Bothalia 28,1: 67–82 (1998)

New combinations in *Antimima* (Ruschioideae, Aizoaceae) from southern Africa

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Keywords: Aizoaceae, *Antimima*, new combinations, *Ruschia*, Ruschioideae, southern Africa

ABSTRACT

As a consequence of the emended description of *Antimima* N.E.Br. by Dehn (1989) and based on extensive comparison of all types of the genera *Antimima* and *Ruschia* Schwantes, and on studies of about 250 fresh collections of *Antimima*, 95 species are tranferred to that genus from *Ruschia*. The arguments for this step, and brief diagnoses of the 100 known species of *Antimima* are given. One species is excluded.

INTRODUCTION

Brown (1930) described the genus *Antimima* with a single species, *A. dualis* (N.E.Br.) N.E.Br.—this species was first named *Mesembryanthemum duale* N.E.Br. (Brown 1920) and was transferred to the genus *Argyroderma* N.E.Br. (Brown 1922), based on similarities of leaf morphology and the light greyish white colouring of the leaves. When, after 18 years of cultivation of the plant, Brown saw a flower and realized that the species was not a member of the genus *Argyroderma* since it lacked the hypanthium characteristic of that genus (Figure 1 A, B).

The species had meanwhile also been described as *Ruschia dualis* L.Bolus (1929), but based on a different type. This name has been used for about 60 years, implying that the genus *Antimima* was a synonym of *Ruschia* Schwantes.

In the course of his studies in the Ruschiinae, Dehn (1989) found that not only *Antimima dualis* but also ± 100 species formerly in the genus *Ruschia* differed so markedly from typical forms of the latter genus, that he re-established the genus *Antimima*. He distinguished five subgenera and made four new combinations: *A. alborubra* (L.Bolus) Dehn, *A. longipes* (L.Bolus) Dehn, *A. microphylla* (Haw.) Dehn, and *A. virgata* (Haw.) Dehn. Later, *Antimima hantamensis* (Engl.) H.E.K. Hartmann & Stüber (1993) and *A. aurasensis* H.E.K. Hartmann (1996) were added.

In a comprehensive survey covering all species of the Aizoaceae, material of types of all species in *Ruschia* and fresh material of ± 250 collections of *Antimima* was examined. As a result, 95 species are here transferred to *Antimima*. With *A. virgata* transferred back to *Ruschia*, based on comparisons of fruits and the type, *Antimima* at present comprises 100 species.

The subdivision of the genus into subgenera will have to be dealt with on a much broader basis. M. Dehn (pers. comm. 1992) noticed that the circumscriptions of the subgenera need reconsideration, in the light of data which must be derived from extensive studies in flowers and leaves, especially heterophylly and Alicean morphology of the epidermis. Features of flowers and leaf anatomy are therefore given sporadically in this treatment, due to lack of data for complete comparisons.

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MS. received: 1997-09-03.

CRITERIA FOR INCLUSION OF SPECIES IN *ANTIMIMA*

Fruit

As demonstrated by Dehn (1989: 199), typical fruits of *Antimima* possess very large closing bodies filling and blocking the distal exit of the locule completely, i.e. no seeds can be expelled through this opening (Figure 1 C, F–H). In contrast, fruits of *Ruschia* have small, hook-shaped closing bodies which never form a complete blockage or barrier for the seeds.

In addition, expanding keels in fruits of *Antimima* are broad and laciniate, diverging distinctly in a ± radial direction and reaching almost to the tip of the valve (Figure 1C, H). In *Ruschia*, the expanding keels are typically shorter and are spread into an almost tangential direction, visible in the open capsule on the valve. Due to these structural differences, fruits of *Antimima* normally open completely (Figure 1F), the valves often even recurving below the horizontal plane, whereas capsules of most species of *Ruschia* open their valves into an erect position only.

Covering membranes possess additional closing devices at their distal ends in both genera in principle. In fruits of *Ruschia* these devices appear mostly in the shape of closing rodlets, rarely as closing ledges or closing bulges. Closing rodlets can also occur in *Antimima*, but in this genus closing ledges (Figure 1C, F) or the lack of any additional closing devices are more common (Figure 1G, H). The last-mentioned condition is absent in *Ruschia*.

In seven species of *Antimima*, the covering membranes possess radial wings (Figure 1G, H) or other protrusions on top, clearly visible in younger fruits. Similar features have been found in genera like *Cheiridopsis* N.E.Br., but never in typical fruits of *Ruschia*.

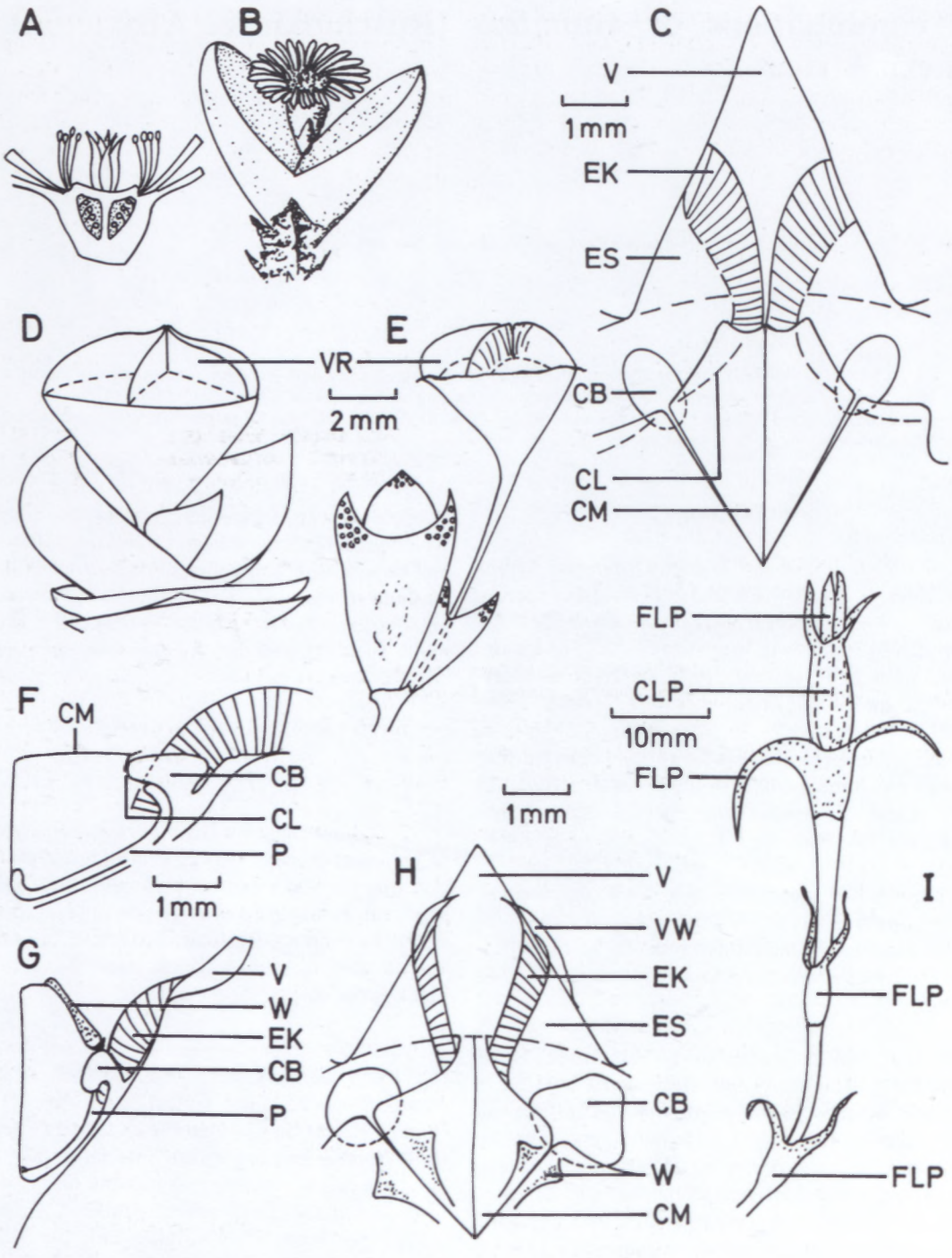

FIGURE 1.—A–D, *Antimima dualis*: A, l.s. through flower showing flat ovary surface and free stigmata, in contrast to *Argyroderma*; B, flowering branch with persisting old leaves below; C, part of open capsule with big closing bodies (CB), no valve wings, expanding keels (EK) diverging moderately and covering membranes (CM), with distinct closing ledge (CL) below near opening; D, side view of fruiting branch of herbarium material. A, B, figs of Brown 1930; C, *Hartmann & Ihlenfeldt 4157* (HBG); D, *Peers NBG 370/33* (BOL!), holotype of *A. villetii*. E, *A. pumila*, *Hartmann 30325* (HBG!), side view of fruiting heterophyllous branch: long connate sheath is papery and smooth, short erect free parts papillate. F, *A. dolomitica*, *Dinter 3782* (BOL, iso.!), radial l.s. through capsule in middle of locule: straight covering membrane (CM) lying distally on big closing body (CB), which is also touched by closing ledge (CL). G, *A. fenestrata*, *Hartmann & Dehn 15626* (HBG!), radial l.s. through capsule in middle of locule: covering membranes sloping down from a high centre ending in a distal recurving pressed against big white closing body (CB); erect wing in nearly radial position stabilizing covering membrane. H, *A. eendornensis*, *Dinter 5207* (B, holo!), part of open capsule with basally distant moderately diverging expanding keels (EK), small valve wings (VW) broadest in middle, very big closing bodies (CB) and covering membranes (CM) pressed against them; covering membranes with radial wings on top lowering towards centre. I, *A. distans*, *Hartmann et al. 20682*: heterophyllous long shoot with several leaf pairs with short connate sheaths and free long parts (FLP) and connate subterminal leaf pair (CLP) forming long sheath with short free parts enclosing terminal leaf pair. ES, expanding sheet; P, placenta; V, valve; VR, valve rim; W, wing on top of covering membrane.

