *A. herrei* Uitew.! In his account of "*A. dodsoniana*", Uitewaal does comment that this "species may be compared with *Astroloba herrei* Uitew .. from which however it is easily distinguished by its more erect and more whitish leaves, which have only very inconspicuous lines on the back, and by its light margins and keel". Again this is an indication of lack of comprehension of variation within a species in this genus.

TAXONOMIC HISTORY OF THEAFOLIOLOSA COMPLEX.

The first member of this complex to be described as a species was Aloe foliolosa, in 1804 by A.H. Haworth. The description was made from living plants in his own collection, which had been sent from the Cape by Francis Masson. He described Aloe foliolosa as having "multifarious very short, rounded ovate smooth bright green horizontal leaves"; and noted that "This is the least leaved of all Aloes; the leaves are at the same time the thinnest, the most numerous and the most crowded".

Aloe foliolosa was next mentioned in the second edition of the Hortus Kewensis (1811) with a note to the effect that it was introduced in 1795 and flowered for most of the summer. Willdenow (1811) in the same year, transferred the species to the genus Apicra and described the leaves as "multifarious, patent, rounded-ovate".

Also in 1811 an illustrated account of Aloe foliolosa by Gawlor (Ker) appeared in the Botanical Magazine. The illustration of the specimen, which was sent by Haworth, includes an unbranched flowering spike, and agrees well with specimens collected at various localities and identified as belonging to the entity foliolosa recognised by the present author. The leaves are shown in the illustration to be very patent. Subsequently Haworth (1912) transferred A. foliolosa to Duval's new genus Haworthia in his Synopsis.

Aloe foliolosa was next mentioned by Salm-Dyk (1817) in his Catalogue and again in his illustrated Monograph (1836-1863). Here the leaves were described as "very crowded, five farious densely arranged in a spiral, about 2 cm long and the same wide in the middle", the base being a little narrower, the apex acute; the younger leaves erect-patent, the older leaves very patent, straight, bright green --- very smooth and shiny", ("nitida"). The excellent illustration agrees well with small plants collected in the field, and referred by the present author to sub species foliolosa.

Also in the Monograph, and in the same section "Foliolosae", appeared an account of a new species, Aloe congesta. The description of leaf arrangement is similar to that for A. foliolosa, but the shape is given as being ovate-acute, the leaves about 3.7 cm. long ("sesquipollicem") and about 2.3 cm ("pollicem") wide at the ovate base from which the leaf is attenuate-acute. Again the leaves are described as bright green, very smooth and shiny. It is only in these two descriptions in his Monograph that Salm-Dyk uses the word "nitida" to describe the texture of the leaf surface. This agrees with the observations made by the present author on the nature of the epidermal cells and how they affect the texture of the leaf.

The illustration agrees well with plants collected from the marginal karoid areas near Cradock, Adelaide and Grahamstown. Here, the peduncle is described as unbranched.

Salm-Dyk noted that this plant flowered in September and October, and was brought to the Berlin Gardens in 1843. At first it was thought to be a more robust variety of Aloe foliolosa Haw. "Now however, it is considered quite distinct on the grounds of less rounded leaves, which are twice as broad, much longer and more crowded, and especially the wide, recurved and patent perianth lobes".

From the drawings, rough measurements for pedicel lengths are 0.4 cm for A. foliolosa and 0.3 cm for A. congesta, while fertile bract lengths are 0.5 cm and 0.7 cm for A. foliolosa and A. congesta respectively. It is difficult to determine the number of veins for the lower sterile bracts in the drawings of A. congesta, but this could be one vein in A. foliolosa.

In 1873 a new species, Aloe deltoidea was described by J.D. Hooker from a plant long cultivated at Kew, with no record of its introduction. Hooker (1873) wrote: "This singular succulent belongs to the same section of Aloe with A. foliolosa ... pentagona ... spirella, imbricata ... spiralis etc. of Haworth It differs from the first-named of these chiefly in size, and in the leaves not being spirally disposed except on the young shoots, though I should much doubt this character being of any value".

The diameter of the stem, the first time such a measurement is used, is given from leaf tip to leaf tip, (according to the illustration), as two inches. The leaves are described as most densely five fariously imbricate, horizontal, deltoid-ovate acuminate about 1.8-2.5 cm long and deep shining green, quite smooth and glabrous.

There is no mention of Salm-Dyk's Monograph, and from the illustration it is difficult to tell whether Hooker's Aloe deltoidea is similar to Salm-Dyk's Aloe congesta and therefore to plants from the Cradock-Grahamstown area, or whether it is similar to the third variety of this complex designated subsp. robusta by the present author. The peduncle is described as stout, and from the illustration it would appear that the lower flowers of the inflorescence are very shortly pedicellate, but it is impossible to see the number of veins in the bracts. Measurements taken from the single withered flower with a visible pedicel, give a pedicel length of 0.2 cm and a fertile bract length of 0.8 cm.

Of all the specimens referred to by the author as sub species congesta, only two had leaves 2.5 cm or less in length, while the great majority of specimens referred to by the author as sub species robusta had basal fertile bracts more than 0.8 cm long, and all had basal flowering pedicels less than 0.2 cm long. In view of the fact that the sub species in the foliolosa complex have been determined on grounds of diversity together with different geographical distribution it is best not to attempt to associate the Aloe deltoidea of Hooker's description definitely with either var congesta or var robusta.

In 1881, Baker listed all three species, A. deltoidea, A. congesta and A. foliolosa under Apicra in his synopsis. Following his description of Apicra deltoidea (Hook. fil.) Baker, he noted that it had been introduced in about 1865 by Cooper* and cited an herbarium specimen "C.B. Spei in lapidosis montis Zuurberg Bolus 2687".**

* Thomas Cooper travelled in South Africa between 1859 and 1862.

** In Kew herbarium and seen by the author.

If the plant Baker described as A. deltoidea is indeed Hooker's Aloe deltoidea, then Aloe deltoidea Hooker is a synonym of Aloe congesta Salm-Dyk. This is the only evidence as to the identity of Hooker's deltoidea, and it could therefore be considered simply a specimen of sub species congesta.

Baker's comments on A. congesta and A. foliolosa are similar to those of previous authors. In 1889, Baker described a new species, Apicra turgida, "near Apicra deltoidea", and introduced into cultivation in 1872, specimens of which he had seen which had been collected in the Albany Division by Hutton. There appear to be no grounds for considering this at all distinct from A. congesta. There is mention of the pale green upper leaves "with several indistinct vertical ribs of darker green", presumably these are the vein lines.

In the *Flora Capensis* (1896) Baker enlarged on the locality of the specimen of A. deltoidea (Bolus 2687) giving it as "Stony places at Hell Poort 2,000 feet", which, as has been shown previously, is a locality well known to the present author for plants agreeing with Salm-Dyk's concept of A. congesta. There appears to be a misprint in the account of A. congesta where it says "leaves ... with spots or tubercles". It is certain that this should read "leaves ... without spots or tubercles".

Baker's key to these three species is very poor and is given below:-

"Leaves arranged in five straight or spirally twisted rows:

Leaves lanceolate-deltoid (1) pentagona

Leaves deltoid:

Upper leaves flat on the face (2) turgida

Upper leaves concave on the face (3) deltoidea

Leaves multifarious, the spirals quite obliterated:

.....

Perianth smooth*

Leaves smooth on back and face:

Leaves deltoid (5) foliolosa

Leaves lanceolate-deltoid (6) congesta

* In the text there is a misprint which reads "Perianth rugose".

As has been seen, leaf arrangement is not of prime taxonomic importance, and the concavity of the upper faces of *Astroloba* leaves depends on turgidity, the greater the water supply, the fatter the leaves and the flatter the upper face. As clarified by Baker, none of these species warrant recognition as separate species.

Berger (1908) considered *A. turgida* a variety of *Apicra deltoidea* (Hook. f.) Bak., which differed from the typical form on account of the spirally arranged leaves. He created a second variety for this species, var *intermedia*, described from living plants, without locality, sent to him by Marloth, which he said differed in its smaller size. His key to these is given below:-

B. Leaves non papillate on the dorsal surface, but often faintly spotted, the spots small and cartilagenous, but not prominent.

a) Dry leaves longitudinally furrowed with elevated nerves.

.....
Leaves ovate-deltoid (7) *A. congesta*

b) Dry leaves smooth

α Leafy stem 3-5 cm in diam. (8) *A. deltoidea*

1. Leaves strictly five farious *A. deltoidea* v. *typica*

11. Leaves more or less spirally five farious

1. Leafy stem 5 cm in diam *A. deltoidea* v. *turgida*

2. Leafy stem 3 cm in diam *A. deltoidea* v. *intermedia*

β Leafy stem graceful 2-2.5 cm in diam .. (9) *A. foliolosa*.

This key is of interest in that it incorporates an anatomical character - the prominent bundle caps mentioned previously, which cause the leaves to dry in a ridged manner. In the *foliolosa* complex, as mentioned earlier, prominent heavily lignified bundle caps are more typical of plants from the western populations described as sub species *robusta* by the present author, than of the more easterly populations of the plants now described as sub species *congesta* and *foliolosa*.

The character of leafy stem diameter is not a good one as it depends on leaf length, angle of leaf with stem and curvature of leaf apex. Altogether the key is highly unsatisfactory and fails to delimit the components of the *foliolosa* group with any success.

Specimens cited by Berger are of interest - under *A. deltoidea* (Hook. fil.) he mentions "Hellpoort (Bolus 2687) (K)" and "Laingsburg, Matjesfontein (Marloth in litt)". The latter specimens undoubtedly, on account of their locality, belong to the sub species *robusta* as construed by the present author. For var *turgida* he mentioned the same plant as Baker, and the unknown origin of var *intermedia* has already been noted. Again on the information given, var *intermedia* Berger cannot be associated with certainty with either sub species *robusta* or *congesta* of the *foliolosa* complex.

Under *Apicra foliolosa* Berger listed "Karoid slopes between Zwartkops and Sundays river at 330 - 600 m" Drege n 4184 ... Herb. Reichb. fil. in Herb. Caes. Pal Vindob"; Marloth 4204; and "Sundays river Thal. (Marloth in litt)". Under *congesta* Berger, noted that the plant was without locality from the Cape.

It would appear that Drege n 4184 is a misquotation and should read Zeyher 4184. A specimen with this number is in the Albany Museum and all the evidence on the label points to it being a Zeyher specimen. The original number "Aloe Harv. 1054" is crossed out which is typical of many Zeyher labels, the writing is similar and there is an illegible inscription in one corner which is found on a number of Zeyher labels and could not possibly be confused with any of Drege's labels. Consultation of Drege's notes on his travels (1844 p. 129-131) shows that for the collecting area IV C c, between the Zwartkops and Sundays river, apparently no Aloes or Apicras were collected. Further evidence for this specimen being a Zeyher one is found on reference to Drege's list of the collecting numbers of Zeyher, Ecklon and Drege (Linnaea 1847). All the Drege numbers listed under Aloe are in the 8,000's, while there are Zeyher numbers "4182 *Aloe pulchra*" and "4187 *Aloe rigida*". Although obviously not all the

collecting numbers are listed, this is a further indication of the specimen being a Zeyher one. As a point of interest also on the herbarium sheet is another label identifying it as the "number quoted by Berger in the Pflanzenreich IV, 38 III, II 120".

The next author to discuss this complex was Uitewaal in the editions of Succulenta between 1937 and 1939. Unfortunately his notes on A. deltoidea and A. foliolosa were not available. In his notes (1939) on Apicra congesta (Salm) Bak he commented that it was in habit like A. deltoidea (Hook.f) Bak. and especially var turgida, mentioning that plants imported by him under the name A. congesta were identical with A. deltoidea var turgida, and in his key treats A. turgida and A. deltoidea as one species. His key is given below:

"A. Plants more or less glaucous.

.....

Plants slender about 3 cm in diam, pale bluish leaves narrow 2 cm long and 1.2 cm broad deltoidea v intermedia

B. Plants more or less a definite green.

Leaves unspotted on the underside or with single very faintly raised flecks.

A. Leaves in 5 straight rows or very slightly twisted.

.....

oo Leaf deltoid deltoidea typ.

B. Leaves spirally twisted or imbricate

.....

oo Perianth smooth, older leaves more or less patent

1) Plants 5-7½ cm in diam.

.....

b) Leaves deltoid, sometimes ovate deltoid

deltoidea var turgida (also congesta)

2) Plants about 2 cm in diameter, leaf margins somewhat thickened

..... foliolosa.

Again this key is unsatisfactory in that it is based on leaf arrangement, leaf colour and size, and the components of

the foliolosa group are not successfully separated.

In his revision of the genus (1947), Uitewaal reduced Apicra deltoidea var turgida (Baker) Berger to Astroloba congesta (Salm.) Uitew., quoting von Poellnitz's opinion that A. congesta was a fattened form of A. turgida. Uitewaal still treated A. deltoidea (Hook.) Uitew. as a separate species on the grounds of leaf arrangement, although considering it very closely related to A. congesta. Intermedia was kept as a variety of A. deltoidea.

Mention must be made of Jacobsen's Handbook (1960) where A. congesta, and A. deltoideae with varieties intermedia and turgida are listed, and "Astroloba turgida (Baker) Jacobs Cape Province Albany"! For localities of A. deltoidea he gave Laingsburg, Matjesfontein, Albany district and Hellpoort. The photographs are poor but those of A. deltoidea in figs. 210 and 212 resemble specimens from Hellspoor.

In the light of the concepts of the entities in the foliolosa group as established by the present author, the group as a whole is treated as a single species, to be called A. foliolosa Haw. on grounds of priority. This species consists of three sub species, foliolosa, congesta (Salm-Dyk) Roberts and robusta sub sp. nov. Roberts. Incorporated in sub sp. congesta are deltoidea* Hooker (as interpreted by Baker), and turgida Baker, while the identity of var intermedia Berger is open to doubt.

For the sake of convenience all the synonyms are listed above as epithets with their original authors, regardless of their former taxonomic rank.

* Excluding specimens from Laingsburg and Matjesfontein included in A. deltoidea by Berger and Jacobsen, which belong to subsp. robusta.

TAXONOMIC ACCOUNT OF THE GENUS ASTROLOBA UITEW

ASTROLOBA Uitewaal in Succulenta 1947 (5): 53 (1947).

In part Haworthia Duval, Pl. Succ. in Hort Alencon.: 7 (1809), including only the species H. spiralis (Linnéus) Duval.

In part Apicra Willdenow in Ges. Naturf. Fr. Berl. Mag. 5: 167 (1811) including only the species A. imbricata (Aiton) Willdenow; A. spiralis (Haworth) Willdenow; A. pentagona (Aiton) Willdenow; A. ballulata (Jacquin) Willdenow and A. foliolosa (Haworth) Willdenow.

Plants caulescent with adventitious roots at the base of the stem. Stem lengths of up to 50 cm. have been recorded in plants growing supported in bushes, but leafy shoots growing unsupported in the open are generally less than 30 cm. in height.

The leaves are basically deltoid in shape with a sheathing base which forms a complete sheath about the stem and is a few mm. wide at its narrowest part. However, the fleshy base of the leaf excluding the sheathing portion, is narrower than the leaf width at a point roughly half way along the leaf length, or, in the case of longer leaves, up to 1.0 cm. below the mid length.

The lower side of a fully developed leaf has a keel which is slightly to one side and extends from the leaf apex for up to two thirds of the leaf length. Both leaf margins and keel are tuberculate for up to two thirds of the leaf length from the apex.

The apex is acute acuminate ending in a short mucro. In some cases the margin of the leaf on the side of the keel loses its identity as a margin near the leaf apex and the keel then functions as a margin. Such an apex is referred to as a "keeled marginate apex", as opposed to a true marginate apex.

The leaves are alternate and spirally arranged, with a phyllotactic fraction of basically $\frac{2}{5}$. In most cases however, every sixth leaf is situated above the leaf formed five leaves before in such a way that the angle of the spiral between the two is not 720, but a varying number of degrees less. This

angle is referred to as the spiral angle. The smaller the spiral angle, the more five ranked are the leaves, the larger it is, the more imbricate is the leaf arrangement.

The ventral side of the leaf may be tuberculate or smooth and the bundle caps of the vascular bundles on the ventral side sometimes show up as fine striations. The epidermal cells from the upper part of the leaf have greatly thickened outer walls. In section the outer surface of these cells may be very convex, giving the leaves a matt surface, or almost flat, in which case the leaves have a glossy sheen.

The inflorescences are axillary and racemose, and may be branched. The base of the peduncle is flattened and has two thin marginal wings, up to 1.0 cm. long and 0.1 - 0.2 cm. wide. Below the raceme, are a varying number of sterile bracts, and it is in the axils of these that the axillary racemes arise.

The flowers are pedicellate, rarely sessile, and arise in the axils of bracts. Sterile and fertile bracts are deltoid and membranous, generally with one central vein, sometimes with several.

The perianth is tubular, and straight, about 1.0 cm. in length. The free lobes are 1.0 - 3.0 cm. long and broad and lie, when fully open in a more actinomorphic manner than in the genus *Haworthia*, where the three anterior lobes tend to group together curving downwards, and the three posterior lobes tend to curve upwards resulting in a bilabiate condition.

Each tepal has three central veins, surrounded by more densely pigmented cells than found in the rest of the tepal. The veins end in the lobes as an inverted V. In two species, the tissue on either side of the central veins is greatly inflated.

The fruit is a capsule.

The basic chromosome number is $n = 7$.

KEY TO THE SPECIES

1. Outer tepals of perianth tube with a very marked inflation of tissue on either side of the midrib.

A. Inflation of the perianth tube very markedly transversely rugose. (The plants are tetraploid).

.....A. spiralis

- B. The inflated tissue of the perianth tube is smooth or slightly undulating, never markedly rugose. (The plants are diploid).

..... A. herrei

11. Outer tepals of perianth tube lacking a marked inflation of tissue on either side of the perianth tube. All species are diploid.

- A. All, or most of the leaves with keeled marginate apices.

1. Leaves with longitudinal striations on the ventral side of the leaf, the vascular bundle caps lignified for the entire length of the leaf. (Tubercles or whitish maculae sometimes present on the lower side of the leaf). A. hallii

2. Leaves without longitudinal striations on the ventral side of the leaf, the vascular bundle caps unligified at the leaf apex. (Tubercles present on some or all of the leaves of any one plant.)

..... A. bullulata

- B. All leaves with true marginate apices.

1. Leaves always tuberculate..... A. rugosa

2. Leaves never tuberculate, occasionally white flecks present, or one or two elongated slightly raised concolourous patches on the under surface of the leaf.

a. Leaves with a matt surface..... A. smutsiana

b. Leaves with a glossy sheen..... A. foliolosa

Astroloba foliolosa (Haworth) Uitewaal

Leaf arrangement five ranked to imbricate, leaves erect to patent, leaf apices curving upwards to outwards. Leaf apex true marginate.

Leaf colour: Scheeles green, Lettuce green, Fern green, or spinnach green; often with a greyish tinge similar to willow green in subsp. robusta; margins and keels concolourous, paler or whitish; more frequently whitish in subsp. robusta.

Tubercles absent, but small elongated, very slightly raised concolorous patches occasionally present in some leaves in subsp. congesta, very rarely subsp. foliolosa; scattered whitish flecks occasionally observed on lower surfaces of leaves in subsp. robusta, apparently absent in the other two subspecies.

Epidermal cells with almost flat outer surfaces, which results in a glossy sheen on the leaves.

Dimensions of leaves and inflorescences vary according to the subspecies and are given in the accounts of these.

Colour of perianth: veins of tepals green with a glaucous or beige tinge, vein endings in lobes of same colour, sometimes with a pink tinge, rest of lobe white or cream, never yellow; tubular part of perianth on either side of midrib greenish white, or pale cream becoming greener towards the base.

Dimensions of perianth: length to neck, 5.8 - 9.9 mm., usually 6.0 - 9.0 mm; basal diameter of tube, 2.2 - 4.0 mm. usually 2.5 - 3.0 mm; basal diameter in size varies from upto 0.3 mm. greater than the middle diameter, to 1.6 mm. less than the middle diameter, usually it is 0 - 0.5 mm. less in diameter than the middle of the tube; dimensions of lobes: length of lobes, 1.4 - 3.00 mm. usually 1.5. - 3.0-long, the inner lobes sometimes slightly longer, width of outer perianth lobes: 1.2 - 3.0 mm. usually 1.5 - 2.0 mm; width of inner lobes; 1.5 - 4.0 mm., usually 2.0 - 3.0 mm.

In the open flower, the outer lobes usually curve back through an angle of 60° , often curving right back to lie parallel to the perianth tube.

This species differs from the other members of the genus in the almost flat outer walls of the epidermal cells, resulting in a leaf with a glossy sheen. Secondary points of difference are the short pedicels and long bracts of the inflorescence and the broad lobes of the perianth.

The three species are based on geographical distribution together with variations in leaf and inflorescence characters.

Aloe deltoidea Hooker fil. in Bot. Mag. 99 t.6071 (1873) and Aloe deltoidea var intermedia Berger in Pflanzenreich 4 (38):120 (1908) are clearly variants of A. foliolosa, but the descriptions are insufficiently detailed to ascribe them to any of the described varieties.

Subsp. foliolosa.

Aloe foliolosa Haworth in Trans. Lin. Soc. Lond. 7 : 7 (1804).

Aiton, Hort. Kew., ii, 2 : 298 (1811); Ker in Bot. Mag. 33 t. 1352 (1811); Salm-Dyk, Cat. Rais. :9 (1817), and Monogr. Aloes : 82 fig. 4 (1836-1863).

Apicra foliolosa (Haworth) Willdenow in Ges. Naturf. Fr.

Berl. Mag. 5 :274 (1811); Haworth, Suppl. Pl Succ. :64 (1819);

Baker in Jour. Lin. Soc. Lond. 18:218 (1881), and in Flora

Capensis 6 (2) : 331 (1896); Berger in Pflanzenreich 4 (38) : 120 (1908)

Haworthia foliolosa (Haworth) Haworth, Syn. Pl Succ.:99 (1812).

Astroloba foliolosa (Haworth) Uitewaal in Succulenta 1947

(5) : 54 (1947).

Leaves in five straight ranks to imbricate, spiral angle usually 10 -40°; leaves patent erect to patent; leaf apices following angle of leaf with stem to curving outwards and downwards in the case of very patent leaves, usually curving outward.

Leaf length: 1.4 - 3.0 cm., usually 1.5 - 2.5 cm.; width of leaf at widest part: 0.9 - 2.1 cm. usually 1.0 - 1.5 cm.; length-breadth ratio: 1.02 - 2.12, usually 1.25 or less to 1.75; position of widest part of leaf: 0.1 cm. above to 0.4 cm. below mid-length, usually 0 - 0.25 cm. below mid-length: mucro length: 0.04 - 0.15 cm., usually 0.05 - 0.10 cm.

Numbers of vascular bundles with caps as seen in transverse section halfway along leaf length, for ventral side: 6.9 - 14.6 per cm., for dorsal side: 3.9 - 8.3 per cm.

Percentage lignification of bundle caps from ventral side of leaf seen as above, variable, 0 - 75%.

Peduncle length: 9 - 29 cm., usually 10 -20 cm.; raceme

length: 6-19 cm., usually 10 - 15 cm.; width of base of peduncle at its widest part: 0.26 - 0.50 cm., usually 0.30 - 0.45 cm.; width of peduncle below first pedicel; 0.15 - 0.35 cm., usually 0.15 - 0.30 cm.

Branched inflorescences recorded in 6% of the specimens examined.

Basal sterile bract: length, 0.56 - 1.30 cm., usually 0.6 - 1.0 cm.; width of base, 0.15 - 0.60 cm., usually 0.15 - 0.45 cm., width half way along length, 0.08 - 0.36 cm., usually 0.10 - 0.20 cm.

Veins of basal sterile bract: bracts with three main veins to bracts with a single vein, usually bracts with one vein and two laterals which do not extend for the entire length of the bract.

Basal fertile bract: length, 0.40 - 0.90 cm., usually 0.40 - 0.80 cm.; width of base, 0.18 - 0.45 cm., usually 0.20 - 0.30 cm.; width half way along length, 0.06 - 0.22 cm., usually less than 0.10 - 0.20 cm.

Veins of fertile bracts: from base of raceme, bracts with one main vein and two laterals which do not extend for the entire length of the bract to bracts with one vein, usually bracts with one vein or one main vein and one basal lateral; from middle and top of raceme, bracts with one main vein and one basal lateral, or with a single vein.

Flowering pedicels: from base of raceme, 0.09 - 0.38 cm., usually 0.15 - 0.25 cm.; from middle of raceme, 0.08 - 0.32 cm., usually 0.10 - 0.20 cm.; fruiting pedicel from base of raceme, 0.14 - 0.37 cm.

DISTRIBUTION

Living specimens examined by the author:-

CAPE PROVINCE.

Graaff Reinet District: Valley of Desolation W. of Graaff Reinet, R29, R60; 10 mi. N. of Graaff Reinet on Middleburg road, R30;

*Most specimens collected by the author are under cultivation at Kirstenbosch.

Cranmere Farm nr. Pearston, R34, 10 mi. S. of Pearston on Waterford road R35. Jansenville District: Toekomst Farm nr. Waterford, R10; Toekomst Farm nr. Lake Mentz R36; nr. Lake Mentz village R37; Mount Stewart R13, 52a. Steytlerville District: Steytlerville R14, 52b. Uitenhage District: Wolwefontein, R11; Baroe, R12; Springbokvlakte s.leg. s.n. in hort. K'bosch.

Herbarium records:-

CAPRI PROVINCE.

Ladismith District: Between Ladismith and Laingsburg, M.S. Pillans 877 (BOL).^o Steytlerville District: Steytlerville, F. Paterson 40^o (BOL); Uitenhage District: Addo Bush. F.R. Long 1175 (GRA) (PRE). Kleinpoort, Barker 5100 (NBG); Wolwefontein, s.leg. No. 27628 in Herb Bol. (BOL). Jansenville District; Waterford, Acocks 11997 (PRE). Graaff Reinet District: Graaff Reinet, H. Bolus 264 (BOL); Thode A 621 No. 17319 in Nat. Herb. (PRE); F. Frith s.n. No. H/3604/59^o in Herb Kew (K); Kruidfontein, H. Bolus 264A (BOL); Kendrew, van der Berg s.n. Nat. Bot. Gdns. 540/23 (BOL); F. Frith s.n. H/3606/59 in Herb Kew (K). ssp. foliolosa

District unknown, probably Uitenhage: Zwartkops - Sundays River, Zeyher 4184 (GRA); Koegakammaskloof Zeyher 1054 (GRA).

Without locality: s.leg. No. 27627 in Herb. Bol (BOL); Exhort s.leg. Nat. Bot. Gdns. 74/44 (NBG).

Subsp. congesta. (Salm-Dyk) Roberts comb. nov. et stat. nov.

Aloe congesta Salm-Dyk, Monogr. Aloes: 82 fig. 1 (1836-1863) - BASICNYM.

Apicra congesta (Salm-Dyk) Baker in Jour. Lin. Soc. Lond. 18:218 (1881), and in Flora Capensis 6 (2) : 333 (1896); Berger in Pflanzenreich 4 (38) : 118 (1908); Uitewaal in Succulenta 1939 (3) : 27 (1939).

Astroloba congesta (Salm-Dyk) Uitewaal in Succulenta 1947 (5) : 54 (1947).

Apicra deltoidea (Hooker fil.) Baker sensu Baker in Jour. Lin. Soc. Lond. 18 : 217 (1881) and in Flora Capensis 6 (2) :

Basal sterile bract: length, 0.70 - 1.27 cm. usually 0.8 - 1.0 cm.; width of base, 0.30 - 0.75 cm. usually 0.45 - 0.60 cm; width halfway along length 0.14 - 0.48 cm. usually 0.15 - 0.30 cm.

Veins of basal sterile bract: bracts with three veins running full length of bract to bracts with a single vein, usually bracts with one main vein and two laterals which do not extend for the entire length of the bract.

Basal fertile bract: length, 0.50 - 0.95 cm. usually 0.6 - 0.8 cm. width at base, 0.28 - 0.58 cm. usually 0.35 - 0.45 cm; width halfway along length, 0.11 - 0.45 cm. usually 0.15 cm. - 0.30 cm.

Veins of fertile bracts: from base of raceme, variable, bracts with one main vein and two laterals which do not extend for the entire length of the bract, to bracts with one vein; from middle of raceme, as for basal fertile bracts, usually bracts with one main vein and one basal lateral or one vein only; from top of raceme, bracts with one main vein and one lateral or bracts with a single vein.

Flowering pedicels: from base of raceme, 0.07 - 0.40 cm. usually 0.15 - 0.25 cm; from middle of raceme, 0.05 - 0.28 cm. usually 0.10 - 0.20 cm.; fruiting pedicel from base of raceme, 0.06 - 0.38 cm.

DISTRIBUTION

Living specimens examined by the author:-

CAPE PROVINCE.

Albany District: Dikkop Vlakte, R40; Comins 2064; Helsingport R41; Krantz Drift, Comins 2063; nr. Alicedale, Comins s.n. Bedford District: S. of Adelaide on Grahamstown road, R38, R39. Cradock District: Rgyner's Kop, R33; Cradock, R32, R53; 19 mi. N. Cradock on Middleburg road R31.

Herbarium Records :-

CAPE PROVINCE.

Albany District: Helsingport, R.A. Dyer 2096 (GRA); R.A. Dyer 975 (PRE); Rosenborth s.n. Stell. Un. Gdns. 7851 (BOL); H. Bolus 2687 (BOL) (K); Brakkloof, Acocks 12049 (PRE); Alicedale, Cruden 209 (GRA); Cradock District: Cradock, s.leg No. 27632 in Herb Bol

331 (1896); Berger in Pflanzenreich 4 (38) : 118 (1908), in part excluding specimens from Laingsburg and Matjesfontein cited in a letter from Marloth.

Apicra turgida Baker in Jour. Bot. 27 : 44 (1889) and in Flora Capensis 6 (2) : 330 (1896).

Apicra deltoidea var turgida (Baker) Berger in Pflanzenreich 4 (38) : 118 (1908).

Astroloba turgida (Baker) Jacobsen, Handbook Succ. Pl. (1) : 227 (1960).

Astroloba deltoidea (Hooker fil) Jacobsen, Handbook Succ Pl. (1) : 227 (1960), in part, excluding plants from Laingsburg and Matjesfontein.

Leaves in five straight rows to imbricate, spiral angle usually 10° or less, to 20°; leaves erect to patent-erect, usually sub-erect; leaf apices curving upwards to outwards, usually following the angle of the leaf with the stem.

Leaf length: 2.0 - 4.7 cm., usually 2.5 - 4.0 cm.; width of leaf at widest part: 1.4 - 2.8 cm., usually 1.5 - 2.3 cm.; length-breadth ratio: 1.39 - 2.33 cm., usually 1.50 - 2.00 cm.; position of widest part of leaf: 0.1 cm. above to 0.7 cm. below mid-length, usually 0.05 cm. below mid-length; mucro length: 0.05 cm. - 0.13 cm. usually 0.05 - 0.10 cm.

Numbers of vascular bundles with caps as seen in transverse section halfway along leaf length: for ventral side, 10.8 - 19.3 per cm., usually 12-15 per cm. for dorsal side 4.7 - 13.3 per cm.

Percentage lignification of bundle caps from ventral side of leaf seen as above, variable, 0 - 97%.

Peduncle length: 6 - 31 cm. usually 15-25 cm; raceme length; 8-25 cm., usually 10 - 20 cm; width of base of peduncle at its widest part: 0.32 - 0.80 cm. usually 0.35 - 0.60 cm; width of peduncle below first pedicel 0.20 - 0.42 cm. usually 0.15 - 0.13 cm.

Branched inflorescences recorded in a third of the specimens examined.

(BOL); Cunningham s.n. No. 27631 in Herb Bol (BOL); Mortimer, H. Davison s.n. Nat. Bot. Gdns. 187/15 (BOL); Rayners Kop, Acocks 11928 (PRE). Middleburg District: Rosmead, J.J. Bruwer s.n. No. 27629 in Herb Bol (BOL).

District unknown, probably Albany: Fish River Rand, Oct. 1896, s.leg s.n. (GRA).

Without locality: Ex hort. Weitz s.n. Nat. Bot. Gdns. 632/35 (NBK); s.leg Nat. Bot. Gdns. 71/44 (NBb), s.leg No. 27633 in Herb Bol (BOL).

Subsp robusta Roberts.

Differt a typo in pedunculo robustiori, floribus vulgo sessilibus vel brevissime pedicellatis, et bracteis subtendentibus eorundem vulgo longioris cum tribus nervis centralibus.

TYPUS. CAPE PROVINCE. Prince Albert District, 5 mi. W. of Prince Albert, Roberts 64 (BOL)

Leaves in five straight rows to imbricate, spiral angle 10° or less, to 20° ; leaves erect to patent-erect, usually sub-erect; leaf apices following angle of leaf with stem or curving outwards, usually curving outwards.

Leaf length: 1.8 - 4.0 cm. usually 2.0 - 3.0 cm.; width of leaf at widest part: 1.0 - 2.4 cm.; usually 1.3 - 2.0 cm.; length-breadth ratio: 1.26 - 2.22, usually 1.50 - 2.00; position of widest part of leaf: 0.2 cm. above to 0.7 cm. below mid length, usually 0 - 0.5 cm. below mid-length; mucro length 0.03 cm - 0.20 cm., usually 0.05 - 0.15 cm.

