Numerical taxonomic studies in the subtribe Ruschiinae (Mesembryanthemaceae) — *Astridia, Acrodon and Ebracteola*

H. F. GLEN*

**Keywords:** Acrodon, Astridia, Ebracteola, Mesembryanthemaceae, numerical taxonomy, Ruschiinae, southern Africa

**ABSTRACT**

A numerical taxonomic study of three genera of the Ruschiinae (Mesembryanthemaceae) is presented. Seven species are recognized in *Astridia*. Four species are recognized in *Acrodon* and two new combinations are made: *A. leptophyllus* (L. Bol.) Glen and *A. duplessiae* (L. Bol.) Glen. Five species are recognized in *Ebracteola* and two new combinations are made: *E. wilmaniae* (L. Bol.) Glen and *E. fullerii* (L. Bol.) Glen. This study is largely based on the cited herbarium material, and the characters used are mainly the following: dimensions of plants, leaves and internodes, number and dimensions of parts of flower and fruit, colour of petals, and colour, dimensions and surface structure of seeds.

**METHODS AND MATERIALS**

Both dried and living specimens, the latter mainly cultivated, were examined in the course of this study. For numerical processing, both scored and measured characters were recorded, and an Operational Taxonomic Unit (OTU) was defined as being equivalent to one micro-taxon as recognized by L. Bolus. As her stated aim (Bolus 1936–1958: iii) was to describe as much as possible of the variation in the specimens examined by her was negligible. Very few, if any, specimens not referable to any of her micro-taxa have been collected since her

---

* Botanical Research Institute, Department of Agriculture and Water Supply, Private Bag X101, Pretoria 0001, RSA.
Eighty-six characters were recorded; some of these were noted as minimum, mean and maximum and others as minimum and maximum without a mean, yielding a total of 121 character strings (Hall 1973), as listed in Table 1. A preliminary examination of a very incomplete portion of this matrix was made using the BOLAID package of programs for numerical taxonomy (Hall 1973); this was the basis for the taxonomic observations of Glen (1984). It was found to be financially unviable to continue processing data for the whole of the subtribe Ruschiinae (538 OTU’s) using BOLAID, so a cheaper and faster system was sought and found in NT-SYS (Rohlf et al. 1977). BOLAID was used on the Burroughs B7700 of the Department of Agriculture and Water Supply, while NT-SYS was made available by the CSIR on their CDC computer. The present account is derived from an examination of 103 OTU’s drawn from all genera recognized as belonging to the subtribe Ruschiinae.

### TABLE 1. — List of 86 characters used. Character strings (Str.):

<table>
<thead>
<tr>
<th>No.</th>
<th>Str.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3 1</td>
<td>Leaf length (greater leaf of a pair)</td>
</tr>
<tr>
<td>2</td>
<td>3 2</td>
<td>Leaf breadth (greater leaf of a pair)</td>
</tr>
<tr>
<td>3</td>
<td>3 3</td>
<td>Leaf thickness (greater leaf of a pair)</td>
</tr>
<tr>
<td>4</td>
<td>3 4</td>
<td>Leaf length (lesser leaf of a pair)</td>
</tr>
<tr>
<td>5</td>
<td>3 5</td>
<td>Leaf breadth (lesser leaf of a pair)</td>
</tr>
<tr>
<td>6</td>
<td>3 6</td>
<td>Leaf depth (lesser leaf of a pair)</td>
</tr>
<tr>
<td>7</td>
<td>1 7</td>
<td>Plant height</td>
</tr>
<tr>
<td>8</td>
<td>1 8</td>
<td>Plant diam.</td>
</tr>
<tr>
<td>9</td>
<td>2 9</td>
<td>Flower colour (betacyanin)</td>
</tr>
<tr>
<td>10</td>
<td>2 10</td>
<td>Flower colour (betaxanthin)</td>
</tr>
<tr>
<td>11</td>
<td>1 11</td>
<td>no. of bracts</td>
</tr>
<tr>
<td>12</td>
<td>1 12</td>
<td>no. of sepals</td>
</tr>
<tr>
<td>13</td>
<td>1 13</td>
<td>no. of petals</td>
</tr>
<tr>
<td>14</td>
<td>2 14</td>
<td>no. of stamens</td>
</tr>
<tr>
<td>15</td>
<td>2 15</td>
<td>no. of staminodes</td>
</tr>
<tr>
<td>16</td>
<td>1 16</td>
<td>no. of stigmas</td>
</tr>
<tr>
<td>17</td>
<td>1 17</td>
<td>max. length of bracts</td>
</tr>
<tr>
<td>18</td>
<td>1 18</td>
<td>max. width of bracts</td>
</tr>
<tr>
<td>19</td>
<td>1 19</td>
<td>max. length of outer sepals</td>
</tr>
<tr>
<td>20</td>
<td>1 20</td>
<td>max. width of outer sepals</td>
</tr>
<tr>
<td>21</td>
<td>1 21</td>
<td>max. length of inner sepals</td>
</tr>
<tr>
<td>22</td>
<td>1 22</td>
<td>max. width of inner sepals</td>
</tr>
<tr>
<td>23</td>
<td>3 23</td>
<td>length of petals</td>
</tr>
<tr>
<td>24</td>
<td>1 24</td>
<td>max. width of petals</td>
</tr>
<tr>
<td>25</td>
<td>3 25</td>
<td>length of stamens</td>
</tr>
<tr>
<td>26</td>
<td>3 26</td>
<td>length of staminodes</td>
</tr>
<tr>
<td>27</td>
<td>3 27</td>
<td>length of stigmas</td>
</tr>
<tr>
<td>28</td>
<td>1 28</td>
<td>length of pedicel</td>
</tr>
<tr>
<td>29</td>
<td>1 29</td>
<td>diam. of pedicel</td>
</tr>
<tr>
<td>30</td>
<td>1 30</td>
<td>diam. of flower</td>
</tr>
<tr>
<td>31</td>
<td>1 31</td>
<td>diam. of capsule</td>
</tr>
<tr>
<td>32</td>
<td>1 32</td>
<td>length of capsule</td>
</tr>
<tr>
<td>33</td>
<td>1 33</td>
<td>± no. of flowers per inflorescence</td>
</tr>
<tr>
<td>34</td>
<td>1 34</td>
<td>width of central discolor stripe in petals (0 if no stripe)</td>
</tr>
<tr>
<td>35</td>
<td>2 35</td>
<td>stripe colour (betacyanin)</td>
</tr>
<tr>
<td>36</td>
<td>2 36</td>
<td>stripe colour (betaxanthin)</td>
</tr>
<tr>
<td>37</td>
<td>1 37</td>
<td>no. of locules per capsule</td>
</tr>
<tr>
<td>38</td>
<td>1 38</td>
<td>extent of covering membrane</td>
</tr>
<tr>
<td>39</td>
<td>1 39</td>
<td>length of covering membrane</td>
</tr>
<tr>
<td>40</td>
<td>1 40</td>
<td>width of covering membrane</td>
</tr>
<tr>
<td>41</td>
<td>1 41</td>
<td>length of valve wings</td>
</tr>
<tr>
<td>42</td>
<td>1 42</td>
<td>width of valve wings</td>
</tr>
<tr>
<td>43</td>
<td>1 43</td>
<td>radial diam. of placental tubercle</td>
</tr>
<tr>
<td>44</td>
<td>1 44</td>
<td>extent to which expanding-keels diverge</td>
</tr>
<tr>
<td>45</td>
<td>1 45</td>
<td>extent of fringe on expanding-keels</td>
</tr>
<tr>
<td>46</td>
<td>1 46</td>
<td>length of internodes</td>
</tr>
<tr>
<td>47</td>
<td>1 47</td>
<td>stem diam.</td>
</tr>
<tr>
<td>48</td>
<td>1 48</td>
<td>length of leaf decurrence on stem</td>
</tr>
<tr>
<td>49</td>
<td>1 49</td>
<td>length of leaf apiculus</td>
</tr>
<tr>
<td>50</td>
<td>1 50</td>
<td>amount of leaf wax (arbitrary scale)</td>
</tr>
<tr>
<td>51</td>
<td>1 51</td>
<td>% specimens flowering in Jan.</td>
</tr>
<tr>
<td>52</td>
<td>1 52</td>
<td>% specimens flowering in Feb.</td>
</tr>
<tr>
<td>53</td>
<td>1 53</td>
<td>% specimens flowering in Mar.</td>
</tr>
<tr>
<td>54</td>
<td>1 54</td>
<td>% specimens flowering in April</td>
</tr>
<tr>
<td>55</td>
<td>1 55</td>
<td>% specimens flowering in May</td>
</tr>
<tr>
<td>56</td>
<td>1 56</td>
<td>% specimens flowering in June</td>
</tr>
<tr>
<td>57</td>
<td>1 57</td>
<td>% specimens flowering in July</td>
</tr>
<tr>
<td>58</td>
<td>1 58</td>
<td>% specimens flowering in Aug.</td>
</tr>
<tr>
<td>59</td>
<td>1 59</td>
<td>% specimens flowering in Sept.</td>
</tr>
<tr>
<td>60</td>
<td>1 60</td>
<td>% specimens flowering in Oct.</td>
</tr>
<tr>
<td>61</td>
<td>1 61</td>
<td>% specimens flowering in Nov.</td>
</tr>
<tr>
<td>62</td>
<td>1 62</td>
<td>% specimens flowering in Dec.</td>
</tr>
<tr>
<td>63</td>
<td>1 63</td>
<td>length of seed</td>
</tr>
<tr>
<td>64</td>
<td>3 64</td>
<td>width of seed</td>
</tr>
<tr>
<td>65</td>
<td>3 65</td>
<td>thickness of seed</td>
</tr>
<tr>
<td>66</td>
<td>1 66</td>
<td>seed colour (red scale)</td>
</tr>
<tr>
<td>67</td>
<td>1 67</td>
<td>seed colour (yellow scale)</td>
</tr>
<tr>
<td>68</td>
<td>1 68</td>
<td>seed colour (grey scale)</td>
</tr>
<tr>
<td>69</td>
<td>1 69</td>
<td>length of micropylar region</td>
</tr>
<tr>
<td>70</td>
<td>1 70</td>
<td>baculae length, embryo region</td>
</tr>
<tr>
<td>71</td>
<td>1 71</td>
<td>baculae height, micropylar region</td>
</tr>
<tr>
<td>72</td>
<td>1 72</td>
<td>baculae length, embryo region</td>
</tr>
<tr>
<td>73</td>
<td>1 73</td>
<td>baculae length, micropylar region</td>
</tr>
<tr>
<td>74</td>
<td>1 74</td>
<td>baculae width, embryo region</td>
</tr>
<tr>
<td>75</td>
<td>1 75</td>
<td>baculae width, micropylar region</td>
</tr>
<tr>
<td>76</td>
<td>1 76</td>
<td>baculae spacing, embryo region</td>
</tr>
<tr>
<td>77</td>
<td>1 77</td>
<td>baculae spacing, micropylar region</td>
</tr>
<tr>
<td>78</td>
<td>1 78</td>
<td>baculae, boundary line irregularity, embryo region</td>
</tr>
<tr>
<td>79</td>
<td>1 79</td>
<td>baculae, boundary line irregularity, micropylar region</td>
</tr>
<tr>
<td>80</td>
<td>1 80</td>
<td>microbacular height</td>
</tr>
<tr>
<td>81</td>
<td>1 81</td>
<td>microbacular length</td>
</tr>
<tr>
<td>82</td>
<td>1 82</td>
<td>microbacular width</td>
</tr>
<tr>
<td>83</td>
<td>1 83</td>
<td>microbacular spacing</td>
</tr>
<tr>
<td>84</td>
<td>1 84</td>
<td>no. of teeth per leaf</td>
</tr>
<tr>
<td>85</td>
<td>1 85</td>
<td>extent of separation between valve &amp; valve wings (capsule)</td>
</tr>
<tr>
<td>86</td>
<td>1 86</td>
<td>chromosome no.</td>
</tr>
</tbody>
</table>

