A monograph about some long existing taxonomic mysteries …

including

Euphorbia leachii Lawant & van Veldhuisen sp. nov., *Euphorbia tridentata* (Lam.) var. *ornithopus* (Jacq.) van Veldhuisen & Lawant comb. & stat. nov. and some dubious interpretations of *Euphorbia patula* Mill.

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Chapter 1. Introduction.

1.1. What the reader may expect when studying this monograph.

Our topic of interest, pertaining to the succulent *Euphorbia* species thriving in South Africa, regards the group of so-called "*Dactylanthes*" which strikes us by its remarkable flowers (cyathia), possessing at the outer edge of the glands conspicuous, teeth-like processes. The glands can vary in number from four to five, even six; their teeth numbering from two to four or five. Regarding the feature "toothed glands", the British botanist, entomologist and gardener A. H. Haworth (1768-1833) observed a remarkable resemblance between several South African succulent *Euphorbia* species, as known at the time; therefore Haworth adopted for them the "generic" name "*Dactylanthes*", or, as he defined, "*Finger-flower Euphorbia's*" (Haworth, 1812).

For the next 120 years, the name *Dactylanthes* remained restricted to the group of species consisting of *Euphorbia globosa* Sims, *Euphorbia tridentata* Lam. and *Euphorbia ornithopus* Jacq. However, in 1931 H. W. R. Marloth expanded the group with *Euphorbia wilmaniae* Marloth and *Euphorbia polycephala* Marloth and in 1940 A. C. White, R. A. Dyer & B. L. Sloane added *Euphorbia planiceps* Marloth ex A.C.White, R.A.Dyer & B.Sloane.

Already for a very long time the *Euphorbia* species commonly named *Euphorbia tridentata* Lam. and *Euphorbia ornithopus* Jacq. may be found in nature as well as in cultivation. However, many plants have been reported to show a much diverging morphology. Conspicuous differences might be observed: plant habit low-spreading or erect, plant small or large, simple branched or much rebranching, stem and/or branches tapering or oval elongated, inflorescence solitary or peduncled or even cymose, cyathia differing in size and colour, and so on. Regardless of being reported from its natural habitat in South Africa, seen in botanical gardens, cultivated in private collections or mentioned in floras and compendia, all these plants are usually called *Euphorbia tridentata* Lam. or *Euphorbia ornithopus* Jacq. irrespective of its diverging morphology.

Particularly the plant labelled *Euphorbia tridentata* Lam., as said well-known with collectors and scientists for a very long time, was surely imported into Europe at the very beginning of the 18th century. During the past two centuries various other names have been given to the species, note that over seventy years ago A. C. White, R. A. Dyer and B. L. Sloane (1941, p. 503) already ascertained

that the different names of the species, usually called "*Euphorbia tridentata*", remain to mystify the collector.

Investigations conducted in the field, many observations from cultivation and the study of relevant plant descriptions and plant portraits published for about 330 years justify the conclusion that by one and the same name "*Euphorbia tridentata* Lam." in fact two different species are included, a species validly recognized as *Euphorbia tridentata* Lam. and a new species to be named *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. The existence of these distinct species was already supposed by the late South African botanist L. C. Leach, who provisionally named them *Euphorbia tridentata* Lam. and *Euphorbia* cf. *tridentata*. Plant descriptions by botanists about the species *Euphorbia tridentata* Lam., *Euphorbia ornithopus* Jacq., *Euphorbia patula* Mill. and related (phrase) names confirm this distinction. In this monograph we will describe the new species *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. (Ch. 2, section 2.50.1). A copper engraving dated 1720 turns out to be the earliest picture of *Euphorbia leachii* Lawant & Van Veldhuisen sp. nov., whereas a watercolour made in 1686 or 1687 pertains to the first illustration of *Euphorbia tridentata* Lam.

Observations from field work and from cultivation led to the conclusion that the overall habit of *Euphorbia tridentata* Lam. and *Euphorbia ornithopus* Jacq. is identical except for the kind of inflorescence and that therefore these species will be reduced to related variety status, namely *Euphorbia tridentata* Lam. var. *tridentata* and *Euphorbia tridentata* Lam. var. *ornithopus* (Jacq.) van Veldhuisen & Lawant comb. & stat. nov. (Ch. 2, section 2.50.2).

In this monograph we will extensively discuss how some taxonomic mystifications live on until today. For instance, one and a half decades ago R. H. A. Govaerts, D. G. Frodin & A. Radcliffe-Smith (2000) decided that the name *Euphorbia tridentata* Lam. has to be considered a synonym of the species named *Euphorbia patula* Mill. as cultivated by the British horticulturist Philip Miller (1691-1771), keeper of the still extant Chelsea Physic Garden, London. In 1768, Miller described the species in the 8th edition of his *The Gardeners Dictionary*, particularly specifying it as a non-tuberculate species. A couple of years ago, the South African botanist P. V. Bruyns (2012) rehabilitated the species name *Euphorbia tridentata* Lam. again as accepted; but by confirming *Euphorbia patula* Mill. to be a valid species, Bruyns assigned the latter name as the earlier name for *Euphorbia ornithopus* Jacq., subsequently reducing this name into synonymy.

The reference made by A. H. Haworth (1812), when ascribing his tuberculate *Dactylanthes patula* to the non-tuberculate species "*Euphorbia* [No.] *11 (Patula)*" by Ph. Miller (1768), is here discussed as a regrettable misidentification on Haworth's part concerning the morphological habit of the latter. Granting non-tuberculate *Euphorbia patula* Mill. (Miller, 1768) as conspecific with the tuberculate *Euphorbia tridentata* Lam. (Govaerts et al., 2000) or with the tuberculate *Euphorbia ornithopus* Jacq. (Bruyns, 2012) are rejected not only because of Haworth's erroneous interpretation of Miller's species, but also for the lack of a herbarium specimen preserved in Miller's herbarium at BM, for the want of an illustration as intended lectotype and for drawbacks in the protologue (Ch. 2, section 2.50.3).

Well over a decade ago S. Carter (2002), describing *Euphorbia tridentata* Lam. and its synonyms, already stated (we cite): "*Euphorbia patula* (Haworth) Sweet [based on *Euphorbia patula* Mill.] ... *its true identity remains in doubt*".

Nevertheless, in a recent molecular phylogeny and classification of *Euphorbia* subg. *Athymalus* (Peirson et al., 2013), the according to Miller explicitly non-tuberculate species *Euphorbia patula* is incorporated in the subsection *Dactylanthes* (Haw.) Pax & K.Hoffm. which comprises succulents with tuberculate stems and branches.

1.2. Method of investigation.

To found our conclusions as mentioned above, we retrieved as best as we could the naming, picturing and description of all species we considered related to the species *Euphorbia tridentata* Lam., *Euphorbia ornithopus* Jacq. and *Euphorbia patula* Mill. In particular, we tracked down all known taxonomic descriptions and citations about the species of our interest for the past 330 years, i. e. since the first mention of a South African succulent *Euphorbia* species in the eighties of the seventeenth century. Because we also found that many botanists, when describing species, quoted earlier published descriptions, we obtained in historical sense a "network" of references in the proper sense of "who refers to whom" and "who is quoted by whom". In this way, in search for possible consistency, we could study the differences or similarities between the various descriptions.

Next, because the second author (RvV) examined the species in the field for a considerable number of times, we included all his observations in this monograph (Ch. 3). Because the late South African botanist L. C. Leach searched several times for these particular species in the field and recorded his findings in a number of hand-written notes, we quoted his field notes verbatim as far as relevant for our study (Ch. 4).

Especially we investigated, surveying the descriptions of the species we found in literature as well as from observations in the field, to what extent inflorescence types as "simple" vs. "cymose" and inflorescence characteristics as "sessile" vs. "short-peduncled" or "long-peduncled" must be considered significant features to distinguish between different species, or not. And concerning the inflorescence, we studied the descriptions of the morphology of the cyathia, carefully comparing the aspects in which they prove to be distinguishing between species (Ch. 5).

1.3. Plan of the monograph.

Chapter 1, pp. 1-4, introduces the main theme of the monograph, describing the research question and method of investigation.

Chapter 2, pp. 5-96, enumerates in chronological order the relevant plant descriptions and plant portraits as retrieved from history since 1686/1687.

Chapter 3, pp. 97-145, records the field work by the second author (RvV) about his encounters with the species of our interest, namely *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., *Euphorbia tridentata* Lam. var. *tridentata* and *Euphorbia tridentata* (Lam.) var. *ornithopus* (Jacq.) van Veldhuisen & Lawant comb. & stat. nov.

Chapter 4, pp. 146-163, discusses the field notes of the late L. C. Leach with regard to the species mentioned in chapter 3, comparing Leach's observations to the field work of the second author.

Chapter 5, pp. 164-178, comprises, concerning the flowering habit and the morphology of the cyathium of the species of our interest, a search for consistency between a description which an author quotes and his or her own description, as well as for consistency between the description of the one to whom is referred by an author and the description of this particular author; the results are summarized in a table and subsequently discussed.

Chapter 6, pp. 179-183, matches the results from historical perspective and the findings from field work, leading to the conclusion that the commonly known name *Euphorbia tridentata* involves two different species, namely *Euphorbia tridentata* Lam. and a new one to be named *Euphorbia leachii* Lawant & van Veldhuisen sp. nov.

Chapter 7, p. 184, summaries these results in a brief conclusion.

Chapter 8, pp. 185-189, presents an important concordance with regard to species retrieved from historical retrospect as well as collected from the field on the one hand and *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., *Euphorbia tridentata* (Lam.) var. *ornithopus* (Jacq.) van Veldhuisen & Lawant comb. & stat. nov., *Euphorbia tridentata* Lam. var. *tridentata* and *Euphorbia patula* Mill. on the other hand.

Chapter 9, p. 190, presents a presumed phylogenetic cladogram to clear the position of the species mentioned above.

Finally, the monograph is concluded by the **Acknowledgements** (p. 190), **Authors' addresses** (p. 191), **List of Figures** (pp. 191-195), **References regarding the sections as enumerated in the historical part** (pp. 195-201), **General references** (pp. 201-202) and the **Contents** (pp. 203-208).

Notes to the Reader.

1. Comments, corrections or clarifications from our, authors', side are put between straight brackets, not italicized (except for plant names).

2. When we cite verbatim an author, his or her statements are reproduced between quotation marks as well as in italics.

3. When we render a statement of an author, we will do it exactly as he or she has spelled it. For instance, Ph. Miller (1768) speaks of "*Patula*" with a capital letter "*P*", C. Linnaeus (1753) of "*Euphorbia Caput medusae*" with a capital "*C*" but without a hyphen; N. E. Brown (1915) notifies "*Euphorbia Caput-Medusae*", hyphenated, with two capitals in the epithet. When citing verbatim these authors, we recognized this spelling, therefore we did not consider this spelling to be a misspelling and insofar, we did not correct an original, verbatim quoted spelling into modern linguistic, botanical usage.

Chapter 2. Searching history: chronological results.

2.1. Attributed to **Hendrik Claudius** (c. 1655-1697), official draughtsman in service of the Dutch United East-India Company (VOC) at the Cape of Good Hope, a watercolour, drawn in 1686 or 1687, is relevant concerning the species of our interest. The painting is preserved as *Folio No. 188* (see Fig. 1) in the volume *Icones Plantarum et Animalium* ("IPA collection"), a collection of watercolours in 1953 acquired by the Africana Museum of Johannesburg (since 1994 called MuseuMAfrica) but nowadays held in the African Studies & Art Department of the Johannesburg Public Library. At the University of Witwatersrand, the botanists M. M. Macnae and L. E. Davidson (Macnae & Davidson, 1969) identified this particular watercolour as *Euphorbia tridentata* Lam.

Fig. 1. Watercolour painted by Hendrik Claudius in 1686 or 1687, preserved as *Folio No. 188* in the *Icones Plantarum et Animalium* collection at Johannesburg, South Africa.

The text on the folio, written in 17th century Dutch language, says:

"*Tithymalus afr. minor / glomerat. / groeijd in de Vlakte en bloeijd in September*",

or,

"*Lesser African Tithymalus, growing closely together as if mutually entangled and united in clews, balls or heads; it grows in the Plain and flowers in September*".

The description includes the Latin habit term "*glomerat.*", an abbreviation for "*glomeratē* " or "*glomeratim*", indicating the habit of plants to form extensive mats, growing closely together as if mutually entangled and united in clews, balls or heads. The habit is caused by the development of a network of rhizomes horizontally spreading below the surface of the ground, forming dense mats; as such this phenomenon is regarding this species mentioned e. g. by J. Burman (1738), re. *Euphorbia anacantha* by A. Berger (1906, date on t. p. 1907) and re. *Euphorbia tridentata* Lam. by R. A. Dyer (1931), A. C. White, R. A. Dyer & B. L. Sloane (1941) and G. Marx (1992).

The painted plant shows erect, somewhat spreading branches, spineless, with flat tubercles. On top of some branches we detect solitary, sessile or nearly sessile cyathia, with five 3- to 4-toothed glands. The small globe on top of the branch second from left depicts a glabrous capsule, not a leaflet.

The habitat is mentioned on Hendrik Claudius' folio as: "*it grows in the Plain* [= in Dutch: "de Vlakte"]", this could very well match the extensive plains which occur, according to Van Wyk & Smith (2001), in the Eastern Cape.

Note that the species, portrayed by Hendrik Claudius (1686 or 1687), is not cited by any author, however, Johannes Burman (1738) copied the painting for an engraving (although resulting in a mirror image) to accompany one of the South African succulent plants he described, see section 2.7, Fig. 4. Regarding the engraving, regrettably Burman does not give any reference to Claudius. Bruyns (2012) designated Burman's engraving as lectotype for *Euphorbia tridentata* Lam.; but we consider Claudius' watercolour the earlier illustration of *Euphorbia tridentata* Lam. (lectotype, designated here). To introduce Claudius' watercolour as the first illustration of *Euphorbia tridentata* Lam., a brief survey of the life and work of the artist must be given to understand the circumstances under which Claudius' paintings were achieved and especially to underline the importance of this watercolour.

The collection *Icones Plantarum et Animalium*, held in the African Studies & Art Department of the Johannesburg Public Library, is regarded the most complete series of watercolours to be attributed to the VOC draughtsman Hendrik Claudius. Allegedly, he was assisted in his "studio" at the Cape by a team of at least 5 copyists, but according to Kennedy (1967) the whole IPA collection must be catalogued under the name of Hendrik Claudius. *Folio No. 188* is one of a series of 343 plant paintings; in 1969 the scientists MacNae & Davidson had the *IPA* collection of Claudius' watercolours thoroughly identified with help from known botanists. Eleven watercolours pertain to *Euphorbia* species, namely one from the North-Western Cape, two from the Northern Cape, six from the Western Cape and two from the Eastern Cape. The *Euphorbia* folios which McNae & Davidson (1969) identified, refer to *Euphorbia arceuthobioides* Boiss., *Euphorbia caput-medusae* L. (two varieties), *Euphorbia clandestina* Jacq., *Euphorbia hamata* (Haw.) Sweet, *Euphorbia loricata* Lam., *Euphorbia mauritanica* L., *Euphorbia tridentata* Lam., *Euphorbia pugniformis* Boiss. in DC, *Euphorbia stellaespina* Haw. and *Euphorbia tuberosa* L.

In the year 1685 the Lords XVII, Directors of the Dutch East India Company (VOC), appointed Hendrik Adriaan van Rheede tot Drakestein (ca. 1836-1691), known for his famous Hortus Malabaricus Indicus about the flora of Malabar, India, as commissioner general to investigate illegal, cunning, private trading by some Dutch colonists at the VOC victualling station called The Cape of Good Hope. For refreshments and medicinal purposes a vast orchard and botanical garden was maintained. As soon as Van Rheede had been informed about the findings of pure copper ore in Namaqualand, his financial interests awakened. He authorized the Commander (Governor) at the Cape, Simon van der Stel (1639-1712), to undertake an expedition to the Copper Mines in Namaqualand, southeast of Springbok, to investigate its possibly commercial profitable benefit. According to the diary kept by Simon van der Stel (Waterhouse, 1932; De Wet & Pheiffer, 1979, summarized in Lawant & Winthagen, 2007) on the 25th of August 1685 an immense contingent of people, waggons, oxen, horses, two field guns (to scare off natives!) and even a boat on a tow cart departed from the Cape colony northward. As customary in those days, but particularly because Commander Simon van der Stel himself was much interested in botany, he got himself accompanied by a much gifted draughtsman, Hendrik Claudius, for making paintings of all interesting topics of natural history the expedition would meet on the way.

From origin a native of Breslau, Silesia, apothecary by profession at Batavia (now Jakarta, Indonesia), in 1683 Hendrik Claudius was sent by the VOC physician-on-duty at Batavia to the Cape to collect botanical specimens of medicinal value. However, once at the Cape, because of his drawing abilities Claudius was engaged in the service of the VOC as an official artist to carry out sketches of plants, animals, native people and landscapes, instructed to portray them all with the truest fidelity. In October 1685, the Simon van der Stel expedition train finally reached the Copper Mines, but mining activities proved not to be of any profit. Upon returning to the Cape colony in January 1686, Claudius set to work. First, in 1686 he compiled a portfolio of pictures to accompany the diary of the Simon van der Stel expedition, this report being shipped to the Netherlands for attention to the Lords XVII of the VOC. The report, including watercolours of two *Euphorbia* species viz. *Euphorbia loricata* Lam. and *Euphorbia stellaespina* Haw., a century later became preserved in the Library of Trinity College, Dublin, Ireland, after being carried off from the Netherlands to England on the eve of the occupation of the Netherlands by the French under Napoleon Bonaparte in 1795 (De Wet & Pheiffer, 1979).

During the years 1686-1687 Hendrik Claudius, allegedly assisted by a small team of copyists, produced a vast assortment of watercolours about topics of natural history pertaining to Southern Africa. How did he have material other than from the Simon van der Stel expedition as mentioned above? As vividly told by Karsten (1951) and Gunn & Codd (1981), the VOC colony at the Cape served from 1652 onwards as a victualling station to the east- and home-bound merchant ships lying at anchor at the Cape of Good Hope, providing the scurvy-ridden crews with clean water and victuals like fresh vegetables, fruit and meat. The demands were fulfilled by maintaining at the Cape colony kitchen gardens, fruit tree orchards and an important sheep and cattle farm. To barter cattle with the native Khoi people, from 1655 on Cape colonists explored off and on the country in various directions. After the setback of the Van der Stel expedition northwards, now to obtain cattle the colonists extended their expeditions particularly eastwards, as far as and beyond the Eastern Cape. Of great importance were the strict orders given to the exploring colonists to bring back home all interesting natural history material they met, including plants of possible edible, medicinal or other useful value, all for the purpose to study and cultivate them in the gardens at the Cape colony. Even today, it is sometimes thought that in that period botanical findings from regions like the Eastern Cape could not have been occurred because at that time Cape colonists had not yet settled as farmers in those districts. Although this last-mentioned statement is correct, to supply the enduring shortage of cattle at the VOC Cape colony, from the very beginning colonists explored

again and again by way of single trips the whole Cape region in easterly directions, exchanging with the natives their livestock, sometimes illicitly, even rustling cattle by means of robbery raids. During the early eighties of the century they went beyond the Great Fish River, and for much time-consuming game-hunting treks possibly even to Natal (Gunn & Codd, 1981). On these occasions they must have collected, among other interesting plants, *Euphorbia* species from the Eastern Cape, like the *Dactylanthes* species of our interest. Consequently from a wide region, from the Western as well as the Eastern Cape, many objects of natural history, especially living plants, came into the possession of the artist Hendrik Claudius and his team of copyists, who painted them accordingly all true to nature. In the second half of 1687 Hendrik Claudius was sent away by the Lords XVII of the Dutch East India Company to the island of Mauritius and next to Batavia (now Jakarta, Indonesia) for being accused of privately selling paintings to French Jesuits visiting the Cape and of giving them for personal profit too much inside information about the weal and woe of the Cape colony.

In summary, Claudius is said to have completed two large folio volumes of paintings in the course of the year 1686 (Wilson et al., 2002), followed by a further collection of watercolours in early 1687. After Claudius' dismissal, in the next years some Cape colonists compiled – but on demand - several selections of available paintings and sent these selections to a lot of wealthy plant collectors and known botanists in Europe. For instance, a selection of Claudius' watercolours, consisting of three volumes, was compiled in 1692 for Nicolaas Witsen, Director of the VOC and Burgomaster of Amsterdam, called the *Codex Witsenii*, including paintings of four *Euphorbia* species, *Euphorbia loricata* Lam., *Euphorbia stellaespina* Haw., *Euphorbia hamata* (Haw.) Sweet and *Euphorbia mauritanica* L. (Wilson et al. 2002, Lawant & Winthagen, 2007). According to the Dutch botanist Herman Boerhaave (1720), ultimately about 1500 watercolours, painted by Claudius and his copyists, became known in Europe. Consequently, English, Dutch, French and German botanists, who were acquainted with various sets of Claudius' paintings, in many cases used them as an example for the paintings and engravings in their own treatises (Edwards, 1978; Wijnands, 1983). As observed by Wijnands & Goldblatt (1992) and Wijnands (1992) the Dutch botanists Johannes Burman (1707-1779) and his son, Nicolaas Laurens Burman (1733-1793), at least owned four different compilations of drawings of Cape plants attributed to Hendrik Claudius, including a copy of the diary of Simon van der Stel to Namaqualand, the 3-volumed *Codex Witsenii* and the *Icones Plantarum et Animalium*. After N. L. Burman's death in 1800 all this material was auctioned, but then it disappeared from sight for many years. Most important to note is, that from 1687 onwards not only paintings but also seeds, succulent plants and bulbs were shipped to Europe, for only this particular material proved to be capable in surviving the very long sailing voyage to the European homeland. Soon living specimens and seeds of Cape plants were carefully nursed in academic and private botanical gardens. From the very beginning of the eighteenth century an extensive garden circuit developed: wealthy and ardent plant collectors assembled and exchanged new exotic introductions for their gardens, greenhouses and country houses, far away from the filthy towns. In addition, many botanists got them eagerly for study and description in their compendias of exotic plants.

2.2.1. Simon van Beaumont (1640-1726), Secretary of the States of Holland and West-Frisia, collected in his monumental horticultural garden at The Hague a rich collection of exotic plants; during four decades before and after the beginning of the 18th century these plants were shipped to him from the Cape, the Canary Islands, the Indian subcontinent and the Caribbean Islands all on his demand. Less is known about the names of the exotic plants that Simon van Beaumont assembled in his garden. But in the year 1690 an unknown botanical artist (only known by his or her monograms "SDM" or "SM" on the paintings) set to work in the "Hortus Simonis van Beaumont" to manufacture gouaches commissioned by the Amsterdam apothecary Albertus Seba (1665-1736)

who had them hand-coloured engraved in his 4-volumed, 446-plate thesaurus which was called with a dual Latin-Dutch title: *Locupletissimi rerum naturalium thesauri accurata descriptio, et iconibus artificiosissimis expressio, per universam physices historiam - Naaukeurige beschryving van het schatryke kabinet der voornaamste seldzaamheden der natuur* (published 1734 - 1765). In 1735

C. Linnaeus consulted Albertus Seba's Cabinet of Natural Curiosities when developing his taxonomic classification system. Twenty-seven original gouaches have been preserved, on inspecting them at L! we only found two drawings of *Euphorbia* species, determined as "*Euphorbia cotinifolia* L." and "*Euphorbia neriifolia* L.", a gouache of a *Phyllanthus* species and two up to today not determined Euphorbiaceae presumably from the Caribbean. No gouaches picturing the species of our interest proved to be present.

2.2.2. Simon van Beaumont's Secretary **François Kiggelaer** (1648-1722), renowned apothecary, in 1690 catalogued the collection at the Hortus Simonis van Beaumont; but Kiggelaer did not include any specimen of our interest (Kiggelaer, 1690). Nevertheless, in some later years (we assume between 1690 and 1716) Simon van Beaumont must have got one from the Cape, for he made Herman Boerhaave (see section 2.4) a present of it; in 1716 Boerhaave sent a specimen of the species to his friend Antoine-Tristan Danty d'Isnard in Paris for description (Danty d'Isnard, 1720, see section 2.5).

2.2.3. Soon after Simon van Beaumont deceased in 1726, his vast collection of exotic plants, shrubs and trees was put up for public sale. The auction catalogue of his whole horticultural estate is preserved at BM and VAD(!); it is compiled by an anonymous hand (**Anonymus, 1726**). By inspection of the items offered for auction, we find in the catalogue mentioned living specimens of succulent *Euphorbia* species which can be identified as *Euphorbia canariensis* L., *Euphorbia heptagona* L. and *Euphorbia neriifolia* L. Two groups of plants, consisting of eight and five plants respectively, for us of particular interest, became presented for sale:

(a) Auction No. 246, No. 247, No. 258, No. 259, No. 267, No. 268, No. 270 and No. 271, all concerning plants listed as "*Tithymalus aizoïdes caule squammato* (*)", or, "*Succulent and evergreen Tithymalus with a scaly stem*";

(b) Auction No. 248, No. 249, No. 255, No. 256 and No. 262, all regarding plants labelled as "*Tithymalus aizoïdes simplici squammato* (*) *caule*", or, "*Succulent and evergreen Tithymalus with an undivided* [i. e. not branched] *scaly stem*".

(*) The botanical term "*squammato*" as mentioned in the auction catalogue has to be considered a spelling error for "*squamato*".

Studying the auction catalogue in depth, we suppose the following. If group (b) is explicitly specified as "*simplici caule*", i. e. "*not branched*"; we conjecture that group (a) consisted of specimens with a "*much-branched*" stem (i. e. "*multiplici caule*"). The question is, from which group stems the plant which Simon van Beaumont, sometime before 1716, donated to H. Boerhaave (see section 2.4), who, in turn, sent it in 1720 to A.-T. Danty d'Isnard for description? If we consider Danty d'Isnard's description (section 2.5) as pertaining to a rebranching plant, its origin has to be from group (a). However, for the time being, we consider this problem not yet solvable.

2.3. **Caspar Commelin** (Casparus Commelinus; 1667 or 1668 - 1731), professor of botany at the Athenaeum Illustre at Amsterdam, described at the turn of the century some *Euphorbia* species from the Cape (Commelin, 1703), including a succulent "*Tithymalus*", now identified as *Euphorbia clava* Jacq. from the Eastern Cape (Wijnands, 1983); the Amsterdam Hortus Medicus already received seeds of the species in the year 1700. In the course of the first 2-3 decades of the 18th

century, also between 1692 and at the latest 1731, Caspar Commelin compiled a checklist of all plant species that became recorded in the 3-volumed *Codex Witsenii*, which was manufactured in 1692. By the way, alas!, only a part of the original *Codex Witsenii* has been preserved (Wilson et al. 2002). Commelin's checklist, called *Catalogus Manuscripto ad Codex Witsenii*, got lost too, but on many occasions it is cited by Johannes Burman (1707-1779) who also studied the then complete *Codex Witsenii* extensively. According to Burman (1738), Caspar Commelin named one species:

"*Tithymalus Africanus aizoides, multiplici squamato caule non folioso, minor*",

or,

"*Lesser succulent and evergreen African Tithymalus with a manifold branched, scaly, not-leafy stem*".

2.4. **Herman Boerhaave** (1668-1738), professor of medicine and botany and at the University of Leiden, Holland, and director of its Hortus Medicus, published in 1720 a catalogue of all the plants growing in the academic medical garden, called *Index alter Plantarum quae in Horto Academico Lugduno-Batavo aluntur.* In *pars prima* of the *Index alter Plantarum, etc*., summing up *Euphorbia* species (pp. 255-259), Herman Boerhaave enumerates 44 non-succulent species listed under "*Tithymalus*" and 11 succulent species listed under "*Euphorbium*"; of the last mentioned ones six species are reported to be coming from the Cape of Good Hope. One of them (p. 258) he describes as follows, we quote:

"*Euphorbium* [No.] *7. Euphorbium; Afrum; caule squamoso; tuberoso* (*)*; minus. Ex Horto Amplissimi Simonis van Beaumont*",

or,

"*Small African Euphorbia, with a stem covered with scales and with a tuberous root. Coming from the garden of the highly honourable Simon van Beaumont*".

(*) We learn from Philip Miller (1743), when he translated in English Boerhaave's Latin text concerning *Euphorbium* [No.] *7, etc.*, that the terminus "*tuberoso*" particularly refers to the *root* of the species.

In his catalogue Boerhaave did not include a picture of the plant but c. 1716 he sent a specimen to a befriended French botanist, A.-T. Danty d'Isnard in Paris, who in 1720 described the plant in full and had it engraved (see section 2.5).

Note that to the species, catalogued by H. Boerhaave (1720) as "*Euphorbium* [No.] *7. Euphorbium; Afrum; caule squamoso; tuberoso; minus*", is referred by A.-T. Danty d'Isnard (1720, reprint 1722) re. *Euphorbium* [No.] *12. Euphorbium anacanthum, squamosum, lobis florum tridentatis,* see Fig. 2a; by R. Bradley (1727) re. *The Large White flower'd African Spurge*, see Fig. 3; by C. Linnaeus (1737) in the *Hortus Cliffortianus*; by J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, see Fig. 4 and by Ph. Miller (1731, 1733, 1735, 1743, 1745) re. *Euphorbium* [No.] *7. Euphorbium, Afrum, caule squamoso, tuberoso, minus.*

2.5. **Antoine-Tristan Danty d'Isnard** (1663-1743), according to Léon Croizat (1934) *Botanicus sine pari*, botanist at the Jardin Royal des Plantes Médicinales in Paris, wrote in 1720 a paper, entitled *Établissement d'un Genre de Plante appellé Euphorbe; avec le dénombrement de ses espèces, de deux desquelles on donne les Descriptions & les Figures*. Danty d'Isnard gives an overview of the succulent *Euphorbia* species which he recognized as "*Euphorbium*", describing 12 different species, two varieties included. It was published in the *Mémoires of the Académie Royale*

des Sciences de France du 10. Décembre 1720, on pp. 384-399, and two years later reprinted in the *Acta de l'Académie Royale des Sciences 1722*, however, with another pagination, *viz*. pp. 502-518.

The subject of our present research was published in the *Mémoires of the Académie Royale des Sciences de France du 10. Décembre 1720*, pp. 387, 392-399, accompanied by an engraving (*Pl. 11*; see Fig. 2a) as well as issued in a reprint of the paper, namely in the *Acta de l'Académie Royale des Sciences 1722*, pp. 502, 507-518, with *Pl. 11* again annexed. It is to this particular reprint of 1722, that J. Burman (1738) refers, when presenting his *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis* (see section 2.7.2). C. Linnaeus (1753) also refers to this reprint when describing the "variety" *Euphorbia caput-medusae 8.β, Euphorbium anacanthum squamosum, lobis florum tridentatis*; note that Linnaeus considers Burman's species quite another "variety" (see section 2.10.1).

Danty d'Isnard, citing the catalogue that Herman Boerhaave published in the same year (1720), introduces the plant he had received from Boerhaave as follows: "*Euphorbium* [No.] *12. Euphorbium anacanthum, squamosum, lobis florum tridentatis*", or, "*Spineless, scaly Euphorbium, with 3-toothed lobes to the flowers*". Danty d'Isnard particularly refers to the species in 1720 published by Herman Boerhaave, namely *Euphorbium Afrum, caule squamoso, tuberoso, minus. Boerh. Ind. Alt. I. 258. No. 7*, or, *Small African Euphorbium, with a stem covered with scales and with a tuberous root. Boerhaave Index alter* [Plantarum, etc.] [pars] *I* [p.] *258. No. 7*.

Antoine-Tristan Danty d'Isnard describes the species in early 18th century French:

"*Cet Euphorbe, auquel le célébre M. Boerhaave a donné le nom que j'ai ci-devant rapporté, n'a été ni décrit, ni gravé, que je sçache, par aucun Auteur.*

N'ayant pas eu occasion de voir la racine des plus forts individus de cette Plante, tel qu'est celui que je vais décrire; je ne parlerai que de celle que j'ai pû remarquer à un jeune pied venu de bouture.

De la circonférence du bas de cette bouture [1] (*) *sortent presque horisontalement, & en rond, plusieurs fibres succulents, blanchâtres en dehors, plus blanches en dedans, dont les plus longues ont environ six à sept pouces, sur trois lignes d'épaisseur vers leur origine, allant de-là toujours en diminuant de grosseur jusqu'à leurs extrémités, qui se terminent en filet: ces fibres se divisent d'espace en espace en plusieurs menues branches garnies de chevelu.*

Du collet de la racine des plus forts pieds [2] *de cet Euphorbe, partent successivement plusieurs tiges arrondies, dont les plus longues ont trois à quatre pieds, & traînent à terre. Quoiqu'à l'œil nud ces tiges paroissent être glabres, elles sont pourtant parsemées de poils catis blancs-sales & fort courts, qu'on apperçoit avec le secours de la loupe; nonobstant la couleur de ces poils, celle du verd de ces tiges, qui par endroits sont teintes de rouge brun, ne laisse pas d'être foncée & obscure, & celle de l'extrémité de leurs tiges & de leurs branches est assez gaye, & quelquefois lavée de purpurin.*

L'épaisseur de ces tiges n'est pas par-tout la même, puisqu'elles sont comme étranglées en certains endroits, & renflées dans d'autres: ici elles peuvent avoir depuis six jusqu'à huit lignes de diamétre, & là trois à quatre seulement, & même quelquefois moins.

Leurs étranglements sont occasionnés par le ralentissement ou le repos de la séve, ils marquent l'âge de ces tiges, ainsi celles où l'on voit, par exemple, quatre de ces étranglements sont âgées de deux ans, puisqu'il y a deux séves chaque année, l'une au printemps, & l'autre à l'automne. Ces tiges étant coupées transversalement [1]*, répandent beaucoup de lait moins âcre que celui de la quatriéme espéce, lequel étant écoulé & essuyé, l'on apperçoit une tranche charnue, dont la portion renfermée dans une cercle brisé en quatre ou cinq endroits, paroît blanche: l'autre portion*

qui est la plus considérable, & qui se trouve comprise entre le contour extérieur du cercle brisé & la peau de la tige, est d'un blanc verdâtre: ce cercle qui est plus blanc qu'aucune autre partie de la tranche [1], y est tracé par la coupe de plusieurs fibres ligneuses & longitudinales.

De l'extrémité de quelques-unes des plus fortes branches & des principales tiges, partent deux, trois, quelquefois quatre ou cinq rameaux disposés en rond, qui d'une base étroite augmentent de grosseur, ensuite ils diminuent insensiblement jusqu'à leur sommet, qui est obtus.

Les tiges, de même que leurs divisions & subdivisions, sont dans toute leur longueur ciselées de figures représentant des écailles à peu-près semblables à celles des Pommes de Pin. Ces écailles sont le plus souvent opposées par paires, qui se croisent successivement & de maniére que leur arrangement décrit quelquefois des spirales.

On remarque que les écailles du bas des tiges, & celles qui approchent le plus de leurs étranglements, sont les plus petites; elles ont le plus souvent quatre à cinq lignes de longueur, sur trois à quatre dans le fort de leur largeur: au lieu que les autres sont ordinairement longues de cinq à six lignes, sur environ deux à trois & demie de large. Elles ont toutes le dos arrondi, qui va se terminer à une éminence, dont la pointe obtuse est chargée d'une seule feuille [3], laquelle après sa chûte, laisse sur cette pointe une cicatrice cendrée. Quoique les feuilles [3] de cette Plante soient de peu de durée, & qu'il ne s'en rencontre qu'à la sommité de ses tiges & de ses branches; il seroit aisé de sçavoir précisément, si on le vouloir, combien un individu peut en avoir donné depuis sa naissance; car comme chacune de ces feuilles n'a pû sortir que d'une de ces écailles, lesquelles ne s'effacent jamais, en comptant celles-ci, on auroit le nombre de celles-là. Il est vrai que les feuilles qui semblent tenir lieu de calyce aux fleurs de cette Plante, ne seroient pas comprises dans ce nombre, aussi ne doivent-elles pas l'être, vû qu'elles sont différentes des autres.

Les feuilles [3] existentes sur les écailles, ont à peu près la forme & le volume de celles de l'Herniaria hirsuta J. B. tom. 3, lib. 29, pag. 379. Elles sont un peu plus épaisses, sans queue, creusées en goutiere en dessus & selon leur longueur, arrondies en dessous, d'un verd clair, parsemées de part & d'autre de petits poils blancs-sales, catis, peu sensibles, & remplies d'un lait qui pique la langue: les plus grandes n'ont guere que deux tiers de ligne dans le sort de leur largeur, sur environ une ligne & un quart de longueur, se terminant en pointe qui se renverse un peu en dessous. Les plus petites ou les naissantes sont colorées de purpurin.

De l'extrémité de la plûpart des plus fortes tiges & des principales branches, sortent ordinairement quatre fleurs, dont trois sont disposées en triangle, dans le centre duquel la quatriéme [4,5], est placée. Celle-ci épanouit la premiére, elle n'a point de pédicule, ni de feuilles qui l'accompagnent, elle porte immédiatement & directement sur l'extrémité de la tige ou de la branche. Cette fleur est, pour ainsi dire, un cône renversé & un peu tronqué, haut d'environ trois à quatre lignes, sur sept à huit de diamétre à sa base. Elle est assez charnue, verte en dehors, & parsemée de ce côté de petits poils catis, pareils à ceux des tiges & des feuilles.

A un ligne en deçà de l'origine de cette fleur [4,5], commencent ses principales découpures, qui forment cinq lobes égaux, placés à pareille distance les uns des autres, & recoupés chacun en trident, quelquefois même en quatre pointes[4], qui représentent autant de fourchons.

Pour décrire avec plus d'exactitude chaque lobe, il me semble qu'il est à propos de le diviser en trois parties principales, que je nommerai inférieure [d], moyenne [e], supérieure [7], l'inférieure représente une espéce de capuchon [d], dont le creux est partagé en deux cavités égales, par une cloison qui regne dans sa longueur. Le haut de ce capuchon est sendu depuis son bord, jusqu'à l'origine de la partie moyenne du lobe, la circonférence de son ouverture est garnie de petits poils blanc-sales, qu'on n'y découvre qu'avec la loupe. Ce capuchon, conjointement avec ses sembables, couvre d'abord l'ovaire & les étamines contenus dans le fond de la fleur. Tous ces capuchons forment ensemble une espéce de bonnet à cinq pans, d'un verd obscur, lavé de rouge brun.

La partie moyenne [e] de ce lobe, n'est, pour ainsi dire, qu'un étranglement qui sépare les deux autres parties, & qui sert comme de cou, ou plûtôt de manche [e] fort court à la supérieure.

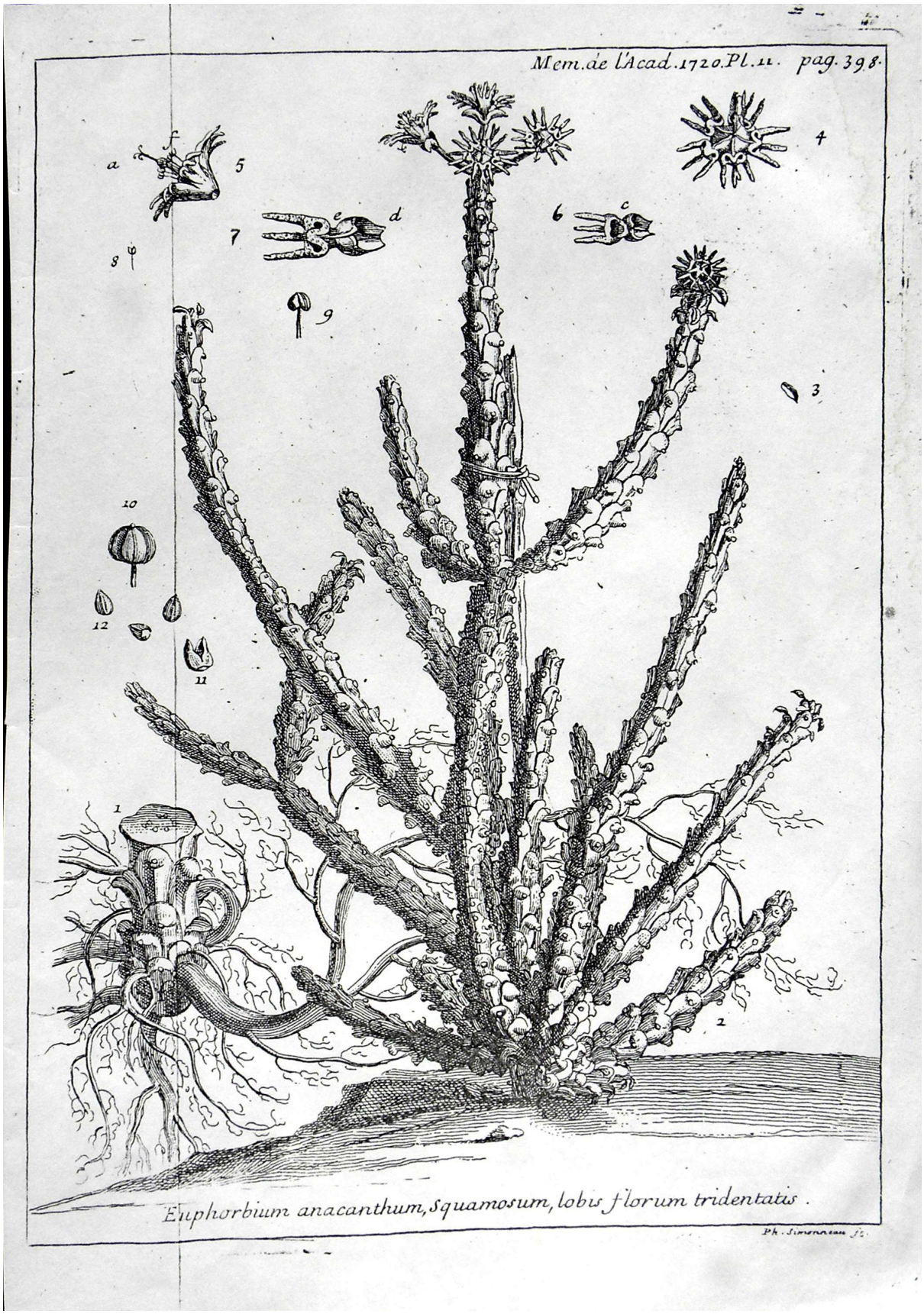


Fig. 2a. Engraving in the *Mémoires of the Académie Royale des Sciences de France du 10 Décembre 1720,* illustrating *Euphorbium anacanthum, squamosum, lobis florum tridentatis*, described by Antoine-Tristan Danty d'Isnard (1720, reprint 1722, *Pl.11*).

Je partagerai aussi cette derniére partie du lobe en inférieure, que j'appelle triangle [c], & en supérieure, que je nomme trident [6,7]. Ces deux parties jointes ensemble ont ordinairement trois à quatre lignes de longueur, sur environ deux & demie de largeur. Ce triangle [c] est attaché par un de ses côtés à la base du trident [6], il est vert-noirâtre en dessus, bordé d'un ornement blanc qui est ciselé ou bouillonné; sa pointe qui d'abord est étendue sur le haut du capuchon, se trousse ensuite, & va s'appliquer presque sur l'origine du second fourchon du trident, ce fourchon [4] se send quelquefois assez profondément en deux parties; tous ces fourchons sont arrondies, ayant environ deux lignes de longueur, sur un tiers de ligne de largeur dans le bas, allant de là toujours en diminuant se terminer en pointe. La haut du trident [7] est ordinairement un peu plus large que sa base, laquelle n'a qu'environ deux lignes: le dessus de ce trident est blanc, ciselé & bouillonné comme le bordé du triangle [c], & le dessous est d'un verd brun, lavé de purpurin.

Il s'éléve du fond de cette fleur [4,5], un ovaire [f] & quinze étamines, dont les filets sont glabres; la partie de chaque filet qui s'est échappée du bonnet, après en avoir écarté les pans, & qui les surmonté d'environ une ligne & demie, est rouge, tirant sur le châtain, & n'a qu'un quart de ligne d'épaisseur; le sommet qu'il porte à son extrémité est jaune, de même que la poussiére qui en sort.

L'ovaire [f] qui se trouve entouré de ces étamines est soutenu par un pédicule glabre, droit, luisant, presque transparent, d'un verd clair, long de deux lignes & demie ou trois lignes, sur un tiers de ligne de diamétre. Cet ovaire est surmonté par une trompe [a] glabre, rougeâtre, longue de deux lignes, épaisse d'un quart de ligne, divisée par le haut en trois crochets disposés en triangle, longs d'environ une ligne, dont les bouts sont tumefiés & un peu applatis.

Les trois autres fleurs, que j'ai dit être disposées en triangle autour de celle que je viens de décrire, paroissent ensuite, elles lui ressembleroient en toutes choses, si elles n'avoient chacune un lobe de moins;la place de celui qui leur manque est occupée par leur ovaire panché à l'occasion de son pédicule qui est toujours courbé. D'ailleurs chaque fleur est soutenue par un pédicule d'un verd gai, long d'environ trois lignes, épais d'un tiers de ligne, garni vers le haut de deux feuilles sans queue, opposées, charnues, d'un verd clair, bordées de purpurin, parsemées de petits poils blancs-sales; ces feuilles qui semblent servir de calyce à la fleur, sont longues chacune de deux lignes ou environ, sur une ligne & demie de diamétre dans le fort de leur largeur, finissant en pointe, terminée par un poil rougeâtre.

Chaque ovaire [10] étant mûr a près de deux lignes & demie de hauteur, sur trois lignes ou environ de diamétre vers la base, qui est sa partie la plus large; sa couleur est d'un rouge tirant sur le châtain: lorsqu'on le regarde avec la loupe, sa peau paroît come chagrinée, & on y découvre de petits poils blancs-sales très-courts. Sa forme est triangulaire, ses angles sont arrondies & relevés selon leur longueur d'un petite côte qui les coupe en deux parties égales: ces angles sont autant de capsules [11] assemblées autour d'un placenta commun, qui contiennent chacune une semence [12] d'un brun clair, dont la figure approche de celle d'une toupie renversée, & sur la tête de laquelle paroît une place quarrée, enceinte d'un rebord ou petite éminence; du centre de cette place jusqu'à la pointe de la toupie, regne une ligne noire qui regardoit la placenta, & qui coupe l'enceinte de la place par un de ses angles. Cette ligne passe entre deux autres petites éminences relevées en forme de côtes, lesquelles se trouvent opposées l'une à l'autre sur les côtés de la toupie, qu'elle coupe, pour ainsi dire, selon sa longueur en deux moitiés égales. Cette toupie est haute d'environ une ligne & demie, sur un peu moins de diamétre dans le plus fort de son épaisseur. La capsule [11] qui la renfermoit, s'ouvre selon sa longueur, par l'endroit qui s'appliquoit au placenta de l'ovaire.

Cette espéce d'Euphorbe est vivace, ses fleurs paroissent en Septembre & Octobre; elles n'ont presque point d'odeur.

Son suc laiteux & âcre, de quelque partie de la Plante qu'on le tire, rougit assez vivement le Papier bleu.

Plusieurs Auteurs, anciens & modernes, ayant écrit des vertus de l'Euphorbe, j'ai crû qu'il seroit inutile de répéter dans ce Mémoire, ce qu'ils en ont rapporté.

Cet Euphorbe croît naturellement en Afrique; il y a environ quatre ans qu'on le cultive au Jardin Royal des Plantes Médicinales à Paris, où il a été envoyé de Leyde par M. Boerhaave",

or, translated in English,

"*This Euphorbium, to which the famous Mr. Boerhaave has given the name which I have cited above* [i. e. *No. 7*: *Euphorbium Afrum, caule squamoso, tuberoso, minus*, H. Boerhaave, 1720] *has not been described or drawn, as far as I know, by any author.*

Not in the position to have a look at the root of the most well-built specimens of this plant, like the one I am going to describe, I will only speak about what I can be observe concerning a fresh root coming from a cutting.