Number of vascular bundles with caps as seen in transverse section half way along leaf length, from ventral side : 5.6 - 12.0 per cm., usually 6 - 12 per cm.; for dorsal side: 2.9 - 7.4 per cm., usually 3 - 6 per cm.

Percentage lignification of bundle caps from ventral side of leaf seen as above: 4 - 100%.

The bundle caps of this subspecies tend to be the largest and have the most heavily lignified sclereid walls in the A.foliolosa

complex, resulting in a more frequent occurrence of faint darker green lines on the undersides of the leaves in this subspecies than in the subspecies foliolosa and congesta.

The leaves often have a greyish tinge similar to Willow green which has not been observed in subspecies foliolosa or congesta and the margins and keels are more frequently whitish.

Usually, (only observed in this subspecies) in at least 50% of each population, the plants have some or all of the leaves with a few white flecks on the lower surface.

Peduncle length: 5 - 22 cm., usually 5 - 15 cm.; raceme length: 5 - 33 cm. usually 5 - 15 cm; width of base of peduncle at its widest part : 0.42 - 1.10 cm. usually 0.45 - 0.75 cm.; width of peduncle below first pedicel: 0.28 - 0.73 cm., usually 0.30 - 0.45 cm.

Peduncle usually unbranched and rarely have unexpanded raceme buds been found in the axils of sterile bracts.

Basal sterile bract: length, 0.75 - 2.15 cm., usually 1.00 - 1.40 cm.; width of base, 0.30 - 1.30 cm., usually 0.45 - 0.75 cm.; width half way along length, 0.17 - 0.52 cm., usually 0.20 - 0.40 cm.

Veins of basal sterile bract: bracts with 5 main veins to bracts with one main vein and two laterals which do not extend for the entire length of the bract, usually bracts with three main veins.

Basal fertile bract: length, 0.43 - 1.50 cm., usually 0.80 - 1.20 cm.; width at base, 0.30 - 0.80 cm., usually 0.40 - 0.60 cm.; width half way along length, 0.16 - 0.40 cm., usually 0.20 - 0.30 cm.

Veins of fertile bracts : from base of raceme, bracts with three main veins to bracts with one vein, usually bracts with three main veins; from middle of raceme, variable, bracts with three main veins to bracts with a single vein; from top of raceme, bracts with three main veins to bracts with one vein, usually bracts with one main vein and one basal lateral, or only a single vein.

Flowering pedicels: from base of raceme, 0.00 - 0.18 cm., usually 0.00 - 0.05 cm.; from middle of raceme 0.00 - 0.05 cm., usually sessile; fruiting pedicel from base of raceme: 0.02 - 0.15 cm., usually 0.10 cm. or less.

DISTRIBUTION

Living specimens examined by the author:-

CAPE PROVINCE

Beaufort West District: Ft. of Molteno Pass Hall 2284;
E. of Nelspoort on Murraysburg road, R28, R42. Laingsburg District:
nr Whitehill, R57; 4 mi. N. Matjesfontein on Sutherland road, R56;
E. of Laingsburg nr farm Rietfontein, R1; nr Spreeuwfontein Farm
on Laingsburg-Ladismith road, R67; nr Whitehill, Oliver s.n..
Ladismith District: nr Rietvlei Farm on Laingsburg-Sevenweeks Poort
road, R65. Prince Albert District: 5 mi. W. Prince Albert, R64;
nr Klaarstroom, R27. Willowmore District: Koppies nr Miller, R8,
R9, R45. Steytlerville District: Steytlerville, R15, R43.

Herbarium Records:-

CAPE PROVINCE

Laingsburg District: Whitehill, s.leg.No.27630 in Herb.
Bol (BOL); ?Matjesfontein, s.leg. Bartlet 349 (BOL). Beaufort West
District: Beaufort West, s.leg. Nat.Bot.Gdns 3172/14 (BOL); N. of
Beaufort West, L.E.Taylor 921 (BOL); Nelspoort, s.leg. Nat.Bot.Gdns.
1908/27 (BOL). Prince Albert District: R.Broom s.n. No.11652 in
Herb Marloth (PRE). Willowmore District: Koppie nr Willowmore,
C.L.Leipoldt 3062 (BOL); nr Miller, J.S.Rees s.n. Nat.Bot.Gdns.
1302/25 (NBG). Steytlerville District: Steytlerville, Dyer 4022
(PRE). Jansenville District: Lake Mentz, S.Schonland s.n. Aug.1921
(PRE); Waterford Acocks 11995 (PRE); Mount Stewart, Compton 20323
(NBG).

District unknown, probably Willowmore: Between Oudtshoorn
and Willowmore, s.leg. Stell.Univ.Gdns. 7849 (BOL).

Without locality: Karoo Gardens Whitehill, Compton 7689 (NBG);
F.Paterson 2160 (BOL).

Astroloba bullulata (Jacquin) Uitewaal in Succulenta 1947

(5): 53(1947).

Aloe bullulata Jacquin, Fragmenta t.109 (1809); Salm-Dyk,
Cat.Rais.: 11 no.29 (1817); Schultes, Syst.Veg. 7 (1) : 660
(1829); Kunth, Enum. Pl.4 : 494 (1843).

Apicra bullulata (Jacquin) Willdenow in Ges. Naturf. Fr. Berl. Mag. 5 : 273 (1811); Haworth, Suppl. Pl. Succ. : 61 (1819); Berger in Pflanzenreich 4 (38) : 116 (1908); non Uitewaal in Succulenta 1938 (2) : 171 - 177 (1938).

Apicra pentagona var. bullulata (Jacquin) Baker in Jour. Lin. Soc. Lond. 18 : 217 (1881), & in Flora Capensis 6 (2) : 330 (1896).

Apicra bicarinata Haworth sensu Berger in Pflanzenreich 4 (38) : 116 (1908).

Apicra egregia von Poellnitz in Fedde. Repert. 28 : 100 (1930), & in Desert Plant Life 9 (3) : 33 (1937); Uitewaal in Succulenta 1938 (2) : 171 - 177 (1938).

Astroloba egregia (von Poellnitz) Uitewaal in Succulenta 1947 (5) : 54 (1947).

Leaves in five straight rows to, rarely, imbricate, spiral angle usually $0 - 10^{\circ}$; leaves usually sub-erect, the leaf apex curving upwards, very frequently upwards and to one side, the side on which the keel is situated.

The leaf apex is keeled marginate.

Tubercles present on some or all of the leaves of any one plant; tubercles fairly prominent, about 1.0 mm. in diameter, each tubercle usually composed of an aggregation of smaller protuberances; tubercles few in number and irregularly scattered, or more numerous forming large aggregations, often grouped in rough transverse rows; tubercles never as numerous as in A. rugosa.

Leaf colour: Agathia Green, Pod Green, Veronese Green, Sap Green or Scheeles Green, frequently with a Garnet Brown overtone; tubercles concolorous, paler or whitish. Vein lines never present. Bundle caps apparently always unligified towards the leaf apices.

Leaf length: 2.3-4.0 cm., usually 2.5-3.5 cm.; width of leaf at widest part 1.3-2.6 cm.; length-breadth ratio: 1.38-2.72, usually 1.50-1.75; position of widest part of leaf: 0.0-0.6 cm. below mid length, usually 0.0-0.5 cm. below midlength. Mucro length: 0.03-0.20 cm., usually 0.05-0.10 cm.

Peduncle length: 14 - 30 cm.; raceme length: 11 - 29 cm.; width of base of peduncle at its widest part: 0.44 - 0.56 cm.; usually 0.45 - 0.55 cm.; width of peduncle below first pedicel, 0.24 - 0.33 cm., usually 0.25 - 0.30 cm.

Branching of inflorescences: unexpanded raceme buds recorded in sterile bract axils of 20% of the specimens examined.

Number of sterile bracts per peduncle: 3 - 7; basal sterile bract: length, 0.42 - 0.73 cm., usually 0.50 - 0.70 cm.; width of base 0.26 - 0.40 cm., usually 0.25 - 0.30 cm.; width half way along length 0.08 - 0.23 cm.. Basal fertile bract: length 0.35 - 0.53 cm., usually 0.35 - 0.50 cm.; width of base 0.20 - 0.30 cm., width half way along length 0.08 - 0.16 cm., usually 0.10 - 0.15 cm..

Flowering pedicel: from base of raceme 0.30 - 0.53 cm., usually 0.40 - 0.60 cm.; from middle of raceme 0.29 - 0.47 cm., usually 0.30 - 0.45 cm.

Colour of perianth: midrib of tepals green often with a reddish brown tinge where the veins end in the lobes, and a glaucous brown tinge in the tubular part of the perianth; the tissue on either side of the veins in the tubular part of the perianth greenish white, often with a faint yellow-brown tinge; perianth lobes bright yellow to creamy yellow.

Dimensions of perianth: length of tube to neck, usually 8.0 - 11.0 mm.; basal diameter of tube usually 3.0 - 3.5 mm., and equal to, or up to, 0.3 mm. greater than the middle diameter; length of lobes usually 1.5 - 2.0 mm., width of outer lobes usually 1.5 mm.; inner lobes slightly broader, usually 1.5 - 2.0 mm. in width.

DISTRIBUTION

Living specimens examined by the author:-

CAPE PROVINCE

Ceres District: 40 mi. N. of Ceres on Sutherland rd., R24.

Laingsburg District: 4 mi. N. of Matjesfontein R25, R55.

Herbarium Records:-

CAPE PROVINCE

Sutherland District: Verlatenkloof, H.Hall s.n. Nat.Bot.Gdns. 258/55 (NBG); Roggeveld Mts near Sutherland, J.D.Logan s.n. No.2763⁴ in Herb.Bol.(BOL); Ceres District: Ceres Karoo, Stell.Univ.Gdns s.n. *b. luvata*

No.27635 in Herb.Bol.(BOL); Laingsburg District: Between Ladismith and Laingsburg, s.leg. s.n. No.9363 in Herb. H.Bolus (BOL).

Astroloba hallii Roberts sp. nov.

Folia cum carina marginem ad apicem formante et vulgo sursum curvante, 2.7 cm. ad 5.8 cm. longa et 1.3 cm. ad 2.0 cm. lata in parte latissima; semper cum nervis fuscioribus longitudinalibus; cum maculis albicantibus vel tuberculis in numero variabilibus irregulariter vel in seriebus longitudinalibus secus nervis adpersis; muris exterioribus cellularum epidermalium inferiorum ex superiore dimidia foliae convexis; pileis fasciculorum vascularum lignificatis per longitudinem integram foliae; pedicellus florae ex base racemi 0.33 cm. ad 0.75 cm. longus et bractea subtendens eiusdem 0.30 cm. ad 0.54 cm. longa; perianthemum cum lobis flavis ad colorem floris lactis.

TYPUS. CAPE PROVINCE. Laingsburg District: Koup, Roberts 26 (BOL).

Aloe pentagona Jacquin, Fragmenta No.277 pl.111 (1809), may provide the earliest epithet applicable to this species but the identity of the species to which the epithet pentagona was originally applied, is very much open to doubt.

Leaves in five straight to spirally twisted rows, spiral angle usually 0 - 10°; leaves erect to patent erect, usually sub-erect; leaf apices usually curving upwards, rarely following the angle of the leaf with the stem.

Keeled marginate apices occur in all, or the majority, of leaves of any one plant.

Whitish maculae or tubercles present on some of the leaves of plants in 88% of specimens examined; maculae, when present, usually few in number and irregularly scattered; tubercles not as prominent as in A.bullulata, and generally smaller since they are not of a compound nature; tubercles few in number and irregularly scattered, or more numerous and usually grouped in longitudinal rows corresponding to the vein lines; tubercles never as numerous as in A. rugosa.

Leaf colour: Agathia Green, Pod Green, Veronese Green or Sap Green; margins and keels darker, frequently reddish-brown towards the leaf apex; apical third of leaf may have a reddish tinge. Tubercles paler, usually darker, often with a reddish tinge.

Longitudinal vein lines always present, very obvious, darker green in colour, often with a reddish tinge towards the apex. Bundle caps lignified for entire length of leaf in all specimens examined.

Leaf length: 2.7 - 5.8 cm., usually 3.0 - 4.0 cm.; width of leaf at widest part 1.3 - 2.0 cm., usually 1.5 - 2.0 cm.; length breadth ratio: 1.72 - 3.14, usually 2.00 - 2.50; position of widest part of leaf: 0.30 - 1.30 cm. below mid length, usually 0.25 - 0.75 cm. below mid length; micro length 0.05 - 0.15 cm.

Peduncle length: 18 - 31 cm., usually 15 - 30 cm.; raceme length: 8 - 32 cm., usually 15 - 25 cm.; width of base of peduncle at its widest part: 0.39 - 0.90 cm., usually 0.45 - 0.60 cm.; width of peduncle below first pedicel: 0.17 - 0.44 cm., usually 0.20 - 0.40 cm.

Branching of inflorescence: branched inflorescences observed in 5% of specimens examined, unexpanded raceme buds in sterile bract axils in 35% of specimens examined.

Number of sterile bracts per peduncle: 3 - 14, usually 4 - 7; basal sterile bract: length 0.43 - 0.93 cm., usually 0.60 - 0.80 cm.; basal width 0.19 - 0.47 cm., usually 0.20 - 0.40 cm.; width half way along length 0.08 - 0.22 cm., usually 0.10 - 0.50 cm..

Basal fertile bract: length 0.30 - 0.54 cm., usually 0.30 - 0.50 cm.; basal width 0.19 - 0.40 cm., usually 0.20 - 0.30 cm.; width half way along length 0.07 - 0.13 cm., usually 0.10 cm.

Flowering pedicel: from base of raceme 0.33 - 0.75 cm., usually 0.40 - 0.50 cm.; from middle of raceme 0.24 - 0.59 cm., usually 0.30 - 0.40 cm.

Colour of perianth: as for A. bullulata, save that the lobes and tissue on either side of the midribs of the perianth tube are occasionally cream in colour. Dimensions of perianth are very similar to those of A. bullulata, save that the length of the tube

to the neck is usually 9.0 - 11.0 mm., and the base of the tube, while usually equal to or up to 0.40 mm. greater than the middle diameter, is occasionally up to 0.30 mm. less than the middle diameter.

This species is close to A. bullulata from which it differs in the presence of very obvious vein lines on the under side of the leaf, and in the fact that the bundle caps are lignified for the entire length of the leaf. Further, the leaves tend to be narrower and the leaf apices more acute than in A. bullulata.

DISTRIBUTION.

Living specimens examined by the author:-

CAPE PROVINCE.

Laingsburg District: Koup, R26, R54; nr farm Rietvlei along Laingsburg-Sevenweeks Poort road, R48, R52.

Herbarium records:-

CAPE PROVINCE.

Laingsburg District: 6 mi. from Laingsburg on rd to Ladismith W.F.Barker 109 (BOL); Between Ladismith and Laingsburg, s.leg. s.n. No.9363 in Herb.H.Bolus, No.27624 in Herb.Bol.(BOL); N. slopes of Swartberg, A.J.Joubert s.n. No.27623 in Herb.Bol.(BOL). Prince Albert District: Prince Albert, J.W.Matthews s.n. Nat.Bot. Gdns.3479/14 (BOL); J.Rennie s.n. Nat.Bot.Gdns.1418/28. Ladismith District: Ladismith, A.J.Joubert 97 (BOL).

Without locality: ex hort. s.leg. No.7983 in Herb.Marloth (PRE).

Astroloba smutsiana Roberts sp. nov.

Folia marginatis ad apicem, apicibus vulgo rectis vel recurvatis, 1.8 cm. ad 3.9 cm. longa, 1.0 cm. ad 2.0 cm. lata in parte latissima, plerumque nervis fuscioribus ad apicem visis; tubercula vel maculae nunquam in natura visis; muris exterioribus cellularum epidermalium inferiorum ex superiore dimidia foliae convexis; pedicellus florum ex base racemi 0.14 cm. ad 0.48 cm. longus et bractea subtendens eiusdem 0.27 cm. ad 0.60 cm. longa; perianthium cum lobis colorem floris lactis habentis vel albis, nunquam flaventibus.

TYPUS. CAPE PROVINCE. Ladismith District: 24 mi. S.
Ladismith on old Barrydale road, Roberts 3 (BOL).

Leaf arrangement variable ranging from leaves in five straight rows to imbricate; leaves sub-erect to patent erect, usually sub-erect, leaf apices following the angle of the leaf with the stem or curving outwards.

The leaf apex is true marginate.

No spots or tubercles, but one or more leaves with one to four elongated, slightly raised shiny patches observed in 16% of specimens examined.

Leaf colour similar to that of A. ballii; margins and keels concolorous or darker, rarely paler; leaf apices often with a reddish brown or garnet brown tinge; darker bundle cap lines visible, extending for a short distance from the apex in 84% of plants examined.

Leaf length: 1.8 - 3.9 cm., usually 2.0 - 3.0 cm.; leaf width at widest part: 1.0 - 2.0 cm., usually 1.25 - 1.50 cm.; length-breadth ratio: 1.14 - 2.31, usually 1.25 - 2.00; position of widest part of leaf, 0.0 - 0.6 cm. below mid length, usually 0.0 - 0.5 cm. below mid length; micro length: 0.04 - 0.13 cm., usually 0.05 - 0.10 cm..

Peduncle length: 8 - 29 cm.; usually 10 - 20 cm.; raceme length: 8 - 25 cm., usually 10 - 20 cm.; width of base of peduncle: 0.22 - 0.42 cm., usually 0.25 - 0.40 cm.; width of peduncle below first pedicel: 0.11 - 0.24 cm., usually 0.15 - 0.20 cm.

Branching of inflorescences: unexpanded raceme buds in axils of sterile bracts observed in 3% of specimens examined.

Number of sterile bracts per pedicel: 2 - 10 bracts, usually 3 - 6; basal sterile bract: length 0.42 - 1.05 cm., usually 0.40 - 0.80 cm.; width of base 0.15 - 0.37 cm., usually 0.20 - 0.30 cm.; middle width half way along length: 0.05 - 0.15 cm., usually 0.05 - 0.10 cm..

Basal fertile bract: length 0.29 - 0.60 cm., usually 0.30 - 0.50 cm.; basal width 0.14 - 0.35 cm., usually 0.15 - 0.30 cm.; middle width 0.06 - 0.13 cm., usually 0.10 cm. or less.

Flowering pedicels: from base of raceme, length 0.14 - 0.48 cm., usually 0.20 - 0.40 cm.; from middle of raceme, length, 0.09 - 0.60 cm., usually 0.20 - 0.30 cm.; fruiting pedicels from base of raceme, length, 0.24 - 0.43 cm..

Colour of perianth: midribs of tepals pale green, tissue on either side of midribs in perianth tube a greenish cream becoming darker at the base of the tube, lobes of perianth white or cream, never yellow.

Dimensions of perianth: length of tube to neck, usually 9 - 11 mm.; basal diameter of tube usually approximately 3.0 mm.; from up to 0.4 mm. greater than the middle diameter to up to 0.4 mm. less, most frequently equal to or less than the middle diameter; length of lobes, approximately 1.5 mm., width of outer lobes usually 1.0 - 1.5 mm., inner lobes sometimes slightly broader.

This species has some affinity with A. hallii, from which it differs in the possession of a true marginate apex. Secondary points of difference are the absence of spots or tubercles in field populations, the usually shorter leaves, the more slender peduncles, the shorter pedicels, and the persistently white or cream perianth lobes.

References which may have been alluding to this species are: Aloe pentagona (Aiton) Haworth sensu Ker in Bot.Mag. 33 t.1338 (1811); Salm-Dyk, Monogr.Aloes.: S1 fig.3 (1836-1863). Aloe spirella (Haworth) Salm-Dyk sensu Salm-Dyk Monogr.Aloes.: S1 fig.3 (1836-1863).

As has been shown, the identity of the original species described by these epithets is so much open to doubt, that the author has been forced to abandon them.

DISTRIBUTION.

Living specimens examined by the author:-

CAPE PROVINCE.

Ladismith District: 20-26 mi. S. of Ladismith on old Barrydale road, R3, R62a, R5, R62b; nr farm Rietvlei on the Laingsburg-Seven-weeks Poort road, R49. Laingsburg District: Rooineck Pass, R51. Riversdale District: Between Adamskraal and Ochertskraal, R63.

Herbarium records:-

CAPE PROVINCE,

Laingsburg District: Rooihoogte, P. Bond 259 (NBG).Ladismith District: Ladismith, P. Ross-Frames s.n. Nat. Bot. Gdn. 2155/26 (BOL).Astroloba rugosa Roberts sp. nov.Aloe aspera Haworth sensu Salm-Dyk Monogr. Aloes.:

S2 fig. 2 (1836-1863); non Haworth in Trans. Lin. Soc.

7 : 6 (1804); non Aiton, Hort. Kew. (ii) 2 : 299 (1811);

non Sprengel Syst. Veg. 2 : 69 (1825); nec Schultes Syst.

Veg. 7 (1) : 651 (1825).

Apicra aspera (Haworth) Willdenow sensu Baker in Jour.

Lin. Soc. Lond. 18 : 218 (1881); Berger in Pflansenreich

4 (38): 116 (1908); Haworth, Suppl. Pl. Succ.: 63 (1819)

in part, excluding description of leafy shoot; non

Willdenow in Ges. Naturf. Fr. Berl. Mag. 5 : 274 (1811).

Astroloba aspera (Haworth) Uitewaal sensu Uitewaal in

Succulenta 1947 (5) : 53 (1947).

non Haworthia aspera (Haworth) Haworth, Syn. Pl. Succ.

: 90 (1812).

Folia marginatis ad apicem, apicibus vulgo recurvatis, 1.4 cm. ad 2.5 cm. longa, 1.1 cm. ad 1.8 cm. lata in parte latissima, tuberculata, tuberculis ad usque 0.5 mm. diametro subregulariter et plus minusve in seriebus longitudinalibus dispersis, 5 usque ad 25 tuberculae in 4 mm² sed constans in eadem planta; muris exterioribus cellularum epidermalium inferiorum ex superiore dimidia foliae convexis, frequenter papillatis; pedicellus florum ex base racemi 0.2 cm. ad 0.9 cm. longus et bractea subtendens eiusdem 0.23 cm. ad 0.50 cm. longa; quodque trium tepalorum exteriorum quibus tubo corollae constituto aliquando in utraque latere nervae centralis cum parenchyma subinflata; lobis colorem floris lactis habentis vel albis.

TYPUS. CAPE PROVINCE. Montagu District: At the end of the Baden road, Roberts 18 (BOL).

The epithet "aspera" was originally applied by Haworth (1804), to a member of the genus *Haworthia*. Subsequently plants belonging to the genus *Astroloba* were incorrectly referred to by the epithet "aspera", and until the presentation of this thesis, the name was in common usage as pertaining to a species of the genus *Astroloba*.

The combination *Astroloba aspera* (Haw.) Uitew. is legitimate, but incorrect for it applies to an *Haworthia*, and the plants of *Astroloba* to which it has been applied are thus without a name.

Accordingly, the plants of *Astroloba* previously referred to by this epithet have to be treated as a new species.

Leaves in five straight rows to imbricate, spiral angle usually $0 - 10^{\circ}$, leaves usually suberect, leaf apices usually curving outwards.

Leaf apices of the true marginate type.

Tubercles present on the exposed parts of all leaves, tubercles fairly evenly distributed, but tending to be arranged in longitudinal series of up to six tubercles converging in a single longitudinal group, density of tubercles varies from approx. 5 per 4 mm. sq. to approx. 25 per 4 mm. sq., but degree of tuberculation the same for all leaves of any one plant; tubercles up to 0.5 mm. in diameter, generally less prominent in plants with a low tubercle density.

Leaf colour as for *A. bullulata*; tubercles typically concolourous.

The convex outer wall of epidermal cells in section frequently appears papillate.

Leaf length: 1.4 - 2.5 cm. usually 1.5 - 2.5 cm.; leaf width at widest part: 1.10 - 1.80 cm. usually 1.25 - 1.50 cm; length-breadth ratio : 1.00 - 1.83, usually 1.00 - 1.75; position of widest part of leaf: 0.2 cm. above mid length to 0.3 cm. below mid length usually 0.1 cm. above to 0.2 cm. below mid length; micro length 0.04 - 0.10 cm.

Peduncle length: 10 - 43 cm. usually 15 - 25 cm.; raceme length: 5 - 27 cm., usually variable, 5 - 20 cm. ; width of base of peduncle: 0.22 - 0.41 cm. usually 0.25 - 0.40 cm.; width of peduncle below raceme: 0.14 - 0.28 cm., usually 0.15 - 0.25 cm.

No branched inflorescences or unexpanded raceme buds in the axils of sterile bracts have been observed.

Number of sterile bracts : 2 - 4; basal sterile bract: length 0.40 - 0.80 cm., usually 0.40 - 0.60 cm.; width of base, 0.13- 0.36 cm. usually 0.20 - 0.30 cm.; middle width halfway along length, 0.06 - 0.23 cm. usually 0.10 - 0.15 cm.

Basal fertile bract : length, 0.23 - 0.50 cm. usually 0.30 - 0.60 cm.; basal width, 0.20 - 0.30 cm.; middle width 0.07 - 0.17 cm. usually 0.10 cm.

Flowering pedicel: from base of raceme, length 0.20 - 0.90 cm. usually variable 0.30 - 0.80 cm.; from middle of raceme length 0.18- 0.92 cm., usually 0.30 - 0.50 cm.

Colour of perianth : midribs of tepals green with a beige or pink tinge; tissue on either side of the three outer tepals of perianth tube may be very slightly inflated, and is white or cream in colour, or with a faint pink or greenish tinge; lobes cream or whitish.

Dimensions of perianth tube: length of tube to neck, usually variable, 7.0 - 12.0 mm.; basal diameter of tube usually 2.5 - 3.5 mm., and usually up to 0.5 mm. greater than the middle diameter; lobe length approx. 1.5 mm; width of outer lobes approx. 1.5 mm.; inner lobes generally slightly broader, and 1.5 - 2.0 mm. in width.

This species differs from the other two members of the genus with tuberculate leaves in the possession of true marginate apices, and in the greater degree of tuberculation and in the more even distribution of the tubercles, and in the smaller size of the leaves. In tuberculation this species is very similar to the intergeneric hybrid Astroworthia X bicarinata, but it is of a smaller size.

DISTRIBUTION

Living specimens examined by the author :-

CAPE PROVINCE.

Montague District: Along the Baden road, R17, R18, R59; Along the Petersfontein road, R19, 20; near farm Brakwater along Dobbelaars Kloof road R21, R22; 2 mi. W of Montagu R23, near farm Rietvlei No.2, R50A. Ladismith District: Approximately 20 mi. S of Ladismith along old Barrydale road, R2; near farm Rietvlei along Laingsburg - Sevenweekspoort road, R66.

Herbarium records :-

CAPE PROVINCE.

Worcester District: 12 mi. SE of Touwsrivier, A.J. Joubert s.n. No.27636 in Herb. Bol. (BOL). Montagu District: Montagu A.J. Joubert s.n. Dec. 1932 (GRA); J. Neil s.n. No. 27637 in Herb. Bol. (BOL); Hurling and Neil s.n. No.27642 in Herb. Bol. (BOL); Kiesies Hoogte, Malang s.n. Nat. Bot. Gdns. 1687/22 (BOL); Montagu ex hort. Bonnievale Jan. 1937, N.J.S. van der Merwe 227 (BOL). Swellendam District: Bonnievale Jan. 1937, N.J.S. van der Merwe 226 (BOL); 6 mi. N of Barrydale, F. Ross-Frames s.n. Nat. Bot. Gdns. 2154/26 (BOL); Warmwaterberg, R. du Plessis s.n. No. 27639 in Herb. Bol. (BOL). Riversdale District: Riversdale E. Ferguson s.n. No.27641 in Herb. Bol. (BOL); Muiskraal, Compton & Lamb s.n. Nat. Bot. Gdns. 2306/27 (BOL). Ladismith District: van Wyksdorp, A.J. Joubert 111 (BOL); Ladismith, s.leg No. 27638 in Herb. Bol (BOL); A.J. Joubert s.n.27640 in Herb. Bol (BOL); Between Ladismith and Laingsburg, N.S. Pillans 857 (BOL). Graaff Riet District: Graaff Riet, s.leg No. 4202 in Herb. Marloth (PRE).

Astroloba herrei Uitewaal in Desert Plant Life 18 (3) (1948): & in Succulenta 1950 (4): 56-58 (1950).

Astroloba dodsoniana Uitewaal in Desert Plant Life 22 (3): 29-32 (1950).

Leaf arrangement varying from leaves in five straight rows to imbricate, leaves usually in five straight to spirally twisted rows; leaves sub-erect or patent-erect, typically sub-erect;

leaf apices curving upward to outward.

Leaf colour Paris green, Cyprus green, Veronese green or Podgreen; margins and keels concolourous or paler, leaf tip very rarely reddish; darker bundle cap lines always present, usually showing as very fine longitudinal ridges.

Leaf dimensions: length, 1.8 - 3.2 cm. typically 2.0 - 2.5 cm.; width at widest part, 0.9 - 1.6 cm., usually 1.0 - 1.5 cm.; length-breadth ratio, 1.44 - 2.42 ; position of widest part of the leaf, 0.1 cm. above to 0.5 cm. below mid length, usually 0.0 - 0.5 cm. below mid length; length of mucro, 0.07 - 0.18 cm. usually 0.50 - 1.0 cm. Leaf apex narrowly acuminate.

Inflorescence: peduncle length: 10 - 30 cm. usually 15-25 cm.; raceme length: 9 - 28 cm.; thickness of peduncle: at base, 0.40 - 0.60 cm., usually 0.40 - 0.55 cm.; below first pedicel, 0.20 - 0.32 cm., usually 0.20 - 0.30 cm.; branched inflorescences or unexpanded raceme buds in axils of sterile bracts to date unobserved; number of sterile bracts, 2 - 5 bracts, usually 2 - 4 bracts.

Dimensions of basal sterile bract: length, 0.70 - 1.10 cm.; width at base, 0.28- 0.50 cm., usually 0.30 - 0.50 cm.; width half way along length, 0.10 - 0.27 cm., usually 0.15 - 0.20 cm.

Dimensions of basal fertile bract : length, 0.60 - 1.10 cm. usually 0.60 - 0.80 cm.; width at base, 0.30 - 0.50 cm.; width half way along length, 0.08 - 0.24 cm., usually 0.10 - 0.20 cm.

Pedicel length: flowering pedicel, from base of raceme, 0.35 - 1.68 cm., usually 0.4 - 0.8 cm.; from middle of raceme, 0.23 - 1.10 cm., usually 0.4 - 0.6 cm.

Perianth tube with a very marked inflation of tissue on either side of the three outer tepals, this inflation may be smooth or slightly undulating; colour of perianth as for A. spiralis.

Dimensions of perianth: length of tube to neck , 7 - 9 mm.; basal diameter of tube usually 2.5 - 4.0 mm.; basal diameter equal to or up to 1.0 mm. less than the middle diameter, more rarely up to 1.0 mm. greater than the middle diameter; length of lobes,

usually 1.5 - 3.0 mm.; width of outer lobes, usually 1.5 - 2.5 mm.; width of inner lobes usually 2.0 - 3.0 mm.

This species differs from A. spiralis in primarily the chromosome number and in the smooth or slightly undulating nature of the inflated tissue of the perianth tube. Other differences of a secondary nature are the very marked bundle cap lines which are always present, frequently existing as fine longitudinal ridges, and the narrowly acuminate nature of the leaf apices. The pedicels tend to be slightly longer in A. herrei.

DISTRIBUTION

Living specimens examined by the author :-

CAPE PROVINCE.

Uniondale District: at farm Hoekplaas N of Uniondale, R16 R44. Prince Albert District: 4 mi. from Prince Albert on Klaarstroom road, R46.

Herbarium records :-

CAPE PROVINCE.

Prince Albert District: Prince Albert, A. Erasmus s.n. *herrei*
No. 13698 in Herb. Marloth (PRE); Acocks 18412 (PRE); Krige s.n.
No. 13009 in Herb. H. Bolus (BOL).

Without locality. Ex hort. s. leg. Aug. 1950 (NBG);
s.leg.No. 27648 in Herb. Bol. (BOL); s.leg. No. 52)5 in Nat. Herb. (PRE).

Astroloba spiralis (Linnaeus) Uitewaal in Succulenta 1947 (5)

: 53 (1947).

Aloe spiralis Linnaeus Sp. Pl. : 322 (1753), & Mantissa :

Obs. : 368 (1771); Aiton Hort. Kew. (1) 1 : 470 (1789);

Willdenow Sp. Pl. 2 (1) : 191 (1799); De Candolle Plantes

Grasses : 56 (1799); Jacquin, Fragmenta No. 226 pl.110

(1809); ^{Aiton} Hort. Kew (11) 2 : 297 (1811); Ker in Bot. Mag.

35 pl. 1455 (1811).

Apicra spiralis (Linnaeus) Baker in Jour. Lin. Soc. Lond.

18 : 217 (1881), & in Flora Capensis 6 (2) : 331 (1896);
Berger in Pflanzenreich 4 (38) : 117 (1908).

Haworthia spiralis (Linnaeus) Duval, Pl. Succ. in Hort.
Alencon. : 7 (1809).

Aloe spiralis var imbricata Aiton, Hort. Kew. (1) 1 :
470 (1789); Willdenow, Sp. Pl. 2 (1) : 191 (1789).