The first step in processing the data with NT-SYS was to standardize the raw matrix so that each character had a mean of zero and a standard deviation of one. The standardized data matrix was then used for further processing, thus ensuring that all characters would be strictly equally weighted in later computations. A matrix of correlations was calculated according to an algorithm described by Rohlf et al. in the NT-SYS manual. An ‘average taxonomic distance’ matrix, giving a measure of the dissimilarity between pairs of OTU’s, was calculated according to the algorithm of Sokal (1961). This gives, in effect, a normalized matrix of Euclidean distances between pairs of OTU’s. Finally, NT-SYS calculated cophenetic matrices and dendrograms for both distance and correlation matrices using UPGMA (unweighted pair-group method with arithmetic averages; Sneath & Sokal 1973). The dendrograms are referred to below as distance and correlation phenograms, respectively.

The classification and circumscriptions of taxa presented here were derived from both distance and correlation phenograms, with constant reference back to the original specimens.
In the specimen citations below, the following abbreviations, which are not found in Index Herbariorum (Holmgren et al. 1981), indicate garden accession numbers:

KG – Karoo Garden, Worcester
NBG – National Botanical Garden, Kirstenbosch. Used where the number is of the form <accession number>/<date>, e.g. 1234/56 is no. 1234 of 1956
SUG — Stellenbosch University Garden

All other abbreviations in the specimen citations indicate herbaria and are according to Index Herbariorum.

1. ASTRIDIA

The genus is a very natural and cohesive group of species, not only very similar in appearance but also confined to a small area in the lower reaches of the Orange River.

In habit, Astridia Dinter is very similar to Ruschia and Stoeberia, all three of which occur in the same area. Ruschia and Stoeberia differ markedly from Astridia in having small (±10 mm in diameter) white flowers rather than large showy ones, in having capsules showing varying degrees of schizocarpy rather than the hygrochastic capsules of Astridia, and non-baculate seeds with well differentiated embryo and micropylar regions (see Figure 1). Astridia can be separated from species of Ruschia of similar habit by its flower size, bracts, stamens, seed surfaces, and by the leaf surface, which is glabrous in Ruschia but velutinous in Astridia. In addition, the flowers of Astridia are solitary, whereas those of Ruschia are typically borne in large, repeatedly branched cymes. The overall appearance of plants of the genus Astridia is so distinctive that they are unlikely to be confused with any other group of Mesembryanthemaceae.

Dinter (1926) published the new combination Astridia velutina Dinter for the plant which he had named Mesembryanthemum velutinum Dinter (non L. Bol.), but he gave only a very brief description of his new genus. Schwantes (1927) supplied an amended generic description in the following year, and recognized a second species, A. maxima (Haw.) Schwant., based on M. maximum Haw. The distinguishing characters of the new genus were stated to be the seeds, which appeared to be covered with hollow spines, and the overall form of the plants.

N. E. Brown (1928) noted that although no distinguishing characters could readily be found for the genus, plants were so distinctive in overall appearance that the genus was possibly a good one. He also noted that the seed character mentioned by

![FIGURE 1. — SEM photographs of seeds of A. Astridia velutina; B. Ruschia maxima; C. Stoeberia beetzii; D. Braunsia geminata. Scale bar= 100μm.](image-url)
Schwantes was not unique in Mesembryanthemaceae. Bolus (1961b) noted a number of relatively subtle characters by which Astridia can be distinguished from Ruschia and other genera. These include:

1. the manner of attachment of the leaves to the stem (in Ruschia old leaves may be broken off complete, but in Astridia a portion of leaf base always adheres to the stem);
2. the form of the bracts (cymbiform in Astridia but semi terete to triquetrous in Ruschia);
3. the ciliate inner stamens of Astridia, as opposed to the glabrous stamens of Ruschia.

Bolus admitted the possibility that any or all of these characters may be found in the genus Ruschia, but the combination of all three, together with the growth habit, appears to define a natural group.

Friedrich (1970) distinguished between Astridia and species of Ruschia of similar habit by

1. the large flowers of Astridia (± 50 mm in diameter when open in Astridia; ± 20 mm in Ruschia);
2. the form of the bracts (cymbiform in Astridia; semiterete to triquetrous in Ruschia);
3. the stigmas, which are always six in Astridia and usually five in Ruschia (this difference is not as significant as it may seem at first sight: carpel numbers are variable throughout the Mesembryanthemaceae, and this variability increases in proportion to the usual number of carpels).

Friedrich was the first to suggest that too many taxa had been described in the genus, and he recognized six species and no infraspecific taxa in SWA/Namibia.

The seed character, used by Schwantes in the original delimitation of the genus, is best seen in the type species, A. velutina, where long, spine-like baculae cover the entire surface of the seed (Figure 1A). These characteristic baculae are not generally as well developed in the other species of the genus, and may be restricted to the micropylar region of the seed, the surface of the cells of the embryo region of such seeds being in the form of low, roughly conical baculae (Figure 4A–D). As Brown (1928) has pointed out, this character is not unique to Astridia, being present, and in fact better developed, in Braunsia (see Figure 1), Antegibbaeum and possibly other genera.

On the south bank of the Orange River, the genus is found in the Richtersveld, in Acocks’s (1975) Western Mountain Karoo, Succulent Karoo and Namaqualand Broken Veld, in an area no more than 100 km × 100 km; on the north bank, it is restricted to a hardly larger area of Giess’s (1971) ‘Desert and succulent steppe (winter rainfall area)’.

The seed character, used by Schwantes in the original delimitation of the genus, is best seen in the type species, A. velutina, where long, spine-like baculae cover the entire surface of the seed (Figure 1A). These characteristic baculae are not generally as well developed in the other species of the genus, and may be restricted to the micropylar region of the seed, the surface of the cells of the embryo region of such seeds being in the form of low, roughly conical baculae (Figure 4A–D). As Brown (1928) has pointed out, this character is not unique to Astridia, being present, and in fact better developed, in Braunsia (see Figure 1), Antegibbaeum and possibly other genera.