Fruits of the majority of species of *Ruschia* lack valve wings altogether, with a few exceptions such as *Ruschia* subgenus *Spinosae*. Capsules of *Antimima* are also mostly devoid of valve wings (Figure 1C), but in a number of species narrow, awn-shaped or even broader valve wings are found, always broadest in the middle and tapering towards both ends (Figure 1H).

Finally, fruits of *Ruschia* develop a long, deep fruit base whereas those of *Antimima* have rather shallow, mostly bowl- or funnel-shaped capsule bases (Figure 1D, E).

Locule numbers are mostly five in both genera, six occurring in several species in *Ruschia* and in *Antimima*.

Leaves

Isophylly (i.e. all leaves of a plant are ± equal), is present in all species of *Ruschia*. In contrast, the species of *Antimima* develop isophylly (Figure 1B, D) *or* heterophylly on a plant, the latter either as a result of two leaf pairs (Figure 1E) of different leaf shapes developing in one season, or as a result of differing leaf shapes developing in sequence along a side branch (Figure 1I). The first condition resembles that in *Cheiridopsis* subg. *Cheiridopsis* (Hartmann & Dehn 1987) or *Mitrophyllum* (Poppendieck 1976). Leaves developing in sequence along a side branch resemble those of *Vanzijlia* L.Bolus (Hartmann 1983). In both cases, the long-sheathed leaf pair forms a papery, persisting sleeve-like protective cover enveloping the subsequent, assimilating leaf pair during the dry season. The dry, persistent sheath consists mostly of the connate lower parts of the leaves of a pair (Figure 1E, I), but in a few cases the leaves are separated to the base but stand closely together forming a protective sleeve-like cover. In these cases, the broad lower parts resemble sheaths that have been slit open, but they were never connate, and the upper parts resemble the free parts of sheathed leaves closely. In general, the epidermis of the sheaths is smoother than that of the free tips, and often the different leaf types differ in their epidermal structures.

Flowers

Flowers of both genera are rather small in the majority of species, rarely exceeding 20 mm in diameter (Figure 1A, B). The petals are white to pink or purple and often arranged in five, rarely six, distinctive groups. Filamentous staminodes are present, surrounding the central cone of stamens. In many cases, the tips elongate and recurve, and are often dark purple to almost black in colour. Characters of the flowers do not differ in principle between *Ruschia* and *Antimima*, neither do inflorescences, which can be solitary or in cymes of various sizes, typical of species but not of either genus.

Growth forms

After the removal of a number of compact species from *Ruschia* by Glen (1986: *Ebracteola* Schwantes, *Acrodon* N.E.Br.) and the re-establishment of *Marlothistella* Schwantes (Hammer 1995), *Ruschia* comprises almost exclusively, shrubby to creeping growth forms with long, visible internodes and branching at the distal ends of the stems.

In *Antimima*, growth forms are variable: compact to caespitose, rarely creeping, or with a compact centre with long shoots climbing into other shrubs. All shrubs with a marked distal branching, proposed for inclusion in *Antimima* (by Dehn on herbarium sheets), had to be excluded from that genus because of their fruit morphology, which resembles that of *Ruschia*.

CORRELATIONS BETWEEN CHARACTER STATES

The possession of the typical fruit permits a definite inclusion of a given plant in *Antimima*, but if fruits on the type sheet are absent or incomplete, the knowledge of the correlation of characters can also help to establish the identity of the material.

In all heterophyllous species with capsules, the expanding keels are basally separated, broad and laciniate, and diverging towards the tips of the valves, not in a tangential position as found in *Ruschia*. Valve wings are absent or present, mostly forming flanges tapering towards the tips. The closing bodies are mostly large, but in some species small white ones are present. In one species no closing body is developed but the capsules show so many similarities with those of other species that the taxon is included here in *Antimima*. Furthermore, it is deduced that heterophylly is correlated with the *Antimima* type of capsule morphology, and as a consequence, all heterophyllous species formerly belonging to the genus *Ruschia* are transferred to *Antimima*.

It should be noted that a revision of *Ruschia* down to species level is not yet available, the circumscription of that genus might therefore require some adjustment at a later stage. Nevertheless, based on the criteria given above, 95 species are transferred here from *Ruschia* to *Antimima*.

TAXONOMY

Antimima *N.E.Br.*, in The Gardeners' Chronicle ser. III, 87: 211 (1930); Dehn: 189 (1989); Hartmann & Stüber: 1 (1993); Hartmann: 229 (1996). Type species: *A. dualis* N.E.Br.

Plants compact, caespitose or with compact centre and long shoots, isophyllous or heterophyllous. *Leaves*: cymbiform with convex sides to nearly finger-shaped, often keeled in upper part; or mostly oval and very often connate for at least part of the length, leaf pairs differing in this feature, mucronate; epidermis cells flat to papillate, wax cover smooth or papillae, with a smooth lateral channel and wax flakes or platelets on rest of surface. *Flowers*: 1(–3), rarely in well-developed cymes; bracts and bracteoles present; petals pink to purple, rarely white, often arranged in 5 (rarely 6) groups. *Filamentous staminodes*: mostly in a central cone surrounding stamens closely. *Capsules*: 5, rarely 6 locules, stalked, always with persisting bracteoles, top with high or low valve rims, base mostly bowl-shaped, sometimes funnel-shaped; covering membranes undulate, more rarely straight, mostly elevated in centre, in several species with radial or tangential wings or other protrusions on them; closing body large, rarely small, absent in one species; expanding keels broad, diverging and radial in distal part, reaching to tip of valve; valves with or without mostly narrow valve wings.

DISTRIBUTION

From Lüderitz and Warmbad, Namibia; southwards to the Northern Cape, Free State, Western Cape, and Eastern Cape, South Africa.

The following species are included in *Antimina* as circumscribed above, most of them transferred from the genus *Ruschia*.

1. **Antimima addita** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia addita L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 284 (1931). Type: *M. Schlechter 8427* (BOL, holo.!).

Plants compact with long shoots, isophyllous. *Leaves*: terete, mucronate. *Capsules*: typical in all respects. Typical of species: rich cymes.

2. **Antimima alborubra** *(L.Bolus) Dehn* in Mitteilungen aus dem Institut für Allgemeine Botanik Hamburg 22: 212 (1989). Type: *Herre 8861* (BOL, holo.!).

Ruschia alborubra L.Bolus: 494 (1934).

Plants with compact centre from which ± 5 long shoots rise, isophyllous. *Leaves*: trigonous to cymbiform. *Capsules*: typical in all respects. Typical of species: very big basal leaves and rather small flowers, smaller than calyx.

3. **Antimima amoena** *(Schwantes) H.E.K.Hartmann*, comb. nov.

Ruschia amoena Schwantes in Monatsschrift der Deutschen Kakteengesellschaft 2: 66 (1930). Type: *Anon. s.n.*, photograph of flowering 'type plant' in collection Schwantes (HBG, lecto.!, here designated).

Plants compact to caespitose, isophyllous. *Leaves*: trigonous, aristate. *Capsules*: typical in all respects. Typical of species: distinct darker lines along keel and margins.

4. **Antimima androsacea** *(Marloth & Schwantes) H.E.K.Hartmann*, comb. nov.

Ruschia androsacea Marloth & Schwantes in Zeitschrift für Sukkulentenkunde 3: 299 (1928). *Mesembryanthemum androsaceum* Marloth: 19 (1927) nom. nud. *Ruschia androsacea* (Marloth) Schwantes: 19 (1927) nom. nud. *Mesembryanthemum androsaceum* (Schwantes) N.E.Br.: 32 (1930). Type: *Marloth 9682* (HBG, holo.!).

Plants forming flat mats, isophyllous. *Leaves*: forming white bodies in the resting state. *Capsule*: top almost flat, base short, funnel-shaped, closing body round, white, rather small for genus; covering membranes convex with a low distal rim, a closing ledge below it, bases of expanding keels just not touching each other at their bases, moderately diverging and tapering into short awns. Typical of species: leaves of a pair form small, brightly white bodies in the dry state.

5. **Antimima argentea** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia argentea L.Bolus in Journal of South African Botany 27: 52 (1960). Type: *Hall 1883* (BOL, holo.!).

Plants compact, isophyllous. *Leaves*: triquetrous with pointed tip, grey from papillae. *Capsules*: typical of genus. Typical of species: awl-shaped silvery to grey leaves.

6. **Antimima aurasensis** *H.E.K.Hartmann* in Kakteen und andere Sukkulenten 47: 231 (1996). Type: *Hartmann et al. 20865* (HBG, holo.!).

Plants caespitose, elongate branches formed when not eaten, isophyllous. *Leaves*: triquetrous. *Capsules*: typical of genus. Similar to *A. perforata* in growth and leaves, but capsules with 5 locules only.

7. **Antimima biformis** *(N.E.Br.) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum biforme N.E.Br. in Kew Bulletin 1929: 58 (1929). *Ruschia biformis* (N.E.Br.) Schwantes: 230 (1938). Type: *Muir s.n.* (K, holo.).

Plants caespitose, heterophyllous. *Leaves*: sheath of one leaf pair forming a body with two very short lobes, other leaf pair almost free, conspicuously dotted. *Capsules*: with expanding keels diverging and transgrading into expanding sheets, closing body knob-shaped. Typical of species: dotted, connate leaves of one pair.

8. **Antimima bina** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia bina L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 282 (1931). Type: *Pillans BOL19610* (BOL, holo.!).

Spreading shrubs to 150 mm high, internodes reddish, heterophyllous. *Leaves*: sheath of one leaf pair oval, white, keel of each leaf running down sheath as a narrow wing, only tips papillate; second leaf pair basally connate for only ± 2 mm, densely papillate, leaves free on long shoots, oval sheaths always at base of short shoots, where both types of leaf pairs are formed alternatively. *Capsules*: with inconspicuous closing ledges, closing body medium-sized. Typical of species: leaves.

9. **Antimima bracteata** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia bracteata L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 93 (1929). Type: *Erni BOL18921* (sheet I) (BOL, lecto.!, here designated).