Aloe imbricata (Aiton) Haworth in Trans. Lin. Soc. 7 :
7 (1804) nom. illegit., Salm-Dyk, Cat Rais. : 10 (1817),
& Monogr. Aloes : Sl fig. 1 (1836 - 1863); Sprengel, Syst.
Veg. 2 : 70 (1825); Schultes, Syst. Veg. 7 : 657 (1829).

Apicra imbricata (Aiton) Willdenow, in Ges. Naturf. Fr.
Berl. Mag. 5 : 273 (1811).

Haworthia imbricata (Aiton) Haworth, Syn. Pl. Succ. :
98 (1812).

Leaf arrangement variable, in five straight ranks to imbricate; leaves erect or sub-erect, the apices following the angle of the leaf with the stem or curving outward, more usually, the former.

Leaf colour: typically Agathia green, Pod green, Veronese green, Sap green and Scheeles green; margins and keels generally concolorous or darker, the leaf apices sometimes slightly reddish brown; occasionally darker bundle caps lines visible on the exposed part of the leaf, extending from the leaf apex; these never show as fine longitudinal ridges.

Leaf dimensions: length, 1.9 - 4.2 cm., usually 2.0 - 3.0 cm; width at widest part, 1.0 - 1.8 cm., usually 1.0 - 1.5 cm.; length-breadth ratio, 1.57 - 2.90; position of widest part of leaf, 0.1 - 0.9 cm. below mid length, usually 0.1 - 0.5 cm. below mid length; length of mucro, 0.04 - 0.16 cm., usually 0.05 - 1.0 cm. Leaf apex acute acuminate.

Inflorescence : peduncle length : 16 - 39 cm., usually 25 - 30 cm.; raceme length: 8 - 36 cm., usually 10 - 25 cm.; thickness of peduncle: at base, 0.26 - 0.56 cm., usually

0.30 - 0.50 cm.; below first pedicel, 0.13 - 0.29 cm., usually 0.15 - 0.25 cm.; branched inflorescences or unbranched inflorescences with unexpanded raceme buds in the axils of sterile bracts, very rarely observed; number of sterile bracts, 3 - 7 bracts, usually 3 - 6 bracts.

Dimensions of basal sterile bract : length, 0.52 - 1.40 cm., usually 0.7 - 1.1 cm.; width at base, 0.20 - 0.40 cm., usually 0.20 - 0.30 cm.; width half way along length 0.05 - 0.15 cm., usually 0.05 - 0.10 cm.

Length of flowering pedicel : from base of raceme, 0.20 - 0.80 cm., usually 0.20 - 0.40 cm.; from middle of raceme, 0.12 - 0.51 cm., usually 0.15 - 0.30 cm.

Perianth tube with a marked inflation of tissue on either side of the three outer tepals, this inflation is very rugose, the rugosity taking the form of pronounced transverse wrinkles; the midribs of the tepals are pale green with a glaucous or beige tinge, the inflated tissue is white and the lobes are always yellow, never white or cream.

Dimensions of perianth : length of tube variable, 7 - 13 mm.; basal diameter of tube usually 2.5 - 4.0 mm.; basal diameter equal to middle diameter, or up to 0.5 mm. more or less than the middle diameter; length of lobes, usually, 1.5 mm.; width of outer lobes, usually 1.5 mm.; width of inner lobes, usually 1.5 - 2.0 mm.

DISTRIBUTION.

Living specimens examined by the author :-

CAPE PROVINCE

Ladismith District : 23 mi. S of Ladismith on old Barrydale road, R6; 8 mi. S of Calitzdorp R48. Oudtshoorn District: 4 mi. out of Oudtshoorn on Friesland road, R7, R61.

Herbarium specimens :-

CAPE PROVINCE:

Ladismith District: Ladismith, A.J. Joubert s.n. No.27626 in Herb. Bol. (BOL). Oudtshoorn District: W.F. Barker 5096 (NBG);

s.leg No. 6510a in Herb. Marloth (PRE); s.leg. No. 27625 in Herb. Bol. (BOL); W. Taylor s.n. Jan. 1916 (GRA); Taylor s.n. Nat. Bot. Gdns. 130/16 (BOL); De Rust, P. Ross-Frames s.n. Nat. Bot. Gdns. 2525/27 (NBG)(BOL). Graaff Riet District: Graaff Riet, Marloth 5112 in Herb Marloth (PRE).

Without locality: Little Karoo H. Herre s.n. Stell. Un. Bdns. 11 (BOL); Ex hort. s.leg. Nat. Bot. Gdns. 343/16 (BOL); sent from Port Elizabeth s.leg. No. 6510b in Herb. Marloth (PRE).

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NOMINA REJICIENDA

Aloe spiralis var pentagona Aiton, Hort.Kew.(1) 1 : 470 (1789);
Willdenow, sp. Pl. 2 (1) : 191 (1799).

Aloe pentagona (Aiton) Haworth in Trans.Lin.Soc. 7 : 7 (1804);
Jacquin, Fragmenta No.277 pl.111 (1809); Ker in Bot.
Mag. 33 t 1138 (1811); Aiton, Hort.Kew (ii) 2 : 298
(1811); Salm - Dyk, Cat. Rais. : 10 (1817), & Monogr.
Aloes.: Sl fig.4 (1836 - 1863); Schultes, Syst.Veg.
7 (1) : 659 (1825).

Apicra pentagona (Aiton) Willdenow in Ges. Naturf. Fr. Berl.
Mag. 5 : 273 (1811); Haworth, Suppl. Pl. Succ.: 62
(1819); Baker in Jour.Lin.Soc. Lond. 18: 217 (1881);
& in Flora Capensis 6 (2) : 330 (1896); Berger in
Pflanzenreich 4 (38) : 117 (1908).

Haworthia pentagona (Aiton) Haworth, Syn. Pl. Succ. : 97 (1812).

Astroloba pentagona (Aiton) Uitewaal in Succulenta 1947 (5)
: 53, 54 (1947), ex err. Haworth nota.

Apicra pentagona var torta Haworth, Suppl. Pl. Succ. : 62 (1819)

Aloe pentagona var torta (Haworth) Kunth, Enum. Pl. 4 : 495 (1843)

Haworthia spirella Haworth, Syn. Pl. Succ. : 97 (1812).

Aloe spirella (Haworth) Salm - Dyk, Cat. Rais. : 10 (1817), &
in Monogr. Aloes : Sl fig.3 (1836 - 1863); Schultes
Syst.Veg. I (1) : 658 (1829).

Apicra pentagona var spirella (Haworth) Baker in Jour.

Lin. Soc. Lond. 18 : 217 (1881), & in Flora Capensis 6.
(2) : 330 (1896); Berger in Pflanzenreich 4 (38)
: 118 (1908).

Astroloba pentagona var spirella (Haworth) Uitewaal in Succulenta
1947 (5) : 54 (1947).

Aloe spiralis Haworth non Linnaeus, in Trans. Lin. Soc. 7 : 7
(1804) nom. illegit; Sprengel, Syst. Veg. 2 : 70
(1825); Schultes, Syst. Veg. 7 (1) : 659 (1829);
Salm - Dyk Monogr. Aloes. : Sl fig. 3 (1836 - 1863).

Apicra spiralis (Haworth) Willdenow in Ges. Naturf. Fr.

Berl. Mag. 5 : 273 (1811); Haworth, Suppl. Pl.

Succ. : 64 (1819).

Haworthia spiralis (Haworth) Haworth, Syn. Pl. Succ. : 97

(1812).

Aloe pentagona var spiralis (Haworth) Salm - Dyk, Cat. Rais.

: 10 (1817).

Astroloba pentagona var spiralis (Haworth) Uitewaal in

Succulenta 1947 (5) : 54 (1947), ex err. Salm - Dyk

nota.

Apicra pentagona var Wildenovii Baker in Jour. Linn. Soc.

Lond. 18 : 217 (1881), & in Flora Capensis 6 (2)

: 330 (1896); Berger in Pflanzenreich 4 (38)

: 117 (1908).

As has been shown in the account of the taxonomic history, there appears to have been some confusion in the past over the correct application of the epithet "pentagona" and consequently over the correct application of the epithet "spirella". Following Article 69 of the International Code, which states: "A name must be rejected if it is used in different senses and so has become a long and persistent source of error.", the present author has rejected all combinations for the genus which include the epithets "pentagona" (Aiton) and "spirella" (Haworth).

The epithet "spiralis" Haworth is at the outset invalid because it is predated by the epithet "spiralis" Linnaeus. As has been shown, there is also some uncertainty over the interpretation of "spiralis" Haworth, and its synonym "Wildenovii" Baker.

INCERTAE SEDIS

Apiera pentagona var torulosa Haworth, Revisiones

:201, 202 (1821)

Astroloba pentagona var torulosa (Haworth) Uitewaal in

Succulenta 1947 (5) : 54 (1947)

Aloe quinquangularis Schultes, Syst. Veg. 7 (1) : 658 (1829)

Aloe spirella var quinquangularis (Schultes) Salm - Dyk,

Monogr. Aloes. : 51 fig. 3b (1836 - 1863).

has not yet reached a decision on the matter of recognition of
"genus composed of interspecific hybrids. It is the opinion of
the present author that hybrid genera should receive official
recognition especially when the constituent hybrids are found in
the field as in this instance. It does seem, however, that a Latin
diagnosis should not be necessary, for the hybrids will vary in
appearance depending upon the parents. For example, a cross between
a species of Astroloba and a member of the truncata group of
Aloes might be completely different in appearance to
A. spirella, possessing succulent leaves and bilobate
flowers. The Thelliers' new Aloes was, however, not
recognized on the grounds that it lacked a Latin diagnosis.

Astroloba torulosa (Haworth) Uitewaal in
Succulenta 1947 (5) : 54 (1947)
Apiera pentagona var torulosa Haworth Suppl. Fl. Succ. : 201, 202 (1821)
Aloe quinquangularis Schultes Syst. Veg. 7 (1) : 658 (1829)
Aloe spirella var quinquangularis (Schultes) Salm - Dyk,
Monogr. Aloes. : 51 fig. 3b (1836 - 1863).
Astroloba torulosa (Haworth) Uitewaal in
Succulenta 1947 (5) : 54 (1947)
Apiera pentagona var torulosa Haworth Suppl. Fl. Succ. : 201, 202 (1821)
Aloe quinquangularis Schultes Syst. Veg. 7 (1) : 658 (1829)
Aloe spirella var quinquangularis (Schultes) Salm - Dyk,
Monogr. Aloes. : 51 fig. 3b (1836 - 1863).
Astroloba torulosa (Haworth) Uitewaal in
Succulenta 1947 (5) : 54 (1947)

×ASTROWORTHIA Roberts hybrid. gen. nov. (= Astroloba x Haworthia)

Genus propositus includens hybridas inter species generum "Astrolobae Uitew. et Haworthiae Duval; descriptio ut in una sola hybrida cognita, Astroworthia x bicarinata (Haw) Roberts comb. nov.

Plantae caulescentes foliis imbricatis tuberculatis; perigonium cylindricum lobis subregularis ad vix bilabiatis.

The International Committee for Botanical Nomenclature has not yet reached a decision on the method of description of genera composed of intergeneric hybrids. It is the opinion of the present author that hybrid genera should^{continue to} receive official recognition especially when the constituent hybrids are found in the field as in this instance. It does seem, however, that a Latin diagnosis should not be necessary, for the hybrids will vary in appearance depending upon the parents. For example, a cross between a species of *Astroloba* and a member of the *truncata* group of *Haworthia* might be completely different in appearance to *x A. bicarinata*, possessing acaulescent leaves and bilabiate flowers. Von Poellnitz's name *Apworthia* was, however, not recognised on the grounds that it lacked a Latin diagnosis.

X Astroworthia bicarinata (Haworth) Roberts comb. nov.

(Astroloba rugosa Roberts x Haworthia Margaritifera (Linnaeus) Haworth.)

Apicra bicarinata Haworth *Suppl. Pl. Succ.* : 63, 64 (1819); Baker in *Jour. Lin. Soc. Lond.* 18 : 29 (1881) & in *Flora Capensis* 6 (2) : 332 (1896); non Berger in *Pflanzenreich* 4 (38) : 116 (1908).

Aloe bicarinata (Haworth) Schultes, *Syst. Veg.* 7 (1) : 652 (1829); Kunth *Enum. Pl.* 4 : 496 (1843).

Apicra skinneri Berger in *Pflanzenreich* 4 (38) : 116 (1908).

Apicra bullulata sensu Uitewaal in *Succulenta* 1938 (11) : 171 - 177 (1938) non (Jacquin) Willdenow in *Ges. Naturf. Fr. Berl. Mag.* 5:73 (1819).

Plants acaulescent up to 10 cm. high; leaf arrangement: leaves in five straight ranks to irregularly imbricate, erect to suberect, usually the latter, leaf apices curving upwards to outwards.

Leaves tuberculate, the tubercles numerous, 0.1 - 0.7 mm. in height and 0.3 - 0.5 mm. in diameter; fairly evenly distributed sometimes a few aggregated into small irregular groups, sometimes into longitudinal groups of up to 6 tubercles.

Leaf keel not always distinct, occasionally two keels present.

Leaf colour: Agathia green, Podgreen, Veronese green, Sap green or Scheeles green, frequently tinged with Garnet brown; tubercles concolorous or paler.

Leaf dimensions: length, 3.3 - 5.1 cm; width at widest part, 1.7 - 2.3 cm; length-breadth ratio, 1.68 - 2.59; position of widest part of leaf in relation to mid-length, 0.1 - 0.8 cm. below mid length; micro length, 0.03 - 0.12 cm.

Inflorescence: length of peduncle, 12 - 36 cm; length of raceme, 4 - 33 cm; thickness of peduncle: at base, 0.36 - 0.73 cm; below first pedicel, 0.16 - 0.37 cm; inflorescences usually either branched or with unexpanded raceme buds in the axils of the sterile bracts; number of sterile bracts, 2 - 5.

Dimensions of basal sterile bract: length, 0.40 - 1.05 cm; width at base, 0.28 - 0.70 cm; width half way along length 0.07 - 0.23 cm.

Dimensions of basal fertile bract: length, 0.33 - 0.81 cm; width at base, 0.28 - 0.60 cm; width half way along length, 0.10 - 0.23 cm.

Length of flowering pedicel: from base of raceme, 0.30 - 0.95 cm; from middle of raceme, 0.26 - 0.57 cm.

Colour of perianth: midribs of tepals pale green, with a glaucous or beige tinge, vein endings in lobes often with a reddish tinge; tissue of the tube on either side of the veins whitish, yellowish beige or with a green or pinkish tinge, becoming darker towards the base of the tube; lobes whitish, cream or yellowish cream; sometimes tube with a very slight inflation of tissue on either side of the midribs of the three outer tepals.

Dimensions of perianth tube: length, 7 - 13 mm;
 diameter of base, 2.5 - 4.5 mm; basal diameter, 0 - 1.5 mm.
 greater than the middle diameter; dimensions of lobes:
 length outer lobes, 1.5 - 2.5 mm; length inner lobes, 1.5 -
 3.0 mm; width outer lobes, less than 1.5 to 2.0 mm; width
 inner lobes, 1.5 - 3.5 mm.

DISTRIBUTION.

Living specimens seen by the author:-

CAPE PROVINCE.

Montagu District: On farm Riet Vlei No.2 nr Montagu;
 R50; From farm garden on Baden road nr Montagu, R.58.

Without locality: Ex hort. Kirstenbosch No.7262;
 Ex Karroo Gardens, Worcester, R 70; Ex hort. B.Carp, R 71;
 Ex hort. Malherbe, R 72; Ex hort. Stell.Univ.Gdns. leg
 H.Herre R 73.

Herbarium records:-

CAPE PROVINCE.

Montagu District: Montagu, Hurling & Neil No.1375
 in Herb.Marloth (PRE); 4 m out of Montagu on the Baden road,
Hurling & Neil s.n. Nat. Bot. Gdns. 1942/28 (BOL);
 Montagu, Hurling & Neil s.n. No.21338 (BOL); on farm
 Rietvlei nr Montagu, Roberts 50 (BOL).

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Locality.	Height of plant.	Spiral angle.	Angle of leaf with stem.	Curvature of leaf apex.
	CM.	o	o	
<u>A. FOLIOLOSA subsp. FOLIOLOSA.</u>				
Steytlerville R14	9	19	60	o
	10	17	80	d
	10	30	70	o
	10	36	65	e*
	10	33	75	d
	10	19	65	o
	11	13	80	o
	11	9	70	d
	11	23	65	o
	13	28	80	o
	13	22	70	o
	14	24	70	o
	17	30	75	o
	18	28	55	o
	-	33	80	d*
Mount Stewart R13	7	26	75	o
	14	30	80	o?
	14	24	70	o
	15	40	70	o
	-	24	75	o
	-	33	70	o
	-	33	70	o
	-	7	65	o
Wolwefontein R11	8	45	80	o
	12	36	85	o
	12	33	80	e*
	12	30	80	o
	13	23	60	r
	14	33	85	o
	14	40	70	o
	17	-	80	e*
	-	18	80	e*
	-	36	75	r
Baroe R12	11	21	65	r
Waterford R10	11	30	70	r
	11	30	80	o
	15	-	60	o
	18	36	85	o
Lake Mentz R36,37	7	-	70	o
	8	36	70	d
	8	16	75	o
	10	30	80	d
	12	30	65	e*
	14	36	70	r
	14	30	75	d
	15	30	80	e*
	16	22	70	o
	20	17	80	o
	22	24	70	o
	27	45	60	r
	30	20	60	e*
	-	23	70	d
	-	36	75	o
	-	30	75	e*
nr. Pearston R34	9	20	60	e*
	10	29	70	o

Appendix Table 1 LEAF ARRANGEMENT IN FIELD POPULATION SAMPLES OF ASTROLOBA (f = following angle of leaf with stem; u = upward; us = upwards & sideways in the direction of the keel; o = outward; d = downwards, in the case of very patent leaves; * = curvature only slight.)

Locality.	Height of plant.	Spiral angle.	Angle of leaf with stem.	Curvature of leaf apex.
	cm.	°	°	
<u>A. FOLIOLOSA subsp. FOLIOLOSA Contd.</u>				
Graaff Reinet R29	10	33	75	r
	11	17	75	o
	12	10	85	o
	15	9	70	o
	16	-	65	o
	-	33	80	r
	-	24	70	o
	-	30	65	o
	-	7	65	o*
	-	21	65	r
	-	28	70	o
	-	14	70	o
	-	16	65	r
	-	9	80	o*
	-	33	80	o
	-	20	70	o
<u>A. FOLIOLOSA subsp. CONGESTA.</u>				
Krantz Drift Commins 2063	6	17	60	r
	14	1	60	o*
	14	4	60	o*
Dikkop Vlakte R40	11	41	35	r
	20	41	40	o*
	21	20	40	o*
	25	13	40	r
Helspoort R41	9	-	45	r
	11	-	50	r
	12	27	55	r
	13	23	35	r
	13	-	55	r
	13	8	55	r
	13	15	40	u*
	14	-	40	u*
	14	36	45	r
	18	26	40	o*
	18	36	40	r
S. of Adelaide R38,39	11	15	60	o
	11	5	30	o
	11	17	60	o
	12	10	45	o
	12	11	60	o
	17	13	45	o
	17	10	50	u
	19	15	50	o
	24	15	35	o
	-	12	50	o*
	-	10	40	r
	-	15	35	o
	-	15	50	o*
	-	20	45	r
	-	20	35	r
	-	9	60	o
Rayners Kop R33	15	20	60	r
	17	15	50	o*

Appendix Table 1. contd. LEAF ARRANGEMENT IN FIELD POPULATION SAMPLES OF ASTROLOBA.

Locality.	Height of plant.	Spiral angle.	Angle of leaf with stem.	Curvature of leaf apex.
	cm.	o	o	
<u>A. FOLIOLOSA subsp. CONGESTA. Contd.</u>				
Rayners Kop R33 (contd.)	20	10	40	f
	-	5	45	f
	-	10	60	f
	-	20	40	u
	-	10	30	f
	-	10	40	f
	-	20	45	u
	-	-	40	f
Cradoek R32	9	23	40	f
	11	25	35	f
	13	20	55	f
	13	21	40	o*
	13	22	60	f
	14	10	60	f
	15	15	60	o*
	16	18	35	o*
	17	9	50	f
	-	20	70	f
	-	28	40	f
	-	8	35	f
	-	9	30	f
	-	19	40	u*
N. of Cradoek R31	8	29	50	o*
	8	20	40	f
	12	33	40	o*
	13	9	45	f
	16	13	40	f
	-	20	40	f
<u>A. FOLIOLOSA subsp. ROBUSTA.</u>				
Miller R8	13	3	150	o
	14	7	40	o*
	17	20	35	o*
	18	4	45	f
	20	11	45	o*
	21	4	45	f
	-	9	40	o*
	-	2	50	o
	-	3	40	o*
	-	10	55	o
	-	0	50	o*
	-	6	50	o*
	-	2	45	f
	-	10	40	o
	-	2	40	o
Nelspoort R28	12	23	50	o
	12	6	45	f
	13	34	35	f
	13	24	40	o*
	17	36	55	o
	20	13	40	o*
	20	28	50	o*
	-	16	35	o*
	-	36	35	f
	-	32	35	o

Appendix Table 1 contd. LEAF ARRANGEMENT IN FIELD POPULATION SAMPLES OF ASTROLOBA contd.

Locality.	Height of plant.	Spiral angle.	Angle of leaf with stem.	Curvature of leaf apex.
	CM.	o	o	
<u>A. FOLIOLOSA subsp. ROBUSTA. Contd.</u>				
Nelspoort R28 (Contd.)	-	35	50	o*
	-	40	50	o*
	-	34	35	o*
Klaarstroom R27	15	28	40	r
E. of Laingsburg R1	15	19	50	o
Prince Albert R64	12	15	50	o*
	-	10	40	r
	-	15	45	o*
	-	12	50	o
	-	2	40	o*
	-	4	45	o
	-	4	50	o*
	-	10	55	o*
	-	3	40	o*
Steytlerville R15	6	1	45	r
	6	16	40	o
	7	16	45	o*
	7	13	40	o*
	8	2	45	r
	8	25	50	o
	8	10	40	r
	8	16	40	r
	9	16	40	r
	10	11	40	o*
	10	18	50	o
	11	6	45	o*
	11	8	45	r
	15	2	45	o
	-	5	45	o*
	-	15	30	r
	-	3	40	o
	-	18	50	o
Ft. Molteno Pass Hall 2284	12	-	60	o*
	13	-	70	o
	14	20	70	o
	15	20	70	o
	16	20	60	o
	16	23	70	o*
	-	30	60	o*
	-	5	75	d
<u>A. SMUTSIANA.</u>				
Ladismith/Barrydale R3	7	15	45	o
	9	8	45	o
	10	36	50	o
	11	18	50	o
	11	36	40	o*
	11	15	50	o*
	11	10	40	o
	12	30	40	o*
	13	21	45	o

Appendix Table 1 contd. LEAF ARRANGEMENT IN FIELD POPULATION SAMPLES
OF ASTROLOBA contd.

Locality.	Height of plant.	Spiral angle.	Angle of leaf with stem.	Curvature of leaf apex.
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A. SMUTSIANA. (Contd.)

Ladismith/Barrydale R5	7	14	40	o*
	8	27	50	o
	10	7	40	f
	11	24	45	o
	11	10	40	o
	11	18	60	o
	12	15	50	o*
	12	30	50	o*
	12	23	45	f
	12	40	55	f
	13	16	35	f
	14	3	45	o*
	18	24	40	f
	19	12	45	f
	20	7	40	f
	-	22	45	f
	-	20	50	o
	-	10	45	o
Laingsburg/Sevenweeks Poort R49	10	11	55	o
	13	14	55	o
	18	20	55	o
	-	33	50	o
	-	13	30	f
Rooinek Pass R51	11	27	50	f
	12	26	60	f
	14	18	50	o
	15	33	40	f
	16	14	45	f
	17	33	40	f
	20	33	50	f
	20	28	40	o*
	20	2	60	o
	21	28	40	f
	-	20	40	o*
	-	24	40	o
	-	28	40	f
	-	30	50	o*

HYBRID BETWEEN A. SMUTSIANA & A. RUGOSA.

Ladismith/Barrydale R4	12	11	45	o
	14	11	40	o
	-	15	40	o

A. HALLII.

Laingsburg/Sevenweeks Poort R48	10	10	45	u
	12	10	50	u
	13	5	45	u
	-	15	55	u
	-	5	40	u
	-	10	50	u
	-	0	40	u
	-	5	50	f
Koup R26	23	10	35	u
	24	0	30	u

Appendix Table 1 contd. LEAF ARRANGEMENT IN FIELD POPULATION SAMPLES OF ASTROLOBA contd.

Locality.	Height of Plant.	Spiral angle.	Angle of leaf with stem.	Curvature of leaf apex.
	cm.	^o	^o	
<u>A. HALLII. (Contd.)</u>				
Koup R26	-	8	40	u
(contd.)	-	7	30	u
	-	5	45	u
	-	16	20	u
	-	0	30	u*
	-	5	40	u*
	-	5	30	u
	-	10	40	u*
	-	5	45	u*
	-	13	50	f
	-	5	30	u*
	-	10	50	u*
	-	10	35	u
	-	2	45	f
<u>A. BULLULATA.</u>				
Ceres/Sutherland Rd R24	5	20	50	us
	6	8	40	us
	22	2	50	us
	-	7	55	us
	-	3	50	us
	-	4	50	us
	-	10	50	us
	-	11	40	us
	-	9	40	u
	-	4	50	u
	-	7	40	u
	-	10	40	us
	-	8	50	us
	-	1	50	u
	-	2	40	u
<u>A. RUGOSA.</u>				
4 Miles W. Matjesfontein R25	8	0	45	us
	8	5	40	us
	9	8	50	us
	11	8	40	us
	24	2	35	us
	30	21	40	us
	-	5	40	us
	-	2	45	us
	-	2	40	us.
<u>A. RUGOSA.</u>				
Ladismith/Barrydale R2	8	14	40	o
	16	20	50	o
Karoid areas near Montague R17 - 23	8	2	40	f
	11	6	40	o
	12	1	45	o
	12	10	40	o
	14	6	50	o
	14	16	45	o*
	14	10	40	f
	15	19	50	o
	18	9	40	o
	21	4	60	o
	25	10	45	o

Appendix Table 1 contd. LEAF ARRANGEMENT IN FIELD POPULATION SAMPLES OF ASTROLOBA Contd.

Locality.	Height of plant.	Spiral angle.	Angle of leaf with stem.	Curvature of leaf apex.
	cm	o	o	
<u>A. RUGOSA. (Contd.)</u>				
Karoid areas near Montague R17-23 (contd.)	-	4	45	o
	-	22	50	o
	-	25	40	o
	-	13	50	o
	-	0	45	o
Rietvlei No. 2 R50a	26	1	40	f
	-	9	40	f
	-	7	40	o
	-	13	50	o
<u>A. HERREI.</u>				
Farm Hoekplaas nr Uniondale R16	6	30	40	o
	9	30	45	o
	20	30	50	o
	-	20	55	o
	-	30	40	o
	-	20	45	o
	-	30	40	o
	-	10	40	o*
	-	20	60	f
	Prince Albert R46	9	10	40
10		15	35	u
13		10	40	u
13		15	40	u
17		10	40	f
19		12	40	f
-		10	45	f
-		15	40	u
-		10	40	u*
-		15	40	o
<u>A. SPIRALIS.</u>				
Oudtshoorn R7	6	10	40	f
	7	10	40	o*
	7	5	30	o
	8	-	50	o
	8	10	40	f
	9	21	25	u
	9	33	45	f
	9	16	45	f
	9	0	35	o*
	11	27	30	f
	12	24	35	f
	16	24	45	o*
	20	30	50	f
	-	14	45	o*
	-	10	40	f
-	10	35	f	
-	26	35	f	
-	20	40	o*	
Calitzdorp R47	12	7	30	f
	13	36	30	f
	13	21	35	f
	13	22	30	f
	13	18	45	f
	17	17	25	f

Appendix Table 1 Cont. LEAF ARRANGEMENT IN FIELD POPULATION SAMPLES OF ASTROLOBA.

Locality.	Length		Width		Distance of		Side on which Keel situated	Keel		Mucro		Length breadth ratio
	cm.	cm.	widest part	leaf base	widest part from base.	widest part from base.		length	length	length.	cm.	
Graaff Reinet R29												
		3.0	1.8	1.0	1.1	R	1.8	0.15	1.67			
		2.4	1.9	1.0	1.1	L	1.5	0.11	1.29			
		2.4	1.7	1.0	1.1	L	1.3	0.08	1.40			
		2.3	1.8	0.9	1.0	R	1.4	0.11	1.28			
		2.3	1.6	0.9	1.1	L	1.3	0.12	1.42			
		2.3	1.5	0.9	1.0	L	1.3	0.12	1.59			
		2.3	1.6	0.8	1.0	L	1.2	0.08	1.42			
		2.2	1.4	0.9	0.9	R	1.3	0.10	1.57			
		2.2	1.7	0.9	0.9	L	1.2	0.07	1.25			
		2.2	1.7	1.0	0.9	R	1.4	0.09	1.28			
		2.2	1.5	0.9	1.0	L	1.3	0.12	1.59			
		2.1	1.7	0.8	0.9	L	1.3	0.09	1.27			
		2.1	1.4	0.9	1.0	L	1.2	0.10	1.50			
		2.0	1.3	0.8	0.9	L	1.3	0.09	1.54			
		2.0	1.4	0.7	0.9	R	1.4	0.07	1.41			
		1.9	1.4	0.8	0.9	L	1.1	0.08	1.37			
		1.9	1.4	0.7	0.8	L	1.2	0.06	1.43			
		1.9	1.5	0.7	0.9	L	1.3	1.10	1.25			
	1.9	1.5	0.8	0.8	R	1.3	0.09	1.31				
Near Pearston R34,35		1.9	1.3	0.8	0.8	R	1.2	0.07	1.53			
		1.7	1.4	0.5	0.8	R	0.8	0.10	1.80			
near Waterford Toekomst Farm R10		1.9	1.6	0.9	0.9	R+L	1.0	0.08	1.20			
		1.8	1.3	0.7	0.7	R	1.0	0.05	1.35			
		1.7	1.4	0.7	0.8	R	1.2	0.11	1.21			
		1.7	1.5	0.9	0.8	R	1.2	0.10	1.14			
		1.5	1.5	0.6	0.7	L	0.9	0.08	1.02			
		1.4	1.0	0.4	0.6	R	0.8	0.05	1.40			
near Lake Mentz R36,37		2.4	2.1	1.2	1.0	L	1.2	0.11	1.15			
		2.2	2.1	1.4	1.1	R	1.2	0.14	1.07			

Appendix Table 2 LEAF DIMENSIONS IN POPULATION SAMPLES OF ASTROLOBA. (All measurements are an average of those for several leaves taken from each plant.)