On the south bank of the Orange River, the genus is found in the Richtersveld, in Acocks’s (1975) Western Mountain Karoo, Succulent Karoo and Namaqualand Broken Veld, in an area no more than 100 km × 100 km; on the north bank, it is restricted to a hardly larger area of Giess’s (1971) ‘Desert and succulent steppe (winter rainfall area)’.

The seed character, used by Schwantes in the original delimitation of the genus, is best seen in the type species, A. velutina, where long, spine-like baculae cover the entire surface of the seed (Figure 1A). These characteristic baculae are not generally as well developed in the other species of the genus, and may be restricted to the micropylar region of the seed, the surface of the cells of the embryo region of such seeds being in the form of low, roughly conical baculae (Figure 4A–D). As Brown (1928) has pointed out, this character is not unique to Astridia, being present, and in fact better developed, in Braunsia (see Figure 1), Antegibbaeum and possibly other genera.

The seed character, used by Schwantes in the original delimitation of the genus, is best seen in the type species, A. velutina, where long, spine-like baculae cover the entire surface of the seed (Figure 1A). These characteristic baculae are not generally as well developed in the other species of the genus, and may be restricted to the micropylar region of the seed, the surface of the cells of the embryo region of such seeds being in the form of low, roughly conical baculae (Figure 4A–D). As Brown (1928) has pointed out, this character is not unique to Astridia, being present, and in fact better developed, in Braunsia (see Figure 1), Antegibbaeum and possibly other genera.

The seed character, used by Schwantes in the original delimitation of the genus, is best seen in the type species, A. velutina, where long, spine-like baculae cover the entire surface of the seed (Figure 1A). These characteristic baculae are not generally as well developed in the other species of the genus, and may be restricted to the micropylar region of the seed, the surface of the cells of the embryo region of such seeds being in the form of low, roughly conical baculae (Figure 4A–D). As Brown (1928) has pointed out, this character is not unique to Astridia, being present, and in fact better developed, in Braunsia (see Figure 1), Antegibbaeum and possibly other genera.

The seed character, used by Schwantes in the original delimitation of the genus, is best seen in the type species, A. velutina, where long, spine-like baculae cover the entire surface of the seed (Figure 1A). These characteristic baculae are not generally as well developed in the other species of the genus, and may be restricted to the micropylar region of the seed, the surface of the cells of the embryo region of such seeds being in the form of low, roughly conical baculae (Figure 4A–D). As Brown (1928) has pointed out, this character is not unique to Astridia, being present, and in fact better developed, in Braunsia (see Figure 1), Antegibbaeum and possibly other genera.

The seed character, used by Schwantes in the original delimitation of the genus, is best seen in the type species, A. velutina, where long, spine-like baculae cover the entire surface of the seed (Figure 1A). These characteristic baculae are not generally as well developed in the other species of the genus, and may be restricted to the micropylar region of the seed, the surface of the cells of the embryo region of such seeds being in the form of low, roughly conical baculae (Figure 4A–D). As Brown (1928) has pointed out, this character is not unique to Astridia, being present, and in fact better developed, in Braunsia (see Figure 1), Antegibbaeum and possibly other genera.

The seed character, used by Schwantes in the original delimitation of the genus, is best seen in the type species, A. velutina, where long, spine-like baculae cover the entire surface of the seed (Figure 1A). These characteristic baculae are not generally as well developed in the other species of the genus, and may be restricted to the micropylar region of the seed, the surface of the cells of the embryo region of such seeds being in the form of low, roughly conical baculae (Figure 4A–D). As Brown (1928) has pointed out, this character is not unique to Astridia, being present, and in fact better developed, in Braunsia (see Figure 1), Antegibbaeum and possibly other genera.

The seed character, used by Schwantes in the original delimitation of the genus, is best seen in the type species, A. velutina, where long, spine-like baculae cover the entire surface of the seed (Figure 1A). These characteristic baculae are not generally as well developed in the other species of the genus, and may be restricted to the micropylar region of the seed, the surface of the cells of the embryo region of such seeds being in the form of low, roughly conical baculae (Figure 4A–D). As Brown (1928) has pointed out, this character is not unique to Astridia, being present, and in fact better developed, in Braunsia (see Figure 1), Antegibbaeum and possibly other genera.

The seed character, used by Schwantes in the original delimitation of the genus, is best seen in the type species, A. velutina, where long, spine-like baculae cover the entire surface of the seed (Figure 1A). These characteristic baculae are not generally as well developed in the other species of the genus, and may be restricted to the micropylar region of the seed, the surface of the cells of the embryo region of such seeds being in the form of low, roughly conical baculae (Figure 4A–D). As Brown (1928) has pointed out, this character is not unique to Astridia, being present, and in fact better developed, in Braunsia (see Figure 1), Antegibbaeum and possibly other genera.

The seed character, used by Schwantes in the original delimitation of the genus, is best seen in the type species, A. velutina, where long, spine-like baculae cover the entire surface of the seed (Figure 1A). These characteristic baculae are not generally as well developed in the other species of the genus, and may be restricted to the micropylar region of the seed, the surface of the cells of the embryo region of such seeds being in the form of low, roughly conical baculae (Figure 4A–D). As Brown (1928) has pointed out, this character is not unique to Astridia, being present, and in fact better developed, in Braunsia (see Figure 1), Antegibbaeum and possibly other genera.

The seed character, used by Schwantes in the original delimitation of the genus, is best seen in the type species, A. velutina, where long, spine-like baculae cover the entire surface of the seed (Figure 1A). These characteristic baculae are not generally as well developed in the other species of the genus, and may be restricted to the micropylar region of the seed, the surface of the cells of the embryo region of such seeds being in the form of low, roughly conical baculae (Figure 4A–D). As Brown (1928) has pointed out, this character is not unique to Astridia, being present, and in fact better developed, in Braunsia (see Figure 1), Antegibbaeum and possibly other genera.
Bothalia 16,2 (1986) 207

FIGURE 3. — Phenogram of Astridia calculated from a correlation matrix using UPGMA. Irrelevant OTU’s are omitted.


Robust, erect, woody shrubs. Leaves opposite, succulent, not toothed, velutinous, obscurely triquetrous, usually grey, blue-grey or glaucous green, usually firmly attached and not falling readily. Flowers solitary, on relatively short pedicels or subsessile, the pedicels each with a pair of relatively small, distinctively boat-shaped bracts which tend to remain attached to the plant on drying. Sepals 6, in two series, the outer 2 fleshy, the inner 4 less so, and with membranous margins. Petals 40 or more, in 1 to many series, lorate, narrowly oblanceolate or narrowly obovate, apices obtuse, white to pale yellow, orange-red or scarlet. Staminodes present or absent.

Stamens numerous, inner filaments densely ciliate. Stigmas 6, subulate to filiform. Capsules 6-locular; covering membranes well developed; valve wings absent or awn-like; placental tubercles present; expanding keels diverging, unadorned. Seeds various shades of maroon to black, with long, spine-like bacularia at least on the micropylar region.

KEY TO THE SPECIES OF ASTRIDIA


A. velutina Dinter & Schwant. var. lutata L. Bol.: 95 (1928-1935; published 1929). A. dinteri L. Bol. var. lutata L. Bol. ex Jacobsen: 413 (1974), nom. nov. pro A. velutina var. lutata. Type: Cape, between Arris and Sendelingsdrift, October 1926. Pillans 5725 (BOL!).


A. hillii L. Bol.: 301 (1962b); L. Bol.: 172 (1965); Jacobsen: 413 (1974). Type: Cape, Grootderm, August 1956. L. J. Hill s.n. in BOL 27253 (BOL!).

Robust shrubs 200–300 mm tall. Stems pale buff to dark brown when young; internodes ± 15 × 4 mm. Leaves minutely velutinous, 15–34 mm long, obscurely keeled, 7–14 mm wide and slightly less thick. Pedicel ± 7 × 2.5 mm. Bracts up to 12 mm long and 6 mm thick. Flowers ± 30 mm in diameter when open. Sepals 6, outer pair up to 7 × 6 mm, inner 4 up to 7 × 5 mm. Petals 40–70 in 1–2 series, white to pink, 12–23 × up to 3 mm, but often narrower. Stamens present, 2–10 mm long, distinct from petals. Staminodes many; filaments 6–9 (–11) mm long. Stigmas subulate to filiform, shorter than longest stamens, 4–8 mm long. Capsule dark grey, broadly obconical, ± 11.5 mm in diameter when closed and 8.5 mm long; valve wings absent; placental tubercles large, radial diameter 1.2 mm. Seeds pale yellow to dark brown, echinate, 1.1–1.5 (–1.85) × 0.7–1.3 × 0.5–1.2 mm, micropylar region 0.3–0.5 mm long; baculae very prominent; microbaculae long but variable.