Plants are loose cushions, isophyllous. *Leaves*: trigonous, smooth. *Capsules*: typical of genus; covering membranes with remains of stiff wings in radial position. Typical of species: radial wings on covering membranes. Similar to *A. compacta*.

10. **Antimima brevicarpa** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia brevicarpa L.Bolus in Notes on Mesembryanthemum and allied genera, part 3: 279 (1954). Type: *Esterhuysen 20444* (BOL, holo.!).

Plants creeping, later forming a mat, heterophyllous. *Leaves*: sheath of one leaf pair long, yellowish, rather smooth, enclosing larger part of subsequent leaf pair with a shorter connate part and longer free parts with papillae, in particular along margins and keel. *Capsules*: with closing bodies broader than thick, almost bean-shaped, covering membranes ± straight with a low rim and closing ledges. Typical of species: creeping habit. Similar to *A. prostrata*, but larger-leaved.

11. **Antimima brevicollis** *(N.E.Br.) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum brevicolle N.E.Br. in Kew Bulletin 1929: 58 (1929). *Ruschia brevicollis* (N.E.Br.) Schwantes: 230 (1938). Type: *Muir 4064* (K, holo.).

Plants caespitose, heterophyllous. *Leaves*: sheath of one leaf pair connate for half its length, other pair with a short connate part. *Capsule*: not known.

12. **Antimima buchubergensis** *(Dinter) H.E.K. Hartmann*, comb. nov.

Ruschia buchubergensis Dinter in Monatsschrift der Deutschen Kakteengesellschaft 2: 219 (1930). Type: *Dinter 6477A* (HBG, lecto.!, here designated: the three sheets of *Dinter 6477* at HBG have been marked A, B, and C; A is chosen as the lectotype because it shows the typical caespitose growth and possesses fruits).

Plants compact to caespitose, isophyllous. *Leaves*: leaf pairs on lateral branches as pea-shaped bodies. *Capsules*: typical of genus, with very narrow valve wings. Typical of species: pea-shaped leaf pairs on proleptic shoots.

13. **Antimima compacta** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia compacta L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 144 (1929). Type: *L.Bolus BOL18977* (BOL, holo.!).

Plants compact, isophyllous. *Leaves*: trigonous with recurved tip. *Capsules*: typical of genus; covering membranes with stiff wings in radial position and tiny valve wings. Very similar to *A. bracteata*.

14. **Antimima compressa** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia compressa L.Bolus in Journal of South African Botany 27: 54 (1960). Type: *Hall NBG1056/48* (BOL, holo.!).

Plants caespitose with some long shoots, isophyllous. *Leaves*: trigonous, papillate. *Capsules*: typical of genus, valve wings very narrow. Typical of species: protruding, diagonal long shoots.

15. **Antimima concinna** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia concinna L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 123 (1929). *Mesembryanthemum comptum* N.E.Br.: 32 (1930). Type: *Pillans NBG370/16* (BOL, lecto.!, here designated); *Mathews 1802/21* (BOL, paralecto!).

Plants compact, heterophyllous. *Leaves*: persisting yellow, papery sheath of one leaf pair around stem, free parts triquetrous, other leaf pair connate for 2–3 mm only, ending in recurved long awn; keels of leaves with distinct, large, long papillae. *Capsules*: typical of genus.

16. **Antimima condensa** *(N.E.Br.) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum condensum N.E.Br. in Kew Bulletin 1929: 58 (1929). *Ruschia condensa* (N.E.Br.) Schwantes: 230 (1938). Type: *Muir 4065* (K, holo.!).

Plants caespitose, heterophyllous. *Leaves*: sheath of one leaf pair as a connate body with only short free tips during the resting period, whitish yellow, smooth, with a protruding roll along line where both leaves are fused in dry state; second leaf pair hardly connate, with elevations above subhypodermal idioblasts and a papillate epidermis. *Capsules*: typical of genus, valve wings narrow.

17. **Antimima crassifolia** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia crassifolia L.Bolus in Notes on Mesembryanthemum and allied genera, part 3: 338 (1958). Type: *Hall BOL25758* (BOL, holo.!).

Low shrubs with some erect flowering branches, isophyllous. *Leaves*: trigonous, thick. *Capsules*: typical of genus, 6-loculed.

18. **Antimima dasyphylla** *(Schltr.) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum dasyphyllum Schltr. in Botanische Jahrbücher 27: 127 (1899). *Ruschia dasyphylla* (Schltr.) Schwantes: 20 (1927). Type: *Schlechter 8773* (B, lecto.!, here designated: one of the two sheets kept at B bears the note 'holotype' by Glen; it is here chosen as the lectotype).

Ruschia concava L.Bolus: 124 (1929). *Mesembryanthemum ciliolatum* N.E.Br.: 32 (1930). Type: *Levyns 1375/26* (BOL, holo.!).

Shrubs, heterophyllous. *Leaves*: sheath of one leaf pair long, orange-brown, free parts only 2–3 mm long, papillate; other leaf pair connate for 4 mm, free parts spreading, longer papillae on keel and margins. *Capsules*: typical of genus but expanding keels transgrading into expanding sheets and with distal awns. Typical of species: inconspicuous expanding keels.

19. **Antimima defecta** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia defecta L.Bolus in Journal of South African Botany 31: 85 (1965). Type: *Van Heerde BOL27654* (BOL, holo.!).

Ruschia deflecta L.Bolus ex Jacobsen: 491 (1970) orthographic variant.

Plants cushion-forming, heterophyllous. *Leaves*: yellow sheaths of one leaf pair on short shoots connate for ± half their length, those on long shoots only connate for ± $^1/_6$ of their length, free parts of both types with distant, big papillae. *Capsules*: typical of genus, but closing bodies hood-shaped and broader than thick. A deviating single fruit on the type sheet with broad valve wings and a longer base belongs to *Amphibolia*, but not to the remaining type material, which agrees with the description.

20. **Antimima dekenahi** *(N.E.Br.) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum dekenahi N.E.Br. in Kew Bulletin 1929: 58 (1929). *Ruschia dekenahi* (N.E.Br.) Schwantes: 230 (1938). Type: *Dekenah 23* (K, lecto.!, here designated); *Muir 4079* (K, paralecto.!).

Plants compact to caespitose, isophyllous. *Leaves*: trigonous, mucronate. *Capsules*: typical of genus. Typical of species: fruits raised above plant and the thick root.

21. **Antimima distans** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum distans L.Bolus in Annals of the Bolus Herbarium 4: 89 (1927a). *Ruschia distans* (L.Bolus) L.Bolus: 236 (1950). Type: *Anon. BOL18550* (BOL, holo.!).

Plants compact with erect, long shoots, heterophyllous. *Leaves*: sheath of one leaf pair long, almost smooth, with a bulge running down side where both leaves meet, and long, ± triquetrous free parts with some large, long papillae along keel only; other leaf pair only slightly connate, free parts densely papillate. *Capsules*: typical of genus. Typical of species: stout, dark brown or maroon, long internodes (Figure 1I).

22. **Antimima dolomitica** *(Dinter) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum dolomiticum Dinter in Feddes Repertorium 19: 150 (1923). *Corpuscularia dolomitica* (Dinter) Schwantes: 186 (1926). *Ruschia dolomitica* Dinter & Schwantes: 69 (1929). Type: *Dinter 3782*, Klinghardtberge (B, lecto.!, here designated); from Alicetal, Buntfeldschuhplateau (B, BOL, paralecto.!).

Plants with compact base with erect, stiff long shoots bearing lateral proleptic bodies consisting of a hazelnut-shaped leaf pair each; ± isophyllous. *Capsules*: typical of genus, closing bodies only medium-sized, as seen from above (Figure 1F). Typical of species: hazelnut-shaped leaf pairs.

23. **Antimima dualis** *(N.E.Br.) N.E.Br.*, Gardeners' Chronicle, ser. III, 87: 211 (1930). Type: *Pearson & Pillans 5483* (K, holo.!).

Mesembryanthemum duale N.E.Br.: 89 (1920). *Argyroderma duale* (N.E.Br.) N.E.Br.: 105 (1922).

Ruschia dualis L.Bolus: 104 (1929). Type: *Hutchinson s.n.* (BOL, lecto.!, here designated from three syntypes cited and placed on one sheet).

Ruschia villetii L.Bolus: 501 (1934) Type: *Peers 1370/33* (BOL, holo.!).

Plants compact, highly branched, isophyllous. *Leaves*: trigonous but keeled, sides convex to straight, whitish grey. *Capsules*: typical of genus; covering membranes almost straight. The species can easily be confused with *A. turneriana*. Characteristic of *A. dualis* are the strictly compact growth, retained also in cultivation, and the strictly solitary flowers (Figure 1A–D).

24. **Antimima eendornensis** *(Dinter) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum eendornense Dinter in Feddes Repertorium Beiheft 53: 86 (1928). Type: *Dinter 5207* (B, holo.!).

Semi-compact dwarf shrublets, isophyllous. *Leaves*: triquetrous with long papillae. *Capsules*: typical of genus with narrow valve wings at the point where they touch edge of valve and with oblique wings on top of covering membranes, 6-loculed (Figure 1H).

Dinter (1928: 86, 87) did not give a formal description, only a short diagnosis in contrast to *Mesembryanthemum hospitale* (now a member of *Ruschia* subgenus *Spinosae*). The type sheet at B had been wrongly placed with *A. quarzitica* up to now.

25. **Antimima elevata** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia elevata L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 305 (1931). Type: *Luckhoff BOL19873* (BOL, holo.!).

Plants caespitose, isophyllous. *Leaves*: with broadly trigonous, rough to warty free parts, greyish. *Capsules*: typical of genus; covering membranes raised high in centre and closing bodies bean-shaped and rather small.

26. **Antimima emarcescens** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia emarcescens L.Bolus in Notes on Mesembryanthemum and allied genera, part 3: 281 (1954). Type: *Acocks 16995* (BOL, holo.!). *Ruschia emarcidens* L.Bolus ex Jacobsen: 492 (1970) orthographic variant.