From the outline at the base of this cutting [1] (*) *emerge almost horizontally, and around, several succulent roots, whitish at the outside, very white inside, the longest ones about 6 to7 thumbs* [16.2-18.9 cm (**)] *by 3 lines* [6.8 mm] *thick at the beginning, gradually decreasing in thickness to the extremities which are ending in threads: these roots spatially divide into several thin rootlets provided with fine hairs.*

From the neck of the stoutest rootstocks [2] *of this Euphorbium successively appear several round stems of which the longest ones are 3 to 4 feet* [97-130 cm (**)], *bending to the ground. Although at first glance these stems look glabrous, nevertheless they are covered with very short, dirty-white shiny hairs, only to be seen by means of a magnifying glass; despite the colour of these hairs, the green colour of the stems, which on some spots are tinged with red-brown, does not show to be dark and obscure, and the colour at the end of the stems and their branches is rather bright and sometimes washed by purpurine* [= a reddish-brown/yellowish tinge].

The thickness of the stems is not everywhere the same, because they are as if constricted at certain spots and swelled up at other ones, here they can possess from 6 up to 8 lines [13.5-18.0 mm] *in diameter and further on* [i. e. at the constrictions] *only 3 to 4 lines* [6.8-9.0 mm] *and sometimes less.*

Their constrictions are caused by the deceleration or pause regarding the flowing of the plant sap, they characterize the age of the stem when you look at them, for instance, four joints are two years old for there are two plant sap flows each year: one in spring and another one in the autumn. These stems, when cut across [1], *shed much milk, less acrid than the fourth kind I described* [i. e. *Euphorbium* (No.) *4 = Euphorbia polygona* Haw.], *when dabbed and wiped off, one notices a fleshy intersection, the inner part enclosed by a ring which is interrupted by four or five angles, looks white; the other part, which is the most important and which is included between the external contour of the fractured ring and the skin of the stem, appears greenish-white; the* [inner] *circle which is more white than any other part of the intersection* [1], *is characterized by the cut of several timber-like and longitudinal fibres.*

From the far end of some of the strongest branches and principal stems appear two, three, sometimes four or five branchlets, arranged at all sides, which from a narrow base increase in thickness, next become gradually smaller until their top, which is obtuse.

The stems, just like their divisions and subdivisions, are over their whole length chiselled with figures representing scales, which more or less resemble those of fir cones. These scales are most often opposite in pairs, which successively intersect in such a way that their arrangement sometimes describes spirals.

One observes that the scales at the foot of the stems as well as the ones which come the most close to the constrictions are the smallest ones, they are most often 4 to 5 lines [9.0-11.3 mm] *by 3 to 4 lines* [6.8-9.0 mm] *where they are the most thick, but where they usually are 5 to 6 lines* [11.3-13.5 mm] *long they are about 2 to 3½ lines* [4.5-7.9 mm] *thick. They all have a convex back ending in a protuberance with an obtuse top and provided with a single leaf* [3], *which, after falling off, leaves at this spot an ashen coloured scar. Although the leaves* [3] *of this plant are of short duration and only can be found at the very end of the stems and the branches, it would be easy to know*

exactly, if you like, how many an individual plant has produced since its birth, for because each leaf only emerges from one of the scales, by counting them one would get the number. Surely the leaves which, concerning the flowers of this plant, appear to serve as calyx, should not to be included in this number, and they do not need so, for they are different from the others.

The leaves [3] *existing on the scales more or less have the form and volume of the ones of a Herniaria hirsuta* [i. e. a species of the family Illecebraceae]. *But they are a bit thicker, stalkless, on top and along their length deepened in a gutter and rounded below, bright green, on certain spots been scattered with short, dirty-white shiny hairs which are hardly noticeable, and full of a milk which tingles the tongue, the biggest ones are only two third line* [1.5 mm] *where they are the most wide, by about 1¼ lines* [2.8 mm] *long, ending into a tip which is bending a little bit downwards. The smallest ones and new growths are coloured purpurine.*

From the end of most of the strongest stems and principal branches commonly appear four flowers, of which three are arranged in a triangle, in its centre a fourth one [4, 5] *is inserted. This one appears first, it has neither a pedicel nor accompanying leaves, it sits immediately and directly on top of a stem or branch* [i. e. sessile]. *The flower is, so to say, a cone upside down, a little bit truncated, about 3 to 4 lines* [6.8-9.0 mm] *high by 7 to 8 lines* [15.8-18.1 mm] *in diameter at its base. It is rather fleshy, green at the outside and at that side strewn with small shiny hairs, like those on the stems and the leaves.*

About one line [2.3 mm] *from the beginning of this flower* [4, 5] *begin the most important cuts, which form five identical lobes, each put at the same distance from the other, and each cut into a trident, sometimes even into four teeth* [4], *all representing as many forks.*

To describe each lobe with most accuracy, I think it is wise to divide it in three principal parts, which I will name inferior [d], *middle* [e] *and superior* [7]. *The inferior part represents a kind of hood* [d] *of which the hollow divides by two similar cavities by a partition, lengthwise established. The top of the hood is cleft from the brim, until the beginning of the middle part of the lobe, the outline of its opening is covered with small dirty-white hairs, only to be discovered by means of a magnifying glass. This hood, together with its equals, first covers up the ovary and the stamens kept in the base of the flower. Together all these hoods form a kind of bonnet with five panels, dark-green coloured with a wash of red-brown.*

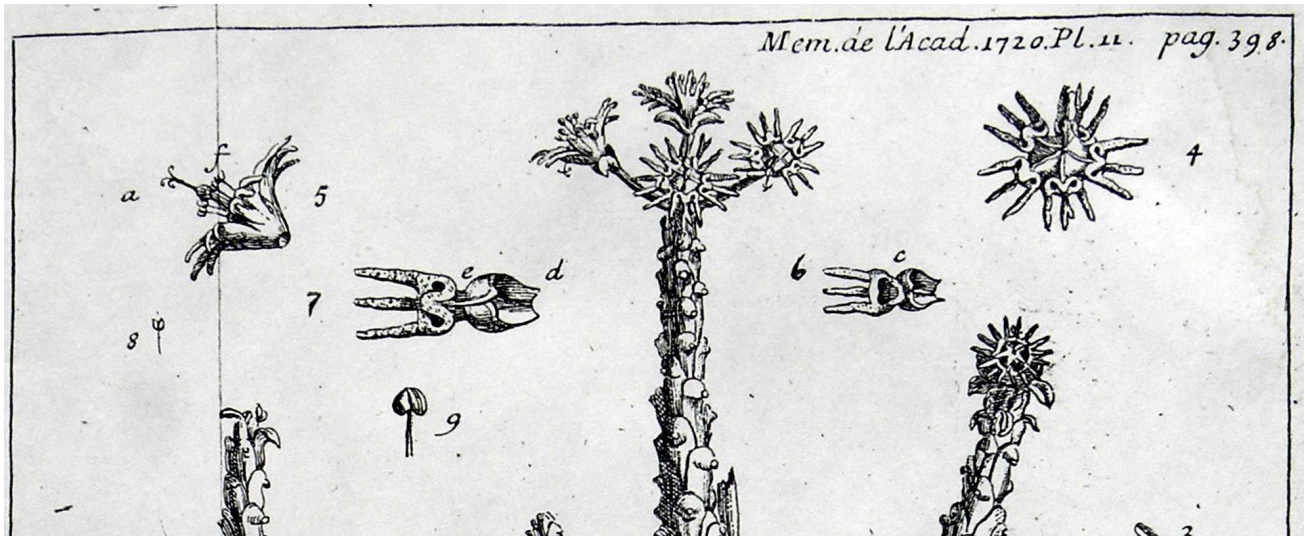


Fig. 2b. Detail of Fig. 2a.

The middle part [e] *of this lobe is, so to speak, only a constriction, which separates the other two parts, and serves as neck, or rather as a very short shaft* [e] *towards the superior part.*

I will also divide this last part of the lobe into an inferior one, which I call triangle [c] and a superior one, which I name trident [6, 7]. These two parts combined usually are 3 to 4 lines [6.8-9.0 mm] *long by 2½ lines* [5.6 mm] *wide. This triangle [c] is attached at one of its sides to the base of the trident [6], it is green-blackish on top, bordered* [at its brim] *by a white decoration which is chiselled or bubbling; its tip, which first extends over the top of the hood, next lifts its skirt up and fastens itself at almost the beginning of the second* [= middle] *fork* [= tooth] *of the trident, this fork [4] sometimes splits itself rather deeply in two parts; all forks are rounded, about 2 lines* [4.5 mm] *long by ⅓ line* [0.8 mm] *wide at the lower end, from there on gradually diminishing, ending into a tip. The top of the trident [7] usually is a bit wider than the base, which is only 2 lines* [4.5 mm], *the top side of this trident is white, chiselled and bubbling like the brim of the triangle [c], the bottom is green-brown, washed with purpurine.*

From the base of the flower [4, 5] an ovary [f] is erected and 15 stamens, of which the filaments are glabrous; that part of each filament which has escaped from the bonnet after having put the panels aside, and has surpassed these by 1½ lines [3.4 mm], *is red resembling auburn, and is only ¼ line* [0.6 mm] *thick; the crown which it bears at the top is yellow, just like the dust* [i. e. pollen] *which shows up.*

The ovary [f], which is surrounded by the stamens, is supported by a glabrous pedicel, erect, shiny, almost transparent, bright-green, 2½ to 3 lines [5.6-6.8 mm] *long by ⅓ line* [0,8 mm] *in diameter. This ovary is crowned by a tube [a]* [= style], *reddish, 2 lines* [4.5 mm] *long, by ¼ line* [0.6 mm] *thick, at the top divided into 3 hooks* [= stigma lobes], *arranged in a triangle about 1 line* [2.3 mm] *long, of which the far ends* [= thecae] *are swollen and a bit flattened.*

The three other flowers, which as I said are arranged in a triangle around the one which I have described just now, appear finally, they would resemble that [former] *one in every respect if they did not each have one lobe less, the position of the missing lobe is occupied by the ovary which is bent down because the pedicel is always curved. By the way, each flower is supported by a bright-green pedicel, about 3 lines* [6.8 mm] *long, ⅓ line* [0.8 mm] *thick, on top provided with two stalkless, opposite, fleshy leaves, bright-green, purpurine-bordered, strewn with small, dirty-white hairs; but the leaflets that seem to serve the calyx of the flower, are each about 2 lines* [4.5 mm] *long by 1½ lines* [3.4 mm] *in diameter at the widest part, ending into a point which terminates into a reddish hair.*

Each ovary [10] has become mature at almost a height of 2½ lines [5.6 mm] *by about 3 lines* [6.8 mm] *in diameter at the base, which is the broadest part; its colour is red resembling chestnut-brown; when one looks at it with a magnifying glass the skin looks in the same way as a human sorrowful facial expression looks, and one observes small, very short dirty-white hairs on it. Its form is triangular, the sides are rounded and elevated along their length by a small ridge which divides them into two similar parts, these sides represent as many casings [11] around a common placenta, each containing a bright-brown seed [12], its form comes close to a top upside down, on its top appears a quadrangular spot, fenced by a ridge or small protuberance, from the centre of this spot until the tip of the top prevails a black line which faces the placenta and cuts the fence at one of the edges. This line passes between two other small protuberances, upright standing like ridges, which on the sides of the top find themselves opposite one to another, along its length this line divides this top into identical halves. This top is about 1½ lines* [3.4 mm] *long by a bit less in diameter at the thickest part. The capsule [11], which contains the seed, opens corresponding to its length at the spot which is fixed to the placenta of the ovary.*

This kind of Euphorbium is perennial; its flowers appear in September and October, they do not have nearly any scent.

Its sap is milky white and acrid, anyhow when one taps the plant, it rather strongly colours litmus paper blue.

About the authors, classical and modern, who have written about the virtues of the Euphorbium, I have assumed it would be useless to repeat in these memoirs what they have written down.

This Euphorbium grows by nature in Africa, since about four years it is cultivated in the Jardin Royal des Plantes Médicinales [i. e. "Le Jardin du Roi", established in 1635] *in Paris, being sent there from Leiden by Mr. Boerhaave*".

(*) Danty d'Isnard's footnotes, here in superscript, refer to *Pl. 11*, see Fig. 2a and Fig. 2b.

(**) The measures in 1720 used by Danty d'Isnard are based on a government decision from 1668, called "*La Toise du Châtelet*"; these old-French measures may be converted as follows: *1 Pied-du-Roi* [foot] = 32,484 cm, *1 pouce* [thumb] = 1/12 pied = 2.707 cm, *1 ligne* [line] = 1/12 pouce = 2.256 mm. At that time, English foot, thumb and line, once converted into actual metrical measures, remarkably differ in results. In 1799, because of the French Revolution, a metric system as known to today was introduced in France.

Note that to the species described by A.-T. Danty d'Isnard (1720) as "*Euphorbium* [No.] *12. Euphorbium anacanthum, squamosum*, is referred by J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, see Fig. 4; by J. Ph. Breyne *fil.* (1739) re. *Euphorbium anacanthum, angusto polygoni folio*, see Fig. 5; by C. Linnaeus (1753) re. *Euphorbia caput-medusae* ["var."] *β, Euphorbium anacanthum squamosum, lobis florum tridentatis*; by J.-B. de Lamarck (1788) re. *Euphorbia* [No.] *11. Euphorbe à trois dents, Euphorbia tridentata*, see Figs 8a, 8b; by W. Aiton (1789) re. *Euphorbia anacantha*; by C. L.Willdenow (1799) re. *Euphorbia* [No.] *17. Euphorbia anacantha,* see Fig. 9; by A. P. de Candolle (1804) re. *Euphorbia tridentata - Euphorbe à trois dents*, see Fig.10; by J. Sims, Ed. (1824) re. *Euphorbia anacantha*, see Fig. 14; by N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata* Lam.; by A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia tridentata* Lam.; by P. V. Bruyns (2012) as a possible lectotype, arguing: "*somewhat more suggestive of Euphorbia patula Mill.*" (cf. section 2.46.2) and by J. A. Peirson et al. (2013) who interpret the mere cyathia on Danty d'Isnard's engraving as typifying *Euphorbia tridentata* Lam., see section 2.49.

Note. Danty d'Isnard's herbarium material was acquired by A. L. de Jussieu (vide *l'Herbier de Jussieu*), duplicates in P-LAM! On inspection, herbarium specimens of *Euphorbia* species from the Jardin du Roi, which once belonged to Danty d'Isnard's plant collection, consist of nine herbaceous *Euphorbia* species and one semi-succulent, but no herbarium specimen of "*Euphorbium* [No.] *12*" has been preserved.

2.6. Richard Bradley (1688-1732), botanist and professor of botany at Cambridge, described in *The History of Succulent Plants: etc., Decas V* (1727, p. 12) bilingually in Latin and in old-English the species "*Euphorbium Africanum caule squamoso, tuberoso, minus - The Large White flower'd African Spurge*"; he referred directly to H. Boerhaave's *Euphorbium Africanum caule squamoso, tuberoso, minus, Boerh. Ind. alt. 258, No. 7* (Boerhaave, 1720). Bradley also includes a plant portrait (see Fig. 3**)**.

Bradley's description of the species in Latin as well as in old-English is as follows:

"*Radix hujus Tithymali alba & crassa fibras aliquot emittit albicantes: Caules ex ipsa radice exit rotundus virridis* [sic!] *& squamosus; circa caulis nascuntur ramuli & ut caulis squamosi, singulis squamis, cum juniores sicut, folia innascuntur parva & augusta. In caulis ramulorumque summitate pediculi oriuntur mediam unciam longi, rotundi & crassi, quorum quisque florem gerit album unicum, monopetalum, in quinque profundas lacinias divisum, ut pentapetalus appareat, haec itaque petala denuo in tres quatuorve alias lacinias dividuntur. Seminibus maturis, & avulsis ramulis facile multiplicari potest, quum, ut cetera Tithymalorum Species aizoides. Tota planta copiose lactescet. Adamat aerem calidum & aridum*".

Fig. 3. *The Large White flower'd African Spurge* described by Richard Bradley (1727, *Fig. 45*).

or

"The root of this Spurge is white and thick, sending out whitish Fibres; from this Root riseth the Stem, round, green and squamous, from which shoot the Branches that also are squamous; from each of which, while the Shoots are young, shoot forth small narrow Leaves. From the Tops of the Stems or Branches, come forth round thick Foot-stalks [peduncles] *half an Inch* [12 mm] *in length, on which come the Flowers, which are whitish and monopetalous, deeply cut in five, so that the Flowers seem to be pentapetalous, and these seeming Petals are again cut in three or four*

Divisions. We may easily encrease this, or any other succulent Tithymal by sowing the Seed, or by Cuttings".

Note that to the species described by R. Bradley (1727) as "*The Large White flower'd African Spurge*", is referred by W. T. Aiton (1811) re. *Euphorbia anacantha*; by A. H. Haworth (1812) re. *Dactylanthes anacantha* and by N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata* Lam.

2.7. **Johannes Burman** (1707-1779), botanist and professor of botany in Amsterdam at the Hortus Medicus, to become the Athenaeum Illustre, became friend and (later on) correspondent of Carl Linnaeus, who in 1735-1738 resided in Holland. Linnaeus regularly stayed at Burman's house; they helped each other by cataloguing plant descriptions and herbarium specimens for publication. In this respect, Linnaeus contributed to the following two works (cf. Uggla, 1937 - not seen, but cited by Stafleu & Cowan, 1976, pp. 414-415).

2.7.1. In the *Thesaurus Zeylanicus*, published in 1737, Burman described plants from the island of Ceylon. They were mostly collected by the German-Dutch physician Paul Hermann (1646-1695), initially engaged by the Dutch VOC, from 1679 on, professor at the University of Leiden. To the work Burman affixed two catalogues of plants collected in the southern Cape colony, altogether 791 new plant species. The first set enumerates plants collected by Hermann c. 1676 on his way home from Ceylon; the second set, the *Catalogus Alter Plantarum Africanarum*, records plants collected by the VOC officials Henrik Bernard Oldenland (1663-1697) and Jan Hartog (1663-1722). Particularly Oldenland pushed in 1689 deeply into the Eastern Cape and collected many new plant specimens. On p. 33 of the *Catalogus Alter Plantarum Africanarum* we find recorded:

"*Tithymalus aizoides, Africanus, simplici, squammato* [sic!] *caule*",

or,

"*Succulent African Tithymalus, with a simple stem, furnished with scales*".

It is to this catalogue item that the Italian botanists Georgio Bonelli & Liberato Sabbati (see section 2.11.1) refer in their *Hortus Romanus, juxta systema Tournefortianum paulo strictius distributus a Giorgio Bonelli, etc. Volume 1* (1772, *Tab. 27*) when describing the species *Tithymalus* [No.] *19. Tithymalus Euphorbium dictus, seu Euphorbio-Tithymalus aizoidea, caule ramoso, procumbente, tetro, & nodoso, foliis nudo, florum petalis e candido roseis, bidentis et tridentis* (see Fig. 6).

2.7.2. Johannes Burman described in the *Rariorum Africanarum Plantarum ad vivum delineatarum, Decades I-IV* (1738) and *Decades V-X* (1739) a fair number of plants that during the foregoing years were introduced into Europe being shipped from the Dutch VOC settlement at the Cape of Good Hope. In *Decas prima* of the *Rariorum Africanarum Plantarum* (1738, p. 10) Burman refers to Caspar Commelin's now lost *Catalogus Manuscripto ad Codex Witsenii*.

Referring to Herman Boerhaave (1720) re. *Euphorbium* [No.] *7, Euphorbium Afrum; caule squamoso; tuberoso; minus* and to Antoine-Tristan Danty d'Isnard (1720, reprint 1722) re. *Euphorbium* [No.] *12. Euphorbium anacanthum, squamosum, lobis florum tridentatis* (see Fig. 2a), Johannes Burman introduces on p. 15-16 the South African plant "*Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*", or, "*Erect Euphorbium, leafless with almost circular branches and 4-angled tubercles*".

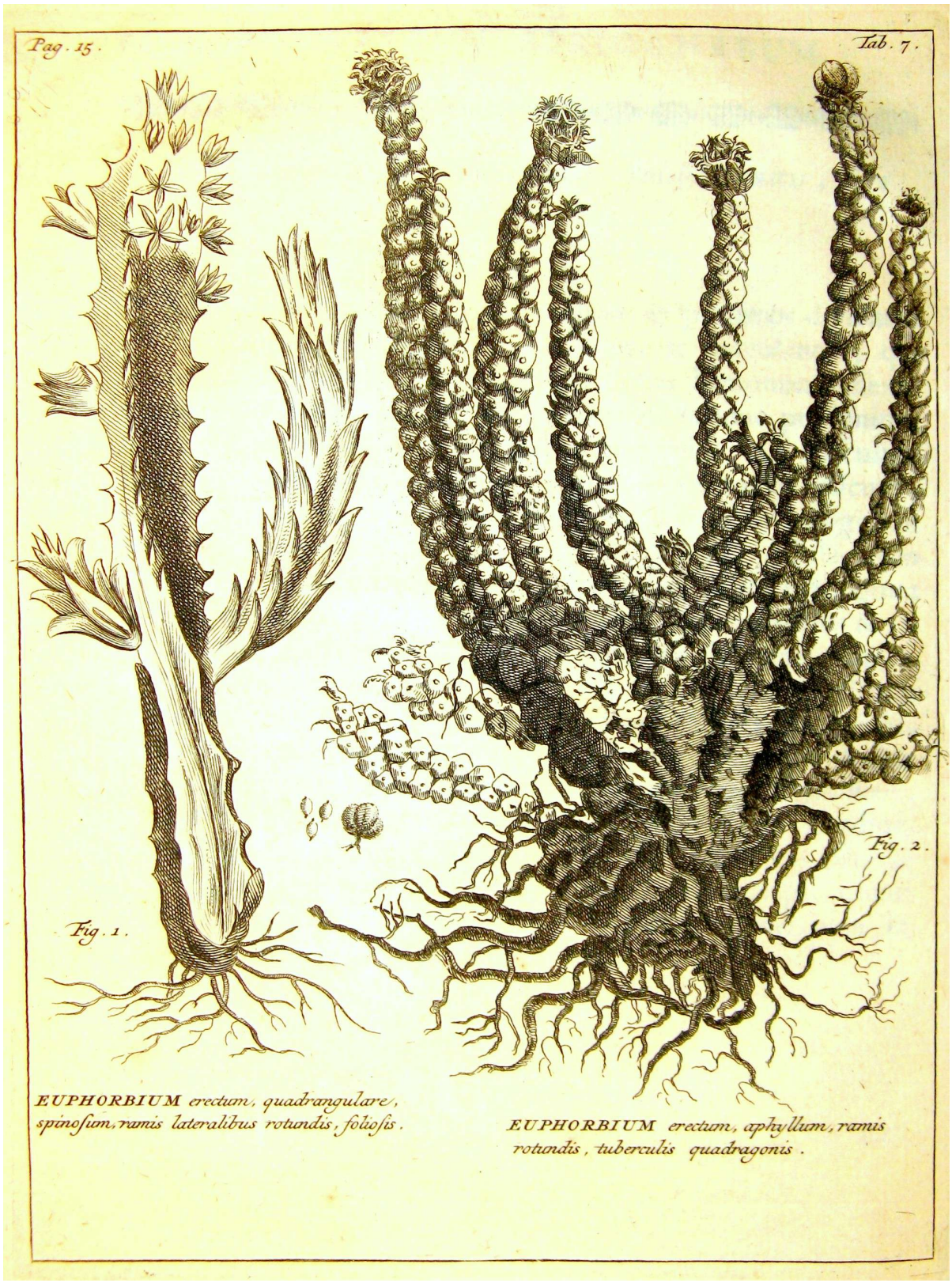


Fig. 4. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis* presented by Johannes Burman in *Rariorum Africanarum Plantarum Decas prima* (1738; *Tab. 7, Fig. 2*). Engraving reproduced from Hendrik Claudius' watercolour (see Fig. 1), mirrored. At left possibly a *Caralluma* species.

Burman's description is accompanied by an engraving (*Tab. 7, Fig. 2*, see Fig. 4), that he had copied and engraved from Hendrik Claudius' watercolour originally painted in 1686 or 1687 (see Fig. 1). Because of the process of engraving Claudius' painting is reproduced as a mirror image; remarkably Johannes Burman does not give any reference or credits to Hendrik Claudius. Johannes Burman defines the species as follows:

"E radice fibrosa, in plurimas fibrillas divisa, nigricante oritur haec planta, quae per laterales ramos, procumbentes, & in terram radices agentes sese diffundit, & propagat, unde in apricis sabulosisque Africae locis, ubi magna quantitate reperitur sibi invicem juncta & intricata colligitur; rami autem fructificationi intervientes in altum eriguntur semispithamales, digitum crassi, glabri, virides, tuberculis planis, quadragonis constantes, aphylli penitus, in summo fasciculum floriferum ex variis flosculis compositum gerentes; flosculi autem ex albo rubescunt & vasculum seminale viride, glabrum, triloculare, ut in caeteris ejus speciebus, relinquunt, quod triasemina oblonga, triangularia, grisea continet. A Commel. in Catal. MSto ad Cod. Wits. Vocatur Tithymalus Africanus aizoides, multiplici squamato caule non folioso, minor & in Cod. Wits. Tithymalus Africanus, minor, erectus: ubi adnotatur, quod mense Septembri flores producat. Huc pertinet Euphorbium anacanthum, squamosum, lobis florum tridentatis Act. Reg. Paris. Ann. 1720, p. 502 [incorrect, p. 502 refers to the reprint from 1722], *quod ramosum admodum est, & idem habetur, ac Euphorbium Afrum, caule squamoso, tuberoso, minus, Boerh. Ind. H. L. B. part I p. 258*",

or,

"*From a darkening, fibrous root, in many fibrils divided, rises this plant, which on account of the lateral, prostrate branches and of the lively rootlets spreads itself out and consequently reproduces itself in sunny and sandy places in Africa, where it is found in large quantity, in itself merged, mutually united and entangled* [i. e. by rhizomes into mats]*; the branches and moreover the flowering and fruiting organs which are showing up, rise to half a span* [ca. 11.5 cm] *in height, one finger thick* [ca. 20 mm]*, smooth, green with flat tubercles, equally rectangular, entirely leafless, bearing on top a flowering fascicle* [i. e. a cyathium] *made up by various florets* [= glands]*, the florets colouring from white into reddish; the seed capsule green, smooth, trilocular, containing, as in similar species, three seeds, oblong* [= elliptical but obtuse at both ends]*, triangular, grey coloured. It is called by Commelin in the Catalogus Manuscripto ad Codex Witsenii a Lesser succulent and evergreen African Tithymalus with a multiple branched and scaly, not-leafy stem, and in the Codex Witsenii* [it is called] *a lesser, erect African Tithymalus, whereby it is noted that it produces flowers in the month of September. Insofar it surely regards the spineless Euphorbium covered with coarse scales, with 3-toothed flower lobes* [i. e. the species *Euphorbium anacanthum, squamosum, lobis florum tridentatis*, described by A.-T. Danty d'Isnard] *in the Acta de l'Académie Royale des Sciences 1720, p. 502* [= repr. 1722]*, indeed it is this much-branched* [species] *but at the same time it also concerns the Small African Euphorbium* [No. 7] *with tuberous, scaly stem of H. Boerhaave in the Index alter Plantarum quae in Horto Academico Lugduno-Batavo aluntur, pars I, p. 258, No. 7* [1720]".

We (authors) are sure Burman intended to designate a cyathium when notifying "*in summo fasciculum floriferum ex variis flosculis compositum gerentes*", or, "*on top* [of the branches] *a flowering fascicle* [i. e. a cyathium] *made up by various florets* [= glands]". Indeed, we see on the accompanying engraving solitary, sessile or at least nearly sessile cyathia with five 3- to 4-toothed glands.

Note that to the species described by J. Burman (1738) as "*Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*", is referred by C. Linnaeus (1753) re. *Euphorbia caput medusae* ["var."] *8.γ, Euphorbium erectum aphyllum, ramis rotundis, tuberculis tetragonis*; by J.-B. de Lamarck (1788) re. *Euphorbia* [No.] *11. Euphorbe à trois dents, Euphorbia tridentata*, see

Fig. 8; by W. Aiton (1789) re. *Euphorbia anacantha*; by C. L. Willdenow (1799) re. *Euphorbia* [No.] *17. Euphorbia anacantha*, see Fig. 10; by A. P. de Candolle (1804) re. *Euphorbia tridentata - Euphorbe à trois dents*, see Fig.11; by Chr. H. Persoon (1807) re. *Euphorbia* [No.] *18. Anacantha*; by A. H. Haworth (1812) re. *Dactylanthes anacantha*; by J. Sims, Ed. (1824) re. *Euphorbia anacantha*, see Fig. 14; by P. E. Boissier (1862) re. *Euphorbia anacantha* Aiton; by A. Berger (1906, date on t. p. 1907) re. *Euphorbia anacantha* Aiton for Burman's engraving; by N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata* Lam.; by A. C. White, R. A. Dyer & B. L. Sloane (1941) re. "*Euphorbia tridentata* Lam. and by P. V. Bruyns (2012) who designates Burman's engraving as lectotype for *Euphorbia tridentata* Lam.

Regarding this engraving, as said Johannes Burman does not give any reference to Hendrik Claudius. Although Bruyns (2012) designates Burman's engraving as lectotype for *Euphorbia tridentata* Lam., we present here Claudius' watercolour from 1686/1687 (see section 2.1, Fig. 1) as the earlier illustration of *Euphorbia tridentata* Lam.

2.8. Johann Philipp Breyne *fil.* (1680-1764), Danzig botanist, zoologist and entomologist, revised and augmented the work of his father, Jacob Breyne. The Danzig merchant and naturalist Jacob Breyne (1637-1697) visited Holland several times, studying exotic and rare plants in the Amsterdam Hortus Medicus and in the botanical gardens of a number of wealthy plant collectors. Here he observed various "*Euphorbium*" species from the Cape and Malabar, India, publishing about them in 1680 and 1689. His son Johann Philipp Breyne, zoologist and entomologist, published in 1739 the work *Jacobi Breynii, Gedanensis, Prodromi fasciculi rariorum plantarum primus et secundus, etc.*, with annexed the *Icones rariorum et exoticarum plantarum aeri incisae (...) tertius, etc.*

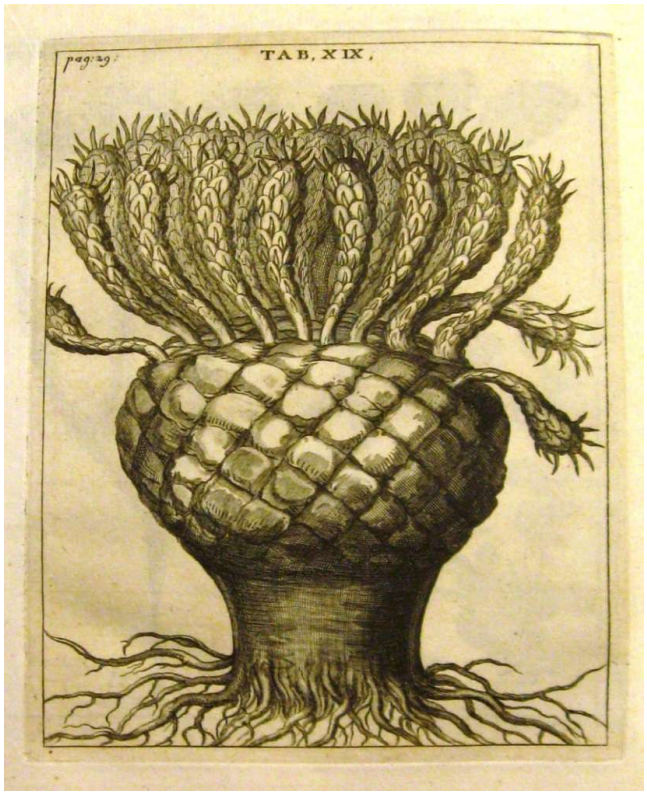


Fig. 5. Johann Philipp Breyne's illustration of Euphorbium anacanthum, angusto polygoni folio (1739, Tab. 19), according to Wijnands (1983) Euphorbia pugniformis Boiss. in DC.

On p. 29 of the *Icones rariorum et exoticarum plantarum* Johann Philipp Breyne *fil.* describes "*Euphorbium anacanthum, angusto polygoni folio*", or, "*Spineless Euphorbia with a narrow, much-angled leaf*", adding a picture of the species (*Tab. 19*, see Fig. 5). Quite strikingly, in a postscript (p. 29) J. Ph. Breyne *fil*. remarks that he considers the true *Euphorbium* [No.] *12. Euphorbium anacanthum squamosum, lobis florum tridentatis* of A.-T. Danty d'Isnard (1720, reprint 1722) a complete different species, we cite: "*pro distinctissima habeam specie*". Quite right, we think.

When C. Linnaeus in 1762 in the *Editio secunda* of the *Species Plantarum* catalogued *Euphorbia caput medusae* ["var."] *8.β, Euphorbium anacanthum squamosum, lobis florum tridentatis* of Danty d'Isnard (1720, *Pl. 11*), as well as when J.-B. de Lamarck in 1788 recorded his own *Euphorbia tridentata*, both botanists included as one of their references the above mentioned picture (*Tab. 19*, Fig. 5), published by J. Ph. Breyne *fil.* in 1739. However, we assume these references have to be considered erroneous, for in fact Breyne's *Tab. 19* most likely pictures *Euphorbia pugniformis* Boiss. in DC, as the Dutch botanist D. O. Wijnands (1983) has argued.

2.9. **Philip Miller** (1691-1771), British citizen, was for many years (1722-1770) superintendent of the famous Chelsea Physick Garden (today still extant as Chelsea Physic Garden), commissioned by the Worshipful Company of Apothecaries in Chelsea, London. Lovingly named by the public "*Hortulanorum Princeps*", princeps of gardeners, Miller published between 1731 and 1771 eight folio editions of the extensive *The Gardeners Dictionary* and another six abridged editions, followed by translations in Dutch, French and German. In 1768, in the last and 8th edition of *The Gardeners Dictionary*, Miller rather reluctantly accepted and applied Carl Linnaeus' binomial nomenclature, putting Linnaean epithets by way of parentheses. Here we restrict ourselves to the following editions.

2.9.1. In the 1st (1731) and 2nd (1733) folio editions of *The Gardeners Dictionary* as well as in the abridged edition of 1735, based on these folio editions, Miller (1735; *Vol. 1*, p. 335) directly quotes Herman Boerhaave (1720) when naming a species of our interest as follows:

"*Euphorbium* [No.] *7. Euphorbium, Afrum, caule squamoso, tuberoso, minus*",

or,

"*Euphorbium* [No.] *7. Small African Euphorbia, with a stem covered with scales and with a tuberous root*".

As confirmed by W. Aiton (1789, see section 2.13) and the nurserymen Messrs C. L. Loddiges & Sons (1818, see section 2.22), in 1731 this succulent plant was already cultivated by Miller in the Chelsea Physic Garden, just a decade after H. Boerhaave described the species.

Miller repeated the same description in *The Gardeners Dictionary (…….) the Fourth* [folio] *Edition*, *Vol. 1*, in 1743 published for the author and sold by J. Rivington, London as well as in a Dutch translation which was published in 1745 at Leiden, The Netherlands, on p. 307.

Note that to the species defined by Miller (1731, 1733, 1735, 1743, 1745) as "[No.] *7, Euphorbium, Afrum, caule squamoso, tuberoso, minus*", is referred by W. Aiton (1789) re. *Euphorbia anacantha*; by C. L. Willdenow (1799) re. *Euphorbia* [No.] *17: Euphorbia anacantha*, see Fig. 10; by A. P. de Candolle (1804) re. *Euphorbia tridentata*, see Fig. 11 and by Messrs C. L. Loddiges & Sons (1818) re. *Euphorbia anacantha*, see Fig. 13.

2.9.2. In *Vol. 1* of *The Gardeners Dictionary (…….) the Sixth* [folio] *Edition, carefully revised and adapted to the present practice* published in 1752 as well as in *Vol. 1* of *The Gardeners Dictionary (…….) the Fourth Edition, abridged from the last Folio Edition, corrected and enlarged* published in 1754, Miller does not refer to the species *Euphorbium, Afrum, caule squamoso, tuberoso, minus* of Boerhaave (1720), as done in the former editions.

Instead of this species Philip Miller enumerates another species, no longer called "*Euphorbium*" but "*Euphorbia*" (see 4th abridged edition 1754, p. 483 and pp. 486-487), however, without giving any reference how and from where he got this tuberculate plant for cultivation in the Chelsea Physic Garden:

"*Euphorbia* [No.] *9. Euphorbia humilis, ramis patulis tuberculatis*",

or, in his own words,

" *Dwarf Euphorbia, with widely spreading Branches covered wit Knobs*"

He also gives a comment: "*The Branches also trail upon the surface of the pots (...) and are full of Protuberances (...) not forming so large and close a Head* [i. e. as a Medusa's Head, described by Miller as *Euphorbia* [No.] *8*]"

Note that the species described by Miller (1752; 1754) as "*Euphorbia* [No.] *9. Euphorbia humilis, ramis patulis tuberculatis*" has not been cited by any author.

2.9.3. Between October 1756 and March 1759 Miller issued 112 separate parts of a new edition of *The Gardeners Dictionary*; in 1759 as a whole published as *The Gardeners Dictionary* (…….) *The Seventh* [folio] *Edition, Revised and Altered according to the latest System of Botany.* In the 7th edition of *The Gardeners Dictionary* the species called "*Euphorbia* [No.] *9, etc.*", as treated in the former editions (see section 2.9.2) is no longer mentioned; but a new species is presented. Again, Miller does not give any specific reference or particular quotation when he introduces the following species:

"*Euphorbia* [No.] *11. Euphorbia inermis, ramis patulis simplicibus teretibus, foliolis linearibus instructis*",

or, in his own words,

"*Euphorbia without spines, having single spreading Branches which are taper, and terminated with very narrow Leaves*".

Miller comments on the species as follows (p. 424), we cite:

"*The eleventh Sort rises with a taper Stalk six or seven Inches* [15-18 cm] *high, sending out from the Top a few taper branches, which spread out on every Side; these are not scaly, like those of the last sort* [i. e. No. 10, a Medusa's Head]*, but taper, and garnished at their Ends with several small narrow leaves which drop off. This sort hath not yet flowered here, having been but a short time in England*".

He also gives an advice:

"*Keep it in wintertime in the glasshouse, free from frost, and in summertime outside but sheltered from too much sun or rain*".

Note that the species by Miller in 1759 described as "*Euphorbia* [No.] *11. Euphorbia inermis, ramis patulis simplicibus teretibus, foliolis linearibus instructis*" has not been cited by any author.

Observe that particularly in this description Miller does not give any mention of botanical terms like "*protuberances*" or "*scales*", whereas elsewhere Miller consequently does so, for instance using the designation "*tubercles*" when treating other *Euphorbias*, like a Medusa's Head or some species later on identified as *Euphorbia procumbens* and *Euphorbia polygona*.

2.9.4. In his last, one-volume 8th folio edition of *The Gardeners Dictionary*, dated 1768, Philip Miller introduced Linnean binomials, but reluctantly and with a bad grace, so he still maintains the usual phrase terms and puts the Linnean epithet between brackets. In our case, the species of our interest is called in Linnean terms: "*(Patula)*", without giving any further reference. Miller defines (p. 457) the species as cited hereafter. But observe that Miller repeats precisely the same collection number and the same descriptive terms as when he published the species nine years before in *The Gardeners Dictionary* of 1759 (see section 2.9.3). Miller again records the species as:

"*Euphorbia* [No.] *11. Euphorbia (Patula) inermis, ramis patulis simplicibus teretibus, foliolis linearibus instructis*",

or, in his own words,

"*Euphorbia without spines, having single spreading branches which are taper, terminated with very narrow leaves*".

Next, Philip Miller comments about the species (p. 459):

"*The eleventh sort rises with a taper stalk six or seven inches* [15-18 cm] *high, sending out from the top a few taper branches, which spread out on every side; these are not scaly, like those of the last sort* [i. e. No. 10, a Medusa's Head]*, but taper, and garnished at their ends with several small narrow leaves which drop off. This sort hath not yet flowered here, having been but a short time in England*".

Remarkably, Miller observes the species as non-tuberculate ("*not scaly*") and, although already for over a decade in cultivation, according to Miller he never had seen flowers. Miller kept a herbarium consisting of about ten thousand specimens. His descriptions Miller drew up from living plants he cultivated at the Chelsea Physic Garden as well as from "dried samples" (Dandy, 1958). In 1774, three years after his death, Sir Joseph Banks incorporating it into his own herbarium acquired Miller's herbarium. Afterwards Banks donated his herbarium to the British Museum, now in the Natural History Museum. In section 2.50.3 we report about Miller's preserved herbarium collection at BM in search for "*Euphorbia* [No.] *11 (Patula)*" - but in vain..... In 1755, the horticulture-loving public, interested in Philip Miller's *The Gardeners Dictionary*, could subscribe to a monthly issue, which presented six hand-coloured plant engravings. In 1760 the 300 plant portraits that in the course of five years were issued, became collectively published in a 2-volumed folio edition, called *Figures of the most beautiful, useful, and uncommon plants described in the Gardeners Dictionary, etc., London, printed for the author.* Alas!, neither "*Euphorbium* [No.] *7*" (Miller, 1731, 1733, 1735, 1743) nor his "*Euphorbia* [No.] *9*" (Miller, 1754) or "*Euphorbia* [No.] *11*" (Miller, 1759) prove to be portrayed (inspected at Teylers Museum, Haarlem, the Netherlands).

Note that to the species described by Philip Miller (1768) as "*Euphorbia* [No.] *11 (Patula)*" (*) is referred by A. H. Haworth (1812) re. *Dactylanthes patula*; by R. Sweet (1826; 1830) re. *Euphorbia* [No.] *28: patula* and re. *Euphorbia* [No.] *35: patula*; by A. H. Haworth naming the specimens on Haworth's Herbarium sheet Fol. no. 328 at OXF *Euphorbia patula* Mill. (considered by P. V. Bruyns (2012) representing the earliest name for *Euphorbia ornithopus* Jacq. as its synonym); by P. E. Boissier (1862) re. *Euphorbia anacantha* Aiton and by N. E. Brown (1915) who presumes

Euphorbia patula Mill. to be "*a small weak form of E. mauritanica Linn. with spreading branches*" (see section 2.35.1). Although S. Carter (2002) considers *Euphorbia patula* (Haworth) Sweet, based on *Euphorbia patula* Mill. a synonym concerning *Euphorbia tridentata* Lam., at the same time she expresses her doubt about its status: "*Euphorbia patula (...) its true identity remains in doubt*" (see section 2.44.2). *Euphorbia patula* Mill. is confirmed to be an accepted species by R. Govaerts, D. G. Frodin & A. Radcliffe-Smith (2000), sinking *Euphorbia tridentata* Lam. (J.-B. de Lamarck, 1788) and *Euphorbia anacantha* Aiton (Aiton, 1789) into synonymy (see section 2.43.2); for the period 2000 until mid-2013 the taxonomic database *Kew World Checklist of Selected Plant Families*, compiled by R. H. A. Govaerts, included as synonyms of *Euphorbia patula* Mill. the species *Euphorbia tridentata* Lam. (J.-B. de Lamarck, 1788), *Euphorbia anacantha* Aiton (Aiton, 1789), *Dactylanthes patula* (Mill.) Haw. and *Dactylanthes anacantha* (Aiton) Haw. (Haworth, 1812) as well as *Medusea patula* (Mill.) Klotzsch & Garcke and *Medusea tridentata* (Lam.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860) (Govaerts, 2000-mid 2013; see section 2.48.1). In IPNI (see section 2.47) both species names *Euphorbia patula* Mill. (Miller, 1768) and *Euphorbia tridentata* Lam. (J.-B. de Lamarck, 1788) remain equally recorded without referring one to the other. Designating the two tuberculate specimens on Haworth's Herbarium sheet Fol. no. 328 at OXF (see Fig. 23) as neotype, P. V. Bruyns (2012) confirms the according to Miller (1768) non-tuberculate species *Euphorbia patula* Mill. as an accepted species, designating the tuberculate species *Euphorbia ornithopus* Jacq. (Jacquin, 1809), *Dactylanthes patula* (Mill.) Haw. (Haworth, 1812) and *Medusea patula* (Mill.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860) as its synonyms. (see section 2.46.2). Bruyns' view is confirmed in the *Kew World Checklist of Selected Plant Families* (Govaerts, mid-2013 sqq.; see section 2.48.2).

(*) The species named by Philip Miller (1768) "*Euphorbia* [No.] *11 (Patula)*" will from now on be quoted, according to ICBN Art. 35.2, Ex. 5 (McNeill et al., 2012), as "*Euphorbia patula* Mill."

2.10. **Carl Linnaeus** (1707-1778), Swedish botanist, professor of medicine and botany at Uppsala, in 1753 founded the beginning of modern plant systematics and the establishment of an actual nomenclature by publishing the first edition of his *Caroli Linnaei* (...) *Species plantarum: exhibentes plantas rite cognitas, ad genera relatas, cum differentiis specificis, nominibus trivialibus, synonymis selectis, locis natalibus, secundum systema sexuale digestas, etc*.

2.10.1. In 1735, Linnaeus started his career as physician and horticulturist employed by the wealthy banker, VOC administrator, amateur botanist and zoologist George Clifford III (1685-1760). On his request, Linnaeus catalogued the extensive collection of 1251 living and 2536 dried plants in Clifford's possession at the countryseat De Hartecamp near Haarlem, The Netherlands. To devise a system of classification, Linnaeus went through all plant publications owned by Clifford in his vast library (295 books), studied and noted down all plant names (mostly phrase names) and arranged them according to the sexual system he devised, classifying the species in groups based on form and numbers of the female and male morphology. In 1737 the result was published in the magnificent *Hortus Cliffortianus*, printed privately for George Clifford, distributed among friends and botanici during the years 1738-1739.

Concerning the genus *Euphorbia*, Linnaeus at first adopted the generic name "*Euphorbia*" and next subsumed under this heading all relevant species names he retrieved from literature, like phrase names beginning with *Euphorbium*, *Tithymalus*, *Tithymaloides*, *Esula*, *Ezula*, *Caacia*, *Cataputia*, *Chamaesyce*, *Ela-Calli*, *Felfel*, *Lathyris*, *Myrsinites, Peplis*, *Pepilis*, *Peplus*, *Pityusa*, *Planta lactaria* and *Schadidacalli* (*Hortus Cliffortianus*, pp. 196-200). He found 195 phrase names which he considered to pertain to *Euphorbia* species, these he classified by reducing them into 25

groups (some subdivided) in the *Hortus Cliffortianus: Classis XIII, Polyandria, Monogynia, Euphorbia*.

In this way the genus "*Euphorbia*" having divided, on p. 197 of the *Hortus Cliffortianus* Carl Linnaeus catalogued by the heading "[No.] *6. Euphorbia inermis, tecta tuberculis imbricatis, foliolo lineari instructis*", or, "*Spineless Euphorbia covered up with at the margins overlapping tubercles which are provided with a small linear leaflet*" twelve *Euphorbia* species coming "*from Africa*", divided in 4 subcategories (designated by Greek characters).

As subcategory "[No.] *6 β*" Linnaeus recorded in the catalogue both "*Euphorbium afrum, caule squamoso, tuberoso, minus*" of Herman Boerhaave (1720) and "*Euphorbium anacanthum, squamosum, lobis florum tridentatis*" of Antoine-Tristan Danty d'Isnard (1720, *Pl. 11*, reprint 1722).

Observe that the mention by Linnaeus of Danty d'Isnard's species interestingly proves that it not only existed in France, but also in Holland, because for belonging to Clifford's collection, live or dried. In the *Hortus Cliffortianus* no plant portrait of this particular species is depicted and no herbarium specimen of the species has been preserved; when consulting at BM(!) all herbarium specimens from the *Hortus Cliffortianus*, except for 14 herbaceous *Euphorbia* species, only two herbarium specimens of a succulent *Euphorbia* proved to be preserved, namely a *Euphorbia antiquorum* L. and a *Euphorbia (Pedilanthus) tithymaloides* L.