Voucher specimens:

SWA NAMIBIA — 2715 (Bogenfels): Sargdeckel (–BC/BD) Dinter 3792 (B, Z).

CAPE. — 2816 (Oranjemund): between Arris and Sendelingsdrift (–BD), Pillans 5725 (BOL, K); Grootderm (–DA), L. J. Hill s.n. in BOL 27253 (BOL); Wisura 626 (NBG), 2817 (Vioolsdrift): Dolomite Peaks (–CA), Wisura 1588 (NBG).

The name Mesembryanthemum velutinum Dinter (1923) is a later homonym of M. velutinum L. Bol. (1922), and is therefore invalid in Mesembryanthemum. However, there is no earlier homonym of the combination Astridia velutina Dinter & Schwant., with Mesembryanthemum velutinum Dinter non L. Bol. as basionym, nor is there any earlier name for this species. According to Art. 72 note 1 of the Rules of Botanical Nomenclature, this combination must be accepted. For this reason, the name Astridia dinteri L. Bol. was superfluous when published and is to be rejected as illegitimate (Art. 63.1).

It will be seen from the scatter diagram in Figure 5 that the various entities included in this species cannot be distinguished on the basis of their leaves. The same is true for all other characters examined, and so several previously-accepted names, as listed in the synonymy above, must become synonyms of A. velutina.

The combination of white to pink flowers, short pedicels (even of the capsules) and relatively short, wide leaves distinguishes this species from all others in the genus. Although the flowers fall rapidly, the fruits stay on their pedicels for up to two years, and so may be used for diagnostic purposes at any season. The distribution of this species is shown in Figure 6.
Robust shrubs 200–300 mm tall. Stems pale buff to dark brown when young, internodes ± 26 × 4.5 mm. Leaves minutely velutinous, 17–55 (–96) mm long, strongly keeled, ± 4–8 (–15) mm wide, 5–10 (–20) mm thick, sheathing stem for 3–5.5 mm. Pedicel ± 9 × 4 mm. Bracts up to 21 mm long and 12.5 mm thick. Flower 45–50 mm in diameter when open. Sepals 6, outer pair up to 17 × 9 mm, inner 4 up to 9.5 × 7.5 mm. Petals 50–90 in 1–several series, white to scarlet red, 14–31 × up to 4 mm. Staminodes few to many, 6.5–13 mm long, distinct from petals. Stamens many; filaments 2.5–12.5 mm long. Stigmas subulate to filiform, shorter or longer than longest stamens, 2–10 (–15) mm long. Capsule dark grey, broadly obconical, ± 12.5 mm in diameter when closed and 9.5 mm long; valve wings present or absent, if present then awn-like; placental tubercles large, radial diameter ± 1.1 mm. Seeds deep maroon, echinate, 0.9–1.45 × (0.65–) 0.85–1.05 × 0.7–0.9 (–1.0) mm, micropylar region 0.3–0.55 mm long; baculae prominent, usually more so on the embryo region; microbaculae long to very long, roughly cylindrical. Chromosome number 2n=18 (De Vos 1947).

Voucher specimens:

CAPE. — 2816 (Oranjemund): Swartpoort (–BB), H. Hall s.n. in NBG 107a/58 (BOL); between Sendelingsdrift and Doornpoort (–BB), Pillans 5830 (BOL, K); 6 miles south of Sendelingsdrift (–BB). Wisura 677 (NBG).

The scatter diagram in Figure 7 shows that the seven formerly accepted taxa included here can not be distinguished by their leaves; this also applies to their seeds. The same lack of distinction extends to other characters examined, and so the previously accepted names listed in the synonymy above must be regarded as synonyms of A. longifolia.

This, the commonest species in the genus, may be distinguished from all others by the long, relatively narrow leaves, which are distinctly narrowed at the
base, and the relatively long pedicels supporting the large, usually red but rarely white flowers and charcoal-grey capsules. The distribution of this species is shown in Figure 8.

FIGURE 7. — Leaf measurements of plants included in Astridia longifolia.

FIGURE 8. — Distribution of Astridia longifolia. ▲; and Acrodon parvifolius. ●


Robust shrubs ± 400 mm tall and 400 mm in diameter. Stems pale grey, with internodes about 15 × 6–7 mm when young. Leaves grey to pinkish, 31–51 × 6–10,5 mm and as deep as wide, digitiform to subfalcate, obscurely keeled, sheathing the stem for about 8 mm. Pedicel ± 10 × 4 mm. Bracts up to 13 mm long and 6,5 mm thick. Flower ± 50 mm in diameter when open. Sepals 6, outer 2 up to 9,5 × 8 mm, inner 4 up to 8 × 5 mm. Petals many in about 6 series, magenta to scarlet red, 22–26 × up to 3 mm, innermost petals merging with staminodes. Stamnodes (7,5–) 9–13 mm long. Stamens many; filaments 5–12 mm long; anthers and pollen pale yellow. Stigmas narrowly subulate, 5–6 mm long. Capsule broadly obconical, ± 12,5 mm in diameter when closed and 9 mm long; valve wings absent; placental tubercles large, radial diameter ± 1,3 mm; expanding keels slightly diverging, not fimbriate. Seeds deep maroon, 1,1–1,3 × 0,85–1,00 × 0,70–0,90 mm, micropylar region 0,35–0,45 mm long; baculae prominent, those on embryo region somewhat more so than those on micropylar region; microbaculae very long, rod-shaped and conspicuous. Chromosome number 2n=18 (Albers & Haas 1978).

Voucher specimens:

CAPE. — 2816 (Oranjemund); Annisfontein (BD), Herre s.n. in SUG 14693 (BOL); Cornellskop (BD), Wisura 1579 (NBG).

The relatively short internodes sheathed by the leaves for half their length, and the long narrow leaves distinguish this species from others of the genus. The distribution of this species is shown in Figure 9.

FIGURE 9. — Distribution of Astridia herrei, ▲; and Acrodon duplessiae. ●


Robust shrubs 300–400 mm tall. Stems pale buff to dark brown when young; internodes ± 20 × 5.5 mm. Leaves minutely velutinous. 30–55 (~70) mm long, strongly keeled, 11–19 mm thick. Pedicel up to 19 mm long and 10 mm thick. Flower ± 50 mm in diameter when open. Sepals 6, outer pair up to 12 × 8 mm, inner 4 up to 11 × 7 mm. Petals ± 50 in 1–2 series, white to yellow, 18–23 × up to 3 mm. Staminodes present, 6–9 mm long, distinct from petals. Stamens many; filaments 4–9 mm long. Stigmas subulate to filiform, shorter or longer than longest stamens, 8.5–11 mm long. Capsule dark grey, broadly obconical, ±11.5 mm in diameter when closed and 10 mm long; valve wings absent; placental tubercles small, radial diameter 0.5 mm. Seeds deep maroon, echinate, 1,1–1,4 × 0.75–1.05 × 0.5–0.9 mm, micropylar region 0.3–0.55 mm long; baculae prominent, more so on micropylar region than embryo region; microbaculae large, elliptical-conical.

Voucher specimens:

SWA/NAMIBIA. — 2816 (Oranjemund): Rooiplepel (-BA). Hardy 4826 (PRE); Lorelei (-BB), Giess, Volk & Bleissner 5421 (WIND).

The yellow colour of the flowers in this species is unique in the genus. Other distinguishing characters are the combination of wide and deep leaves relative to their length, relatively long pedicels and long capsules. The distribution of this species is shown in Figure 10.

![FIGURE 10. — Distribution of Astridia citrina, ●; A. speciosa, ○; Acrodon leptophyllus, ▲; and Ebracteola wilmaniae, ◆.](image)


Shrublets ± 200 mm tall and in diameter. Branches with internodes ± 25 × 5 mm when young. Leaves velvety, 20–63 mm long, 7–22 mm wide and thick, obscurely keeled, sheathing stem for ± 5 mm. Pedicels very short. Bracts up to 13 mm long and 8 mm thick. Flowers ± 70 mm in diameter when open. Sepals 6, outer pair up to 9 × 6.5 mm, inner 4 up to 8 × 4 mm. Petals many, red-orange, (23–) 25–33 × up to 3.5 mm, grading into staminodes. Staminodes 11–12 mm long. Stamens very many; filaments 5.5–9 mm long; anthers and pollen golden. Stigmas filiform, (9–) 10–11 mm long, overtopping stamens. Capsule and seeds not seen.

Voucher specimens:

SWA/NAMIBIA. — 2816 (Oranjemund): north of Sendelingsdrift (-BB). H. Hall 1869 = NBG 175:60 (BOL); Kahans Mine (-DD), Rusch sub Ditte 8594 (B).