Plants with compact centre with long shoots, heterophyllous; roots thickened and forming elongate, potato-shaped tubers. *Leaves*: one leaf pair with dry, papery sleeve-like covers longer than free parts, but not connate; other leaf pair with sheaths shorter than free parts, smooth, papery during dry season, free parts triquetrous, with low papillae, turning dark when drying, both types 7–10 mm long. *Capsules*: typical of genus with high valve rims.

27. **Antimima erosa** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia erosa L.Bolus in Notes on Mesembryanthemum and allied genera, part 3: 279 (1954). Type: *Acocks 17126* (BOL, holo.!).

Plants densely shrubby, isophyllous. *Leaves*: terete, apically rounded. *Capsules*: typical of genus; covering membranes straight; valve wings very narrow. Resembles species of *Rhinephyllum* in growth form, both occur in the same area, so that they can easily be confused.

28. **Antimima evoluta** *(N.E.Br.) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum evolutum N.E.Br. in Kew Bulletin 1913: 120 (1913). *Ruschia evoluta* (N.E.Br.) L.Bolus: 178 (1928a). Type: *Pearson 5946* (K, holo.!).

Plants compact, white in the resting state, heterophyllous. *Leaves*: sheath of one leaf pair forming white body in dry season, smooth, keel markedly smooth, margins ciliate, completely embracing subsequent leaf pair with longer free parts with short papillae on them. *Capsules*: with closing body pointing into locule like a finger; expanding keels very similar to the short ones of *A. dualis*.

29. **Antimima exsurgens** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia exsurgens L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 280 (1931). Type: *L.Bolus BOL19334* (BOL, holo.!).

Plants with compact centre and long shoots, each internode with papery whitish apical rim, appearing corky below and drying into rings, stems therefore resembling cones put one into the other, heterophyllous. *Leaves*: sheath of one leaf pair turning papery for most of its length (± 6 mm) in the resting state, free apical part of ± 2 mm with very low papillae; second leaf pair enveloped during the resting period, ± 6–8 mm long, triquetrous, epapillate; in both leaf types keel and margins rounded. *Capsules*: typical of genus.

30. **Antimima fenestrata** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia fenestrata L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 281 (1931). Type: *Luckhoff BOL19612* (BOL, holo.!).

Compact shrubs forming tiny tree-like shapes, heterophyllous. *Leaves*: sheath of one leaf pair long, smooth, white, embracing subsequent leaves at bases, these latter free for ± $^1/_2$ their length and withering in a peculiar way: hardened bundles along keel (and into the apical tooth) and margins form a triangular window frame and persist much longer than intermediate tissue so that finally triangular openings are formed. *Capsules*: typical of genus; highly undulate covering membranes with very broad, horizontally arranged wings on top almost completely hiding covering membranes when seen from above (Figure 1G). Typical of species: windowed leaves drying white, with frames remaining on plants.

31. **Antimima fergusoniae** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia fergusoniae L.Bolus in South African Gardening and Country Life 18: 279 (1928b). *Mesembryanthemum fergusoniae* (L.Bolus) N.E.Br.: 32 (1930). Type: *Ferguson BOL1882* (sheet I) (BOL!).

Plants caespitose, heterophyllous. *Leaves*: both pairs forming sheaths, one pair with pronounced bulges above tannin idioblasts and low papillae; second pair with lower bulges but longer papillae. *Capsules*: typical of genus.

After the first description in English in September 1928 (Bolus 1928b), Bolus published a Latin description of the species as well in November 1928 (Bolus 1928d: 7), where she cited the type. Nevertheless, the description in September fulfills all requirements for the new combination to be validly published, at that time.

32. **Antimima gracillima** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

R. gracillima L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 203 (1930). Type: *Frames BOL 19208* (BOL, holo.!).

Plants compact with decumbent long shoots, heterophyllous. *Leaves*: sheaths of leaf pairs on short shoots connate for ± $^1/_2$ their length, those on long shoots for ± $^1/_4$, free parts of both types with distant, big papillae, aristate. *Capsules*: not known.

33. **Antimima granitica** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum graniticum L.Bolus in Annals of the Bolus Herbarium 4: 88 (1927a). *Ruschia granitica* (L.Bolus) L.Bolus: 221 (1950). Type: *Pillans BOL17772* (BOL, holo.!).

Plants caespitose, isophyllous. *Leaves*: trigonous, apically roundish. *Capsules*: typical of genus; valve wings very narrow.

34. **Antimima hallii** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia hallii L.Bolus in Notes on Mesembryanthemum and allied genera, part 3: 218 (1950). Type: *Hall BOL24059* (BOL, lecto.!, here designated); *Peers BOL 24060* (BOL, paralecto.!).

Plants with compact centre with long shoots, erect at first, decumbent later, rooting at nodes some distance from the primary centre and developing a secondary compact centre, heterophyllous. *Leaves*: sheaths of both types of leaves papery, white, disintegrating early; bases of second leaf pair almost separated by a triangle of stem tissue, with low papillae, old leaves closely set on short shoots. *Capsules*: typical of genus. Typical of species: formation of secondary compact centres with adventitious roots.

35. **Antimima hamatilis** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia hamatilis L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 106 (1929). *Mesembryanthemum hamatile* (L.Bolus) N.E.Br.: 32 (1930). Type: *Pillans 6080* (BOL, holo.!).

Plants with decumbent branches, heterophyllous. *Leaves*: sheath of one leaf pair connate for ± $^1/_2$ its length, free parts papillate, mucro to 1 mm long; second leaf pair connate for $^1/_6$ of its length, free parts papillate, longer papillae along keel and margins, these leaves forming repeatedly on fresh long shoots. *Capsules*: unknown.

36. **Antimima hantamensis** *(Engler) H.E.K.Hartmann & Stüber*, Contributions from the Bolus Herbarium 15: 68 (1993). *Mesembryanthemum hantamense* Engl.: 190 (1909) Type: *Meyer s.n.* (B, holo.!).

Ruschia disarticulata L.Bolus: 286 (1931). *Eberlanzia disarticulata* (L.Bolus) L.Bolus: 387 (1958) Type: *L.Bolus 19335* (BOL, holo.!).

Ruschia stellata L.Bolus: 140 (1927/1928). *Mesembryanthemum stellans* (L.Bolus) N.E.Br.: 32 (1930). *Eberlanzia stellata* L.Bolus nom. nud. Type: *Compton 1414/27* (BOL, holo.!).

Flat shrubs smelling of fish when damaged, covered in spines derived from big dichasial inflorescences, isophyllous. *Leaves*: trigonous. *Capsules*: with high valve rims extending over edge of capsule, otherwise with typical features. Plants always densely covered with spines, making it easy to recognise them.

37. **Antimima herrei** *(Schwantes) H.E.K.Hartmann*, comb. nov.

Ruschia herrei Schwantes in Zeitschrift für Sukkulentenkunde 3: 301 (1928a). *Mesembryanthemum herrei* (Schwantes) N.E.Br.: 32 (1930). Type: Karrooport Ceres, *H. Herre in Bot. Gard. Stellenbosch 1876*. As this could not be traced, the following lectotype is designated: *Anon. s.n.* (HBG!, photograph of 'my type plant' in collection Schwantes HBG).

Plants compact, heterophyllous. *Leaves*: sheath of one leaf pair papery for most of its length; other leaf pair free (flowering plant on photograph showing free leaves only), as is the case during the growing and flowering period. *Capsules*: typical of genus; covering membranes with low protrusions in radial direction near centre of fruit. Placed by Schwantes (1928a: 302) in a group called '*Ruschiella*', not described formally, together with '*R. ventricosa*' and '*R. schlechteri*', both also heterophyllous.

38. **Antimima intervallaris** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia intervallaris L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 91 (1929). Type: *Pillans 6056* (BOL, holo.!).

Shrubs with decumbent branches, heterophyllous. *Leaves*: first leaf pair with long, loose sheaths enclosing subsequent leaves; other leaf pair hardly connate, both glabrous, green; epidermis papillate, epidermis cells with lower papillae on smaller leaves. *Capsules*: typical of genus; valve wings or very narrow bands appearing only when a fresh fruit is opening. In the leaf sequence, the species resembles that of *Vanzijlia annulata*. The citation of the name *Ruschia intervallaris* L.Bolus under *Mossia intervallaris* is an error (Brown 1930: 71, 151).

39. **Antimima ivori** *(N.E.Br.) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum ivori N.E.Br. in Kew Bulletin 1929: 58 (1929). *Ruschia ivori* (N.E.Br.) Schwantes: 230 (1938). Type: *Dekenah 67* (K, lecto.!, here designated); *Muir 4285* (K, paralecto.!).

Plants with flat mats, heterophyllous. *Leaves*: sheath of one leaf pair smooth, white in its lower half, often suffused purplish, tips disintegrating into thread-like protuberances, sheath enclosing subsequent leaf pair of papillate leaves connate only for ± $^1/_3$ of its length; surface of epidermis of outer leaf pair of elongate cells with cuticular folds covered by an almost continuous wax layer. *Capsules*: typical of genus, but top with low rims, 6-loculed. Typical of species: laciniate upper parts of highly connate leaf pairs persisting on plant for many years. In this feature, and in leaf surfaces, it resembles *A. pygmaea* most closely, differing in the truncate leaf tips and in fruit morphology from the latter.

40. **Antimima karroidea** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia karroidea L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 306 (1931). Type: *Archer 364* (BOL, holo.!).

Plants compact with long decumbent shoots, numerous short shoots on them, heterophyllous. *Leaves*: sheath of one leaf pair whitish, keel of shorter free part continuing as a row of long papillae on sheath and internode below; alternating leaf pair with a sheath only 1.5 mm long, free parts subulate. *Capsules*: typical of genus; expanding keels merging into expanding sheets. Similar in leaf shapes and sequence to *A. fergusoniae*.

41. **Antimima klaverensis** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum klaverensis L.Bolus in Annals of the Bolus Herbarium 4: 96 (1927a). *Ruschia klaverensis* (L.Bolus) Schwantes: 58 (1949). Type: *Compton NBG291/22* (BOL, holo.!).

Plants caespitose, smelling of fish, isophyllous. *Leaves*: trigonous to terete. *Capsules*: typical of genus. Leaves, fruit and growth form agree well with those of *A. watermeyeri*, which lacks a fishy smell.