Locality.	Length cm. ⁴	Width widest part cm.	Distance of widest part from base cm.	Side on which keel situated.	Keel length cm.	Mucro length. cm.	Length breadth ratio	
<u>A. FOLIOLOSA subsp. FOLIOLOSA. (Contd.)</u>								
near Lake Mentz R36, 37 (Contd.)	2.2	1.5	1.0	L	1.2	0.11	1.43	
	2.1	1.7	1.1	L	1.0	0.08	1.22	
	1.9	1.5	0.9	R	1.1	0.10	1.27	
	1.7	1.4	0.9	L	1.0	0.10	1.19	
	1.6	1.2	0.8	L	0.8	0.10	1.39	
	1.6	1.5	0.8	R+L	0.9	0.10	1.07	
	1.5	1.4	0.9	L	0.8	0.10	1.07	
	1.5	1.2	0.6	R	0.9	0.10	1.26	
	1.4	1.1	0.7	L	0.8	0.07	1.28	
	1.4	0.9	0.6	L	0.8	0.05	1.55	
	1.4	1.0	0.5	R	0.8	0.07	1.44	
	1.4	1.1	0.6	L	0.8	0.05	1.23	
	1.4	1.1	0.7	L	0.8	0.05	1.23	
	near Wolwefontein R11	2.2	1.5	1.0	L	1.3	0.06	1.50
2.1		1.6	1.1	R+L	1.2	0.08	1.34	
2.1		1.4	0.9	R	1.2	0.12	1.56	
1.9		1.4	0.9	L	1.2	0.12	1.42	
1.9		1.5	0.9	L	1.1	0.08	1.26	
1.9		1.4	0.8	L	0.9	0.07	1.37	
1.8		1.2	0.9	R	1.0	0.07	1.46	
1.7		1.3	0.9	L	1.0	0.09	1.31	
1.7		1.2	0.8	L	1.1	0.10	1.42	
1.7		1.5	0.8	R+L	0.8	0.10	1.12	
1.7		1.3	0.8	R	1.0	0.1	1.29	
1.7		1.3	0.8	R	1.0	0.1	1.29	
near Mount Stewart *(From Baroe) R12,13		2.5	1.5	1.0	L	1.5	0.13	1.70
		2.5	1.4	1.1	L	1.4	0.11	1.82
	2.4	1.1	1.1	R	1.3	0.11	2.14	
	*2.2	1.6	1.1	L	1.3	0.09	1.40	
	2.1	1.4	1.0	R	0.9	0.09	1.47	

Appendix Table 2 LEAF DIMENSIONS IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Length cm.	Width widest part cm.	Distance of widest part from base cm.	Side on which keel situated.	Keel length cm.	Micro length. cm.	Length breadth ratio
<u>A. FOLIOLOSA subsp. FOLIOLOSA. (Contd.)</u>							
near Mount Stewart (Contd.)	1.9	1.6	0.9	L	1.1	0.07	1.19
	1.9	1.3	0.8	R	1.2	0.10	1.42
	1.8	1.1	0.8	L	1.2	0.09	1.60
	1.7	1.3	0.8	R	1.1	0.07	1.28
Steytlerville R14	2.5	1.5	0.9	R+L	1.4	0.11	1.71
	2.4	1.3	0.7	R	1.5	0.11	1.92
	2.3	1.7	1.0	R	1.4	0.11	1.35
	2.3	1.4	0.9	L	1.5	0.07	1.63
	2.3	1.4	0.8	R	1.4	0.06	1.61
	2.2	1.2	0.7	R	1.3	0.12	1.81
	2.2	1.8	1.1	L	1.2	0.08	1.19
	2.2	1.5	1.1	R	1.5	0.1	1.48
	2.0	1.6	0.8	R	1.2	0.09	1.72
	2.0	1.6	0.8	R	1.5	0.10	1.28
	2.0	1.4	0.7	L	1.2	0.06	1.32
	2.0	1.4	0.8	R	1.4	0.10	1.49
	2.0	1.3	0.9	L	1.2	0.11	1.48
	2.0	1.3	0.7	R	1.1	0.06	1.51
	1.9	1.3	0.7	R	1.0	0.05	1.57
	1.9	1.1	0.6	R	1.3	0.08	1.63
1.8	1.1	0.6	L	1.0	0.05	1.43	
1.8	1.2	0.6	R	1.3	0.06	1.69	
1.8	1.2	0.7	L	1.1	0.07	1.62	
1.8	1.2	0.6	R	1.2	0.09	1.50	
1.8	1.2	0.8	L	1.1	0.11	1.50	
1.8	1.4	0.7	L	1.0	0.11	1.53	
1.8	1.4	0.7	L	1.1	0.09	1.57	
1.8	1.4	0.8	R	1.1	0.06	1.23	
1.8	1.4	0.8	L	1.1	0.09	1.30	
1.8	1.3	0.7	L	1.2	0.09	1.40	

Appendix Table 2 LEAF DIMENSIONS IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Length cm.	Width widest part cm.	Distance of widest part from base cm.	Side on which keel situated	Keel length cm.	Micro length. cm.	Length breadth ratio
Steytlerville (Contd.)	1.8	1.2	0.7	L	1.1	0.10	1.49
	1.8	1.2	0.8	L	1.3	0.07	1.52
	1.7	1.2	0.8	R	1.0	0.09	1.45
	1.7	1.4	0.7	R+L	0.9	0.05	1.18
	1.7	1.2	0.6	L	1.1	0.04	1.40
	1.7	1.2	0.7	R	1.1	0.09	1.44
	1.6	1.2	0.6	L	1.0	0.05	1.31
<u>A. FOLIOLOSA subsp. FOLIOLOSA. (Contd.)</u>							
19 miles north of Cradock near Knutsford R31	3.5	2.1	1.3	L	1.9	0.12	1.67
	3.2	1.6	1.2	R	1.8	0.1	2.03
	3.0	1.6	1.1	R	2.0	0.09	1.90
	2.9	1.7	1.1	R+L	1.9	0.08	1.76
	2.9	1.8	1.1	R+L	1.8	0.08	1.63
	2.7	1.7	1.1	L	1.6	0.12	1.61
	2.6	1.7	1.1	L	1.4	0.12	1.50
<u>A. FOLIOLOSA subsp. CONGESTA.</u>							
Cradock R32	4.0	2.1	1.7	R	2.3	0.10	1.91
	3.8	1.8	1.7	R+L	2.4	0.10	2.14
	3.6	2.1	1.4	R	2.2	0.07	1.73
	3.6	2.1	1.6	L	2.1	0.07	1.70
	3.5	1.7	1.6	R	2.0	0.08	2.03
	3.3	1.7	1.2	L	1.7	0.08	1.94
	3.3	2.0	1.4	L	1.7	0.09	1.63
	3.2	1.8	1.3	L	2.0	0.09	1.81
	3.1	1.7	1.3	L	1.9	0.09	1.85
	2.9	1.4	1.1	L	2.0	0.13	2.21
2.8	1.6	1.4	R	1.8	0.09	1.80	
2.7	1.7	1.3	R	1.8	0.10	1.70	
2.7	1.6	1.3	L	1.7	0.08	1.69	
2.5	1.8	1.3	R	1.6	0.06	1.51	
	1.5	0.9	1.1	R+L	1.4	0.05	1.63

Appendix Table 2 LEAF DIMENSIONS IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Length cm.	Width widest part cm.	Distance of widest part from base cm.	Side on which keel situated.	Keel length cm.	Mucro length. cm.	Length breadth ratio
<u>A. FOLIOLOSA subsp. CONGESTA. (Contd.)</u>							
near Rayners Kop R33	4.6	2.3	1.6	R	2.5	0.11	2.00
	4.5	1.9	1.4	R	2.6	0.1	2.33
	4.0	2.2	1.5	R	2.6	0.09	1.82
	4.0	2.4	1.4	R	2.1	0.65	1.66
	3.7	1.9	1.2	R	2.2	0.08	1.95
	3.5	1.9	1.4	R	2.2	0.06	1.89
	3.5	2.1	1.5	L	2.1	0.08	1.68
	3.4	2.1	1.5	R	1.9	0.06	1.62
	3.4	2.0	1.6	L	1.9	0.07	1.74
	2.9	2.1	1.4	R+L	1.7	0.08	1.39
12 to 18 miles from Adelaide on Grahamstown Rd. R38,39	4.4	2.8	1.8	L	2.8	0.08	1.58
	4.2	2.5	1.7	R	2.8	0.09	1.71
	3.7	2.7	1.4	R+L	2.3	0.05	1.72
	3.7	2.9	1.7	L	2.2	0.07	1.35
	3.4	1.9	1.2	R	1.9	0.10	1.76
	3.3	2.2	1.5	L	2.2	0.08	1.50
	3.3	1.8	1.2	L	1.9	0.10	1.81
	3.1	1.8	1.4	R	2.0	0.10	1.72
	3.0	1.8	1.1	R+L	1.9	0.09	1.68
	3.0	1.7	1.1	L	2.1	0.07	1.74
	2.9	2.1	1.2	L	1.6	0.08	1.39
	2.8	1.9	1.1	R	1.6	0.08	1.51
	2.8	1.9	1.0	L	1.6	0.07	1.39
	2.7	1.7	1.0	L	1.7	0.06	1.59
	2.7	1.7	1.0	L	1.6	0.08	1.59
Hellsport R40	4.4	1.9	1.4	R	2.4	0.09	2.32
	4.0	2.2	1.4	L	2.2	0.10	1.80
	3.7	1.9	1.4	L	2.3	0.07	1.92
	3.7	2.0	1.2	L	2.1	0.09	1.87

Appendix Table 2 LEAF DIMENSIONS IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Length cm.	Width widest part leaf base cm.	Distance of widest part from base cm.	Side of which keel situated.	Keel length cm.	Mucro length. cm.	Length breadth ratio
<u>A. FOLIOLOSA subsp. CONGESTA (Contd.)</u>							
Hellsport R40 (Contd.)	3.6	2.1	1.3	R+L	2.0	0.07	1.71
	3.5	1.8	1.3	R+L	2.0	0.06	2.00
	3.5	1.7	1.4	L	2.1	0.10	2.12
	3.4	2.4	1.4	L	2.0	0.09	1.40
	3.4	1.7	1.3	R	1.8	0.10	2.03
	3.3	2.3	1.4	R	1.9	0.09	1.44
Dikkop Vlakke R41	4.7	2.8	1.7	R	2.7	0.12	1.66
	4.7	2.6	1.7	R	2.6	0.13	1.82
	4.2	2.4	1.8	R	2.5	0.09	1.75
	4.1	2.3	1.8	R	2.4	-	1.78
	3.9	2.2	1.7	R+L	2.0	0.05	1.77
	2.8	1.9	1.2	R+L	1.4	0.06	1.46
Krantz Farm Albany District Gommans 2063	2.0	1.4	1.1	L	1.1	0.05	1.46
<u>A. FOLIOLOSA subsp. ROBUSTA.</u>							
Base of Molteno Pass Hall 2284	2.3	1.5	1.0	L	1.5	0.10	1.53
	2.3	1.5	1.0	L	1.4	0.07	1.53
	2.2	1.5	1.0	L	1.2	0.07	1.47
	2.2	1.4	1.1	R	1.4	0.06	1.57
	2.2	1.4	0.9	L+R	1.5	0.07	1.57
	1.8	1.1	0.9	L	1.2	0.04	1.64
Nelsport R27	3.9	2.0	1.5	L	2.1	0.11	1.93
	3.8	1.7	1.3	R	2.2	0.20	2.21
	3.7	1.9	1.4	R	2.0	0.13	1.92
	3.6	2.0	1.4	R	2.1	0.10	1.80
	3.6	1.8	1.1	L	2.1	0.17	2.00
	3.5	2.0	1.4	L	2.1	0.13	1.80
3.4	2.1	1.4	L	1.7	0.14	1.67	

Appendix Table 2 leaf dimensions in population samples of *astroloba* (Contd.)

Locality.	Length cm.	Width widest leaf part cm.	Distance of widest part from base cm.	Side on which Keel situated.	Keel length cm.	Micro length. cm.	Length breadth ratio
<u>A. FOLIOLOSA subsp. ROBUSTA. (Contd.)</u>							
Nelspoort R27 (Contd.)	3.2	2.0	1.1	L	2.2	0.10	1.67
	3.3	1.7	1.0	R	1.8	0.14	1.91
	3.2	1.9	1.2	L	1.7	0.10	1.68
	3.1	1.6	1.2	L	1.8	0.85	2.00
	3.0	1.8	1.3	R&L	1.7	0.12	1.67
	2.6	1.6	0.9	R	1.7	0.14	1.94
		1.1	R&L	1.5	0.10	1.51	
4 miles N.W. of Matjes- fontein R56	2.8	1.6	1.0	R	1.5	0.05	1.77
	2.4	1.5	1.3	R	1.2	0.05	1.60
	2.4	1.4	0.9	L	1.4	0.05	1.68
	2.7	1.4	0.9	R&L	1.6	0.53	1.92
20 miles S.E. of Laingsburg near farm Spreeufontein R67	3.0	1.9	1.0	L	1.5	0.04	1.58
	2.7	1.7	0.8	L	1.1	0.05	1.59
	2.5	1.8	0.9	R	1.3	0.06	1.39
	2.5	1.8	1.0	R	1.1	0.05	1.39
	2.4	1.9	1.0	L	1.4	0.03	1.26
	2.4	1.8	0.8	R	1.2	0.05	1.33
Prince Albert R64	3.7	2.4	1.4	L	1.8	0.04	1.54
	3.5	2.0	1.3	R	1.6	0.05	1.80
	3.5	1.9	1.1	R	1.8	0.05	1.87
	3.2	1.7	1.0	L	1.6	0.04	1.91
	3.1	1.8	1.0	L	1.9	0.03	1.76
	2.9	1.5	0.9	R	1.6	0.03	2.06
		1.0	L	1.6	0.04	1.93	
		1.1	L	1.6	0.06	1.50	
		0.9	R	1.5	0.06	1.96	
		1.3	R	1.6	0.05	1.80	

Appendix Table 2 LEAF DIMENSIONS IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Length.	Width widest part	leaf base	Distance of widest part from base	Side on which Keel situated.	Keel length	Mucro length.	Length breadth ratio	
	cm.	cm.	cm.	cm.		cm.	cm.		
<u>A. FOLIOLOSA subsp. ROBUSTA. (Contd.)</u>									
Klaarstroom R27	4.0	2.1	1.8	1.6	L	2.1	0.10	1.91	
	4.0	1.8	1.3	1.6	L	2.1	0.10	2.22	
near Miller R8,9	3.9	2.1	1.1	1.6	L	2.3	0.13	1.84	
	3.9	2.0	1.0	1.5	L	2.1	0.15	1.95	
	3.7	2.2	1.1	1.7	L	2.3	0.05	1.90	
	3.6	2.2	1.1	1.6	L	2.0	0.11	1.67	
	3.6	2.1	1.1	1.4	L	2.1	0.11	1.73	
	3.4	2.2	1.1	1.3	R	2.0	0.11	1.47	
	3.3	1.8	0.9	1.2	R	1.9	0.06	1.83	
	3.3	2.0	0.9	1.3	R	1.8	0.10	1.67	
	3.2	1.9	0.9	1.1	R	1.8	0.08	1.73	
	3.1	1.9	0.9	1.3	R	2.0	0.07	1.63	
	3.1	1.5	0.9	1.4	L	1.8	0.10	2.07	
	3.0	2.4	1.2	1.3	L	1.7	0.10	1.25	
	2.9	1.9	1.0	1.2	L	1.8	0.10	1.58	
	2.9	1.5	0.7	1.2	R+L	1.6	0.08	1.93	
Steytlerville R15	2.9	1.1	1.1	1.4	L	1.6	0.04	1.48	
	2.8	1.5	0.9	1.2	R	1.7	0.08	1.87	
	2.8	1.8	1.0	1.3	L	1.5	0.1	1.56	
	2.6	1.7	1.0	1.1	R	1.5	0.10	1.53	
	3.5	2.0	1.1	1.5	L	1.9	0.11	1.75	
	3.0	1.9	1.0	1.1	L	1.8	0.10	1.55	
	2.9	1.7	0.9	1.2	R	1.9	0.12	1.76	
	2.8	1.7	1.0	1.1	L	1.7	0.10	1.70	
	2.8	1.5	0.9	0.9	R	1.8	0.15	1.87	
	2.7	1.5	0.8	1.0	L+R	1.7	0.10	1.90	
2.7	1.8	1.1	1.1	L	1.6	0.13	1.50		
	1.7	1.0	1.1	L	1.7	0.05	1.64		

Appendix Table 2 LEAF DIMENSIONS IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Length.	Width widest part	Distance of widest part from base	Side on which keel situated.	Keel length.	Micro length.	Length breadth ratio
	cm.	cm.	cm.		cm.	cm.	
<u>A. FOLIOLOSA subsp. ROBUSTA. (Contd.)</u>							
Steytlerville R15 (Contd.)	2.7 2.7 2.7 2.6 2.6 2.5 2.5 2.4 2.3 2.3 2.3 2.1	1.5 1.4 1.3 2.0 1.7 1.6 1.6 1.8 1.6 1.6 1.4 1.3	1.2 1.0 1.0 1.1 1.1 1.0 1.1 1.1 1.0 0.8 1.0 0.9	R R R+L L L R L R L R R L	1.6 1.7 1.4 1.8 1.7 1.5 1.3 1.4 1.5 1.3 1.5 1.3	0.12 0.18 0.09 0.12 0.09 0.10 0.12 0.11 0.13 0.09 0.10 0.85	1.80 1.92 2.09 1.33 1.56 1.53 1.33 1.47 1.51 1.65 1.55
<u>A. BULLULATA.</u>							
Ceres/Sutherland Rd. R24	4.0 3.7 3.5 3.4 3.3 3.3 3.2 3.2 3.2 3.1 3.0 2.4 2.3 2.3	1.5 2.3 2.3 1.5 2.2 1.5 2.1 1.8 2.3 2.0 1.9 1.8 1.6 1.4 1.3	1.4 1.5 1.5 1.3 1.2 1.3 1.4 1.1 1.4 1.3 1.3 1.2 1.1 1.1 0.9	R L R R R R R R+L L R+L R R L L R R R	1.9 1.9 2.0 1.4 1.6 1.8 1.7 1.5 1.7 1.9 1.8 1.7 1.3 1.5 1.4	0.10 0.10 - 0.15 0.20 0.11 0.10 0.11 0.09 0.09 0.06 0.09 0.09 0.08 0.09	2.72 1.64 1.52 2.23 1.54 2.17 1.56 1.77 1.42 1.60 1.63 1.70 1.52 1.64 1.70

Appendix Table 2 LEAF DIMENSIONS IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Length.	Width widest part	Distance of widest part from base	Side on which Keel situated.	Keel length	Mucro length.	Length breadth ratio
	cm.	cm.	cm.		cm.	cm.	
<u>A. BULLULATA. (Contd.)</u>							
4 miles W. of Matjesfontein R25	4.0	2.6	2.0	R+L	2.7	0.07	1.52
	3.7	2.0	1.1	L	2.5	0.08	1.90
	3.5	2.1	1.3	R	2.3	0.09	1.69
	3.4	2.4	1.6	L	1.7	0.08	1.45
	3.4	2.4	1.1	L	2.4	0.11	1.38
	3.1	1.9	1.3	R	2.2	0.03	1.63
	3.0	2.1	1.2	R	2.0	0.10	1.46
	2.8	1.6	1.1	L	1.9	0.08	1.75
	2.8	2.0	1.0	L	2.0	0.06	1.41
Ex. Hort	2.9	2.3	1.0	R	2.1	-	1.28
	2.6	1.6	0.9	L	1.6	0.07	1.60
<u>A. HALLII.</u>							
Koup R26	5.8	1.9	1.0	L	3.2	0.15	3.14
	4.3	2.1	1.3	L	2.7	0.11	2.05
	4.3	1.8	1.3	R	2.6	0.11	2.46
	4.2	2.04	1.4	R+L	2.4	0.11	2.15
	4.2	1.8	1.3	L	2.1	0.11	2.37
	4.2	1.6	1.6	L	2.2	0.11	2.64
	4.1	1.9	1.5	L	2.6	0.09	2.13
	4.0	1.9	1.4	L	2.5	0.11	2.08
	3.6	1.6	1.2	L	2.1	0.10	2.29
	3.5	1.8	1.0	R	1.9	0.06	1.94
	3.4	2.0	1.2	R	2.2	0.08	1.74
	3.4	1.6	0.9	L	1.9	0.12	2.17
	3.2	1.4	0.9	L	2.0	-	2.37
	3.1	1.6	1.1	L	2.1	0.08	2.00
	3.0	1.4	1.2	R	2.0	0.09	2.22
	2.8	1.6	0.9	L	1.8	0.09	1.72
	2.7	1.3	0.7	R	1.4	0.05	2.08

Appendix Table 2 LEAF DIMENSIONS IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Length.	Width widest part	leaf base	Distance of widest part from base	Side on which keel situated.	Keel length.	Micro length.	Length breadth ratio	
	cm.	cm.	cm.	cm.		cm.	cm.		
nr. Farm Rietvlei on Laingsburg/Sevenweeks- poort Rd. R48	3.5	1.7	1.0	1.4	L	2.0	0.08	2.03	
	3.4	1.7	1.0	1.4	L	1.9	0.12	2.06	
	3.4	1.7	1.1	1.2	R	2.2	0.12	1.91	
	3.4	1.6	1.0	1.2	R	2.1	0.13	2.09	
	3.4	1.6	0.9	1.2	L	1.8	0.09	2.18	
	3.1	1.3	0.7	1.0	R	1.6	0.10	2.39	
	3.1	1.3	0.9	1.1	L	1.7	0.11	2.48	
	3.1	1.4	0.9	1.1	L	1.9	0.10	2.14	
	3.1	1.4	1.0	1.0	L	2.0	0.10	2.22	
				<u>A. HALLII.</u> (Contd.)					
nr. Farm Rietvlei on Laingsburg/Sevenweeks- poort Rd. R49	2.2	1.4	0.7	1.0	L	1.3	0.06	1.59	
	2.2	1.4	0.8	0.9	R+L	1.3	0.07	1.59	
	2.0	1.0	0.7	0.9	R	1.2	0.05	2.00	
	1.9	1.3	0.7	0.9	R	0.9	0.08	1.48	
	1.8	1.2	0.8	0.9	L	1.0	0.07	1.49	
				<u>A. SMUTSIANA.</u>					
	3.1	1.6	0.9	1.2	R	2.0	0.05	1.96	
	3.1	1.9	1.3	1.2	R+L	1.8	0.07	1.59	
	3.1	1.5	1.0	1.1	R+L	2.0	0.07	2.07	
	3.0	1.4	1.0	1.4	R	1.5	0.09	2.19	
2.9	1.6	1.0	1.2	L	1.7	0.06	1.76		
2.9	1.6	0.9	0.9	L	1.7	0.08	1.76		
2.8	1.7	1.0	1.3	R	1.4	0.08	1.67		
2.7	1.2	0.8	1.1	L	1.5	0.06	2.23		
2.4	1.4	0.9	1.1	R	1.4	0.08	1.59		
2.4	1.3	0.9	1.1	L	1.4	0.08	1.85		
2.3	1.2	0.8	1.0	R	1.1	0.05	1.84		
2.3	1.3	0.7	0.9	R	1.3	0.08	1.74		
2.2	1.5	0.9	1.0	L	1.5	0.08	1.46		
2.1	1.3	0.8	0.9	L	1.1	0.07	1.58		

Appendix Table 2 LEAF DIMENSIONS IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Length.	Width widest part	Distance of widest part from base	Side on which keel situated.	Keel length	Mucro length.	Length breadth ratio
	cm.	cm.	cm.		cm.	cm.	
<u>A. SMUTSIANA (Contd.)</u>							
Ladismith/Barrydale Rd. R3	2.7	1.4	1.2	R	1.4	0.10	1.93
	2.7	1.5	1.2	L	1.4	0.10	1.83
	2.7	1.7	1.1	L	1.7	0.10	1.62
	2.7	1.6	1.1	R	1.5	0.10	1.71
	2.6	1.8	1.2	R	1.4	0.08	1.49
	2.5	1.0	1.1	R+L	1.4	0.09	1.58
	2.5	0.9	1.2	R	1.4	0.08	1.27
	2.5	0.9	1.1	L	1.4	0.06	1.51
	2.4	1.7	1.0	L	1.5	0.10	1.38
	2.2	1.1	1.1	L	1.2	0.08	1.29
	2.2	0.7	1.0	L	1.3	0.06	1.59
	2.2	0.7	0.9	R+L	1.3	0.07	1.56
	2.2	0.7	0.9	R	1.0	0.12	1.63
	2.1	1.8	1.1	R	1.1	0.05	1.14
	2.1	0.7	0.9	R+L	1.3	0.16	1.46
	2.1	0.7	0.9	R	1.1	0.06	1.61
	2.0	0.7	0.9	R	1.2	0.05	2.11
	1.9	0.7	0.9	R	0.9	0.09	1.48
	1.9	0.8	0.8	R	1.2	0.09	1.35
	1.9	1.1	1.0	L	1.1	0.07	1.27
	1.9	0.8	0.9	R	1.0	0.10	1.23
	1.8	0.8	0.9	L	1.0	0.07	1.49
Ladismith/Barrydale Rd. R5	3.1	1.5	1.1	R+L	2.0	0.07	2.02
	3.1	1.9	1.2	R+L	1.8	0.07	1.59
	3.1	1.6	1.2	R	2.0	0.05	1.96
	3.0	1.4	1.4	R	1.5	0.09	2.11
	3.0	1.8	1.4	R	1.4	0.10	1.67
	3.0	1.5	1.2	L	1.5	0.10	1.97
	2.9	0.9	0.9	L	1.7	0.06	1.76
	2.8	1.0	1.3	R	1.3	0.08	1.67

Appendix Table 2 LEAF DIMENSIONS IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality..	Length cm.	Width		Distance of widest part from base	Side on which Keel situated.	Keel length cm.	Mucro length. cm.	Length breadth ratio	
		widest part cm.	leaf base cm.						
Ladismith/Barrydale Rd. R5 (Contd.)	2.8	1.6	1.0	1.2	L	1.7	0.05	1.79	
	2.8	1.2	-	1.1	R	1.7	0.13	2.30	
	2.8	1.4	0.7	1.0	R+L	1.6	0.12	2.01	
	2.7	1.2	0.8	1.0	L	1.4	0.08	2.23	
	2.4	1.3	0.9	1.1	L	1.4	0.08	1.85	
	2.4	1.4	0.9	1.1	R	1.8	0.07	1.59	
	2.4	1.6	0.8	1.0	L	1.2	0.10	1.50	
	2.4	1.8	1.4	1.1	R+L	1.4	0.08	1.32	
	2.3	1.2	0.8	1.0	R	1.1	0.05	1.84	
	2.3	1.3	0.9	0.9	L	1.5	0.10	1.74	
	2.2	1.4	0.8	0.9	L	1.2	0.12	1.60	
	2.2	1.3	0.8	0.8	L	1.3	0.10	1.73	
	2.2	1.5	0.9	1.0	L	1.5	0.08	1.46	
	2.2	1.3	0.7	0.9	R	1.3	0.08	1.72	
	2.1	1.3	0.8	0.9	L	1.1	0.03	1.58	
	Between Adamskraal and Ochertskraal R63	3.9	1.9	1.3	1.5	R	2.2	0.09	2.05
		3.8	1.6	1.2	1.3	L	1.5	0.06	2.31
		3.5	1.9	1.2	1.3	R	2.2	0.05	1.84
		2.9	1.5	0.9	1.3	R	1.8	0.06	1.93
		2.6	1.7	1.1	1.2	R	1.4	0.05	1.53
2.3		1.3	0.8	1.0	L	1.4	0.04	1.74	
<u>HYBRID BETWEEN A. SMUTSIANA & A. RUGOSA</u>									
Ladismith/Barrydale Rd. R4.	2.0	1.5	0.7	0.9	L+R	1.2	0.07	1.30	
	2.0	1.3	0.7	0.6	R	1.3	0.07	1.53	

Appendix Table 4 LEAF DIMENSIONS IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Length.		Width		Distance of widest part from base	Side on which Keel situated.	Keel length.	Mucro length.	Length breadth ratio
	cm.	cm.	cm.	cm.					
Upper Baden R17	2.2	1.3	0.8	1.0	R	1.2	0.06	1.69	
	2.0	1.4	0.8	1.1	R	1.0	0.06	1.43	
	2.0	1.5	0.8	0.9	R	0.9	0.06	1.33	
	1.9	1.8	0.9	1.0	R	1.1	0.06	1.06	
	1.9	1.5	0.7	1.0	R	1.0	0.06	1.27	
	1.7	1.6	0.8	1.0	L	0.8	0.05	1.06	
	1.4	1.3	0.7	0.8	L	0.8	0.05	1.08	
	2.2	1.6	0.9	1.1	R	1.1	0.07	1.38	
	2.2	1.5	0.7	1.2	R	1.3	0.06	1.47	
	2.2	1.4	0.7	1.1	R	1.1	0.06	1.57	
4 miles out of Montagu on Baden Rd R18	2.1	1.7	1.0	1.1	R	1.1	0.04	1.24	
	1.8	1.5	0.8	1.0	R	1.0	0.07	1.20	
	1.7	1.2	0.7	0.8	R	0.8	0.05	1.69	
	1.7	1.7	1.1	1.0	R+L	1.0	0.05	1.00	
	2.5	1.7	1.0	1.2	R	1.1	0.05	1.47	
	2.2	1.3	0.8	1.0	L	1.2	0.06	1.69	
	2.2	1.3	0.7	1.0	R	1.1	0.07	1.69	
	2.2	1.4	0.9	1.1	R	1.0	0.05	1.57	
	2.0	1.3	0.8	1.0	L	1.1	0.06	1.54	
	1.9	1.4	0.8	1.0	R+L	0.9	0.05	1.36	
nr. Pietersfontein R19	1.8	1.3	0.8	0.8	L	1.0	0.05	1.39	
	1.7	1.1	0.7	0.9	L	0.8	0.05	1.55	
	2.1	1.7	0.9	1.1	L	1.2	0.09	1.24	
	1.8	1.4	0.08	1.0	L	0.9	0.10	1.29	
	2.3	1.6	1.0	1.0	R	1.5	0.04	1.44	
	2.3	1.3	0.8	1.1	R	1.2	0.04	1.77	
	2.3	1.4	1.0	1.1	L	1.3	0.05	1.64	
	2.1	1.7	0.9	1.1	L	1.2	0.09	1.24	
	1.8	1.4	0.08	1.0	L	0.9	0.10	1.29	
	2.3	1.6	1.0	1.0	R	1.5	0.04	1.44	
nr. Pietersfontein R20	2.3	1.3	0.8	1.1	R	1.2	0.04	1.77	
	2.3	1.4	1.0	1.1	L	1.3	0.05	1.64	
Dobbelaarskloof Rd. R21	2.3	1.3	0.8	1.1	R	1.2	0.04	1.77	
	2.3	1.4	1.0	1.1	L	1.3	0.05	1.64	

Appendix Table 2 LEAF DIMENSIONS IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Length.	widest part	Width leaf base	Distance of widest part from base	Side on which Keel situated	Keel length	Mucro length.	Length breadth ratio
	cm.	cm.	cm.	cm.	cm.	cm.	cm.	
<u>A. RUGOSA. (Contd.)</u>								
Dobbelaarskloof Rd. R21 (Contd.)	2.1 1.9 1.9 1.8	1.4 1.3 1.3 1.2	0.9 0.7 0.8 0.7	1.0 0.9 0.9 0.9	R L L R+L	1.0 1.0 0.9 0.9	0.05 0.07 0.07 0.06	1.50 1.46 1.46 1.50
Dobbelaarskloof Rd. R22	2.2 2.2 2.0 2.0 1.7 1.6	1.4 1.4 1.5 1.5 1.5 1.1 1.3	1.0 0.9 0.8 1.0 0.8 0.6 0.8	1.1 1.2 1.2 1.0 1.0 0.9 1.0	R+L L L R R L L	1.2 1.0 1.1 1.0 1.0 0.8 0.8	0.05 0.06 0.05 0.05 0.08 0.04 0.06	1.57 1.57 1.47 1.33 1.33 1.55 1.23
2 miles out of Montagu at Baden turn off R23	2.2 2.1 2.0 2.0 1.9 1.9 1.9 1.7 1.6	1.7 1.7 1.5 1.2 1.3 1.6 1.4 1.3 1.6 1.5	1.0 1.1 0.8 0.7 0.7 0.8 0.9 0.9 0.8	1.0 1.0 1.3 1.0 1.0 1.1 0.8 1.0 1.0	R L+R L R L L R+L L R+L L	1.1 1.2 0.9 1.0 1.0 0.8 0.9 0.9 0.8 0.9	0.05 0.06 0.08 0.05 0.05 0.08 0.04 0.05 0.04	1.29 1.53 1.33 1.67 1.46 1.19 1.34 1.46 1.06 1.07
Farm Rietvlei no. 2 R50A	2.4 2.2 2.0 2.0	1.6 1.2 1.4 1.4	1.1 0.7 0.9 0.8	1.1 1.0 1.0 1.0	R L R R	1.3 1.1 0.9 1.0	0.06 0.05 0.05 0.05	1.50 1.83 1.43 1.43
Ladismith/Barrydale R2	2.0 1.9	1.4 1.5	0.8 0.8	0.9 1.0	L R	1.0 1.0	0.04 0.05	1.43 1.27

Appendix Table 2 LEAF DIMENSIONS IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Length cm.	Width		Distance of widest part from base cm.	Side on which keel situated	Keel length cm.	Micro length. cm.	Length breadth ratio
		widest part cm.	leaf base cm.					
Ladismith/Barrydale R2 (Contd.)	1.8	1.4	0.8	0.8	R	0.9	0.05	1.27
	1.8	1.5	0.9	0.8	L	0.8	0.06	1.20
	1.7	1.4	0.7	0.7	L	0.8	0.05	1.21
Outshoorn R7,61			<u>A. RUGOSA.</u> (Contd.)					
			<u>A. SPIRALIS.</u>					
	4.2	1.5	1.2	1.4	L	2.9	0.04	2.90
	3.7	1.3	1.0	1.0	R+L	2.3	0.16	2.82
	3.5	1.3	1.0	1.5	L	2.5	0.13	2.70
	3.5	1.3	0.9	1.2	L	1.8	0.08	2.60
	3.0	1.4	1.1	1.1	L	2.1	0.07	2.54
	3.0	1.4	0.8	1.0	L	2.1	0.14	2.19
	3.0	1.5	0.9	1.0	R+L	1.9	0.12	2.19
	2.9	1.2	0.8	1.0	L	1.9	0.09	1.95
	2.9	1.2	0.9	1.0	L	1.9	0.15	2.37
	2.8	1.2	0.9	0.9	R	2.0	0.13	2.33
	2.8	1.2	1.0	1.1	L	1.9	0.07	2.33
	2.7	1.3	1.0	1.1	L	1.9	0.09	2.02
	2.5	1.0	0.8	0.8	L+R	1.6	0.10	2.47
	2.4	1.0	0.7	0.9	L	1.7	0.14	2.44
	2.4	1.2	0.8	0.8	L	1.6	0.09	1.96
	2.4	1.5	1.1	1.0	L	1.6	0.11	2.00
	2.2	1.0	0.7	0.7	R	1.5	0.07	1.64
	2.2	1.1	0.9	0.9	R	1.5	0.09	2.18
2.2	1.2	0.8	0.8	R	1.4	0.12	2.00	
2.2	1.2	0.9	0.8	L	1.2	0.07	1.86	
1.9	1.2	0.9	0.7	L	1.3	0.06	1.90	
				R	1.3	0.10	1.85	
Ladismith-Barrydale Rd. R6	3.0	1.8	1.5	1.4	R	1.4	0.10	1.67