The flowers of this species are the largest and showiest in the genus. Like A. vanheerdei, to which it is very similar, it may be distinguished from A. longifolia by its subsessile flowers (and, presumably, capsules). It is similar to A. longifolia and different from A. vanheerdei in the narrowing of the leaf bases and the presence of staminodes. These three species are very close, and still more detailed studies may show that they are all one species. The distribution of this species is shown in Figure 10.

1.6 Astridia hallii L. Bol., Notes on Mesembryanthemum and allied genera 3; 298 (1958); Jacobsen: 413 (1974). Type: SWA/Namibia, Lorelei opposite Sendelingsdrift, July 1955, H. Hall s.n. in NBG 489:55 (BOL!).


Robust shrubs 200–300 mm tall. Stems pale buff when young; internodes ± 30 mm long and 8 mm in diameter. Leaves glaucous, triquetrous, keeled, 42–78 (~118) mm long, (~4–) 14–20 mm wide and thick, minutely velutinous. Sheathing stem for ± 7 mm. Pedicels ± 13 × 4 mm. Bracts up to 24 mm long and 11 mm thick. Flower ± 60 mm in diameter when open. Sepals 6, outer pair up to 13 × 12 mm, inner 4 up to 10 × 6 mm. Petals ± 70, white or rarely pale pink, 22–36.5 × up to 3 mm. Staminodes absent. Stamens many, 3.5–11 mm long. Capsule broadly obconical, ± 13.5 mm in diameter when closed and 9.5 mm long; covering membranes present, covering most of interior; valve wings present or absent, if present then long and awn-like; placental tubercles large, radial diameter ± 1.4 mm; expanding keels slightly to widely diverging. Seeds medium brown to dark maroon, 0.95–1.5 × 0.7–1.0 × 0.5–0.9 mm, micropylar region 0.3–0.55 mm long; baculae prominent, more so on embryo region than on micropyte; microbaculae conspicuous, long, cylindrical to elliptical.

Voucher specimens:


As will be seen from the scatter diagram in Figure 11, Astridia ruschii is quite indistinguishable from A. hallii in leaf characters. The same is true for all other characters examined. These two names must therefore be regarded as referring to the same species.
The relatively wide leaves, long pedicels and broad, shallow capsules distinguish this species from all others. The distribution of this species is shown in Figure 12.


Robust shrubs ± 200 mm tall. Stems pale buff when young; internodes ± 27 mm long and 5 mm in diameter. Leaves glaucous, triquetrous, keeled, 38–57 (–65) mm long, 10–13 (–14.5) mm wide and 16–21 (–23) mm thick, minutely velutinous, sheathing stem for ± 7 mm. Pedicels very short. Bracts up to 17 mm long and 8.5 mm thick. Flowers ± 50 mm in diameter when open. Sepals 6, outer pair up to 12 × 8 mm, inner 4 up to 10 × 6 mm. Petals ± 70, magenta-red, 19–20 × up to 2 mm. Staminodes absent. Stamens many, 4–9 mm long. Stigmas filiform, 6–7 mm long. Capsule and seeds not seen.

Voucher specimen:
CAPE. — 2816 (Oranjemund): between Annisfontein and Bloeddrift (–BD), P. van Heerden s. n. in NBG 251/62 (BOL!).

This species differs from A. longifolia in the relatively broad leaf-bases, the subsessile flowers and the absence of staminodes. The first of these characters distinguishes it from A. speciosa, as do the laterally compressed leaves and the absence of staminodes. The distribution of this species is shown in Figure 13.

This species is known only from the type specimen, and so must be regarded as the rarest and least-known member of this genus.

Excluded species
Astridia maxima (Haw.) Schwant. in Zeitschrift für Sukkulentenkunde 3: 16 (1927). This is based on Mesembryanthemum maximum Haw., and is correctly called Ruschia maxima (Haw.) L. Bol.

2. ACRODON

Acrodon N.E. Br. is a genus of four rather similar-looking species of dwarf habit. Two of these species have, until now, been included in Ruschia, and the arrangement of specimens in BOL indicates that L. Bolus and her co-workers were in some doubt as to whether these two genera should be retained or merged into one. Ruschia is regarded here as a genus of typically shrubby plants, most of which have flowers in cymose inflorescences. Only in the section Uncinata does one find plants in which the leaf keel is toothed; these plants are shrubs with leaves decurrent on the internodes, and flowers with petals of uniform colour, often arranged in five 'fascicles'.

FIGURE 11. — Leaf measurements of plants included in Astridia hallii.

FIGURE 12. — Distribution of Astridia hallii, ▲: and Ebracteola fulleri. ●

The leaves of *Acrodon* are longer and wider than those of *Ruschia* section *Uncinata*, and dark green rather than greyish. The flowers of *Acrodon* are solitary, and the petals are evenly spaced. They are characterized by a central longitudinal stripe of a darker colour than the rest of the petal. *Acrodon* is therefore among the more distinctive genera in the family Mesembryanthemaceae.

It may be distinguished from *Ruschia* section *Uncinata* not only on morphological but also on geographical grounds. *Ruschia* section *Uncinata* is characteristically found in the upper Karoo and SWA/Namibia, with outlying species in the Orange Free State and western Transvaal, while *Acrodon* is restricted to the southern Cape and Little Karoo, in Acocks's (1975) Fynbos, Coastal Rhenosterbosveld, Coastal Macchia, Succulent Mountain Scrub and Karroid Broken Veld types.

Plants of this small genus were among the first highly succulent members of the family Mesembryanthemaceae to become known in Europe. *Acrodon bellidiflorus* was well known in England (Bradley 1717; Dillenius 1731) and the Netherlands (Linnaeus 1738; Van Royen 1740) early in the eighteenth century. It appears that this species was introduced into cultivation, at least in England and Germany, as early as the end of the seventeenth century, as the first descriptions of it date from 1700 (Plucanet 1717; Dillenius 1731) and the Netherlands (Linnaeus 1738; Van Royen 1740) early in the eighteenth century. It seems that this species was introduced into cultivation, at least in England and Germany, as early as the end of the seventeenth century, as the first descriptions of it date from 1700 (Plucanet 1717; Dillenius 1731) and the Netherlands (Linnaeus 1738; Van Royen 1740) early in the eighteenth century. It seems that this species was introduced into cultivation, at least in England and Germany, as early as the end of the seventeenth century, as the first descriptions of it date from 1700 (Plucanet 1717; Dillenius 1731) and the Netherlands (Linnaeus 1738; Van Royen 1740) early in the eighteenth century. It seems that this species was introduced into cultivation, at least in England and Germany, as early as the end of the seventeenth century, as the first descriptions of it date from 1700 (Plucanet 1717; Dillenius 1731) and the Netherlands (Linnaeus 1738; Van Royen 1740) early in the eighteenth century. It seems that this species was introduced into cultivation, at least in England and Germany, as early as the end of the seventeenth century, as the first descriptions of it date from 1700 (Plucanet 1717; Dillenius 1731) and the Netherlands (Linnaeus 1738; Van Royen 1740) early in the eighteenth century. It seems that this species was introduced into cultivation, at least in England and Germany, as early as the end of the seventeenth century, as the first descriptions of it date from 1700 (Plucanet 1717; Dillenius 1731) and the Netherlands (Linnaeus 1738; Van Royen 1740) early in the eighteenth century. It seems that this species was introduced into cultivation, at least in England and Germany, as early as the end of the seventeenth century, as the first descriptions of it date from 1700 (Plucanet 1717; Dillenius 1731) and the Netherlands (Linnaeus 1738; Van Royen 1740) early in the eighteenth century. It seems that this species was introduced into cultivation, at least in England and Germany, as early as the end of the seventeenth century, as the first descriptions of it date from 1700 (Plucanet 1717; Dillenius 1731) and the Netherlands (Linnaeus 1738; Van Royen 1740) early in the eighteenth century. It seems that this species was introduced into cultivation, at least in England and Germany, as early as the end of the seventeenth century, as the first descriptions of it date from 1700 (Plucanet 1717; Dillenius 1731) and the Netherlands (Linnaeus 1738; Van Royen 1740) early in the eighteenth century.
2.1 Acrodon bellidiflorus (L.) N. E. Br. in Gardeners' Chronicle, series 3, 81: 12 (1927); Jacobsen: 404 (1974).

Mesembryanthemum bellidiflorum L.: 484 (1753); DC.: 424 (1828); Salm Dyck: § 12: t. 1 (1836-63; published 1840). Iconotype: Mesembryanthemum bellidiflorum Dill.: 244 t. 189 fig. 233 (1731).


M. bellidiflorum L. var. simplex DC.: t. 41 (1798-1837; published 1799). Type not cited.

M. bellidiflorum L. var. viride Haw.: 106 (1821); DC.: 424 (1828); Salm Dyck: § 12: t. 1B (1836-63; published 1840); Berger: 221 (1908). Type not cited.

Ruschia longifolia L. Bol.: 500 (1928-35; published 1935); Jacobsen: 556 (1974). Type: Cape, Huis River Pass, November 1933. Herre s.n. in SUG 10234 (BOL!).