42. **Antimima koekenaapensis** *(L.Bolus) H.E.K. Hartmann*, comb. nov.

Ruschia koekenaapensis L.Bolus in Journal of South African Botany 28: 299 (1962). Type: *Hall 2398* (BOL, holo.!).

Plants compact with long shoots, these in turn with short shoots bearing flowers appearing in bundles or dense groups in the following year, isophyllous. *Leaves*: triquetrous, pointed. *Capsules*: typical of genus. Typical of species: tufted short flowering shoots.

43. **Antimima komkansica** *(L.Bolus) H.E.K. Hartmann*, comb. nov.

Ruschia komkansica L.Bolus in Journal of South African Botany 28: 298 (1962). Type: *Hall 2550* (BOL, holo.!).

Shrubs up to 600 mm high, isophyllous. *Leaves*: trigonous. *Capsules*: typical of genus; very narrow valve wings and low radial wings on covering membranes. Plants very tall for genus.

44. **Antimima lawsonii** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum lawsonii L.Bolus in Annals of the Bolus Herbarium 4: 85 (1927a). *Ruschia lawsonii* (L.Bolus) L.Bolus: 219 (1950). Type: *Lawson 18551* (BOL, holo.!).

Plants compact, isophyllous. *Leaves*: triangular to triquetrous, light grey, hard. *Capsules*: most similar to those of *A. dualis*, but closing body smaller and almost hook-shaped. Grows far from most other species of genus, settling in distinct, stony habitats on limestone and seemingly unable to explore adjacent areas with a sand cover where grass and trees predominate.

45. **Antimima leipoldtii** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia leipoldtii L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 61 (1929). *Mesembryanthemum leipoldtii* (L.Bolus) N.E.Br.: 32 (1930). Type: *Leipoldt BOL18905* (BOL, holo.!).

Low shrubs, heterophyllous. *Leaves*: sheath of one leaf pair long, smooth, long free parts with some big papillae along keel only; other leaf pair short, with long papillae. *Capsules*: typical of genus; valves with distinct narrow wings broadest at middle.

46. **Antimima leucanthera** *(L.Bolus) H.E.K. Hartmann*, comb. nov.

Mesembryanthemum leucantherum L.Bolus in Annals of the Bolus Herbarium 4: 7 (1925). *Ruschia leucanthera* (L.Bolus) L.Bolus: 239 (1927b). Type: *Tugwell BOL17108* (BOL, lecto.!, here designated); *Russell NBG8/24* (BOL, paralecto.!).

Plants compact to caespitose, isophyllous, hypocotyl and roots thickened. *Leaves*: trigonous, mucronate. *Capsules*: typical of genus, interior falling off persistent old outer bundles of capsule, leaving a prickly star on plant where a fruit has been; in young fruits narrow valve wings in angle where expanding keel meets edge of valve. In habitat, plants adorned by whitish capsules for most of year. Similar to *A. dekenahi*, but differing in wings on covering membranes and longer papillae along keel and margins of leaves.

47. **Antimima limbata** *(N.E.Br.) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum limbatum N.E.Br. in Kew Bulletin 1929: 59 (1929). *Ruschia limbata* (N.E.Br.) Schwantes: 230 (1938). Type: *Marloth 13173* (K, holo!).

Plants creeping, isophyllous. *Leaves*: trigonous with convex sides, keel and margin reddish brown. *Capsules*: typical of genus. Leaves dry beautifully with reddish margins. Creeping growth forms are rare in *Antimima*.

48. **Antimima lodewykii** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia lodewykii L.Bolus in Notes on Mesembryanthemum and allied genera, part 3: 218 (1950). Type: *L.van Heerde (3) BOL 23640* (BOL, lecto.!, here designated: chosen from several sheets).

Plants compact, heterophyllous. *Leaves*: sheath of one leaf pair white, smooth, free tips papillate; second leaf pair also highly connate, but entirely papillate, only bulging keel and margins apically smooth, enclosed during the resting state. *Capsules*: typical of genus; closing bodies shaped like heads of snakes and small. Typical of species: very tight arrangement of old leaves, like pieces of meat on a spit.

49. **Antimima loganii** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia loganii L.Bolus in Notes on Mesembryanthemum and allied genera, part 3: 61 (1937). Type: *Logan 31* (BOL, holo.!).

Plants caespitose, white during the dry season, heterophyllous. *Leaves*: sheath of one leaf pair long, smooth, with short, free parts with papillae; other leaf pair only a little connate, free parts trigonous, papillate, apiculate, both ± 9 mm long. *Capsules*: typical of genus; narrow valve wings. Typical of species: raised, star-shaped fruits above the white tiny shrub during dry season.

50. **Antimima lokenbergensis** *(L.Bolus) H.E.K. Hartmann*, comb. nov.

Ruschia lokenbergensis L.Bolus in Journal of South African Botany 30: 239 (1964). Type: *Esterhuysen 30699* (sheet I) (BOL, lecto.!, here designated: chosen from 2 sheets).

Shrubs to 450 mm high, isophyllous. *Leaves*: elongate-ovate. *Capsules*: typical of genus. Almost free leaves unusually rounded for genus.

51. **Antimima longipes** *(L.Bolus) Dehn* in Mitteilungen aus dem Institut für Allgemeine Botanik Hamburg 22: 211 (1989). Type: *Pillans 5811* (BOL, holo.!).

Ruschia longipes L.Bolus: 256 (1927b). *Mesembryanthemum longipes* (L.Bolus) N.E.Br.: 32 (1930).

Plants are caespitose cushions to ± 80 mm high, isophyllous. *Leaves*: slender, trigonous. *Capsules*: on pedicels 60 mm long; covering membranes with large horizontal wings forming a second layer over them, closing ledges low and inconspicuous; closing body typical. Typical of species: fruit morphology with valve wings and radial wings on covering membranes plus presence of big white closing bodies.

52. **Antimima luckhoffii** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia luckhoffii L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 283 (1931). Type: *Luckhoff 19611* (BOL, holo.!).

Plants caespitose, heterophyllous. *Leaves*: one leaf pair with brown sheath at base and with 2–3 mm long free parts densely covered with low papillae, tip thus forming a ± triangular top; other leaf pair with short sheath 5–6 mm long, free parts with translucent margins and keel. *Capsules*: not known.

53. **Antimima maleolens** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia maleolens L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 22 (1928d). *Mesembryanthemum maleolens* (L.Bolus) N.E.Br.: 32 (1930). Type: *Pillans BOL17796* (BOL, holo.!).

Shrubs up to 250 mm high smelling of salted fish, isophyllous. *Leaves*: trigonous. *Capsules*: typical of genus.

54. **Antimima maxwellii** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia maxwellii L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 106 (1929). *Mesembryanthemum maxwellii* (L.Bolus) N.E.Br.: 32 (1930). Type: *M.Bolus BOL18939* (BOL, holo.!).

Plants with compact centre with long shoots and highly branched, tufted short shoots, bearing flowers (and fruits) in groups, heterophyllous. *Leaves*: smooth, papery sheath of one leaf pair of ± 5 mm length enclosing base of subsequent leaf pair with sheath of ± 4 mm and free parts up to 15 mm long; epidermis cells of free parts almost flat, only slightly protruding. *Capsules*: typical of genus; covering membranes raised high near centre and with indications of radial protrusions, but these appear as if folded and not forming a wing proper. Typical of species: dense groups of short shoots developing on long shoots.

55. **Antimima menniei** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia menniei L.Bolus in Journal of South African Botany 31: 86 (1965). Type: *Mennie BOL27660* (BOL, holo.!).

Plants caespitose with erect branches, heterophyllous. *Leaves*: short, smooth sheath of one type of leaf pair persisting as envelopes around stem, long, free parts with big, distant papillae; bracteoles without a sheath, leaves almost separated by tissue of pedicel. *Capsules*: typical of genus; expanding keels transgrading into expanding sheets.

56. **Antimima mesklipensis** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia mesklipensis L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 281 (1931). Type: *Mathews (Ryder) NBG2250/30* (BOL, holo.!).

Plants caespitose, heterophyllous. *Leaves*: one leaf pair with greyish brown sheath, 2–3 mm long, free parts distantly papillate; other leaf pair connate for < 1 mm, free parts broadly trigonous, densely papillate. *Capsules*: not known. Resembles *A. persistens* in persistence of old (longer) leaves.

57. **Antimima meyerae** *(Schwantes) H.E.K.Hartmann*, comb. nov.

Ruschia meyerae Schwantes in Monatsschrift der Deutschen Kakteengesellschaft 2: 64 (1930). Type: *Anon. s.n.* (HBG, lecto.!, here designated: photograph of the 'type plants' in collection Schwantes HBG).

Compact shrublets, heterophyllous with 3 different types of leaves. *Leaves*: most commonly sheaths whitish yellow with reddish brown free tips; epidermis at tips with rounded, low papillae; leaves up to 8 mm long; at bases of side branches first leaf pair with a white-yellow sheath, but without any different free tips, ± 5 mm long; second leaf pair hardly connate, free parts with prominent, long papillae giving leaves a rough appearance, ± 5 mm long. *Capsules*: very hard, differing from typical form by possession of small finger-shaped closing bodies. Typical of species: formation of at least three different leaf forms and development of four new branches under terminal fruit, in contrast to common pattern of two or single branch.

58. **Antimima microphylla** *(Haw.) Dehn* in Mitteilungen aus dem Institut für Allgemeine Botanik Hamburg 22: 213 (1989). Type: drawing by Duncanson [K, lecto.!, designated by Dehn: 213 (1989)].

Mesembryanthemum microphyllum Haw.: 73 (1803). *Ruschia microphylla* (Haw.) Schwantes: 20 (1927).

Low shrublets, heterophyllous. *Leaves*: set densely, keels cartilaginous. *Capsule*: not known.

59. **Antimima minima** *(Tischer) H.E.K.Hartmann*, comb. nov.

Cheiridopsis minima Tischer in Succulenta 9: 145 (1927). Type: *Anon. s.n.* (HEID).