2.10.2. Based on the classification which Carl Linnaeus in 1737 had devised for the *Hortus Cliffortianus*, revising it in the next years, in the first edition of *Caroli Linnaei Species Plantarum, etc.* (1753, pp. 450-464) Linnaeus treats 56 *Euphorbia* species and another 10 "subcategories". In *Tomus I*, p. 452, with regard to the generic group "*Euphorbia Caput medusae, Euphorbia* [No.] *8.α - 8.ζ*", Linnaeus describes a - nowadays so-called - "*Euphorbia caput-medusae* complex", in fact an assemblage of six different species (Wijnands, 1983). By the way, as can be read in the preface of his *Hortus Cliffortianus* (1737, translation Heller, 1968, p. 676), Linnaeus firmly detested the use of a plant category like "variety"; arguing that in case it has to come to designate a plant to a rank just below that of "species", preferably it must be indicated by a post-fixed Greek character. Nevertheless, Linnaeus' division of the *Euphorbia caput-medusae* complex in six subcategories has been understood by A. C. White, R. A. Dyer & B. L. Sloane (1941) and even by S. Carter (2002) as a subdivision in varieties. As we understand today, Linnaeus' assemblage of "*Euphorbia Caput medusae, Euphorbia* [No.] *8.α - 8.ζ*" consists of six different species, not varieties; in case we follow Linnaeus' naming we will put the term "variety" between quotation marks, citing it as ["var."] between straight brackets.

Linnaeus regards the species of our interest as belonging to two "varieties" of the *Classis XI, Dodecandria, Trigynia, genus Euphorbia* [No.] *8, Euphorbia Caput medusae*, to be specified as follows:

(a) Referring to A.-T. Danty d'Isnard (1720, reprint 1722, *Pl. 11*, see Fig. 2a) Linnaeus records one *Euphorbia* "variety" as "*Euphorbia Caput medusae 8.β, Isnard. act. 1720. p. 502. t. 11*", namely:

"*Euphorbium anacanthum squamosum, lobis florum tridentatis*",

or,

"*A spineless Euphorbium covered with scales with 3-toothed flower-lobes*".

(b) Referring to J. Burman (1738, *Tab. 7, Fig. 2*, see Fig. 4) Linnaeus distinguishes another *Euphorbia* "variety", namely "*Euphorbia Caput medusae 8.γ, Burm. afr. 16. t. 7. f. 2*"; in Burman's phrase name Linnaeus only substituted Latin "*quadra-*" for Greek "*tetra-*" because the terminus "*-gonus*" is already from Greek descent. He named it as:

"*Euphorbium erectum aphyllum, ramis rotundis, tuberculis tetragonis*",

or,

"*An erect, leafless Euphorbium with almost circular branches and 4-angled tubercles*".

Note that to the two species described by C. Linnaeus (1753) as "*Euphorbia Caput medusae* ["var."] *8.β*, *Euphorbium anacanthum squamosum, lobis florum tridentatis*" and "*Euphorbia Caput medusae* ["var."] *8.γ*, *Euphorbium erectum aphyllum ramis rotundis, tuberculis tetragonis*" are referred by A. C. White, R. A. Dyer & B. L. Sloane (1941) and S. Carter (2002) under the one and only heading, namely *Euphorbia tridentata* Lam.

2.10.3. In the *Editio secunda* of the *Species Plantarum*, published in 1762-1763, in *Tomus I* (1762, p. 648) Linnaeus augments the references for "*Euphorbia Caput medusae 8.β, Euphorbium anacanthum squamosum, lobis florum tridentatis. Isnard. act. 1720. p. 502. t. 11*" by the quotation "*Breyn. prodr. 3. p. 29. t. 19*" (*cf.* section 2.8). We consider this addition quite unbelievable regarding the accuracy of Linnaeus; therefore, we think this later addition must be a slip of the pen made by the author. The more so, for in the *Icones rariorum plantarum (...) tertius, etc.* Johann Philipp Breyne *fil.* (1739) himself remarks, when describing (p. 29) "*Euphorbium anacanthum, angusto polygoni folio*", or, "*A spineless Euphorbia with a narrow, much-angled leaf*" and adding the picture of the species (*Tab. 19*, see Fig. 5), that he considers the true *Euphorbium anacanthum squamosum, lobis florum tridentatis* of A.-T. Danty d'Isnard (1720) quite a different species in comparison with his *Tab. 19* (see section 2.8).

2.11. The Italian botanists **Giorgio Bonelli** (1724-1782) and **Niccolò Martelli** (1735-1829), both professor of botany at the University of Rome, were in 1770 commissioned by the French publishers and printers Jean Bouchard et Jean-Joseph Gravier to conceive an illustrated catalogue of plants cultivated in the Hortus Romanus on Janiculum Hill (today called Collina Gianicolo), founded in 1660 under aegis of Pope Alexander VII. The actual work was done by the pharmacist and custos (curator) of the Hortus Romanus **Liberato Sabbati** (1714-1778), after his death continued by his son **Constantino Sabbati** (1734?-?), gardener and reappointed custos of the garden. The result became an impressive, eight-volume folio handbook of 800 hand-coloured plant pictures (100 per volume), with texts, entitled *Hortus Romanus, juxta systema Tournefortianum paulo strictius distributus a Giorgio Bonelli, etc*., published 1772-1793. Giorgio Bonelli contributed to volume 1, following Tournefort's principles of plant identification; volumes II-VIII were edited by Niccolò Martelli according to the Linnaean binomial system. Plant specimens were drawn by Cesare Ubertino, Liberato and Constantino Sabbati and engraved by the renowned botanical and ornithological artist **Maddalena Bouchard** (flourished 1770-1793), all pages one-by-one hand-coloured by a team of able artisans. Less than 300 sets of the eight-volume work were printed; complete sets are extremely rare (Stafleu & Cowan, 1976, p. 270) and very precious (up to c. $90.000).

Pages 14-15 of *Volume 1* (1772) of the *Hortus Romanus, etc.* at first contain a brief general introduction to the genus of our interest (we cite): "*VII. Tithymalus Tournefort, Euphorbia Lin., Euphorbium Isnard & Boerh. &c.*". Bonelli & Sabbati enumerate twenty-two non-succulent and succulent *Euphorbia* species, the succulent ones consisting of three Cape plants. The plates and descriptions of the following two succulent *Euphorbia* species are for us important.

2.11.1 The species "*Tithymalus* [No.] *19*" is described by Bonelli & Sabbati on p. 15, accompanied by an engraving (*Tab. 27*; see Fig. 6), as follows:

"*Tithymalus* [No.] *19. Tithymalus Euphorbium dictus, seu Euphorbio-Tithymalus aizoidea, caule ramoso, procumbente, tetro, & nodoso, foliis nudo, florum petalis e candido roseis, bidentis, & tridentis. Burman Zeil.*",

or,

Fig. 6. Maddalena Bouchard's engraving of *Tithymalus* [No.] *19. Tithymalus Euphorbium dictus, etc.* described by G. Bonelli & L. Sabbati (1772; *Tab. 27*) and quoted by J.-B. de Lamarck (1788) when presenting his *Euphorbia tridentata* Nobis.

"*Tithymalus* [No.] *19. Tithymalus, known as Euphorbium or a succulent and evergreen Euphorbio-Tithymalus, with a branching main stem bending prostrate over the surface of the ground*

[procumbent], *blackish and knotted* [knobby], *leafless, concerning the flowers with reddening glossy-white petals, 2- and 3-toothed. J. Burman, Thesaurus Zeylanicus*".

As cited, Bonelli & Sabbati refer in their description of the species to the *Thesaurus Zeylanicus* of Johannes Burman (1737), particularly to the second appendix to this work, viz. the *Catalogus Alter Plantarum Africanarum*. Here we find catalogued (p. 33): "*Tithymalus aizoides, Africanus, simplici, squammato caule*", or, "*Succulent African Tithymalus, with a simple stem, furnished with scales*". It is assumed that the plant has been collected by the VOC official Henrik Bernard Oldenland (1663-1697) who in 1689 travelled deeply into the Eastern Cape (see section 2.7.1).

Note that to the species described by G. Bonelli & L. Sabbati (1772) as "*Tithymalus* [No.] *19. Tithymalus Euphorbium dictus, etc.* is referred by J.-B. de Lamarck (1788) re. *Euphorbia* [No.] *11. Euphorbe à trois dents, Euphorbia tridentata*.

2.11.2. The species "*Tithymalus* [No.] *21*" is defined (p. 15) by Bonelli & Sabbati, accompanied by an engraving (*Tab. 29*; see Fig. 7), as:

"*Tithymalus* [No.] *21. Tithymalus, seu Euphorbium, aizooides, caule crasso, et ramoso*",

Fig. 7. Maddalena Bouchard's engraving of Bonelli & Sabbati's *Tithymalus* [No.] *21. Tithymalus seu Euphorbium, aizooides, caule crasso, et ramoso* (1772; *Tab. 29*).

or,

"*Tithymalus* [No.] *21. Tithymalus or Euphorbium, succulent & evergreen, with a thick and much-branched stem*".

However, we hesitate to include this engraving in our paper for not relevant enough regarding the species of our interest, although some nearly sessile, two-toothed cyathia can be discerned. For G. Bonelli & L. Sabbati (1772) give no references about this species; no other author cites or quotes it.

2.12. **Jean-Baptiste Antoine Pierre de Monnet le Chevalier de Lamarck** (1744-1829), French biologist, botanist at the Jardin des Plantes in Paris, next professor of zoology at the Muséum d'Histoire Naturelle, first founder of an evolution theory, escaped the guillotine of the French Revolution, next simply called Citizen Lamarck. He initiated the immense *Encyclopédie méthodique - Botanique* in 13 volumes (1783-1817). In *Tome 2, pars 2* of the *Encyclopédie méthodique. Botanique* (1788, pp. 411-440) Jean-Baptiste de Lamarck briefly treats the family Euphorbiaceae, and more extensively the genus *Euphorbia*. He rejects the opinion of Linnaeus that the "flower" of a *Euphorbia* is a true flower ("*corolla monopetala*"), correctly emphasizing its role as a typical inflorescence. De Lamarck treats 97 non-succulent and succulent *Euphorbia* species.

When describing "*Euphorbe à trois dents, Euphorbia tridentata*" (pp. 416-417) J.-B. de Lamarck explicitly refers to A.-T. Danty d'Isnard (1720, reprint 1722, *Pl. 11*, see Fig. 2a) re. *Euphorbium* [No.] *12. Euphorbium anacanthum, squamosum, lobis florum tridentatis*, to J. Burman (1738, *Tab.7, Fig. 2*, see Fig. 4) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, to J. Ph. Breyne *fil.* (1739, *Tab. 19*, see Fig. 5) re. *Euphorbium anacanthum, angusto polygoni folio* (*) and to G. Bonelli & L. Sabbati (1772, *Tab. 27*, see Fig. 6) re. *Tithymalus* [No.] *19. Tithymalus Euphorbium dictus, seu Euphorbio-Tithymalus aizoidea, caule ramoso, procumbente, tetro, & nodoso, foliis nudo, florum petalis e candido roseis, bidentis et tridentis*.

De Lamarck describes "*Euphorbe à trois dents, Euphorbia tridentata*" as follows:

"*Euphorbia* [No.] *11. Euphorbe à trois dents, Euphorbia tridentata. Euphorbia inermis ramosa subtuberculata, calycum laciniis externis supra concavis coloratis tridentatis. N.*",

or,

"*Euphorbia* [No.] *11. Euphorbia tridentata. Spineless Euphorbia, much-branched, more or less tuberculate, flower with outward stretching strips taper-pointed incised and on top curved inwards, colourful, 3-toothed. Nobis* [i. e. validated by me, J.-B. de Lamarck]".

Jean-Baptiste de Lamarck adds a further description of the plant:

"*Dans cet Euphorbe, les rameaux nombreux qui naissent du collet de la racine, ne partent pas & ne divergent pas d'un centre commun en forme de rayons, comme dans l'espèce ci-dessus* [i. e. *Euphorbia caput-medusae* L.]*; mais ils se portent irrégulièrement de divers côtés. Ces rameaux son cylindriques, charnus, verdâtres, de l'épaisseur du doigt, embriqués de tubercules moins élevées que dans l'espèce précédente, & la plupart nuds, les plus jeunes seulement étant munis de quelques feuilles à leur sommet. Les fleurs sont assez grandes, plus belles que dans aucune autre espèce de ce genre, panachées de blanc & de pourpre, & très-remarquables par la forme des divisions extérieures de leur calice. Elles naissent trois ou quatre ensemble au sommet des rameaux, sur des pédoncules simples, longs de deux lignes, & disposées presque en faisceau ou en ombelle. Chaque pédoncule soutient deux bractées ovales, opposées situées sous la fleur. Le calice est turbiné, partagé en dix divisions, dont cinq intérieures sont ovales, pourprées, ciliées en leur bord, &*

inclinées sur la fleur, tandis que les cinq autres rejetées en dehors, & ouvertes horizontalement, sont plus grandes, concaves en dessus, pourpres dans leur concavité, & à trois dents longues, ridées, & très-blanches; souvent il manque une de ces divisions extérieures du calice, & c'est alors vers ce côté que s'incline le pistil de la fleur. Cette plante croît dans l'Afrique, & est cultivée au Jardin du Roi. ħ. (v. v.). Elle fleurit en Septembre. Ses capsules sont ponctuées ou comme chagrinées",

or, translated in English,

"*Regarding this Euphorbia, from the neck of the root numerous branches arise, but not as rays from a common centre, as is the case with the preceding described species* [i. e. *Euphorbia caput-medusae* L.], *but they are branching irregularly at different sides. These branches are cylindrical, fleshy, greenish, one finger thick* [~19 mm], *all around covered with tubercles less elevated as in the preceding described species, and whereas the greater part* [of the branches] *is bare, only the youngest ones are provided with leaflets. The flowers are rather large, more beautiful than whichever other species of the genus, decorated with white and purple, very remarkable by the form of their outward incisions of the calyx. They grow by 3 or 4 together on the top of the branches, on simple peduncles 2 lines* [4.5 mm] *long, more or less arranged in a bundle or umbel* [i. e. clustered, not by way of a cymose inflorescence]. *Each peduncle has two opposite oval bracts, located below the flower. The calyx is like a turbine* [i. e. obconical, inversely conical top-shaped], *divided in ten parts, of which the five inward parts* [the lobes] *are oval, purple, ciliate at the rim and bending inward, whereas the five other parts are spreading horizontally outward, on top concave, purple in the cavity, with three long teeth, wrinkled, and very white; often one of the outward parts of the calyx is missing because at this place the pistil is bending over. The plant grows in Africa, and is cultivated in the Jardin du Roi, as a shrub or woody plant; v. v.* [i. e. visa viva, or, a live specimen seen]. *It flowers in September. The capsules are stippled or like a human sorrowful facial expression looks* [note that Danty d'Isnard (1720; repr. 1722) used the same characterization!].

The *Herbier De Lamarck* at Paris (P-LAM) owns a herbarium specimen of *Euphorbia tridentata* (P00381880, see Fig. 8a); the herbarium sheet only contains a cyathium and a capsule.

When in the second decade of the 20th century the British botanists Nicholas E. Brown, John Hutchinson and David Prain were preparing contributions for the *Flora Capensis*, *Vol. 5, section 2* about the family Euphorbiaceae in South Africa (Brown, 1915; see section 2.35), John Hutchinson made in Paris, France, a drawing of the herbarium specimen of *Euphorbia tridentata* Lam. at P-LAM (Fig. 8b). On the sheet he wrote: "*this is all there is of the type. Drawn from the type*".

Today, the Kew Herbarium Catalogue preserves this drawing as herbarium sheet K000253271 for being the type of *Euphorbia patula* Mill., noting "collector Lamarck, South Africa" (sic!).

Observe that P. V. Bruyns (2012) designates as lectotype for *Euphorbia tridentata* Lam. the engraving in J. Burman (1738) namely *Tab.7, Fig. 2*, see Fig. 4. But J. Burman (1738) copied this engraving from a watercolour painted in 1686/1687 by H. Claudius (see section 2.1), not giving any reference to Claudius; we present Claudius' watercolour as the earlier illustration of *Euphorbia tridentata* Lam.

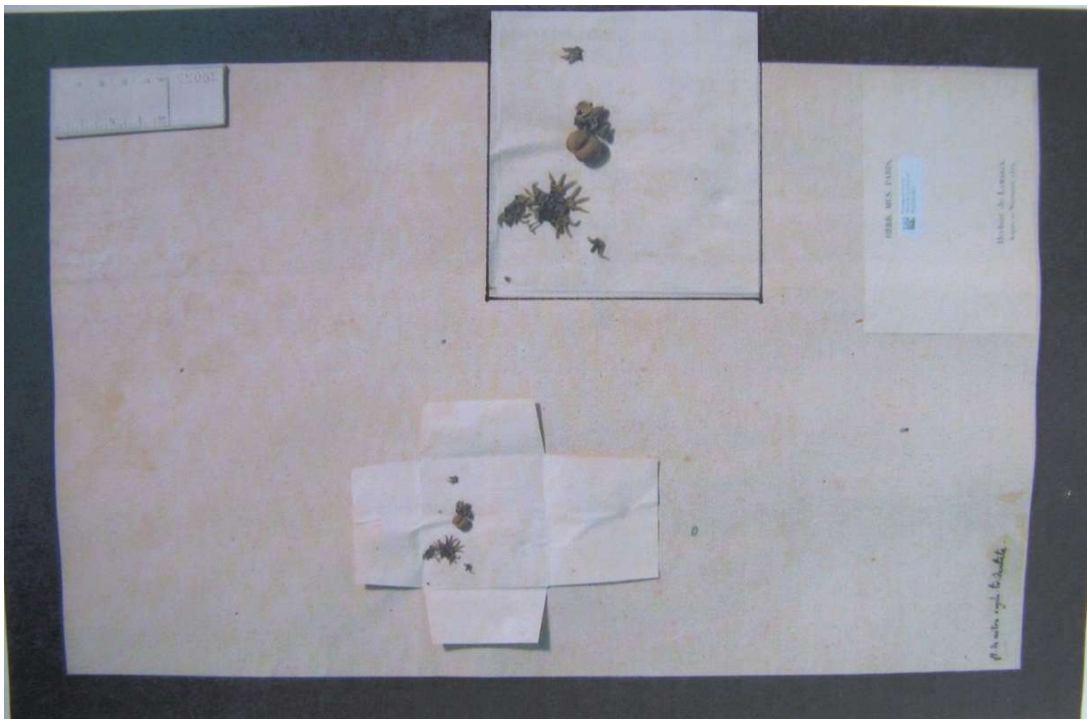


Fig. 8a. Herbarium specimen of *Euphorbia tridentata* Lam., P00381880, at P-LAM (courtesy of Thomas Haevermans).

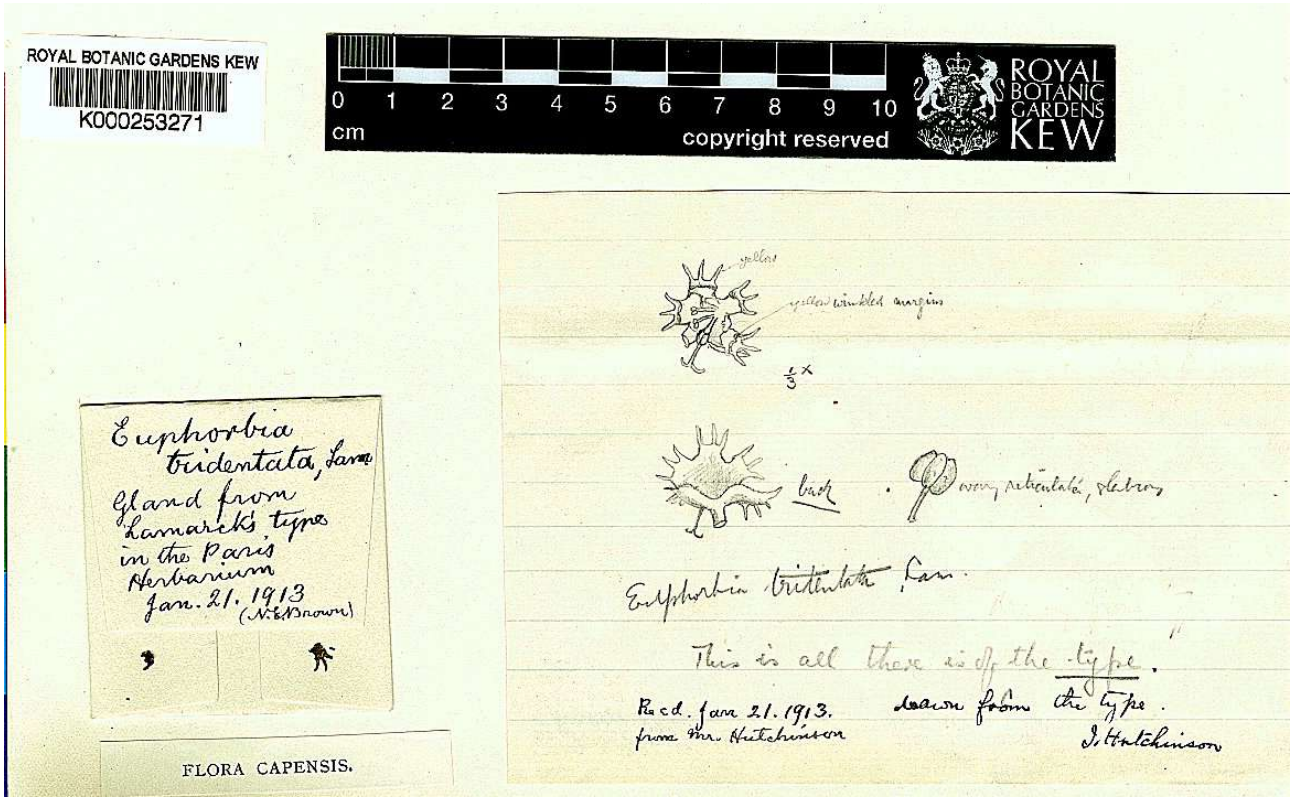


Fig. 8b. Drawing made by J. Hutchinson of the herbarium specimen of *Euphorbia tridentata* Lam. at P-LAM to clarify the description of the species by N. E. Brown in the *Flora Capensis* (Brown, 1915). Courtesy of RBG, Kew.

Note that to the species described by J.-B. de Lamarck (1788) as "*Euphorbia tridentata* Lam." is referred by C. L. Willdenow (1799) re. *Euphorbia* [No.] *17. Euphorbia anacantha*, see Fig. 10; by A. P. de Candolle (1804) re. *Euphorbia tridentata - Euphorbe à trois dents*, see Fig. 11; by Chr. H. Persoon (1807) re. *Euphorbia* [No.] *18. Anacantha*; by J. L. M. Poiret, Ed. (1812) re. *Euphorbia* [No.] *11. Euphorbe à trois dents, Euphorbia tridentata* Lam.; by J. Sims, Ed. (1824) re. *Euphorbia anacantha*, see Fig. 14; by J. F. Klotzsch & C. A. F. Garcke (1859; 1860) re. *Medusea tridentata*; by P. E. Boissier (1862) re. *Euphorbia anacantha* Aiton; by A. Berger (1906, date on t. p. 1907) re. *Euphorbia anacantha* Aiton; by N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata* Lam.; by E. P. Phillips in I. B. Pole Evans, Ed. (1925) re. *Euphorbia tridentata* Lam., see Fig. 18; by G. F. Frick (1930) re. *Euphorbia tridentata* Lam., see Fig. 20; by R. A. Dyer (1931) re. *Euphorbia tridentata* Lam.; by H. W. R. Marloth (1931) re. *Euphorbia tridentata* Lam., see Fig. 21**;** by A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia tridentata* Lam.; by G. Marx (1992) re. *Euphorbia tridentata* Lam.; by P. V. Bruyns in P. Goldblatt & J. Ch. Manning, Eds (2000) re. *Euphorbia tridentata* Lam.; by R. Govaerts, D. G. Frodin & A. Radcliffe-Smith (2000) re. *Euphorbia patula* Mill. (Miller, 1768) who consider *Euphorbia tridentata* Lam. and *Euphorbia anacantha* Aiton its synonyms; for the period 2000 until mid-2013 in the *Kew World Checklist of Selected Plant Families* re. *Euphorbia patula* Mill. considering as synonyms *Euphorbia tridentata* Lam. (J.-B. de Lamarck, 1788)*, Euphorbia anacantha* Aiton (Aiton, 1789), *Dactylanthes patula* (Mill.) Haw. and *Dactylanthes anacantha* (Aiton) Haw. (Haworth, 1812), *Medusea patula* (Mill.) Klotzsch & Garcke and *Medusea tridentata* (Lam.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860) (Govaerts, 2000 until mid-2013, see section 2.48.1), in the International Plant Index (IPNI) re. *Euphorbia tridentata* Lam.; by S. Carter (2002) re. *Euphorbia tridentata* Lam.; by P. V. Bruyns et al. (2006) re. *Euphorbia tridentata* Lam. classifying the species within *Euphorbia* subg. *Rhizanthium*; by P. V. Bruyns (2012) re. *Euphorbia tridentata* Lam., considering as synonyms *Euphorbia anacantha* Aiton (Aiton, 1789), *Dactylanthes anacantha* (Aiton) Haw. (Haworth, 1812) and *Medusea tridentata* (Lam.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860); this is confirmed in the *Kew World Checklist of Selected Plant Families* re. *Euphorbia tridentata* Lam. (Govaerts, mid-2013 sqq., see section 2.48.2).

(*) The reference to this picture must be an error made by J.-B. de Lamarck, for most likely Breyne's *Tab. 19* is picturing *E. pugniformis* Boiss. in DC (Wijnands, 1983, p. 101); note that J. Ph. Breyne *fil.* (1739) already had his doubts too, see section 2.8. Another possibility is, De Lamarck unthinkingly quoted C. Linnaeus from the second edition of the *Species Plantarum* (1762-1763), see section 2.10.3.

2.13. William Aiton (1731-1793), British gardener & botanist, Royal Gardener at Kew, in 1789 compiled in 3 successive volumes the *Hortus Kewensis, or, a Catalogue of the Plants cultivated in the Royal Botanic Gardens at Kew.*

In *Volume 2* of the *Hortus Kewensis* (1789, p. 136), provided by a Linnaean binomial name but still accompanied by phrase terms, he catalogues "*Euphorbia anacantha*". Aiton refers to A.-T. Danty d'Isnard (1720, repr. 1722) re. *Euphorbium* [No.] *12. Euphorbium anacanthum, squamosum, lobis florum tridentatis*, see Fig. 2a, to J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, see Fig. 4 and furthermore to Ph. Miller's *Euphorbium* [No.] *7. Euphorbium, Afrum, caule squamoso, tuberoso, minus*, particularly quoting the first edition of *The Gardeners Dictionary* of 1731.

William Aiton describes "*Euphorbia anacantha*" as follows:

"*Euphorbia anacantha. Euphorbia inermis imbricata, tuberculis foliolo subrotundo instructis, floribus terminalibus solitariis sessilibus, petalis palmatis*",

or,

"*Euphorbia anacantha. Spineless Euphorbia, as if covered with overlapping roof tiles* [imbricate; i. e. with scales parallel overlapping at the margins]*, with tubercles and provided with somewhat circular* [i. e. 6:5] *leaflets, with at the ends solitary and sessile flowers with palmate petals*".

Aiton intends to indicate, noting "*flowers with palmate petals*", that the flowers possess lobes or glands like the fingers of an outspread hand. As domicile Aiton records the Cape of Good Hope, labelling it "*Scaly Spurge*", he notes it in culture (in England) in 1731 (cf. Miller, 1731), flowering as a shrub or woody plant in September and October.

Observe that in the period ca.1700 - ca.1900 neither the geographic term "at the Cape of Good Hope" nor the more common indication "at the Cape" pertain to the Cape Colony and its immediate surroundings, but in a general sense refer to the whole southern part of present South Africa.

Note that to the species described by W. Aiton (1789) as "*Euphorbia anacantha*" is referred by C. L. Willdenow (1799) re. *Euphorbia* [No.] *17. Euphorbia anacantha*, see Fig. 10; by A. P. de Candolle (1804) re. *Euphorbia tridentata - Euphorbe à trois dents*, see Fig. 11; by Chr. H. Persoon (1807) re. *Euphorbia* [No.] *18. Anacantha*; by A. H. Haworth (1812) re. *Dactylanthes anacantha*; by J. Sims (1824) re. *Euphorbia anacantha*, see Fig. 14; by J. F. Klotzsch & C. A. F. Garcke (1859; 1860) re. *Medusae tridentata*; by P. E. Boissier (1862) re. *Euphorbia anacantha* Aiton; by A. Terracciano (1905) re. *Euphorbia anacantha* Aiton, see Fig. 15; by A. Berger (1905; 1906, date on t. p. 1907) re. *Euphorbia anacantha* Aiton; by N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata* Lam.; by A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia tridentata* Lam. and by R. Govaerts, D. G. Frodin & A. Radcliffe-Smith (2000) re. *Euphorbia patula* Mill. (Miller, 1768) who consider as synonyms Aiton's *Euphorbia anacantha* together with *Euphorbia tridentata* Lam. (J.-B. de Lamarck, 1788). In the *Kew World Checklist of Selected Plant Families*, for the period 2000 until mid-2013, as synonyms of *Euphorbia patula* Mill. (Miller, 1768) were reported *Euphorbia anacantha* Aiton, *Euphorbia tridentata* Lam. (J.-B. de Lamarck, 1788), *Dactylanthes patula* (Mill.) Haw. and *Dactylanthes anacantha* (Aiton) Haw. (Haworth, 1812) as well as *Medusea patula* (Mill.) Klotzsch & Garcke and *Medusea tridentata* (Lam.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860) (Govaerts, 2000 until mid-2013). To "*Euphorbia anacantha*" (Aiton, 1789) is referred by S. Carter (2002) re. *Euphorbia tridentata* Lam.; in the International Plant Index (IPNI); by P. V. Bruyns (2012) who considers *Euphorbia anacantha* Aiton, *Medusea tridentata* (Lam.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860) and *Dactylanthes anacantha* (Aiton) Haw. (Haworth, 1812) synonyms of *Euphorbia tridentata* Lam. (J.-B. de Lamarck, 1788); this point of view is confirmed in the *Kew World Checklist of Selected Plant Families* re. *Euphorbia tridentata* Lam. (Govaerts, mid-2013 sqq.). L. C. Wheeler (1943, p. 460) considered *Euphorbia anacantha* Aiton typical for Haworth's genus Dactylanthes (Haworth, 1812).

2.14. Noel (Martin) Joseph de Necker (1730-1793), French-born but active in Mannheim, Germany as personal physician and botanist, for years criticized Linnaeus' system for classifying plants as described in Linnaeus' *Systema Naturae*. After twelve years of study, at last he had developed a new classification system, naming it a "*secundum systema naturale nobis detectum, stabilita*"; he published it in 1790 as *Elementa botanica, genera genuina, species naturales omnium vegetabilium detectorum eorumque characteres diagnosticos ac peculiares exhibentia, secundum systema omologicum seu naturale, evulgata*. Based on 44 different morphological characteristics of the flowering habit, N. J. de Necker (1790a) classified the plants as known in his time in 33 "genera". Each "genus", provided with a by the author personally devised special name, was

accompanied by a full-page engraving (Tabula) which depicted by a range of small "icons" the particular diagnostic flower characteristics of the "species naturales" within each "genus" (*Corollarium, etc.*, N. J. de Necker, 1790b). The "*Genus XXIX Cyrtosiphytum*" (presented on p. 331, accompanied by *Tabula XXIX*) includes 38 "species naturales", which are de facto mostly Euphorbiaceae described by previous authors. For instance, we find as "species naturales" (pp. 352-354) designated the "species": "*Euphorbia*", "*Keraselma*", "*Athymalus*", "*Pedilanthus*" and "*Tithymalus*". However, because the names of N.J. de Necker's "species naturales" are derived from generic names used by previous authors and therefore in fact represent genera, the "species naturales" cannot be regarded as generic names for being unitary designations of species, and hence must be considered as not validly published; the more all issues and editions of the *Elementa botanica, etc.*, are regarded suppressed works (opera utique oppressa), cf. Wheeler, 1943 (p. 471), Stafleu & Cowan, 1983 and ICBN Art. 20.4, 34.1, App. VI in McNeill et al. (2012). And as C. S. Rafinesque in passing mentions (*Flora Telluriana*, part 4, p. 112, no. 1169, 1836 publ. 1838), regarding the "species naturalis *Athymalus*" (in fact "genus *Athymalus*"), De Necker has omitted to designate any types to have ascertained which *Euphorbia* species particularly belong here.

To distinguish the "species naturalis *Athymalus*" from the "species naturales *Euphorbia*" and "*Keraselma*", N. J. de Necker (1790a, p. 331, p. 353) applies, concerning the perigonium (named by him "perigynanda propria"), diagnostically the morphological characteristics "*duplex, exterior monosepala, obconica, cavo-lobata, interior 5-sepala, cucullato-furcato cum dentibus alterna furcis obtusis*", or, "*perigon twofold: exterior* [= involucre] *one joined sepal, conical with apex downward, concave lobed, interior* [= glands and appendages] *consisting of 5 sepals, split, the parts provided with a hood, alternatingly denticulate with obtuse forks*". To illustrate these flower characteristics he copied the pictures of the cyathium of *Euphorbium anacanthum, squamosum, lobis florum tridentatis*, in 1720 (repr. 1722) described by A.-T. Danty d'Isnard (see Fig. 2a, 2b in section 2.5). Without giving reference or any credit to Danty d'Isnard he had them redrawn (although with minute differences) and engraved to show characteristics of flowers (De Necker, 1790b, *Corollarium, etc., Tab. XXIX, fig. 1a, b*; Fig. 9).

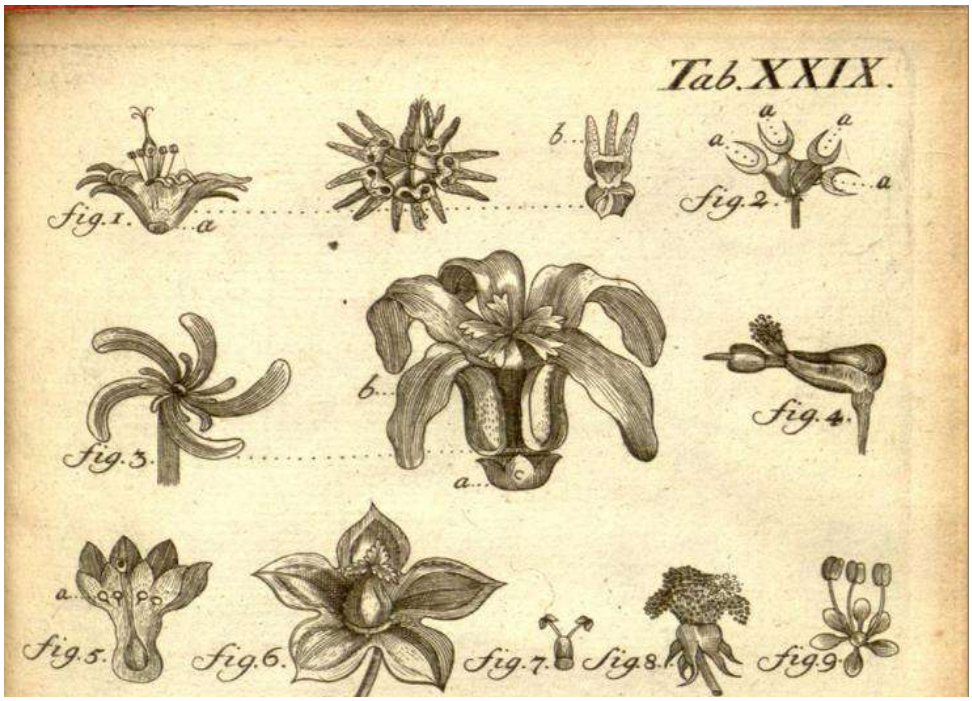


Fig. 9. The uppermost part of *Tab. XXIX* in N. J. de Necker, *Corollarium, etc.* (1790b). See text above.

N. J. de Necker's "species naturalis *Athymalus*", but in fact "genus *Athymalus*", was on implication designated by H. G. L. Reichenbach (1828 publ. 1829) as a subgenus of the genus *Euphorbia* L., namely *Euphorbia* subg. *Athymalus* Necker ex Rchb. (see section 2.29), but failing the designation of a type, this proposition must be considered invalid, being a *nomen nudum* (Wheeler, 1943, p. 460, 484). Nevertheless, J. A. Peirson et al. (2013) adopted Reichenbach's subgenus to become *Euphorbia* subg. *Athymalus*. Peirson et al. used part of the engraving on *Tab. XXIX* to illustrate the description of this subgenus, considering the depicted cyathia typical for *Euphorbia tridentata* Lam. and as such sufficiently representative of designating this *Euphorbia* as the type for the name *Athymalus*, see section 2.49.

2.15. Carl Ludwig Willdenow (1765-1812), German physician, botanist, professor of natural history and botany, director of the Royal Botanical Garden of Berlin, re-edited Carl Linnaeus' *Species Plantarum*. The fourth edition, called *Caroli a Linné Species Plantarum, etc., editio quarta (...) curante Carolo Ludovico Willdenow*, in 1797-1825 was published in 6 volumes. In *Tomus 2, pars 2* of the fourth edition of the *Species Plantarum, etc.* Carl Ludwig Willdenow enumerates (1799, p. 888) "*Euphorbia* [No.] *17. Euphorbia anacantha* **-** *Dreyzähnige Wolfsmilch* [Three-toothed Spurge]".

Willdenow refers to A.-T. Danty d'Isnard (1720, repr. 1722) re. *Euphorbium* [No.] 12. *Euphorbium anacanthum, squamosum, lobis florum tridentatis*, see Fig. 2a, to J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, see Fig. 4, to Ph. Miller (1731, 1733, 1735, 1743 and 1745) re. *Euphorbium* [No.] 7. *Euphorbium, Afrum, caule squamoso, tuberoso, minus*, to J.-B. de Lamarck (1788) re. *Euphorbia* [No.] 11. *Euphorbia tridentata*, see Figs 8a, 8b and to W. Aiton (1789) re. *Euphorbia anacantha*. The Museum Botanicum Berolinense (B!) owns a herbarium specimen of Willdenow's *Euphorbia anacantha*, Cat. Nr. 09247 (see Fig. 10).

On the sheet of the specimen we read:

"*Polyandria Trigynia. Euphorbia Anacantha - articulosa, carnosa, tuberculata, foliis subulatis, floribus subsolifloriferis* [? – on the sheet nearly illegible], *terminalibus, pedunculis abbreviatis bibracteatis, petalis trifidis. Sp. pl. 888. Habitat ad Cap. b. Spei*",

or,

"*Euphorbia anacantha - jointed* [segmented], *fleshy, tuberculate, with awl-shaped leaves, with flowers more or less separately flowering* [?] *at the ends* [of the branches], *with short twofold bracteate peduncles and three-tongued petals. Species Plantarum* [= Fourth edition], [p.] *888. Habitat Cape of Good Hope*".

Later, in another hand, the German botanist D. F. L. von Schlechtendal (1794-1866) wrote on the herbarium sheet: "*Euphorbia ornithopus*"; maybe Von Schlechtendal had seen the description of "*Euphorbia ornithopus* Jacq." by C. L. Willdenow in the *Enumeratio Plantarum Horti Regii Botanici Berolinensis, etc., Pars 1* (1809), see section 2.19. When we measure the length of the three peduncles of Willdenow's herbarium specimen, we find 7-15 mm; the cyathium seems to possess four or five 3- to 4-toothed glands.

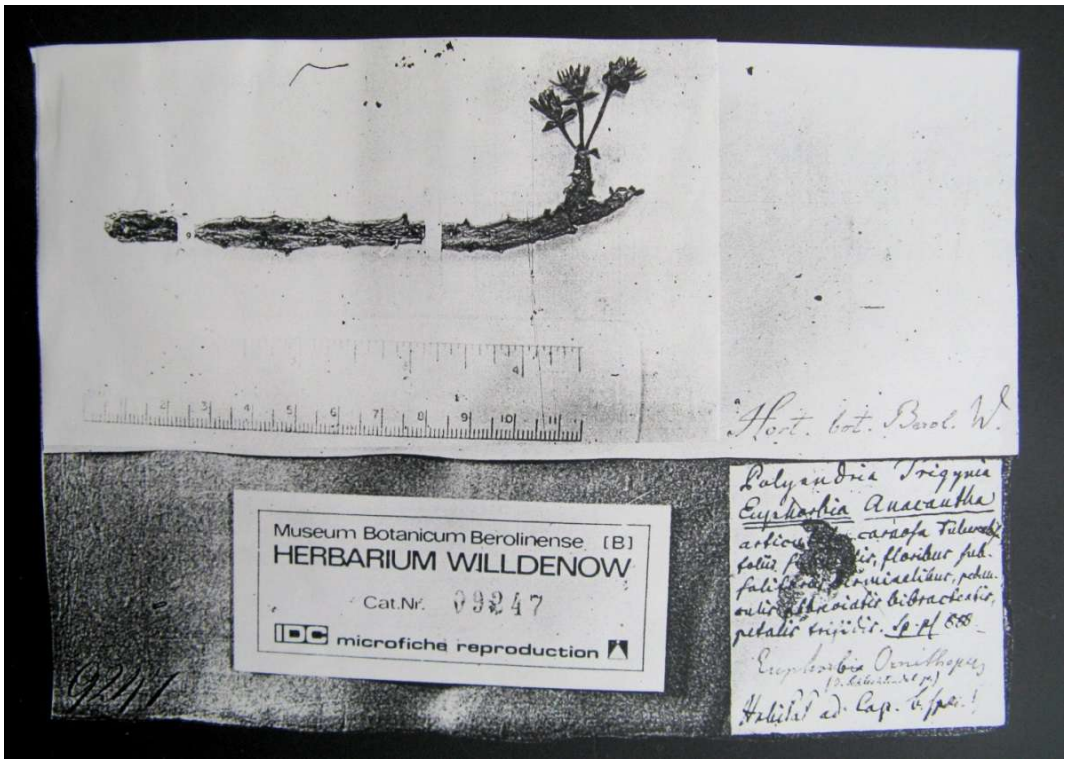


Fig. 10. Herbarium specimen of C. L. Willdenow's *Euphorbia anacantha*, Cat. Nr. 09247, at B.

Note that to the species described by C. L. Willdenow (1799) as "*Euphorbia anacantha*" is referred by A. P. de Candolle (1804) re. *Euphorbia tridentata* - *Euphorbe à trois dents*, see Fig.11; by W. T. Aiton (1811) re. *Euphorbia anacantha*; by J. L. M. Poiret (1812) re. *Euphorbia* [No.] *11. Euphorbe à trois dents, Euphorbia tridentata* Lam.; by A. H. Haworth (1812) re. *Dactylanthes anacantha*; by J. Sims (1824) re. *Euphorbia anacantha*, see Fig. 14; by R. Sweet (1818) re. *Euphorbia* [No.] *23 anacantha*; by R. Sweet (1826) re. *Euphorbia* [No.] *29 anacantha*; by R. Sweet (1830) re. *Euphorbia* [No.] *36 anacantha*; by J. H. F. Link (1822) re. *Euphorbia* [No.] *81. Euphorbia anacantha* Willd. and by N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata*.

2.16. Augustin Pyramus de Candolle (1778-1841), Swiss botanist at Geneva, portrayed 182 succulent plants in his *Plantarum Succulentarum Historia - Histoire des Plantes Grasses*, a folio edition in 32 parts, compiled in 1798-1837. From paintings by the famous artist and botanist **Pierre-Joseph Redouté** (1759-1840) the plates were produced as stipple engravings, printed in colour and finished by hand whereas A. P. de Candolle mostly did the accompanying texts. In *Livraison* (= part) *26* from An X [= August 1804] a colour print of "*Euphorbia tridentata* - *Euphorbe à trois dents*" (*Pl. 144*, see Fig. 11) was published. We assume De Candolle particularly studied J.-B. de Lamarck's *Euphorbia tridentata* in depth, as can be traced back to a conspicuous reference in his description of the species, see hereafter.

Preceding *Pl. 144*, Augustin Pyramus de Candolle at first refers to J.-B. de Lamarck (1788) re. *Euphorbia* [No.] *11. Euphorbia tridentata*, see Fig. 8, next to A.-T. Danty d'Isnard (1720, repr. 1722) re. *Euphorbium* [No.] *12. Euphorbium anacanthum, squamosum, lobis florum tridentatis*, see Fig. 2a, to J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, see Fig. 4, to Ph. Miller (1731, 1733, 1735, 1743, 1745) re. *Euphorbium* [No.] *7. Euphorbium, Afrum, caule squamoso, tuberoso, minus*, to W. Aiton (1789) re. *Euphorbia anacantha* and finally to C. L. Willdenow (1799) re. *Euphorbia* [No.] *17. Euphorbia anacantha*, see Fig. 10.

Fig. 11. Colour printed engraving of *Euphorbia tridentata* [Lam.] from a painting by Pierre-Joseph Redouté, published by A. P. de Candolle in *Plantarum Succulentarum Historia*, Livraison 26 (1804, *Pl. 144*).

De Candolle describes the species at first in Latin (not translated) and next in French (translated into English), we quote:

"*EUPHORBIA TRIDENTATA. Radix albicans, subfibrosa, ad collum crasse. Caules plurimi, ad collum ramosi, dein simplices, cylindrici, basi incrassati, subpatuli, atrovirides, intus latescentes, areolis subspatulatis et apice mammillosis notati. Folia in quaque areola solitaria, sessilia, ovata, patula, acuta, atroviridia, subcrassa, margine rubentia, tenuissime denticulata. Flores sessiles, terminales, 3-4 aggregati, successive florentes, bracteis oppositis, ovatis, basi stipati. Calyx monophyllus, carnosus, campanulatus, decemfidus, laciniis quinque externis, albidis, patulis, magnis, supra concavis, in tria cornua subulato-conica divergentia abeuntibus et sic stellam quindecim radiis donatam simulantibus; quinque internis, foliaceis, ovarium fere tegentibus, ovatis, apice ciliatis et tridentatis, spiraliter Hermanniae petalorum more incumbentibus. Stamina 12-15; filamenta crassa, media articulata, teretia, calyce paulo breviora, filis sterilibus acutis subpinnatifidis intermixta et paululum superata. Antherae tetragonae, didymae, quadrisulcatae, crassae. Pistillum: ovarium pedicellatum, è calyce vix exsertum, trigonum, obtusatum. Stylus solitarius, exsertus.*

Stigmata tria, nunc divergentia, nunc approximata, primo clavata et flavicantia, deinde cylindrica et fusca. Pericarpium: capsula, in nostris abortiva, trigona, obtusa, trilocularis, trivalvis, punctata seu fere tuberculosa (LAM.). Semina ....."