Appendix Table 2 LEAF DIMENSIONS IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Length.	Width widest part	leaf base	Distance of widest part from base	Side on which Keel situated	Keel length	Mucro length	Length breadth ratio
	cm.	cm.	cm.	cm.		cm.	cm.	
<u>A. SPIRALIS. (Contd.)</u>								
Callitzdorp R47	3.4	1.5	1.1	1.1	L	2.0	0.06	2.41
	2.7	1.5	1.1	1.0	R	1.6	0.06	1.86
	2.6	1.5	1.2	1.1	R+L	1.4	0.08	1.71
	2.6	1.3	0.9	1.1	R+L	1.5	0.05	2.06
	2.5	1.3	0.8	1.0	L	1.5	0.07	1.92
	2.4	1.5	1.0	1.1	R+L	1.2	0.08	1.57
<u>A. HERREI.</u>								
Farm Hoekpleas nr. Uniondale R16	3.2	1.6	0.8	1.4	L	1.6	0.16	2.03
	2.6	1.5	0.8	1.2	R+L	1.4	0.18	1.67
	2.3	1.3	0.7	1.1	L	1.3	0.09	1.80
	2.2	1.2	0.7	0.9	R	1.2	0.12	1.78
	2.2	1.1	0.5	1.0	R	1.1	0.08	1.96
	2.1	1.3	0.7	1.0	L	1.2	0.09	1.62
	2.1	1.1	0.6	1.0	L	1.2	0.09	1.87
	2.1	1.4	0.8	1.1	L	1.1	0.10	1.44
	2.1	1.3	0.8	1.0	R	1.1	0.10	1.68
	1.8	1.2	0.7	1.0	L	1.0	0.09	1.46
Prince Albert R46	2.9	1.4	1.0	1.0	L	1.8	0.10	2.00
	2.7	1.3	0.8	1.0	R	1.5	0.12	2.08
	2.7	1.4	1.0	1.0	R+L	1.5	0.11	1.98
	2.5	1.0	0.8	1.2	R	1.3	0.13	2.42
	2.5	1.3	0.9	1.1	R	1.5	0.11	2.00
	2.5	1.4	1.0	1.1	L	1.5	0.07	1.75
	2.4	1.1	0.9	0.9	R	1.4	0.10	2.21
	2.4	1.0	0.8	1.0	R	1.8	0.08	2.40
	2.4	1.1	1.0	0.9	R	1.5	0.10	2.09
	2.3	1.3	0.8	1.0	L	1.2	0.10	1.76
	2.1	0.9	0.7	0.8	L	1.2	0.09	2.28

Appendix Table 2 LEAF DIMENSIONS IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality, Lowest Fertile Length, Width, Distance of Side on Keel, Micro Length, Length
 Length, Basal Length, widest part base, widest part from base, which Keel situated, length, length, breadth, ratio

cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
0.40	0.13	0.75	0.17	0.15	0.32	0.17	0.17	16.0	12.0
0.40	0.12	0.70	0.17	0.15	0.32	0.17	0.17	14.0	15.0
0.45	0.17	0.57	0.17	0.15	0.32	0.17	0.17	21.0	9.0
0.45	0.06	0.52	1.0	0.8	0.37	1.9	0.03	0.03	2.52
0.45	0.17	0.70	0.30	0.24	0.24	1.8	-	-	2.50
0.46	0.15	0.68	1.2	0.8	-	-	-	-	-
0.50	0.13	0.60	0.14	0.14	0.24	0.24	0.24	14.0	14.0
0.50	0.17	0.70	0.20	0.14	0.24	0.24	0.24	18.0	18.0
0.50	0.10	0.70	0.29	0.14	0.24	0.24	0.24	19.0	19.0
0.50	0.20	0.70	0.33	0.14	0.24	0.24	0.24	21.0	21.0
0.50	0.20	0.72	0.30	0.14	0.24	0.24	0.24	22.0	22.0
0.52	0.10	0.65	0.09	0.14	0.24	0.24	0.24	14.0	14.0
0.52	0.13	0.70	0.22	0.14	0.24	0.24	0.24	19.0	19.0
0.52	0.14	0.65	0.14	0.14	0.24	0.24	0.24	19.0	19.0
0.53	0.13	0.75	0.18	0.14	0.24	0.24	0.24	23.0	23.0
0.55	0.17	0.75	0.16	0.14	0.24	0.24	0.24	15.0	15.0
0.55	0.18	0.73	0.16	0.14	0.24	0.24	0.24	15.0	15.0
0.55	0.17	0.65	0.22	0.14	0.24	0.24	0.24	15.0	15.0
0.56	0.18	0.65	0.22	0.14	0.24	0.24	0.24	23.0	23.0
0.60	0.18	0.71	0.23	0.14	0.24	0.24	0.24	15.0	15.0
0.60	0.17	0.77	0.22	0.14	0.24	0.24	0.24	16.0	16.0
0.60	0.19	0.68	0.20	0.14	0.24	0.24	0.24	16.0	16.0
0.60	0.17	0.60	0.20	0.14	0.24	0.24	0.24	15.0	15.0
0.60	0.22	0.60	0.20	0.14	0.24	0.24	0.24	15.0	15.0
0.60	0.13	0.65	0.13	0.14	0.24	0.24	0.24	15.0	15.0
0.62	0.17	0.62	0.26	0.14	0.24	0.24	0.24	15.0	15.0
0.62	0.16	0.62	0.26	0.14	0.24	0.24	0.24	15.0	15.0
0.62	0.16	0.62	0.26	0.14	0.24	0.24	0.24	15.0	15.0

LEAVES FROM KEW GARDENS.

"Apicra pentagona"

Appendix Table 3. INDICATIONS OF INFLORESCENCE IN POPULATIONS SAMPLED OF AETHIOPIA. (* Indicated inflorescence was not properly developed, or was damaged; # indicates the number of bracteoles; & indicates the number of compound stems borne in the axils of the sterile bracts.)

Locality. Lowest Fertile Bract Lowest Sterile Bract Pedicel Length No. of Length No. of
 middle basal middle basal Flowering Fruiting sterile Peduncle Width side
 length-width, -width, length-width, -width, Basal-middle basal bracts. at branches
 length-width, -width, length-width, -width, bracts. base raceme, below Peduncle-Raceme

A. FOLIOLOSA subsp. FOLIOLOSA.

Locality	Lowest Fertile Bract length-width, -width, middle basal	Lowest Sterile Bract length-width, -width, middle basal	Pedicel Length	No. of Fruiting basal bracts.	No. of sterile bracts.	Peduncle Width at base	Length	No. of side branches
Graaff	0.40	0.13	0.16	-	4	0.33	16.0	0
Reinet R60	0.40	0.12	0.17	-	6	0.33	14.0	0
	0.45	0.17	0.18	0.32	5	0.48	21.0	0
	0.45	0.06	-	0.37	4	0.30	9.0	0
	0.45	0.17	0.19	0.24	3	0.42	17.0	0
	0.46	0.15	0.15	-	6	0.30	15.0	0
	0.50	0.13	0.17	-	5	0.28	16.0	0
	0.50	0.17	0.14	-	4	0.40	18.0	0
	0.50	0.10	0.28	0.19	6	0.35	15.0	0
	0.50	0.28	0.30	0.23	4	0.34	21.0	0
	0.50	0.35	0.26	-	4	0.42	22.0	0
	0.50	0.30	0.41	0.24	4	0.37	14.0 ⁴	0
	0.52	0.10	0.34	-	4	0.34	19.0	0
	0.52	0.13	0.32	0.17	5	0.34	18.0	1b
	0.52	0.14	0.22	0.21	7	0.40	19.0	0
	0.53	0.13	0.22	0.25	3	0.40	19.0	0
	0.55	0.17	0.22	-	3	0.41	23.0	0
	0.55	0.13	0.15	0.23	5	0.39	13.0	0
	0.55	0.17	0.16	-	7	0.40	15.0	0
	0.56	0.18	0.11	0.26	5	0.4	16.0	0
	0.60	0.18	0.14	-	5	0.39	23.0	0
	0.60	0.17	0.19	-	5	0.33	18.0	0
	0.60	0.37	0.24	-	5	0.38	20.0	0
	0.60	0.31	0.34	0.24	6	0.37	15.0	0
	0.60	0.20	0.16	-	7	0.44	17.0	1b
	0.60	0.20	0.19	0.38	4	-	15.0	0
	0.60	0.15	0.19	0.22	5	0.39	15.0	0
	0.62	-	-	0.38	3	0.34	10.0	0
	0.62	0.26	0.16	0.22			19.0	
	0.62	0.30	0.37	-				
	0.62	0.30	0.37	-				
	0.62	0.12	0.14	-				

Appendix Table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA. (* indicates inflorescence was not properly developed, or was damaged; b indicates the number of branches; a indicates the number of unexpanded raceme buds in the axils of the sterile bracts).

Locality.	Lowest Fertile Bract		Lowest Sterile Bract		Pedicel Length		No. of		Peduncle Width		Length		No. of side branches
	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	
	middle basal length--width.		middle basal length--width.		Flowering basal-middle basal		sterile bracts.		at base		below raceme		
	length--width.		length--width.		length--width.		length--width.		length--width.		length--width.		
	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	
A. FOLIOLOSA subsp. FOLIOLOSA. (Contd.)													
Graaff Reinnet R60 (Contd.)	0.64	0.15	0.35	0.17	0.25	0.18	0.29	5	0.37	0.26	17.0	16.0	0
	0.65	0.11	0.22	0.17	0.40	0.18	-	5	0.37	0.21	22.0	24.0	0
	0.65	0.17	0.30	0.20	0.35	0.10	-	4	0.41	0.23	16.0	17.0	0
	0.70	0.15	0.35	0.18	0.20	0.08	-	3	0.34	0.16	23.0	14.0	0
	0.75	0.18	0.32	0.17	0.32	0.19	0.29	4	0.40	0.20	18.0	10.0	0
Wolwefontein R11	0.57	0.22	0.13	-	-	0.23	-	-	-	0.25	-	17.0	0
	0.65	-	-	-	-	0.30	-	5	0.40	0.35	19.0	12.0	0
	0.70	-	-	-	-	0.30	-	6	0.38	0.30	28.0	14.0	0
Mount Stewart R13, 52b	0.53	0.10	0.29	0.13	0.33	0.32	-	4	0.34	0.21	15.0	6.0*	0
	0.60	-	-	-	-	0.15	-	-	0.42	0.30	19.0	8.0	0
	0.62	0.11	0.30	-	-	0.17	-	8	0.32	0.23	13.0	6.0	0
	0.62	0.10	0.28	0.15	0.35	0.13	-	-	-	-	-	-	0
	0.62	0.15	0.30	0.15	0.33	-	-	-	-	-	-	-	0
	0.70	0.10	0.30	0.14	0.43	-	-	-	-	-	-	-	0
	0.73	0.11	0.28	0.15	0.28	-	-	-	-	-	-	-	0
Baroe R12	0.90	-	-	-	-	0.32	-	2	0.50	0.30	18.0	9.0*	1b
Stetlerville R14, R43a	0.50	0.06	0.30	-	-	0.13	0.28	6	0.48	0.29	18.0	18.0	0
	0.50	0.10	0.20	0.08	0.30	0.09	0.14	5	0.27	0.23	22.0	11.0*	0
	0.52	0.10	0.28	-	-	0.15	-	6	0.26	0.23	11.0	-	0
	0.55	0.13	0.20	0.14	0.30	0.26	-	3	0.38	0.25	14.0	14.0	0
	0.55	0.10	0.30	0.08	0.30	0.12	0.27	6	0.47	0.25	23.0	10.0*	0
	0.60	0.10	0.25	0.16	0.25	0.10	-	4	-	-	-	-	0
	0.61	0.10	0.25	0.12	0.22	0.20	-	5	0.33	0.20	16.0	7.0*	0
	0.61	0.07	0.30	0.12	0.32	0.29	-	5	0.35	0.23	11.0	8.0*	0
	0.62	0.10	0.25	0.12	0.22	0.09	0.19	5	0.32	0.25	16.0	-	0
	0.70	0.06	0.28	0.12	0.22	0.15	0.25	5	0.29	0.23	14.0	13.0	0
	0.70	0.08	0.28	-	-	0.08	-	3	0.34	0.20	16.0	-	0

Appendix table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality. Lowest Fertile Bract middle basal length-width.--width. Lowest Sterile Bract middle basal length-width.--width. Pedicel Length Flowering sterile basal bracts. No. of Peduncle Width at base raceme. Peduncle-Raceme branches. Length side No. of

cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm.

A. FOLIOLOSA subsp. FOLIOLOSA. (Contd.)

Steytler-ville R14, R43a (Contd)	0.70	0.17	0.28	0.75	0.17	0.28	-	0.10	-	-	5	-	0.32	-	15.0	-	8.0*	-
	0.70	0.07	0.20	0.80	0.09	0.22	0.22	0.17	0.22	0.22	5	5	0.39	0.24	12.0	15.0	10.0	0
	0.70	0.07	0.30	0.85	0.12	0.30	0.30	0.24	0.30	0.30	3	3	0.38	0.25	14.0	14.0	14.0	0
	0.70	0.17	0.30	0.85	0.20	0.30	0.30	0.16	0.26	0.26	8	8	-	-	-	-	-	0
	0.70	0.12	0.30	0.92	0.16	0.33	0.33	-	0.14	0.14	4	4	0.38	0.28	17.0	17.0	-	0
	0.70	0.10	0.30	1.00	0.12	0.30	0.30	0.19	0.24	0.24	10	10	0.38	0.28	16.0	16.0	12.0	0
	0.70	0.10	0.30	1.03	0.12	0.30	0.30	0.17	0.20	0.20	7	7	0.42	0.26	21.0	21.0	9.0*	0
	0.70	0.10	0.23	1.15	0.12	0.40	0.40	0.10	-	-	-	-	-	-	-	-	-	0
	0.75	0.10	0.25	1.15	0.12	0.30	0.30	0.23	0.24	0.24	10	10	0.38	0.26	15.0	15.0	13.0	0
	0.85	0.08	0.40	1.25	0.20	0.50	0.50	0.16	0.20	0.20	7	7	0.42	0.30	-	-	-	0
	-	-	-	0.93	0.10	0.28	0.28	-	-	-	-	-	-	-	-	-	-	-

Springbok
Vlakte nbg
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	0.75	-	0.30	0.75	-	0.35	0.35	0.09	0.14	0.14	5	5	0.47	0.23	17.0	17.0	7.0*	0
	0.46	0.11	0.22	0.71	0.13	0.24	0.24	0.14	0.19	0.19	7	7	0.26	0.16	14.0	14.0	-	0

Herbarium Specimens.

Addo Bush	0.45	0.08	0.20	-	-	-	-	-	0.14	0.14	5	5	0.21	0.15	14.0	14.0	9.0*	0
	-	-	-	-	-	-	-	0.07	0.18	0.18	-	-	0.27	0.18	-	-	-	-
Koegakannas Kloof	0.60	0.06	0.20	0.90	0.10	0.30	0.30	0.15	0.18	0.18	3	3	0.39	0.21	20.0	20.0	7.0*	0
Swartkops/Sundays	0.50	0.08	0.18	1.00	0.10	0.24	0.24	-	0.25	0.25	4	4	0.27	0.20	16.0	16.0	9.0*	0
Kleinpoort	0.70	0.10	0.24	0.90	0.20	0.30	0.30	0.20	0.28	0.28	5	5	0.37	0.24	21.0	21.0	16.0	0
	0.83	0.08	0.20	1.30	0.10	0.22	0.22	0.15	0.23	0.23	7	7	0.41	0.25	20.0	20.0	12.0	1a
	0.85	0.14	0.20	1.00	0.18	0.42	0.42	0.20	0.28	0.28	4	4	0.32	0.25	18.0	18.0	19.0	1b

Appendix table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality. Lowest Fertile Bract middle basal length-width, -width. Lowest Sterile Bract middle basal length-width, -width. Pedicel Length Flowering Fruiting sterile basal-middle basal bracts. No. of sterile bracts. Peduncle Width at base below raceme. Peduncle-Raceme branches. Length No. of side

cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm.

A. FOLIOLOSA subsp. FOLIOLOSA. (Contd.)

Herbarium Specimens (Contd.)

Steytlerville	0.73	0.10	0.26	1.05	0.10	0.20	0.15	-	5	0.37	0.17	10.0	11.0	0
Kruidfontein	0.60	0.10	0.30	0.75	0.10	0.30	0.20	0.15	4	0.30	0.21	18.0	8.0*	0
	-	-	-	0.75	0.08	0.20	0.29	-	-	-	-	-	-	-
Waterford	0.75	0.08	0.23	1.00	0.36	0.60	0.15	0.10	5	0.36	0.17	13.0	6.0*	0
	-	-	-	-	-	-	-	0.20	3	0.29	0.24	20.0	12.0	0
Graaff-Reinet	0.63	0.10	0.22	-	-	-	0.14	-	3	0.28	0.22	14.0	11.0	0
	0.50	Op10	0.28	0.70	-	-	0.08	-	5	0.30	0.20	13.0	5.0*	0
nr. Laingsburg?	0.60	0.14	0.25	0.95	0.10	0.36	-	-	-	-	-	-	-	-
	0.55	0.12	0.30	0.70	0.10	0.30	0.15	0.07	4	0.34	0.25	10.0	12.0	0
	0.55	0.10	0.30	0.80	0.12	0.30	-	-	-	-	-	-	-	-

A. FOLIOLOSA subsp. CONGESTA.

Craddock R32,53	0.65	0.16	0.30	0.88	0.27	0.50	0.17	0.11	5	0.47	0.28	27.0	18.0	2a
	-	-	-	-	-	-	0.25	0.18	5	0.47	0.30	25.0	15.0*	-
	-	-	-	-	-	-	0.18	0.14	5	0.41	0.23	27.0	15.0	-
	-	-	-	-	-	-	0.30	0.20	5	0.75	0.40	30.0	18.0*	-
	-	-	-	-	-	-	0.25	0.20	5	0.54	0.29	24.0	19.0	-
	-	-	-	-	-	-	-	-	5	0.50 ⁴	0.30	17.0	15.0	-
	-	-	-	-	-	-	0.21	0.20	5	0.48	0.24	28.0	16.0	-
	-	-	-	-	-	-	-	-	7	0.55	0.30	19.0	13.0	-
	-	-	-	-	-	-	-	-	6	0.70	0.30	29.0	8.0*	-
	-	-	-	-	-	-	-	0.26	5	0.59	0.38	25.0	24.0*	5a
	-	-	-	-	-	-	0.40	0.23	5	0.61	0.30	16.0	17.0*	3a
	-	-	-	-	-	-	-	0.20	5	0.60	0.27	23.0	18.0	5a
	-	-	-	-	-	-	-	0.24	7	0.65	0.37	30.0	18.0*	7a
	-	-	-	-	-	-	0.28	0.21	5	0.47	0.24	25.0	11.0*	-

Appendix Table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality. Lowest Fertile Bract middle basal length-width.--width. cm. Lowest Sterile Bract middle basal length-width.--width. cm. Pedicel Length Flowering basal-middle cm. No. of Sterile bracts. Peduncle Width at base cm. below raceme. Peduncle-Raceme branches. Length cm. No. of side

CM.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	No. of side
<u>A. FOLIOLOSA subsp. CONGESTA. (Contd.)</u>															
Hellpoort	0.55	0.45	0.80	0.28	0.60	0.13	0.09	-	5	0.32	0.30	6.0	16.0	2b	
R41	0.170	0.37	0.75	0.25	0.45	0.10	0.07	0.10	4	0.39	0.24	19.0	12.0*	4a	
	0.70	0.40	0.90	0.45	0.40	0.07	0.06	0.09	3	0.37	0.24	18.0	18.0	2ab	
	0.70	0.45	0.90	0.45	0.70	-	0.09	0.11	3	0.49	0.30	18.0	12.0	3b	
	0.72	0.35	1.00	-	0.40	0.24	0.14	-	4	0.60	0.28	14.0	15.0	1b	
	0.73	0.34	0.90	0.17	0.35	-	0.13	0.20	4	0.37	0.23	12.0	14.5	1b	
	0.76	0.40	0.80	0.30	0.70	-	0.14	0.28	3	0.53	0.31	14.0	12.0	3b	
	0.78	0.38	0.80	0.20	0.40	-	0.08	0.10	2	0.39	0.25	16.0	12.0	2a	
	0.80	0.35	0.80	0.20	-	-	0.07	0.06	2	0.54	0.28	22.0	19.0	2a	
	0.80	0.40	0.92	0.48	0.60	-	0.08	0.08	4	0.40	0.25	17.0	11.5	4a	
	0.80	0.45	1.10	-	0.60	0.25	0.17	-	4	0.69	0.32	17.0	17.0	4a	
	0.83	0.43	1.10	0.25	0.56	0.16	0.12	-	5	0.70	0.35	20.0	14.0	4a	
	0.90	0.46	0.95	-	0.60	-	-	0.16	2	0.77	0.37	23.0	15.0	2b	
	0.95	0.40	1.20	0.35	0.70	-	0.10	0.16	5	0.75	0.34	21.0	17.0	5b	
Dikkop	0.70	0.45	0.85	0.30	0.60	0.08	0.14	-	2	0.73	0.33	16.0	9.0*	2a	
Vlakte	0.80	0.40	0.76	0.30	0.50	0.19	0.13	-	2	0.50	0.29	17.0	15.0	2a	
R40	0.80	0.35	0.85	0.30	0.60	0.14	0.14	-	3	0.59	0.20	25.0	11.0	3b	
	0.83	0.43	1.00	0.46	0.75	-	-	0.27	3	0.50	0.34	14.0	17.0	3b	
	0.85	0.50	0.90	0.40	0.70	-	-	0.30	3	0.59	0.31	15.0	20.0	3b	
	0.90	0.58	0.90	0.23	0.70	-	0.12	0.14	2	0.80	0.38	18.0	11.0	2b	
	-	-	-	-	-	0.20	0.10	-	3	0.64	0.30	20.0	11.0	3a	
<u>Herbarium Specimens.</u>															
Hellpoort	0.45	0.40	0.70	0.28	0.42	0.17	0.13	-	3	0.38	0.25	19.0	15.0	0	
	0.50	0.25	-	-	-	-	-	-	-	-	-	-	-	-	
	0.70	0.30	-	-	-	-	-	-	-	-	-	-	-	-	
	0.80	0.40	0.95	0.33	0.47	0.18	0.15	-	5	0.42	0.17	19.0	12.0	3b	
	0.80	0.36	0.95	0.20	0.40	0.14	0.10	-	3	0.55	0.20	21.0	7.0*	2b	

Appendix table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality. Lowest Fertile Bract Lowest Sterile Bract Pedicel Length No. of Length No. of
 middle basal middle basal Flowering Fruiting sterile side
 length-width. length-width. basal-middle basal bracts. base raceme. Peduncle-Raceme branches.

	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
<u>Herbarium Specimens (Contd.)</u>												
Cradoek	0.63	0.20	0.28	-	0.16	-	-	5	0.45	0.20	9.0	8.0
Raynerskop	-	-	-	-	-	0.09	0.15	-	0.28	0.21	17.0	11.0
Mortimer	0.50	0.23	0.34	-	0.14	0.09	-	4	0.33	0.23	22.0	18.0
Brakkloof	0.60	0.23	0.33	-	0.15	-	-	2	0.30	0.25	18.0	18.0
Aliceedale	-	-	-	-	0.18	0.07	-	2	0.31	0.20	22.0	20.0

A. FOLIOLOSA subsp. ROBUSTA.

Foot of	0.43	0.22	0.50	0.75	0.30	0.40	-	0.05	-	0.30	12.0	11.5
Molteno Pass	0.55	0.28	0.45	0.80	0.23	0.50	0.12	-	-	0.38	15.5	13.5
Hall 2284	0.65	0.25	0.52	0.90	0.30	0.60	0.07	-	-	0.35	15.5	19.0
	0.70	0.20	0.42	0.80	0.28	0.52	0.07	0.13	-	0.29	12.5	9.0
	0.70	0.20	0.40	0.95	0.25	0.46	-	0.10	-	0.30	12.5	11.0
	0.70	-	-	1.05	-	-	0.13	0.05	0.58	-	-	-
	0.70	0.18	0.35	1.20	0.25	0.50	-	0.14	-	0.37	16.0	9.5
	0.72	0.28	0.40	0.80	0.28	0.50	0.10	-	-	0.30	8.5	9.0
	0.73	0.23	0.42	0.95	0.17	0.45	-	0.15	-	0.30	6.5	11.5
	0.75	0.22	0.50	0.98	0.22	0.45	-	0.14	-	0.38	12.0	11.5
	0.80	0.25	0.55	1.15	0.25	0.50	-	0.05	-	-	-	-
	0.90	0.14	0.40	1.20	0.17	0.48	-	0.08	-	0.38	15.0	15.0
	0.90	0.17	0.55	1.35	0.23	0.68	-	0.04	-	0.46	10.0	13.5
	0.95	0.25	0.58	1.00	0.22	0.55	0	-	0.50	0.38	12.0	9.5
	0.95	0.17	0.55	1.35	0.23	0.68	-	0.05	0.57	0.40	15.0	12.0
	1.00	0.18	0.55	1.20	0.18	0.66	-	0.07	-	0.30	10.0	10.0
	0.72	0.28	0.43	-	-	-	-	-	-	-	-	-

Appendix table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality. Lowest Fertile Bract Lowest Sterile Bract Pedicel Length No. of Length No. of
 middle basal middle basal Flowering sterile at side
 length-width.--width. length-width.--width. basal-middle basal bracts. base raceme. Peduncle-Raceme branches.

A. FOLIOLOSA subsp. ROBUSTA. (contd.)

Locality.	Lowest Fertile Bract middle basal length-width.--width.	Lowest Sterile Bract middle basal length-width.--width.	Pedicel Length cm.	No. of sterile bracts.	No. of at base	Length cm.	No. of side raceme branches.		
Nelspoort	0.95	0.45	0.22	0.55	0	0.57	0		
	1.00	0.50	0.30	0.55	0	0.61	0		
	1.05	0.45	0.37	0.45	0.02	0.42	0		
	1.05	0.50	0.52	0.78	0	0.60	0		
	1.10	0.40	0.20	0.50	0	0.59	0		
	1.10	0.50	0.30	0.50	0.03	0.68	0		
	1.10	0.45	0.31	0.62	0	0.63	0		
	1.10	0.45	0.35	0.60	0	0.60	0		
	1.15	0.45	0.20	0.60	0.03	0.58	0		
	1.15	0.62	0.50	1.30	0	0.60	0		
	1.20	0.40	0.20	0.55	0.02	0.64	0		
	Whitehill	1.00	0.57	0.37	0.75	0	0.64	0	
		1.05*	0.73	0.27	0.80	0.03	0.83	1a	
		1.10	0.55	0.37	0.80	0	0.64	0	
		1.12	0.68	0.20	0.70	0.02	0.75	0	
1.15		0.65	0.30	0.87	0	0.84	0		
1.23		0.75	0.28	0.72	0	1.10	0		
1.30		0.75	0.28	0.70	0.03	0.94	0		
1.35		0.80	0.35	0.80	0	0.95	0		
1.50		0.73	0.32	0.95	0.07	0.67	0		
near Geelbek R1		0.93	0.45	0.23	0.55	0	0.57	0	
		0.94	0.47	0.30	0.52	0	0.61	0	
		Prince Albert R64	0.75	0.50	0.17	0.50	0.02	0.64	0
			0.75	0.50	0.21	0.54	0	0.74	1a
			0.80	0.55	0.20	0.60	0.02	0.60	1a
			0.84	0.53	0.32	0.85	0	0.76	0

Appendix table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Lowest Fertile Bract middle basal length-width.--width.	Lowest Sterile Bract middle basal length-width.--width.	Pedicle Length Flowering basal-middle bracts.	No. of sterile bracts.	No. of Peduncle Width at base raceme.	Peduncle-Raceme branches.	Length	No. of side branches.
	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.

A. FOLIOLOSA subsp. ROBUSTA (Contd.)

Prince Albert (Contd.)	0.90	0.48	1.15	0.30	0.65	0.06	0	-	4	0.76	0.44	17.0	8.0	0
	0.92	0.50	1.15	0.30	0.75	-	0	0.07	5	0.65	0.46	20.5	14.5	0
	0.93	0.65	1.20	0.30	0.72	-	-	0.05	4	0.90	0.54	14.0	26.0	0
	0.95	0.52	1.20	0.32	0.97	-	-	0.03	4	0.57	0.35	13.5	12.0	0
	0.95	0.55	1.20	0.38	0.70	0.02	0	-	3	0.60	0.36	11.0	14.0	1a
	0.95	0.60	1.30	0.40	0.80	0.02	0	-	5	0.75	0.58	17.5	10.0	0
	0.95	0.50	1.45	0.40	0.71	0	0	-	7	0.74	-	12.5	12.0	0
	1.05	0.60	1.25	0.23	0.45	0.05	0	0.07	3	0.75	0.47	13.0	18.0	0
	1.05	0.60	1.35	0.20	0.65	0.04	0	-	4	0.84	0.51	12.0	13.0	0
	1.05	0.40	1.35	0.26	0.41	0.05	0.02	-	6	0.66	-	15.5	8.0	0
	1.05	0.40	1.40	0.17	0.60	0.07	0.02	-	7	0.76	0.50	15.0	14.5	0
	1.10	0.60	1.30	0.30	0.80	-	0.04	0.12	5	0.63	0.48	16.0	11.5	0
	1.10	0.75	1.40	0.26	0.70	0.02	0	0.06	5	1.10	0.65	16.0	33.0	0
	1.10	0.42	1.45	0.23	0.50	-	0.02	0.05	6	0.67	0.49	13.0	13.0	0
	1.10	0.43	1.45	0.22	0.70	0	0	-	5	1.09	0.69	12.0	5.0	0
	1.10	0.60	1.55	0.22	0.83	0	0	-	6	0.97	0.64	14.0	7.5	0
	1.15	0.60	1.45	0.17	0.60	0.04	0	-	5	0.92	-	11.0	16.5	0
	1.20	0.65	1.45	0.26	0.70	0.02	0	0.04	8	1.09	0.73	15.0	14.5	1a
	1.30	0.62	1.34	0.20	0.62	0.06	0.02	-	3	0.75	0.54	10.0	20.0	0
	1.35	0.56	1.85	0.30	0.60	0.02	0	0.05	5	1.05	0.73	10.0	30.0	1a
near Miller R45	1.0	0.45	1.10	0.35	0.50	0.04	0	-	3	0.33 ^s	-	6.0	5.0	0
	1.05	0.45	1.50	0.30	0.55	0.07	0.02	-	5	0.66 ^s	-	9.0	5.5	0
	1.05	0.50	1.65	0.45	0.60	0.03	0	-	5	0.40 ^s	0.23 ^s	5.5	4.5	0
	1.10	0.55	1.40	0.50	0.60	0.02	0	-	5	0.47	0.29	7.5	12.5	0
	1.10	0.50	1.45	0.40	0.50	0.03	0	-	5	0.51	0.30 ^s	8.0	12.0	0
	1.20	0.50	1.30	0.23	0.48	0.09	0	-	5	0.66	0.29 ^s	11.0	13.0	0
	1.30	0.50	1.70	0.40	0.55	0.03	0	-	4	0.60	0.38	7.0	9.5	0
Steytlerville R43	0.70	0.53	1.00	0.30	0.46	-	0.02	0.07	5	0.70	0.40	10.0	10.5	0
	0.72	0.45	1.10	0.23	0.60	-	0	0.04	5	0.52	0.32	10.0	0.95	0

Appendix Table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality. Lowest Fertile Bract middle basal length-width.--width. cm. Lowest Sterile Bract middle basal length-width-width. cm. Flowering Pedicel Length Fruiting basal length-width. cm. Peduncle Width at base cm. No. of sterile bracts. c. Length cm. No. of side branches.

A. FOLIOLOSA subsp. ROBUSTA (Contd.)

Steytlerville	0.83	0.34	0.50	1.20	0.30	0.60	0	-	7	0.50	-	9.0	6.0	0
R43 (Contd.)	0.85	0.35	0.50	1.00	0.40	0.55	0	-	5	0.50	0.30	5.3	8.0	0
	0.87	0.33	0.48	1.20	0.30	0.40	0	-	4	0.50	0.22 ^s	7.0	7.0	0
	0.90	0.32	0.55	1.30	0.38	0.70	0	0.02	7	0.67	0.38	7.3	6.5	0
	0.95	0.30	0.60	1.15	0.20	0.50	0	-	2	0.69	0.40	9.0	15.0	0
	0.95	0.30	0.65	1.20	0.30	0.50	0	0.04	5	0.82	0.46	8.5	13.0	0
	1.00	0.30	0.61	1.30	0.20	0.50	0	-	7	0.70	0.32	13.5	12.0	0
	1.05	0.30	0.55	1.40	0.28	0.65	0	-	5	0.70	0.35	5.5	10.0	0
	1.05	0.30	0.50	1.40	0.30	0.60	0.03	0.07	4	0.50	0.34	5.0	10.0	0
	1.05	0.28	0.60	1.70	0.35	0.70	0.02	0.07	5	0.69	0.37	13.0	21.0	0
	1.08	0.33	0.60	1.60	0.40	0.77	0.03	0.06	4	0.72	0.45	10.0	14.0	0
	1.10	0.30	0.55	1.40	0.30	0.60	0.03	-	5	0.72	0.28	9.5	11.5	0
	1.10	0.40	0.50	1.50	0.35	0.60	0.04	0.14	3	0.58	0.32	11.0	13.5	0
	-	-	-	-	-	-	-	0.09	-	-	0.50	-	-	0
	-	-	-	-	-	-	-	0.06	-	-	0.40	-	-	0
	-	-	-	-	-	-	-	0.45	-	-	0.45	-	-	0
	-	-	-	-	-	-	-	0.05	-	-	0.29	-	-	0
	-	-	-	-	-	-	-	0.02	-	-	0.30	-	-	0
	-	-	-	-	-	-	-	0.04	-	-	0.35	-	-	0
	-	-	-	-	-	-	-	0.08	-	-	0.28	-	-	0

Herbarium Specimens.