Pre-Linnaean citations:

Ficoides africana mesembrianthemum triquetro folio, flore albo, parvo. polyanthos, Plukenet: 77 (1700); Ray: 364 n. 2 (1704).

Ficoides africana humilis, folio triangulari breviori nonnihil spinoso seu denticulato, Volckamer: 166 (1700). Ficoides seu ficus aizoides africana folio triangulari crasso brevi glauco ad tres margines aculeata. Boerhaave 1: 290 n. 21 (1720).

Dwarf succulents; internodes hidden by leaf bases. Leaves bright green, triquetrous, not compressed, 14-54 (-80) mm long, 2-8 (-10) mm wide and thick, with a number of small teeth on apical end of keel. Pedicels ± 38 × 1.5 mm, with a pair of bracts near base, these leaf-like, up to 22 mm long and 4.5 mm thick. Flowers ± 35 mm in diameter when open. Sepals 5, in two series, outer pair narrowly deltoid, up to 12 × 8 mm, inner 3 broadly deltoid to almost rectangular, up to 8 × 6 mm. Petals ± 40-60, 2-seriate, white or pale pink with a central magenta stripe and magenta margins and apices, these usually obtuse, 7-19 × up to 3 mm. Staminodes usually absent, if present then 4-5,2 mm long, white with pink apices, sharply distinct from petals. Stamina numerous; filaments 1-6 mm long, papillate at base, innermost filaments papillate in lower half; anthers magenta; pollen white. Stigmas 5, broadly subulate, 1-4 mm long. Capsule 9 × ± 11 mm; covering membrane covering most of interior; valve-wings present or absent, when present awn-like; placental tubercles large, radial diameter 1-1.5 mm; expanding keels narrowly diverging or almost parallel, fringed with small papillae or unadorned. Seeds dark maroon, 0.96-1.55 × 0.81-1.14 × 0.49-1.07 mm, micropylar region 0.32-0.67 mm long; baculae hemispherical-cylindrical, well spaced, almost as well developed on micropylar region as on embryo region;

FIGURE 16. — SEM photographs of seeds of A. Acrodon bellidiflorus; B. A. parvifolius; C. A. duplessiae; D. A. leptophyllus. Scale bar=100μm.

Voucher specimens:

A. bellidiflorus differs from A. parvifolius in that the former species grows in small tufts of long leaves and has large flowers and relatively larger fruits. A. parvifolius grows in large mats with trailing stems bearing short, wide leaves, small flowers and relatively small fruits. The leaves of A. duplessiae have marginal teeth, are glaucous green and are dorsally compressed, while those of A. bellidiflorus have teeth only on the keel, and are bright green and sym-
metrical in transverse section. Capsules of *A. duplessiae* are generally slightly broader in relation to their depth than those of *A. bellidiflorus*, and seeds are smaller and darker in colour. *A. leptophyllus* also has glaucous leaves, but these tend to be longer than those of *A. bellidiflorus*. The capsules of *A. leptophyllus* are significantly longer relative to their diameter than those of *A. bellidiflorus*.

No individual character or group of characters can be used to distinguish between specimens hitherto assigned to *A. bellidiflorus*, *A. subulatus* and *Ruschia longifolia* (cf. Figure 20). It is therefore necessary to regard these three names and their nomenclatural synonyms as referring to the same species, the correct name being *A. bellidiflorus*. The distribution of this species is shown in Figure 6.


![Graphs and diagrams showing measurements of *Acrodon* species](image-url)
Creeping, succulent-leaved herbs forming mats up to 1 m in diameter. Stems with internodes not completely hidden by leaf bases; young internodes, when visible, pale brown and shiny. Leaves bright green to olive green, reddish brown at apices, laterally compressed, sharply triquetrous. 13-17.5 mm long, 2-3 (4) mm wide and 2.5-5 mm thick, with a few small teeth on keel at apex. Pedicels ± 14 mm long and slightly over 1 mm in diameter, with a pair of leaf-like bracts at base. Flowers opening about midday, small for genus, 17-20 mm in diameter when open. Sepals 5, in two series, outer pair up to 5 x 4 mm, inner 3 up to 4 x 3 mm. Petals ± 35, white to pink, with a central longitudinal pink to magenta stripe and magenta margins, 6-8 x 1 mm. Staminodes few, sharply distinct from petals, white with pink apices, 3.5-4.5 mm long. Stamens in several series: filaments papillate at base or in lower half, pink, 2-3 mm long; anthers deep purple; pollen pink. Stigmas subulate, pink. Capsule 5 x ± 8.5 mm; covering membranes covering most of the interior; valve wings awn-like; placental tubercles small, radial diameter ± 0.8 mm; expanding keels almost parallel, unadorned. Seeds deep brown. 0.7-0.9 (-1.0) x 0.6-0.7 x 0.45-0.65 mm. Pollen pink.

Stigmas pillate in lower half; anthers magenta; pollen white. Stamens in two series, outer pair narrowly deltoid, up to 12 x 7.5 mm. inner 3 broadly deltoid to almost rectangular, up to 9.5 x 7.5 mm. Petals 5, broadly subulate, 1-3.5 mm long. Flowers ± 35 mm in diameter when open. Sepals in two series, outer pair narrowly deltoid, up to 12 x 7.5 mm, inner 3 broadly deltoid to almost rectangular, up to 9.5 x 7.5 mm. Petals ± 45, 3-seriate, white or pale pink with a central magenta stripe and magenta margins and apices, these usually emarginate, rarely obtuse, 11.5-13 x 3 mm. Staminodes absent. Stamens numerous; filaments pink, 2.5-5.5 mm long, papillate at base, innermost filaments papillate in lower half; anthers magenta; pollen white. Stigmas broadly subulate, 1-3.5 mm long. Capsule 11 x ± 12 mm; covering membranes covering most of interior; valve-wings awn-like; placental tubercles large, radial diameter 1.4 mm; expanding keels widely diverging, fringed with small papillae. Seeds very dark maroon to black, 0.9-1.2 x 0.61-0.73 (-0.80) x 0.53-0.65 (-0.71) mm. Micropylar region 0.34-0.47 mm long; baculae large, hemispherical-cylindrical, well spaced, almost as well developed on micropylar region as on embryo region; microbacculae rod-shaped, conspicuous.

Voucher specimen:

Differences between A. duplessiae on the one hand and A. bellidiflora and A. parvifolia on the other are discussed under those species. Leaves of A. duplessiae are generally much broader and slightly shorter than those of A. leptophylla; they also have marginal teeth, which are lacking in the latter species. In A. duplessiae the petals are somewhat longer than in A. leptophylla, and the capsules are shallower in relation to their diameter. Distribution of this species is shown in Figure 9.

2.4 Acrodon leptophyllus (L. Bol.) Glen, comb. nov.


Dwarf succulents; internodes hidden by leaf bases. Leaves glaucous green, triquetrous, dorsally flattened, laterally or not compressed, 15-75 (-102) mm long, 2.2-9.8 (-12.5) mm wide and half to twice as thick, with a number of small teeth on apical end of keel. Pedicels ± 34 x 2 mm, with a pair of bracts near base, these leaf-like, up to 27 mm long and 5 mm thick. Flowers ± 30 mm in diameter when open. Sepals 5, in two series, outer pair narrowly deltoid, up to 12 x 7.5 mm, inner 3 broadly deltoid to almost rectangular, up to 9.5 x 7.5 mm. Petals 45-60, 2-seriate, white or pale pink with a central magenta stripe and magenta margins and apices, these usually emarginate, rarely obtuse, 8-17 x ± 2 mm. Staminodes usually absent, if present then (2-) 3-5 mm long, distinct from petals, white with pink apices. Stamens numerous; filaments pink, (1.5-) 2.5-5.5 mm long, papillate at base, innermost filaments papillate in lower half; anthers magenta; pollen white. Stigmas broadly subulate, 1.3-5.5 mm long. Capsule 11 x ± 12 mm; covering membranes covering almost all of interior; valve-wings awn-like, rarely absent; placental tubercles large, radial diameter 1.5 mm; expanding keels almost parallel, fringed with small papillae or unadorned. Seeds maroon to black, 1.00-1.50 x 0.84-1.10 x 0.75-0.97 (-1.04) mm. Micropylar region 0.39-0.68 mm long; baculae hemispherical-cylindrical, well spaced, almost as well de-
veloped on micropylar region as on embryo region; microbaculae rod-shaped, conspicuous.

Voucher specimens:

Differences between this species and others in the genus are discussed above, under the species concerned. Distribution of this species is shown in Figure 10.

The name 'Ruschia leptophylla' was published in a fascicle of Notes on Mesembryanthemum and allied genera dated 29th January 1932, while the fascicle in which the name 'R. macrophylla' was published is dated 24th June 1932. The reason for choosing the epithet leptophylla rather than macrophylla for this species, therefore, rests on consideration of a priority of about six months.