The succeeding, slightly different description in French runs as follows:

"*EUPHORBE À TROIS DENTS. Racine blanchâtre, épaisse au collet, un peu fibreuse. Tiges nombreuses, épaisses à la base, simples ou rameuses vers le collet, cylindriques, lactescentes, un peu étalées, longues de 2 décimètres, charnues, d'un vert obscur, marquée d'aréoles convexes, et dont la forme approche de celle d'une spatule tronquée à sa base. Feuilles solitaires au sommet de chaque aréole, sessiles, ovales, étalées, finement dentelées, pointues, d'un vert foncé ou un peu rougeâtres sur les bords,un peu épaisses, longues de 4-10 millimètres, sur 3-8 de largeur. Fleurs terminales, presque sessiles, réunies trois ou quatre ensemble, munies à leur base de deux bractées ovales, opposées. Calice d'une seule feuille, en cloche, à dix divisions, cinq extérieures étalés, blanchâtres, calleuses, concaves au dessous,divisées chacune en trois pointes coniques divergentes, ce qui donne à la fleur l'aspect d'une étoile 1a quinze rayons; cinq intérieures foliacées, ovales, embriquées les unes sur les autres avant l'épanouissement, rapprochées sur l'ovaire, ciliées vers le sommet, qui se termine par trois dents, dont celle du milieu est pointue. Étamines 15-20, insérées sur le réceptacle, entremélées de filets stériles, s'épanouissant successivement; filaments articulés, cylindriques, plus courts que les divisions intérieures du calice; anthères tétragones, assez grosses. Pistil: ovaire triangulaire, obtus, porté sur un pédicelle égal à la longueur des filets des étamines, surmonté de trois stigmates d'abord divergentes et en forme de massue, ensuite rapprochés et cylindriques. Péricarpe: Capsule triangulaire, obtuse, à trois loges, à trois valves, un peu chagrinée en dehors (LAM.). Graisses solitaires dans chaque loge. L'Euphorbe à trois dents est originaire du Cap-de-Bonne-Espérance. Perannuelle. Elle est cultivée depuis long temps dans les serres du Muséum d'Histoire naturelle, où elle fleurit ordinairement à la fin de l'été*",

or,

"*Euphorbia tridentata. Root whitish, somewhat fibrous, thick at the neck* [of the plant]. *Numerous branches, thick at the base, solitary or branching around the neck, cylindrical, milky inside, somewhat spreading, 2 decimetre long, fleshy, dark-green coloured, marked by convex areoles* [tubercles]*, whose form resemble a spatula* [i.e. one side broadly rounded, other side tapering] *but truncated at the base. Leaves solitary on the top of each areole, sessile, oval, spreading, finely toothed, pointed, dark-green or a little bit reddish along the margins, somewhat fleshy, 4-10 mm long by 3-8 mm wide. Terminal flowers, nearly sessile, by three or four together clustered, at their base provided with two opposite oval bracts. Calyx one whole leaf, shaped like a bell-glass, divided in ten parts, the five outward parts spreading, whitish, callous, on top concave* [hollow]*, each in three awl-shaped to conical diverging points divided, which gives the whole flower the aspect of a star with fifteen rays; the five interior parts leaf-like, oval* [*ovate* in Latin]*, before unfolding each other overlapping like roof tiles, bending onto the ovary, ciliate up to the end which is terminating into three teeth, of which the middle one is pointed. Stamens 15-20, situated on the receptacle, alternating with sterile, somewhat feathery threads, successively appearing; filaments fleshy, articulate, cylindrical, and shorter than the inward parts of the calyx; anthers 4-angled, rather large. Pistil: the ovarium obtuse and 3-angled, on a pedicel equally long as the threads of the stamens, crowned with three stigmata, which at first club-like spreading, later on cylindrical and jointed. Pericarp: a three-angled obtuse capsule, three-valved, at the outside somewhat wrinkled such as a human sorrowful facial expression looks (LAM)* (*). *One solitary seed in each valve. Euphorbia tridentata comes from the Cape of Good Hope. Perennial. In culture in the greenhouses of the Muséum d'Histoire Naturelle for a long time, where it usually flowers at the end of the summer*".

(*) A.-T. Danty d'Isnard (1720), see section 2.5 and J.-B. de Lamarck (1788), see section 2.12 made the same observation!

Some differences exist between De Candolle's Latin and French text. In Latin the top of the tubercles is annotated "*apice mammillosis notati*", or, "*provided with remarkable nipples*" whereas the pericarp is observed "*punctata seu fere tuberculosa*", or, "*stippled or nearly fully tuberculate*". In Latin, the filaments are "*media articulata, teretia*", i. e. "*half-way articulated, cylindrical to tapering*". The anthers are not only "*4-angled*", but in Latin also "*didymae, quadrisulcatae, crassae*", or, "*twofold split* [= bifurcated]*, quadruple grooved, fleshy*". However, most significant is, what he says about the terminal flowers. In Latin, they are "*sessiles*", but in French particularly "*presque sessiles*", i. e. "*nearly sessile*". The mention in Latin, which is absent in French, that the flowers, by "*3-4 aggregati*", are "*successive florentes*" expresses the characteristic that the short-peduncled flowers, by 3 to 4 close together clustered at the end of the branches, successively start flowering one after another.

Note that to the species described by A. P. de Candolle (1804) as "*Euphorbia tridentata* [Lam.]" is referred by Chr. H. Persoon (1807) re. *Euphorbia* [No.] *18. Anacantha*; by W. T. Aiton (1811) re. *Euphorbia anacantha*; by J. Sims (1824) re. *Euphorbia anacantha*, see Fig. 14; by R. Sweet (1818) re. *Euphorbia* [No.] *23 Euphorbia anacantha*; by P. E. Boissier (1862) re. *Euphorbia anacantha* Aiton; by A. Berger (1905; 1906, date on t. p. 1907) re. *Euphorbia anacantha* Aiton; by N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata* Lam. and by A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia tridentata* Lam.

2.17. Christiaan Hendrik Persoon (1761-1836), South African botanist and mycologist, Dutch citizen, living in Paris, composed a review of ca. 20.000 plant species, mainly from herbarium specimens at Paris, in 1805-1807 published in 2 volumes. In *Pars 2(2)* (1807, p. 11) of his *Synopsis Plantarum seu Enchiridium Botanicum, etc., curante C. H. Persoon*, Chr. H. Persoon records "*Euphorbia* [No.] *18. Anacantha*", referring to and repeating the description of *Euphorbia anacantha* by W. Aiton (1789); he is also referring to J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, see Fig. 4, to J.-B. de Lamarck (1788) re. *Euphorbia* [No.] *11. Euphorbia tridentata*, see Figs 8a, 8b and to A. P. de Candolle (1804; *Pl. 144*) re. *Euphorbia tridentata* [Lam.], see Fig. 11. He notes its origin at the Cape of Good Hope.

Persoon annotates "*Euphorbia* [No.] *18. Anacantha*" as follows:

"*Euphorbia inermis imbricata, tuberculis foliolo subrotundo instructis, floribus terminalibus solitariis sessilibus, petalis palmatis,*

or,

"*Spineless Euphorbia, as if covered with overlapping roof tiles with tubercles and provided with somewhat circular* [i. e. 6:5] *leaflets, with at the ends solitary and sessile flowers with palmate petals*".

Note that to the species defined by Chr. H. Persoon (1807) as "*Euphorbia* [No.] *18. Anacantha*" is referred by A. H. Haworth (1812) regarding the species *Dactylanthes anacantha*.

2.18. Nikolaus Joseph Freiherr von Jacquin (1727-1817), born in Leiden (Netherlands), studied medicine at the University of Leiden, later moved first to Paris and then to Vienna. In 1755 Nikolaus von Jacquin was sent to the West Indies and Central America by Franz I Stephanus (1708-1765), Emperor of the Holy Roman Empire [i. e. present Austria] to collect plants for the garden of Schloss Schönbrunn in Vienna. He assembled a large collection of plant, animal and mineral specimens. In 1762, he became professor of minerals at the Mining Academy in Chemnitz (now Slovakia) and in 1768, he was appointed professor of botany and chemistry and Director of the

botanical garden of the University of Vienna. N. J. von Jacquin promoted Linnaeus' binomial nomenclature emphatically. Because of his merits in the field of botany, he was elected a foreign member of the Royal Swedish Academy of Sciences in 1783 and in 1806 he was made baron. About his botanical investigations he published seven, richly illustrated books. In *Fragmenta Botanica Figuris Coloratis Illustrata* (1809) N. J. von Jacquin introduced (p. 76, *Tab. 120, fig. 2*, see Fig. 12) "*Euphorbia* [No.] *238. Euphorbia Ornithopus*".

N. J. von Jacquin describes the species as follows:

"*Sine patria indicata accepimus ex Anglia ipsam plantam, quae forte ex Promontorio bonae Spei eft. Floret quotannis, sed fructum huc usque nullum dedit. Nomine triviali vocavi Ornithopum, quia petala singula pedem avis cum tribus digitis sive singulis haud male refert. Tota fruticofa & glabra lactescit abunde. Caules plusculi, ramosi, debiles, erectiusculi, carnosi, creeiformes, pedales, basi digitum crassi, teretes, juniores virides, uniores glauci, in tubercula horizontalia crassa & acuta undique protuberantes, quae juniora ex apice emittunt singula folium ovale sessile integerrimum planum minimum viride & tandem marcescens deciduumque. Pedunculi in ramis terminales, pauci aggregati, uniflori, teretes, erecti, biunciales, involucro universali destituti, infra flores bracteis duabus vel tribus patentissimis foliaque simillimis ceu involucro partiali instructi. Flores erecti, hermaphroditi, inodori. Calyx turbinatus, viridis, limbo quadrifido & obtuso. Petala quatuor, infundibuliformia, ex glauco virentia, bilabiata; labio superiori sive extimo, tricorni, longo, patulo, facie ex albo reticulata rugosaque, labio inferiori oblongo, connivente, brevissimo, albo. Stamina circiter duodecim. Germen ovatum, glabrum. Styli tres. In tabula sistitur tota planta, & auctus flos dimidius, utrinque conspectus*",

or,

"*Not any native country specified, we received from England this particular plant which perhaps comes from the Cape of Good Hope* (*). *It flowers yearly, but till now it has not given any fruit. Concerning an everyday name I have labelled it Ornithopum, because the separate petals, not at all wrongly, refer to a bird's foot with three separate toes. Entire shrubby and glabrous, it copiously produces milk. As for the habit a lot of stems, much-branched, loosely built, somewhat or almost erect, fleshy, close together one foot wide* [32.5 cm], *at the base one finger* [ca. 20 mm] *thick, narrowly circular tapering, the younger* [stems] *fresh-green, more than one greyish-green, tubercles crosswise fleshy and pointed, everywhere swollen, the separate younger* [stems] *bringing forth from their tip an oval, sessile leaf, wholly flat, at the least fresh-green and once withering soon deciduous. At the end of the branches peduncles, in small number clustered together,* [each] *bearing one flower, tapering, erect, two inches long* [5.1 cm], *not provided with* [the kind of] *an involucre as generally known, beneath the flower with two or three widely spreading bracts, with an involucre likewise provided with similar, partially divided leaves. The flowers erect, bisexual, scentless. Calyx obconical* [i. e. top-shaped], *fresh-green, with a limb deeply divided into 4 parts, obtuse. Four petals, funnel-shaped, from greyish-green becoming fresh green, two-lipped; upper lip stretching outwards, 3-horned, long, flat, the general shape white, netted and wrinkled; lower lip oblong, connivent* [i. e. converging], *very short, white. Stamens about twelve. Ovary ovate, glabrous. Three styles. In the picture the whole plant is displayed, and a flower enlarged, in two halves, both sides in general view*".

(*) Regarding *Euphorbia ornithopus* Jacq., A. C. White, R. A. Dyer & B. L. Sloane (1941, p. 509) write, we cite: "*It was described by Jacquin in 1809, and may not improbably have been brought to the Imperial Gardens at Schönbrunn near Vienna by Boos and Scholl, whose travels in South Africa in search of plants for these gardens extended as far as Albany district*".

Fig. 12. Plant portrait of *Euphorbia ornithopus*, depicted by N. J. von Jacquin (1809; *Tab. 120, Fig.2*); at right our enlargement of the flowering habit.

Note that to the species described by N. J. von Jacquin (1809) as "*Euphorbia Ornithopus*" is referred by C. L. Willdenow (1809) re. *Euphorbia* [No.] *6. Euphorbia Ornithopus*; by J. L. M. Poiret (1812) re. *Euphorbia ornithopus* Jacq.; by R. Sweet (1818) re. *Euphorbia* [No.] *29: ornithopus*; by R. Sweet (1826) re. *Euphorbia* [No.] *33: ornithopus*; by R. Sweet (1830) re. *Euphorbia* [No.] *41: ornithopus*; by J. H. F. Link (1822), K. Sprengel (1826), P. E. Boissier (1862), A. Berger (1905, see Fig. 16), A. Berger (1906, date on t. p. 1907, see Fig. 17), N. E. Brown (1915), G. A. Frick (1930, see Fig. 19), R. A. Dyer (1931), H. W. R. Marloth (1931, see Fig. 21), A. C. White, R. A. Dyer & B. L. Sloane (1941), G. Marx (1992), R. Govaerts, D. G. Frodin & A. Radcliffe-Smith (2000), S. Carter (2002) and in the International Plant Names Index all re. *Euphorbia ornithopus* Jacq. From 2000 until mid-2013 *Euphorbia ornithopus* Jacq. was cited in the *Kew World Checklist of Selected Plant Families* (Govaerts, 2000 until mid-2013). But P. V. Bruyns (2012) designates *Euphorbia ornithopus* Jacq., together with *Dactylanthes patula* (Mill.) Haw. (Haworth, 1812) and *Medusea patula* (Mill.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860) synonyms of *Euphorbia patula* Mill. (Miller, 1768), because the latter is confirmed by Bruyns to be a valid species based on herbarium sheet Fol. no. 328 from Haworth's Herbarium, preserved at OXF

(see section 2.46.2, Fig. 23). Bruyns' notion is also followed by R. H. A. Govaerts in the *Kew World Checklist of Selected Plant Families* (Govaerts, mid-2013 sqq.).

2.19. Carl Ludwig Willdenow (1765-1812), professor of natural history and botany and director of the Royal Botanical Garden of Berlin, catalogued all plants cultivated in the Royal Botanical Garden at Berlin. In the *Enumeratio Plantarum Horti Regii Botanici Berolinensis, etc., Pars 1* (1809) 45 *Euphorbia* species, mostly herbaceous, some succulent or semi-succulent, are recorded; on p. 501 Willdenow describes "*Euphorbia* [No.] *6. Euphorbia Ornithopus*", referring to N. J. von Jacquin (1809, see Fig. 12.

Willdenow notes about *Euphorbia ornithopus* Jacq.:

"*Euphorbia Ornithopus. E. inermis, tuberculata, tuberculis folio oblongo caduco instructis, pedunculis solitariis ternisve unifloris terminalibus, petalis tripartitis. Jacq. fragm. bot. t. 120. Habitat ad Cap. b. spei. Suffrutex. Pedunculi uniflori bracteis binis ellipticis sub flore instructi. Affinis Euphorbiae Anacanthae* (*) *sed flores pedunculati et petala profunde tripartita nec tridentata*",

or,

"*Euphorbia ornithopus. A spineless, tuberculate Euphorbia, with tubercles provided with an oblong, soon deciduous leaf, with solitary* [= simple] *peduncles or threefold, terminally* [supporting] *one flower, with petals divided in threes. N. J. von Jacquin, Fragmenta Botanica Figuris Coloratis Illustrata*, *Tab. 120, fig. 2. Habitat at the Cape of Good Hope. Woody plant. The peduncles, only bearing one flower, provided with two elliptical bracts below the flower. Resembles Euphorbia anacantha Aiton, however, the flowers are peduncled and the petals are deeply divided in threes and not at all threefold toothed*".

(*) Willdenow refers to the species *Euphorbia anacantha* which he described in his *Caroli a Linné Species Plantarum, etc., editio quarta (...) curante Carolo Ludovico Willdenow, Tomus 2, pars 2* (Willdenow, 1799, p. 888, see section 2.15).

Note that to the species described by C. L. Willdenow (1809) as "*Euphorbia* [No.] *6. Euphorbia Ornithopus*" is referred by J. L. M. Poiret (1812) re. *Euphorbia ornithopus* Jacq.; by R. Sweet (1818) re. *Euphorbia* [No.] *29: ornithopus*; by R. Sweet (1826) re. *Euphorbia* [No.] *33: ornithopus*; by R. Sweet (1830) re. *Euphorbia* [No.] *41: ornithopus*; by J. H. F. Link (1822) re. *Euphorbia ornithopus* and by N. E. Brown (1915) re. *Euphorbia ornithopus* Jacq.

2.20. William Townsend Aiton (1766-1849), son of William Aiton, botanist and Royal Gardener at Kew, thoroughly revised his father's *Hortus Kewensis*, the new edition called *Hortus Kewensis; or, a Catalogue of the Plants cultivated in the Royal Botanic Gardens at Kew by the late William Aiton, second edition, enlarged by W. T. Aiton,* in five volumes issued in the years 1810-1813.

In *Vol. 3* of the revised *Hortus Kewensis* (1811, p. 158), recording again "*Euphorbia anacantha*", W. T. Aiton refers to R. Bradley (1727) re. *The Large White flower'd African Spurge*, see Fig. 3, to C. L. Willdenow (1799) re. *Euphorbia* [No.] *17. Euphorbia anacantha*, see Fig. 10 and to A. P. de Candolle (1804) re. *Euphorbia tridentata* [Lam.], see Fig. 11.

Very interestingly he says the species is cultivated before 1727, a date which agrees with the year of publication of the work by Richard Bradley (1727).

Note that to the species described by W. T. Aiton (1811) as "*Euphorbia anacantha*" is referred by A. H. Haworth (1812) re. *Dactylanthes anacantha* and by J. Sims (1824) re. *Euphorbia anacantha*, see Fig. 14.

2.21. Jean Louis Marie Poiret (1755-1834), French clergyman, botanist, later on professor in natural history, initially acted as co-author with J.-B. de Lamarck conceiving and publishing the *Encyclopédie Méthodique - Botanique* (1783-1817), but finally Poiret became sole editor. In *J.-B. A. P. de Lamarck, Encyclopédie Méthodique: Botanique, Supplément*, *Tome 2, pars 2* (1812) Poiret treats new finds and notes addenda et corrigenda about the species already described in former volumes.

2.21.1. About De Lamarck's *Euphorbia* [No.] *11. Euphorbe à trois dents, Euphorbia tridentata* Poiret confirms (p. 607): "*…L'euphorbia tridentata, n°. 11, est l'euphorbia anacantha Willd. & Ait.*", referring to W. Aiton (1789) re. *Euphorbia anacantha* and to C. L. Willdenow (1799) re. *Euphorbia* [No.] *17. Euphorbia anacantha*.

Note that to J.-B. de Lamarck's "*Euphorbia* [No.] *11, Euphorbia tridentata*", as outlined by J. L. M. Poiret (1812) in his supplement to the *Encyclopédie Méthodique, Botanique*, only is referred by N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata*.

2.21.2. Also in *J.-B. A. P. de Lamarck, Encyclopédie Méthodique: Botanique, Supplément, Tome 2, pars 2* (1812, p. 610), Poiret treats "*Euphorbia* [No.] *111. Euphorbe pied d'oiseau*", referring to N. J. von Jacquin (1809) and C. L. Willdenow (1809) re. *Euphorbia ornithopus*:

"*Euphorbia ornithopus Jacq. Euphorbia inermis, tuberculata, tuberculis folio oblongo, caduco instructis; pedunculis solitariis ternisve, unifloris, termi-nalibus; petalis tripartitis. Willd. Enum. Plant. Hort. Berol. 1. Pag. 501 - Jacq. Fragm. tab.120*",

or,

"*Euphorbia ornithopus Jacq. A spineless, tuberculate Euphorbia, with tubercles provided with an oblong, soon deciduous leaf, with simple peduncles or threefold, terminally* [supporting] *a solitary flower, with petals divided in threes. C. L. Willdenow (1809) - N. J. von Jacquin (1809)*".

Poiret comments:

"*Cette plante se rapproche beaucoup de l'euphorbia tridentata; elle en diffère par ses pétales & par ses fleurs pédonculées. Ses tiges sont dépourvues d'aiguillons, chargées de tubercules d'où sortent des feuilles glabres, oblongues & caduques. Les pédoncules sont terminaux, solitaires ou au nombre de trois, soutenant une seule fleur; deux bractées elliptiques sous chaque fleur; les pétales à trois découpures. Cette plante croît au Cap de Bonne-Espérance. Suffrutex*",

or,

"*This plant resembles very much Euphorbia tridentata*; *it differs because of its petals and its peduncled flowers. Its branches are devoid of spines, covered with tubercles from which appear glabrous leaflets, oblong and soon deciduous. The peduncles are terminal* [i. e. at the end of the branches], *simple or threefold, supporting solely one flower, two elliptical bracts underneath each flower, the* [flower] *petals with three cuts. This plant grows at the Cape of Good Hope. Woody plant*".

Note that to the species described by J. L. M. Poiret (1812) as "*Euphorbia* [No.] *111. Euphorbe pied d'oiseau*" is referred by N. E. Brown (1915) re. *Euphorbia ornithopus* Jacq.

2.22. Adrian Hardy Haworth (1768-1833), British botanist, entomologist and gardener, became a commonly respected leading authority about British Lepidoptera and about succulent plants, often consulted by managers of natural history museums and regularly visited by foreign botanists. In 1792, after marriage, Haworth settled in Little Chelsea, a beloved rural location of horticulturists, nursery owners and market gardeners, a hamlet now wholly engulfed by the spread of London. Here he studied insects and crustaceans, as well as succulent plants, particularly mesembryanthemum species, which he obtained from the Royal Botanic Gardens at Kew and from a fair number of privately owned nurseries in his neighbourhood as well as from around London. In 1814, he sold his whole collection of succulent plants. From 1817 on, residing at Little Chelsea, Haworth established a Museum of Natural History and a botanical garden, in 1821 starting again to assemble a new collection of succulents. At the time of his death, he had collected 40,000 insects, 20,000 herbarium plant specimens, 1600 natural history books and 500 living plants (Stearn, 1965; Boulger, 1891). On August 23d, 1833, while in the early evening watering his plants in his garden, he was suddenly seized by an attack of cholera, dying the following day, one of the last victims of the cholera epidemic that had spread through Britain. His vast collections were auctioned by his widow; the botanical specimens were bought by Henry Barron Fielding (1805-1851), a British botanist who judged it a sport to collect herbarium specimens. So, after studying Haworth's herbarium specimens, Fielding threw away most of them as soon as he could acquire smarter ones elsewhere (Clokie, 1964, Stearn, 1965, Stafleu & Cowan, 1979), a few remaining specimens becoming preserved as part of "The Fielding Herbarium", now at OXF (*cf.* Fig. 23).

Adopting Linnaeus' binomial naming, Haworth conceived within the taxon *Euphorbia* L. a "genus" called "*Dactylanthes*", or "Finger-flower plants". In the *Synopsis Plantarum Succulentarum, cum descriptiones, synonymis, locis; observationibus anglicanis, culturaque* (Haworth, 1812) at first Haworth gave a general characterization of four species, namely *Dactylanthes patula*, *Dactylanthes anacantha*, *Dactylanthes tuberculata* and *Dactylanthes hamata*, which he subsumes in the "genus" *Dactylanthes* (pp. 132-133):

"*Calyx 4-5-partitus laciniis expansis carnosis lacunosis altè digitatis. Capsula 3-cocca. Caetera (exceptis paleis petalisque) Euphorbieae, at caulibus inermibus teretibus viridibus subimbricatim tuberculatis, tuberculis supremis apice folioliferis, foliolo ovato expanso. Character ex sicc*.",

or,

"*Calyx in 4-5 parts divided, provided with widely spread, fleshy flaps, pitted with shallow holes, prominently finger-like cut. Fruit threefold sectioned. Otherwise (except for the chaff-like petals) like the Euphorbieae, however, with spineless, narrowly circular tapering stems covered with tubercles which more or less overlap each other parallel at the margins, the tubercles at the utmost top bearing leaflets, each ovate leaflet spreading widely out. The typical elements inferred from specimens in dried state*".

In 1819 Haworth published a *Supplement* to his *Synopsis Plantarum Succulentarum* from 1812; upon closer inspection no new data regarding the species of our interest prove to be mentioned.

2.22.1. Regarding "*Dactylanthes patula*" Adrian Hardy Haworth refers to (we cite) "*Euphorbia patula Mill. dict. ed. 8*", i. e. the non-tuberculate species described in 1768 by Philip Miller in the 8th edition of *The Gardeners Dictionary* as *Euphorbia* [No.] *11 (Patula)*. Haworth describes "*Dactylanthes patula*" as follows (p. 132):

"*Dactylanthes patula. (Spreading) inermis ramis teretibus flagelliformis tuberculis quadragonis. Euphorbia patula, Mill. dict. ed. 8. Obs.: Rami fere prostrati elongati flagelliformes, parum ramosi, ramulis apice rarius floriferis. Flores solitarii longè pedunculati, foliolis calycinis expansis*

carnosis rugosis albis, instar floris Stapeliae, at praesingulariter palmatis, vel potius digitatis. Habitat C.B.S.? Floret Aug. Cult. ante 1768",

or,

"*Dactylanthes patula, spreading, spineless, with more or less circular or narrowly cylindrical tapering and supple* [flagelliformis = squid-like] *branches with 4-angled tubercles. Euphorbia patula, Miller, The Gardeners Dictionary, 8th edition* [1768]. *Observations: The branches are nearly prostrate spreading, very long and supple, tapering, hardly branched, at the end of the branchlets limitedly bearing flowers. The flowers solitary on exceptionally long peduncles, the flower leaflets of the calyx white wrinkled, like a Stapelia flower, particularly palmate or rather finger-like. Habitat Cape of Good Hope? Flowering time August. In cultivation before 1768*".

Observe that Haworth's description of *Dactylanthes patula*, quoting Philip Miller's *Euphorbia patula*, does not fit in with the description which Miller himself gives about his species, we cite: "*Euphorbia* [No.] *11 (Patula) (...) the eleventh sort rises with a taper stalk six or seven inches [15-18 cm] high, sending out from the top a few taper branches, which spread out on every side; these are not scaly, like those of the last sort* [i. e. No. 10, a Medusa's Head] *(...) this sort hath not yet flowered here*". Whereas Miller notifies that the branches are *"... taper ... not scaly*", Haworth designates "*Dactylanthes patula*" as possessing "*... tapering branches ... with 4-angled tubercles*". Moreover, whereas Miller says he never has seen flowers, Haworth notes "*flower ... palmate or rather finger-like*".

We conclude Haworth must have studied Miller's descriptions very inadequately, in the same sense as others have blamed him for careless work (Boulger, 1891), see section 2.50.3.

Note that to the species described by A. H. Haworth (1812) as "*Dactylanthes patula*" is referred by R. Sweet (1818) re. *Euphorbia* [No.] *22: patula*; by R. Sweet (1826) re. *Euphorbia* [No.] *28: patula*; by R. Sweet (1830) re. *Euphorbia* [No.] *35: patula*; by J. F. Klotzsch & C. A. F. Garcke (1859; 1860) re. *Medusea patula* and by P. E. Boissier (1862) re. *Euphorbia anacantha* Aiton. The botanists N. E. Brown (1915, p. 300) and A. C. White, R. A. Dyer & B. L. Sloane (1941, p. 508) consider Haworth's *Dactylanthes patula* a synonym of *Euphorbia ornithopus* Jacq. (Jacquin, 1809), for describing *Euphorbia patula* Mill., N. E. Brown (1915, pp. 292-293) argues that Haworth's *Dactylanthes patula* could not be based on Miller's *Euphorbia* [No.] *11 (Patula)* from 1768 (see section 2.35.1), an opinion supported by A. C. White, R. A. Dyer & B. L. Sloane (1941). Nevertheless, from 2000 until mid-2013, in the *Kew World Checklist of Selected Plant Families*, the species *Dactylanthes patula* (Mill.) Haw. was considered, together with *Dactylanthes anacantha* (Aiton) Haw. (Haworth, 1812), *Euphorbia tridentata* Lam. (J.-B. de Lamarck, 1788), *Euphorbia anacantha* Aiton (Aiton, 1789), *Medusea patula* (Mill.) Klotzsch & Garcke and *Medusea tridentata* (Lam.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860) synonyms of *Euphorbia patula* Mill. (Miller, 1768) (Govaerts, 2000 until mid-2013). To the species *Dactylanthes patula* (Mill.) Haw. is referred by S. Carter (2002) re. *Euphorbia tridentata* Lam. (J.-B. de Lamarck, 1788) albeit together with *Dactylanthes anacantha* (Aiton) Haw. (Haworth, 1812), *Euphorbia anacantha* Aiton (Aiton, 1789), *Medusea patula* (Mill.) Klotzsch & Garcke and *Medusea patula* (Mill.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860). P. V. Bruyns (2012) designates Haworth's *Dactylanthes patula*, together with *Euphorbia ornithopus* Jacq. (Jacquin, 1809) and *Medusea patula* (Mill.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860) synonyms of the non-tuberculate *Euphorbia patula* Mill. because the latter is confirmed to be a valid species for based on the tuberculate specimens glued on herbarium sheet Fol. no. 328 from Haworth's Herbarium, preserved in the Oxford University Herbaria (see section 2.46.2, Fig. 23). In the *Kew World Checklist of Selected Plant Families* the species *Dactylanthes patula* (Mill.) Haw. is treated, together with *Medusea patula* (Mill.) Klotzsch

& Garcke and *Euphorbia ornithopus* Jacq. (Jacquin, 1809), synonyms of *Euphorbia patula* Mill. (Miller, 1768) (Govaerts, mid-2013 sqq.).

2.22.2. Concerning "*Dactylanthes anacantha*" A. H. Haworth refers to R. Bradley (1727) re. *The Large White flower'd African Spurge*, see Fig. 3, to J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, see Fig. 4, to W. Aiton (1789) re. *Euphorbia anacantha*, to C. L. Willdenow (1799) re. *Euphorbia* [No.] *17. Euphorbia anacantha*, see Fig. 10, to Chr. H. Persoon (1807) re. *Euphorbia* [No.] *18. Anacantha* and to W. T. Aiton (1811) re. *Euphorbia anacantha*. Haworth's description (pp. 132-133) follows the one by W. Aiton (1789):

"*Dactylanthes anacantha. (Scaly) inermis imbricata, tuberculis foliolo subrotundo instructis, floribus terminalibus solitariis sessilibus, petalis palmatis. Habitat C.B.S. Floret August. Cult. ante 1727*",

or,

"*Spineless Dactylanthes, scaly as if covered with overlapping roof tiles, with tubercles and provided with somewhat circular leaflets, with at the ends solitary and sessile flowers with palmate petals. Habitat Cape of Good Hope; flowering time August; in cultivation before 1727*".

Note that to the species described by A. H. Haworth (1812) as "*Dactylanthes anacantha*" is referred by J. Sims (1824) re. *Euphorbia anacantha*, see Fig. 14; by J. H. F. Link (1822) re. *Euphorbia* [No.] *81. Euphorbia anacantha* Willd.; by J. F. Klotzsch & C. A. F. Garcke (1859; 1860) re. *Medusea tridentata*; by K. Sprengel (1826) re. *Euphorbia* [No.] *26. Anacantha*; by P. E. Boissier (1862) re. *Euphorbia anacantha* Aiton; by A. Berger (1906, date on t. p. 1907) re. *Euphorbia anacantha* Aiton; by N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata* Lam.,; by G. A. Frick (1930) re. *Euphorbia tridentata* Lam., see Fig. 20 and by A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia tridentata* Lam. To the species *Dactylanthes anacantha* (Aiton) Haw. is referred by S. Carter (2002) re. *Euphorbia tridentata* Lam. albeit together with *Dactylanthes patula* (Mill.) Haw. From 2000 until mid-2013, in the *Kew World Checklist of Selected Plant Families* the species *Dactylanthes anacantha* (Aiton) Haw. was considered together with *Dactylanthes patula* (Mill.) Haw. (Haworth, 1812), *Euphorbia tridentata* Lam. (J.-B. de Lamarck, 1788), *Euphorbia anacantha* Aiton (Aiton, 1789), *Medusea patula* (Mill.) Klotzsch & Garcke and *Medusea tridentata* (Lam.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860) synonyms of a valid *Euphorbia patula* Mill. (Miller, 1768) (Govaerts, 2000 until mid-2013). P. V. Bruyns (2012) considers *Dactylanthes anacantha* (Aiton) Haw., together with *Euphorbia anacantha* Aiton (Aiton, 1789) and *Medusea tridentata* (Lam.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860), synonyms of *Euphorbia tridentata* Lam. The same is confirmed in the *Kew World Checklist of Selected Plant Families* (Govaerts, mid-2013 sqq.).

2.23. Conrad L. Loddiges (1738-1826), Dutch-born horticulturist, from 1761 on owning a famous nursery in Hackney near London, introduced many exotic species from abroad in the British Empire because of the rising interest of the public in horticulture. Together with his sons and some collaborators, from 1817 until 1833 inclusive, Conrad Loddiges published an annual series of 10 monthly issues of 10 engraved and hand-coloured plant portraits each, entitled *The Botanical Cabinet, consisting of Coloured Delineations of Plants from all Countries, with a short Account of each, Directions for Management, &c. &c.* Finally 20 volumes of 100 engravings each, accompanied by a brief description by George Loddiges (1784-1846), son of Conrad Loddiges, were bound. The prints are rare, for as soon as the last volume of the series, volume 20, had been finished, once and for all a worker at the printer's stole the whole lot of 2000 copper plates...

In *The Botanical Cabinet, etc., Vol. 3* (1819, date on t. p. 1818), Messrs C. L. Loddiges & Sons portrayed "*Euphorbia anacantha*", *Plate No. 220* drawn and engraved by George Cooke, see Fig. 13.

The accompanying text runs as follows:

"*Euphorbia anacantha. Class Dodecandria. Order Trigynia. This plant was cultivated by Miller in 1731. It is a native of the Cape of Good Hope, and seldom grows above 6 or 8 inches* [15-20 cm] *high. It flowers for a considerable time in the autumnal months, admitting of ready increase by cuttings: the soil ought to be of a dry nature, such as sandy loam mixed with old mortar. In the winter season the plant should be kept in the greenhouse, and allowed little or no water*".

Most likely George Loddiges refers to Ph. Miller's first edition of *The Gardeners Dictionary* of 1731, wherein Miller introduces the small tuberculate species *Euphorbium* [No.] *7*" *Euphorbium, Afrum, caule squamoso, tuberoso, minus*, see section 2.9.1.

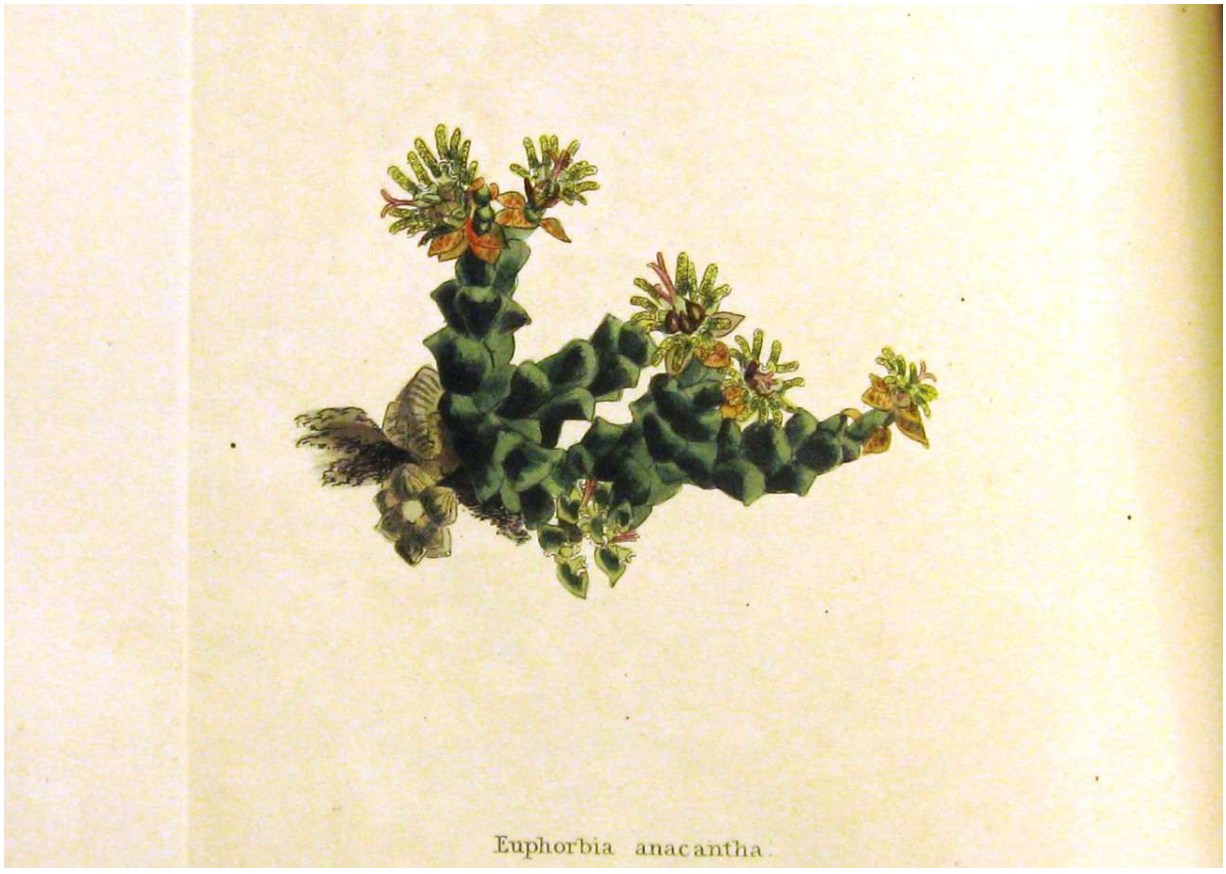


Fig. 13. Hand-coloured engraving of *Euphorbia anacantha* in *The Botanical Cabinet*, *Vol. 3*, *Pl. 220*, published by Messrs. C. L. Loddiges & Sons in 1819 (date on title page 1818).

Note that to the species presented by Messrs C. L. Loddiges & Sons (1819, date on t. p. 1818) as "*Euphorbia anacantha*" is referred by P. E. Boissier (1862) re. *Euphorbia anacantha* Ait. and by N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata*. Alwin Berger (1905; 1906, date on t. p. 1907) considers *Pl. 220*, which accompanies Messrs Loddiges' description, in fact as picturing *Euphorbia ornithopus* Jacq. (see sections 2.33.1 and 2.34.2). However, see our comment in section 2.34.2.

2.24. John Sims (1749-1831), British practising physician in London and botanist, edited *Curtis's Botanical Magazine* during the years 1800-1826. Started in 1787 by William Curtis, the magazine is still extant. In 1824 John Sims presented and described in *Vol. 51* of *Curtis's Botanical Magazine* the species "*Euphorbia anacantha: Scaly Finger-flowered Spurge*", accompanied by a hand-coloured plant portrait (*Pl. No. 2520*, see Fig. 14).

Sims refers to A.-T. Danty d'Isnard (1720, repr. 1722) re. *Euphorbe* [No.] *12. Euphorbium anacanthum, squamosum, lobis florum tridentatis*, see Fig. 2a, to J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, see Fig. 4, to J.-B. de Lamarck (1788) re. *Euphorbia* [No.] *11. Euphorbia tridentata*, see Figs 8a, 8b, to W. Aiton (1789) re. *Euphorbia anacantha*, to C. L. Willdenow (1799) re. *Euphorbia* [No.] *17. Euphorbia anacantha*, see Fig. 10, to A. P. de Candolle (1804) re. *Euphorbia tridentata* [Lam.], see Fig. 11, to W. T. Aiton (1811) re. *Euphorbia anacantha* and finally to A. H. Haworth (1812) re. *Dactylanthes anacantha*.

John Sim's description, in his own words, is as follows:

"*This plant has altogether the habit of a Stapelia, the same kind of fleshy, jointed, tuberculate branches; the tubercles are generally four-sided, marked at the point with the remains of a small ovate, deciduous leaf. At the extremities of the flowering branches from three to five oval fleshy leaves are produced, serving as an involucrum to the flower, from the centre of which issues the peduncle, bearing, according to the usual language, a single flower, with four or five tubular petals, each having a two-lipped limb, the underlip much the longest, and terminated with three subulate* [i. e. awl-shaped, tapering from a narrowly broad base to a very fine point] *teeth, green on the underside, rugose* [wrinkled] *and beautifully variegated on the upper; the upper lip three-lobed, white tinged with purple. From a flat receptacle in the centre of the petals grows the female flower, a single, obsolete three-cornered germen* [ovary], *with a tripartite style, and lobular stigmas, at first erect, but speedily, as in most of the genus, cernuous* [slightly drooping]*; the germen is surrounded by several stamens, which rise in succession: anthers two-lobed, lobes divaricate* [i. e. spreading by a wide angle]. *The whole plant when wounded exudes white milk, which is not acrid* [sic!].

Native of the Cape of Good Hope. Requires to be kept in the greenhouse, or dry-stove. Propagated by cuttings. Flowers in September and October.

Communicated by Messrs. Loddiges and Sons" [cf. section 2.23].

Alwin Berger (1905; 1906, date on t. p. 1907) considers *Pl. No. 2520*, depicting *Euphorbia ornithopus* Jacq. (see sections 2.33.1 and 2.34.2); however, see our comment in section 2.34.2.

Note that to the species described by J. Sims (1824) as "*Euphorbia anacantha*" is referred by R. Sweet (1826) re. *Euphorbia* [No.] *29. Anacantha*; by R. Sweet (1830) re. *Euphorbia* [No.] *36. Anacantha*; by P. E. Boissier (1862) re. *Euphorbia anacantha* Aiton; by N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata* Lam. and by A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia tridentata* Lam.

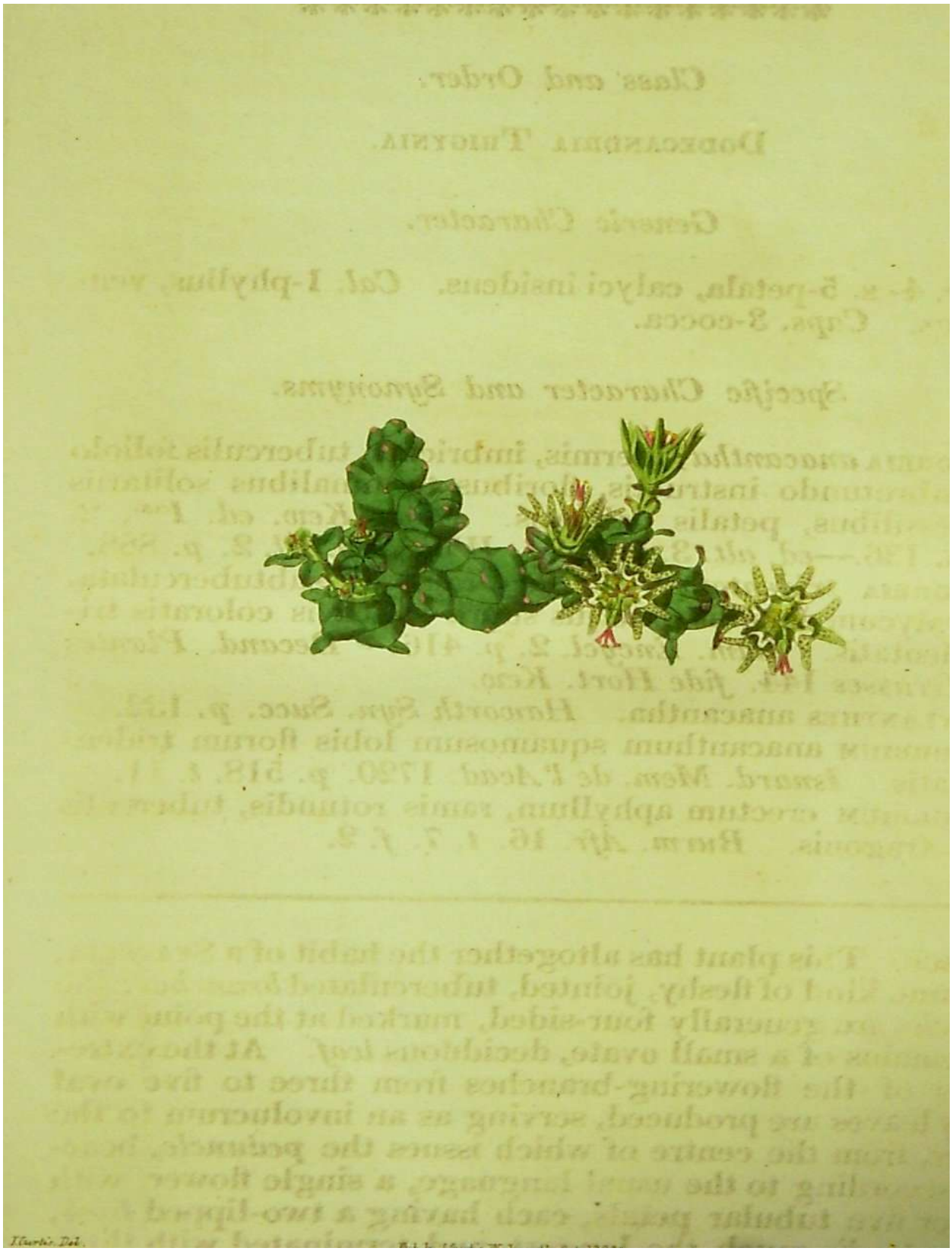


Fig. 14. *Euphorbia anacantha* in *Curtis's Botanical Magazine*, *Vol. 51, Pl. No. 2520*, edited by J. Sims (1824).

2.25. Robert Sweet (1783-1835), British botanist, ornithologist and horticulturist, published several catalogues about plants cultivated in British gardens and hothouses, with instructions for management and propagation. Robert Sweet intended to enumerate all the plant species that at his

time were "*cultivated in the gardens of Great Britain*". In 1818 he records 123 *Euphorbia* species, in 1826 163 *Euphorbia* and 6 *Pedilanthus* species and in 1830 193 *Euphorbia* and 6 *Pedilanthus* species. However, although Lamarck published his *Euphorbia tridentata* already in 1788, not any trace of this species can be found in Sweet's successive enumerations for at that time cultivated in Great Britain.

Sweet published in 1818, adopting the classification of C. Linnaeus in "*Classes*" and "*Orders*", the *Hortus Suburbanus Londinensis; or, a catalogue of plants cultivated in the neighbourhood of London; arranged according to the Linnean System, etc*. Concerning the genus *Euphorbia*, Sweet catalogues on p. 107 three species for us of interest.

2.25.1. "*Euphorbia* [No.] *22: patula* H. S.", referring to A. H. Haworth's *Dactylanthes patula*, described in 1812 in the *Synopsis Plantarum Succulentarum*, based by Haworth on Ph. Miller's "*Euphorbia* [No.] *11 (Patula)*" (Miller, 1768). Robert Sweet calls the species "*spreading*".

Note that the species, described by R. Sweet (1818) as "*Euphorbia* [No.] *22: patula*", is considered by N. E. Brown (1915, p. 300) and by A. C. White, R. A. Dyer & B. L. Sloane (1941, p. 508) a synonym of *Euphorbia ornithopus* Jacq.; the more, N. E. Brown as well as A. C. White, R. A. Dyer & B. L. Sloane explicitly state: "*not of Miller*"! On the contrary, S. Carter (2002) considers R. Sweet's *Euphorbia* [No.] *22: patula* a synonym of *Euphorbia tridentata* Lam., although Sweet's name is illegitimate for being a homonym, namely a name published at a later point in time but spelled like another type of the same rank previously published, namely *Euphorbia patula* of Ph. Miller (1768). P. V. Bruyns (2012) argues that because Sweet referred to Haworth (1812) and hence back to Miller's *Euphorbia patula*, he only published a new combination for *Euphorbia patula* Mill.

2.25.2. "*Euphorbia* [No.] *23: anacantha*", referring to C. L. Willdenow (1799) re. *Euphorbia* [No.] *17. Euphorbia anacantha* and to A. P. de Candolle (1804) re. *Euphorbia tridentata* [Lam.], particularly citing *Pl. No. 2520*, see Fig. 11, mentioning the species "*scaly; flowers in September-October; introduced 1727*". Note that the species described by R. Sweet (1818) as "*Euphorbia* [No.] *23: anacantha*" has not been cited by any author.

2.25.3. "*Euphorbia* [No.] *29: Ornithopus*", calling it "*Bird's-foot*"; unlike most of the epithets he is enumerating, Sweet records the species with a capital "*O*". Sweet refers to N. J. von Jacquin (1809) and C. L. Willdenow (1809) re. *Euphorbia ornithopus* Jacq., giving as date of cultivation in England the year 1816. Note that the species described by R. Sweet (1818) as "*Euphorbia* [No.] *29: Ornithopus*" has not been cited by any author

2.26. Eight years later **Robert Sweet** published a new catalogue, called *Sweet's Hortus Britannicus; or, a catalogue of plants, indigenous, or cultivated in the gardens of Great Britain, arranged according to their Natural Orders, etc.* In the first edition of *Sweet's Hortus Britannicus*, printed in 1826, three species of our interest are enumerated on p. 356 (see below sub **a**); in an updated *Second Edition*, published in 1830, on p. 453 the same records as mentioned in 1826 have been repeated (sub **b**).