Beaufort	0.70	0.20	0.30	0.90	0.20	0.30	0	-	5	0.50	0.24	10.0	17.0	0
West	0.75	0.28	0.40	0.95	0.20	0.35	0	-	5	0.47	0.20	15.5	14.0	0
	1.00	0.20	0.40	1.15	0.28	0.35	0	-	5	0.65	0.45	11.5	7.5	0
Matjesfontein	0.75	0.26	0.40	1.00	0.28	0.30	0	-	5	0.58	0.26	15.0	9.0	0

Appendix Table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality. Lowest Fertile Bract middle basal length-width.--width. Lowest Sterile Bract middle basal length-width.--width. Pedicel Length Flowering sterile basal-middle basal bracts. No. of sterile side branches. Peduncle-Raceme branches. Peduncle Width at base raceme. below raceme. Length No. of side branches.

cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm.

A. FOLIOLOSA subsp. ROBUSTA. (Contd.)

Herbarium Specimens (Contd.)

near White-hill	1.00	0.16	0.40	1.30	0.20	0.50	-	0.1	3	0.55	0.30	14.5	9.0	0
	1.05	0.30	0.40	1.45	0.30	0.60	0	-	3	0.61	0.29	9.5	7.0	0
	1.35	0.28	0.43	1.35	0.20	0.40	0	-	4	0.80	0.35	8.0	11.0	0
Prince Albert	0.92	0.20	0.40	1.10	0.20	0.35	0	-	5	0.70	0.32	12.0	21.0	0
Willowmore	1.00	0.24	0.44	1.80	0.30	0.60	0	-	8	0.80	0.38	8.5	10.5	0
	0.82	0.30	0.48	1.00	0.30	0.50	0.08	0.04	3	0.53	0.27	12.0	14.5	0
Mt. Stewart	-	-	-	-	-	-	-	-	4	0.50	0.29	9.5	10.0	0
	-	-	-	-	-	-	-	-	2	0.50	0.28	10.0	8.0	0
Steytlerville	0.70	0.23	0.40	-	-	-	0.05	0.02	4	0.58	0.29	6.0	5.0*	0
	0.75	0.28	0.55	1.10	0.20	0.40	0.05	0.03	4	0.43	0.25	9.0	9.0	0
Waterford	-	-	-	-	-	-	-	-	-	0.83	-	-	-	0
Lake Mentz	0.90	0.20	0.40	1.40	0.50	0.62	0	-	4	1.20	0.35	8.5	10.5	0
	-	-	-	-	-	-	-	-	-	1.29	-	-	-	0
<u>A. SMUTSIANA.</u>														
23 miles from Ladismith on old Barrydale Rd. R3,62A	0.30	0.13	0.20	0.50	0.10	0.22	0.48	0.35	6	-	0.19	-	18.0	0
	0.30	0.10	0.30	0.57	0.13	0.30	0.18	0.13	4	0.38	0.20	14.0	7.0*	0
	0.30	0.08	0.24	0.70	0.10	0.28	0.32	0.23	3	0.30	0.15	19.0	11.0	0
	0.35	0.09	0.22	0.42	0.10	0.22	0.24	0.22	3	0.23	0.11	17.0	6.0*	0
	0.36	0.12	0.22	0.45	0.15	0.21	0.14	0.36	4	0.24	0.12	14.0	8.0	0
	0.37	0.08	0.17	0.43	0.08	0.15	0.32	0.26	4	0.28	0.15	14.0	13.0	0

Appendix Table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Lowest Fertile Bract		Lowest Sterile Bract		Pedicel Length		No. of sterile bracts.		Peduncle Width		length		No. of side branches		
	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.			
A. SMUTSIANA. (Contd.)															
23 miles from Ladismith on old Barrydale Rd. R3,62a (Contd.)	0.37	0.10	0.22	0.57	0.13	0.22	0.26	0.16	0.27	6	0.27	0.17	15.0	13.0	0
	0.39	0.10	0.19	0.65	0.12	0.30	0.40	0.26	0.40	10	0.34	0.20	23.0	15.0	0
	0.40	0.08	0.24	0.66	0.10	0.30	0.34	0.28	0.40	7	0.42	0.23	29.0	16.0	0
	0.40	0.12	0.21	0.75	0.06	0.37	0.40	0.23	-	7	0.35	0.24	28.0	14.0	0
	0.41	0.08	0.22	0.60	0.05	0.20	0.42	0.60	-	6	0.30	0.20	20.0	17.0	0
	0.45	0.11	0.22	0.59	0.07	0.23	0.48	0.30	-	6	0.30	0.19	22.0	17.0	0
	0.45	0.08	0.22	0.62	0.08	0.20	0.28	0.19	-	5	0.33	0.23	10.0	23.0	0
	0.47	0.08	0.20	0.61	0.08	0.22	0.40	0.34	-	4	0.33	0.23	20.0	16.0	0
	0.50	0.08	0.22	0.62	0.08	0.20	0.33	0.22	-	4	0.28	0.20	21.0	17.0	0
	0.52	0.07	0.21	0.88	0.06	0.23	0.40	0.32	0.32	5	0.39	0.24	20.0	15.0	0
	0.52	0.10	0.25	0.90	0.13	0.30	0.25	0.23	-	6	0.28	0.20	13.0	17.0	0
	0.54	0.08	0.30	0.51	0.09	0.25	0.26	0.22	-	4	0.39	0.24	10.0	9.0	0
	0.60	0.06	0.24	0.82	0.14	0.28	0.23	0.22	0.24	5	0.40	0.20	8.0	9.0	0
	-	-	-	0.65	0.08	0.22	0.23	0.21	0.24	8	0.30	0.18	14.0	12.0	0
	-	-	-	-	-	-	0.24	0.17	-	4	0.37	0.18	13.0	14.0	2a
26 miles from Ladismith on old Barrydale Rd. R5,62b	0.29	0.10	0.17	1.00	0.15	0.29	0.25	0.22	0.25	6	0.32	0.17	14.0	13.0	0
	0.30	0.10	0.20	0.58	0.12	0.30	0.15	0.09	-	3	0.38	0.16	17.0	10.0	0
	0.33	0.10	0.20	0.55	0.09	0.24	0.37	0.30	-	4	0.37	0.12	19.0	16.0	0
	0.33	0.11	0.26	0.70	0.12	0.30	0.26	0.19	-	5	0.35	0.19	18.0	12.0	0
	0.35	0.09	0.19	0.64	0.09	0.23	0.35	0.25	-	5	0.22	0.16	14.0	11.0	0
	0.35	0.10	0.21	0.72	0.14	0.25	0.21	0.20	0.25	6	0.36	0.27	12.0	12.0	0
	0.36	0.10	0.30	0.62	0.10	0.28	0.35	0.28	-	6	0.33	0.20	25.0	10.0	0
	0.37	0.08	0.34	0.70	0.08	0.32	0.35	0.27	-	6	0.33	0.18	28.0	11.0	0
	0.40	0.07	0.20	0.58	0.10	0.27	-	0.26	0.36	6	0.30	0.20	17.0	16.0	0
	0.40	0.08	0.14	0.65	0.06	0.18	0.25	0.20	-	5	0.25	0.20	20.0	18.0	0
	0.42	0.09	0.20	0.64	0.08	0.22	0.36	0.23	0.43	5	0.31	0.20	21.0	18.0	0
	0.45	0.08	0.22	0.76	0.10	0.20	0.32	0.26	0.32	7	0.37	0.20	13.0	17.0	0
	0.48	0.08	0.29	0.55	0.07	0.22	0.40	0.35	-	6	0.32	0.19	28.0	8.0	0
	0.51	0.07	0.20	0.80	0.12	0.27	-	0.19	0.30	6	0.35	0.23	17.0	18.0	0
	0.52	0.08	0.23	1.05	0.07	0.25	0.32	0.23	-	5	0.34	0.20	16.0	16.0	0
	0.58	0.10	0.30	0.85	0.11	0.25	0.30	0.20	-	7	0.30	0.19	23.0	14.0	0

Appendix Table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF *ASTROLOBA* (Contd.)

Locality.	Lowest Fertile Bract Length-width .-width. cm.	Lowest Sterile Bract middle basal length-width.-width. cm.	Pedicle Length Flowering cm.	No. of sterile bracts.	Peduncle Width at base cm.	Length cm.	No. of side branches.
<u>A. SMUTSIANA (Contd.)</u>							
PUTATIVE HYBRID BETWEEN A. RUGOSA AND A. SMUTSIANA.							
26 miles from Ladismith on old Barrydale Rd. R5,62b (Contd.)	-	-	0.29 0.19	4	-	17.0	0
	-	-	0.29 0.24	2	0.31	20.0	0
23 miles from Ladismith on Old Barrydale rd.	0.38	0.48	0.37 0.29	2	0.30	24.0	0
	0.66	0.95	0.28 0.20	7	0.35	23.0	0
	0.76	1.40	0.34 0.18	6	0.38	25.0	0
<u>A. HALLII.</u>							
20 miles E. of Iaings- burg nr. farm Rietvlei R52	0.30	0.60	0.53	6	0.39	19.0	0
	0.33	0.62	0.42 0.34	9	0.44	31.0	0
	0.36	0.72	0.35 0.35	8	0.49	28.0	0
	0.38	0.80	0.56 0.40	8	0.47	27.0	0
	0.43	0.65	0.50 0.40	5	0.53	32.0	0
	0.43	0.73	0.63 0.49	6	0.49	27.0	0
	0.43	0.80	0.40 0.37	6	0.39	23.0	1a
	0.44	0.73	0.42 0.38	5	0.56	27.0	1a
	0.48	0.63	0.65 0.50	5	0.49	32.0	0
	0.48	0.65	0.69 0.47	6	0.57	29.0	0
Koup R54	0.30	0.52	0.57 0.55	6	0.54	15.0	0
	0.30	0.57	0.60 0.59	10	0.60	24.0	0
	0.35	0.50	0.46 0.37	4	0.48	20.0	0
	0.35	-	0.50 0.40	7	0.50	20.0	0
	0.35	0.43	0.44 0.40	7	0.60	19.0	0
	0.35	0.75	0.49 0.46	7	0.50	18.0	2a
	0.35	0.60	0.45 0.35	8	0.59	19.0	0

Appendix Table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTRALOBIA (Contd.)

Locality	Lowest Fertile Bract		Lowest Sterile Bract		Pedicel Length		Nc. of Peduncle Width		Length		No. of side branches.	
	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.		
Koup R54 (contd.)	0.42	0.07	0.25	0.08	0.30	0.40	0.39	-	0.73	0.40	32.0	0
	0.43	0.10	0.20	0.18	0.47	0.42	0.35	-	0.67	0.38	19.0	14a
	0.45	0.10	0.20	0.13	0.26	0.50	0.33	-	0.45	0.29	12.0	0
	0.45	-	0.22	0.08	0.22	0.75	0.48	-	0.47	0.29	20.0	0
	0.45	0.10	0.30	0.08	0.40	0.35	0.28	-	0.56	0.30	13.0	0
	0.45	0.08	0.23	0.11	0.43	0.47	0.40	-	0.64	0.39	18.0	0
	0.45	0.10	0.20	0.15	0.28	0.48	0.36	-	0.56	0.30	28.0	0
	0.46	0.08	0.24	0.10	0.40	0.39	0.30	0.41	0.85	0.38	20.0	0
	0.50	-	0.30	0.08	0.45	0.45	0.40	-	0.80	0.35	31.0	2b
	0.50	0.10	0.21	0.15	0.24	0.39	0.35	0.47	0.52	0.30	21.0	0
	0.50	-	0.25	0.08	0.40	0.68	0.40	-	0.55	0.35	14.0	1a
	0.50	0.10	0.30	0.12	0.44	0.37	0.35	-	0.70	0.30	19.0	0
	0.50	0.10	0.32	0.08	0.35	0.68	0.57	-	0.67	0.38	18.0	0
	0.52	-	0.40	0.08	0.40	0.48	0.42	-	0.90	0.44	19.0	0
	0.53	0.14	0.25	0.20	0.20	0.53	0.46	0.53	0.64	0.40	25.0	2a
0.53	0.08	0.30	0.09	0.38	0.49	0.45	-	0.51	0.37	24.0	1a	
0.54	0.10	0.20	0.22	0.30	0.45	0.45	0.48	0.68	0.34	24.0	2a	
Ex. Hort.	-	-	-	-	-	-	-	-	0.60	-	17.0	-
	-	-	-	-	-	-	-	-	0.55	-	21.0	-
<u>Herbarium Specimens.</u>												
Prince Albert	0.30	-	0.15	-	-	0.33	0.24	-	-	-	8.0	0
Ex. Hort	0.75	0.10	0.30	0.13	0.40	0.30	0.25	-	-	27.0	13.0	1b,a
<u>A. BULLULATA.</u>												
Matjesfontein	0.35	0.12	0.23	0.16	0.30	0.37	0.30	0.39	0.44	0.24	24.0	0
R55	0.35	0.13	0.22	0.21	0.35	0.49	0.35	-	0.57	0.24	15.0	0

Appendix Table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Lowest Fertile Bract		Lowest Sterile Bract		Pedicel Length		No. of Peduncle Width		Length		No. of side branches.						
	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.							
Matjiesfontein R55 (Contd.)	0.40	0.14	0.24	0.55	0.16	0.25	0.48	0.30	-	0.42	5	0.50	0.28	27.0	20.0	0	
	0.42	0.08	0.25	0.57	0.10	0.28	0.41	0.40	-	0.42	5	0.49	0.33	20.0	14.0	0	
	0.43	0.16	0.23	0.60	0.18	0.30	0.53	0.47	-	-	5	0.56	0.30	29.0	22.0	1a	
	0.45	0.15	0.30	0.55	0.13	0.40	0.49	0.40	-	-	3	0.54	0.25	11.0	17.0	1a	
	0.45	0.10	0.20	0.73	0.23	0.27	0.53	0.45	-	-	7	0.55	0.27	24.0	30.0	0	
	0.47	0.15	0.25	0.65	0.15	0.26	0.52	0.47	-	-	5	0.49	0.32	18.0	18.0	0	
	0.48	0.08	0.20	0.73	0.08	0.27	0.53	0.45	-	-	7	0.55	0.27	24.0	30.0	0	
	Ex. Hort	0.35	-	0.20	0.60	-	-	0.45	-	-	-	4	-	-	-	-	0
	-	-	-	-	-	-	0.40	-	-	-	-	0.80	-	-	-	-	-
<u>A. BULLULATA (Contd.)</u>																	
<u>Herbarium Specimens.</u>																	
Verlaten Kloof	0.53	-	-	0.70	-	-	0.45	-	-	-	5	-	0.30	18.0	18.0	0	0
Ceres Karoo	0.37	-	-	0.42	-	-	0.38	0.29	-	-	3	-	-	19.0	17.0	0	0
Between Laingsburg & Ladismith	0.35	-	-	0.55	-	-	0.38	-	-	-	6	-	-	18.0	26.0	0	0
	0.35	-	-	0.70	-	-	0.30	-	-	-	4	-	-	17.0	13.0	0	0
	0.38	-	-	0.55	-	-	-	-	-	-	-	-	-	15.0	11.0	0	0
<u>A. RUGOSA X A. SMUTSIANA. cont.</u>																	
Hybrid R4	-	-	-	-	-	-	0.40	0.30	-	-	3	0.25	0.16	26.0	15.0	0	0
	-	-	-	-	-	-	0.45	-	-	-	-	0.28	-	-	-	-	-
	-	-	-	-	-	-	0.50	0.40	-	-	3	0.32	0.15	16.0	7.0	0	0
	-	-	-	-	-	-	0.50	0.30	-	-	2	0.32	0.18	21.0	17.0	0	0

Appendix Table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Lowest Fertile Bract		Lowest Sterile Bract		Pedicel Length		No. of Peduncle Width		Length		No. of side branches.	
	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.		
Oudtshoorn R68	0.32	0.08	0.22	0.08	0.39	-	0.20	0.30	0.16	17.0	15.0	0
	0.42	0.12	0.20	0.08	0.40	0.20	0.19	-	0.14	26.0	16.0	0
	0.42	0.10	0.22	0.10	0.22	-	0.14	0.25	0.18	28.0	18.0	0
	0.45	0.07	0.25	0.07	0.23	-	0.17	0.30	0.15	28.0	22.0	0
	0.50	0.10	0.20	0.10	0.23	-	0.20	0.30	0.17	32.0	17.0	0
	0.54	0.10	0.25	0.13	0.32	0.26	0.17	-	0.17	16.0	14.0	0
	0.55	0.08	0.22	0.15	0.20	-	0.16	0.23	0.17	28.0	22.0	0
	0.55	0.09	0.23	0.07	0.20	0.25	0.14	-	0.13	26.0	13.0	0
	0.55	0.10	0.28	0.10	0.25	-	0.20	0.37	0.22	34.0	20.0	0
	0.58	0.08	0.23	0.08	0.22	-	0.15	0.20	0.40	28.0	17.0	0
	0.59	0.06	0.20	0.08	0.22	-	0.15	0.17	0.35	28.0	17.0	0
	0.60	0.08	0.23	0.09	0.22	-	0.15	0.44	0.35	26.0	23.0	0
	0.60	0.08	0.23	0.12	0.09	-	0.25	-	0.56	36.0	36.0	2a
	0.60	0.08	0.27	0.08	0.35	0.18	0.20	-	0.41	28.0	22.0	0
	0.63	0.07	0.24	0.08	0.23	0.23	0.19	-	0.35	23.0	18.0	0
	0.63	0.09	0.28	0.09	0.26	-	0.20	0.26	0.37	29.0	24.0	0
	0.64	0.07	0.26	0.08	0.38	-	0.23	0.28	0.44	37.0	19.0	0
	0.67	0.09	0.23	0.08	-	-	0.18	0.28	0.42	24.0	19.0	0
	0.70	0.07	0.23	0.08	0.23	0.39	0.38	-	0.45	29.0	21.0	0
	0.72	0.10	0.30	0.10	0.20	0.18	0.15	-	0.50	35.0	22.0	0
0.75	0.06	0.23	0.08	0.27	0.34	0.38	-	0.45	29.0	18.0	0	
0.80	0.09	0.28	0.12	0.30	0.28	0.18	0.32	0.44	39.0	23.0	0	
0.86	0.07	0.25	0.05	0.27	0.34	0.27	-	0.49	33.0	23.0	0	
-	-	-	0.10	0.27	0.33	0.24	-	0.55	39.0	31.0	0	
-	-	-	-	0.27	0.34	0.30	-	0.55	38.0	33.0	1a	
Calitstdorp R64	0.47	0.10	0.25	0.08	0.25	-	0.51	0.70	0.24	29.0	21.0	0
	0.48	0.23	0.35	0.13	0.26	0.80	0.46	0.82	0.29	30.0	20.0	3a
	0.50	0.10	0.30	0.11	0.30	0.78	0.46	-	-	33.0	13.0	3a
	0.55	0.05	0.18	0.08	0.30	-	-	0.20	-	28.0	10.0	0
	0.60	0.07	0.20	-	-	0.17	0.13	-	-	28.0	12.0	0
	0.60	0.57	0.28	0.12	0.32	-	0.17	0.29	0.19	25.0	13.0	0
-	-	-	-	-	0.46	0.37	-	-	19.0	23.0	-	

A. SPIRALIS.

Appendix Table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality. Lowest Fertile Bract middle basal length-width.-width. cm. Lowest Sterile Bract middle basal length-width.-width. cm. Pedicel Length Flowering basal bracts. cm. No. of sterile bracts. cm. Peduncle Width at base below raceme. cm. Length of side branches. cm. No. of side branches.

Locality.	Lowest Fertile Bract middle basal length-width.-width.	cm.	cm.	Lowest Sterile Bract middle basal length-width.-width.	cm.	cm.	Pedicel Length Flowering basal bracts.	cm.	No. of sterile bracts.	cm.	Peduncle Width at base below raceme.	cm.	Length of side branches.	cm.	No. of side branches.
26 miles S. of Ladismith R6	0.57	0.10	0.23	0.67	0.10	0.23	0.38	0.30	5	0.28	0.14	25.0	8.0	0	
Herbarium specimens.	-	-	-	1.0	-	-	0.50	0.43	7	0.35	0.24	33.0	21.0	0	
Oudtsheern	-	-	-	1.0	-	-	0.40	0.35	7	0.30	0.22	33.0	18.0	0	
	0.50	0.26	0.08	0.75	0.20	0.08	0.29	0.21	5	-	-	22.0	15.0	0	
	0.65	0.20	0.07	-	-	-	-	-	6	-	0.19	33.0	21.0	0	
	0.60	0.20	0.06	-	-	-	0.27	0.20	6	-	0.18	22.0*	14.0	0	
	0.60	0.14	0.06	1.00	-	-	0.20	-	4	0.35	0.17	19.0	-	0	
	-	-	-	-	-	-	-	-	-	-	-	22.0	-	0	
	-	-	-	-	-	-	0.33	0.30	-	-	0.23	21.0	11.0	0	
	-	-	-	-	-	-	-	0.26	-	-	0.20	24.0	15.0	0	
	0.40	0.10	0.04	0.95	0.28	0.08	0.29	0.25	6	-	0.17	33.0	14.0	0	
	0.50	0.20	0.06	0.90	0.26	0.10	0.22	0.31	5	-	0.19	25.0	15.0	0	
	0.60	0.20	0.06	0.75	0.20	0.06	0.42	0.24	5	-	0.23	28.0	-	0	
De Rust	0.70	0.25	0.07	1.10	0.28	0.10	-	0.27	7	-	0.19	34.0	21.0	0	
Little Karoo	0.35	0.14	0.06	-	-	-	0.22	0.12	4	-	0.18	16.0	15.0	0	
Graaff Reinet(?) no. 5112 in herb. Marloth (PRE)	0.65	0.20	0.04	1.40	0.40	0.14	0.25	0.24	4	-	0.19	25.0	14.0	0	
"Sent from Port Elizabeth No. 6510b in herb Marloth (PRE)	0.62	0.30	0.06	0.95	0.35	0.08	0.28	0.10	-	-	-	-	-	0	

A. SPIRALIS. (Contd.)

Appendix Table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Lowest Fertile Bract		Lowest Sterile Bract		Pedicel Length		No. of Peduncle Width		Length		No. of side branches.			
	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.				
Ex. Hort	0.60	0.20	0.06	0.90	0.20	0.08	0.23	0.21	-	7	0.13	22.0*	10.0	0
<u>A. SPIRALIS (Contd.)</u>														
<u>A. HERREI.</u>														
Unlondale R44	0.60	0.24	0.35	0.70	0.20	0.35	0.80	0.70	-	2	0.28	25.0	13.0	0
	0.60	0.15	0.30	1.0	0.20	0.50	0.40	0.40	-	4	0.23	22.0	15.0	0
	0.65	0.20	0.30	0.80 ⁴	0.20	0.30	-	-	-	5	-	-	-	0
	0.65	0.16	0.30	0.90	0.27	0.35	0.23	0.23	-	3	0.23	20.0	-	0
	0.72	0.18	0.45	1.00	0.20	0.40	0.60	0.55	-	3	0.26	10.0	18.0	0
	0.75	0.15	0.35	0.90	0.15	0.35	0.45	0.45	-	3	0.23	19.0	-	0
	0.75	0.15	0.35	-	-	-	0.95	0.70	-	1	0.27	18.0	9.0	0
	0.75	0.10	0.40	-	-	-	0.78	0.65	-	-	-	-	28.0	-
Prince Albert R46	-	-	-	-	-	-	-	-	2.0	-	0.32	-	25.0	-
	0.60	0.18	0.35	0.75	0.14	0.32	0.58	0.48	-	3	0.27	23.0	-	0
	0.60	0.13	0.30	0.82	0.20	0.45	0.68	0.53	-	4	0.27	19.0	14.0	0
	0.62	0.18	0.35	0.70	0.20	0.30	0.69	0.64	-	2	0.29	22.0	-	0
	0.62	0.12	0.30	0.80	0.15	0.35	0.63	0.55	-	3	0.25	19.0	-	0
	0.63	0.17	0.30	0.80	0.14	0.30	0.60	0.50	-	3	0.20	20.0	-	0
	0.65	0.23	0.43	0.80	0.20	0.50	-	-	-	3	0.20	22.0	-	0
	0.70	0.16	0.30	0.75	0.20	0.30	0.64	0.47	-	3	0.26	30.0	-	0
	0.75	0.15	0.35	1.00	0.14	0.28	0.50	0.47	-	2	0.29	18.0	-	0
	0.77	0.18	0.40	0.92	0.15	0.40	0.80	0.56	-	3	0.30	24.0	-	0
	0.85	0.13	0.45	1.10	0.15	0.45	0.94	-	-	2	0.30	26.0	-	0
<u>Herbarium Specimens.</u>														
Prince Albert	0.70	0.08	0.40	1.08	0.10	0.40	-	-	-	-	-	-	-	-
	0.75	0.12	0.45	-	-	-	1.02	0.85	-	-	0.28	-	19.0	-
	0.75	0.12	0.48	-	-	-	1.18	0.96	-	-	0.39	-	26.0	-
	0.80	0.17	0.45	0.95	0.10	0.50	1.68	1.10	-	-	0.26	-	24.0	-

Appendix Table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Lowest Fertile Bract		Lowest Sterile Bract		Pedicel Length		No. of Peduncle Width		Length		No. of side branches.	
	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.		
Pietersfont- ein R19,20	0.23	-	-	-	0.75	0.72	-	3	0.40	0.25	29.0	0
	0.28	-	-	-	0.40	0.30	-	4	0.23	0.18	14.0	0
	0.30	-	-	-	0.55	0.50	-	3	0.30	0.23	18.0	0
	0.32	-	-	-	0.32	-	-	3	0.25	0.20	14.0	0
	0.35	-	-	-	0.52	0.38	-	3	0.30	0.20	27.0	0
	0.36	-	-	-	0.80	0.50	-	4	0.30	0.22	20.0	0
	0.40	-	-	-	0.80	0.70	-	4	0.30	0.23	21.0	0
	0.40	-	-	-	0.48	0.48	-	3	0.28	0.20	12.0	0
	0.40	0	-	-	0.64	0.55	-	2	0.25	0.23	15.0	0
	0.50	-	-	-	0.80	-	-	2	0.30	0.20	22.0	0
Baden-Baden Area R17,18, 59	0.30	0.12	0.25	0.48	0.80	0.44	-	2	0.24	0.15	24.0	0
	0.30	0.12	0.23	-	0.70	0.37	-	2	0.26	0.15	13.0	0
	0.30	0.08	0.23	0.40	0.63	0.55	-	3	0.26	0.15	34.0	0
	0.30	0.08	0.22	0.48	0.65	0.51	-	3	0.34	0.17	28.0	0
	0.30	-	-	-	0.60	0.50	-	3	0.28	0.20	33.0	0
	0.30	-	-	-	0.60	-	-	2	-	-	33.0	0
	0.30	-	-	-	0.62	0.50	-	2	0.32	0.20	20.0	0
	0.31	-	-	-	0.45	0.40	-	3	0.33	0.25	19.0	0
	0.32	0.09	0.20	0.53	0.71	-	-	4	0.35	0.17	23.0	0
	0.32	0.07	0.20	0.42	0.27	0.92	0.89	4	0.32	0.17	29.0	0
	0.35	-	-	-	-	0.50	-	3	0.22	0.19	25.0	0
	0.38	0.10	0.20	0.48	0.75	0.55	-	3	-	-	24.0	0
	0.38	0.08	0.20	-	0.49	0.40	-	3	0.35	0.14	23.0	0
	0.40	0.12	0.22	0.45	0.49	0.42	-	3	0.37	0.17	22.0	0
	0.40	0.07	0.25	0.55	0.46	-	-	3	0.41	0.19	26.0	0
0.40	-	-	-	0.40	0.40	-	3	0.35	0.20	21.0	0	
0.40	-	-	-	0.50	0.40	-	3	0.28	0.26	30.0	0	
0.43	-	-	-	0.60	0.50	-	4	0.30	0.23	20.0	0	
0.45	-	-	-	0.40	0.30	-	2	0.26	0.20	14.0	0	

A. RUCOSA.

Appendix Table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA. (Contd.)

Locality.	Lowest Fertile Bract		Lowest Sterile Bract		Pedicel Length		No. of sterile bracts	Peduncle Width		Length	No. of side branches.	
	cm.	cm.	cm.	cm.	cm.	cm.		cm.	cm.			cm.
A. RUGOSA. (Contd.)												
2 miles out of Montagu R23	0.28	-	-	-	0.45	0.35	-	3	0.25	24.0	6.0	0
	0.35	-	-	-	0.35	-	-	2	0.28	18.0	-	0
	0.35	-	-	-	0.51	0.40	-	4	0.28	23.0	7.0	0
	0.35	-	-	-	0.60	0.48	-	2	0.30	31.0	27.0	0
	0.35	-	-	-	0.75	-	-	3	0.27	25.0	10.0	0
	0.40	-	-	-	0.60	0.40	-	3	0.30	22.0	11.0	0
0.50	-	-	-	0.65	0.49	-	4	0.30	26.0	18.0	0	
"Montagu Dist" K'bosch Hort	0.32	0.10	0.25	0.12	0.27	0.46	0.52	4	0.28	24.0	11.0	0
	0.32	0.13	0.28	0.12	0.20	0.30	-	3	0.29	21.0	14.0	0
	0.33	0.08	0.20	-	0.50	0.44	-	2	0.27	21.0	11.0	0
	0.38	0.11	0.20	0.08	0.27	0.50	0.55	3	0.37	30.0	16.0	0
	0.40	0.12	0.30	0.12	0.25	0.57	-	3	0.37	43.0	16.0	0
	-	-	-	-	-	-	-	-	-	-	-	-
Dobbebaars Kloof R21,22	0.30	-	-	-	0.50	-	-	3	0.40	21.0	8.0	0
	0.31	-	-	-	0.47	-	-	4	0.28	20.0	5.0	0
	0.33	0.09	0.23	0.10	0.54	0.48	-	4	0.33	25.0	12.0	0
	0.35	-	-	-	0.30	-	-	3	0.26	13.0	-	0
	0.37	-	-	-	0.55	0.45	-	3	0.25	25.0	11.0	0
	0.40	-	-	-	0.90	0.68	-	4	0.27	26.0	15.0	0
	0.45	-	-	-	0.80	0.55	-	2	0.26	24.0	15.0	0
	0.45	-	-	-	0.60	0.55	-	4	0.30	26.0	16.0	0
	0.49	-	-	-	0.85	0.65	-	2	0.34	26.0	12.0	0
23 miles out of Ladismith on old Berry- dale Rd. R2	0.30	-	-	-	-	-	-	2	-	-	-	-
	0.31	0.10	0.23	0.16	0.30	-	-	-	-	-	-	-
	0.35	0.15	0.28	0.11	0.28	-	-	-	-	-	-	-
	0.37	0.17	0.22	0.14	0.24	-	-	-	-	-	-	-
	0.40	0.13	0.28	0.16	0.35	0.28	-	4	0.30	24.0	-	0

Appendix Table 3 DIMENSIONS OF INFLORESCENCE IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality. Lowest Fertile Bract Lowest Sterile Bract Pedicel Length No. of Length No. of
 middle basal middle basal Flowering Fruiting sterile at below side
 length-width.--width. length-width.--width. basal-middle basal bracts. base raceme. Peduncle--Raceme branches.

cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm. cm.

A. RUGOSA. (Contd.)

23 miles out of Ladismith on old Barrydale Rd. R2	0.40	0.13	0.30	0.60	0.12	0.30	0.49	0.40	-	3	0.27	0.16	17.0	9.0	0
	0.42	0.15	0.25	0.58	0.12	0.28	0.46	0.34	-	3	0.30	0.20	23.0	13.0	0
	0.45	0.13	0.23	0.56	0.16	0.33	0.36	0.32	-	4	0.34	0.23	24.0	13.0	0
	0.45	0.15	0.28	0.80	0.15	0.28	0.44	0.30	-	4	0.40	0.16	17.0	13.0	0
	-	-	-	-	-	-	0.40	0.35	-	3	0.28	0.18	27.0	17.0	0

Herbarium Specimens.

