

Taxonomy of the *Euphorbia pseudoglobosa* aggregate, including the description of two new varieties

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Fig. 1: *Euphorbia pseudoglobosa* var. *pseudoglobosa*: Growing in full sun, this specimen from the Heidelberg area resembles *Euphorbia pseudoglobosa* var. *juglans* (photo Rikus van Veldhuisen).

According to molecular and morphological studies (Bruyns, 2012, Peirson et al., 2013, Ritz et al., 2003), *Euphorbia pseudoglobosa* Marloth and *E. juglans* Compton are very closely related species, restricted to the Western Cape Province of South Africa. However it is important to note that the distribution areas of these endemic taxa are separated by a geographical barrier, i.e. the Langeberg range, some 250 km long, 20 km wide and up to 2,075 m high. *Euphorbia juglans* inhabits the semi-desert Little Karoo north of the mountains, while the territory of *E. pseudoglobosa* lies to the south in the wetter Fynbos riches of the Overberg region and Heidelberg vicinity.

That notwithstanding, *E. juglans* has been synonymised with *E. pseudoglobosa* by Bruyns (2012). We are, however, of the opinion that their marked ecoregional separation should not be completely neglected, and that the reasons

why these plants were originally seen as two divergent species still remain taxonomically relevant. Since they do not possess sufficiently distinct, easy to identify morphological characters to be considered clearly separate species and taking into account the results from the above mentioned DNA-research, it has been concluded that they belong to a conglomerate of taxa which is assigned to *E. pseudoglobosa* or *E. pseudoglobosa* aggregate, group or complex.

Based on the findings of the molecular phylogeny study of *Euphorbia* subgenus *Athymalus* (Euphorbiaceae) by Peirson et al. (2013), *E. pseudoglobosa* agg. is in *E.* section *Anthacanthae* Lem. subsection *Florispinae* Haw. series *Meleuphorbia* (A.Berger) Bruyns. Other species included in this taxonomic subdivision are *E. cumulata* R.A.Dyer, *E. ferox* Marloth, *E. heptagona* L., *E. tubiglans* Marloth (incl. *E. tubiglans* Marloth ex R.A.Dyer var. *jansenvillensis* (Nel) D.H.Schnabel,



Fig. 2: A specimen of *Euphorbia pseudoglobosa* var. *pseudoglobosa* from the Malgas area without blunt dry remains of peduncles (photo Detlef H. Schnabel).



Fig. 3: The specimen from the Malgas area illustrated here is another example of the very variable appearance of *E. pseudoglobosa* var. *pseudoglobosa*: A copiously spiniferous plant with clearly above-ground secondary stems (photo Detlef H. Schnabel).

van Veldh. & Marx), *E. mammillaris* L., *E. meloformis* Aiton, *E. nesemannii* R.A.Dyer, *E. obesa* Hook.f., *E. pentagona* Haw., *E. pillansii* N.E.Br., *E. polygona* Haw., *E. pulvinata* Marloth, *E. stellispina* Haw., and *E.*

susannae Marloth. These are all South African endemics except *E. pulvinata*, which also occurs in Lesotho.

Typically all these closely affiliated species are dioecious (rarely a plant's cyathium contains both sexes)



Fig. 4: A specimen of *Euphorbia pseudoglobosa* var. *pseudoglobosa* from the Bredasdorp area with distinct spine-like persistent peduncles (photo Detlef H. Schnabel).



Fig. 5: Feeble spiniferous specimen of *Euphorbia pseudoglobosa* var. *pseudoglobosa* from the Bredasdorp area (photo Detlef H. Schnabel).



Fig. 6: *Euphorbia pseudoglobosa* var. *pseudoglobosa* of the Heidelberg subpopulation with prostrate, elongated branches growing in the shadow of a bush (photo Rikus van Veldhuisen).

with the male cyathia nearly twice the diameter of the female cyathia. Further common characteristics are a usually shrubby growth habit as well as a vertically ribbed main stem and branches in which the distinct ribs are made up of tubercles.