2.26.1(a). "*Euphorbia* [No.] *28: patula* Mill."; Sweet (1826) explicitly refers to Ph. Miller (1768) re. *Euphorbia* [No.] *11. Euphorbia (Patula)* as well as to *Dactylanthes patula* of A. H. Haworth (1812). The species is notified by Sweet as "*spreading*". Note that Sweet's "*Euphorbia* [No.] *28:*

patula Mill." is treated by N. E. Brown (1915, p. 300) as a synonym of *Euphorbia ornithopus* Jacq.; Brown states about Sweet's *Euphorbia* [No.] *28: patula*, we cite: "*not of Miller*".

2.26.1(b). "*Euphorbia* [No.] *35: patula* Mill."; Sweet (1830) explicitly refers to Ph. Miller (1768) re. *Euphorbia* [No.] *11. Euphorbia (Patula)* as well as to *Dactylanthes patula* of A. H. Haworth (1812). The species is notified by Sweet as "*spreading*". Note that Sweet's "*Euphorbia* [No.] *35: patula* Mill" has not been cited by any author.

2.26.2(a). "*Euphorbia* [No.] *29: anacantha*", being "*scaly"*, flowering in September-October and introduced in 1727, is considered by Sweet (1826) consistent with *Euphorbia* [No.] *17. Euphorbia anacantha* of C. L. Willdenow (1799), see Fig. 9, and with *Euphorbia* anacantha of J. Sims (1824) particularly citing *Pl. No. 2520*, see Fig. 13. Note that Sweet's "*Euphorbia* [No.] *29: anacantha*" has not been cited by any author.

2.26.2(b). "*Euphorbia* [No.] *36: anacantha*", being "*scaly"*, flowering in September-October and introduced in 1727, is considered by Sweet (1830) consistent with *Euphorbia* [No.] *17. Euphorbia anacantha* of C. L. Willdenow (1799), see Fig. 9, and with *Euphorbia* anacantha of J. Sims (1824) particularly citing *Pl. No. 2520*, see Fig. 13. Note that Sweet's "*Euphorbia* [No.] *36: anacantha*" has not been cited by any author.

2.26.3(a). "*Euphorbia* [No.] *33: Ornithopus*", naming it "*Bird's-foot*", mentioning its flowering in June- August and giving as date of cultivation in England the year 1816, Sweet (1826) is referring to N. J. von Jacquin (1809) re. "*Euphorbia ornithopus*" and C. L. Willdenow (1809) re. *Euphorbia ornithopus* Jacq. Note that Sweet's "*Euphorbia* [No.] *33: Ornithopus*" has not been cited by any author.

2.26.3(b). "*Euphorbia* [No.] *41: Ornithopus*", naming it "*Bird's-foot*", mentioning its flowering in June- August and giving as date of cultivation in England the year 1816, Sweet (1830) is referring to N. J. von Jacquin (1809) re. "*Euphorbia ornithopus*" and C. L. Willdenow (1809) re. "*Euphorbia ornithopus* Jacq.". Note that Sweet's "*Euphorbia* [No.] *41: Ornithopus*" has not been cited by any author.

2.27. Johann Heinrich Friedrich Link (1767-1851), German philosopher, botanist, director of the botanical garden in Breslau, professor of botany at Berlin, successor to Carl Ludwig Willdenow, published about natural history and especially about the plants cultivated in the Royal Botanical Garden in Berlin.

2.27.1. In *Enumeratio plantarum horti regii botanici berolinensis altera, etc., Pars 2* (1822, p. 10) J. H. F. Link incorporates within the *Section Dodecandria Trigynia (b) rami non conferti, pedunculi axillaris non persistentes* the species "*Euphorbia* [No.] *81. Euphorbia anacantha* Willd." from the Cape Good Hope. Link is referring to C. L. Willdenow (1799) re. *Euphorbia* [No.] *17. Euphorbia anacantha* and to A. H. Haworth (1812) re. *Dactylanthes anacantha*.

Note that the species described by J. H. F. Link (1822) as "*Euphorbia* [No.] *81. Euphorbia anacantha* Willd." has not been cited by any author.

2.27.2. In the same *Section Dodecandria Trigynia (b) rami non conferti, pedunculi axillaris non persistentes* of the *Enumeratio plantarum horti regii botanici berolinensis altera, etc., Pars 2* (p. 10). J. H. F. Link records "*Euphorbia* [No.] *82. Euphorbia ornithopus*", referring to N. J. von Jacquin (1809) and C. L. Willdenow (1809) re. *Euphorbia ornithopus* Jacq.

Note that the species described by J. H. F. Link (1822) as "*Euphorbia* [No.] *82. Euphorbia ornithopus*" has not been cited by any author.

2.28. Kurt Sprengel (1766-1833), German botanist, physician, professor of medicine and botany at Halle, assembled during his life a considerable herbarium (nearly 22.000 species), partly spread, partly destroyed. He used it as touchstone for the works of Carl Linnaeus. Sprengel conceived a new edition of Linnaeus' *Systema Vegetabilium*, called *Caroli Linnaei (...) Systema Vegetabilium, editio decima sexta curante Curtio Sprengel, etc.*, published in 5 volumes (1824-1828).

2.28.1. In *Vol. 3* (1826, p. 787) of the *Systema Vegetabilium* Kurt Sprengel records, referring to *Dactylanthes anacantha* of A. H. Haworth (1812), "*Euphorbia* [No.] *26. Anacantha*".

Kurt Sprengel describes it as follows:

"*Euphorbia imbricata ramosa, tuberculis 4gonis folio subrotundo instructis, floribus terminalibus sessilibus, appendiculis involucri palmatis. C.B.S.*",

or,

"*A much-branched Euphorbia, imbricately scaly* [i. e. as if covered with overlapping roof tiles], *with 4-angled tubercles provided with a somewhat circular leaf, with at the end* [of the branches] *sessile flowers, the involucrum possessing palmate appendages* [i. e. appendiculate]; *Cape of Good Hope*".

Note that to the species described by K. Sprengel (1826) as "*Euphorbia* [No.] *26. Anacantha*" is referred by N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata* Lam.

2.28.2. Kurt Sprengel also briefly describes "*Euphorbia* [No.] *27. Ornithopus Jacq.*", referring to *Euphorbia ornithopus* of N. J. von Jacquin (1809). Kurt Sprengel describes the species as follows:

"*Euphorbia imbricata, tuberculis folio oblongo instructis, floribus terminalibus pedunculatis, appendiculis involucre 3partitis*",

or,

"*An imbricately scaly* [i. e. as if covered with overlapping roof tiles] *Euphorbia, with tubercles provided with an oblong leaf, with at the ends* [of the branches] *peduncled flowers, the involucrum possessing appendages divided in threes* [i. e. tripartite]".

Note that to the species, described by K. Sprengel (1826) as "*Euphorbia* [No.] *27. Ornithopus*" is referred by N. E. Brown (1915) re. *Euphorbia* [No.] *78. Euphorbia ornithopus* Jacq.

2.29. Heinrich Gottlieb Ludwig Reichenbach (1793-1879), German ornithologist, botanist, professor of natural history and director of the botanical garden at Dresden, was not only a prolific author but also a renowned botanical artist. He devised, intended for use in herbaria and botanical gardens, a classification entitled *Conspectus regni vegetabilis per gradus naturalis evoluti, tentamen, pars prima* (Reichenbach, 1828 publ. 1829). Plants were arranged according to a hierarchical system, involving classes, ordines, formationes, familias, tribus, genera, subgenera and

synonyms. By "synonyms" Reichenbach enumerated other generic names as known from literature. The species of our interest are classified as follows:

Classis VIII: Thalamanthae / Ordo II: Schizocarpicae / Formatio I: Ranunculiflorae / Familia CXII: Rutaceae / Subfamilia A: *Euphorbiaceae* / Tribus: *Tithymaleae* / Genus: *Euphorbia* L. / Subgenera: a. *Euphorbia* Neck., b. *Keraselma* Neck., c. *Athymalus* Neck., d. *Tithymalus* Neck. Synonyms (generic names): *Euphorbia* Haw., *Treisia* Haw., *Dactylanthes* Haw., *Medusea* Haw., *Tithymalus* Haw., *Galarrhoeus* Haw., *Esula* Haw., *Anisophyllum* Haw. Other genera in this tribe, according to Reichenbach, are: *Pedilanthus* Neck., *Hendecandra* Eschsch., *Anthostemma* A. Juss. and *Dalechampia* Plum.

As discussed in section 2.14 the names *Euphorbia*, *Keraselma*, *Athymalus* and *Tithymalus* are treated by N. J. de Necker (1790a) as species names, but in fact represent generic names from previous authors, and therefore may not be considered to be validly published. By H. G. L. Reichenbach (1828 publ. 1829) implicitly reduced into subgenera of genus *Euphorbia* L., according to L. C. Wheeler (1943, p. 460, p. 484) these subgenera must be considered invalidly published, each being a *nomen nudum*, failing the designation of a type.

Nevertheless, N. J. de Necker's "species naturalis *Athymalus*", in fact "genus *Athymalus*", was designated by H. G. L. Reichenbach (1828 publ. 1829) as a subgenus of the genus *Euphorbia* L., namely *Euphorbia* subg. *Athymalus* Necker ex Rchb. (see section 2.29).

Recently, Reichenbach's *Euphorbia* subg. *Athymalus* was adopted by J. A. Peirson et al. (2013) in a phylogenetic study to cover a group of largely succulent and mainly African *Euphorbia* species; Peirson et al. used part of the engraving on De Necker's *Tab. XXIX* (N. J. de Necker, 1790b) to illustrate the description of this subgenus, considering the mere cyathia typical enough for *Euphorbia tridentata* Lam. and therefore designating *Euphorbia tridentata* Lam. as the type for the name *Athymalus*, see section 2.49.

2.30. Johann Friedrich Klotzsch (1805-1860), German mycologist, botanist, curator of the Berlin Herbarium, re-edited, together with **Christian August Friedrich Garcke** (1819-1904), professor of botany at Berlin, the naming of the genus *Euphorbia*, introducing new "genera". Judged by characters about the typical involucrum, the occurrence of tubercles, the want of spines and leaves, and the peduncled flowers, they conceived the "genus" *Medusea*, comprising all together nine species; the results became part of a much-embracing paper, entitled *Linné's natürliche Pflanzenklasse Tricoccae des Berliner Herbarium's im Allgemeinen und die natürliche Ordnung Euphorbiaceae insbesondere*. At first in 1859 prematurely published in the *Monatsberichte der Königlichen Preussischen Akademie der Wissenschaften zu Berlin, März 1859*, and in 1860 definitely printed in the *Abhandlungen der Königlichen Preussischen Akademie der Wissenschaften zu Berlin, Physikal. Abh. 10.3.1859*, the botanists Klotzsch & Garcke introduced two species of interest for us.

2.30.1. In the *Monatsberichte, etc.* (1859, p. 251) and soon also in the *Abhandlungen, etc*. (1860, p. 61) the authors enumerated "*Medusea tridentata* Klotzsch et Garcke". Regarding this species Klotzsch & Garcke refer to J.-B. de Lamarck (1788) re. *Euphorbia* [No.] *11. Euphorbia tridentata*, to W. Aiton (1789) re. *Euphorbia anacantha* and to A. H. Haworth (1812) re. "*Medusea anacantha*" (sic!). The habitat is announced "*in the Cape of Good Hope*".

Note that to the species enumerated by J. F. Klotzsch & C. A. F. Garcke (1859, 1860) as "*Medusea tridentata* Klotzsch et Garcke" is referred by P. E. Boissier (1862) re. *Euphorbia anacantha* Aiton; by N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata* Lam., by A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia tridentata* Lam. To both species *Medusea tridentata* (Lam.) Klotzsch & Garcke and *Medusea patula* (Mill.) Klotzsch & Garcke is referred by S. Carter (2002) re. *Euphorbia tridentata* Lam. From 2000 until mid-2013 the taxonomic database *Kew World Checklist of Selected Plant Families*, compiled by R. H. A. Govaerts, included *Medusea tridentata* (Lam.) Klotzsch & Garcke and *Medusea patula* (Mill.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860) as synonyms of *Euphorbia patula* Mill., together with *Euphorbia tridentata* Lam. (J.-B. de Lamarck, 1788), *Euphorbia anacantha* Aiton (Aiton, 1789), *Dactylanthes patula* (Mill.) Haw. and *Dactylanthes anacantha* (Aiton) Haw. (Haworth, 1812) (Govaerts, 2000 until mid-2013). P. V. Bruyns (2012) considers *Medusea tridentata* (Lam.) Klotzsch & Garcke a synonym of *Euphorbia tridentata* Lam. together with *Euphorbia anacantha* Aiton (Aiton, 1789) and *Dactylanthes anacantha* (Aiton) Haw. (Haworth, 1812). Bruyns' notion is confirmed in the *Kew World Checklist of Selected Plant Families* (Govaerts, mid-2013 sqq.).

2.30.2. The species "*Medusea patula* Klotzsch et Garcke" was at first enumerated in the *Monatsberichte, etc.* (1859, p. 251) and next in the *Abhandlungen, etc.* (1860, p. 61), J. F. Klotzsch & C. A. F. Garcke referring to *Dactylanthes patula* of A. H. Haworth (1812) and again mentioning the habitat "*in the Cape of Good Hope*".

Note that the species listed by J. F. Klotzsch & C. A. F. Garcke (1859; 1860) as "*Medusea patula* Klotzsch et Garcke" is considered by N. E. Brown (1915, p. 300) and by A. C. White, R. A. Dyer & B. L. Sloane (1941, p. 508) a synonym of *Euphorbia ornithopus* Jacq., whereas S. Carter (2002) cites *Medusea patula* (Mill.) Klotzsch & Garcke and *Medusea tridentata* (Lam.) Klotzsch & Garcke both synonyms of *Euphorbia tridentata* Lam. But P. V. Bruyns (2012) regards *Medusea patula* (Mill.) Klotzsch & Garcke not pertaining to a new name, but a new combination for *Euphorbia patula* Mill. (Miller, 1768), hence Bruyns considers it a synonym of the latter, accompanied by *Euphorbia ornithopus* Jacq. (Jacquin, 1809) and *Dactylanthes patula* (Mill.) Haw. (Haworth, 1812) as synonyms (see section 2.46.2). Bruyns' notion is followed in the *Kew World Checklist of Selected Plant Families* (Govaerts, mid-2013 sqq.).

2.31. Pierre Edmond Boissier (1810-1885), Swiss botanist, traveller and collector, during his life a renowned authority concerning the genus *Euphorbia*, was invited by the French-Swiss botanist Alphonse Pyramus de Candolle (1806-1893), son of Augustin Pyramus de Candolle (1778-1841), to contribute the tribe Euphorbieae to the *Prodromus systematis naturalis regni vegetabilis*, an extensive survey of all known seed plants at the time. Initiated by Augustin P. de Candolle, who authored the first 7 volumes (1824-1839), the next 10 volumes (1844-1873) were edited by Alphonse P. de Candolle. Boissier compiled all sections for the *Euphorbiaceae - subordo Euphorbieae*, in 1862 published in *Pars 15(2)*, pp. 3-188, of the *Prodromus*. The work was supplemented by a list of *Addenda et Corrigenda*, pp. 1261-1269, published in 1866.

2.31.1. On p. 86 of the *Prodromus systematis naturalis regni vegetabilis, Pars 15(2)* Boissier describes "*Euphorbia* [No.] *328. Euphorbia anacantha* Ait.", referring to W. Aiton (1789) re. *Euphorbia anacantha*, to J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, see Fig. 4, to Ph. Miller (1768) re. *Euphorbia* [No.] *11. Euphorbia (Patula)*, to J.-B. de Lamarck (1788) re. *Euphorbia* [No.] *11. Euphorbia tridentata*, see Figs 8a, 8b, to A. P. de Candolle (1804) re. *Euphorbia tridentata* [Lam.], see Fig. 11, to A. H. Haworth (1812) re.

Dactylanthes anacantha as well as to A. H. Haworth (1812) re. *Dactylanthes patula*, to Messrs C. L. Loddiges & Sons (1819, date on t. p. 1818) re. *Euphorbia anacantha*, see Fig. 13, to J. Sims (1824) re. *Euphorbia anacantha*, see Fig. 14 and finally to J. F. Klotzsch & C. A. F. Garcke (1860) re. *Medusea tridentata*.

Boissier describes the species as follows:

"*Euphorbia anacantha (Ait. H. Kew. II, p. 136), caulibus carnosis cylindricis ascendentibus vel decumbentibus simplicibus vel parce ramosis, podariis ex areolâ spathulaeformi depressissime conicis basi contiguis, foliis minutis ovato-oblongis subtriquetris cito deciduis, involucris paucis subterminalibus sessilibus basi bifoliolatis magnis turbinatis lobis ovatis ciliato-dentatis purpureis, glandulis patentibus concavo-bilabiatis labio superiori brevi tridentato inferiori in tres lacinias subulato-conicas partito, stylis inferne coalitis indivisis, capsulâ minute rugulosâ, semine ..... . Planta rhizocarpica, seu perennis herbacea, vel suffrutex. In Prom. B. Spei. Caules digito subcrassiores, areolae basi 6-8 lineas longae. Involucrum diametro semipollicare. (v. v. ster. cult.)*",

or, translated in English,

"*Euphorbia anacantha* Aiton*, with fleshy, cylindrical simple branches, rising or prostrate, but limitedly branching; with cone-shaped podarii* [i. e. tubercles] *from the spatula-shaped areole being remarkably sunken at the centre, contiguous at the base; with very small leaves, ovate-oblong somewhat deltoid, soon deciduous; with but a few involucres more or less at the ends of the branches, sessile, with at their base twofold leaved, large obconical* [= top-shaped] *lobes* [= leaflets]*, purple, ovate, toothed with fine hairs; with spreading glands, concave two-lipped, the short upper lip three-folded, the underlip divided in three awl-shaped to conical strips; with styles at its foot undivided connected; the capsule slightly wrinkled, seed .....*[= not seen]. *Sprouting from the roots, the whole year evergreen, or even a woody plant. In the Cape of Good Hope. The branches are one finger* [ca. 20 mm] *more or less thick, the areoles at their base 6-8 lines* [13.5-18 mm] *long. Diameter of the involucrum a half-inch* [ca. 12 mm]. *A live but sterile specimen seen in cultivation*".

Note that to the species described by P. E. Boissier (1862) as "*Euphorbia* [No.] *328. Euphorbia anacantha* Ait." is referred by N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata* Lam.

2.31.2. Boissier also contributed to the *Prodromus systematis naturalis regni vegetabilis, Pars 15(2)* (1862, p. 87) the mention of "*Euphorbia* [No.] *329. Euphorbia Ornithopus*", only referring to *Euphorbia ornithopus* of N. J. von Jacquin (1809).

Boissier's description runs as follows:

"*Euphorbia Ornithopus (Jacq. fragm. p. 76, t. 120, fig. 2), a basi ramosa, caulibus cylindricis podariis prominentibus acutis ex areolâ longitudinaliter elongatâ decurrenti ortis tuberculatis, foliis minutis ovatis cito deciduis, pedunculis 1-3 subterminalibus elongatis simplicibus vel bifidis, involucro 2-3-foliato turbinato lobis obtusis, glandulis concavis bilabiatis labio superiori quadrato brevi inferiori profunde tripartito laciniis linearibus facie superiori rugoso-lacunosis, stylis inferno coalitis indivisis. Suffrutex. In Prom. B. Spei (Jacq.). Caules pedales, debiles, erectiusculi, basi digitum crassi. Pedunculi bipollicares. Ab E. anacanthâ* [see section 2.29.1] *involucris pedunculatis, ab E. globosâ podariis prominentioribus, caule non moniliformiter strangulato etc. distincta (v. s. cult. in h. Berol.)*,

or,

"*Euphorbia ornithopus* Jacq., *much-branched at the base, with cylindrical stems and with prominently sharp-pointed podarii* [i. e. tubercles], *from the downwards lengthwise elongated areole becoming tuberculate, with small, ovate, soon deciduous leaves, with more or less at the ends of the branches 1-3 elongated, simple or bifurcated peduncles, with a 2-3-leaved obconical* [top-shaped] *involucre with obtuse lobes, with concave, two-lipped glands with a quadrangle, short upper lip and a lower lip deeply divided in 3 linear strips taper-pointed incised*, *which are on top covered with wrinkles and pitted with shallow holes. Styles at the lower part undivided. Woody plant. In the Cape of Good Hope (according to N. J. von Jacquin). Stems together one foot wide* [c. 32 cm], *habit loosely built, somewhat or almost erect, at the base one finger* [ca. 20 mm] *thick. Peduncles two inches* [ca. 50 mm] *long. Differs from E. anacantha* [see section 2.31.1] *regarding the peduncled involucres, and differs from E. globosa because of the more prominent tubercles and because of the not at regular intervals constricted cylindrical stem. A dried* [i. e *in sicco*] *specimen from cultivation seen in the botanical garden at Berlin*".

Note that to the species described by P. E. Boissier (1862) as "*Euphorbia* [No.] *329. Euphorbia Ornithopus*" is referred by N. E. Brown (1915) re. *Euphorbia* [No.] *78. Euphorbia ornithopus* Jacq.

2.32. Achille Terracciano (1861-1917), Italian botanist, curator at the Istituto Botanico, Roma, and professor of botany in Sassari, in 1905 published in *Vol. 3* of the *Contribuzioni Biologia Vegetale of the Real Istituto Botanico di Palermo* a paper about the different procedures of asexual reproduction (agamospermy) of a number of succulent plants.

Fig. 15. Achille Terracciano's picture of *Euphorbia anacantha* Aiton (1905; *Tav. I, Fig. 5*) showing rootlets at the constrictions of the branches.

Presenting *Euphorbia anacantha* Aiton on p. 42 of the *Contribuzioni Biologia Vegetale, Vol. 3*, Achille Terracciano focuses on the aerial rootlets, which grow at the constrictions of the lower

tuberous joints (*Tav. I, fig. 5*, see Fig. 15); he suggests that as soon as the rootlets reach the ground, they root firmly, whereupon the original tuberous parts become loose and fall onto the soil; in this way the plants reproduce in a vegetative way.

Note that the paper by A. Terracciano has not been cited by any other botanist.

2.33. Alwin Berger (1871-1931), German-born gardener, botanist, curator of Thomas Hanbury's famous botanical garden at La Mortola, Italy, specialist in succulents, wrote during his life several books and papers about the various succulent species that he nursed at La Mortola. Berger contributed to the very first journal of the in 1892 established Gesellschaft für Kakteenfreunde, from 1898 on called Deutsche Kakteen-Gesellschaft, namely the *Monatschrift für Kakteenkunde*, several papers about the genus *Euphorbia*. In *Band XV* (1905), pp. 60-63, Berger treats "*Die Euphorbien der Untergattung Dactylanthes Haw.*", describing, besides *E. globosa* Sims, the following two species.

2.33.1. On p. 61 of the *Monatschrift für Kakteenkunde*, *Band XV*, Alwin Berger briefly describes "*Euphorbia anacantha* Ait.", referring to W. Aiton (1789) re. *Euphorbia anacantha*, to A. P. de Candolle (1804; *Pl. 144* ["*Pl. 154*" incorrect] re. *Euphorbia tridentata* [Lam.], see Fig. 11, and to P. E. Boissier (1862) re. *Euphorbia anacantha* Aiton.

Alwin Berger describes the species as follows:

"*Euphorbia anacantha Ait. Wuchs dicht rasenförmig mit aufrechten, bis 15 cm langen, am Grunde fingerstarken, nach oben verjüngten Stämmchen, bedeckt von länglichen, nach oben vierseitigen Podarien, dieselben etwas kegelförmig erhaben und in der Jugend mit einem eilänglichen Blättchen versehen. Blüten einzeln oder zu mehreren endständig, sitzend mit zwei bis drei stumpflichen, fein gewimperten Deckblättchen. Cyathium breitkegelig, etwa erbsengross mit rundlichen gefransten Zipfeln. Drüsen 5, wagerecht abstehend, mit rundlicher, niedergebogener, sehr kurzer Oberlippe; Unterlippe dreizipfelig; Zipfel lineal, oberseits weiss mit vertieften grünlichen Punkten. Griffel bis fast an die Spitze verwachsen, Narben rundlich-verkehrt-eiförmig, ungeteilt. Ganzes Cyathium etwa 1 cm breit*",

or,

"*Euphorbia anacantha* Aiton. *In growth forming a dense mat with erect, to 15 cm long, at the base one finger thick* [c. 20 mm], *towards the top rejuvenated branchlets, covered with oblong podarii* [= tubercles], *at the upper side quadrangular and somewhat conical in relief and when young provided with an ovate-oblong leaflet. Flowers terminally, solitary or with more, sessile with 2-3 obtuse, finely eyelashed bracts. Cyathium broad conical, more or less as large as a pea with roundish, frayed tips. Glands 5, horizontally spreading, with roundish, bent-down, very short upper lip, underlip three-tipped; tips linear, top white with deepened greenish dots. Style to almost the top connected, stigmata roundish obovate, undivided. Whole cyathium about c. 1 cm wide*".

Note that the species described by A. Berger (1905) as"*Euphorbia anacantha* Aiton" has not been cited by any other author.

2.33.2. On p. 61-62 Alwin Berger discusses "*Euphorbia ornithopus* Jacq.", referring to N. J. von Jacquin (1809) and P. E. Boissier (1862) both re. *Euphorbia ornithopus* Jacq.

At first, Berger notifies about the species:

"*Euphorbia ornithopus Jacq. Kleiner sukkulenter Strauch mit reichverzweigten gegliederten Ästen. Glieder finger- bis daumendick; Podarien verlängert, kleine flachkegeliche Warzen bildend; Blätter klein, eiförmig, fein begrannt, bald abfallend. Blütenstiele endständig zu 1 bis 3, verlängert, einfach oder gabelich geteilt, kahl, unter den Cyathien mit zwei bis drei rundlichen oder eiförmigen Deckblättchen. Cyathien kegelförmig, verhältnismässig gross, Zipfel stumpf, kapuzenförmig, Drüsen 4, zweilippig, Oberlippe fast quadratisch, klein, porzellanweiss,Unterlippe verlängert, mit drei bis vier linealen, grubig weisspunktierten Zipfeln. Griffel zur Hälfte verwachsen, Narben zweiteilig*",

or,

"*Euphorbia ornithopus* Jacq. *Small succulent shrub with much-branched, jointed branches. Segments one finger to one thumb thick* [c. 20-24 mm]*; podarii* [= tubercles] *elongated, producing small flat, conical warts; leaves small, ovate, finely hairy, soon deciduous. Peduncles terminally, from 1 to 3, elongated, simple or forked, glabrous, below the cyathia with 2 to 3 circular or ovate bracts. Cyathia conical, comparatively large, tips obtuse, like a hood. Glands 4, two-lipped, upper lip almost square, small, china white, underlip elongated, with 3 to 4 linear, deeply lined, white-speckled tips. Style to its half connected, stigmata bifid*".

Next, Alwin Berger comments about "*Euphorbia ornithopus* Jacq":

"*Diese Art ist in ihrem Habitat außerordentlich variabel und oft recht täuschend. Im Freien in unfruchtbarem Boden bleibt sie sehr klein, die Glieder werden kaum 2 bis 3 cm lang; an besseren Standorten wurden sie bedeutend länger, in Gewächshäusern, die ja bekanntermaßen die Pflanzen leicht zu geilerem Wuchse verleiten, kann man recht hübsche Ampelpflanzen aus ihr erziehen*. (…..) *Die Abbildungen im Bot. Mag. t. 2520 und in Loddiges Bot. Cabinet t. 220 werden von Boissier als E. anacantha zitiert, unter welchem Namen sie auch veröffentlicht wurden. In Wirklichkeit gehören sie aber zu E. ornithopus und stellen eben nur derartige winzige Exemplare dar, wie ich sie oben erwähnt habe; bei solchem Wachstum sind die Blüten oft auch bedeutend kürzer gestielt*",

or,

"*This species is in its habitat extremely variable and often very deceptive. In the wild on barren ground, it remains very small, the segments hardly become 2 to 3 cm long; at better places they become significantly longer, in greenhouses, which to the best of our knowledge easily tempt plants to a more luxuriant growth, one is able to cultivate nice hanging plants* [Fig. 16]. (.....) *The plant portraits pictured in Curtis's Botanical Magazine* [cf. Sims, 1824, *Pl. No. 2520,* see Fig. 14] *and in Loddiges' The Botanical Cabinet Pl. 220* [cf. Messrs C. L. Loddiges & Sons, 1819, date on t. p. 1818, *Pl. 220,* see Fig. 13] *have been cited by Boissier as Euphorbia anacantha, by which name they also have been published. In fact they belong to Euphorbia ornithopus and represent such tiny specimens as I have mentioned above; in accordance with such growth habit the flowers are often also considerably shorter peduncled*".

Note that to the species described by A. Berger (1905) as "*Euphorbia ornithopus*" is only referred by N. E. Brown (1915) re. *Euphorbia ornithopus* Jacq.

2.34. About two years later Alwin Berger covered all succulent *Euphorbia* species as known at the time in the booklet *Sukkulente Euphorbien*, published in October 1906 (date on title page 1907). Besides discussing *Euphorbia globosa* Sims, Berger also treats the following two species relevant for us, namely "*Euphorbia* [No.] *86. Euphorbia ornithopus*" (pp. 106-107) and "*Euphorbia* [No.] *87. Euphorbia anacantha*" (pp. 107-108).

Euphorbia ornithopus Jacq., als Ampelpflanze gezogen.
ich einer für die „Monatsschrift für Kakteenkunde" hergestellten Photographie.

Fig. 16. *Euphorbia ornithopus* Jacq. pictured as hanging plant in A. Berger (1905).

2.34.1. About the species "*Euphorbia* [No.] *86. Euphorbia Ornithopus*" Alwin Berger refers to N. J. von Jacquin (1809) and P. E. Boissier (1862) re. *Euphorbia ornithopus* Jacq.

Accompanied by a drawing, see Fig. 16, Berger describes the species as follows:

"*Euphorbia Ornithopus Jacq. Kleiner sukkulenter, reichverzweigter Halbstrauch mit fleischiger Wurzel. Äste oder Glieder bis daumendick und fingerlang. Podarien verlängert, hervorragende, kleine kegelförmige Warzen bildend, frisch grün. Blätter klein, dick, eiförmig, mit kleiner Grannenspitze, bald abfallend. Blütenstiele zu 1-3, endständig, kurz oder meist verlängert, einfach oder gabelich geteilt, kahl, nur unter dem Cyathium mit 2-3 rundlichen oder eiförmigen Hochblätter. Cyathien kegelförmig, verhältnismäßig groß, Zipfel stumpf, kapuzenförmig, Drüsen 4, mit kleiner, fast quadratischer, porzellanweißer Oberlippe und 3-4-zähniger, längerer Unterlippe, die Abschnitte derselben schmal, oberseits grubig vertieft und weiß gezeichnet. Fruchtknoten gestielt, später überhängend; Griffel zur Hälfte verwachsen, Narben zweiteilig. Kapsel ähnlich wie bei voriger* [i. e. *Euphorbia globosa* Sims]. *Kapland; wie vorige seit langer Zeit eingeführt und von ebenso leichter Kultur. An der Riviera ganz hart. Etwas geil wachsende Pflanzen machen längere, schlankere Stengel und ebenso lange Blütenstiele. An sterilen Orten wird alles gedrungerer. Die Abbildungen im Bot. Mag. t. 2520 und in Loddiges Bot. Cab. t. 220 gehören beide zu dieser und nicht zur folgenden Art* [i. e. *Euphorbia anacantha* Aiton]",

or,

"*Euphorbia ornithopus* Jacq. *Small, succulent, much-branched subshrub with a fleshy root. Stems and branches up to one finger thick* [c. 20 mm] *and one finger* [c. 8-10 cm] *long. Podarii* [= tubercles] *elongated, producing small, protruding conical warts, fresh green. Small, thick, ovate*

leaves with a small, bristly tip, soon deciduous. Peduncles one to three, terminally [i. e. at the end of the branches]*, short or for the greater part elongated, simple or forked, glabrous, only below the cyathium with 2-3 circular or ovate bracts. Cyathia conical, comparatively large. Tip obtuse, like a hood. Glands 4, with almost square, china-white upper lip and 3-4-toothed, elongated lower lip, its incisions narrow, top pitted with holes and markedly white. Ovary pedicelled, later on hanging over; style half connected, stigmata twofold. Capsule like the former one* [i. e. *Euphorbia globosa* Sims]. *The Cape; like the former one already for a long time introduced and likewise easy to cultivate. At the Riviera a totally hardy plant. More or less lushly growing plants produce longer, more slender branches and likewise longer peduncles. On barren places everything becomes stouter* [stocky]. *The pictures in Bot. Mag. t. 2520* [cf. J. Sims, 1824, see Fig. 14] *and in Loddiges Bot. Cab. t. 220* [cf. C. L. Loddiges & Sons, 1819, date on t. p. 1818, see Fig. 13] *both belong to this species and not to the following one* [i. e. *Euphorbia anacantha* Aiton]".

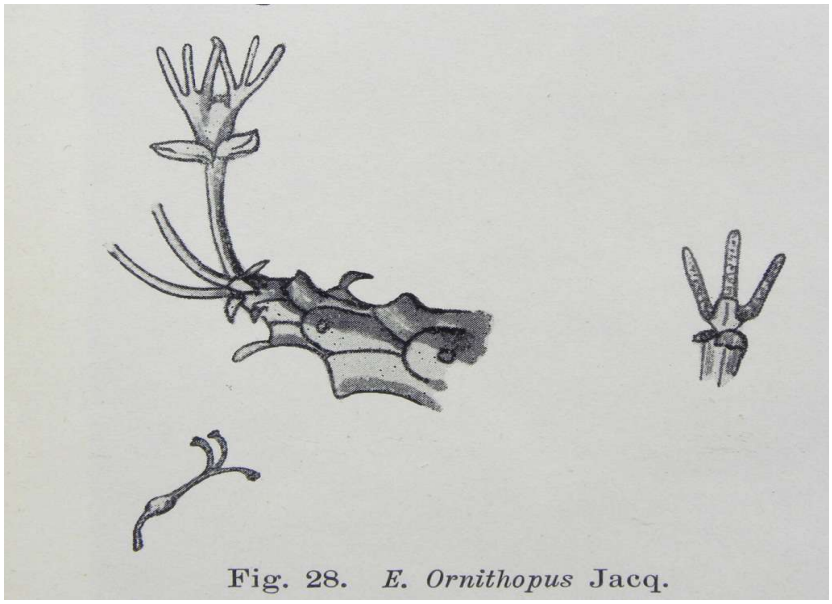


Fig. 28. *E. Ornithopus* Jacq.

Fig. 17. *Euphorbia ornithopus* Jacq., drawn by Alwin Berger, in *Sukkulente Euphorbien* (1906; date on t. p. 1907).

Note that to the species described by A. Berger (1906, date on t. p. 1907) as "*Euphorbia* [No.] *86. Euphorbia ornithopus*" is only referred by N. E. Brown (1915) re. *Euphorbia* [No.] *78. Euphorbia ornithopus* Jacq.

2.34.2. Also in *Sukkulente Euphorbien* Alwin Berger introduces "*Euphorbia* [No.] *87. Euphorbia anacantha*", referring to W. Aiton (1789) re. *Euphorbia anacantha*, to J.-B. de Lamarck (1788) re. *Euphorbia tridentata*, see Figs 8a, 8b, to A. P. de Candolle (1804; *Pl. 144* ["*154*" incorrect]) re. *Euphorbia tridentata* [Lam.], see Fig. 11 and to A. H. Haworth (1812) re. *Dactylanthes anacantha*. For an appropriate picture of the species he recommends *Tab.7, Fig. 2* in J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, see Fig. 4.

Berger's description of the species runs as follows:

"*Euphorbia anacantha Ait. Aus einem fleischigen Wurzelstock gedrungen verästelte Sukkulente, fast rasenförmig, Äste 10-20 cm lang, am Grunde fingerstark, nach oben verjüngt, mit länglichen, nach oben vierseitig werdenden Podarien, dieselben etwas kegelförmig erhaben mit rundlicher Blattnarbe. Blätter klein, eilänglich. Ganze Pflanze hellgrün, später leicht grau bereift. Blüten einzeln oder zu mehreren, fast sitzend, auf den Spitzen der Äste, mit 2-3 oval-länglichen,*

stumpflichen, am Rande fein bewimperten Deckblättchen. Hü11e breit kegelförmig, erbsengroß, aufrecht, Zipfel rundlich, bräunlich grün, am Rande gefranst, Drüsen 5, wagerecht abstehend, zweilippig, Oberlippe rundlich, niedergebogen, sehr kurz, Ûnterlippe dreizipfelig, Zipfel lineal, oberseits weiß mit vertieften grünlichen Punkten. Griffel bis fast an die Spitze verwachsen, Narben ungeteilt, rundlich keulenförmig. Ganzes Cyathium etwa 1 cm breit. Kapland; seit langer Zeit eingeführt, von leichter Kultur und Vermehrung, trotzdem seltener als die vorigen [i.e. *Euphorbia ornithopus* Jacq.] *in den Gärten. An der Riviera winterhart. Blüht nur sehr selten. Diese Art ist von E. Ornithopus leicht zu unterscheiden: durch die verlängerten Äste, die sitzenden, fast endständigen Blüten, die wagerechten Drüsen, deren Zipfel auch kürzer sind als bei E. Ornithopus. Eine gute Abbildung findet sich in Burm. Rar. pl. afr. t. 7 Fig. 2*",

or,

"*Euphorbia anacantha* Aiton. *From a fleshy rootstock a thick-set stocky much-branching succulent, almost forming a dense mat, branches 10-20 cm, at the base one finger thick* [c. 20 mm], *towards the top rejuvenated, with oblong podarii* [= tubercles], *at the upper side becoming quadrangular and somewhat conical in relief with a round leaf-scar. Leaves small, ovate-oblong. Whole plant bright green, later on grey rimmed. Flowers at the top of the branches solitary or with more, almost sessile, bracts 2-3, oval-oblong, obtuse, at the rim finely frayed lobes. Involucre broad conical, erect, as large as a pea; tips roundish, brownish-green, at the rim frayed; glands 5, horizontally spreading, two-lipped, upper lip roundish, bent down, very short, underlip three-tipped, linear, its top white, with deepened, greenish dots. Style connected almost to the top, stigmata undivided, round club-like. The whole cyathium about 1 cm wide. The Cape; introduced a long time ago, easy to cultivate and propagate, nevertheless in the gardens rarer than the former one* [i. e. *Euphorbia ornithopus* Jacq.]. *Hardy at the Riviera* [i. e. at La Mortola]. *Flowering very seldom. Easily to distinguish from E. ornithopus because of its extended branches, the sessile flowers at nearly the end of the branches, the horizontally spreading glands with lips which are shorter in comparison with E. ornithopus. A good picture is found in J. Burman (1738)*".

Note that to the species described by A. Berger (1906, date on t.p. 1907) as "*Euphorbia* [No.] *87. Euphorbia anacantha* [Aiton]" is only referred by N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata* Lam.

N. B. Of some importance is Alwin Berger's repeated comment that the plant portraits pictured in Messrs C. L. Loddiges & Sons' *The Botanical Cabinet, etc.* (1819, date on t. p. 1818, *Pl. 220*, see Fig. 13) and in John Sims' *Curtis's Botanical Magazine* (1824, *Pl. No. 2520*, see Fig. 14) belong to *Euphorbia ornithopus* Jacq., and not to *Euphorbia anacantha* Aiton. Berger argues that these colour engravings picture plants from the wild, for remaining on barren ground very small and as such staying considerably short-peduncled. However, we, authors, are not convinced of Berger's arguments that the cited pictures refer only to *Euphorbia ornithopus* Jacq., because the same reasoning may apply to *Euphorbia tridentata* Lam. as well.

2.35. Nicholas Edward Brown (1849-1934), British botanist, contributed to the *Flora Capensis*, edited by Sir W. T. Thiselton-Dyer, the descriptions of the South African *Euphorbia* species as known at the time (N. E. Brown, 1915). Regarding the species of our interest, Brown records "*Euphorbia patula* Mill.", "*Euphorbia tridentata* Lam." and "*Euphorbia ornithopus* Jacq." as separate species.

2.35.1. In the *Flora Capensis Vol. 5, section 2, part 2* N. E. Brown (1915, pp. 292-293) treats "*Euphorbia* [No.] *69. Euphorbia patula (Mill.)*", referring to Philip Miller's *Euphorbia* [No.] *11 (Patula)*" published in the 8th edition of *The Gardeners Dictionary* (Miller, 1768).

Brown describes the species as follows, finally giving a comment:

"*Euphorbia patula (Mill. Gard. Dict. ed. viii. no. 11); succulent and spineless; stem 6-7 inches* [15-18 cm] *high, tapering upwards, producing at the top a few tapering branches, spreading on every side, not ("scaly") tuberculate and bearing at their tips several small narrow deciduous leaves; flowers unknown. South Africa: formerly cultivated at Chelsea. Haworth refers this plant to his Dactylanthes patula, but Miller's description does not seem to accord with that plant* [i. e. *Dactylanthes patula*] *which is a synonym of E. ornithopus Jacq. Can Miller's plant be a small weak form of E. mauritanica Linn. with spreading branches? He* [Miller] *describes the branches as not 'scaly', by which I suppose he means they are not tuberculate, since those of E. Caput-Medusae, Linn. are described* [i. e. by Miller] *as scaly*".

P. V. Bruyns (2012) considers N. E. Brown's comments about the according to Philip Miller non-tuberculate "*Euphorbia patula* Mill." erroneous, because at the time Haworth (1812) based the description of the species *Dactylanthes patula* on Miller's *Euphorbia patula* (Miller, 1768); the more, Bruyns argues, on sheet Fol. no. 328 in Haworth's Herbarium at OXF Haworth himself has written in his own hand *Euphorbia patula* Mill. below two, otherwise much tuberculate, plant specimens (see Fig. 23). Over a century later N. E. Brown has written on herbarium sheet Fol. no. 328: "*Euphorbia ornithopus, Jacq., determinavit N. E. Brown*". But according to Bruyns (2012), by the name *Dactylanthes patula* is not a new publication meant but merely a new combination for Miller's *Euphorbia patula*. For this reason, Bruyns argues, *Euphorbia patula* Mill. is confirmed to be a valid species with *Euphorbia ornithopus* Jacq. (Jacquin, 1809), *Dactylanthes patula* (Mill.) Haw. (Haworth, 1812) and *Medusea patula* (Mill.) Klotzsch & Garcke (Klotzsch & Garcke, 1859,1860) as its synonyms, see section 2.46.2.

2.35.2. Also in the *Flora Capensis Vol. 5, section 2, part 2* N. E. Brown (1915, pp. 298-299) treats "*Euphorbia* [No.] *77. Euphorbia tridentata (Lam.)*", referring to J.-B. de Lamarck (1788) re. *Euphorbia* [No.] *11. Euphorbia tridentata*, see Figs 8a, 8b**,** to A.-T. Danty d'Isnard (1720, reprint 1722) re. *Euphorbium* [No.] *12. Euphorbium anacanthum, squamosum, lobis florum tridentatis*, see Fig. 2a, to R. Bradley (1727) re. *The Large White flower'd African Spurge*, see Fig. 3, to J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, see Fig. 4, to W. Aiton (1789) re. *Euphorbia anacantha*, to C. L. Willdenow (1799) re. *Euphorbia* [No.] *17. Euphorbia anacantha*, see Fig. 10, to A. P. de Candolle (1804) re. *Euphorbia tridentata* [Lam], see Fig. 11, to J. L. M Poiret (1812) re. *Euphorbia* [No.] *11. Euphorbia tridentata*, to A. H. Haworth (1812) re. *Dactylanthes anacantha*, to Messrs C. L. Loddiges & Sons (1819, date on t. p. 1818) re. *Euphorbia anacantha*, see Fig. 13, to J. Sims (1824) re. *Euphorbia anacantha*, see Fig. 14, to K. Sprengel (1826) re. *Euphorbia* [No.] *26. Anacantha*, to J. F. Klotzsch & C. A. F. Garcke (1860) re. *Medusea tridentata*, to P. E. Boissier (1862) re. *Euphorbia anacantha* Aiton and finally to A. Berger (1906, d. on t. p. 1907) re. *Euphorbia anacantha* Aiton.

N. E. Brown describes the species from J.-B. de Lamarck's type at P-LAM (see Fig. 8b) as follows:

"*Euphorbia tridentata (Lam. Encycl. ii. 416); plant dwarf, succulent, spineless, branching from the base; branches ascending or somewhat spreading, 1-6 inches* [2.5-15.2 cm] *long, ⅓-½ inch* [8.5-12.7 mm] *thick, cylindric or slightly tapering upwards, tessellately* [= cubical, all sides equal] *tuberculate with hexagonal flattish tubercles ¼-⅓ inch* [6.4-8.5 mm] *in diameter, having a slightly prominent whitish leaf-scar, glabrous, dull green; leaves sessile, soon deciduous, 2-3 lines* [4.5-6.8 mm] *long, 1½ -2 lines* [3.4-4.5 mm] *broad, elliptic or elliptic-oblong, acute, dark green, with a reddish minutely toothed margin; peduncles 3-4 at the ends of the branches, about 2 lines* [4.5 mm] *long, bearing a pair of ovate or elliptic bracts and 1 involucre, glabrous; involucre about ½-⅔ inch*

(c. 13-17 mm) *in diameter, cup-shaped, glabrous, with 5 glands and 5 transversely oblong toothed and ciliate inflexed, purplish lobes; glands subcontiguous* [i.e. somewhat adjoining], *about 2½ lines* [5.6 mm] *in diameter across the tips, very concave at the basal part, divided into 3-4 spreading finger-like corrugated white processes 1-1½ lines* [2.2-3.4 mm] *long; ovary pedicellate, scarcely exserted, with styles ¼ inch* [6.4 mm] *long, united for two-thirds of their length, with entire spreading tips. South Africa, without locality. Herb. Lamarck! Described from Lamarck's type and the figures above quoted* (*)".

(*) When compiling the *Flora Capensis*, *vol. 5*, the species was not seen by N. E. Brown himself but by his co-author John Hutchinson, who made at P-LAM, on behalf of Brown, a drawing of the herbarium specimen, see section 2.12, Fig. 8b. Today, the Kew Herbarium Catalogue records this drawing as herbarium sheet K000253271 for being the type concerning *Euphorbia patula* Mill., annotating "collector Lamarck, South Africa" (sic!).

Note that to the species described by N. E. Brown (1915) as "*Euphorbia* [No.] *77. Euphorbia tridentata (Lam.)*" is referred by E. P. Phillips in I. B. Pole Evans, Ed. (1925) re. *Euphorbia tridentata* Lam., see Fig. 18; by R. A. Dyer (1931) re. *Euphorbia tridentata* Lam. and by A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia tridentata* Lam.

2.35.3. Finally, in the *Flora Capensis Vol. 5, section 2, part 2*, N. E. Brown (1915; pp. 299-300) describes "*Euphorbia* [No.] *78. Euphorbia ornithopus (Jacq.)*", referring to N. J. von Jacquin (1809); to C. L. Willdenow (1809), J. L. M. Poiret (1812), K. Sprengel (1826), P. E. Boissier (1862) and A. Berger (1905; 1906, d. on t. p. 1907) all re. *Euphorbia ornithopus* Jacq. According to N. E. Brown is *Medusea patula*, as recorded by J. F. Klotzsch & C. A. F. Garcke (1859; 1860), a synonym of *Euphorbia ornithopus* Jacq.; other synonyms concern *Dactylanthes patula* of A. H. Haworth (1812) and the species illegitimately renamed by R. Sweet (1818; 1826) as *Euphorbia patula*. However, according to N. E. Brown, because Haworth based his description of *Dactylanthes patula* on *Euphorbia patula* of Ph. Miller (1768), whereas this *Euphorbia patula* Mill. must be considered quite another species, Sweet's renaming of *Dactylanthes patula* [Haw.] into "*Euphorbia patula*" (Sweet, 1818, 1826) must be regarded pertaining to a species "*not of Miller*" (Brown, 1915, p. 300), for not based on a real specimen of Miller (cf. section 2.35.1). By the way, Brown considers the two herbarium specimens glued on sheet Fol. no. 328 in Haworth's Herbarium at OXF (see Fig. 23) in fact picturing *Euphorbia ornithopus* Jacq, although initially Haworth himself has written *Euphorbia patula* Mill. on it (see 2.35.1).