"Graaff Reinet (?) No. 4202 in herb. Marloth (PRE)	0.48	0.07	0.23	0.80	0.06	0.25	0.54	0.37	-	4	-	0.22	9.0*	24.0	0
	-	-	-	-	-	-	0.42	0.28	-	5	-	0.24	17.0*	17.0	0
Bonnievale, v.d. 226 (BOL)	0.50	0.08	0.23	-	-	-	0.73	0.58	-	2	0.25	0.10	17.0	19.0	0
Barrydale Nbg 2154/26 (BOL)	0.35	0.09	0.25	-	-	-	0.22	0.26	-	2	0.25	0.13	17.0	8.0	0
	-	-	-	-	-	-	0.46	0.39	-	3	-	-	15.0	6.0	0
	-	-	-	-	-	-	0.20	0.18	-	3	0.23	0.09	18.0	6.0	0
Muiskraal	0.40	0.08	0.26	-	-	-	-	-	0.53	3	-	0.13	18.0	9.0	0
	-	-	-	-	-	-	0.27	0.20	-	3	-	0.07	-	-	0
Ladismith	0.35	0.13	0.25	0.48	0.12	0.23	0.47	0.39	-	2	-	0.10	16.0	7.0	0
Betw. L'smith & Laingsburg	0.45	0.08	0.23	0.75	0.13	0.20	0.55	0.30	-	5	0.22	0.17	26.0	11.0	0
	-	-	-	-	-	-	0.50	0.39	-	2	-	0.14	13.0	-	0
	-	-	-	-	-	-	0.74	-	-	-	-	-	-	-	-
Ex. Hort NBG 1396/28(BOL)	0.45	0.10	0.25	0.65	0.10	0.23	0.30	0.27	-	2	-	0.09	10.0*	5.0	0

locality.	PERIANTH TUBE			LOBES			GYNAECIUM			DIFFERENCE BETWEEN DIAMETER OF		ANGLE OF OPEN			LOBES		
	Length to Neck-Neck-Middle-Base	Diameter	cm.	Outer-Inner	Length	Width	Length	Outer-Inner	Overy-Style	Middle and Neck	Base and Middle	Ant. Outer	Post. Inner	Outer-Lats.-Inner-Lats.			
																cm.	cm.
<u>A. FOLIOLOSA Subsp. FOLIOLOSA.</u>																	
Steytlerville R52a	a	.87	.25	.31	.28	.17	.17	.15	.20	.43	.50	.06	-.03	35	20	30	20
	a	.86	.24	.33	.32	.15	.17	.15	.20	.48	.50	.09	-.01	70	30	50	30
	a	.84	.26	.33	.30	.20	.20	.15	.23	.40	.33	.07	-.03	60	40	30	30
	a.	.82	.23	.31	.28	.17	.17	.17	.24	.39	.32	.08	-.03	50	50	50	50
	a	.81	.25	.29	.28	.17	.17	.17	.23	.35	.37	.04	-.01	60	40	40	40
	a ⁴	.80	.29	.32	.32	.20	.20	.17	.22	.44	.49	.03	0	80	60	55	55
	a	.76	.25	.33	.27	.17	.16	.16	.24	.38	.39	.08	-.06	60	40	40	40
	a	.75	.28	.32	.30	.18	.18	.18	.25	.38	.38	.04	-.02	90	70-60	50	50
	a	.74	.22	.29	.29	.15	.17	.15	.22	.43	.33	.07	0	30	10	s	s
	a	.70	.20	.32	.27	.17	.18	.18	.22	.39	.40	.12	-.05	40	30	30	30
Mount Stewart R52b	a	.81	.22	-	.24	.19	.18	.17	.17	.32	.46	-	-	-	-	-	-
	a	.80	.28	.37	.30	.17	.18	.17	.21	.40	.41	.09	-.07	35	15	20	s
	a	.73	.20	.26	.26	.14	.14	.13	.15	.30	.35	.06	0	-	-	-	-
Wolwefontein R11	a	.78	.23	.37	.28	.20	.20	.17	.20	.37	.29	.14	-.09	-	-	-	-
Lake Mentz R36	a	.75	.25	.30	.28	.18	.18	.18	.21	.35	.22	.05	-.02	90	90	40	20
	a	.70	.23	.30	.25	.20	.18	.20	.22	-	-	.07	-.05	-	-	-	-
Springbok Vlakte Nbg 171/59	c	.78	.22	.28	.27	.19	.20	.18	.25	.36	.43	.06	-.01	50	20	70	45
	c	.76	.21	.28	.24	.19	.20	.20	.22	.35	.40	.07	-.04	60	60	70	40
Graaff Reinet R60	a	.99	.34	.40	.40	.20	.24	.18	.24	.50	.26	.06	0	180	90	75	60
	a	.93	.27	.36	.34	.20	.23	.14	.30	.46	.47	.09	-.02	60	60	50	40

Appendix Table 4 DIMENSIONS OF PERIANTH IN POPULATION SAMPLES OF ASTROLOBA (a-Flowered in situ; b, c, d & f - flowered at Kirstenbosch in 1960, 61, 62 & 64 respectively; s, referring to the lobes, means that they are more or less straight, often slightly inwardly hooded.)

Locality.	PERIANTH TUBE		LOBES				GYNAECIUM		DIFFERENCE BETWEEN DIAMETER OF		ANGLE OF OPEN LOBES					
	Length to Neck-Neck	Diameter	Length	Outer-Inner	Width	Length	Middle and Neck	Base and Middle	Ant. Outer-Outer-Lats.	Post. Inner-Inner-Lats.	Ant. Outer-Outer-Lats.	Post. Inner-Inner-Lats.	Ant. Outer-Outer-Lats.	Post. Inner-Inner-Lats.		
															cm.	cm.
<u>A. FOLIOLOSA Subsp. FOLIOLOSA (Contd.)</u>																
Graaff Reinet R60 (Contd.)	.86	.29	.38	.37	.20	.23	.20	.30	.50	.23	.09	-.01	110	80	60	30
	.85	.26	.35	.33	.18	.20	.15	.26	.40	.37	.09	-.02	40	40	50	30
	.85	.26	.35	.33	.20	.22	.15	.23	.36	.20	.09	0.02	60	60	60	30
	.85	.23	.30	.28	.20	.20	.14	.25	.34	.40	.07	-.02	70	60	60	40
	.85	.29	.38	.33	.20	.22	.20	.25	.40	.35	.09	-.05	80	70	80	45
	.85	.27	.34	.29	.20	.20	.20	.30	.44	.32	.07	-.05	80	75	50	35
	.83	.20	.29	.37	.23	.27	.20	.35	.43	.37	.19	-.02	60	50	30	20
	.83	.32	.37	.30	.20	.22	.15	.25	.33	.38	.05	-.07	75	60	45	30
	.83	.23	.28	.30	.18	.20	.12	.27	.40	.53	.05	.02	80	80	60	35
	.83	.27	.34	.35	.20	.20	.20	.27	.33	.45	.07	.01	60	60	50	40
	.82	.26	.34	.30	.20	.22	.17	.28	.40	.32	.08	-.04	60	70	70	40
	.82	.27	.35	.32	.20	.20	.15	.25	.44	.38	.08	-.03	105	80	90	60
	.80	.26	.34	.30	.20	.23	.16	.30	.39	.28	.08	-.06	105	95	90	55
	.78	.27	.38	.35	.19	.23	.17	.25	.38	.35	.11	-.03	90	85	80	70
	.76	.30	.43	.35	.20	.22	.20	.25	.34	.30	.13	-.08	100	85	90	70
	.68	.23	.28	.28	.17	.20	.16	.25	.36	.32	.05	0	100	85	90	50
<u>A. FOLIOLOSA Subsp. CONGESTA.</u>																
Gradock R32	.90	.25	.32	.28	.19	.20	.16	.20	.35	.16	.07	-.04	60	60	30	30
	.90	.30	.40	.30	.20	.20	.20	.23	.40	.15	.10	-.10	-	-	-	60
	.90	.30	.40	.30	.20	.22	.20	.24	.40	.18	.10	-.10	60	60	60	30
	.90	.30	.35	.30	.20	.20	.18	.22	.40	.40	.05	-.05	60	60	30	40
	.83	.28	.37	.36	.18	.20	.20	.27	.38	.43	.09	-.01	80	90	70	40
	.80	.28	.37	.37	.18	.20	.20	.23	.40	.40	.09	0	60	70	50	30
	.70	.29	.43	.27	.18	.18	.20	.22	.32	.22	.14	-.16	90	90	30	30
	.70	.25	.32	.25	.20	.20	.17	.23	.30	.20	.07	-.07	-	-	-	-
Rayners Kop R33	.75	.32	.35	.32	.21	.22	.20	.26	.28	.25	.03	-.03	110	110	110	110
	.75	.30	.32	.30	.19	.20	.20	.25	.40	.27	.02	-.02	110	110	60	60

Appendix Table 4 DIMENSIONS OF PERIANTH IN POPULATION SAMPLES OF STROLOBA.

Locality.	PERIANTH TUBE			LOBES			GYNAECIUM			DIFFERENCE BETWEEN DIAMETER OF		ANGLE OF OPEN			LOBES
	Length of Neck-Neck	Diameter	cm.	Length	Width	cm.	Length	cm.	Middle and Neck	cm.	Base and Middle	cm.	Ant. Outer-Outer-Lats.	Post. Inner-Inner-Lats.	
A. FOLIOLOSA Subsp. CONGESTA. (Contd.)															
Rayners Kop R33 (Contd.)	a	.75	.27	.32	.20	.20	.19	.24	.38	.20	.05	-.02	90	30	60
	a	.75	.32	.38	.16	.20	.17	.22	.40	.20	.06	-.08	60	40	40
	a	.70	.28	.38	.16	.19	.15	.23	.40	.20	.10	-.08	30	S	S
	a	.70	.28	.30	.19	.20	.18	.28	.30	.20	.02	-.05	40	S	S
	a	.70	.27	.30	.20	.20	.18	.23	.30	.20	.03	-.01	30	S	S
	a	.70	.31	.36	.20	.20	.20	.29	.40	.20	.05	-.05	180	50	50
A. FOLIOLOSA Subsp. CONGESTA. (Contd.)															
Helspoort R41	b	.79	.29	.34	.23	.27	.20	.32	.38	.20	.05	-.04	60	40	S
	b	.77	.29	.34	.22	.24	.20	.25	.35	.20	.05	-.05	120	70	70
	b	.77	.28	.35	.23	.25	.20	.30	.40	.20	.07	.05	80	S	S
	b	.73	.24	.29	.18	.22	.20	.30	.40	.20	.05	-.05	-	-	-
	b	.68	.24	.29	.19	.22	.18	.28	.40	.20	.05	-.02	-	-	-
	b	.65	.25	.33	.21	.22	.17	.23	.40	.20	.08	-.05	80	10	S
	b	.62	.24	.29	.20	.20	.18	.22	.40	.20	.05	-.01	60	10	S
	b	.60	.28	.32	.21	.21	.16	.25	.36	.20	.04	-.04	90	30	S
	b	.58	.23	.29	.20	.20	.16	.23	.35	.20	.06	-.05	80	S	S
Dikkop Vlakte R40	b	.70	.36	.39	.23	.24	.20	.28	.40	.20	.03	-.04	60	60	60
	b	.67	.29	.33	.20	.20	.20	.29	.35	.20	.04	-.03	60	S	S
	b	.65	.28	.30	.20	.21	.20	.29	.35	.20	.02	-.03	90	S	S
	b	.65	.28	.36	.28	.28	.22	.30	.45	.20	.08	-.09	30	90	90
	b	.64	.35	.38	.25	.28	.22	.28	.40	.20	.03	-.04	-	-	-
Krantz Drift Commins 2063	a	.75	.27	.28	.20	.20	.20	.24	.40	.20	.01	-.06	-	-	-
A. FOLIOLOSA Subsp. ROBUSTA															
Steytlerville R43	a	.96	.29	.29	.25	.32	.20	.30	.38	.20	0	.01	140	60	60
	a	.85	.28	.32	.28	.30	.20	.30	.40	.20	.04	0	135	60	60

Appendix Table 4 DIMENSIONS OF PERIANTH IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	PERIANTH TUBE		LOBES		GYNAECIUM		DIFFERENCE BETWEEN DIAMETER OF		ANGLE OF OPEN		LOBES				
	Length	Diameter	Length	Width	Length	Middle and Neck	Base and Middle	Ant. Outer-Lats.	Post. Inner-Lats.						
	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.					
<u>A. FOLIOLOSA Subsp. ROBUSTA (Contd.)</u>															
Steytlerville R43 (Contd.)	a	.82	.27	.28	.30	.30	.28	.40	.23	0	.01	140	-	-	-
	a	.80	.30	.32	.22	.33	.33	.30	.21	.04	-.02	-	-	70	70
	a	.79	.34	.32	.30	.40	.40	.42	.23	.02	-.02	105	70	130	130
	a	.78	.32	.32	.26	.36	.36	.45	.35	.02	0	150	130	45	45
	a	.74	.32	.33	.20	.30	.30	.35	.30	.05	.01	180	170	45	40
	a	.70	.34	.30	.20	.27	.27	.35	.15	.04	-.04	40	40	40	40
	a	.58	.26	.23	.20	.30	.30	.28	.25	.02	-.03	80	50	50	50
8 miles East of Laingsburg R1	a	.78	.34	-	.19	.32	.32	-	-	-	-	90	120	120	120
	a	.73	.27	.30	.20	.30	.30	.30	.27	0	.03	90	120	120	120
	a	.72	.28	.30	.20	.30	.30	.35	.30	.02	0	90	90	90	90
	a	.70	.26	.29	.20	.30	.30	.30	.23	.03	0	90	100	100	100
	a	.70	.26	.28	.18	.25	.25	.30	.30	.02	0	100	100	100	100
	a	.90	.26	.30	.20	.30	.30	.35	.25	.08	-.04	110	90	90	70
Nelspoort R42	a	.85	.30	.30	.18	.23	.23	.37	.20	.05	0	80	60	60	60
	a	.80	.38	.30	.22	.30	.30	.40	.28	.08	-.08	100	80	80	80
	a	.79	.37	.30	.20	.28	.28	.40	.25	.08	-.07	-	-	-	-
	a	.77	.29	.28	.20	.27	.27	.30	.23	.05	-.02	80	100	100	50
	a	.70	.30	.33	.20	.29	.29	.35	.18	.05	-.03	-	-	-	-
	a	.70	.28	.30	.20	.26	.26	.30	.23	.04	-.02	50	30	30	30
	a	.70	.30	.28	.20	.23	.23	.30	.25	.07	-.03	100	80	80	80
	a	.66	.30	.27	.20	.22	.22	.35	.30	.05	-.03	40	40	40	40
<u>A. SMUTSIANA.</u>															
Ladismith-Barrydale Rd R3,62a	b	1.21	.27	.36	.18	.18	.15	.15	.45	.09	.01	-	-	-	-
	b	1.19	.23	.28	.17	.18	.18	.40	.40	.05	0	-	-	-	-
	b	1.17	.24	.29	.15	.18	.18	.37	.40	.05	0	-	-	-	-
	c	1.15	.20	.35	.10	.15	.15	.38	.45	.15	-.02	40	40	40	40
	b	1.14	.28	.37	.15	.15	.15	.35	.60	.09	-.03	-	-	-	-

Appendix Table 4 DIMENSIONS OF PERIANTH IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	PERIANTH TUBE		LOBES			GYNAECIUM		DIFFERENCE BETWEEN DIAMETER OF		ANGLE OF OPEN LOBES							
	Length to Neck-	Diameter	Outer-	Inner	Width	Length	Length	Middle and Neck	Base and Middle	Ant. Outer-	Post. Inner	Inner-Lobe					
													cm.	cm.	cm.	cm.	cm.
A. SMUTSIANA. (Contd.)																	
Ladismith-Barrydale Rd R3, 62b (Contd.)	b	1.10	.25	.34	.15	.10	.15	.15	.42	.40	.09	0	15	40	0	0	0
	c	1.10	.20	.27	.13	.13	.17	.17	.32	.50	.09	-.02	45	45	0	0	0
	c	1.10	.20	.28	.14	.15	.18	.18	.32	.50	.08	0	45	40	0	0	0
	c	1.10	.24	.31	.10	.14	.17	.18	.40	.42	.09	.04	40	40	0	0	0
	c	1.00	.24	.28	.17	.16	.17	.17	.40	.55	.04	0	60	45	0	0	20
	c	.96	.20	.28	.15	.15	.19	.19	.35	.52	.08	0	40	50	0	0	20
	c	.95	.25	.29	.15	.13	.15	.15	.38	.43	.04	0	60	60	0	0	40
	a	.90	.20	.30	.15	.12	.15	.15	.40	.40	.10	0	60	70	0	0	40
	a	.90	.23	.28	.15	.15	.13	.13	.32	.57	.05	.02	80	40	0	0	40
	a	.88	.20	.32	.15	.15	.13	.13	.32	.54	.12	-.03	40	45	0	0	20
	a	.88	.22	.34	.13	.15	.13	.14	.35	.38	.12	0	60	30	0	0	15
	a	.84	.20	.29	.13	.15	.13	.15	.36	.50	.08	.01	40	45	0	0	20
	a	.86	.20	.37	.12	.15	.15	.15	.38	.46	.17	0	70	45	0	0	-
Ladismith-Barrydale Rd R5, 62b	b	1.10	.23	.33	.15	.15	.17	.17	.30	.55	.07	.03	45	60	0	0	25
	b	1.10	.20	.32	.14	.15	.15	.15	.30	.40	.12	0	65	40	0	0	20
	b	1.08	.24	.32	.15	.16	.14	.15	.35	.35	.08	0	40	20	0	0	20
	a	1.04	.20	.28	.12	.15	.15	.15	.50	.50	.08	.02	55	20	0	0	20
	a	1.03	.23	.30	.15	.15	.15	.15	.56	.62	.09	-.02	40	60	0	0	25
	c	1.02	.19	.30	.12	.13	.14	.14	.35	.40	.11	-.01	60	60	0	0	-
	a	1.02	.23	.34	.15	.15	.17	.17	.44	.35	.11	-.02	60	60	0	0	-
	c	1.00	.22	.29	.13	.14	.17	.17	.30	.40	.07	.01	60	60	0	0	-
	c	1.00	.20	.30	.10	.13	.17	.17	.28	.40	.10	-.01	55	60	0	0	20
	c	1.00	.19	.29	.10	.13	.15	.15	.25	.30	.11	-.01	60	60	0	0	15
	a	1.00	.20	.32	.10	.15	.12	.12	.46	.40	.08	-.02	60	60	0	0	-
	a	.98	.23	.38	.15	.15	.16	.16	.40	.40	.16	-.01	80	45	0	0	20
	a	.97	.24	.41	.15	.15	.16	.16	.37	.37	.17	-.03	50	30	0	0	20
	a	.96	.23	.38	.15	.15	.15	.15	.47	.49	.07	.03	10	10	0	0	15
	a	.89	.23	.33	.15	.16	.15	.15	.44	.37	.09	-.02	30	10	0	0	30
	a	.83	.20	.27	.13	.14	.14	.14	.25	.35	.10	-.03	20	30	0	0	15

Appendix Table 4 DIMENSIONS OF PERIANTH IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	PERIANTH TUBE		LOBES				GYNAECIUM		DIFFERENCE BETWEEN DIAMETER OF		ANGLE OF OPEN LOBES				
	Length to Neck-Neck	Diameter	Middle-Base	Outer-Inner	Length	Width	Length	Middle and Neck	Middle and Middle	Base	Ant. Outer-Outer-	Post. Inner-Inner-	Lats.	Lats.	
															cm.
<u>HYBRID BETWEEN A. SMUTSIANA & A. RUGOSA.</u>															
Ladismith- Barrydale Rd. R2	1.27	.23	.29	.32	.16	.15	.18	.37	.45	.06	.03	45	45	45	45
c	1.25	.23	.29	.32	.15	.15	.18	.35	.55	.06	.03	-	-	-	-
c	1.24	.23	.29	.32	.15	.15	.18	.35	.35	.06	.03	-	-	-	-
c	1.20	.23	.28	.32	.14	.14	.18	.35	.40	.05	.04	30	30	30	30
b	1.20	.23	.28	.30	.15	.16	.17	.40	.55	.05	.02	-	-	-	-
b	1.20	.20	.27	.30	.15	.15	.18	.35	.30	.09	.01	-	-	-	-
b	1.20	.24	.29	.33	.17	.16	.18	.40	.48	.05	0	-	-	-	-
b	1.20	.25	.29	.33	.15	.15	.17	.40	.45	.04	.04	-	-	-	-
b	1.10	.23	.28	.30	.14	.14	.16	.34	.50	.05	.02	60	60	50	30
b	1.10	.24	.28	.28	.15	.15	.15	.30	.60	.04	0	60	60	40	25
c	1.10	.28	.37	.36	.18	.18	.17	.42	.70	.09	-.01	-	-	-	-
c	1.00	.25	.36	.35	.17	.15	.17	.39	.65	.11	-.01	-	-	-	-
b	.92	.19	.29	.28	.18	.18	.15	.17	.38	.45	-.01	50	20	40	10
<u>A. RUGOSA.</u>															
23 Miles South of Ladismith R2	1.20	.23	.32	.35	.18	.15	.19	.40	.35	.09	.03	-	-	-	-
b	1.20	.25	.33	.37	.16	.15	.20	.35	.50	.08	.04	-	-	-	-
b	1.20	.25	.30	.35	.15	.15	.19	.40	.40	.09	.01	-	-	S	S
b	1.18	.19	.28	.30	.18	.13	.19	.35	.40	.09	.02	20	20	S	S
b	1.18	.20	.27	.32	.17	.12	.19	.37	.42	.07	.05	10	10	-	-
b	1.14	.21	.28	.30	.15	.14	.17	.40	.30	.07	.02	-	-	-	-
b	1.10	.23	.27	.30	.15	.15	.18	.40	.30	.04	.03	-	-	-	-
a	1.05	.23	.28	.30	.15	.14	.16	.40	.48	.05	.02	-	-	-	-
b	.96	.23	.30	.33	.15	.15	.17	.39	.28	.07	.03	50	30	20	15
b	.90	.20	.30	.32	.15	.15	.18	.32	.23	.10	.02	30	20	10	S
b	.90	.23	.30	.34	.16	.16	.20	.42	.30	.07	.04	30	20	10	10
b	.90	.20	.33	.34	.16	.14	.17	.38	.38	.07	.01	30	20	20	10
b	.85	.23	.27	.29	.17	.15	.19	.43	.31	.04	.02	15	15	20	15
b	.83	.21	.29	.32	.17	.15	.17	.37	.30	.08	.03	20	20	20	20

Appendix Table 4 DIMENSIONS OF PERIANTH IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	PERIANTH TUBE		LOBES				GYNAECIUM		DIFFERENCE BETWEEN DIAMETER OF		ANGLE OF OPEN LOBES			
	Length to Neck-Neck	Diameter	Outer-Inner	Length	Width	Length	Ovary-Style	Middle and Neck	Base and Middle	Ant.	Outer-Inner	Post. Inner		
													cm.	cm.
nr. Ladismith Nbg. 428/58	.80	.28	.30	.15	.15	.18	.32	.23	.08	.02	60	50	10	10
Koo R17-23	a	-	.32	-	-	-	.32	.25	-	-	-	-	-	-
	a	.25	.35	.14	.19	.17	.29	.26	.17	.01	-	-	-	-
	b	.20	.37	.18	.15	.18	.28	.37	.08	.03	70	30	20	20
	b	.22	.30	.15	.15	.18	.30	.40	.10	.02	60	55	15	30
	c	.20	.30	.15	.14	.15	.37	.37	.08	.03	50	20	10	10
	b	.20	.28	.18	.17	.20	-	-	-	-	-	-	-	-
	a	.24	.25	.25	.16	.15	.28	.37	.05	0	50	20	10	10
	b	.20	.25	.25	.17	.18	-	-	-	0	35	15	10	10
Koo Nbg 452/58	b	.30	.30	.15	.18	.18	.36	.32	.04	.04	20	10	10	10
	b	.20	.30	.15	.13	.15	.24	.23	.10	0	40	15	15	15
	c	.20	.30	.15	.13	.18	.27	.30	.10	0	40	15	15	15
	c	.19	.30	.32	.16	.18	.27	.30	.11	.02	70	40	30	10
<u>A. HALLII.</u>														
Approx. 20 miles East of Laingsburg R52	a	.78	.28	.15	.18	.18	.30	.29	.07	0	40	30	20	10
	a	.78	.30	.32	.16	.21	.39	.45	.05	.02	35	40	20	10
	a	.84	.30	.29	.16	.16	.34	.28	.07	-.01	-	-	-	-
	a	.90	.30	.32	.18	.16	.38	.44	.05	.02	50	40	40	20
	a	.95	.35	.32	.18	.24	.44	.35	.10	-.03	35	45	80	10
	a	1.00	.35	.34	.17	.25	.40	.41	.07	-.01	35	40	80	20
	a	1.00	.40	.42	.19	.25	.50	.50	.12	.02	40	40	25	15
	a	1.02	.40	.43	.17	.25	.54	.59	.13	.03	30	30	20	10
	a	1.05	.41	.42	.16	.24	.46	.33	.14	.01	20	30	20	10
	a	1.05	.41	.42	.15	.24	.46	.33	.14	.01	20	30	20	10

Appendix Table 4 DIMENSIONS OF PERIANTH IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	PERIANTH TUBE.		LOBES		GYNAECIUM		DIFFERENCE BETWEEN DIAMETER OF		ANGLE OF OPEN		LOBES		
	Length to Neck-Neck	Diameter	Length	Width	Length	Ovary-Style	Middle and Neck	Base and Middle	Ant. Outer-Outer-Lats.	Post. Inner-Inner-Lats.	Ant. Outer-Outer-Lats.	Inner-Inner-Lats.	
													cm.
A. HALLII. (Contd.)													
Koup	.85	.30	.18	.13	.16	.37	.32	.06	0	60	30	40	20
a	.90	-	.16	.16	.20	.32	.60	-	-	5	90	40	40
a	.90	-	.20	.15	.20	.32	.60	-	-	60	40	60	20
a	.94	.34	.18	.13	.16	.39	.62	.09	0	45	45	10	10
a	.95	-	-	-	-	-	-	-	-	45	-	-	-
a*	.95	-	.15	.15	.20	.40	.35	-	0	-	-	-	-
d	.96	.37	.18	.18	.20	-	-	.11	-	-	-	-	-
a	.97	.32	.18	.14	.18	.44	.40	.09	.03	60	30	40	10
a	.99	.30	.18	.15	.22	.41	.38	.07	.04	90	70	10	10
a	1.00	-	-	-	-	-	-	-	-	-	-	-	-
a	1.00	.33	.18	.13	.18	.41	.44	-	-	60	30	40	15
a	1.00	.40	.22	.20	.25	.47	.58	.10	.02	80	60	35	20
d	1.04	.32	.18	.15	.19	.44	.65	.08	.01	85	65	65	20
a	1.05	.36	.17	.13	.18	.45	.40	.10	.04	50	30	20	10
a	1.06	.36	.18	.15	.18	.45	.37	.13	.02	45	40	20	10
a	1.06	.38	.20	.16	.18	.43	.45	.14	-	90	90	45	45
a**	1.10	-	.14	.12	.16	.44	.56	-	.01	60	50	45	15
a	1.10	.34	.18	.13	.18	.44	.60	.11	.01	75	65	70	25
a	1.10	.37	.17	.15	.22	.47	-	.11	-	-	-	-	-
d	1.13	.34	.18	.17	.20	-	-	.11	-	-	-	-	-
A. BULLULLATA.													
Matjesfontein	1.00	.41	.18	.13	.16	.47	.65	.17	0	47	47	30	20
R55	.98	.41	-	-	-	-	-	.16	.03	-	-	-	-
a	.95	-	.18	.15	.19	.40	.40	-	-	-	-	-	-
a	.94	.33	.18	.13	.19	.35	.46	.09	.02	50	35	30	20
a	.92	.35	.14	.17	.18	.40	.43	.10	.03	90	80	50	40
a	.90	.31	.17	.14	.18	.42	.52	.08	.01	85	60	50	35

Appendix Table 4 DIMENSIONS OF PERIANTH IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	PERIANTH TUBE			LOBES			GYNAECIUM			DIFFERENCE BETWEEN DIAMETER OF		ANGLE OF OPEN LOBES					
	Length to Neck-Neck	Diameter	Middle-Base	Outer-Inner	Length	Width	Outer-Inner	Ovary-Style	Middle and Neck	Base and Middle	Ant.	Outer Post.	Inner				
														cm.	cm.	cm.	cm.
<u>A. BULLULATA. (Contd.)</u>																	
Matjesfontein R55 (Contd.)	a	.89	.24	.33	.34	.17	.18	.13	.18	.43	.59	.08	.02	30	20	30	10
	a	.83	.23	.30	.32	.16	.17	.13	.17	.36	.55	.07	.02	80	70	50	30
	a	.80	.23	.29	.32	.15	.17	.13	.17	.40	.55	.06	.03	85	60	70	50
Worcester Karoo Gdns. Dec. 1959		1.20	.25	-	.30	.19	.20	.18	.20	.40	.32	-	-	-	-	-	-
<u>A. HERREI.</u>																	
Nbg. no. number	b	.80	.30	.50	.44	.30	.30	.23	.30	.32	.20	.20	-.06	65	40	40	5
Hoekplaas Farm N.W. of Uniondale R44	a	.80	.30	.50	.56	.23	.25	.20	.24	.40	.20	.20	.06	50	30	30	5
	a	.72	.24	.42	.42	.18	.16	.18	.20	.37	.28	.18	0	125	90	90	5
	a	.70	.25	.40	.35	.20	.18	.20	.23	.37	.18	.15	-.05	-	-	-	5
	a	.70	.20	.40	.33	.25	.24	.20	.25	.40	.27	.20	-.07	50	25	25	5
	a	.64	.27	.42	.40	.27	.28	.20	.28	.30	.20	.15	-.02	40	20	20	5
Prince Albert R46	a	.70	.26	.37	.34	.25	.32	.24	.30	.30	.20	.11	-.03	50	8	8	5
	a	.67	.25	.40	.30	.25	.27	.23	.28	.38	.15	.15	-.10	60	60	60	5
	a	.66	.25	.45	.36	.30	.25	.30	.25	.40	.30	.20	-.09	45	45	45	5
	a	.65	.25	.39	.29	.27	.28	.23	.29	.30	.15	.14	-.10	-	-	-	5
	a	.57	.25	.37	.30	.25	.22	.15	.25	.30	.15	.12	-.07	40	30	10	10
<u>A. SPIRALIS.</u>																	
Calitzdorp R47	f	.87	.20	.35	.38	.15	.15	.12	.15	-	-	.15	.03	-	-	-	-

Appendix Table 4 DIMENSIONS OF PERIANTH IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	PERIANTH TUBE		LOBES		GYNAECIUM		DIFFERENCE BETWEEN DIAMETER OF		ANGLE OF OPEN LOBES	
	Length	Diameter	Length	Width	Length	Middle and Neck	Base and Middle	Ant. Outer-Lats.	Post. Inner-Lats.	
	cm.	cm.	cm.	cm.	cm.	cm.	cm.	0	0	
26 miles South of Ladismith R6	1.14	.41	.15	.14	.40	.17	.01	30	S	
	1.13	.34	-	-	.40	.12	.03	40	S	
Oudtshoorn R61	1.19	.40	.19	.16	.39	-	-	50	-	
	.98	.34	.15	.14	.40	.11	0	30	10	
	.98	.30	.15	.12	.47	.11	.03	50	S	
	.97	.30	.15	.13	.38	.10	.01	40	20	
	.94	.35	.15	.10	.35	.15	-.03	20	20	
	.93	.35	.15	.15	.34	.18	0	60	30	
	.92	.32	.16	.14	.34	.15	-.03	80	20	
	.90	.34	.15	.12	.32	.15	-.04	70	-	
	.90	.35	.14	.10	.30	.17	-.07	50	15	
	.85	.30	.15	.12	.35	.11	-.05	30	20	
	.84	.30	.16	.12	.36	.10	-.03	30	20	
	.83	.35	.15	.13	.30	.15	-.05	55	10	
	.83	.43	.16	.11	.29	.20	-.05	20	-	
	.82	.38	.16	.11	.32	.32	-	-	-	
	.77	.27	.15	.11	.32	.08	0	45	25	
	.76	.29	.16	.13	.30	.10	-.03	70	10	
	.75	.34	.15	.14	.32	.11	-.04	10	S	
	.74	.32	.14	.11	.31	.14	-.04	40	20	
	.73	.26	.15	.11	.30	.07	-.02	35	10	

A. SPIRALIS. (Contd.)

* Ex Karoo Gardens, Worcester, Dec. 1959.

Appendix Table 4 DIMENSIONS OF PERIANTH IN POPULATION SAMPLES OF ASTROLOBA (Contd.)