The only difference between plants identified as Ruschia macrophylla and those previously called R. leptophylla and R. compressa is in the ratio of leaf thickness to leaf length, and even in this character there is a small degree of overlap (Figure 21). In all other measured characters the overlap is complete (see, for example, Figures 18 & 19), and the states of 'multi-state' characters are the same for all the taxa included in the present species. For this reason the taxa united here are not retained as separate species.

3. EBRACTEOLA

This genus comprises five remarkably similar-looking species. They are readily distinguished from most genera in the subtribe Ruschiinae by their dwarf habit, leaves without teeth and petals without longitudinal stripes, and from most Mesembryanthemaceae of dwarf habit by their thickened, woody rootstocks. The whitish colour of the seeds and the absence of bracts are useful accessory characters but do not appear in all species of Ebracteola.

The first species of Ebracteola Dinter & Schwant. to become known was described under the name Mesembryanthemum wilmaniae from near Kimberley (Bolus 1916). This was followed by M. montis-moltkei from the other extremity of the range of this genus, near Windhoek (Dinter 1922), M. derenbergianum in the following year (Dinter 1923), Ruschia fullerii a few years later (Bolus 1929) and finally, after a thirty-year interval, Ebracteola candida (Bolus 1961a). The genus was first described to accommodate M. montis-moltkei and M. derenbergianum (Dinter & Schwantes 1927).

Apart from Friedrich's (1970) study of the SWA/Namibian material, no critical study of the genus has been published until now. Three species of the genus were examined in the course of a study of the subtribe Lampranthinae (Glen 1978), but the only conclusion to be drawn at that time was that Ebracteola was not a member of that subtribe, and was probably better placed in the subtribe Ruschiinae.

The generic name refers to the absence of bracts in most specimens of these two species, with a diminutive ending to indicate the dwarf habit of plants of this genus.

The phenograms used to generate the classification presented here are shown in Figures 22 & 23. The great similarity between the different species of Ebracteola is shown graphically by the scatter diagrams in Figures 24–26. From these it can be seen that the species are difficult to separate reliably on the basis of character pairs plotted on scatter diagrams, but that multivariate methods using as many characters as possible together, not just two at a time, distinguish more certainly between very close species.

The protologue of the genus does not indicate which of the two first-accepted species was to be
taken as the type of the genus. The choice of *E. montis-moltkei* (Dinter) Dinter & Schwant. was made by Von Poellnitz (1933: 40), without any reason being given. This choice must necessarily be followed, but it may be pointed out that the other species placed in their new genus by Dinter & Schwantes, *E. derenbergiana* (Dinter) Dinter & Schwant., was alone transferred from *Ebracteola* to *Ruschia* by Bolus (in Jacobsen 1955) and Weber (1968).

The species here transferred to *Ebracteola* from *Ruschia*, namely *E. wilmaniae* and *E. fulleri*, are dwarf cushion-forming succulents with essentially semiterete leaves, although forms of *E. wilmaniae* with sharply triquetrous leaves are known. They also have solitary flowers which are very similar to each other and to other species previously included in *Ebracteola*. These characters are rare in the *Ruschiinae*, and so these species were found to be closer to other species classified under *Ebracteola* than to any species of *Ruschia*, regardless of which measure of similarity was used. For this reason they are transferred from *Ruschia* to *Ebracteola*.

**FIGURE 22.** — Phenogram of *Ebracteola* calculated from a distance matrix using UPGMA. Irrelevant OTU's are omitted.

**FIGURE 23.** — Phenogram of *Ebracteola* calculated from a correlation matrix using UPGMA. Irrelevant OTU's are omitted.

**FIGURE 24.** — Leaf measurements of all species of *Ebracteola*.
FIGURE 25. — Capsule measurements of all species of *Ebracteola*.

FIGURE 26. — Seed measurements of all species of *Ebracteola*. 

Dwarf clump-forming succulents with strongly enlarged, caudiciform rootstocks and internodes completely hidden by leaf bases. *Leaves* elongate, triquetrous to terete, without teeth, glabrous, apple-green to glaucous, yellowish or reddish. *Flowers* usually solitary, rarely ternate; pedicels with 2 bracts, or bracts absent. *Sepals* 5, in two series, outer pair fleshy, inner 3 slightly smaller, with membranous margins. *Petals* ± 25–60, in 1–2 series, lorate, narrowly oblanceolate or narrowly obovate. *Staminodes* present. *Stamens* many, erect. *Stigmas* 5, subulate. *Capsules* turbinate, grey, woody, 5-locular; covering membranes well developed; valve wings absent or if present then awn-like to wing-like; placental tubercles usually present, rarely absent. *Seeds* small, cream to maroon, with distinct baculae. Figure 27.

![Figure 27](image-url)
3.1 Ebracteola wilmaniae (L. Bol.) Glen, comb. nov.


Dwarf clump-forming succulents with strongly enlarged, caudiciform rootstocks and internodes completely hidden by leaf bases. **Leaves** glaucous-green, triquetrous to semiterete, 9–39 (–60) × 2–5 (–7,5) mm, narrowing towards apices, these often reddish. **Pedicels** ± 10 × 1,7 mm, with a pair of leaf-like bracts, these up to 13,5 mm long and 4 mm thick. **Flowers** ± 30 mm in diameter when open. **Sepals** 5, outer pair up to 10 × 5 mm, inner 3 up to 8 × 4 mm. **Petals** pink to white, 30–50 in 1–2 series, 10–17,5 x 3–8 mm long, white with pink apices. **Stamens** many; filaments 1–4 mm long and 1 mm thick, slightly diverging, conspicuously fringed. **Filaments** ± 12 mm long and 1 mm in diameter, with a pair of small bracts, these up to 4,5 mm long and 1 mm thick, otherwise similar to leaves. **Flowers** 25–30 mm in diameter when open. **Sepals** 5, outer pair up to 7 mm long and 3,5 mm wide at base, inner 3 up to 6 mm long and 4 mm wide at base. **Petals** pink to white, ± 40 in 1–2 series, 12–18 mm long and up to 2 mm wide. 

**KEY TO THE SPECIES OF EBRACTEOLA**

1a Leaves sharply triquetrous:

2a Flowers ± 30 mm in diameter; capsules 8–9 mm in diameter and 6–7 mm long; bracts present; petals white to pale pink; plants found in the northern Cape and western Transvaal. .......... 1. **E. wilmaniae**

2b Flowers ± 25 mm in diameter; capsules 6–7 mm in diameter and 4–5 mm long; bracts absent; petals bright magenta-pink; plants found in SWA/Namibia (Windhoek District). .............. 5. **E. montis-moltkei**

3a Bracts absent; flowers ± 20 mm in diameter; petals bright pink. .......... 4. **E. derenbergiana**

3b Bracts present; flowers 25–30 mm in diameter; petals white to pale pink:

4a Bracts scale-like, not over 5 mm long; leaves 13–28 mm long, 2–4 mm wide and thick; petals pale pink. .......... 2. **E. fullerii**

4b Bracts leaf-like, 8 mm long or longer; leaves 9–60 mm long, 2–7,5 mm wide and thick; petals white to pale pink:

5a Flowers often ternate; found in SWA/Namibia (Lüderitz District); leaves thicker than wide. ............................................ 3. **E. candida**

5b Flowers solitary; found in the northern Cape and western Transvaal; leaves wider than thick or equally wide and thick. .................................. 1. **E. wilmaniae**

**3.2 Ebracteola fullerii** (L. Bol.) Glen, comb. nov.

**Ruschia fullerii** L. Bol.: 159 (1928–1935; published 1929); Jacobsen: 552 (1974). Type: Cape, Pella, August 1929, **Fuller 48** (BOL).

Dwarf clump-forming succulents with strongly enlarged, caudiciform rootstocks and internodes completely hidden by leaf bases. **Leaves** glaucous green, semiterete to terete, (13–) 15–28 mm long, 2–4 mm in diameter, narrowing towards apices, these often reddish. **Pedicels** ± 12 mm long and 1 mm in diameter, with a pair of small bracts, these up to 4,5 mm long and 1 mm thick, otherwise similar to leaves. **Flowers** 25–30 mm in diameter when open. **Sepals** 5, outer pair up to 7 mm long and 3,5 mm wide at base, inner 3 up to 6 mm long and 4 mm wide at base. **Petals** pink to white, ± 40 in 1–2 series, 12–18 mm long and up to 2 mm wide. **Stamens** few, sharply distinct from petals, 3,5–6 mm long, white with pink apices. **Stigmas** ± 30; filaments 1–4 mm long. **Capsule** subulate, 3.5–4 mm long, slightly longer than stamens. **Capsule** turbinate, grey, 5,5 × 7 mm; covering membranes covering almost all of interior; valve wings absent; placental tubercles small, radial diameter ± 0,8 mm; expanding keels slightly diverging, conspicuously fringed. **Seeds** whitish, 0,69–0,82 × 0,52–0,63 × 0,41–0,53 mm; micropylar region (0,23–) 0,25–0,33 mm long; baculae distinct, almost flat; microbaculae small.