Brown describes "*Euphorbia ornithopus* Jacq.", distinguishing between a "*short-jointed*" and a "*long-jointed*" form, as follows, we cite:

"*Euphorbia ornithopus (Jacq. Fragm. 76, t. 120, fig. 2); plant (excluding the peduncles) 2-3 inches* [5.1-7.6 cm] *high, succulent, spineless, irregularly branching close to the ground, dimorphic; branches procumbent or straggling, often one over another, jointed, with 3-5 laxly spiral series of acute conical tubercles, mostly 1-2 lines* [2.2-4.5 mm] *prominent, glabrous, dull green or purplish; stem joints in one form (which although bearing bisexual involucres, only some of them appear to prove fertile) mostly cylindric and 1-4 inches* [2.5-10.2 cm] *long, 3-5 lines* [6.8-11.1 mm] *thick excluding the tubercles, or some of them ovoid or subglobose and less than 1 line* [2.2 mm] *long; in another form (in which nearly all the involucres appear fertile) they are subglobose, oblong or shortly cylindric, ½-1¼ inch* [1.3-3.2 cm] *long; leaves rudimentary, deciduous, 1-2½ lines* [2.2-5.6 mm] *long, ½-¾ line* [1.1-1.6 mm] *broad, lanceolate, acute, glabrous; peduncles of the long-jointed form solitary* [i. e. simple], *terminal, 1½-3 inches* [3.8-7.6 cm] *long, ¾-1 line* [1.7-2.2 mm] *thick, bearing 3-4 small alternate bracts below the middle, a pair or whorl of 3 larger elliptic bracts 2-2½ lines* [4.5-5.6 mm] *long and 1½ line* [3.4 mm] *broad at its apex and 1 involucre, or forking into a 2-3-rayed cyme or umbel* (*) *with rays ⅔-1½ inches* [1.7-3.8 cm] *long, each with 1 involucre,*

glabrous; peduncles of the short-jointed form 1-3 at the apex of the branches ½-1½ inch [1.3-3.8 cm] *long, 1-2 lines* [2.2-4.5 mm] *thick, simple or forking into 2-3 rays, otherwise as in the long-jointed from; involucre (including the glands) 5-6 lines* [11.1-13.5 mm] *in diameter, obconic-cup-shaped, glabrous, green, with 4 glands and 5 inflexed-connivent, subquadrate ciliate lobes; glands ¼ inch* [0.6 cm] *long and broad, ascending-spreading, deeply divided into 3-4 subulate fingerlike lobes with white-margined pits along the inner side, and an oblong white lobe inflexed over the cavity in the basal part of the gland; ovary exserted and curved to one side; styles 2-3 lines* [4.5-6.8 mm] *long, united to about the middle, ascending-spreading above, with dilated and somewhat 2-lobed tips; capsule erect, ⅓ inch* [8.5 mm] *in diameter, with 3 slight rounded lobes, glabrous. South Africa; without locality, cultivated specimens!*

"*Described from living plants cultivated at Kew, received from South Africa without indication of locality. This species is closely allied to E. globosa Sims, but is decidedly different in its elongated cylindric stem-joints, which even where they are subglobose are different in appearance, and the involucres seem always to have 4 glands, whilst in E. globosa there are constantly 5. There are certainly two forms of this plant, which, whilst not strictly unisexual, seem to have a tendency to be so. The short-jointed form when out of flower looks specifically distinct from the long-jointed form, but the flowers are identical, and by its shorter and stouter peduncles and by usually perfecting fruit, I am inclined to believe it to represent the female form of the plant, although the long-jointed form also develops fruit. It has been in cultivation for over 100 years, yet no wild specimens seem to have been collected*".

(*) We understand that N. E. Brown does not describe a peduncled, typical cymose inflorescence consisting of a central, sessile cyathium and pedicelled lateral cyathia, but merely an inflorescence on one or more simple peduncles, sometimes more than once forked, clustered on top of the branches.

Note that to the species described by N. E. Brown (1915) as "*Euphorbia* [No.] *78. Euphorbia ornithopus (Jacq.)*" is only referred by A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia ornithopus* Jacq.

2.36. Illtyd Buller Pole Evans (1879-1968), chief botanist at the Division of Botany and Plant Pathology at Pretoria, South Africa, started in 1921 the yearly magazine *The Flowering Plants of Africa / Die Blomplante van Afrika*, presenting hand-coloured plates of flowering plants indigenous to South Africa. He had the plant portraits drawn by the botanical artist **Kathleen Annie Lansdell** (1888-1967) and secured for the descriptions **Edwin Percy Phillips** (1884-1967), botanist-taxonomist at the National Herbarium, Pretoria. By the way, the serial itself is still extant and in the course of time, up to now, over 70 succulent *Euphorbia* species from South Africa were depicted.

In 1925, in *Vol. 5* of *The Flowering Plants of Africa*, the editor Illtyd B. Pole Evans introduces "*Euphorbia tridentata*", the plant being drawn by Kathleen A. Lansdell (*Pl. 197*, see Fig. 18). The references are to J.-B. de Lamarck (1788) re. *Euphorbia* [No.] *11. Euphorbia tridentata*, see Figs 8a, 8b and to N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata* Lam.

The accompanying text, edited by Illtyd B. Pole Evans and written by Edwin P. Phillips, is as follows:

"*The species of Euphorbia figured on the accompanying Plate is a somewhat rare plant and until quite recently, it was not known where the plant was found, although it was known in European gardens and figured almost 100 years ago. The plant belongs to a small group of three species in the genus characterised by having the branches constricted at their origin of growth. All of them are very dwarf plants. We are indebted to Mr. H. M. Bartlett of Riversdale for the specimens, which*

he sent in July 1924, and these were successfully grown at the Division of Botany, Pretoria, and flowered in September 1925. Plant dwarf, succulent, spineless, branching from the base. Branches ascending or somewhat spreading, 2.5 to15 cm long, 1 to 1.4 cm thick, cylindrical or slightly tapering upwards, tessellately tuberculate with hexagonal flattish tubercles 6 to 10 mm in diameter, having a slightly prominent whitish leaf-scar, glabrous, dull green. Leaves sessile, soon deciduous, 4-6 mm long, 3 to 4 mm broad, elliptic or elliptic-oblong, acute, dark green, with a reddish minutely toothed margin. Peduncles 3 to 4 at the ends of the branches, about 4 mm long, bearing a pair of ovate or elliptic bracts and one involucre, glabrous. Involucre about 1.3 to 1.8 cm in diameter, cup-shaped, glabrous, with 5 glands and 5 transversely oblong toothed and ciliate inflexed, purplish lobes. Glands subcontiguous, about 5 mm in diameter across the tips, very concave at the basal part, divided into 3 to 4 spreading finger-like corrugated white processes 2 to 3 mm long. Ovary pedicellate, scarcely exserted, with styles 7 mm long, united for two-thirds of their length, with entire spreading tips. National Herbarium, Pretoria, No. 2989".

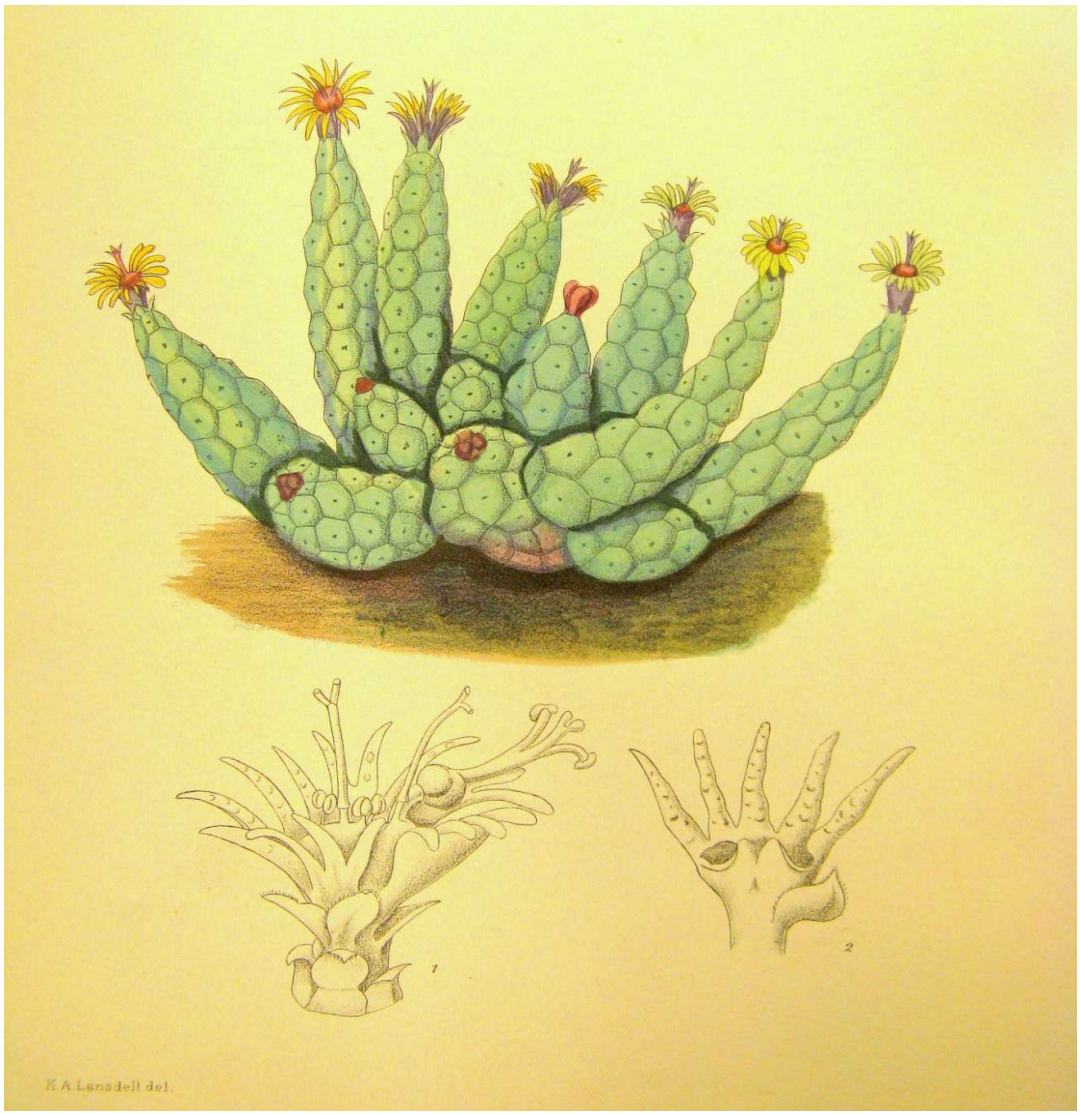


Fig. 18. Miss Kathleen A. Lansdell's drawing of Euphorbia tridentata Lam. in the The Flowering Plants of Africa (1925; Pl. 197).

Observe that a discrepancy arises between the drawing by Kathleen A. Lansdell and the accompanying descriptive text, clearly borrowed by E. P. Phillips from the description of the

species by N. E. Brown (1915), who indicates the existence of a "clustered" inflorescence, namely "*... peduncles 3 to 4 at the ends of the branches, about 4 mm long, bearing a pair of ovate or elliptic bracts and one involucre, glabrous*". For the drawing by Miss Lansdell, after a specimen collected by H. M. Bartlett of Riversdale, shows solitary, sessile flowers, at best nearly sessile but surely not peduncled, as can be seen on the inset at left. The fact signifies that *Pl. 197*, although accompanied by a description based on Brown's text, is not representative for the species presented by N. E. Brown in the *Flora Capensis* (1915). The discrepancy attracted the attention of the South African botanist H. W. R. Marloth too; although not giving further details, according to him *Pl. 197* does not represent the typical form of *Euphorbia tridentata* Lam. (Marloth, 1931).

Note that to the plant portrait presented by I. B. Pole Evans, Ed. (1925) as "*Euphorbia tridentata* Lam.", is referred by H. W. R. Marloth (1931), see above, and that it is reproduced by A. C. White, R. A. Dyer & B. L. Sloane (1941, *Fig. 518*) re. *Euphorbia tridentata* Lam.

2.37. Gerhardt A. Frick (1878-1976), America-born paper merchant of German descent, famous collector of *Euphorbia* species, in 1929 co-founder of the CSSA and from 1935 until 1937 inclusive chief editor of *Euphorbia Review*, *Journal of the International Euphorbia Society*, regularly wrote about succulent euphorbias. He published about them in the *Journal of the Cactus and Succulent Society of America* as well as in the short-lived *Euphorbia Review.*

In the very first volume of the *Journal of the Cactus and Succulent Society of America, Vol. 1, No. 10* (April 1930), on pp. 186-188, Frick treats the group "*Euphorbia Dactylanthes*", incorporating five species, namely *Euphorbia globosa* Sims, *Euphorbia ornithopus* Jacq., *Euphorbia tridentata* Lam., *Euphorbia pseudoglobosa* Marloth and *Euphorbia susannae* Marloth (sic!).

2.37.1. On p.187 presenting "*Euphorbia ornithopus* [Jacq.]", accompanied by a picture (see Fig. 19), Frick bases his description on N. E. Brown (1915) re. *Euphorbia ornithopus* Jacq.:

"*E. ornithopus is closely allied to E. globosa, but is decidedly different in appearance in its elongated cylindric stem-joints, which branch close to the ground in a straggling fashion, often one over another; one to four inches* [2.5-10.2 cm] *long and usually one-fourth inch* [0.64 cm] *in diameter; color is dark green, like E. globosa and also turns purplish in the sun; leaves are small, rudimentary and deciduous; the bracts are from a quarter to half inch* [c. 0.6-1.3 cm] *long, and forked very much resembling a bird's foot, hence the name 'ornithopus'. There are two forms of this plant, the short jointed and the long jointed form, but the flowers of both are the same, consequently this difference is not sexual, as both develop fruit*".

Note that the species described by G. A. Frick (1930) as "*Euphorbia ornithopus* [Jacq.]" has not been not cited by any author.

2.37.2. About "*Euphorbia tridentata* [Lam.]" G. A. Frick refers in the *Journal of the Cactus and Succulent Society of America*, *1930, Vol. 1, No. 10* on pp. 187-188 to J.-B. de Lamarck (1788) re. *Euphorbia* [No.] *11. Euphorbia tridentata*, to A. H. Haworth (1812) re. *Dactylanthes anacantha* and to A. Berger (1906, date on t. p. 1907) re. *Euphorbia anacantha* Aiton.

Frick defines the species as follows:

"*E. tridentata is also a dwarf plant of this group, spineless, branching from the base, ascending branches are somewhat spreading, one to six inches* [2.5-15.2 cm] *long, one-third to one-half inch*

[c. 0.8-1.3 cm] *thick; is also cylindric, slightly tapering upwards, having a slightly prominent whitish leaf-scar; colour dark green; leaves very small and sessile, soon deciduous. This plant is listed in Berger's Sukkulente Euphorbien as E. anacantha Haw., a synonym, but E. tridentata Lam. holds priority. The species is not so well known among collectors, and the only plant known to the writer is in the Desert Rare Plant Gardens of Escondido, California*".

Note that the species described by G. A. Frick (1930) as "*Euphorbia tridentata* [Lam.]" has not been cited by any other author. But the photograph of a cultivated "*Euphorbia tridentata*" (see Fig. 20), which Frick adds to his paper, asking our attention to note the length of the peduncles, is reproduced by A. C. White, R. A. Dyer & B. L. Sloane (1941, p. 512, *Fig. 535*), commenting that in fact it pictures *Euphorbia ornithopus* Jacq.

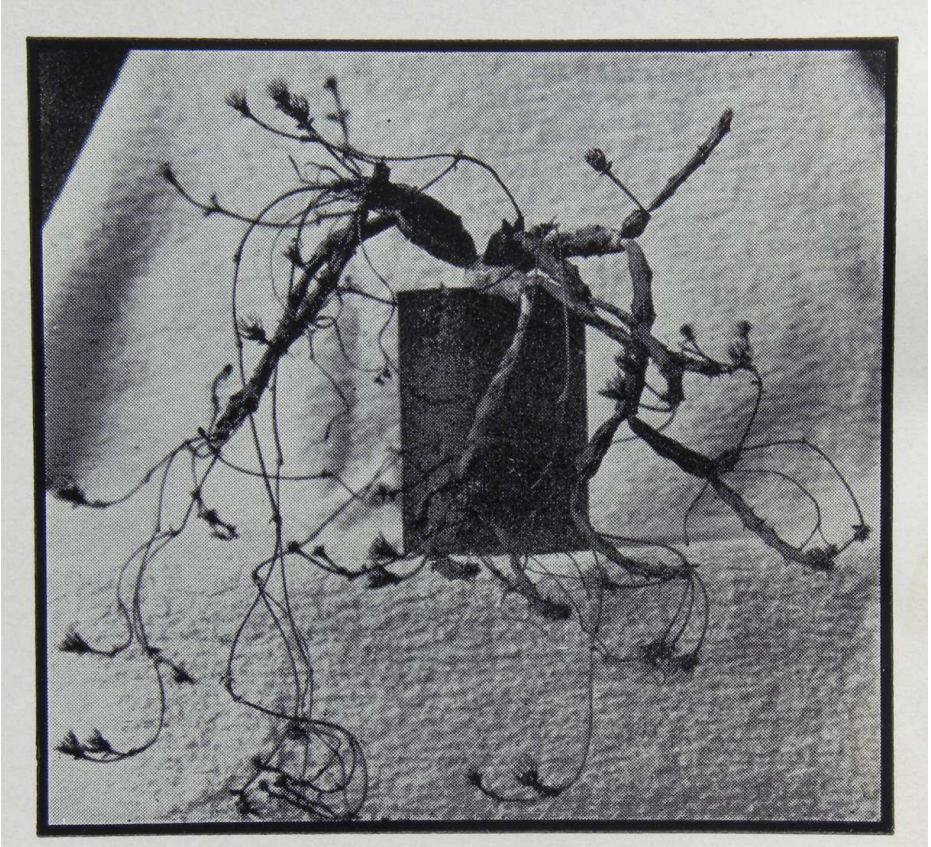


Fig. 20. A cultivated *Euphorbia tridentata* in G. A. Frick (1930), photo by W. I. Beecroft.

2.38. Robert Allen Dyer (1900-1987), South African botanist, curator of the Albany Museum Herbarium, later Director of the Pretoria Botanical Research Institute, prolific researcher, co-editor of the *The Succulent Euphorbieae (Southern Africa)*, surveyed and keyed the Euphorbia species found in the Eastern Cape Province, publishing in 1931 the results in the *Records of the Albany Museum, Vol. IV, Part 1(2)* (January 1931).

On pp. 64-110 of an extensive paper, entitled *Notes on Euphorbia species of the Eastern Cape Province with descriptions of three new species*, Dyer keyes 55 *Euphorbia* species from the Eastern Cape; he classifies *Euphorbia tridentata* Lam. and *Euphorbia ornithopus* Jacq., together with *Euphorbia globosa* Sims, in Group "F", namely (p. 75, we cite): "*Plants very dwarfed with no stem,*

producing globose, clavate and cylindrical branches, constricted at their junction; glands of involucre with 3-5 finger-like processes".

R. A. Dyer keys "*Euphorbia tridentata* Lam." and "*Euphorbia ornithopus* Jacq." as follows:

- "*Euphorbia* [No.] *35. Euphorbia tridentata. Its branches subglobose, slightly narrowed at the upper end or subcylindrical, peduncle 0-2 inches* [0-5 cm] *long, arising gradually from the apex of the branches, involucre 5-glanded*".

- "*Euphorbia* [No.] *36. Euphorbia ornithopus. Branches as in previous, peduncles ½-4 inches* [1.3-10 cm] *long, involucre 4-glanded*".

Next, Dyer describes these two species more in depth (1931, pp. 88-89).

2.38.1. Regarding "*Euphorbia* [No.] *35. Euphorbia tridentata* [Lam.]" Dyer refers to J.-B. de Lamarck (1788) re. *Euphorbia* [No.] *11. Euphorbia tridentata* and to N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata* Lam.

Dyer describes the species as follows:

"*Euphorbia tridentata* [Lam.]. *The type of this species is without locality, but specimens agreeing with the description and quoted figures have been collected in the Riversdale Division and also in Albany. The local plants are exceedingly common in limited areas at Botha's Hill (Dyer 885), and on Penrock Farm in the Botha's River Valley (Dyer 680) where dense mats are formed. However, owing to the fact that the branches die off yearly, except under cover, it is often impossible to locate the roots. These, and specimens included in E. ornithopus, differ further from E. globosa (from Uitenhage) in that the underground subglobose or cylindrical rhizomes run somewhat parallel to the ground surface. Some plants of Dyer 885 were found to possess 5-6 glands on each cyathium, the normal being five. This indication of instability is interesting in the light of the following species* [i. e. *Euphorbia ornithopus* Jacq.]*, which has 4 glands*".

Note that to the species described by R. A. Dyer (1931) as "*Euphorbia* [No.] *35. Euphorbia tridentata* [Lam.]" is only referred by A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia tridentata* Lam.

2.38.2. Concerning "*Euphorbia* [No.] *36. Euphorbia ornithopus* [Jacq.]" Dyer refers to N. J. von Jacquin (1809) and N. E. Brown (1915), both re. *Euphorbia ornithopus* Jacq.; he also compares "*Euphorbia ornithopus* Jacq." with "*Euphorbia tridentata* Lam." (pp. 88-89):

Dyer describes the species as follows:

"*Euphorbia ornithopus was described by Brown from living plants without locality of origin. He states: 'It has been in cultivation for over 100 years, yet no wild specimens seem to have been collected'. During March 1927 plants agreeing with the description sufficiently for identification were collected 12 miles from Grahamstown on Piggott Bridge Road in karroid scrub (Dyer 858). The determination was confirmed by Dr. R. Marloth 12/4/27. Nevertheless there is a marked similarity between Dyer 858* [= *Euphorbia ornithopus* Jacq.] *and Dyer 885* [= *Euphorbia tridentata* Lam.] *and the respective localities are only a few miles apart and the possibility of Dyer 858 being derived from Dyer 885 must not be overlooked.*

A large number of plants were examined and with a very few exceptions all cyathia were 4-glanded. The peduncles were ½-4 inches [1.3-10 cm] *long with a terminal cyathium, or more often forked at the apex, into 2-4 branches* [= pedicels], *each bearing one cyathium. The cyathia produced at the ends of these branches were invariably 4-glanded, bisexual, and the young stalked ovary was bent over in the position of the absent gland. When only one terminal cyathium was produced, it was 4-glanded, bisexual, and developed fertile seed. When branches* [i. e. pedicels] *were produced at the apex of the* [main] *peduncle, the terminal* [central] *cyathium was usually aborted. In exceptional cases cyathia were produced in both positions on the same* [main] *peduncle, thus the single* [central] *cyathium was sessile at the base of peduncle branches* [pedicels]. *Although this single cyathium was often aborted, it occasionally reached maturity. The important fact is that it was found to possess 5 glands, and this would seem to illustrate its near affinity with Dyer 885* [= *Euphorbia tridentata* Lam.]. *No appreciable difference was noticed between the individual glands and capsules of Dyer 858* [= *Euphorbia ornithopus*] *and* [Dyer] *885* [= *Euphorbia tridentata*]".

Note that to the species described by R. A. Dyer (1931) as "*Euphorbia* [No.] *36. Euphorbia ornithopus* [Jacq.]" is only referred by A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia ornithopus* Jacq.

2.39. Hermann Wilhelm Rudolf Marloth (1855-1931), German-born South African botanist, practised pharmacy and chemistry for a living while actively engaged in the exploration of the South African flora. He collected and described in books and journals many new discoveries from the field. In 1931 he published a paper called "*Euphorbia, section Dactylanthes*" in the *South African Gardening & Country Life, Vol. 21* (May 1931, p. 127, p. 133), discussing *Euphorbia globosa* Sims, *Euphorbia ornithopus* Jacq., *Euphorbia tridentata* Lam., and presenting as species novae *Euphorbia wilmaniae* Marloth and *Euphorbia polycephala* Marloth.

Marloth discusses the differences between *Euphorbia ornithopus* and *Euphorbia tridentata* as follows:

"*Euphorbia ornithopus and Euphorbia tridentata. These two species resemble each other in their vegetative parts and both vary according to their environment. In exposed dry situations they produce robust short shoots approaching those of typical plants of Euphorbia globosa, but under moister and less sunny conditions or when well sheltered by shrubs, the shoots become elongated and lanky. Although the writer has cultivated the two species side by side for a number of years, he is unable to decide definitely, to which one a new specimen shown him may belong, if it is without flowers or fruit. In the flowering condition, especially when there is a set of flowers available, they can be easily distinguished*.

Euphorbia tridentata (Fig. 1) [see Fig. 21] bears a solitary flower immediately at the end of a shoot without any peduncle or with a short one only, but Euphorbia ornithopus (Fig. 2) produces a peduncle one or two inches [2.5-5 cm] long crowned by an umbel [= cluster of pedicels] of flowers, each flower borne on a pedicel half an inch [c. 1.3 cm] long or more. The remarkable feature of the flower of the latter species is that it possesses only four glands, the vacant space being occupied by the exserted and incumbent ovary. All records of the plants cultivated in Europe during a century and a half mention only these 4-glanded flowers, but Mr. R. Dyer at Grahamstown and the writer have been able [re. *Euphorbia ornithopus*] *to discover some 5-glanded flowers as well. They occur only occasionally as the central flower of an umbel* [= cyme] *and are always male and without a pedicel* [= sessile]. *Our illustration* [see Fig. 21**]** *shows one such cyathium sessile in the centre of the umbel* [= cyme] *on the right (Fig. 2)*".

Marloth continues:

"*Although both species had been introduced into Europe from South Africa over 150 years ago, no specific locality of their occurrence was known until quite recently. E. tridentata was first definitely recorded by Dr. J. Muir from the neighborhood of Riversdale (1924), and one of his specimens was figured (not the typical form) in "South African Flowering Plants" on plate 197 (1925)* [see Fig. 17]. *Since then it has been found near Grahamstown by Mr. R. Dyer and near Kingwilliamstown by the Rev. Morley Crampton.*

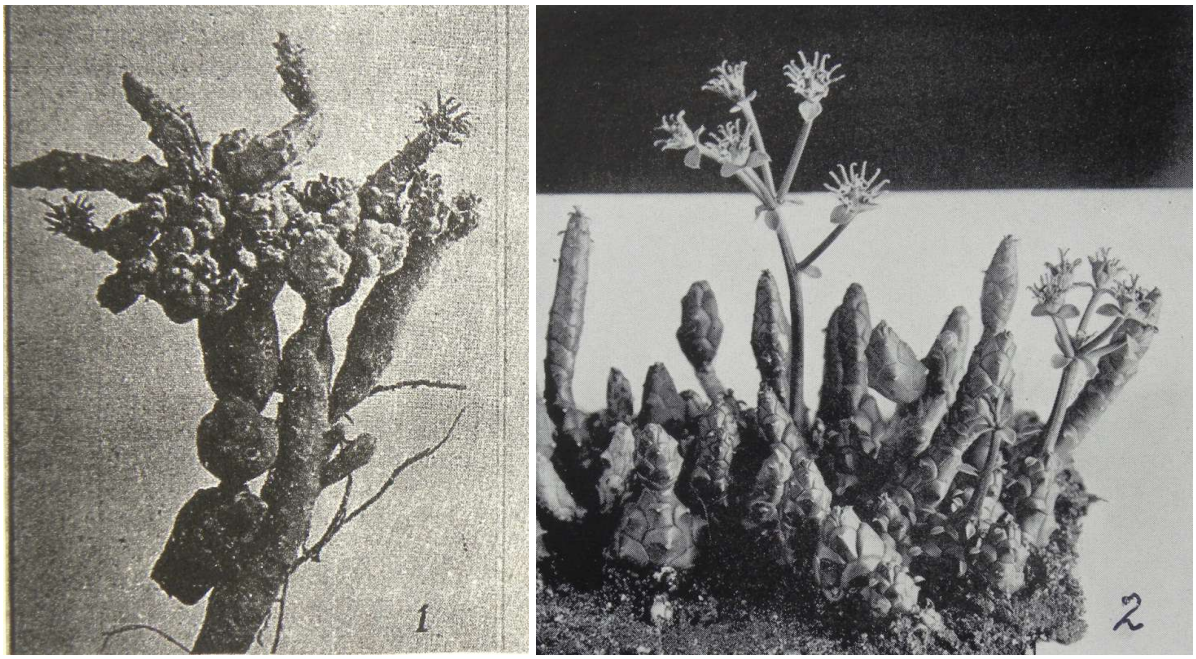


Fig. 21. According to H. W. R. Marloth "*Fig. 1.* Euphorbia tridentata *Lam. From Grahamstown*" and "*Fig. 2.* Euphorbia ornithopus *Jacq. Plant from Grahamstown cultivated at Cape Town, shoots more elongated than on wild plants*" are shown. Reproduced from *South African Gardening & Country Life* (1931; p. 127).

Euphorbia ornithopus was first re-found by Mr. R. Dyer [Dyer, 1931, see section 2.38.2] *near Grahamstown and later on received by me from the Cradock district*".

Note that to the species described by H. W. R. Marloth (1931) as "E. ornithopus Jacq." and "Euphorbia tridentata Lam." is only referred by A. C. White, R. A. Dyer & B. L. Sloane (1941).

2.40. Alain Campbell White (1880-1951), American writer, composer, historian and collector, and **Boyd Lincoln Sloane** (1885-1955), American teacher, school principal and avid botany student met each other in the thirties of the previous century, both committed succulent aficionados, at first specialising in *Stapelieae* and next in succulent *Euphorbieae*. Co-authored by **Robert Allen Dyer** (1900-1987), South African botanist, in 1941 they compiled the impressive two-volume handbook *The Succulent Euphorbieae (Southern Africa)*, published in Pasadena, California. In *Vol. 2*, pp. 501-512, A. C. White, R. A. Dyer & B. L. Sloane (1941) put together all information as known at the time about "*Euphorbia tridentata* Lam." and "*Euphorbia ornithopus* Jacq.".

2.40.1. About "*Euphorbia tridentata* Lam.", on pp. 501-507 of *The Succulent Euphorbieae (Southern Africa)*, the authors refer to J.-B. de Lamarck (1788 ["1786" incorrect]) re. *Euphorbia* [No.] *11. Euphorbia tridentata*, see Figs 8a, 8b, to A.-T. Danty d'Isnard (1720, reprint 1722) re.

Euphorbium [No.] *12. Euphorbium anacanthum, squamosum, lobis florum tridentatis*, see Fig. 2a, to J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, see Fig. 4, to C. Linnaeus (1753) re. *Euphorbia caput-medusae* ["var."] *β*, *Euphorbium anacanthum squamosum, lobis florum tridentatis* as well as to C. Linnaeus (1753) re. *Euphorbia caput-medusae* ["var."] γ, *Euphorbium erectum aphyllum, ramis rotundis, tuberculis tetragonis*, to W. Aiton (1789) re. *Euphorbia anacantha*, to A. P. de Candolle (1804) re. *Euphorbia tridentata* [Lam.], see Fig. 11, to A. H. Haworth (1812) re. *Dactylanthes anacantha*, to J. Sims (1824) re. *Euphorbia anacantha*, see Fig. 14, to J. F. Klotzsch & C. A. F. Garcke (1859) re. *Medusea tridentata*, to N. E. Brown (1915) re. *Euphorbia* [No.] *77. Euphorbia tridentata* Lam., to E. P. Phillips and Miss K. A. Lansdell in I. B. Pole Evans, Ed. (1925) re. *Euphorbia* [No.] *77. Euphorbia tridentata*, see Fig. 18, to R. A. Dyer (1931) re. *Euphorbia tridentata* Lam. and finally to H. W. R. Marloth (1931) re. *Euphorbia tridentata* Lam., see Fig. 21.

The authors describe the species as follows:

"*Euphorbia tridentata* Lam. *Plant: a spineless dwarf succulent, with the main stem a continuation of a tuberous main root, usually producing a number of cylindrical rhizomes below ground level and branching freely at the base; branches ascending or somewhat spreading, up to 15 cm long, 8-12 mm thick, cylindrical or slightly tapering upward, often rebranched in short irregular joints, tessellate tuberculate, glabrous, dull green; tubercles hexagonal, 6-8 mm in diameter, flattish, with a slightly prominent whitish leaf scar at the apex. Leaves: soon deciduous, sessile, 4-6 mm long, 3-4 mm broad, elliptic, or elliptic-oblong, acute, dark green, with a reddish, minutely toothed margin. Inflorescence: cyathia solitary, produced 3 or 4 from the end of each branch, pedunculate; peduncles about 4 mm long, glabrous, bearing 2 or more bracts; bracts ovate or elliptic; involucre cup-shaped, 1.2-1.7 cm in diameter, glabrous, with 5 glands and 5 transversely oblong, toothed and ciliate, inflexed, purplish lobes; glands subcontiguous, about 5 mm in diameter across the tips, two-lipped with the lower lip divided along the outer margin into 3 or 4 spreading, finger-like, corrugated, white processes 2-3 mm long. Pistillate flower: ovary pedicelled, but scarcely exserted from the involucre; styles 6 mm long, united into a column at the base for ⅔ of their length, free above, with entire, spreading tips. Capsule: obtusely 3-lobed. Type locality: South Africa, without precise locality. Distribution: Cape Province, including Riversdale, Albany and Cradock, and possibly Bedford districts*".

A. C. White, R. A. Dyer & B. L. Sloane present the following pictures of the species, we quote: "Fig. 517. *Euphorbia tridentata* Lam., plant collected in Riversdale district, photo: R. Marloth"; "Fig. 518. *Euphorbia tridentata Lam*., from a drawing by Miss K. A. Lansdell in The Flowering Plants of Africa, 1925, of a plant collected in Riversdale district" (see Fig. 18); "Fig. 519. *Euphorbia tridentata* Lam., from the plate by Danty d'Isnard, in Act. Paris, 1720" (see Fig. 2a); "Fig. 520. *Euphorbia tridentata* Lam., from the plate in Burman, Rar. Afr. Plant, 1738" (see Fig. 4); "Fig. 521. *Euphorbia tridentata* Lam., a cultivated plant in flower, New Jersey, photo: J. B. Snethlage"; "Fig. 522. *Euphorbia tridentata* Lam., a cultivated plant, Japan, showing elongation of the branches, photo: H. Isida"; "Fig. 523. *Euphorbia tridentata* Lam., from the plate in Curtis's Botanical Magazine, 1824" (see Fig. 14); "Fig. 524. *Euphorbia tridentata* Lam., branches of plants collected 10 miles [16 km.] from Grahamstown on Botha Ridge by the Queens Road, photo: R. A. Dyer"; "Fig. 525. *Euphorbia tridentata* Lam., a cultivated plant, Pretoria, photo: C. A. Smith"; "Fig. 526. *Euphorbia tridentata* Lam., the plant shown in Fig. 525, as viewed from above, photo C. A. Smith" and "Fig. 527. *Euphorbia tridentata* Lam., from a drawing by P. J. Redouté in De Candolle, Plantes Grasses" (see Fig. 11).

The authors remark about the species:

"*Euphorbia tridentata was first collected early in the 18th century probably in the Riversdale district, where plants have been found in recent years, but no record of its discovery has survived. It was figured in 1720 by Danty d'Isnard of Paris, who called it Euphorbium anacanthum squamosum (the 'spineless, scaly Euphorbia'), and the synonym, E. anacantha Ait., which was based on d'Isnard's name, has continued to challenge the valid name for a century and a half and still crops up frequently to mystify the collector.*

The species was imported to Europe so long ago that all traces of its origin were lost, beyond the tradition that it came from South Africa. It was not until 1920 that Dr. J. Muir rediscovered it near Riversdale, and in 1927 Dyer found it on Botha Ridge 10 miles (16 km) northeast of Grahamstown on the Queens Road, growing in association with E. bothae Lotsy & Godd. Specimens abound there in restricted areas, as well as on Penrock Farm in the Botha River valley, where dense mats are formed, each plant spreading for some distance by means of subglobose or cylindrical rhizomes, which run underground parallel to the ground surface. Curiously enough, the branches die off yearly and at certain seasons it is frequently impossible to locate the roots and rhizomes. In cultivation the branches live for several years. E. tridentata grows also in Cradock district, and possibly in Bedford, but the identification of the plants collected in the latter district is not certain.

The name of E. tridentata means the "3-toothed Euphorbia", referring to the pattern of the involucre glands. They are 2-lipped, the lower lip (or lobe) dividing into a fringe of 3 or 4 long, slender teeth, with the upper lip inflexed over the cavity at the base of the gland. The teeth or processes of the lower lip are usually described as little fingers, and their shape is quite different from that of the broader segments into which the margins of the glands are divided, for instance, in E. caput-medusae L. In 1812 Haworth based upon their structure a new genus, which he called Dactylanthes, or 'Finger Flower'. Although Haworth's genus has not been maintained, Berger adopted it as the basis of one of his sections, and the name remains a convenient designation for the small group of six species so far known which possess 'finger glands'.

The five other members of the group are E. ornithopus Jacq., which dates from 1809, E. globosa Sims, first described by Haworth in 1823 as a Dactylanthes, the much more recent E. polycephala Marloth and E. wilmaniae Marloth, both of 1931, and a new species, E. planiceps [Nob.]. *Of these, E. ornithopus is a very near neighbour of E. tridentata in Albany and Cradock districts. E. globosa has also been credited in the Flora Capensis* [see N. E. Brown, 1915] *to Albany district, though there may have been some confusion in this identification since the more definitely established habitat of E. globosa is restricted to Uitenhage and Port Elizabeth. E. polycephala hails from Cradock, E. wilmaniae from Griqualand West and Little Namaqualand, and E. planiceps from Griqualand West. Except for the last two named, there is clearly a rather close geographical relationship between the members of the entire sextet and all six present species may perhaps be of fairly recent evolution from a single ancestral form. In particular it is possible that E. ornithopus, as collected in karoid scrub on the Piggott Bridge road, 12 miles (20 km) from Grahamstown, may well have been derived from the colonies of E. tridentata on Botha Ridge, only a few miles distant*".

The authors (*op. cit.*, pp. 506-507, see also p. 76, below, cf. Fig. 22) discuss the differences and similarities between "*Euphorbia tridentata* Lam." and "*Euphorbia ornithopus* Jacq.":

"*The inflorescence of Euphorbia tridentata Lam. varies from that of Euphorbia ornithopus Jacq. in a number of particulars. The peduncles are in general very much shorter; the cyathia are solitary, whereas in E. ornithopus they often form cymes; but of most importance is the fact that in E. tridentata the involucre glands are usually 5 in number, whereas in the involucres of E. ornithopus there are normally 4 glands. In neither case is the count absolutely constant. Plants of E. tridentata from Botha Ridge showed 6 glands in some involucres, while an interesting case of involucres of E. ornithopus with 5 glands will be mentioned in the note on that species*".

The authors conclude:

"*The plants of the "finger flower" group are relatively non-poisonous to animals. The latex of E. tridentata in particular appears to be very mild, as this species is a ready victim (or so it seems to the collector) of every plant pest known. Even the prudent snail eats of it readily*".

Note that to the species described by A. C. White, R. A. Dyer & B. L. Sloane (1941) as "*Euphorbia tridentata* Lam." is only referred by S. Carter (2002) re. *Euphorbia tridentata* Lam.

2.40.2. Concerning "*Euphorbia ornithopus* Jacq.", on pp. 508-512 of *The Succulent Euphorbieae (Southern Africa)*, *Vol. 2*, A. C. White, R. A. Dyer & B. L. Sloane refer to N. J. von Jacquin (1809), to N. E. Brown (1915), R. A. Dyer (1931) and H. W. R. Marloth (1931) all re. *Euphorbia ornithopus* Jacq. Note that White, Dyer & Sloane consider *Dactylanthes patula* Haworth of A. H. Haworth (1812), *Euphorbia patula* [Haworth] Sweet of R. Sweet (1818; nom. illeg.) and *Medusea patula* Klotzsch & Garcke of J. F. Klotzsch & C. A. F. Garcke (1859; 1860) synonyms of *Euphorbia ornithopus* Jacq. However, P. V. Bruyns (2012) regards the last three statements erroneous for A. H. Haworth (1812) based his *Dactylanthes patula* on Miller's *Euphorbia patula* (Miller, 1768), therefore *Dactylanthes patula* (Mill.) Haw. (Haworth, 1812), *Euphorbia patula* [(Haworth) Sweet] (Sweet, 1818) and *Medusea patula* (Mill.) Klotzsch & Garcke (Klotzsch & Garcke, 1859; 1860) are not new publications but, according to Bruyns, are merely new combinations for Ph. Miller's "*Euphorbia patula*" (Miller, 1768) and have to be regarded, equally together with *Euphorbia ornithopus* Jacq., synonyms of *Euphorbia patula* Mill.

A. C. White, R. A. Dyer & B. L. Sloane describe "*Euphorbia ornithopus* Jacq." as follows:

"*Euphorbia ornithopus. Plant: a spineless dwarf succulent 5 to 7.5 cm high, excluding the inflorescence, main stem a continuation of the tuberous main root, forming a turnip-shaped body 10 to 20 cm long and 2.5 to 5 cm thick, producing numerous rhizomes below ground level and branching freely above ground; rhizomes cylindric, running underground subparallel to the ground surface and putting out new roots and branches at intervals and at their ends; branches shortly cylindric or subglobose, 1 to 3 cm long, 6 to 10 mm thick, usually narrowing at the upper end, much elongated in shape and then sometimes procumbent or straggling, often putting out new joint-like branches, glabrous, dull green or purplish, with 3 to 5 laxly spiral series of acute conical tubercles 2- 4 mm prominent. Leaves: rudimentary, soon deciduous, 2 to 5 mm long, 1 to 1.5 mm broad, lanceolate. Inflorescence: cyathia solitary or in cymes of 2 to 5, produced from the apex of the branches, pedunculate; peduncles 1.2 to 10 cm long, simple or branching at the apex (in the cymes) into 2 to 4 cyme branches, the cymes consisting of a central sessile cyathium in the fork of the cyme branches, this central cyathium often aborted and the cyme then resembling an umbel; bracts 3 to 4 below the middle of the peduncle, small, alternate, and a pair or a whorl of 3 larger ones at the apex of the peduncle subtending the cyathium or cyme; involucre obconic cup-shaped, 1 to 1.2 cm in diameter, glabrous, green, with 4 or 5 glands and 5 inflexed-connivent, subquadrate, ciliate lobes; glands 5 in the occasional central sessile cyathium of the cymes, 4 in the other cyathia, ascending-spreading, 6 mm long, 2-lipped with the lower lip deeply divided into 3 or 4 subulate, finger-like processes with minute white-margined pits along their upper side and the upper lip inflexed over the cavity at the base of the gland. Pistillate flower: ovary exserted from the involucre on a recurved pedicel; styles 4 to 6 mm long, united into a column at the base for about half their length, free above, the free portion ascending-spreading, with dilated and somewhat bifid tips. Capsule: erect, 8 mm in diameter, with 3 slightly rounded lobes, glabrous. Type locality: South Africa, without precise locality. Distribution: Cape Province, Albany District: 12 miles (20 km) from Grahamstown on Piggott Bridge Road; Cradock District: Halesowen and Riverview.*

A. C. White, R. A. Dyer & B. L. Sloane present the following pictures of the species, we quote: "Fig. 528. *Euphorbia ornithopus* Jacq., plant collected by R. A. Dyer near Grahamstown, photo: R. Marloth"; "Fig. 529. *Euphorbia ornithopus* Jacq., flowering branches of a cultivated plant, from W. Haage, 1931"; "Fig. 530. *Euphorbia ornithopus* Jacq., a fruiting plant in cultivation, California, photo: J. R. Brown"; "Fig. 531. Contrast between the inflorescence of *E. ornithopus* Jacq. and *E. tridentata* Lam., photo: J. R. Brown" [here reproduced, see Fig. 21], "Fig. 532. *Euphorbia ornithopus* Jacq., flowering branch of a cultivated plant from the rockery of Hurling and Neil, Bonnie Vale, C. P., etc., photo W. J. Louw", "Fig. 533. *Euphorbia ornithopus* Jacq., a cultivated plant, Japan, photo: H. Isida"; "Fig. 534. *Euphorbia ornithopus* Jacq., a fruiting plant in cultivation, Japan, photo: H. Isida"; "Fig. 535. *Euphorbia ornithopus* Jacq., a cultivated plant with elongated branches and peduncles rivalling those of *E. globosa* Sims, photo W. I. Beecroft, from Cact. & Succ. Journ, America, 1930" [note that this picture was earlier published by G. A. Frick (1930) to illustrate a cultivated *Euphorbia tridentata* Lam., see section 2.37.2, Fig. 20].

The authors remark about the species:

The name of E. ornithopus ("the bird's foot Euphorbia") refers to the shape of the involucre glands with their 3 or 4 finger-like processes, which produce the effect of a bird's claw. The origin of the plant is uncertain. It was described by Jacquin in 1809, and may not improbably have been brought to the Imperial Gardens at Schönbrunn near Vienna by Boos and Scholl, whose travels in South Africa in search of plants for these gardens extended as far as Albany district. The species was finally localized by Dyer near Grahamstown in 1927. It occurs also in the Cradock District".

The authors (*op. cit.*, pp. 509-512, see also p. 74, above, cf. Fig. 22) discuss the differences and similarities between "*Euphorbia tridentata* Lam." and "*Euphorbia ornithopus* Jacq.":

The close relationship existing between E. ornithopus and E. tridentata has been mentioned in note to the latter species [cf. p. 74]. *It was pointed out that the cyathia of E. tridentata are always solitary, whereas those of E. ornithopus frequently develop into cymes. If one compares an involucre of E. tridentata with one of E. ornithopus, one will find no appreciable difference in the structure of the individual glands, but the variation in their number is extremely interesting. Normally an involucre of E. tridentata has 5 glands, rarely it may have 6; the occasional variation appears to be a matter of chance. The involucres of E. ornithopus normally have only 4 glands, rarely they have 5; and here the variation appears to have a sexual significance, as will be explained in the next paragraph. The phenomenon is striking, because it occurs so regularly, at least among the plants which have been examined in the wild state, and also because it will be met with again in E. polycephala, but not in any other member of the group.*

As has just been mentioned, the cyathia of E. ornithopus are produced in cymes as well as singly. When a cyme is developed it sometimes has a sessile cyathium at the base set in the fork of the cyme branches; more frequently this basal cyathium aborts and the cyme takes the form of an umbel. The significant thing is this: in the rare cases where the basal cyathium of a cyme matures, the involucre has 5 glands; but in the remaining cyathia of the cymes only 4 glands occur, and this is the case also where the cyathia are solitary. In the involucres where 5 glands are found only male flowers are matured, whereas in those with only 4 glands both male and female flowers develop and the ovary is exserted from the involucre and bent over precisely in the direction of the opening caused by the absence of the fifth gland.

Individual specimens of E. ornithopus are of irregular shape. Some have short branches, other more elongated ones. At times they are difficult to distinguish from the branches of E. tridentata, and then the gland count will prove helpful toward identification".