Locality.	Leaf width. cm.	No. vasc. bundles seen in T.S.		No. of bundles per cm. (B)		Mean of B. for each plant.	
		Ventral-Dorsal	Ventral-Dorsal	ventral-Dorsal	ventral-Dorsal	Ventral-Dorsal	Ventral-Dorsal
		Subsp. CONGESTA.					
Cradock R32	2.1	40	30	19.05	14.29	-	-
	2.5	44	31	17.60	12.40	18.33	13.34
	2.5	47	-	18.76	-	-	-
	2.4	43	26	17.92	10.83	17.01	10.42
	2.3	37	23	16.09	10.00	-	-
	2.3	33	23	14.33	10.00	15.04	10.26
	1.9	30	20	15.75	10.50	-	-
	1.8	26	16	14.44	8.89	15.38	8.96
	1.9	31	17	16.31	8.95	-	-
	2.1	28	15	13.40	7.14	14.94	7.74
	2.0	31	14	15.50	7.00	-	-
	2.2	35	20	15.92	9.09	-	-
	1.9	30	19	15.75	10.00	14.82	9.17
	1.8	25	15	13.89	8.33	-	-
	1.9	28	16	14.73	8.42	14.28	7.57
	1.9	29	13	15.26	6.84	-	-
	2.0	27	14	13.50	7.00	-	-
	2.0	27	16	13.50	8.00	-	-
	1.8	25	19	13.89	10.56	13.25	9.16
	1.5	20	12	13.33	8.00	-	-
	1.9	24	17	12.63	8.95	-	-
	2.3	26	18	11.31	7.83	13.15	8.66
	2.0	30	19	15.00	9.50	-	-
	2.0	26	15	13.00	7.50	12.29	6.65
	1.9	22	11	11.58	5.80	-	-
	2.1	27	18	12.86	8.57	12.18	8.29
	2.0	23	16	11.50	8.00	-	-
	2.0	23	16	11.50	8.00	12.07	8.35
	1.9	24	17	12.63	6.70	-	-
	1.9	22	16	11.58	8.22	11.88	8.46
	2.3	28	20	12.17	8.70	-	-
	2.0	23	11	11.50	6.50	10.84	6.05
	2.1	22	11	10.52	6.50	-	-
	2.1	22	10	10.52	5.15	-	-
S. of Adelaide R38,39	2.5	39	29	15.60	11.60	14.32	9.93
	2.3	30	19	13.04	8.26	-	-
	2.5	36	25	14.40	10.00	13.93	9.42
	2.6	35	23	13.46	8.85	-	-
	1.9	25	11	13.15	5.79	13.46	4.71
	1.8	24	7	13.33	3.89	-	-
	1.8	25	8	13.89	4.44	-	-
	2.6	32	22	12.30	8.44	11.86	7.79
	2.1	24	15	11.43	7.14	-	-

Appendix Table 5 SHOWING THE NUMBER OF VASCULAR BUNDLES WITH BUNDLE CAPS AS SEEN IN TRANSVERSE SECTION HALF WAY ALONG THE LONGITUDINAL AXIS OF LEAVES IN A. FOLIOLOSA COMPLEX.

Locality.	Leaf width.	No. vasc. bundles seen in T.S.		No. of bundles per cm.(B)		Mean of B. for each plant.	
		Ventral-Dorsal	Ventral-Dorsal	Ventral-Dorsal	Ventral-Dorsal	Ventral-Dorsal	Ventral-Dorsal
<u>Subsp. CONGESTA (Contd.)</u>							
S. of Adelaide R38,39 (Contd.)	2.4	31	19	12.67	7.92	11.69	7.71
	2.5	24	16	9.60	6.40	-	-
	2.5	32	22	12.80	8.80	-	-
	2.5	29	25	11.60	10.00	-	-
	1.9	22	12	11.58	6.32	11.47	5.66
	2.2	25	11	11.36	5.00	-	-
Helspoort R41	2.4	31	22	12.93	9.17	12.77	9.15
	2.3	29	21	12.61	9.13	-	-
	2.4	28	17	11.67	7.08	12.33	7.04
	2.0	26	14	13.00	7.00	-	-
Dikkop R40	2.9	45	38	15.51	13.10	14.96	12.15
	2.5	36	28	14.40	11.20	-	-
	2.8	39	33	14.25	11.79	13.79	11.64
	2.7	36	31	13.33	11.48	-	-
Alicedale Commins 2063	2.0	24	20	12.00	10.00	12.59	10.69
	2.2	29	25	13.19	11.37	-	-
	2.2	29	22	13.19	10.00	13.35	10.75
	2.0	27	23	13.50	11.50	-	-
<u>Subsp. ROBUSTA.</u>							
Molteno Pass Hall 2284	1.5	18	11	12.00	7.4	-	-
	1.6	18	11	11.25	6.88	-	-
	1.6	18	9	11.25	5.75	-	-
	1.8	20	10	11.09	5.56	-	-
	1.8	19	8	10.56	4.44	-	-
	1.8	18	11	10.00	6.11	-	-
Nelspoort R28	1.8	17	8	9.44	4.44	-	-
	2.4	20	13	8.33	5.42	-	-
E. of Laingsburg R1	1.4	16	7	11.43	5.00	10.05	3.83
	1.5	13	4	8.67	2.67	-	-
20 miles S.E. of Laingsburg R	2.2	16	8	7.36	3.64	6.54	3.96
	2.1	12	9	5.71	4.29	-	-
	2.0	12	8	6.00	4.00	5.75	4.00
	2.0	11	8	5.50	4.00	-	-
	2.1	12	8	5.71	3.90	5.67	3.35
	2.0	11	6	5.50	3.00	-	-
	1.9	11	6	5.79	3.16	-	-
	2.2	13	8	5.91	3.64	5.65	3.62
	2.0	13	9	6.50	4.50	-	-
	2.2	10	6	4.55	2.73	-	-
	2.1	11	6	5.24	2.86	5.62	3.43
	2.0	12	8	6.00	4.00	-	-
nr. Whitehill 0	1.8	17	7	9.33	3.76	9.14	3.63
	1.8	15	6	8.33	3.33	-	-
	1.9	17	7	8.95	3.68	-	-
	1.8	17	7	9.33	3.76	-	-
	1.6	13	11	8.13	6.88	7.89	6.67

Locality,	Leaf width.	No. vasc. bundles seen in		No. of bundles per cm.(B)		Mean of B. for each plant.	
		T.S.	Ventral-Dorsal	Ventral-Dorsal	Ventral-Dorsal	Ventral-Dorsal	Ventral-Dorsal
	cm.	Subsp. ROBUSTA. (Contd)					
nr. Whitehill 0 (Contd.)	1.7	13	11	7.65	6.47	-	-
	1.8	13	7	7.22	3.76	6.25	3.44
	1.8	10	6	5.56	3.33	-	-
	1.8	11	6	6.11	3.33	-	-
	1.8	11	6	6.11	3.33	-	-
Prince Albert R64	1.9	20	8	10.53	4.21	10.72	4.71
	1.9	20	9	10.53	4.74	-	-
	1.8	20	10	11.09	5.55	-	-
	2.0	19	7	9.50	3.50	9.77	3.55
	1.8	18	6	10.00	3.33	-	-
	1.9	19	6	10.00	3.16	-	-
	1.9	18	8	9.47	4.21	-	-
	2.0	20	9	10.00	4.50	9.67	4.50
	2.0	17	9	8.50	4.50	-	-
	2.0	21	9	10.50	4.50	-	-
	2.2	21	13	9.33	5.91	9.66	5.23
	2.2	22	10	10.00	4.55	-	-
	2.2	19	10	8.64	4.55	8.76	5.44
	2.2	18	11	8.18	5.00	-	-
	2.1	16	12	7.62	5.71	-	-
	2.0	21	13	10.50	6.50	-	-
	2.7	23	12	8.52	4.44	8.40	4.62
	2.6	22	12	8.46	4.62	-	-
	2.5	21	12	8.20	4.80	-	-
	1.9	13	9	7.00	4.74	8.36	4.43
	2.1	18	9	8.57	4.29	-	-
	2.1	20	9	9.52	4.29	-	-
	1.8	13	8	7.22	4.44	7.43	4.73
	1.9	15	9	7.57	4.74	-	-
	1.6	12	8	7.50	5.00	-	-
Nr. Miller R8	2.2	22	11	10.00	5.00	8.86	4.77
	2.2	19	10	7.73	4.55	-	-
	2.0	18	6	9.00	3.00	8.39	2.94
	2.2	18	7	8.18	3.19	-	-
	2.0	16	4	8.00	2.00	-	-
	1.8	16	6	8.89	3.3	-	-
	1.9	15	6	7.89	3.16	-	-
	1.6	11	6	6.88	3.75	8.11	3.64
	1.5	14	7	9.33	4.67	-	-
	1.6	13	4	8.13	2.50	-	-
Klaarstroom R27	2.5	23	15	9.41	6.00	9.90	6.46
	2.5	27	18	10.39	6.92	-	-
	2.5	21	14	8.40	5.60	8.43	5.11
	2.6	22	12	8.46	4.62	-	-
Steytlerville R15	1.6	20	6	12.50	3.75	11.75	3.35
	1.7	17	5	10.00	2.94	-	-

Appendix Table 5 Contd. NUMBERS OF VASCULAR BUNDLES WITH BUNDLE CAPS IN THE A. FOLIOLOSA COMPLEX (Contd.)

Locality.	Leaf width. cm.	No. vasc. bundles seen in T.S.		No. of bundles per cm.(B)		Mean of B. for each plant.		
		Ventral-Dorsal	Ventral-Dorsal	Ventral-Dorsal	Ventral-Dorsal	Ventral-Dorsal	Ventral-Dorsal	
<u>Subsp. ROBUSTA (Contd.)</u>								
Steytlerville	2.0	22	11	11.00	5.5	10.77	5.32	
R15 (Contd.)	1.9	20	10	10.53	5.14	-	-	
	1.8	19	9	10.57	5.00	10.55	4.32	
	1.8	20	8	11.09	4.44	-	-	
	1.7	17	6	10.00	3.53	-	-	
	1.8	20	6	11.09	3.33	10.36	2.96	
	1.8	18	5	10.00	2.78	-	-	
	1.8	18	5	10.00	2.78	-	-	
	1.8	17	6	9.33	3.33	9.94	3.54	
	1.8	19	7	10.56	3.76	-	-	
<u>Subsp. FOLIOLOSA.</u>								
Miscellaneous	1.4	12	-	8.57	-	-	-	
Localities	1.4	13	8	9.29	5.71	-	-	
	1.3	9	5	6.92	3.85	-	-	
	1.3	19	10	14.62	7.69	-	-	
	1.2	16	10	13.33	8.33	-	-	
	1.1	12	8	10.91	7.27	-	-	
	1.1	11	9	10.00	8.18	-	-	
	1.1	15	9	13.64	8.18	-	-	
	1.0	13	8	13.00	8.00	-	-	

Appendix Table 5 Contd. NUMBERS OF VASCULAR BUNDLES WITH BUNDLE CAPS
IN THE A. FOLIOLOSA COMPLEX (Contd.)

Locality.	% Lignification.		Area largest bundle cap (1 unit = 130 μ)		Thickness of sclereid wall bundle cap (1 unit = 35 μ)	
	%	Mean %	sq.unit	Mean sq.unit.	unit	Mean unit
<u>Subsp. ROBUSTA.</u>						
Molteno Pass Hall 2284	-	93	-	2.0	-	.45
	-	88	-	1.6	-	.40
	-	88	-	1.8	-	.35
	-	83	-	0.9	-	.40
	-	76	-	1.6	-	.35
Whitehill R57	-	90	-	7.0	-	.20
	-	77	-	3.2	-	.40
20 Miles S.E. of Laingsburg R65	86	-	2.4	-	.45	-
	72	79	3.4	2.9	.60	.53
	83	-	2.2	-	.50	-
	73	78	2.1	2.2	.45	.48
	80	-	2.4	-	.60	-
	57	69	2.6	2.5	.55	.68
	-	100	-	5.7	-	.55
	100	-	5.0	-	.55	-
	94	97	5.0	5.0	.50	.53
	100	-	1.8	-	.45	-
	90	95	1.6	1.7	.35	.40
	95	-	4.1	-	.45	-
	95	95	5.3	4.7	.50	.48
	95	-	6.8	-	.60	-
	92	94	4.8	5.8	.65	.63
	95	-	6.4	-	.65	-
	90	93	7.0	6.7	.55	.60
	88	-	9.0	-	6.5	-
	87	88	6.3	7.7	.60	.63
	91	-	3.8	-	.50	-
	83	87	3.7	3.8	.45	.48
Klaarstroom R27	-	86	-	7.2	-	.65
	-	78	-	6.4	-	.60
Miller R8	-	100	-	3.0	-	.40
	89	-	7.3	-	.55	-
	84	-	8.1	-	.60	-
	95	89	7.8	7.8	.55	.57
	-	88	-	8.6	-	.65
	-	84	-	7.3	-	.65
	73	-	3.6	-	.65	-
	90	82	4.6	4.1	.55	.60
Steytlerville R15	-	94	-	4.4	-	.50
	-	81	-	5.3	-	.75
	-	69	-	2.6	-	.50
	-	63	-	2.7	-	.50
	-	49	-	3.4	-	.45
	-	19	-	2.8	-	.40
	-	4	-	6.0	-	.30
<u>Subsp. CONGESTA.</u>						
Craddock R32	-	97	-	1.3	-	.30
	-	91	-	1.7	-	.30
	-	90	-	1.9	-	.35
	-	88	-	1.3	-	.35
	-	86	-	1.3	-	.35
	-	77	-	1.8	-	.35
	-	66	-	1.7	-	.25
	-	60	-	1.3	-	.25

Appendix Table 6 SIZE AND LIGNIFICATION OF LARGEST BUNDLE CAPS FROM VENTRAL SIDE OF LEAF IN A. FOLIOLOSA COMPLEX.

Locality.	% Lignification.		Area Largest bundle cap (1 unit = 130 μ)		Thickness of sclereid wall bundle cap (1 unit = 35 μ)	
	%	Mean %	sq.unit	Mean sq.unit	unit	Mean unit
<u>Subsp. CONGESTA. (Contd.)</u>						
Cradock R32 (Contd.)	-	40	-	1.0	-	.25
	82	-	1.0	-	.25	-
	42	62	1.0	1.0	.25	.25
	66	-	1.2	-	.20	-
	2	34	1.4	1.3	.10	.15
	-	6	-	1.4	-	.15
Adelaide R38,39	-	77	-	1.0	-	.20
	-	64	-	1.1	-	.15
	-	52	-	0.9	-	.25
	-	51	-	1.0	-	.15
	-	23	-	1.2	-	.15
	-	1	-	1.3	-	.10
	-	1	-	1.1	-	.10
Helspoort R41	-	88	-	1.2	-	.35
	-	82	-	1.2	-	.30
	-	77	-	2.4	-	.30
	-	77	-	1.5	-	.25
Alice Dale Commins	-	90	-	1.0	-	.30
	-	50	-	1.0	-	.25
	-	14	-	1.8	-	.20
Dikkop Vlakte R40	-	94	-	1.8	-	.35
	-	35	-	1.8	-	.20
	-	0	-	2.3	-	0
<u>Subsp. FOLIOLOSA.</u>						
Miscellaneous Localities	-	75	-	0.9	-	.25
	-	75	-	0.6	-	.30
	-	50	-	0.8	-	.25
	-	25	-	1.0	-	.35
	-	25	-	0.6	-	.15
	-	13	-	0.7	-	.20
	-	13	-	1.1	-	.20
	-	0	-	1.0	-	-
	-	0	-	0.8	-	-
	-	0	-	0.7	-	-

Appendix Table 6 SIZE AND LIGNIFICATION OF LARGEST BUNDLE CAP FROM VENTRAL SIDE OF LEAF IN A. FOLIOLOSA COMPLEX. Cont.

Subspecies.	Leaf length.	Diam. ped. base.	Leaf length.	Diam. ped. base.
	cm.	cm.	cm.	cm.
<u>FOLIOLOSA.</u>				
Graaff Reinet R29	3.0	.28	2.1	.28
	2.3	.32	1.9	.36
	2.2	.32	2.0	.38
	2.2	.36	1.9	.38
	2.4	.35	2.3	.25
	2.3	.34	2.0	.23
Lake Mentz R36,37	1.6	.24	1.5	.30
	1.4	.27	2.1	.36
	1.5	.34	1.4	.35
	1.4	.35	1.6	.33
	2.1	.31	1.7	.33
	1.9	.39	1.4	.33
	1.4	.25		
nr. Waterford R10	1.7	.35	1.5	.35
	1.5	.70	1.8	.36
Wolwefontein R11	1.9	.41	2.1	.31
	1.8	.30	1.7	.35
	2.0	.45	2.2	.38
	1.7	.34	1.9	.37
	1.7	.31	2.1	.50
Baroe R12	2.2	.35		
Mount Stewart R13	1.7	.38	2.5	.29
	2.1	.42	1.9	.37
	1.8	.34		
Steytlerville R14	2.3	.31	2.3	.27
	2.5	.45	2.1	.37
	1.7	.38	1.9	.29
	1.8	.30	1.8	.25
	2.3	.25	1.9	.29
	1.7	.29	1.8	.28
	2.2	.32	2.2	.43
	2.1	.38	2.4	.31
	1.7	.25	1.8	.43
	1.9	.35	2.1	.39
	1.7	.32	1.8	.28
	2.0	.39	1.8	.37
	2.3	.32	1.7	.25
	1.8	.38	1.8	.37
<u>CONGESTA.</u>				
19 Miles N. of Cradock R31	2.8	.25	2.7	.44
	2.9	.55	2.6	.44
Cradock R32	3.6	.42	3.3	.47
	3.3	.44	2.7	.46
	2.9	.40	3.8	.40
	3.2	.32	4.0	.48
	2.7	.34	3.3	.45
	2.8	.47	3.5	.48
Rayners Kop R33	2.9	.50	3.4	.37
	3.5	.44	3.5	.42
	4.0	.40	4.6	.55
	3.4	.49	4.5	.39

Appendix Table 7 LENGTH OF LEAF AND BASAL DIAMETER OF OLD PEDUNCLE BASES IN FIELD POPULATION SAMPLES OF A. FOLIOLOSA COMPLEX.

Species	Area of largest bundle cap from ventral side of leaf in sq.units	Vertical distance from lower epidermis of same bundle cap in units
<u>A. HERREI</u>		
Uniondale R16	19.0	1.0
	11.4	0.8
	9.2	0.7
	8.7	1.0
	7.5	1.5
	6.3	0.7
	4.4	0.7
	2.4	0.7
Prince Albert R46	5.6	1.0
	5.2	1.1
	5.1	1.0
	4.8	1.1
	4.0	0.8
	3.8	1.2
	3.7	0.9
<u>A. SPIRALIS</u>		
Oudtshoorn R7	2.9	4.0
	2.3	3.5
	2.3	3.2
	1.0	3.6
Calitzdorp R47	3.6	3.0
	3.4	3.2
	3.2	3.8
	3.1	3.2
	2.6	2.7
	2.2	3.2
	1.4	3.5
Ladismith-Barrydale R6	0.8	4.5
	0.6	3.0
<u>A. SMUTSIANA</u>		
Ladismith-Barrydale	4.5	2.8
R3, R5	4.5	2.7
	3.9	2.8
	3.0	3.0
	2.9	2.5
	2.6	1.5
	2.3	2.5
	1.8	2.0

Appendix Table 8. VERTICAL DISTANCE FROM LOWER EPIDERMIS OF LARGEST BUNDLE CAP AND APPROXIMATE AREA OF SAME BUNDLE CAP, AS SEEN IN TRANSVERSE SECTION HALF-WAY ALONG LEAF (1 Unit = 130 μ)

Locality	Height of plant	Spiral Angle	Angle of leaf with stem	Curvature of leaf apices
	cm.	o	o	
	<u>HAWORTHIA MARGARITIFERA</u>			
Rietvlei R50B	11	30	20	u
	6	33	20	u
	13	40	30	u
	<u>XASTROWORTHIA BICARINATA</u>			
Miscell. garden plants:-				
Ex B. Carp	10	13	25	o
Ex. Malherbe	6	Irreg.	40	f
Ex H. Herre (3 Vaalkoppens?)	18	Irreg.	40	f
	14	5	30-50	o
Ex Karroo Gdns.	9	8	35-40	u

Appendix Table 9A. LEAF ARRANGEMENT IN SPECIMENS OF HAWORTHIA MARGARITIFERA AND XASTROWORTHIA BICARINATA.

(See Appendix Table 1).

Locality.	Length cm.	Width widest leaf part cm.	Distance of widest part from base cm.	Side on which keel situated	Keel length cm.	Mucro length cm.	Length breadth ratio
<u>X ASTROWORTHIA BICARINATA.</u>							
Baden Baden R58	4.4 3.9	1.7 1.7	1.4 1.3	R R	1.9 1.0	0.10 0.10	2.59 2.29
Rietvlei R50	4.6 3.5	2.0 2.0	1.7 1.5	R R	1.7 1.3	0.08 0.09	2.28 1.75
Misc. Garden Plants - No. 7262 K'bosch	4.5 3.7	2.3 2.2	1.8 1.4	Sl. double "	1.9, 2.3 1.8, 2.0	0.08 0.12	1.96 1.68
Ex. B. Carp	3.3	2.1	1.6	L	0.7	0.03	1.56
Ex. Karoo Gardens	5.1	2.8	1.9	L	1.6	0.09	1.82
Ex. J. Malherbe	3.4	1.8	1.6	L	1.2	0.07	1.89
Ex. H. Herre (3 Vaal Koppen ?)	4.6 3.9	2.1 2.0	1.6 1.5	R L	2.4 1.5	0.10 0.08	2.24 1.95
<u>HAWORTHIA MARGARITIFERA.</u>							
Rietvlei R50B	9.0 6.8 5.3	2.3 2.5 1.6	2.0 1.8 1.5	L L L	3.2 2.9 1.8	0.13 0.12 0.10	3.96 2.70 3.28

Appendix Table 9B DIMENSIONS OF LEAVES IN ASTROWORTHIA BICARINATA AND HAWORTHIA MARGARITIFERA.

Locality. Lowest Fertile Bract middle basal length-width.--width. cm. Lowest Sterile Bract middle basal length-width.--width. cm. Pedicel Length Flowering sterile basal bracts. cm. No. of Peduncle Width at base raceme. cm. Length below side No. of Peduncle Raceme branches. cm. No. of side branches.

Locality.	Lowest Fertile Bract middle basal length-width.--width. cm.	Lowest Sterile Bract middle basal length-width.--width. cm.	Pedicel Length Flowering sterile basal bracts. cm.	No. of Peduncle Width at base raceme. cm.	Length below side No. of Peduncle Raceme branches. cm.
<u>X ASTROWORTHIA BICARINATA. (Contd.)</u>					
<u>Herbarium Specimens.</u>					
	0.55	0.80	0.47	0.56	35.0
	0.55	0.80	0.47	0.54	26.0
	0.60	1.25	0.47	0.46	37.0
			0.47	0.32	13.0
			0.50	0.56	15.0
					1a
					0
					5b
					3b
					2b
<u>HAWORTHIA MARGARITIFERA.</u>					
Rawsonville	0.34	0.90	0.59	0.50	18.0
	0.50	0.70	0.60	0.55	38.0
	0.50	0.70	0.32	-	41.0
	0.60	0.85	-	0.61	41.0
					39.0
					5b
					2b
					2alb
					4b
<u>Herbarium Specimens.</u>					
	0.60	1.50	0.34	0.47	10.0
			0.39	-	13.0

Appendix Table 9C DIMENSIONS OF INFLORESCENCES IN ASTROWORTHIA BICARINATA & HAWORTHIA MARGARITIFERA.

Locality.	Lowest Fertile Bract		Lowest Sterile Bract		Pedicel Length		No. of Peduncle Width		Length		No. of side branches.	
	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.		
	middle basal length--width.--width.		middle basal length--width.--width.		Flowering basal--middle basal		sterile at base raceme, Peduncle-Raceme		below raceme, Peduncle-Raceme			
	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.		
<u>XASTROWORTHIA BICARINATA.</u>												
Baden-Baden R58	0.36	0.17	0.30	0.75	0.18	0.40	0.42	3	0.16	-	18.0	2b
	0.40	0.15	0.28	-	-	-	-	-	0.19	-	21.0	1b
	0.42	0.18	0.28	0.75	0.20	0.38	-	3	0.19	13.0	23.0	0
	0.45	0.20	0.29	0.60	0.18	0.28	0.62	3	0.20	18.0	18.0	1b3a
	0.45	-	0.30	0.70	-	0.43	-	5	0.22	18.0	17.0	3b
	0.47	-	0.30	0.70	-	0.60	-	4	0.24	27.0	-	
Rietvlei R50	0.43	-	0.30	0.40	-	0.35	-	3	0.22	14.0	14.0	2a
	0.45	-	0.43	0.60	-	0.38	-	3	0.24	15.0	13.0	2a
	0.45	0.10	0.30	0.60	0.13	0.38	-	4	0.23	21.0	26.0	1b
	0.49	0.18	0.40	0.83	0.07	0.63	-	4	0.26	27.0	18.0	2b
Misc. Garden Plants - No. 7262 K'bosch	0.70	0.23	0.50	0.85	0.20	0.65	-	3	0.32	25.0	16.0	0
	0.70	0.21	0.60	0.90	0.20	0.65	-	4	0.37	27.0	20.0	0
	0.72	-	0.47	0.90	-	0.46	-	3	0.34	19.0	20.0	1a
	0.73	0.20	0.43	1.00	0.23	0.70	-	3	0.25	25.0	-	1b
	0.75	0.15	0.45	0.80	0.20	0.50	-	3	0.30	21.0	21.0	3a
	0.81	0.15	0.44	1.05	0.16	0.59	-	4	0.35	20.0	18.0	0
	-	-	-	0.85	0.20	0.60	-	3	0.25	-	-	3b
	-	-	-	-	-	-	-	3	-	36.0	17.0	3a
Ex. B. Carp	0.33	0.17	0.38	0.60	0.13	0.45	-	3	0.21	25.0	8.0	2a
	0.35	0.16	0.40	0.60	0.15	0.45	-	4	0.27	19.0	4.0	3a
Ex. Karoo Gardens	0.24	0.10	0.30	0.47	0.10	0.35	-	5	0.30	12.0	18.0	0
	-	-	-	-	-	-	-	3	0.25	24.0	33.0	2a
Ex. H. Herre (3 Vaal Koppens ?)	0.43	0.12	0.33	0.53	0.10	0.45	-	3	0.25	30.0	15.0	2b1a
	0.45	0.13	0.35	0.75	0.15	0.50	-	2	0.20	33.0	14.0	1b
	0.55	-	0.35	0.70	-	0.40	-	4	0.21	17.0	12.0	2a
	0.55	-	0.30	0.90	-	0.30	-	4	0.20	25.0	-	2a

	PERIANTH TUBE		LOBES				GYNAECIUM		DIFFERENCE BETWEEN DIAMETER OF		ANGLE OF OPEN LOBES.			
	Length to Neck-Neck	Diameter	Length	Outer-Inner	Width	Length	Ovary-Style	middle and Neck	Base and Middle	Ant. Outer-Inner	Post. Inner-Outer-Lats.	Ant. Outer-Inner	Post. Inner-Outer-Lats.	
														cm.
*ASTROWORTHIA BICARINATA.														
Baden-Baden R58	0.90 .95	.27 .28	.20 .19	.20 .20	.15 .16	.20 .21	- -	- -	.07 .08	.10 .10	110° 70°	70° 60°	40° 40°	
Rietveld R50	1.13 .93 .87 .85	.29 .28 .26 .28	.20 .18 0.18 .20	.20 .19 .20 .22	.14 .15 .17 .16	.24 .21 .22 .21	.29 .38 - -	.33 .41 - -	.04 .02 .06 .05	.07 .05 .07 .07	70° 90° - -	50° 40° - -	50° 30° - -	
Misc. Garden Plants No. 7262 K'bosch	.94 .98 .91 .87 .86 .84 .82 .80 .79	.35 .35 .32 .35 .34 .34 .30 .32 .30	.20 .20 .23 .23 .23 .25 .20 .20 .16	.28 .25 .27 .25 .23 .25 .21 .21 .18	.20 .16 .15 .17 .16 .15 .17 .15 .15	.30 .30 .25 .31 .29 .31 .30 .25 .23	- - .37 .38 .36 .40 .37 .30 .37	- - .37 .32 .24 .30 .37 .26 .30	.12 .11 .05 .10 .07 .10 .03 .05 .02	.04 .05 .05 .00 .00 .04 .03 .01 .01	- - 125° 90° 90° 180° 90° 90° 140°	- - 90° 70° 70° 100° 90° 80° 80°	- - 70° 60° 60° 70° 45° 30° 55°	- - 40° 60° 60° 70° 30° 20° 30°
Ex. B. Carp.	.97 .72	.34 .36	.21 .22	.25 .23	.13 .17	.18 .25	.36 .49	.33 .44	.08 .04	.02 .07	100° 180°	40° 65°	50° 50°	30° 50°
Ex. H. Herre (3 Vaal Koppen)	1.05 .94 1.03 .93	.28 .29 .26 .25	.20 .18 .20 .20	.20 .18 .23 .20	.17 .15 .18 .16	.22 .18 .20 .20	.29 .37	.34 .23	.02 .04 .07 .05	.05 .06 .03 .05	90° 90° 60°	60° 60° 40°	65° 50° 30°	50° 40° 30°
Ex. Karoo Gdn's	1.06 .90	.34 .32	.25 .20	.25 .21	.15 .14	.19 .20	.39 -	.37 -	.10 .05	.04 .03	85° -	60° -	50° -	40° -

Appendix Table 9D DIMENSIONS OF PERIANTH IN ASTROWORTHIA BICARINATA

Plant	Length	Width	Depth	Volume	Weight	Number	Mean	Standard
<i>Haworthia margaritifera</i>	1.5	1.2	0.8	0.96	0.12	10	1.1	0.2
<i>Haworthia margaritifera</i>	1.8	1.5	1.0	1.35	0.15	10	1.4	0.2
<i>Haworthia margaritifera</i>	2.0	1.8	1.2	2.16	0.20	10	1.7	0.3
<i>Haworthia margaritifera</i>	2.2	2.0	1.4	2.88	0.25	10	1.9	0.3
<i>Haworthia margaritifera</i>	2.5	2.2	1.6	4.50	0.30	10	2.1	0.4
<i>Haworthia margaritifera</i>	2.8	2.4	1.8	6.05	0.35	10	2.3	0.4
<i>Haworthia margaritifera</i>	3.0	2.6	2.0	7.80	0.40	10	2.5	0.5
<i>Haworthia margaritifera</i>	3.2	2.8	2.2	9.86	0.45	10	2.7	0.5
<i>Haworthia margaritifera</i>	3.5	3.0	2.4	12.60	0.50	10	2.9	0.6
<i>Haworthia margaritifera</i>	3.8	3.2	2.6	15.46	0.55	10	3.1	0.6
<i>Haworthia margaritifera</i>	4.0	3.4	2.8	18.53	0.60	10	3.3	0.7
<i>Haworthia margaritifera</i>	4.2	3.6	3.0	21.60	0.65	10	3.5	0.7
<i>Haworthia margaritifera</i>	4.5	3.8	3.2	25.92	0.70	10	3.7	0.8
<i>Haworthia margaritifera</i>	4.8	4.0	3.4	31.10	0.75	10	3.9	0.8
<i>Haworthia margaritifera</i>	5.0	4.2	3.6	37.00	0.80	10	4.1	0.9
<i>Haworthia margaritifera</i>	5.2	4.4	3.8	43.26	0.85	10	4.3	0.9
<i>Haworthia margaritifera</i>	5.5	4.6	4.0	50.00	0.90	10	4.5	1.0
<i>Haworthia margaritifera</i>	5.8	4.8	4.2	57.17	0.95	10	4.7	1.0
<i>Haworthia margaritifera</i>	6.0	5.0	4.4	64.80	1.00	10	4.9	1.1
<i>Haworthia margaritifera</i>	6.2	5.2	4.6	72.88	1.05	10	5.1	1.1
<i>Haworthia margaritifera</i>	6.5	5.4	4.8	81.54	1.10	10	5.3	1.2
<i>Haworthia margaritifera</i>	6.8	5.6	5.0	90.72	1.15	10	5.5	1.2
<i>Haworthia margaritifera</i>	7.0	5.8	5.2	100.50	1.20	10	5.7	1.3
<i>Haworthia margaritifera</i>	7.2	6.0	5.4	110.88	1.25	10	5.9	1.3
<i>Haworthia margaritifera</i>	7.5	6.2	5.6	122.64	1.30	10	6.1	1.4
<i>Haworthia margaritifera</i>	7.8	6.4	5.8	134.96	1.35	10	6.3	1.4
<i>Haworthia margaritifera</i>	8.0	6.6	6.0	147.84	1.40	10	6.5	1.5
<i>Haworthia margaritifera</i>	8.2	6.8	6.2	161.28	1.45	10	6.7	1.5
<i>Haworthia margaritifera</i>	8.5	7.0	6.4	175.80	1.50	10	6.9	1.6
<i>Haworthia margaritifera</i>	8.8	7.2	6.6	191.36	1.55	10	7.1	1.6
<i>Haworthia margaritifera</i>	9.0	7.4	6.8	208.00	1.60	10	7.3	1.7
<i>Haworthia margaritifera</i>	9.2	7.6	7.0	225.76	1.65	10	7.5	1.7
<i>Haworthia margaritifera</i>	9.5	7.8	7.2	244.65	1.70	10	7.7	1.8
<i>Haworthia margaritifera</i>	9.8	8.0	7.4	264.72	1.75	10	7.9	1.8
<i>Haworthia margaritifera</i>	10.0	8.2	7.6	286.00	1.80	10	8.1	1.9

Appendix Table 9E. DIMENSIONS OF PERIANTH IN HAWORTHIA MARGARITIFERA.

nr. Montagu nr. Rawsonville	PERIANTH TUBE		LOBES				GYNAECIUM		DIFFERENCE BETWEEN DIAMETER OF		ANGLE OF OPEN LOBES.	
	Length cm.	Neck-Neck to cm.	Diameter cm.	Middle-Base cm.	Outer-Inner cm.	Length cm.	Width cm.	Length cm.	Middle and Neck cm.	Base and Middle cm.	Ant. Outer Lats.	Inner Lats.
	1.07	.20	.29	.43	.30	.31	.12	.17	.09	.14	180	60
	1.05	.29	.35	.46	.22	.29	.12	.20	.06	.11	185	60
	1.05	.30	.37	.47	.25	.27	.10	.20	.07	.10	180°	60
	1.03	.29	.34	.46	.21	.26	.10	.22	.05	.12	-	-

HAWORTHIA MARGARITIFERA.