Peirson et al. (2013) consider *Euphorbia pseudoglobosa* as different from other species of the series *Meleuphorbia* in having:

1. a main stem and branches (secondary stems), which are distinct from each other (together with *E. nesemannii*)
2. a storage organ with a tuberous root and a single, often completely subterranean main stem, with

branch apices only appearing at ground level (together with *E. susannae*)

3. no persistent flower stalks or stipular spines (together with *E. tubiglans* and *E. susannae*)

Distinct or not distinct?

Distinguishing very closely allied species can be a head-scratcher to taxonomists. Therefore these taxa are usually lumped into a species aggregate, rather than accepted as distinct species. This does not necessarily imply that there is no morphological or molecular divergence at a lower taxonomic level between these difficult to interpret taxa.



Fig. 7: *Euphorbia pseudoglobosa* var. *pseudoglobosa* from south-west of Heidelberg (photo J. Gerhard Marx).



Fig. 8: A specimen of *E. pseudoglobosa* var. *juglans* from the same locality (south of the Anysberg Nature Reserve) as the specimen shown in Fig. 9. Another example, in terms of emphasizing how difficult it can be to determine to which taxon a specimen belongs if no locality data are available nor how high the species' morphological variation apparently is (photo Rikus van Veldhuisen).

To go into this matter, the relevant literature regarding the sister species *E. pseudoglobosa* and *E. juglans* was reviewed, including the molecular surveys of Bruyns et al. (2006), Peirson et al. (2013) and Ritz et al. (2003).



Fig. 9: *Euphorbia pseudoglobosa* var. *juglans* growing south of the Anysberg Nature Reserve (photo Rikus van Veldhuisen).

This review was accompanied by extensive studies of plant phenotypes in the field, in cultivation and in virtual herbaria (BOL, K, PRE), which make collections of digital images of preserved specimens available to the public on the Internet.

Taxonomically significant morphological variation within and among specimens of both *E. pseudoglobosa* and *E. juglans* was evaluated by measuring significant morphological traits (e.g. habit, height, thickness and surface colour of stems, length and number of peduncles, shape, number and depth of ribs, habit of inflorescence, colour and number of nectary glands and indumentum on involucre) for cultivated specimens and those in habitat at the currently known localities. Based on these data collection and published treatments (e.g. Eggli, 2002, Jacobsen, 1954, White et al., 1941) a list of quantitative and qualitative characteristics to separate the taxa was compiled (see table 1, page 19).

In the field every taxon was extensively photographed. A distribution map is provided.

As a result of the comparative morphological analysis, we classify *E. juglans* as a variety of *E. pseudoglobosa* and propose two additional morphologically distinct varieties. Herbarium vouchers were prepared from field collected specimens and were deposited in the Compton Herbarium (NBG) of the South African National Biodiversity Institute in Kirstenbosch Botanic Gardens, Cape Town.

The present study was undertaken to show the diversity of variation within *E. pseudoglobosa* agg.



Fig. 10: A 'lusus naturae' (a whim of nature): The cyathia of this *E. pseudoglobosa* var. *juglans* specimen, quite unusual, are hermaphroditic viz. containing both sexes (photo Detlef H. Schnabel).

Does identification and delineation of varieties make sense?

Some taxonomists who use neutral molecular markers (sequences of DNA that are not or only very little influenced by natural selection) avoid establishing taxa below the species level (e.g. Bruyns, 2012). Intraspecific variation is usually ignored, not least because, for the time being, it is not possible to identify and separate members of the same species by molecular-based techniques.

Also, when systematists are looking at the broader picture of a hyper diverse plant genus like *Euphorbia* with more than 2000 species worldwide, they cannot hope to understand the considerable variation within most individual species and so that level of detail is often glossed over (Paul E. Berry, pers. comm. to the first author (DHS), 7 July 2013).

Still, in spite of all taxonomic deficiencies and complexity, morphological variation should be considered at the species and population levels, because it may reflect local adaption of populations to changing environments, even though a few selected neutral DNA sequences show no genetic differentiation. Such evolutionary important, rapidly evolving, locally-adapted populations could represent the early stages in speciation (Ballentine & Greenberg, 2010).