A. C. White, R. A. Dyer & B. L. Sloane (1941, p. 510, *Fig. 531*) illustrate their observations in the following picture (Fig. 22), here reproduced:

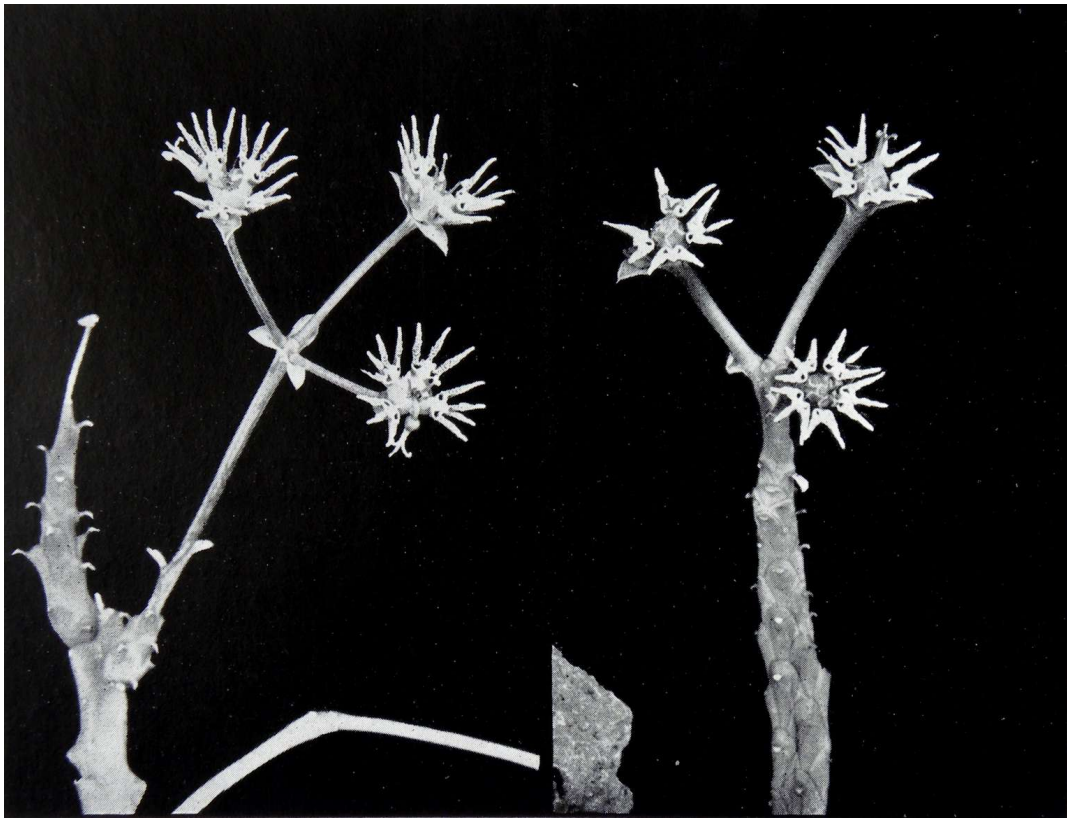


Fig. 22. "Contrast between the inflorescence of Euphorbia ornithopus Jacq. (left) and Euphorbia tridentata Lam. (right). Note the long peduncle and the four glands on the cyathia in the former with the ovary exserted at the point where a fifth gland appears to be missing". Reproduced from A. C. White, R. A. Dyer & B. L. Sloane (1941, p. 510, Fig. 531), photo by J. R. Brown.

Note that to the species described by A. C. White, R. A. Dyer & B. L. Sloane (1941) as "*Euphorbia ornithopus* Jacq." is referred by S. Carter (2002) for icones as well as by P. V. Bruyns (2012) for comment, designating *Euphorbia ornithopus* Jacq. as a synonym of *Euphorbia patula* Mill.

2.41. Gerhard Marx (b. 1956), professional artist at the Albany Museum, South Africa, and keen connoisseur of South African succulents, in1992 treated *The Succulent Euphorbias of the South-eastern Cape Province, part 1: dwarf species & smaller shrubs* in *The Euphorbia Journal, vol. 8,* pp.74-102, with photographs from the field.

2.41.1. On p. 79 of his paper Gerhard Marx describes "*Euphorbia tridentata* Lam.":

"*Closely related, but also very distinct from Euphorbia globosa, this species is of more inland distribution and can be found in small isolated localities to the north and northeast of Grahamstown. It is also reported from the Steytlerville area, although the writer has never seen it in the latter area. Characteristic of Euphorbia tridentata is its neat cyathia with four- or five-fingered glands, as well as the plant's habit of spreading by underground rhizomes.Tiny groups of compact globular heads are almost evenly spaced above ground, while as many as ten such head clusters can all be connected underground and constitute a single plant*".

2.41.2. On p. 80 of his paper Gerhard Marx treats "*Euphorbia ornithopus* Jacq.". Marx observes about this species:

"*Sometimes it can be difficult to distinguish the somewhat variable Euphorbia ornithopus from E. polycephala on the one hand and from E. tridentata on the other. However, E. ornithopus can normally be distinguished from E. tridentata by its habit of forming larger clusters of heads, the colour of which is generally greener than the brown-grey to dull blue-grey of E. tridentata. The branches are also more pointed and slightly larger than in the case of E. tridentata. Generally the branches of E. ornithopus are also more tubercled. When in flower, of course, the distinction is clear and easy, since the cyathia of E. ornithopus are borne on cymes on obvious peduncles and the glands generally number four (occasionally only three glands are present). To distinguish Euphorbia ornithopus from E. polycephala can occasionally be much more difficult. The only obvious differences are in the cyathia, the habit of E. ornithopus forming much smaller clusters or 'mats' at ground level, and the large swollen root system of E. polycephala. The distribution of Euphorbia ornithopus seems to be restricted to the area northwest of Grahamstown toward Adelaide and probably not further west than Cookhouse*".

Note that to the species described by G. Marx (1992) as "*Euphorbia tridentata* Lam." and "*Euphorbia ornithopus* Jacq." is referred by S. Carter (2002), especially for icones.

2.42. Peter Goldblatt (b.1943) & **John Ch. Manning** (b. 1962), South African botanists, edited on behalf of the National Botanical Institute in Pretoria a survey, entitled *Cape Plants: a Conspectus of the Cape flora of South Africa*, published in the journal *Strelitzia, No. 9* (2000). Not mentioning *Euphorbia ornithopus* Jacq., but only enumerating "*Euphorbia tridentata* Lam.", the South African botanist **Peter V. Bruyns** (b.1957) contributed the following description (p. 458):

"*Euphorbia tridentata - Vingerpol. Branches cylindrical to clavate and often rhizomatous, stems to 15 mm long, 6-12 mm diameter, with more prominent tubercles and cyathia 12-17 mm diameter, glands pale yellow to white. Flowering October-December. Grassy flats or stony karroid slopes, Ladysmith, Riversdale to E. Cape*".

The species described by P. V. Bruyns in Goldblatt & Manning (2000) as "*Euphorbia tridentata* Lam." is cited again by P. V. Bruyns in a survey about the nomenclature and typification of South African *Euphorbia* species (Bruyns, 2012).

2.43. Rafaël Govaerts (b. 1968)**, David G. Frodin** (b. 1940) **& Alan Radcliffe-Smith** (1938-2007), British botanists, compiled the *World Checklist and Bibliography of Euphorbiaceae (with Pandaceae)*, in 2000 published by The Board of Trustees of the Royal Botanic Gardens, Kew.

2.43.1. On p. 799 of the *World Checklist and Bibliography of Euphorbiaceae, vol. 2*, R. Govaerts, D. G. Frodin & A. Radcliffe-Smith (2000) recorded Ph. Miller's *Euphorbia patula* (Miller, 1768) as a valid species, sinking *E. tridentata* Lam. (J.-B. de Lamarck, 1788) as well as *Euphorbia anacantha* Aiton (Aiton, 1789) into synonymy.

2.43.2. On p. 794 of the *World Checklist and Bibliography of Euphorbiaceae, vol. 2*, the authors recorded *Euphorbia ornithopus* Jacq. (Jacquin, 1809) as a valid species.

2.44. Susan Carter (b. 1933), British botanist, specialist regarding the tribe Euphorbieae, Honorary Research Associate at Kew, traveller and collector, prolific writer about new *Euphorbia* findings, President of the International Euphorbia Society, has up to now described 150 *Euphorbia* species in

her name, of which 35 together with other botanists. Susan Carter treated the tribe Euphorbieae in the *Illustrated Handbook of Succulent Plants: Dicotyledons*, edited by Urs Eggli, published in 2002.

2.44.1. Susan Carter describes "*Euphorbia ornithopus* Jacq." on pp. 172-173 of the *Illustrated Handbook of Succulent Plants: Dicotyledons*, referring to N. J. von Jacquin (1809) re. *Euphorbia ornithopus*; for icones she refers to A. C. White, R. A. Dyer & B. L. Sloane (1941, pp. 508-512) and G. Marx (1992, p. 80).

The species is described by Carter as follows:

"*Euphorbia ornithopus* Jacq. *Shrublets to 7.5 cm; root tuberous, merging into stem, plant body to 20 x 5 cm, producing rhizomes and much-branched above ground; branches subglobose to 3x1 cm, tessellated with rounded tubercles to 4 mm in laxly spiral series; leaves to 5 mm, deciduous; cyathia solitary, or in cymes of 2- to 5-rayed umbels; peduncles 1.2-10 cm with several scattered bracts; cyathia to 12 mm diameter; glands 4, or 5 on central cyathium of the umbel, two-lipped, margin with 3-4 linear processes to 5 mm with a line of minute white-edged pits; fruit subglobose, 8 mm diameter, pedicel exserted, recurved; seed not known. Closely related to E. globosa and E. tridentata. Distribution RSA (Eastern Cape). Type (icono): l. c., t. 120, 2*".

Note that the species described by S. Carter (2002) as "*Euphorbia ornithopus* Jacq." has not been cited by any author.

2.44.2. On p. 197 of the *Illustrated Handbook of Succulent Plants: Dicotyledons* Susan Carter describes "*Euphorbia tridentata* Lam.", referring to J.-B. de Lamarck (1788) ["1786" incorrect] re. *Euphorbia* [No.] *11. Euphorbia tridentata*, to C. Linnaeus (1753) re. *Euphorbia caput-medusae* ["var."] *β*, *Euphorbium anacanthum squamosum, lobis florum tridentatis* as well as re. *Euphorbia caput-medusae* ["var."] γ, *Euphorbium erectum aphyllum, ramis rotundis, tuberculis tetragonis*, to W. Aiton (1789) re. *Euphorbia anacantha*, to A. H. Haworth (1812) re. *Dactylanthes patula* as well as *Dactylanthes anacantha*, to R. Sweet (1818) re. *Euphorbia* [No.] *22: patula* [(Haworth) Sweet] (*nom. illeg.*), to J. F. Klotzsch & C. A. F. Garcke (1859, 1860) re. *Medusea tridentata* as well as *Medusea patula*, to A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia tridentata* Lam. for icones (*op. cit.*, pp. 501-507) and to G. Marx (1992) re. *Euphorbia tridentata* Lam. also for icones (*op. cit.*, p. 79).

Carter's description of "*Euphorbia tridentata* Lam." is as follows:

"*Euphorbia tridentata* Lam. *Shrublets; root tuberous, merging into stem, plant body producing rhizomes and much-branched at base; branches erect-spreading, to 15 cm, 8-12 mm diameter, laxly rebranching, tessellated with flattened tubercles to 8 mm diam.; leaves to 6x4 mm, deciduous; cyathia solitary, several at tips of branches; peduncles approx. 4 mm with a few bracts; cyathia to 17 mm diameter; glands two-lipped, margin with 3-4 linear white processes to 3 mm long; fruit obtusely lobed, slightly exserted; seed not known. Distribution RSA (Eastern Cape). Type: P; Kew (fragment)* (*)".

(*) The fragment at Kew concerns herbarium sheet K000253271 depicting a drawing of J.-B de Lamarck's type at P-LAM (P00381880), made by J. Hutchinson on behalf of N. E. Brown when they compiled together the *Flora Capensis* (Brown, 1915; see section 2.12, Fig. 8b). Today, the Kew Herbarium Catalogue records drawing K000253271 as the type for *Euphorbia patula* Mill., annotating "collector Lamarck, South Africa" (sic!).

Interestingly, Susan Carter (2002) remarks (p. 197): "*E. patula* (Haworth) Sweet" [based on *Euphorbia patula* Mill. (Miller, 1768)] *is included in the synonymy with a question mark, since its true identity remains in doubt*". The species *Euphorbia patula* (Haworth) Sweet (Sweet, 1818), mentioned by S. Carter (2002) regarding "*Euphorbia tridentata* Lam.", is discussed by P. V. Bruyns (2012), for Bruyns regards *Euphorbia patula* (Haworth) Sweet (Sweet, 1818), *Dactylanthes patula* (Mill.) Haworth (Haworth, 1812) and *Medusea patula* (Mill.) Klotzsch & Garcke (Klotzsch & Garcke (1859; 1860), together with *Euphorbia ornithopus* Jacq. (Jacquin, 1809), all synonyms of *Euphorbia patula* Mill. (Miller, 1768), see section 2.46.2.

2.45. Peter V. Bruyns, Ruvimbo J. Mapaya & Terrence Hedderson (2006) undertook the reconstruction of the phylogenetic relationships among southern African species of *Euphorbia* as based on ITS and psbA-trnH sequence data (Bruyns et al., 2006). It turned out that the southern African *Euphorbia* species consist of 4 major groups, to be recognized as subgenera: *Chamaesyce* Raf., *Esula* Pers., *Euphorbia* and *Rhizanthium* (Boiss.) Wheeler. Whereas the first three subgenera are almost cosmopolitan, subgenus *Rhizanthium* is mainly African. This subgenus comprises nine sections; the species of our interest belong to section *Dactylanthes* (Haw.) A. Berger, *Sukkulente Euphorbien*: 10, 104 (1906, publ. 1907) and *Dactylanthes* Haw., *Synopsis Plantarum Succulentarum*: 132-133 (1812). As lectotype for this section the authors have chosen *Dactylanthes anacantha* (Aiton) Haw.

Belonging to "Clade A", Bruyns, Mapaya & Hedderson characterize subgenus *Rhizanthium* as follows:

"*Shrubs to small succulents or geophytes, mostly bisexual. Stems terete (sometimes clavate), main stem often much thicker (and sometimes sunken into ground) than the slender side branches (or side branches reduced to woody thorns), green and photosynthetic, usually succulent, rarely woody or covered with brown bark, usually covered with more or less conical tubercles which are arranged into distinct angles along stem, tips usually glabrous. Leaves spirally arranged, herbaceous and deciduous to fleshy and reduced and rapidly caducous (usually borne on tips of tubercles), stipules mostly absent. Inflorescence terminal to axillary, sometimes branching, cyathia mostly solitary, often borne at tips of branchlets that become spines, bracts large to small and scale-like, involucral glands often with finger-like processes. Seeds carunculate to ecarunculate*".

Among the 90 southern African *Euphorbia* species belonging to *Euphorbia* subgenus *Rhizanthium* (Boiss.) Wheeler the authors recognize as valid species: "*Euphorbia tridentata* Lam." and "*Euphorbia ornithopus* Jacq.".

2.46. The South African botanist **Peter V. Bruyns** (b. 1957) succeeded in retrieving most of the original publications of 185 Euphorbia species naturally occurring in southern Africa (Botswana, Lesotho, Namibia, South Africa, Swaziland), consequently he found, also for most of the published synonyms, 368 validly described species names. As enumerated in the paper *Nomenclature and typification of southern African species of Euphorbia*, published in *Bothalia* 42(2), pp. 217-245 (2012), Bruyns consulted for each particular name the protologue, searching in a number of relevant herbaria for the designated holotype. When retrieved, locality and date were noted. When a holotype could not be located, a lectotype was chosen, if a lectotype could not be designated, a neotype was selected. Where needed, Bruyns revised the taxonomy by sinking species names into synonymy or validating certain species names or synonyms as new species.

2.46.1. P. V. Bruyns (2012) regards "*Euphorbia tridentata* Lam." (J.-B. de Lamarck, 1788) as a valid species, recognizing herbarium specimen P00381880 at P-LAM as holotype and herbarium

specimen K000253271 at K as isotype (*), although concerning the type locality in South Africa the collector is unknown. According to Bruyns (2012) its synonyms are *Euphorbia anacantha* Aiton (Aiton, 1789), *Dactylanthes anacantha* (Aiton) Haw. (Haworth, 1812) and *Medusea tridentata* (Lam.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860). As lectotype Bruyns designates the illustration in J. Burman (1738, *Tab. 7, fig. 2*, see Fig. 4) concerning the species *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, remarking (we cite): "*..... the one selected as lectotype here corresponds more closely the concept of Euphorbia tridentata* [Lam.] *adopted here, while that of D'Isnard* [i. e. A.-T. Danty d'Isnard, 1720, reprint 1722, *Pl. 11*, see Fig. 2a, concerning *Euphorbium* [No.] *12. Euphorbium anacanthum, squamosum, lobis florum tridentatis*] *is somewhat more suggestive of Euphorbia patula* [Mill.]".

(*) The designated isotype at Kew concerns herbarium sheet K000253271 depicting a drawing of J.-B de Lamarck's type at P-LAM (P00381880), made in Paris by J. Hutchinson on behalf of N. E. Brown when they compiled together the *Flora Capensis* (Brown, 1915; see section 2.12, Fig. 8b). Today, the Kew Herbarium Catalogue records the drawing of Lamarck's type at Paris as the type for *Euphorbia patula* Mill., noting "collector Lamarck, South Africa" (sic!).

2.46.2. Concerning *Euphorbia patula* Mill. (Miller, 1768), Bruyns (2012) confirms its validation using herbarium sheet Fol. no. 328 in A. H. Haworth's Herbarium at OXF as neotype for *Euphorbia patula* Mill., the species to which A. H. Haworth in 1812 referred when he described his *Dactylanthes patula*. On the herbarium sheet we observe, see Fig. 23:

1. The stamp "The Fielding Herbarium" in the right hand corner.
2. To the left, the label "Haworths Herbarium" as determined by Mrs. An Clokie at OXF in 1964 (cf. H. N. Clokie, 1964).
3. The writings at right are by Haworth's own hand, for he wrote on the sheet "*...mihi*" and "*my own*".
4. At first Haworth validated the herbarium specimen as "*Euphorbia elongata, mihi*", but crossed it out, maybe because he discovered that a *Euphorbia elongata* Poir. in Lamarck (1812) was published earlier.
5. Next, he designated the specimen as "*Euphorbia procumbens, Mill.*", but struck this name out too.
6. Finally he named it "*Euphorbia patula, Mill.*".
7. At left we see a branch without flowers, labelled "*My own*", at right a branch with a relatively long-peduncled twofold forked inflorescence, labelled "*Grimwood's. St.* 21" [which we interpret as: "at Grimwood; status planta rhizocarpica seu perennis herbacea, i. e. plant with fruiting stems growing from the roots or rather a perennial plant".
8. N. E. Brown (1849-1934) determinated about a century later the specimens as "*Euphorbia ornithopus* Jacq.".
9. At the foot of the sheet, in quite another hand, the herbarium specimen is called "*E. anacantha*, Ait.". It remains quite uncertain whether this is a more recent designation, or a former one.
10. The two herbarium specimens are obviously tuberculate, whereas according to Miller (1768) "*Euphorbia patula* Mill." is not.
11. No original habitat or indigenous locality is mentioned; although we readily can assume the species originally comes from South Africa, the Cape, this is not mentioned on the sheet.
12. On the sheet there is no mention of the species name "*Dactylanthes patula*" which Haworth in 1812 connected with "*Euphorbia patula* Mill." (Haworth, 1812).
13. On the sheet no date is given, but see hereafter for more details about the date of preservation.

Fig. 23. Folio no. 328, cat. nr. 00059830 and nr. 00059831, from Haworth's Herbarium at OXF. Courtesy of Serena Marner, Manager of the Fielding-Druce Herbarium (OXF).

Please, note that A. H. Haworth indeed wrote on the herbarium sheet in his own handwriting "*Euphorbia patula Mill.*", but also note that in 1812 Haworth already had referred to this name when describing *Dactylanthes patula* (Haworth, 1812, see section 2.22.1). Two specimens are glued onto the herbarium sheet, a sterile one labelled by Haworth as "*my own*" and a fertile specimen labelled "*Grimwood's.*" and "*St.* ♃". The last two designations we (authors) understand as "at Grimwood" and "Status: [for short] perennial" respectively (note the full stop after the genitive "*Grimwood's.*), whereas the latter label is cited by Bruyns only as "Grimwood's St.". But it is known from literature, e. g. from Haworth's biography in the Dictionary of National Biography, Oxford U. P. and from the website British History Online, that Haworth not only got his specimens from the Royal Botanic Gardens at Kew through the Royal Gardener W. T. Aiton *fil*., but also obtained plants from several privately owned (market) nurseries around London, for instance most probably the specialized nursery of a certain Daniel Grimwood not far away from his residence at Salamanca Terrace in Little Chelsea. As we have outlined in section 2.22, Haworth sold his whole collection in 1814, starting again to assemble a collection in 1821. We cannot prove for sure, but we conjecture that herbarium sheet Fol. no. 328 was preserved between 1821 and 1833, the year of his death; after Haworth's death the sheet became preserved in The Fielding Herbarium and next at OXF. Although Bruyns notifies as locality "South Africa, Cape", this is not mentioned on the herbarium sheet. As synonyms of *Euphorbia patula* Mill. Bruyns designates *Euphorbia ornithopus* Jacq. (Jacquin, 1809), *Dactylanthes patula* (Mill.) Haw. (Haworth, 1812) and *Medusea patula* (Mill.) Klotzsch et Garcke (Klotzsch & Garcke, 1859, 1860). As lectotype for *Euphorbia ornithopus* Jacq. Bruyns designates the drawing in N. J. von Jacquin, *Fragmenta Botanica*, *Tab. 120, Fig. 2* (1809), see Fig. 12.

As can be seen on herbarium sheet Fol. no. 328 from Haworth's Herbarium (Fig. 23), the botanist N. E. Brown (1849-1934) determined both herbarium specimens as *Euphorbia ornithopus* Jacq.; Brown clearly considered these specimens not in agreement with Miller's description of Euphorbia *patula* in the 8th edition of The Gardeners Dictionary of 1768. According to Brown (1915; pp. 292-293) "*Haworth refers this plant* [= *Euphorbia patula* Mill.] *to his Dactylanthes patula, but Miller's description does not seem to accord with that plant* [= *Dactylanthes patula* Haw.] *which is a synonym of Euphorbia ornithopus Jacq.*" (see section 2.35.1). However, Bruyns considers "*Euphorbia patula* Mill.", based on Haworth's naming of the specimens on sheet Fol. no. 328 the earliest valid name for *Euphorbia ornithopus* Jacq. As we in this monograph already often recapitulated, P. V. Bruyns (2012) summarized the confusion concerning the correct naming of the species too, we cite:

"*The name Euphorbia patula Mill. has been a source of considerable confusion. N. E. Brown (1915: 292-293) suggested that it was a weak form of E. mauritanica and this was taken up by White et al. (1941: 120), while Carter (2002) referred it to E. tridentata. Both Brown (1915) and White et al. (1941) considered, wrongly, that Dactylanthes patula was published* [as a new species] *by Haworth (1812), while it was merely a new combination for Miller's name E. patula. White et al. (1941) also believed that Robert Sweet (1818) described a new species "Euphorbia patula". However, there he referred to "H.S.", which meant "Haworth on Succulent Plants", i. e. Haworth (1812). Since this provided a clear reference to Haworth's book and hence back to Miller (1768), it did not constitute publication of a new, and then illegitimate name Euphorbia patula Sweet, as was assumed in White et al. (1941) and Carter (2002), but merely referred to Miller's E. patula. White et al.(1941) also considered that Klotzsch & Garcke (1859) published a new name Medusea patula, but this, too, is wrong and this was also a new combination for E. patula Mill. Consequently, they missed the fact that Miller's name E. patula was the earliest valid name for E. ornithopus*".

Nevertheless, in our opinion N. E. Brown was quite right when he identified the herbarium specimens on Fol. no. 328 from Haworth's Herbarium (Fig. 23) as *Euphorbia ornithopus* Jacq., currently to be renamed *Euphorbia tridentata* (Lam.) var. *ornithopus* (Jacq.) van Veldhuisen & Lawant comb. & stat. nov. (see section 2.50.2). In section 2.50.3, we comment about the unjustifiable interpretation of the morphological habit of *Euphorbia patula* Mill.

2.47. The **International Plant Names Index** (IPNI), a cooperation of The Royal Botanic Gardens, Kew, the Harvard University Herbaria and the Australian National Herbarium, produces an online database with vascular plant names listed alphabetically; it only provides links to nomenclatural synonyms if based on the same type; therefore IPNI may not be regarded as a taxonomic database. Accessed April 1, 2014, the following names are equally recorded without referring one to another:

Euphorbia patula Mill. (Miller, 1768), *Euphorbia tridentata* Lam. (J.-B.de Lamarck, 1788) and *Euphorbia ornithopus* Jacq. (Jacquin, 1809).

2.48. The **Kew World Checklist of Selected Plant Families**, Royal Botanic Gardens, Kew presents a taxonomic database. Concerning the plant family Euphorbiaceae, the genus *Euphorbia* may be retrieved, compiled by R. H. A. Govaerts (Govaerts, 2000 until mid-2013 and Govaerts, mid-2013 sqq.)

2.48.1. For the period 2000 until mid-2013 *Euphorbia patula* Mill. was registered as a valid species, including as synonyms *Euphorbia tridentata* Lam. (J.-B. de Lamarck, 1788), *Euphorbia anacantha* Aiton (Aiton, 1789), *Dactylanthes anacantha* (Aiton) Haw. (Haworth, 1812), *Dactylanthes patula* Haw. (Haworth, 1812), *Medusea tridentata* (Lam.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860) and *Medusea patula* (Mill.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860). Separately was recorded *Euphorbia ornithopus* Jacq. (Jacquin, 1809) as another valid species.

2.48.2. From mid-2013 on *Euphorbia patula* Mill. is registered as a valid species, including as synonyms *Dactylanthes patula* Haw. (Haworth, 1812), *Medusea patula* (Mill.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860) and *Euphorbia ornithopus* Jacq. (Jacquin, 1809). However, see our comment in section 2.50.3. As another valid species is now recorded *Euphorbia tridentata* Lam. (J.-B. de Lamarck, 1788), including as synonyms *Euphorbia anacantha* Aiton (Aiton, 1789), *Dactylanthes anacantha* (Aiton) Haw. (Haworth, 1812) and *Medusea tridentata* (Lam.) Klotzsch & Garcke (Klotzsch & Garcke, 1859, 1860).

2.49. Jess A. Peirson, Peter V. Bruyns, Ricarda Riina, Jeffery J. Morawetz & Paul E. Berry published in *Taxon* Vol. 62(6), 2013, pp. 1178-1199, a paper entitled "A molecular phylogeny and classification of the largely succulent and mainly African *Euphorbia* subg. *Athymalus* (Euphorbiaceae)". The authors undertook a phylogenetic analysis, based on nuclear ribosomal ITS and plastid *ndhF* regions, about *Euphorbia* subg. *Athymalus* Neck. ex Rchb., sampling 88 species. This subgenus, comprising about 150 species, is strictly confined to the arid regions of the Old World, namely Africa, Arabia, Madagascar, with the main point in southern Africa. The results of the phylogenetic analysis led to a division of the subgenus in 7 sections; the section *Anthacanthae* comprising 5 subsections. One of them, the subsection *Dactylanthes*, consists of the succulent species *Euphorbia bruynsii* L.C.Leach, *Euphorbia patula* Mill. and *Euphorbia polycephala* Marloth, all together sister to *Euphorbia globosa* (Haw.) Sims and *Euphorbia wilmaniae* Marloth; but the geophytic, in fact non-succulent species *Euphorbia pseudotuberosa* and *Euphorbia trichadenia* are also "weakly" belonging to subsection *Dactylanthes*. As notified in the paper, DNA was extracted from cultivated specimens of *Euphorbia patula* Mill., one of the species of our interest. Upon inspection of pictures of these plants, supplied to us courtesy Mrs R. Riina, they

proved to be labelled *Euphorbia ornithopus* Jacq., allegedly by name reduced to synonyms of *Euphorbia patula* Mill. by P. V. Bruyns (2012), one of the authors of the paper. None of these cultivated plants, used for DNA extraction, were unfortunately provided with original habitat or collection data.

Initially P. V. Bruyns et al. (2006) designated the taxon, by J. A. Peirson et al. (2013, pp. 1188-1189) now labelled *Euphorbia* subg. *Athymalus*, as *Euphorbia* subg. *Rhizanthium* (Boiss.) Wheeler, see section 2.45. But Peirson et al. choose to typify their subgenus by referring to the description and illustration of the flowering habit of the "species naturalis *Athymalus*" (*nomen utique rejiciendum*, for in fact "genus *Athymalus*", see section 2.14), presented by N. J. de Necker (De Necker, 1790a). De Necker's "species naturalis *Athymalus*" was reduced by H. G. L. Reichenbach (1828 publ. 1829, see section 29) to a subgenus, namely *Euphorbia* subg. *Athymalus*, without giving any types or habitat or collection data, therefore considered by L. C. Wheeler (1943, p. 460, p. 484) a *nomen nudum*, namely a designation of a new taxon published without a description or diagnosis or reference to a description or diagnosis. Peirson et al. regard the upper part of N. J. de Necker's engraving on *Tab. XXIX*, *fig. 1a, b* (*Corollarium, etc.,* De Necker, 1790b, see Fig. 9) validly illustrating the description of *Euphorbia* subg. *Athymalus*, by considering the depicted cyathia typical for *Euphorbia tridentata* Lam. and therefore designating *Euphorbia tridentata* Lam. as the type for the name of the subgenus. Observe that N. J. de Necker had the mentioned pictures redrawn, with minute differences, from an engraving in 1720 published by A.-T. Danty d'Isnard concerning the species *Euphorbium anacanthum, squamosum, lobis florum tridentatis* (compare Figs 2a, 2b in section 2.5 and Fig. 9 in section 2.14), but without giving reference or any credit to Danty d'Isnard. L. C. Wheeler (1943, p. 460) did not recognize De Necker's engravings of the cyathia (copied from Danty d'Isnard's treatise), but preferred to compare them with the cyathia pictured by J. Sims in *Pl. No. 2520*, see Fig. 14, regarding *Euphorbia anacantha - Scaly Finger-flowered Spurge* (Sims, 1824, see section 2.24). Wheeler considers Sims' species, based on *Euphorbia anacantha* Aiton (Aiton, 1789) and *Dactylanthes anacantha* Haworth (Haworth, 1812) a typical member of the genus *Dactylanthes* as introduced by A. H. Haworth; indeed, *Euphorbia anacantha* Aiton and *Dactylanthes anacantha* Haworth are today considered synonyms of *Euphorbia tridentata* Lam. Although indicated by Wheeler (1943, p. 484) a *nomen nudum*, nonetheless Peirson et al. (2013, pp. 1188-1189) consider Reichenbach's subgenus *Euphorbia* subg. *Athymalus* validly published, because it refers to the pictures and brief description of the cyathial habit of N. J. de Necker's illegitimate published "species naturalis *Athymalus*". Peirson et al. consider the mere cyathia as pictured on *Tab. XXIX*, copied by N. J. de Necker from the engraving published by Danty d'Isnard in 1720, representative enough to establish *Euphorbia tridentata* Lam. as the type for their subgenus.

Note that J. A. Peirson et al. do not refer to the *entire* morphological habit of the species published by Danty d'Isnard, but restrict themselves to its cyathial morphology only, like did De Necker, and by implication Reichenbach too. However, A.-T. Danty d'Isnard (1720, see section 2.5, Fig. 2a, 2b) presents a plant with a cymose inflorescence composed of cup-like cyathia with upward pointing glands. Although surely *Euphorbia tridentata* might very occasionally develop a cymose inflorescence, this is not at all its typical flowering habit, mostly this species shows sessile or very short peduncled, saucer-shaped, widely horizontally outspread cyathia. In our positive opinion N. J. de Necker's *Tabula XXIX, fig. 1a, b* (see Fig. 9), although being for a very small part a copy of the engraving which accompanies the paper by A.-T. Danty d'Isnard (1720), is illustrating the cyathia of *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., and not in the least typical of the cyathia of *Euphorbia tridentata* Lam.!

2.50. Pjotr Lawant (b. 1929) **& Rikus van Veldhuisen** (b. 1959), Officers of the *International Euphorbia Society*, UK-based, summarized in *Euphorbia World*, 2014, vol. 10(1), pp. 8-15 about the species *Euphorbia tridentata* Lam. (J.-B. de Lamarck, 1788), *Euphorbia ornithopus* Jacq. (Jacquin, 1809) and *Euphorbia patula* Mill. (Miller, 1768) the results of observations conducted in the field and of investigations from cultivation as well as from plant descriptions and plant portraits published in historical perspective for about 330 years. The field observations and the investigations from cultivation as well as the study of relevant historical plant descriptions justify their conclusion that by one and the same name "*Euphorbia tridentata* Lam." in fact two different species are included, namely a species validly recognized as *Euphorbia tridentata* Lam. and a new species to be named *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. The existence of these distinct species was already presupposed by the late South African botanist L. C. Leach, who provisionally named them *Euphorbia tridentata* Lam. and *Euphorbia* cf. *tridentata* respectively (The Leach Archive, field notes & notebooks, cf. Becker & Moller, 2010). The differences between *Euphorbia tridentata* Lam. and *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. are discussed in section **2.50.1**. A close study of the species *Euphorbia ornithopus* Jacq. necessitated the authors to have it reduced to a variety status of *Euphorbia tridentata* Lam., see section **2.50.2**. Finally, critically studying all what has been said by botanists about *Euphorbia patula* Mill. (Miller, 1768) and because of the want of any type material in Miller's Herbarium at BM, the authors consider the interpretation of the morphological habit of *Euphorbia patula* Mill., as presented by Bruyns (2012) and Govaerts (mid-2013 sqq.), as unjustifiable, see their argumentation in section **2.50.3.**

2.50.1. Entitled "*Euphorbia leachii* Lawant & van Veldhuisen sp. nov., a new species from South Africa" the authors present in *Euphorbia World*, 2014, vol. 10(1): 5-8 the new species as follows:

***Euphorbia leachii* Lawant & van Veldhuisen sp. nov.**

Type: South Africa, along the Great Fish River, as shown on Fig. 2 (map), Jan. 5, 2009, at roadside of N10, SE of Cradock, *R. Becker & A. Moller RBAM1326* (holotype UNIN, isotype PRE).

Diagnosis: The habit of *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. is very much the same as *Euphorbia tridentata* Lam. but differs from this species by being smaller in all dimensions. In sunny conditions the branches of *E. leachii* as well as of *E. tridentata* are spherical, however, when lengthening in shady conditions or etiolating in cultivation the segments of the branches of *E. leachii* lengthwise become thickened at the middle, making an elongated oval shape, rather than tapering towards the apex as in *E. tridentata*. The cyathia of *E. tridentata* are solitary, sessile or shortly pedunculate on a short, thick, straight and stiff peduncle only 4 mm long, but *E. leachii* differs from this species by most often developing a cymose inflorescence on a much longer and thinner peduncle which bears two to as much as seven cyathia, and also the bracts and lobes are more finely pubescent, the lobes more bifid than fimbriate toothed as with *E. tridentata*. Whereas *E. tridentata* has cyathia with thickly white encrusted glands, horizontally spreading, with whitish finger-like processes recurving backwards a little, giving the whole cyathium the shape of a saucer, the glands of *E. leachii* are straight pointing upwards, giving the cyathium a remarkably cup-shaped appearance, provided with processes which are more slender, green-coloured and covered with minute, pustule-like whitish-rimmed craters on the upper surface. Contrary to the cup-shaped cyathium of *E. leachii*, the cyathium of *Euphorbia tridentata (*Lam.) var. *ornithopus* (Jacq.) van Veldhuisen & Lawant comb. nov. is saucer-shaped as noted above for *E. tridentata* Lam. Moreover, the cymose inflorescence of *E. leachii*, having a central, sessile cyathium which is always bisexual and persistent, in this respect differs from the cyme of *Euphorbia tridentata* var. *ornithopus* which has always a central, unisexual, male cyathium.

Description: Plant a spineless, succulent, dwarf shrublet, up to 10 cm high, branching from the base from a tuberous root which develops rhizomes; whole plant tessellate tuberculate, tubercles slightly spiralled, hexagonal, flattened, to 8 mm in diameter. **Branches** at first more or less erect, spherical, soon producing long, slender branches, segmented (jointed), the segments of the branches lengthwise becoming thickened at the middle, making an elongated oval shape, up to 12-15 mm thick, in summertime bright green turning into maroon, approx. 1-2 cm long in harsh, sunny, dry conditions but up to 10 cm long in shady conditions; rebranching at or near the apex of the main branches; otherwise spreading sideways when becoming older; in cultivation often elongating to 15-40 cm. **Leaves** towards the apex of young branches sessile, small, acute, ovate, ca. 6x4 mm, dark-green, soon deciduous. **Inflorescences** at the ends of the branches varying from occasionally a solitary, sessile cyathium to much more often a cyme on a thin, short or long peduncle; peduncle and cyme branches shiny green, obscurely ribbed, patchily finely white pubescent, cymes with two to as much as seven cyathia have been observed. **Cyathia** obconical cup-like, always bisexual, central cyathium sessile, with 5 glands, the lateral cyathia short-pedicelled, generally with 5 glands but only occasionally with 4 glands. **Bracts** two, elliptic-oblong, greenish-brown with margins reddish, finely ciliate above. **Involucre** glabrous, green becoming brown-maroon. **Lobes** maroon-brownish, denticulate to almost bifid toothed. **Glands** straight pointing upwards, giving the whole cyathium a cup-shaped look, green-coloured, provided occasionally with 2 but mostly 3 finger-like greenish processes, covered on the upper surface with minute, whitish-rimmed but green-pitted pustule-like craters; processes sometimes slightly or deeply forked, at the base of each gland a pure white, obtuse to truncate flap or lip infolded over a funnel-like cavity, maroon-brownish coloured, the white colour of the lip presenting a conspicuous contrast with the green colour of the glands and processes. **Male flowers** pedicel pinkish-green, filament carmine-red, anthers dark purplish-brown; pollen pale yellow. **Ovary** orange-brown, pedicel glabrous, greenish-yellow flushed red, styles ca. 7 mm long, connate for two-thirds, orange-reddish brown, stigmas orange-reddish. **Capsule** obtusely 3-lobed, exserted, seeds not yet seen.

Systematic position: *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. belongs to *Euphorbia* subg. *Athymalus* Neck. ex Rchb., sect. *Anthacanthae*, subsect. *Dactylanthes* (Haw.) Pax & K. Hoffm. in Engler & Prantl (cf. Peirson et al, 2013).

Distribution and habitat: South Africa, Eastern Cape Province, along the Great Fish River ranging from west of Grassridge Dam as far as Golden Valley, south of Cookhouse (Fig. 24). In Karoo bush vegetation, sometimes on open flat ground with grasses, more often on stony places or stony hillsides between karroid Great Fish River shrubs. Note that the natural distribution area of this species is strictly separated from the known distribution of *E. tridentata* Lam. (Eastern Cape, including Riversdale, Mosselbay and Albany District).

Etymology: The name *Euphorbia leachii* is chosen to honour the late South African botanist Leslie (Larry) Charles Leach, who, as can be read from his field notes and notebooks preserved at the University of Limpopo, Polokwane, South Africa, already presupposed that within the name *Euphorbia tridentata* Lam. two different species might be involved.

Earliest illustration: A.-T. Danty d'Isnard, A.-T. (1720). *Euphorbium anacanthum, squamosum, lobis florum tridentatis*, p. 387, pp. 392-399, *Pl. 11* (reprinted 1722, p. 502, 507-518, *Pl. 11*). See section 2.5, Fig. 2a, Fig. 2b; here designated.

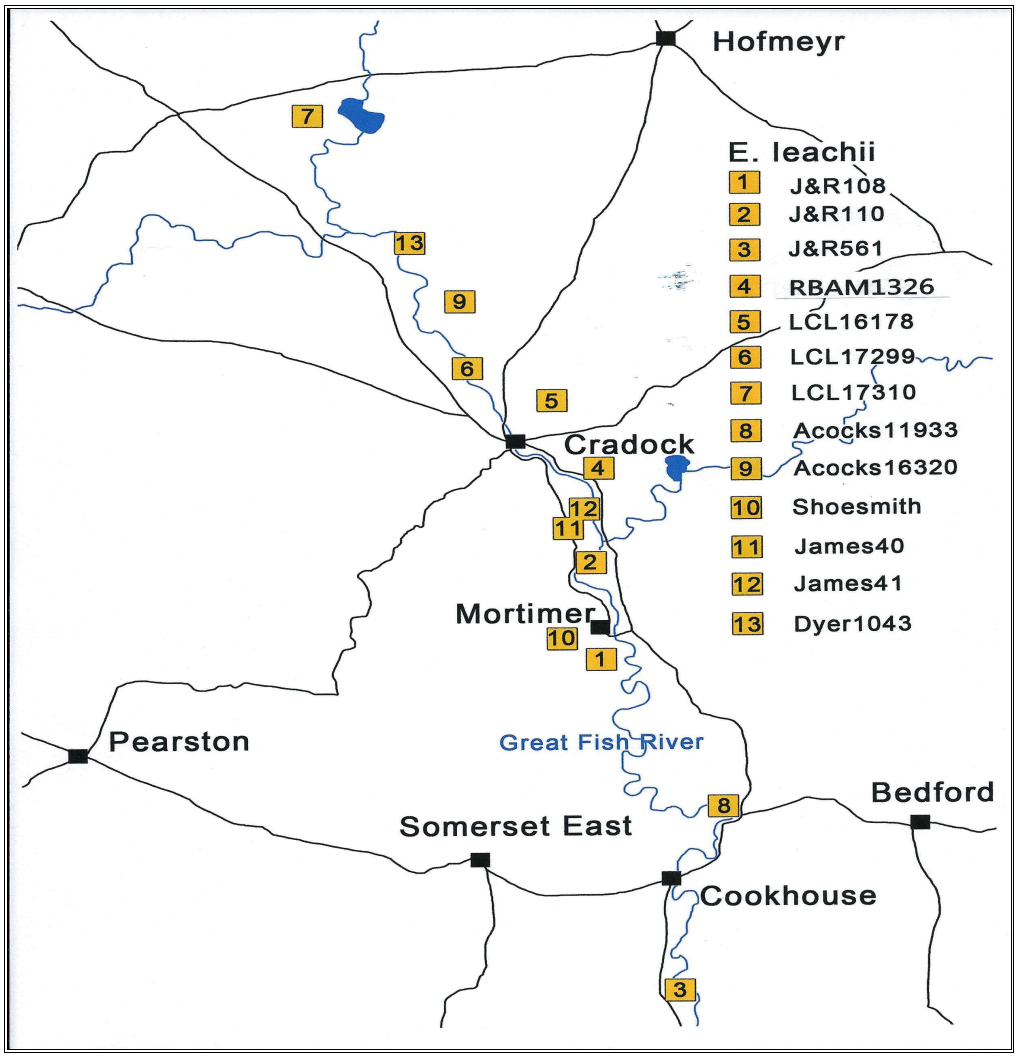


Fig. 24. Distribution map of *Euphorbia leachii* Lawant & van Veldhuisen sp. Nov.

Synonyms: *Euphorbium anacanthum squamosum, lobis florum tridentatis*, in C. Linnaeus (1753), *Species Plantarum, Tomus 1*, p. 452; *Tithymalus Euphorbium dictus, seu Euphorbio-Tithymalus aizoidea, caule ramoso, procumbente, tetro, & nodoso, foliis nudo, florum petalis e candido roseis, bidentis, & tridentis*, in G. Bonelli & L. Sabbati (1722), *Hortus Romanus, juxta systema Tourne-fortianum paulo strictius distributus a Giorgio Bonelli, etc., Vol. 1*, p. 15, Tab. 27; possible synonyms**:** *Euphorbium; Afrum; caule squamoso; tuberoso; minus*, in H. Boerhaave (1720), *Index alter Plantarum quae in Horto Academico Lugduno-Batavo aluntur, Pars 1*, p. 258; *Euphorbium Afrum, caule squamoso tuberoso, minus*, in Ph. Miller, *The Gardeners Dictionary, etc., Ed. 1* (1731), *Ed. 2* (1733), *Abridged Ed.* (1735), *Ed. 4* (1743) and Dutch translation, 1745.

Discussion: Although *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. is for the first time validated here, it must have been known already for a very long time, perhaps for over three centuries, with collectors and botanists alike. However, we conjecture that it always had been labelled "*Euphorbia tridentata*" or "*Euphorbia ornithopus*", whereas in fact many cultivated specimens particularly relate to *Euphorbia leachii.* Even in the field, some confusion about a correct naming of the species may exist. This paper clarifies the observable differences to distinguish between the species correctly.

For comparison concise description of *Euphorbia tridentata* Lam.

Description: **Plant** a spineless, succulent, dwarf shrublet, branching from the base from a tuberous root, which develops rhizomes. **Branches** ascending or somewhat spreading, 3-15 cm long, 10-30 mm thick, spherical or cylindrical tapering upwards, sometimes rebranching in short irregular segments, tuberculate, glabrous, dull green. **Leaves** sessile, soon deciduous, 4-6 mm x 3-4 mm, elliptic, dark green with a reddish, finely toothed margin. **Inflorescence**: solitary with three or four cyathia produced from the end of a branch, usually sessile but sometimes on thick, very stiff peduncles ca. 4 mm long, occasionally a cyme with up to 5 cyathia is produced. **Cyathia** with 4-5 glands provided with usually 3 finger-like processes, widely spreading and forming a saucer-like shape, only the central involucre cup-shaped. **Bracts** two or more, ovate or elliptic. **Glands** subcontiguous, ca. 5 mm in diameter across the tips, two-lipped with the lower lip divided along the outer margin into three white, corrugated finger-like processes, 2-3 mm long, transversely oblong, inflexed or a little bit recurved at the tip. **Ovary** pedicellate, scarcely exserted, with styles ca. 6 mm long, united for ⅔ of their length, with spreading tips. **Capsule** 3-lobed, obtuse, exserted.

Basionym: *Euphorbia* [No.] *11. Euphorbia tridentata* in J.-B. de Lamarck*, Encyclopédie méthodique. Botanique.* 2(2): 416-417 (1788). Note that *Euphorbia tridentata* Lam. was considered by R. Govaerts, D. G. Frodin & A. Radcliffe-Smith (2000) a synonym of *Euphorbia patula* Mill., whereas the species always was considered by S. Carter (2002) a valid species on its own; recently it became reinstated as such by P. V. Bruyns (2012).

Holotype: Herbier de Lamarck P00381880 at P-LAM. Isotype at Kew, labelled *E. patula* Lam. (!).

Illustration: Watercolour "*Tithymalus africanus minor*", in 1686 or 1687 painted by Hendrik Claudius, draughtsman of the Dutch United East-India Company (VOC), preserved as *Folio No. 188* in the collection *Icones Plantarum et Animalium* at the Public Library, Johannesburg, RSA (Fig. 1 in this monograph); here designated.The Dutch botanist J. Burman copied this watercolour to have it engraved (mirrored) in 1738 (see Fig. 4), without giving any credits to Claudius. Bruyns (2012) designated Burman's engraving as lectotype for *Euphorbia tridentata* Lam., but Claudius' watercolour is earlier.

Type locality: East and west of Riversdale, around Grahamstown, east of Alicedale, the vicinity of Heidelberg and near Hartenbos.

A note about plants labelled "*Euphorbia tridentata*" or "*Euphorbia ornithopus*" in collections.

Plants labelled as "*Euphorbia tridentata*" or "*Euphorbia ornithopus*" are already for a very long time in cultivation; e.g. in 1930 G. A. Frick published a picture of a cultivated plant of "*Euphorbia tridentata* Lam." in the *Journal of the Cactus and Succulent Society of America*, vol. 1(10): 188, although A. C. White, R. A. Dyer & B. L. Sloane (1941, p. 512) adopted this picture to illustrate "*Euphorbia ornithopus*" Jacq. Interestingly, these authors stress the elongated branches and long cyathial peduncles particularly rivalling those of *Euphorbia globosa* Sims, especially in cultivation.

However, in many cases we found out that cultivated plants labelled as "*Euporbia tridentata*" or "*Euphorbia ornithopus*" are explicitly not plants with thick and tapering branches with large, widely spread and purely white, saucer-shaped flowers, but plants with elongated, oval branches with joints that are thickening in the middle, sometimes rebranching, provided with thin and long peduncles and cymes with green-toothed, upwards pointing cup-shaped flowers showing a spectacular white infolded lip or flap (see Fig. 79). The latter features they perfectly share with the

plants found in the Cradock area along the Great Fish River! Most often labelled "*Euporbia tridentata*" or "*Euphorbia ornithopus*", or even today "*Euphorbia patula*" (Peirson et al., 2013), as said above they must regularly have been collected for over three centuries and nursed in collections by these names. In conclusion: we are convinced that in collections we mostly do not meet "*Euporbia tridentata / ornithopus / patula*" plants, but on the contrary cultivated "*Euphorbia leachii*" species....