Plants compact, isophyllous. *Leaves*: trigonous. *Capsules*: typical of genus. Description of fruit permits the conclusion that the species belongs to *Antimima*, where in several species, centrally raised covering membranes occur combined with deep-set, white, flat closing bodies.

60. **Antimima minutifolia** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia minutifolia L.Bolus in Journal of South African Botany 30: 239 (1964). Type: *Hall 2829* (BOL, holo.!).

Dark shrublets, outer long shoots decumbent, heterophyllous. *Leaves*: long sheath of one leaf pair turning white, basally maroon, free parts 1–2 mm long, papillate; second leaf pair hardly connate, free parts 3–4 mm long, papillate and ciliate along margins, latter leaves on long shoots, sheaths always at bases of short side shoots, on which both leaf types alternate regularly. *Capsules*: typical of genus. Typical of species: dark appearance as a result of dark stems which are well visible because leaves are very short.

Distinguished from *A. distans* from the same area by much more slender stems and a broad cushion shape with age. The first description appeared in June 1928, being validly published at that time; the Latin description appeared in August 1928 (Bolus 1928c), but was superfluous at that time.

61. **Antimima modesta** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia modesta L.Bolus in Notes on Mesembryanthemum and allied genera, part 3: 105 (1937). Type: *Holloway 63* (BOL, holo.!).

Ruschia modesta L.Bolus forma *glabrescens* L.Bolus: 54 (1960). Type: *Geyer SUG13973* (BOL, holo.!).

Plants compact with long, erect, stiff shoots, isophyllous. *Leaves*: boat-shaped with convex sides. *Capsules*: typical of genus. The name should be used for stout plants with few to some flowers per inflorescence from a restricted area north of the Gariep River in Namibia.

62. **Antimima mucronata** *(Haw.) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum mucronatum Haw. in Miscellanea naturalia: 73 (1803). *Ruschia mucronata* (Haw.) Schwantes: 20 (1927). Type: drawing 980/203 of Duncanson (K, lecto.!, here designated).

Ruschia mathewsii L.Bolus: 139 (1927/1928) Type: *Mathews NBG 1893/24* (BOL, holo.!).

Plants compact with decumbent long shoots, heterophyllous. *Leaves*: sheath of one leaf pair smooth, later white, thin, papery, keel markedly horny, ciliate to serrulate; second leaf pair connate for 1–2 mm only, free parts ± 10 mm long, with distinct awn borne apically, with low papillae, keel ciliate to serrulate, wax in dense layers of vertical platelets on free parts. *Capsules*: typical of genus; expanding keels merging gradually into expanding sheets.

The drawing of Duncanson (K!) shows a plant in the growing season with several long shoots (with prominent internodes) with shortly connate, spreading leaves, resembling those of long shoots of *A. mathewsii* very closely.

63. **Antimima mutica** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia mutica L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 61 (1929). *Mesembryanthemum muticum* (L.Bolus) N.E.Br.: 32 (1930). Type: *Pillans BOL18898* (BOL, holo.!).

Compact shrublets, heterophyllous. *Leaves*: sheath of one leaf pair white, ± 4 mm long, free tips ± 3 mm long, covered by fine papillae, longer ones on margins; second leaf pair with a 1–2 mm long sheath, free parts ± 6 mm long, papillate, the latter on long shoots, short shoots beginning with a sheathed leaf pair, later both types alternating regularly. *Capsules*: typical of genus. Smaller-leaved version of *A. peersii*.

64. **Antimima nobilis** *(Schwantes) H.E.K.Hartmann*, comb. nov.

Ruschia nobilis Schwantes in Monatsschrift der Deutschen Kakteengesellschaft 2: 65 (1930). Type: *M. Schlechter s.n.* (HBG, collection Schwantes!).

Plants compact with long shoots, isophyllous. *Leaves*: trigonous with convex sides, thick. *Capsules*: typical of genus; closing bodies sometimes smaller; covering membranes sometimes a little reduced, 6-loculed.

65. **Antimima nordenstamii** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia nordenstamii L.Bolus in Journal of South African Botany 30: 241 (1964). Type: *Nordenstam 799* (BOL, holo.!).

Plants compact with long, erect, or decumbent shoots with dark purple to blackish internodes, several to many short shoots developing on distal nodes, arrangement resembling mistletoe on a branch, heterophyllous. *Leaves*: one leaf pair with a wide, yellow sheath with only short free parts, ± 6 mm long overall; other pair united for ± $^1/_4$ of its length, trigonous, obtuse, up to 12 mm long; epidermis of free parts papillate. *Capsules*: typical of genus. Typical of species: blackish internodes and crowded short shoots bearing flowers.

66. **Antimima oviformis** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia oviformis L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 261 (1931). Type: *Herre SUG9311* (BOL, holo.!).

Low shrubs with long shoots only, heterophyllous. *Leaves*: sheath of one leaf pair 5–8 mm long, free papillate tips shortly triquetrous, breaking off easily leaving only sheaths on plants; other leaf pair with a short connate base, triquetrous, papillate. *Capsules*: unknown. Typical of species: bare, golden brown shoots.

67. **Antimima papillata** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia papillata L.Bolus in South African Gardening and Country Life 17: 256 (1927b); L.Bolus: 129 (1927/1928). *Mesembryanthemum papillatum* (L.Bolus) N.E.Br.: 32 (1930). Type: *Pillans 5713* (BOL, holo.!).

Ruschia meyeri Schwantes: 300 (1928a). *Mesembryanthemum meyeri* (Schwantes) N.E.Br.: 32 (1930). Type: *Anon. s.n.*, photograph of type material (HBG, lecto.!, collection Schwantes, here designated).

Plants compact with bundles of erect long shoots, heterophyllous. *Leaves*: white, smooth sheath of one leaf pair connate for at least $^1/_2$ its length; second pair connate for ± 3 mm, free parts elongate-trigonous with rather large, dense papillae, with a dense cover of wax platelets transgrading into threads, underlying continuous wax breaking eventually into big plates. *Capsules*: without closing bodies, but with typical broad expanding keels and narrow valve wings broadest at middle, both features typical of genus.

68. **Antimima paucifolia** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia paucifolia L.Bolus in Journal of South African Botany 30: 240 (1964). Type: *Esterhuysen 30700* (BOL, holo.!).

Shrubs with diagonal long shoots, heterophyllous. *Leaves*: sheath of one leaf pair white, basally maroon, with short free parts ± 2 mm long, upper part breaking away after resting period along pre-formed ring, leaving a clear-cut edge surrounding stem; second leaf pair triquetrous, connate part only ± 1 mm long, all free parts of leaves with papillae of medium height, keel and the margins with distant, longer papillae. *Capsules*: typical of genus. Similar to *A. exsurgens*.

69. **Antimima pauper** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia pauper L.Bolus in Journal of South African Botany 27: 259 (1961). Type: *Littlewood KG211/61* (BOL, holo.!).

Plants compact with long shoots on which short shoots are developed in tufted bundles, isophyllous. *Leaves*: rounded at tip. *Capsules*: typical of genus.

70. **Antimima peersii** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia peersii L.Bolus in Notes on Mesembrianthemum and allied genera, part 1: 139 (1927/1928). *Mesembryanthemum formulosum* N.E.Br.: 32 (1930). Type: *Peers NBG3725/15* (= *BOL44507*, not *3825/15* as in one description, BOL, lecto.!, here designated).

Plants compact with long shoots, heterophyllous. *Leaves*: sheath of one leaf pair white, often with a copper-coloured tinge at its upper end, ± 8 mm long, free parts ± 10 mm long; subsequent leaf pair only a little connate with ± 20 mm long free parts appressed to each other during resting state, long shoots with these latter leaves only, short shoots starting with sheathed leaf pair, leaf forms alternating later; epidermis of free parts papillate. *Capsules*: typical of genus; narrow valve wings and medium-sized closing bodies.

71. **Antimima perforata** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia perforata L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 80 (1929). *Mesembryanthemum perforatum* (L.Bolus) N.E.Br.: 32 (1930). Type: *Kolle in Pillans 6097* (BOL, lecto.!, here designated: chosen from several sheets).

Ruschia paripetala L.Bolus var. *occultans* L.Bolus: 125 (1929). Type: *Pillans 5827* (BOL, holo.!).

Plants with erect, stiff branches with proleptic short shoots from a rather dense, caespitose centre. *Capsules*: typical of genus with 6 locules.

72. **Antimima persistens** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia persistens L.Bolus in Journal of South African Botany 29: 16 (1963) nom. illeg., non L.Bolus: 334 (1932). Type: *Van Breda 1750/62* (BOL, holo.!).

Plants compact with long shoots, heterophyllous. *Leaves*: sheaths of one leaf pair ± 4 mm long and free parts ± 2 mm long, these dominant on long shoots; other leaf pair connate for ± 2 mm, free parts ± 4 mm long, all free parts with elevations and papillae, on short shoots, types of leaf pairs alternating regularly, longer leaves persisting over several years. *Capsules*: typical of genus; closing bodies medium-sized.

The name *Ruschia persistens* was used for two different species by Bolus (1932, 1963), the latter being an illegitimate name in *Ruschia*. However, the epithet is available in the genus *Antimima*.

73. **Antimima pilosula** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia pilosula L.Bolus in Notes on Mesembryanthemum and allied genera, part 3: 259 (1954). Type: *Hall NBG285/54* (BOL, holo.!).

Shrubs with many scars from old leaves, isophyllous. *Leaves*: subfalcate to subclavate. *Capsules*: typical of genus; valve wings in their basal halves broader than expanding keels.

The broad, tapering valve wings, resembling those of *Eberlanzia schneideriana* (A.Berger) H.E.K.Hartmann, are unusual in the genus. The species is placed here based on the broad, typical closing bodies and the undulate covering membranes with inconspicuous closing ledges only.

74. **Antimima piscodora** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia piscodora L.Bolus in Notes on Mesembrianthemum and allied genera, part 1: 141 (1927/1928). *Mesembryanthemum piscodorum* (L.Bolus) N.E.Br.: 32 (1930). Type: *Tugwell BOL17109* (BOL, holo.!).