**Voucher specimens:**

SWA/NAMIBIA. — 2616 (AUS): Aus (–CB), **Ernst 235** (BOL).


**Ebracteola fullerii** is widely distributed in the lower Orange River Valley and along the edge of the Na-
mib Desert. Its distribution range extends from Aus through Vioolsdrift to Kakamas (see Figure 12).

The leaves of this species are semiterete to terete, distinguishing it from *E. montis-moltkei* and some forms of *E. wilmaniae*. The presence of small bracts distinguishes the present species from *E. derenbergiana*, in which bracts are absent, and from *E. candida* and semiterete-leaved forms of *E. wilmaniae*, both of which species have large, almost leaf-like bracts. Its distribution range also distinguishes this species from all other members of the genus.


Dwarf clump-forming succulents with enlarged, caudiciform rootstocks and internodes completely hidden by leaves. *Leaves* glaucous-green, semiterete to obscurely triquetrous, 33–42 (–47,5) mm long, 4–6 (–7) mm wide and 5–8 (–9) mm thick. *Flowers* often ternate, otherwise solitary. *Pedicels* ± 12,5 × 1,5 mm, with a pair of leaf-like bracts up to 22,5 mm long and 4 mm thick. *Flowers* ± 25 mm in diameter when open. *Sepals* 5, outer pair up to 10 × 5 mm, inner 3 up to 8 × 4 mm. *Petals* white, ± 50, 12–19 × up to 2 mm. *Staminodes* many, white, 3,5–7 mm long. * Stamens* many; filaments 2,5–5,5 mm long. *Stigmas* subulate, 3–4,5 mm long, roughly equal in length to stamens. Capsule not seen. *Seeds* whitish, 0,80–0,97 × 0,63–0,71 × 0,55–0,67 mm, micropylar region 0,31–0,41 mm long; baculae low but distinct; microbaculae small to moderate in size.

Voucher specimens:


Plants of this species with ternate flowers are distinguished from all other species in the genus by this character. The presence of bracts on the pedicel distinguishes this species from *E. derenbergiana* and *E. montis-moltkei*. The much greater size of the bracts distinguishes this species from *E. fulleri*. The relatively broader, slightly laterally compressed leaves and the distribution range (Figure 28) distinguish *E. candida* from *E. wilmaniae*.


*M. derenbergianum* Dinter var. *interioris* Dinter: 105 (1928), nom. nud.

Dwarf clump-forming succulents with strongly enlarged, caudiciform rootstocks and internodes completely hidden by leaf bases. *Leaves* glaucous green, semiterete to terete, 10–39 (–48) × 2,5–7 mm, nar­rowing towards apices, these often reddish. *Pedicels* ± 10 × 2 mm, without bracts. *Flowers* ± 20 mm in diameter when open. *Sepals* 5, outer pair up to 9,5 × 4,5 mm, inner 3 up to 7,5 × 4 mm. *Petals* magenta, 50–60 in 1–2 series, 10–15 up to 1,5 mm. *Staminodes* present, sharply distinct from petals, (4–) 5–7 mm long, white with pink apices. *Stamens* many; filaments 2,5–5,5 mm long. *Stigmas* subulate, 2–3 mm long, shorter than stamens. *Capsule* turbinate, grey, 6 × 8 mm; covering membranes covering most of interior; valve wings present, awn-like; placental tubercles large, radial diameter ± 1,2 mm; expanding keels slightly diverging, unadorned. *Seeds* yellowish brown, 0,60–0,89 × 0,48–0,68 × 0,33–0,53 mm, micropylar region (0,17–) 0,21–0,31 mm long; baculae distinct, almost flat; microbaculae small.

Voucher specimens:


Friedrich (1970) cites only one of the Dinter specimens in full, merely noting that four other specimens from different localities were cited in the protologue. This may be regarded as being equivalent to the choice of a lectotype, and to the extent that it is, the choice is followed here. The Berlin sheet is cited as holo-lectotype, as it was annotated by Friedrich, while the SAM sheet was not so annotated.

The semiterete to terete, rather than sharply triquetrous leaves distinguish this species from *E. montis-moltkei*. Other useful characters include the much thicker pedicels, narrower petals of generally deeper magenta colour, staminodes which do not merge into petals, and conspicuous placental tubercles in the capsules. The absence of bracts and different distribution range (Figure 28) distinguish this species from *E. fulleri* and *E. wilmaniae*. Differences between *E. derenbergiana* and *E. candida* are discussed under the latter species.

Dwarf clump-forming succulents with strongly enlarged, caudiciform rootstocks and internodes completely hidden by leaf bases. Leaves glaucous green, sharply triquetrous, 12-41 mm long, 2-7 (-9) mm thick, often somewhat thicker than wide, narrowing towards apices, these often reddish. Pedicels ±7,5 ±1,3 mm, without bracts. Flowers 15-30 mm in diameter when open. Sepals 5, the outer pair up to 11 ±5 mm, inner 3 up to 9 ±4 mm. Petals magenta to white, 25-60 in 1-2 series, (6-)8-14 ± up to 2 mm. Stamens many, merging into petals, 2,5-7,5 mm long, white with pink apices. Staminodes ±35-75; filaments 2-4 (-6) mm long. Stigmas ±0,14-0,19-0,31 mm long, shorter or longer than stamens. Capsule turbinate, grey, 5 ±7 mm; covering membranes covering most of interior; valve wings present, aawn-like to wing-like; placental tubercles absent or small, radial diameter ±0,8 mm; expanding keels slightly to moderately diverging, fringed. Seeds whitish to maroon, 0,48-0,60 (0,84) ±0,35-0,47 ±0,45-0,51 (-0,60) mm, micropylar region (0,14-) 0,19-0,31 mm long; baeculae distinct, almost flat; microbaeculae large.

Voucher specimens:

SWA Namibia. — 2217 (Windhoek): Ruschberg (-CA). Dinter 2641 (B), Dinter 3515 (HBG); Moltkeblick (-CB), Dinter 3509 (BA, SAM); Giess 11511 (WIND). 2317 (Naukas): Klein Aub (-DC), Giess 8792 (WIND).

Again, the Dinter specimens cited as holo-synotypes above are those annotated by Friedrich.

The absence of bracts in this species and widely separated distribution ranges separate *E. montis-moltkei* on the one hand from *E. fulleri* and *E. wilmanniae* on the other. The sharply triquetrous leaves provide another useful character distinguishing this species from *E. fulleri*, while the staminodes merging into petals serve to distinguish *E. montis-moltkei* from *E. wilmanniae*. Differences between this species and others of the genus not mentioned above are discussed under those species. The distribution of this species is shown in Figure 13.

**Acknowledgements**

The curators of the following herbaria are thanked for facilities made available to the author as a visitor, and for the loan of material: B. BOL, G. J. K. M. NBG, S. SAM, WIND and Z. Part of this work was done while at Kew as South African Liaison Officer; the Director and staff of the Royal Botanic Gardens, Kew are thanked for every kind of assistance and encouragement, and especially for SEM facilities. I should like to thank Mr D. S. Hardy, Dr O. A. Leistner and Mr E. J. van Jaarsveld for helpful comment and suggestions made while this paper was in draft.

REFERENCES


Bergeranthus derenbergianus (Dinter) Schwant., 223
candida L. Bol., 223
derenbergiana (Dinter) Dinter & Schwant., 223
tulleri (L. Bol.) Glen, 222
montis-moltkei (Dinter) Dinter & Schwant., 223
vallis-pacis Dinter, 223
wilmaniae (L. Bol.) Glen, 222
Lampranthus ruber (L. Bol.) L. Bol., 209
Mesembryanthemum
bellidiflorum L., 214

var. glaucescens Haw., 214
var. simplex DC., 214
var. subulatum (Mill.) Haw., 214
var. viride Haw., 214
derenbergianum Dinter, 223
var. interioris Dinter, 223
longifolium L. Bol., 209
montis-moltkei Dinter, 224
renniei L. Bol., 224
rubrum L. Bol., 209
subulatum Mill., 214
velutinum Dinter, 207
vermeuleniae L. Bol., 222
wilmaniae L. Bol., 222
Ruschia
constricta L. Bol., 217
derenbergiana (Dinter) L. Bol.
nom. invalid., 223
derenbergiana (Dinter) C. Weber, 223
duplessiae L. Bol., 217
fulleri L. Bol., 222
leptophylla L. Bol., 217
longifolia L. Bol., 214
longifolia (L. Bol.) L. Bol., 209
macrophylla L. Bol., 217
renniei (L. Bol.) Schwant. ex Jacobsen, 224
rubra (L. Bol.) L. Bol., 209
wilmaniae (L. Bol.) L. Bol., 222
var. angustifolia L. Bol., 222
var. vermeuleniae (L. Bol.) L. Bol., 222