Furthermore, it is our view that taxa below the rank of species are not only fundamentally essential for un-



Fig. 11: Typical specimen of *E. pseudoglobosa* var. *juglans* growing in arid conditions west of Ladismith which seems likely to be the type locality (photo J. Gerhard Marx).

derstanding the process of speciation, but their nomenclatural acceptance has also important implications for conservation policy. Protecting conservation units such as varieties, forms and subspecies ensures that a wide range of possible adaptive potential for the species is preserved. This may lead to increased survival chances of the species in a high-pressure, competitive environment. Once lost, gene variants cannot be recovered.



Fig. 12: Solitary inflorescence of a female *E. pseudoglobosa* var. *juglans*, west of Ladismith (photo Detlef H. Schnabel)..



Fig. 13: Close-up of male cyathia of *Euphorbia pseudoglobosa* var. *juglans*, west of Ladismith (photo Detlef H. Schnabel).



Fig. 14: Male *E. pseudoglobosa* var. *juglans* specimens from west of Ladismith appear not to show walnut sized branches and an almost entirely subterranean habit of growth, which are assumed to be characteristic for the taxon. The elongated body of the male specimen shown here is about 140 mm long – much larger than typical *juglans*. Note the branching inflorescence (photo Detlef H. Schnabel).

Intraspecific levels, in particular “subspecies” and “variety”, are not consistently used by taxonomists and hence confusion prevails (Hamilton & Reichard, 1992, Stuessy, 2009). Below we are establishing varieties within *E. pseudoglobosa*. These varieties reflect intraspecific morphological variation as well as differences in habitats and geographical ranges.



Fig. 15: *Euphorbia pseudoglobosa* var. *juglans* from the variety’s most western distribution area south-east of Touwsrivier. Compared to the subpopulation from west of Ladismith the plants are smaller and branches rarely elongate, also the shape is quite different as is the yellow-brown body colour (photo Rikus van Veldhuisen).

Taxonomic treatment

Euphorbia pseudoglobosa var. *pseudoglobosa*, in South African Gardening & Country Life 19: 191 (1929), incl. *Euphorbia frickiana* N.E.Br., J. Cact. Succ. Soc. Amer. 2: 491. (1931)

Type: South Africa, Western Cape Province, near Krombeks River, Riversdale distr., Sept. 1933, Muir 4089 (holotype: PRE).

Description: Dioecious perennial dwarf succulent with fleshy roots and underground primary or main stem; **stem** tuberous, cylindrical or ± globose, producing clusters of glabrous secondary stems or branches from the apex at ground level; **branches** above or below ground or partially to almost completely buried, rebranching with stem connections very short and narrow, globular to cylindrical, dull green, with a subtle white wax layer, 12 to 35 mm in diameter and up to 300 mm long, 5- to 10-ribbed; **ribs** tuberculate; **tubercles** flattish, wider than long; **cyathia** solitary, pedunculate; **peduncles** up to 7 mm long, deciduous or persistent; **bracts** small, 3 below the involucre and 1 or 2 on the lower part of the peduncle; **involucre** up to 4 mm in diameter, glabrous, 5 glands; **glands** contiguous, oblong, green; **ovary** nearly sessile; **capsule** and **seeds** unknown.

Flowering time: Spring and in autumn

Distribution: Colonies are very small and scattered throughout the Riversdale to Bredasdorp area south of the Langeberg range. Here, a field survey by DHS may be mentioned as an example for its very limited occurrence. A detailed inventory of the species present at its locality south-east of Malgas was conducted in May 2017. This locality encompasses approximately 1,000 square meters and contains only 20 specimens.

White et al. (1941) also stated a locality 56 km north of Montagu, but this is situated north of the Langeberg mountain belt in *E. juglans* territory and the pictured plant also looks more similar to that taxon. We are of the opinion that this locality and photograph rather refer to *E. juglans* (see note to its taxonomic status below).

The overall current population trend is declining and the species is subject to several threats ranging from droughts, overgrazing, trampling by livestock

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