Plants compact with long shoots. *Capsules*: incompletely described: covering membranes touching closing body; expanding keel denticulate, but these features are typical of genus.

75. **Antimima prolongata** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia prolongata L.Bolus in Notes on Mesembryanthemum and allied genera, part 3: 280 (1954). Type: *Acocks 16937* (sheet 1) (BOL, lecto.!, here designated: chosen from 2 sheets).

Plants compact with very long, thin, yellow long shoots in other bushes, heterophyllous. *Leaves*: one type of leaf pair forming a papery sheath-like cover of two parts ± 10 mm long, connate only for ± 1 mm, apical part papillate, subulate; second leaf pair ± 8–10 mm long, triquetrous, subulate, papillate, mucro recurved. *Capsules*: typical of genus. Typical of species: pseudo-sheaths formed by one leaf pair consisting of almost free leaves, but turning papery for dry season like connate sheaths in other species.

76. **Antimima propinqua** *(N.E.Br.) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum propinquum N.E.Br. in Kew Bulletin 1929: 59 (1929). *Ruschia propinqua* (N.E.Br.) Schwantes: 230 (1938). Type: *Muir 4071* (K, holo.).

Plants compact, heterophyllous. *Leaves*: sheath of one leaf pair connate; second leaf pair almost free, 5–6 mm long, free parts keeled, margins and keel finely ciliate, all glaucous-green. *Capsules*: not known.

77. **Antimima prostrata** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia prostrata L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 61 (1929). *Mesembryanthemum prostratum* (L.Bolus) N.E.Br.: 32 (1930). Type: *Leipoldt BOL18899* (BOL, holo.!).

Plants creeping with proleptic side branches as tiny lateral bodies, later forming a mat, heterophyllous. *Leaves*: sheath of one leaf pair long, yellowish, rather smooth, enclosing larger part of subsequent leaf pair with a shorter sheath and longer free parts with papillae, in particular along margins and keel, often two or more leaf pairs of second type following each other, ± 3 mm long, body ± 2.5 mm diam. *Capsules*: typical of genus. Small-leaved version of *A. brevicarpa* sharing similar character states with that species, in particular the same type of fruit and ecology.

78. **Antimima pumila** *(Fedde & Schuster) H.E.K. Hartmann*, comb. nov.

Mesembryanthemum pumilum L.Bolus ex Fedde & Schuster in Just's Botanischer Jahresbericht 41: 92 (1918). *Ruschia pumila* (Fedde & Schuster) L.Bolus: 60 (1929). *Mesembryanthemum pumilum* (L.Bolus) N.E.Br.: 32 (1930) nom. illeg. Type: *Pearson 3917* (BOL, holo.!).

Ruschia levynsiae (L.Bolus) Schwantes: 58 (1949). *Mesembryanthemum levynsiae* L.Bolus: 256 (1927b). Type: *Levyns NBG1373/26* (BOL, holo.!).

Plants compact, heterophyllous. *Leaves*: smooth sheath on one leaf pair with short, spreading, papillate, rough tips; second leaf pair enclosed which unfolds during rainy season showing two almost oval, spreading leaves, connate slighty at bases and exhibiting upper surfaces, a rare condition in compact Ruschioideae; epidermis papillate. *Capsules*: typical of genus.

The difference in appearence between the resting state, when the yellowish green leaf pair forming a round body with the free tips protruding, and the growing phase is striking—in season, the bright green leaf pair spreads so completely that the persistent sheaths are hardly visible. This difference is the reason why Bolus described the species twice within two years, having seen *Ruschia pumila* in the resting state only, but *Ruschia levynsiae* growing, developing the described heterophylly (Figure 1E). Bolus (1913: 150) had described '*M.* pumilum, circa 5 cm altum', using the adjective as a descriptive word only, not as a formal epitheton to name a species, as she stated herself in 1929, when describing *Ruschia pumila*. Meanwhile, Fedde & Schuster (1918) had taken *Mesembryanthemum pumilum* L.Bolus as a validly described name, which it became only through their cita-

tion of the basionym and the type, hence the authorship 'L.Bolus ex Fedde & Schuster'.

79. **Antimima pusilla** *(Schwantes) H.E.K.Hartmann*, comb. nov.

Ruschia pusilla Schwantes in Zeitschrift für Sukkulentenkunde 3: 300 (1928a). *Mesembryanthemum parvum* N.E.Br.: 32 (1930). Type: photograph of type (HBG, lecto.!, in collection Schwantes HBG, here designated).

Plants compact, heterophyllous. *Leaves*: very similar in so far as they both develop long, smooth sheaths, one leaf pair with low distant papillae on short free parts (this one persisting during dry season enclosing next leaf pair); other with distinctly longer papillae thus looking rougher, papillae elongated along margins. *Capsules*: with expanding keels merging into expanding sheets and both together covering lower half of valve (when open); closing body small with a hollow underneath into which placenta extends. The heterophylly may be overlooked easily, but the fact that during the resting time one leaf pair encloses the subsequent one indicates the different roles the two leaf pairs play.

80. **Antimima pygmaea** *(Haw.) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum pygmaeum Haw. in Supplementum plantarum succulentarum: 98 (1819). *Ruschia pygmaea* (Haw.) Schwantes: 92 (1928b). Type: drawing no. 996/204 by Duncanson (K, lecto.!, here designated).

Plants caespitose, forming mats, heterophyllous. *Leaves*: sheath of one leaf pair developing into a conical body enveloping subsequent leaf pair, upper part disintegrating into a cracked cover through which the following leaf pair grows when rain starts to fall, tips of both leaf types pointed and triangular as seen from above; epidermis very smooth, covered by a thin rugose layer of wax. *Capsules*: typical of genus; very narrow valve wings, 6-loculed. Typical of species: conical white bodies formed by leaf pairs in resting period becoming cracked with time; laciniate old leaves occur also in *A. ivori*, but those are truncate and appear like a trimmed edge.

81. **Antimima quarzitica** *(Dinter) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum quarzziticum Dinter in Feddes Repertorium 19: 151 (1923). *Ruschia quarzitica* (Dinter) Dinter & Schwantes: 69 (1929). *Corpuscularia quarzitica* (Dinter) Schwantes: 186 (1926). Type: *Dinter 3866* (B, holo.!).

Plants compact with erect to spreading long shoots, bearing short shoots with several leaf pairs, isophyllous. *Leaves*: triquetrous, apically recurved. *Capsules*: typical of genus; closing bodies medium-sized.

82. **Antimima roseola** *(N.E.Br.) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum roseolum N.E.Br. in Kew Bulletin 1929: 60 (1929). *Ruschia roseola* (N.E.Br.) Schwantes: 230 (1938). Type: *Muir 4067* (not 4062, as in description) (K, holo.!).

Plants caespitose, heterophyllous. *Leaves*: sheath of one leaf pair long, whitish with rather short free tips; epidermis nearly smooth; margins and keel turning white with age, keel continuing in a fold or narrow wing down sheath and stem below; second leaf pair with longer free parts with medium long papillae. *Capsules*: typical of genus; expanding tissue thick and short at base of valve, rising to inner side, but not forming a distinct expanding keel.

83. **Antimima saturata** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia saturata L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 122 (1929). *Mesembryanthemum atrocinctum* N.E.Br.: 32 (1930). Type: *Pillans BOL18952* (BOL, holo.!).

Plants compact with long shoots, heterophyllous. *Leaves*: white, papery sheath of one leaf pair 3–4 mm long, free parts 4–5 mm long, with low papillae; other leaf pair united for ± 2 mm only, free parts up to 10 mm long, with long papillae on keel and margins, low papillae of different sizes on sides, wax cover dense, consisting of flakes often connected. *Capsules*: unknown.

The heterophylly had not been recognized in the original description, nor the differences in papillae. In both features, the species resembles *A. mathewsii*, which has thicker and more robust stems but is similar in the irregular branching pattern.

84. **Antimima saxicola** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia saxicola L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 46 (1929). *Mesembryanthemum saxicola* (L.Bolus) N.E.Br.: 32 (1930). Type: *Smith 4090* (sheet II) (BOL, lecto.!, here designated from several sheets of that collection).

Plants compact with long shoots blackish brown with age, isophyllous. *Leaves*: triquetrous, keel and margins cartilaginous. *Capsules*: typical of genus; covering membranes deeper in centre. Plants resemble those of *Ruschia orientalis* L.Bolus and *Ruschia putterillii* (L.Bolus) L.Bolus with tiny closing bodies, in growth form and ecological preferences.

85. **Antimima schlechteri** *(Schwantes) H.E.K.Hartmann*, comb. nov.

Ruschia schlechteri Schwantes in Zeitschrift für Sukkulentenkunde 3: 301 (1928a). *Mesembryanthemum schlechteri* (Schwantes) N.E.Br.: 32 (1930). Type: *Anon. s.n.*, photograph of 'type plant' (HBG, lecto.!, here designated, collection Schwantes HBG).

Plants compact, with few longer shoots with dense heads of leaves and fruits, heterophyllous. *Leaves*: longer sheaths of leaf pairs persisting as a series of tubes around old stem for several years, free parts of leaves short; other type of leaf pair trigonous, epidermis almost smooth, ± 9 mm long, connate for ± 5 mm. *Capsules*: typical of genus; narrow valve wings and radial wings on covering membranes.

86. **Antimima simulans** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia simulans L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 260 (1931). Type: *Frames BOL19375* (BOL, holo.!).

Low shrubs, heterophyllous. *Leaves*: sheaths of one leaf pair 4–5 mm long, free parts 1–2 mm long, papillae

low; other leaf pair with sheath ± 4 mm long, free parts up to 9 mm long, on long shoots at each node in one season. *Capsules*: unknown.

87. **Antimima sobrina** *(N.E.Br.) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum sobrinum N.E.Br. in Kew Bulletin 1929: 60 (1929). *Ruschia sobrina* (N.E.Br.) Schwantes: 230 (1938). Type: *Muir 4014* (K, holo.).

Plants caespitose, heterophyllous. *Leaves*: sheaths of one type of leaf pair connate for just over half their length; other leaf pair almost free, free parts trigonous, keel scabrous, 3–5 mm long. *Capsules*: not known.

88. **Antimima solida** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum solidum L.Bolus in Annals of the Bolus Herbarium 3: 136 (1922). *Ruschia solida* (L.Bolus) L.Bolus: 239 (1927b). Type: *Pillans 2421* (sheet I) (BOL, lecto.!, here designated: chosen from two sheets).

Ruschia solida (L.Bolus) L.Bolus var. *stigmatosa* L.Bolus: 94 (1929). Type: *Pillans 6048 I*, cited as *NBG147/28*, marked ' = *147/25*' on sheet (BOL, lecto.!, here designated: chosen from two sheets).

Plants compact to forming big mats, isophyllous. *Leaves*: finger-shaped to terete. *Capsules*: typical of genus; only dorsal bundles of fruit present, interior having fallen out as a tumble fruit, tiny valve wings sometimes present. Resembles *Argyroderma fissum* (Haw.) L.Bolus in its decumbent growth and finger-shaped leaves; both species grow sympatrically and can easily be confused in their vegetative state. Since fruits remain on the plants in both species, a distinction in habitat is easier.

89. **Antimima stayneri** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia stayneri L.Bolus in Journal of South African Botany 27: 260 (1961). Type: *Stayner KG450/61* (BOL, holo.!).

Shrubs with stout stems, heterophyllous. *Leaves*: papery protective cover of two parts derived from one type of leaf pair, these leaves elongate, free, to 10 mm long, tips slender, pointed, dark when dry; second pair almost free, finely papillate, ± 8 mm long. *Capsules*: typical of genus. In leaves and stems *A. stayneri* resembles *A. emarcescens* and *A. subtruncata*, but the latter species grow as climbers in other bushes.

90. **Antimima stokoei** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia stokoei L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 160 (1929). Type: *Stokoe NBG28/25* (BOL, holo.!).

Plants compact, heterophyllous. *Leaves*: long sheath in one type of leaf pair, free parts with some short, dispersed papillae; other leaf pair with short sheaths and long, papillate free parts. *Capsules*: with very narrow valve wings and small closing bodies. The type looks very similar to that of *A. verruculosa*, differing mainly in the diameter of the flower, a feature known to change during anthesis.

91. **Antimima subtruncata** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia subtruncata L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 211 (1930). Type: *L.Bolus BOL19231* (BOL, holo.!).

Ruschia subtruncata L.Bolus var. *minor* L.Bolus: 286 (1954). Type: *Acocks 17185* (BOL, holo.!).

Plants compact with long shoots twining in other bushes, heterophyllous; side branches with scars and somewhat spiny remains of closely set leaf pairs. *Leaves*: one leaf pair with papery protective cover of two parts ± 10 mm long, connate for only ± 2 mm, apical part papillate; second leaf pair enveloped during resting period, ± 6–10 mm long, free parts triquetrous, papillate, with some bigger papillae along margins, mucro recurved. *Capsules*: typical of genus; expanding sheets rising to form keels. Typical of species: pseudo-sheaths formed by one leaf pair consisting of almost free leaves, but turning papery for the dry season like connate sheaths in other species; these sheaths are about as long as broad in *A. subtruncata*. Similar in general appearence to *A. emarcescens* and *A. stayneri*, both with slender leaves.

92. **Antimima triquetra** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia triquetra L.Bolus in South African Gardening and Country Life 18: 178 (1928a); L.Bolus: 231 (1928d). *Mesembryanthemum triquetrum* (L.Bolus) N.E.Br.: 33 (1930). Type: *Banks NBG1935/15* (BOL, holo.!).

Plants compact with long shoots, erect at first, later decumbent, heterophyllous. *Leaves*: one type of leaf pair with a papery protective cover of two parts ± 8 mm long, connate for only ± 2 mm, apical part subulate, with low papillae; second leaf pair ± 6–8 mm long, triquetrous, with long papillae along keel and margins, mucro erect. *Capsules*: typical of genus. Typical of species: pseudo-sheaths formed by one leaf pair consisting of almost free leaves, but turning papery for the dry season like connate sheaths in other species—in this feature, the species resembles *A. subtruncata*.

93. **Antimima tuberculosa** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia tubercolusa L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 110 (1929). *Mesembryanthemum enorme* N.E.Br.: 33 (1930). Type: *Leipoldt BOL18940* (BOL, holo.!).

Plants caespitose, forming mats with age, isophyllous. *Leaves*: trigonous. *Capsules*: typical of genus with very narrow valve wings. The epithet *tuberculosa* refers to the big closing body Bolus noticed when describing the species.

94. **Antimima turneriana** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia turneriana L.Bolus in Journal of South African Botany 29: 175 (1963). Type: *Van Breda 1912/63* (BOL, holo.!).

Plants compact in habitat, developing some long shoots in cultivation, isophyllous. *Leaves*: triquetrous with convex sides. *Capsules*: typical of genus; radial protrusions ± wing-shaped, disintegrating later, forming rows of long teeth; valve wings at first as broad as

expanding keels, disintegrating later quickly. Similar to *A. dualis*, both compact in habitat, but the latter never changing shape.

95. **Antimima vanzylii** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia vanzylii L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 209 (1930). Type: *Van Zyl in Fuller 94* (BOL, holo.!).

Plants compact with long shoots when not eaten, isophyllous. *Leaves*: triquetrous. *Capsules*: typical of genus. In spite of their strong smell of soda, plants are obviously rather heavily browsed by animals.

96. **Antimima varians** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia varians L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 209 (1930). Type: *L.Bolus BOL19212* (BOL, holo.!).

Plants compact with long shoots developing shorter side shoots in bundles or groups. *Capsules*: typical of genus.

97. **Antimima ventricosa** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Mesembryanthemum ventricosum L.Bolus in Annals of the Bolus Herbarium 3: 128 (1922). *Cheiridopsis ventricosa* (L.Bolus) N.E.Br.: 73 (1926). *Ruschia ventricosa* (L.Bolus) Schwantes: 106 (1927). Type: *Pillans NBG475/16* (BOL, holo.!).

Plants compact, heterophyllous. *Leaves*: one type of leaf pair with a long sheath connate for almost half its length; second with a longer free part; free parts trigonous and papillate in both types, but more densely so in younger, less connate leaves, 40–80(–120) mm long, 13–17 mm broad, 10–13 mm diam. *Capsules*: without valve wings, expanding keels distant, 4–6-loculed, incompletely known. The low number of locules excludes the species from *Cheiridopsis*, where it might otherwise belong.

98. **Antimima verruculosa** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia verruculosa L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 125 (1929). *Mesembryanthemum verruculosum* (L.Bolus) N.E.Br.: 33 (1930). Type: *Haymes NBG592/26* (BOL, holo.!).

Low shrublets, heterophyllous. *Leaves*: sheath of one leaf pair long, smooth with a short, papillate, free part; other leaf pair with a short sheath and longer papillae. *Capsules*: with a small closing body, partly destroyed. The 'type plant' is very similar to *A. stokoei*, which has larger flowers.

99. **Antimima watermeyeri** *(L.Bolus) H.E.K.Hartmann*, comb. nov.

Ruschia watermeyeri L.Bolus in Notes on Mesembrianthemum and allied genera, part 1: 146 (1927/1928). Type: *Watermeyer NBG554/23* (BOL, holo.!).

Ruschia stenopetala L.Bolus: 53 (1960) Type: *Littlewood KG276/60* (BOL, holo.!).

Ruschia obtusifolia L.Bolus: 298 (1962) Type: *Hall 2467* (BOL, holo.!).

Plants caespitose, isophyllous. *Leaves*: trigonous to roundish. *Capsules*: typical of genus; extremely narrow valve wings at areas where expanding keel meets edge of valve.

The type material of all species included here is very similar to that of *A. klaverensis* in growth pattern, leaf shape, and fruit morphology, differing only in the absence of the fishy smell reported for the latter species.

100. **Antimima wittebergensis** *(L.Bolus) H.E.K. Hartmann*, comb. nov.

Mesembryanthemum wittebergense L.Bolus in Annals of the Bolus Herbarium 4: 88 (1927a). *Ruschia wittebergensis* (L.Bolus) Schwantes: 106 (1927). Type: *Compton NBG 1920/24* (BOL, holo.!).

Plants caespitose, isophyllous. *Leaves*: cymbiform or boat-shaped. *Capsules*: with small closing bodies, exceptionally broad and thick closing ledges and narrow valve wings.

SPECIES EXCLUDED FROM *ANTIMIMA*

Ruschia virgata *(Haw.) L.Bolus* in South African Gardening and Country Life 17: 239 (1927); L.Bolus: 72 (1927/1928).

Mesembryanthemum virgatum Haw.: 88 (1803); *Antimima virgata* (Haw.) Dehn: 213 (1989). Type: *Bortenschlag s.n.* (K, lecto.!, designated by Dehn 1989: 213).

Plants with erect, thin branches from a denser centre, often in other bushes. *Leaves*: triquetrous, hardly connate, pair at its base leaving a triangle of stem visible between them. *Capsule*: base elongate, funnel- to bell-shaped, top almost semi-orbicular from high valve rims; covering membranes forming a roof, ridge being the contact line, closing ledges sharp and long; closing body nearly hook-shaped, hollow; expanding keels distant at bases. Material matching the collection of Bortenschlag, which was seen by Haworth, possesses fruits of the *Ruschia* type, with deep locules and small, hook-shaped closing bodies. The species is therefore placed back in *Ruschia*.

ACKNOWLEDGEMENTS

The basic work has been supported financially over many years by the Deutsche Forschungsgemeinschaft; additional travel grants were received from the University of Hamburg, the Hansische Universitätsstiftung, and the Cactus and Succulent Society of America. To all donors I am most grateful. I should also like to thank many friends, colleagues, students, and collaborators during field trips and in connection with the extensive studies on the material. The directors of the herbaria B, BOL, K are thanked for extensive loans of type sheets, for making available prints of drawings, and for much additional information. My thanks go also to several referees who have helped to reduce mistakes in citations and explanations.

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