Fig. 25. Cyathium of a plant commonly labelled in cultivation "*Euphorbia tridentata*", but in fact representing *Euphorbia leachii* Lawant & van Veldhuisen sp. Nov.

2.50.2. Entitled "*Euphorbia tridentata* (Lam.) var. *ornithopus* (Jacq.) van Veldhuisen & Lawant comb. & stat. nov., an inevitable reduction" **Rikus van Veldhuisen & Pjotr Lawant** reduce in *Euphorbia World*, 2014, vol. 10(1): 9-11, *Euphorbia ornithopus* Jacq. into a variety of *Euphorbia tridentata* Lam. To found the reduction the authors give the following argumentation:

***Euphorbia tridentata* (Lam.) var. *ornithopus* (Jacq.) van Veldhuisen & Lawant comb. & stat. nov.**

Type: Holotype unknown, according to notes by N. J. von Jacquin (1809) he acquired for description a cultivated specimen from "*Anglia*" (= U. K.). Lectotype, designated by Bruyns (2012): N. J. von Jacquin (1809), *Euphorbia ornithopus*, *Fragmenta Botanica, etc.,* p. 76, *Tab. 120, Fig. 2*.

Taxonomy: Comparing *Euphorbia tridentata* Lam. and *Euphorbia ornithopus* Jacq. - the latter in our opinion by P. V. Bruyns (2012) incorrectly reduced to a synonym of *Euphorbia patula* Mill. - observations from fieldwork and cultivation as well as from descriptions in historical perspective have led us to the conclusion that we are dealing with one and the same species. In both species the cyathium is very much the same, being widely spread saucer-shaped and having identical glands with white, corrugated finger-like processes. Note that R. A. Dyer noted already the same observation in the field, suggesting *Euphorbia ornithopus* Jacq. being derived from *Euphorbia tridentata* Lam. (Dyer, 1931). However, whereas *E. tridentata* usually has solitary, sessile or very short-peduncled 5-glanded cyathia, *E. ornithopus* flowers more frequently with a cyme on a rather long peduncle, up to 10 cm long. Although in the very first description of *E. ornithopus* by N. J. von Jacquin (1809) the flowering habit was described as having at the apex of the branches a cluster of 4-glanded cyathia separately growing on simple peduncles, about 5 cm long, P. E. Boissier (1862) augmented Jacquin's description by remarking that also forked peduncles could be observed, and according to N. E. Brown (1915) even forking into 2-3 rays. R. A. Dyer (1931) added to the

morphology of the flowers the existence of a cymose inflorescence with a central 5-glanded, unisexual male cyathium next to lateral, 4-glanded bisexual cyathia; for quite some time before the lateral cyathia mature the central cyathium often begins to wither. A. C. White, R. A. Dyer & B. L. Sloane (1941) and S. Carter (2002) confirmed Dyer's observations. Nevertheless, *E. tridentata* has been observed to flower sometimes with a cymose inflorescence too, although provided, alongside the lateral 4-glanded bisexual cyathia, with a strictly bisexual central 5-glanded cyathium; on the other hand, even *E. ornithopus* flowers sometimes with some solitary, sessile, 5-glanded bisexual cyathia as *E. tridentata* does generally. The only distinguishing feature between the two species is, particularly in the case of a cymose inflorescence, the difference in the sexuality of the central, 5-glanded cyathium: unisexual, male with *E. ornithopus*, bisexual with *E. tridentata.*

Because the overall habit of both species as named before is identical except for the kind of inflorescence, we do not recognize *Euphorbia tridentata* Lam. and *Euphorbia ornithopus* Jacq. as separately validated species but have reduced them to varieties, i. c. *Euphorbia tridentata* Lam. var. *tridentata* and *Euphorbia tridentata* Lam. var. *ornithopus* (Jacq.) van Veldhuisen & Lawant comb. & stat. nov.

Distribution: Type locality North of Grahamstown.

2.50.3. Entitled "Some dubious interpretations of *Euphorbia patula* Mill." **Pjotr Lawant & Rikus van Veldhuisen** argue in *Euphorbia World*, 2014, vol. 10(1):12-15 that the actual interpretation of the morphological habit of *Euphorbia patula* Mill. (Miller, 1768) is unjustifiable. To found their conclusion the authors state the following argumentation.

Euphorbia patula, described by Philip Miller (1768), has been considered to include *Euphorbia tridentata* Lam. as a synonym from 2000 up to 2013 (Govaerts et al., 2000); but subsequently the latter has once more validated (Bruyns, 2012). Since 2012 *Euphorbia patula* Mill. comprises *Euphorbia ornithopus* Jacq.as its synonym. However, we seriously doubt the reasons why the reduction of these species into synonyms of *Euphorbia patula* Mill. may be considered justifiable, taking into account a persistent misinterpretation of its morphological habit.

Philip Miller, the "most distinguished and influential British gardener of the eighteenth century" (Le Rougetel, 1990) and keeper of the still extant Chelsea Physic Garden, regularly described *Euphorbia* plants in successive editions of The Gardeners Dictionary. In the 8th edition of 1768 (p. 457) he presents from the Chelsea Physic Garden "*Euphorbia [No.] 11. Euphorbia (Patula) inermis, ramis patulis simplicibus teretibus, foliolis linearibus instructis*", or, in Miller's own words, "*Euphorbia without spines, having single spreading branches which are taper, terminated with very narrow leaves*". Next, Miller comments (p. 459): "*The eleventh sort rises with a taper stalk six or seven inches high, sending out from the top a few taper branches, which spread out on every side; these are not scaly, like those of the last sort* [i. e. No. 10, a Medusa's Head*], but taper, and garnished at their ends with several small narrow leaves which drop off. This sort hath not yet flowered here, having been but a short time in England*". Whereas Miller designates in the same enumeration *Euphorbia* [No.] *10. Euphorbia (Fructus Pini)* [i. e. *Euphorbia caput-medusae*] and [No.] *12. Euphorbia (Procumbens)* [i. e. *Euphorbia procumbens*] as obviously tuberculate species, he particularly presents *Euphorbia* [No.] *11. Euphorbia (Patula)* as a non-tuberculate ("not scaly") species. All later authors who refer to Miller's description of *Euphorbia patula* but apply this name to any tuberculate species, seem to have missed this point. According to the rules of nomenclature their descriptions cannot be accepted, however, and have to be rejected when it comes to applying the name *Euphorbia patula* Mill. to any such plant. We will discuss several such erroneous

applications below to trace how this misidentification entered into botanical literature and persisted there until today.

In his Synopsis Plantarum Succulentarum (1812) the British botanist, entomologist and gardener A. H. Haworth (1768-1833) introduced as a new species *Dactylanthes patula*, explicitly referring to *Euphorbia patula* as in 1768 described by Miller in the 8th edition of The Gardeners Dictionary. Haworth describes the species as follows, we cite: *"(Spreading) inermis ramis teretibus flagelliformis tuberculis quadragonis. Euphorbia patula. Mill. dict. ed. 8.*", or, translated, "*Spreading, spineless, with long-tapering and supple, transversely almost circular or narrowly cylindrical branches and with 4-angled tubercles. Euphorbia patula Mill. Gard. Dict. ed. 8, no. 11 (1768)*".

Here, for the first time we find the misapplication of the name *Euphorbia patula* to a tuberculate species; also, whereas Miller notifies the branches as "*taper ... not scaly*", Haworth designates them as "*with 4-angled tubercles*"; and moreover, whereas Miller says he has never seen flowers, Haworth notes "*flower ... palmate or rather finger-like*". These discrepancies were already observed by N. E. Brown (1915), A. C. White, R. A. Dyer & B. L. Sloane (1941) and S. Carter (2002), who all doubted the true identity of Miller's *Euphorbia patula*. N. E. Brown (1915) comments: "*Haworth refers this plant to his Dactylanthes patula, but Miller's description does not seem to accord with that plant* [i. e. *D. patula*] *which is a synonym of E. ornithopus Jacq. Can Miller's plant be a small weak form of E. mauritanica Linn. with spreading branches? He describes the branches as not scaly, by which I suppose he means they are not tuberculate, since those of E. Caput-Medusae Linn. are described* [i. e. by Miller] *as scaly*". Consequently, when discussing the tuberculate species *E. ornithopus* Jacq., both N. E. Brown (1915) and A. C. White, R. A. Dyer & B. L. Sloane (1941) consider Haworth's *Dactylanthes patula* its synonym, but they reject Miller's *E. patula* as such. Treating *Euphorbia mauritanica*, A. C. White, R. A. Dyer & B. L. Sloane (1941) state: *"…. one should note the name of E. patula Miller (Gard. Dict. Ed. viii, No. 11.1768). This is an unknown plant, cultivated long ago in the botanic gardens of the Worshipful Company of Apothecaries in Chelsea, London, which may have been a weak form of E. mauritanica (…) whatever this ancient E. patula may have been, it has now wholly vanished and collectors who find the name on their labels or in catalogs should disregard it*".

About 60 years later, in the World Checklist and Bibliography of Euphorbiaceae R. Govaerts, D. G. Frodin & A. Radcliffe-Smith (2000) confirmed *Euphorbia patula* Mill., Gard. Dict. ed. 8, no. 11 (1768) as a valid–species, by accepting Miller's description, no matter how unclear it is. Following this decision, they reduced tuberculate *Euphorbia tridentata* Lam. as one of its synonyms – which clearly is not in accordance with Miller's own description. Still, this notion was maintained by R. Govaerts in the Kew World Checklist of Selected Plant Families in the period 2000 up to mid-2013; and it is up to today upheld in the ITIS Catalogue of Life 2013 Annual Checklist.

Recently P. V. Bruyns (2012) reinstated *Euphorbia tridentata* Lam. as a valid species. According to Bruyns the typification of *E. patula* Mill. is based on herbarium sheet Fol. no. 328 preserved in the Haworth Herbarium, part of the University of Oxford Fielding-Druce Herbarium at Oxford University, Oxford, UK. Bruyns designates this herbarium sheet as neotype for *Euphorbia patula* Mill., because on sheet Fol. 328 Haworth himself has written, beneath the two obviously tuberculate herbarium specimens glued on the sheet, in his own handwriting at first "*Euphorbia elongata, mihi*", next "*Euphorbia procumbens, Mill.*", finally "*Euphorbia patula, Mill.*". Note, that again, it is not Miller who applies this name to a tuberculate species, but a later author – so, here we have the same erroneous application as discussed above.

By the way, in an unknown hand is also written on sheet Fol. 328 "*E. anacantha, Ait*."; furthermore N. E. Brown labelled the sheet as "*Euphorbia ornithopus, Jacq*.".

Next, accepting *Euphorbia patula* Mill. (Miller, 1768) as typified, P. V. Bruyns (2012) reduced *Euphorbia ornithopus* Jacq. as its synonym, with, according to him, *Euphorbia patula* as the earlier name; the name *Dactylanthes patula* (Mill.) Haw., being published later (1812), is also considered a synonym. All doubts about the true identity of *Euphorbia patula* Mill., as mentioned above by N. E. Brown (1915), A. C. White, R. A. Dyer & B. L. Sloane (1941) and S. Carter (2002), are dismissed by Bruyns (2012) as erroneous, because, he says, Haworth in 1812 published his *Dactylanthes patula* merely as a new combination for *Euphorbia patula* Mill.

However, establishing a new combination or name at a new rank based on a legitimate, previously published name, which, as its basionym provides the final epithet (cf. ICBN Art. 6.10 in McNeill et al.), all depends whether identical species are concerned – and this is exactly what we deny.

Even today *E. patula* Mill. is recorded in the Kew World Checklist of Selected Plant Families (Govaerts, mid-2013 sqq.) with *Euphorbia ornithopus* Jacq. reduced to one of its synonyms, the latter statement–unjustified in our opinion. It is worth mentioning that anno 2014 the Kew Herbarium Catalogue and Electronic Plant Information Centre both refer to herbarium sheet K000253271 for *E. patula* Mill., noting "*collector Lamarck, South Africa*" (sic!); however, this sheet is only referring to the drawing made by J. Hutchinson in 1913 for N. E. Brown's Flora Capensis by portraying by hand Lamarck's herbarium specimen of Euphorbia tridentata at P-LAM, so here again there is a misinterpretation.

Nevertheless, in a recent molecular phylogeny and classification of *Euphorbi*a subg. *Athymalus* (Peirson et al., 2013), the according to Miller explicitly non-tuberculate species *Euphorbia patula* is incorporated in the subsection *Dactylanthes* (Haw.) Pax & K.Hoffm. which comprises succulents with tuberculate stems and branches.

There is one last argument to be discussed: what might Miller's "*Euphorbia* [No.] *11. Euphorbia (Patula)*" ever has been? Is there any herbarium specimen preserved, or if not, perhaps a drawing from Miller's hand to serve as nomenclatural type if no original material is extant? Already for over a decade Miller must have cultivated the plant, for in the former, 7th folio edition of The Gardeners Dictionary (1759) he commented about this particular Euphorbia in exactly the same words as he later used in the 8th edition of The Gardeners Dictionary (1768). Miller did not give references for the species, whereas he usually did so concerning other *Euphorbia* species he described. Because Miller says: "*This sort hath not yet flowered here*", it means that for over a decade he did not see any flowers; therefore it remains quite uncertain which particular plant he really cultivated in the Chelsea Physic Garden.

Miller's diagnostic term "*patulus*", or, "*outspread*", pertains to more than one species with a dwarf habit; the characteristic is not exclusively distinctive for this species. So we considered it important to investigate whether a herbarium specimen of *E. patula* has been preserved, serving as the type. Three years after his death in 1774, Miller's herbarium collection was purchased by Sir Joseph Banks and afterwards donated to the British Museum, London; today, all the former Chelsea Physic Garden herbarium specimens, assembled by Philip Miller, are housed in the General Herbarium of the Natural History Museum, BM, in London. At our request and directions Mr John Hunnex, Herbarium Technician of the General Herbarium, thoroughly scrutinized the herbarium for all Chelsea Physic Garden specimens that can be identified as Miller's. Nine specimens are listed as

Euphorbia species from Miller's original herbarium, all herbaceous: *Euphorbia amygdaloides*, *E. cotinifolia*, *E. heterophylla*, *E. hyberna*, *E. hyssopifolia*, *E. myrsinites*, *E. segetalis* (two sheets) and *E. thymifolia*. Alas! No other specimen is marked "*Euphorbia* [No.] *11. Euphorbia (Patula)*" or, most importantly, no other specimen could be retrieved bearing specifically on a sheet a description matching or near to the relevant description enumerated in The Gardeners Dictionary of 1768.

There are also herbarium specimens from Miller's Chelsea Physic Garden in the Sloane Herbarium at the BM; inspecting an annotated list compiled by J. E. Dandy (1958) it turns out that only specimens that were cultivated by Miller during the years 1727-1739 have been preserved, which is also 2-3 decades before he published a newly acquired plant like one *Euphorbia patula*.

Regarding drawings by Miller's hand, during the years 1755 to 1760 inclusive, he monthly issued hand-coloured plant engravings, all concerning the Chelsea Physic Garden; at last in 1760 all 300 plant portraits were collectively published in a 2-volumed folio edition. We inspected in Teylers Museum, Haarlem, the Netherlands, both volumes but no "*Euphorbia [No.] 11. Euphorbia (Patula)*" proved to be portrayed.

In conclusion, as said above, when describing the tuberculate *Dactylanthes patula*, the reference made by Haworth (1812) to the non-tuberculate species Euphorbia patula of Miller (1768) must be a serious misinterpretation; the same misidentification was made by Haworth when labelling the two tuberculate specimens on herbarium sheet Fol. 328 with the name "*Euphorbia patula, Mill*.", which, in fact according to Miller, is an explicitly non-tuberculate species. However, even in his time, misinterpretations made by Haworth were not unknown.

In 1814 Haworth sold his whole collection of succulent plants (to which *Dactylanthes patula* belonged), starting again to assemble a new collection of succulents in 1821. Because Haworth's herbarium sheet Fol. 328 is not provided with any date, we are not sure whether it was made before 1814 or after 1821. Nevertheless, when naming his herbarium specimens, with most assumedly his own former publications still at hand, he must have kept on by thoughtlessly applying labels that we now consider erroneously phrased. From Haworth's biography we learn that even in his own time Haworth was seriously criticized for incorrect taxonomical identifications particularly regarding his Synopsis Plantarum Succulentarum, for according to Boulger (1891) and Stearn (1965) "*the validity of his taxonomic procedures was open to criticism*".

Therefore, the typification made by P. V. Bruyns (2012) concerning *Euphorbia patula* Mill. by designating Haworth's herbarium sheet Fol. 328 as neotype, has to be considered unjustified for being faulty, as well as the reduction of *Euphorbia ornithopus* Jacq. to its synonym to be rejected. Studying Miller's description of *Euphorbia patula*, also some important drawbacks in the protologue become clear, for neither a type, illustration, reference, synonym, citation or quote of affiliated specimens is mentioned, nor any geographical and collection data. Designating *Euphorbia tridentata* Lam. as a synonym of the species *Euphorbia patula* Mill. as done in the past decade by Govaerts et al. (2000), by Govaerts in the Kew World Checklist (2000 to mid-2013), later on *Euphorbia ornithopus* Jacq. as a synonym of *Euphorbia patula* Mill. by Bruyns (2012) and again by Govaerts in the Kew World Checklist (mid-2013 sqq.), has to be rejected not only on account of the drawbacks in the protologue, but more so on account of an early, erroneous identification made by Haworth (1812) that unjustifiably-lives on until today, leading to an erroneous nomenclature.

So, weakening the alleged identity of *Euphorbia patula* Mill. by the arguments given above, for the time being we re-establish its "true" identity as a remaining mystery, as Susan Carter (2002) already supposed.

By the way, as said before, in our opinion N. E. Brown had quite right when he identified the two tuberculate herbarium specimens on Fol. no. 328 from Haworth's Herbarium (Fig. 23) as *Euphorbia ornithopus* Jacq., this species currently to be renamed *Euphorbia tridentata* (Lam.) var. *ornithopus* (Jacq.) van Veldhuisen & Lawant comb. & stat. nov. (see section 2.50.2). Herewith we reiterate Brown's statement.

Chapter 3. Observations from the field and from cultivation.

3.1. Introduction.

The second author (RvV) researched the known localities of the species *Euphorbia tridentata*, *Euphorbia ornithopus* and their affiliates within the section *Dactylanthes* for a considerable number of times. Here are his field notes and observations.

3.2. Meeting a problem.

When we, the second author (RvV) and his travel companion Jaap Keijzer, prepared for our first trip to South Africa, we received from Mrs Daphne Pritchard, founder of the Euphorbiaceae Study Group and Vice-President of the International Euphorbia Society, a message about the locality of a *Euphorbia* species growing south of Cradock, which she for the time being labelled "*Euphorbia* sp. aff. *polycephala*". The challenge of finding something new seemed to be worthwhile enough to visit the designated area. Without any difficulty, on November 2, 1999, we indeed discovered this plant on two different localities (collection nr. J&R108 and coll. nr. J&R110). Afterwards, collected seeds proved to be of easy cultivation; it turned out that this *Euphorbia* species seemed rather similar to the plants we already cultivated as *Euphorbia tridentata* Lam. Although at first the newly found species was labelled *Euphorbia* sp. aff. *polycephala*, without any hesitation we considered that equally well it could provisionally be named *Euphorbia* sp. aff. *tridentata*.

In 2003, four years later, we found on a fourth trip to South Africa in the vicinity of Riversdale *Euphorbia* plants of which we at first were very puzzled about their identity, but soon we realized that they could be related to *Euphorbia tridentata* Lam. (coll. nr. J&R374). The plants seemed to differ considerably from the plants we once found south of Cradock. Their habitat also proved to be different, because they were growing in deep shade under dense shrubs, moreover, the habitat locality was more than 500 km to the west of the locality mentioned above. These "Riversdale" *Euphorbia* species also possessed a much sturdier habit, having a thick tuberous root. In cultivation, germinated seeds grew very slowly and it took quite a few years before the plants flowered. Our surprise was no less, when they produced large, white, saucer-shaped cyathia. Initially we considered them identical to *Euphorbia* plants we cultivated by the name *E. wilmaniae* Marloth. But on November 14, 2006 we, the second author (RvV) accompanied by Alma Moller, Rolf Becker and Jaap Keijzer, succeeded in finding some true *Euphorbia wilmaniae* plants at a location west of Griekwastad / Griquatown (coll. nr. J&R421). In nature *Euphorbia wilmaniae* Marloth proves to be a distinctly different plant compared to the plants we nurse in cultivation by the name *Euphorbia wilmaniae* as well as compared to the plants we found near Riversdale. In habitat it is a much smaller plant, and showed thin, pronouncedly tuberculate stems. So, after a profound study, we concluded that the plants we found near Riversdale as well as the plants we cultivated by the name *Euphorbia wilmaniae* must in fact belong to *Euphorbia tridentata* Lam.

Now having identified both *Euphorbia wilmaniae* Marloth and *Euphorbia tridentata* Lam., the question that was left was: what is the true identity of the *Euphorbia* plants which we found south of Cradock on our trip in 1999?

3.3. The Cradock plants.

Let us return to the habitat of the *Euphorbia* species growing south of Cradock, to which at first was identified and labelled *Euphorbia* sp. aff. *polycephala*, according to the data provided by Mrs Daphne Pritchard. As said, the plants are easily found well south of Cradock, especially south-west of Mortimer. They are very small plants with stems about 1 cm in length and in diameter, growing abundantly in flat farmland with little other vegetation, mostly between rocks and/or sheltered by

some other plants, sometimes even in the very open with no protection at all. At this locality few succulents may be found, for instance some *Mesembryanthemum* species, a cluster of *Aloe saponaria* Haw. and plants of *Euphorbia micracantha* Boiss. fully covered with beautiful dark-red cyathia. At that time, some of our plants were flowering, but the flowers proved to be rather inconspicuous. In cultivation seedlings adapted well and in the course of the following years they grew into nice plants which, although remaining quite small, flowered reliably.

On the same occasion, travelling from Mortimer to Cradock, we found beyond Mortimer the same species on the western slope of a stony hill south of Cradock, the hill covered with large, appealing plants of *Aloe ferox* Mill. Again we found the plants very easily as they were growing here in immense numbers, accompanied by *Euphorbia micracantha* Boiss. Compared to cultivated seedlings of the plants from the Mortimer locality, in cultivation seedlings of the Cradock plants grew into large clusters with somewhat stouter stems, pronouncedly tuberculate, but they tended to flower less frequently. Nevertheless, comparing the flowering habit and the shape of the cyathia, we could not ascertain any difference between the plants from the first or from the other mentioned locality.

In February 2012, on another trip we found a *Euphorbia* species which we provisionally labelled *Euphorbia* sp. aff. *tridentata* (coll. nr. J&R561). These plants grew south of Cookhouse, well over 60 km to the south of the locality of the Cradock plants. Plants were growing sheltered between rocks and between clumps of grasses, conspicuously less exposed to direct sunlight compared with the species we discovered before at other localities (e. g. coll. nr. J&R108 and coll. nr. J&R110). At this newly found shadowy locality, the plants displayed features similar to what they do so easily in cultivation, namely producing elongated, almost etiolated stems and, in flower, having long peduncles. Nevertheless, exposed to direct sunlight, the plants maintained a globose habit. Apart from these ecological adaptations, no other differences regarding the characteristic features of these plants were observed compared with the ones from the Cradock locality. This locality increases the natural habitat of our plant well to the south; it is not a wild guess that the natural habitat of this plant is considerably larger as understood up to now, probably because of its inconspicuous habit and possibly because it is not known as a different species, compared with e. g. *Euphorbia tridentata* Lam. or *Euphorbia ornithopus* Jacq. However, raised from seed, the longer we had these plants in cultivation the more striking features could be noticed. We summarize these observations as follows:

(1) Regarding its habit this plant is relatively small, smaller than other related species like *Euphorbia tridentata*, *E. ornithopus*, *E. globosa* or *E. polycephala*. In cultivation the branches tend to elongate, although a short, round, basal stem remains; when elongating the stems are not tapering, producing from time to time constrictions, the joints oval, thickened in the middle. Irregular rebranching also happens frequently; the small leaves on top of fresh growth are rather long-lived, but become deciduous in the dry season; grown in bright sunlight the stems easily get a purple tinge.

(2) At first flowers are borne sessile at the end of the stems, soon accompanied by one or more rather long-peduncled cymose inflorescences. The sessile or nearly sessile central cyathium of the cyme is bisexual, provided with five glands; the lateral cyathia of the cyme are also bisexual, possessing four to five glands. The outward shape of the glands is highly variable, sometimes having two teeth but more frequently showing three teeth; on some plants the teeth are forked, often more than once. Sometimes only a single sessile flower is produced; sometimes a cyme is shown without a central, sessile flower, this one maybe already soon become overblown and aborted. A

cyme may consist of two, three, four or even five flowers, whereas the pedicels may not be of equal length.

(3) Besides the mainly green colour of the glands, the hood or bonnet, folded over the base of the gland, shows a pure white colour. This striking feature gives the whole cyathium a special appearance. All glands are pointing upwards, giving the whole flower the shape of a cup. By the way, this habit is also shared with *Euphorbia globosa* Sims.

At first provisionally named *Euphorbia* sp. aff. *tridentata*, currently the species is labelled *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. (see section 2.50.1; also published in Pj. Lawant & R. van Veldhuisen, 2014).

Fig. 26. A flowering plant of *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., coll. nr. J&R108, growing without any shade protection.

Fig. 27. A fruiting plant of *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., coll. nr. J&R108, from the same locality.

Fig. 28. A young stem of *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., coll. nr. J&R108, emerging from a stolon and showing its tuberculate stem with rather large, long-lived leaves.

Fig. 29. This cultivated plant of *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., coll. nr. J&R108, shows the elongated growth habit, normal in cultivation, with irregular rebranching. The bisexual central flower of the cyme has five glands with greenish-marbled, twofold to threefold forked teeth.

Fig. 30. Close-up of the central flower of *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., coll. nr. J&R108.

Fig. 31. Whereas the first-flowering central cyathium of *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., coll. nr. J&R108, becomes overblown, a cyme of three flowers is produced on relatively long pedicels. Some glands of this particular specimen start to produce twofold forked teeth.

Fig. 32. The erect pointing of the glands gives the whole cyathium of *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., coll. nr. J&R108, the shape of a cup. Note the greenish-marbled teeth.

Fig. 33. The development of a young, central cyathium of *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., coll. nr. J&R110, can be seen on the main stem in the centre of the picture.

Fig. 34. South of Cradock on a stony, west-facing hillside *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., coll. nr. J&R110, grows in the very open. Note the spherical growth form and the quite pronounced tubercles.

Fig. 35. *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., coll. nr. J&R110, pictured from the side, showing the low spreading habit.

Fig. 36. *Euphorbia* coll. nr. J&R561 south of Cookhouse. Note the tiny spherical stolons popping up everywhere between the stones. In this phase it is not yet possible to tell to which species it will belong: *Euphorbia tridentata* or our new *Euphorbia leachii* Lawant & van Veldhuisen sp. nov.? However, see Fig. 37!

Fig. 37. Not until seen in flower can one correctly recognize coll. nr. J&R561 to be the new *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. by the cup-shaped cyathium with the greenish-white marbled teeth on the glands.

Fig. 38. In nature the cyme of *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., coll. nr. J&R561, is sometimes produced on very long dichasial branched peduncles, as pictured here, bearing fruits.

Fig. 39. Growing in shaded conditions the stems of *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., coll. nr. J&R561, become much longer, completely losing their spherical habit. Often only one single flower is produced on a long peduncle.

Fig. 40. Sometimes *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., coll. nr. J&R561 spreads by dense patches of tiny heads.

Fig. 41. On behalf of the Euphorbia Planetary Biodiversity Inventory (PBI), an international collaborative project to research all possible information on the genus *Euphorbia*, the South-African botanists Rolf Becker and Alma Moller regularly conducted intensive field work. In recent years they found at the roadside of the N10 just south of Cradock *Euphorbia* species which they initially labelled as *Euphorbia ornithopus* Jacq. (coll. nr. RBAM1326), but currently named it *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. At this particular locality the plants grow on large boulders which form a wall due to past road construction activities. Plants show a very lush growth, as in cultivation, forming dense patches with long trailing thin stems.

Fig. 42. Collection nr. RBAM1326, designated as holotype of *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. at UNIN (isotype at PRE), originally found by R. Becker & A. Moller along the Great Fish River, SE of Cradock, on 5th Jan. 2009 and retrieved again by the second author (RvV).

3.4. The Springbokvlakte plants.

During another trip to South Africa, on November 19, 2001, coincidentally we were looking for the yellow pollen form of *Euphorbia albipollinifera* L.C.Leach on the Springbokvlakte, east of Steytler-ville, but in vain. However, we detected a lot of miniature succulents, like *Lithops localis*

(N.E.Br.) Schwantes by the thousands, *Aloinopsis schooneesii* L.Bolus, *Adromischus bicolor* Hutchinson, *Aloe longistyla* Baker and *Astroloba foliolosa* (Haw.) Uitewaal. Also several species of *Euphorbia* were growing here: *Euphorbia esculenta* Marloth, *Euphorbia ferox* Marloth in large numbers, *Euphorbia stellata* Willd. in miniature form and probably a hybrid of *Euphorbia heptagona* L. But, by a stroke of luck, our eyes were cast on only one single *Euphorbia* specimen, in vain we searched for other specimens.

Cultivated from collected seed, the species designated coll. nr. J&R223, proved to be closely related to the plants we had found two years earlier south of Cradock, although differing from these plants in some characteristics. For instance, the branches remained smaller, the tubercles rather flattened with quite persistent leaves, the stems strikingly blue tinged and even more quickly turning purple in sunny conditions. Furthermore, on the cyathium five upward pointed glands were produced, mostly bearing three (sometimes two) teeth, remarkably greenish-yellow tinged with some brown and green tinge. Nevertheless, we assumed it to be very closely related to our new *Euphorbia leachii* Lawant & van Veldhuisen sp. nov.

Fig. 43. The cyathium of coll. nr. J&R 223 is recognizable by its greenish-yellow coloured upward pointed glands.

Fig. 44. This cup-shaped cyathium of coll. nr. J&R223 bears five two-toothed greenish-yellow coloured, erect pointed glands. Considered closely related to *Euphorbia leachii* Lawant & van Veldhuisen sp. nov.

Fig. 45. The cyathium of coll. nr. J&R223 shows the typical cup-shaped appearance. Plant considered closely related to Euphorbia *leachii* Lawant & van Veldhuisen sp. nov.

3.5. The Calitzdorp plants.

In 2004, the second author (RvV) received some habitat pictures, which were taken by the South African photographer Maddy Lehmann in the vicinity of Calitzdorp. These pictures went for some years unnoticed, but they were remembered when he stumbled upon some hand-written notes that the late botanist L. C. Leach (1909-1996) compiled about a yet undescribed species, coll. nr. LCL16826, from inside the Karoo National Park, near Beaufort West. No wonder, because on closer inspection the plants on the pictures photographed by Maddy Lehmann looked very similar to the drawings which Leach made when studying the Beaufort West plants (see section 3.6.).

As can be seen in the pictures (Fig. 46, Fig. 47) the branch-like stems are not globular and the tubercles are very pronounced; the architectural habit of the plant differs from what can be found regarding the Cradock and the Springbokvlakte plants. Although the flowers of these plants in general seem to resemble those of the plants found south of Cradock, yet remarkable specific differences may be noticed, particularly the almost horizontally spreading glands with quite thin processes covered with pure white "sculptured" pustules on top of them. For these reasons, these plants possibly may be a variety of *Euphorbia tridentata* Lam.

Fig. 46. Pictured near Calitzdorp, this young *Euphorbia* specimen may represent a variety of *Euphorbia tridentata*. Photo courtesy of Maddy Lehmann.

Fig. 47. The same species as pictured before in fruiting stage. Photo courtesy of Maddy Lehmann.

The observations mentioned above greatly aroused our curiosity. Therefore, regarding the trip that we, the second author (RvV) accompanied by Leo van der Hoeven, Jaap Keijzer and Bob Potter, planned for February 2012, a search for it became highly annotated on our priority list. However, where to spot it?

Luckily enough there was one picture of Maddy Lehmann showing the *Euphorbia* growing together with *Haworthia truncata* var. *maughanii* (Poelln.) Halda. This variety of *Haworthia truncata* is extremely rare in nature and only a few localities are known to exist. Because these

localities are kept secret and are guarded by local people too, in fact it took quite a lot of searching to pinpoint the exact locality of the *Euphorbia* which Maddy Lehmann had once pictured. But ultimately it proved to be rather easy to spot the *Euphorbia* plants as they were growing on the locality at large numbers, albeit in a relatively small area, but indeed accompanied by *Haworthia truncata* var. *maughanii.* In addition, *Haworthia truncata* Schönland var. *truncata* was well represented, because both *Haworthia* varieties were growing right next to one another. By the way, in the recent past this locality was regularly visited by large numbers of succulent enthusiasts, arriving by numerous coaches during field excursions organized by the Succulent Society of South Africa at the occasion of its congresses. It is amazing that all these visitors never noticed before this small, unique *Euphorbia* plant as a possible variety of *Euphorbia tridentata* Lam. Or, is it just another example how poorly understood this group of species is?

We were able to observe some striking features of this small *Euphorbia*, coll. nr. J&R564. At first prematurely considered another specimen of *Euphorbia wilmaniae* Marloth, namely just as small, forming short stems with large tubercles, popping up from between stones and sheltering plants. This species is said to spread under soil level from stolons. Regarding coll. nr. J&R564 we could not find any original mother plant with a caudex-like rootstock as we observed when studying *Euphorbia wilmaniae*. Compared to *Euphorbia wilmaniae* the tubercles show the same appearance, but they are less pronounced and less closely fitting together. The stems of this minute *Euphorbia* from the Calitzdorp locality proved mostly to have four ribs, whereas the five ribs of *Euphorbia wilmaniae* are hard to distinguish. Compared with *Euphorbia wilmaniae*, some other remarkable features of the Calitzdorp plants may be observed: they are rebranching above soil level, the leaves are relatively large and long-lived, the cyathia remain relatively small and the almost horizontally spreading glands have quite thin teeth with white “encrusted” pustules on the upper side. All together, the flowers are the smallest ones of the whole group of related species of the section *Dactylanthes* Haw. So we tend to consider this *Euphorbia* coll. nr. J&R564 a variety of *Euphorbia tridentata* Lam., but in future more research is surely needed.

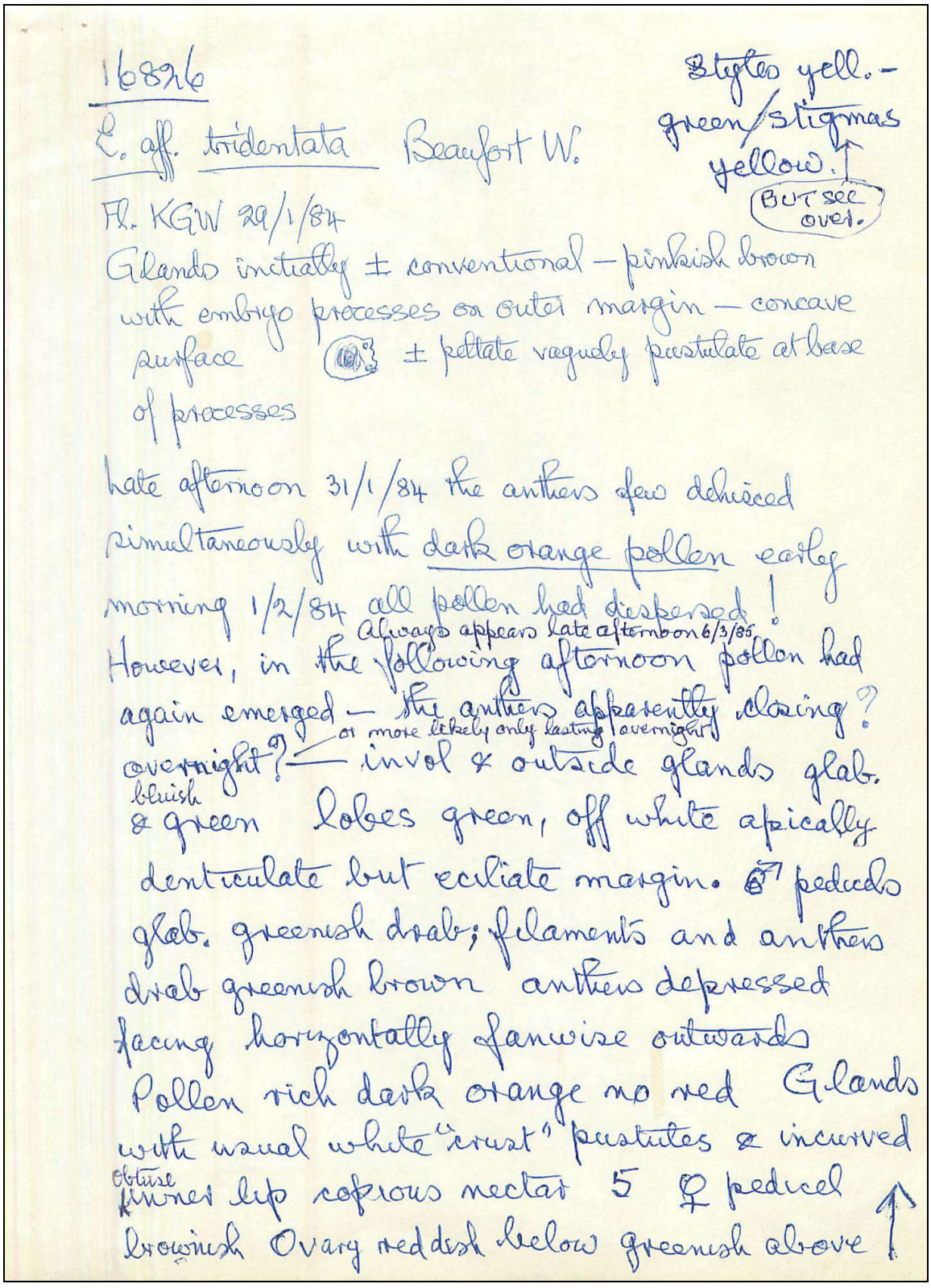
Fig. 48. *Haworthia truncata* Schönland var. *truncata*, *Haworthia truncata* var. *maughanii* (Poelln.) Halda, *Crassula tecta* Thunb. and in the background *Euphorbia* coll. nr. J&R564, all growing happily together at the Calitzdorp locality. Coll. nr. J&R564 may possibly be a variety of *Euphorbia tridentata* Lam. Photo Leo van der Hoeven.

Fig. 49. Two stems of *Euphorbia* coll. nr. J&R564 from the Calitzdorp locality, showing their normal branching growth habit with heavily tuberculate and widely spaced 4-ribbed stems. Possibly another variety of *Euphorbia tridentata* Lam.

Fig. 50. Flowering plant of *Euphorbia* coll. nr. J&R564, possibly a variety of *Euphorbia tridentata*.

3.6. The Beaufort West plants.

Comparing the photographs of the *Euphorbia* plants that Maddy Lehmann took near Calitzdorp and the drawings and notes made by L. C. Leach about a *Euphorbia* plant he designated by his coll. nr. LCL 16826, found near Beaufort West, the resemblance is striking. Leach studied this species on several occasions (1984, 1985 and 1988), initially labelling it *Euphorbia* aff. *tridentata*, later on designating the name *Euphorbia branchii*, honouring W. R. Branch who found them in the Karoo National Park. But the name Leach never validated; the reason why he did not, we do not know. On our recent (2012) plant-hunting trip we hoped to discover the plants which Leach labelled *Euphorbia branchii*, at their habitat inside the Karoo National Park near Beaufort West. Alas! We were unable to search that particular area for this interesting plant, because we were not allowed to get out of the car, for doing so without being guarded by rangers could turn out very dangerous because of wild animals chasing around. Thanks to Rolf Becker and Alma Moller, who in the past years digitized the complete Leach legacy, particularly his hand-written notebooks and field notes, drawings and photographs, today Leach's observations from the field have become accessible to the public (Becker & Moller, 2010). It seems therefore appropriate to reproduce here the drawings and notes that Leach made about his observations of coll. nr. LCL16826 from Beaufort West, at its habitat located inside the Karoo National Park. The first two pages from his field notes about the species refer to observations made in 1984 and 1985, the next two concern the year 1988 (Figs 51a - 51d).


16826

E. aff. tridentata Beaufort W.

Stigtes yell.-green/stigmas yellow. ↑ BUT see over.

Fl. KGW 29/1/84

Glands initially ± conventional – pinkish brown with embryo processes on outer margin – concave surface ± pettate vaguely pustulate at base of processes

late afternoon 31/1/84 the anthers few dehisced simultaneously with dark orange pollen early morning 1/2/84 all pollen had dispersed! Always appears late afternoon 6/3/85. However, in the following afternoon pollen had again emerged – the anthers apparently closing overnight? – or more likely only lasting overnight — invol & outside glands glab. bluish & green lobes green, off white apically denticulate but ecliate margin. ♂ peduncle glab. greenish drab; filaments and anthers drab greenish brown anthers depressed facing horizontally fanwise outwards Pollen rich dark orange no red Glands with usual white "crust" pustules & incurved obtuse thinner lip copious nectar 5 ♀ peduncle brownish Ovary reddish below greenish above ↑

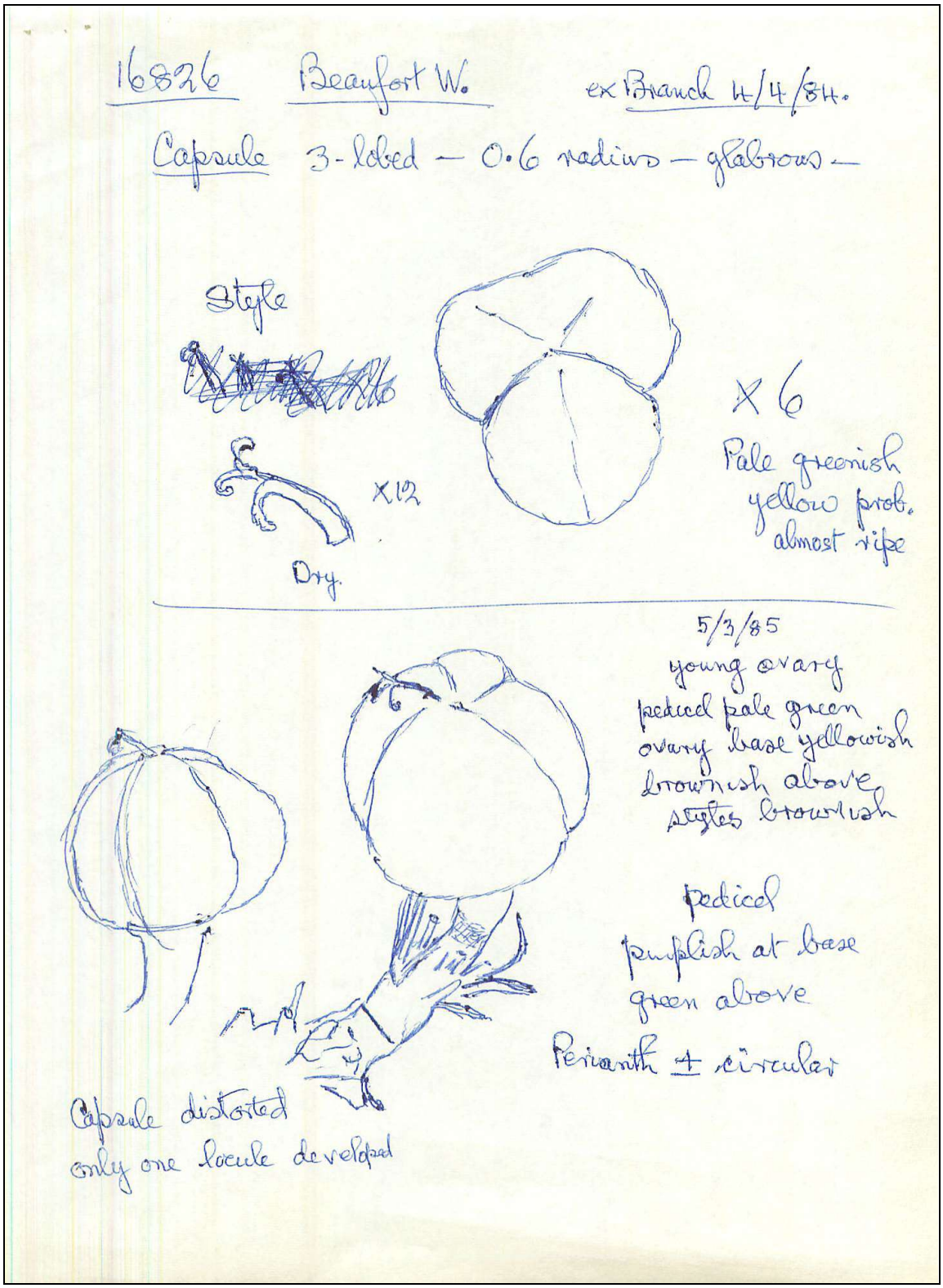


Fig. 51b. Drawings made by L. C. Leach picturing style and capsule of coll. nr. LCL16826, provisionally naming it *Euphorbia branchii.*

16826 E. branchii Beaufort W. 6/12/88

Peduncle brownish to green prominent tubercle teeth cf. E. pedemontana leaves blue-green glab. narrow pinkish margin. caducous Involucre & underside of glands and processes slightly glossy glab. blue-green Glands & processes suberect pale blue green numerous white pustules on processes closely infolded upper lip obtuse to subobtuse greenish white — cavity pale green inside pustules pale green in hollows holes irreg. small toothed apex ecilate ♂ pedicels glab. off white green; filaments brownish anthers grey green darks purple lipped pollen deep dark orange bracteoles filamentose hand hairy glab. Anthers young orange cell vermilion lipped Ovary: pedicel glab. pale grn. Ovary pale dull orange glab

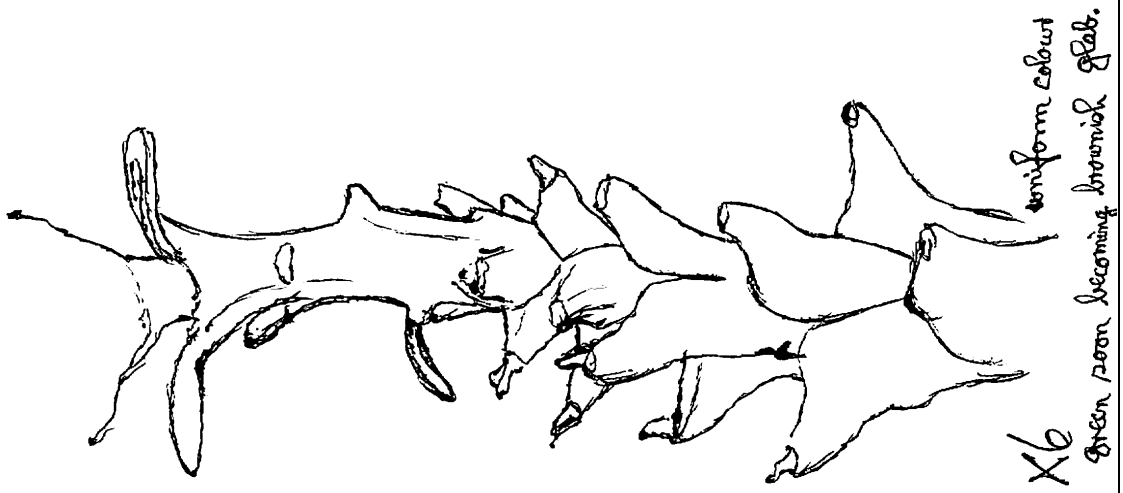


Fig. 51c. Field note by L. C. Leach about coll. nr. LCL16826 from Beaufort West, provisionally named by Leach *Euphorbia branchii*, dated 6th Dec. 1988.

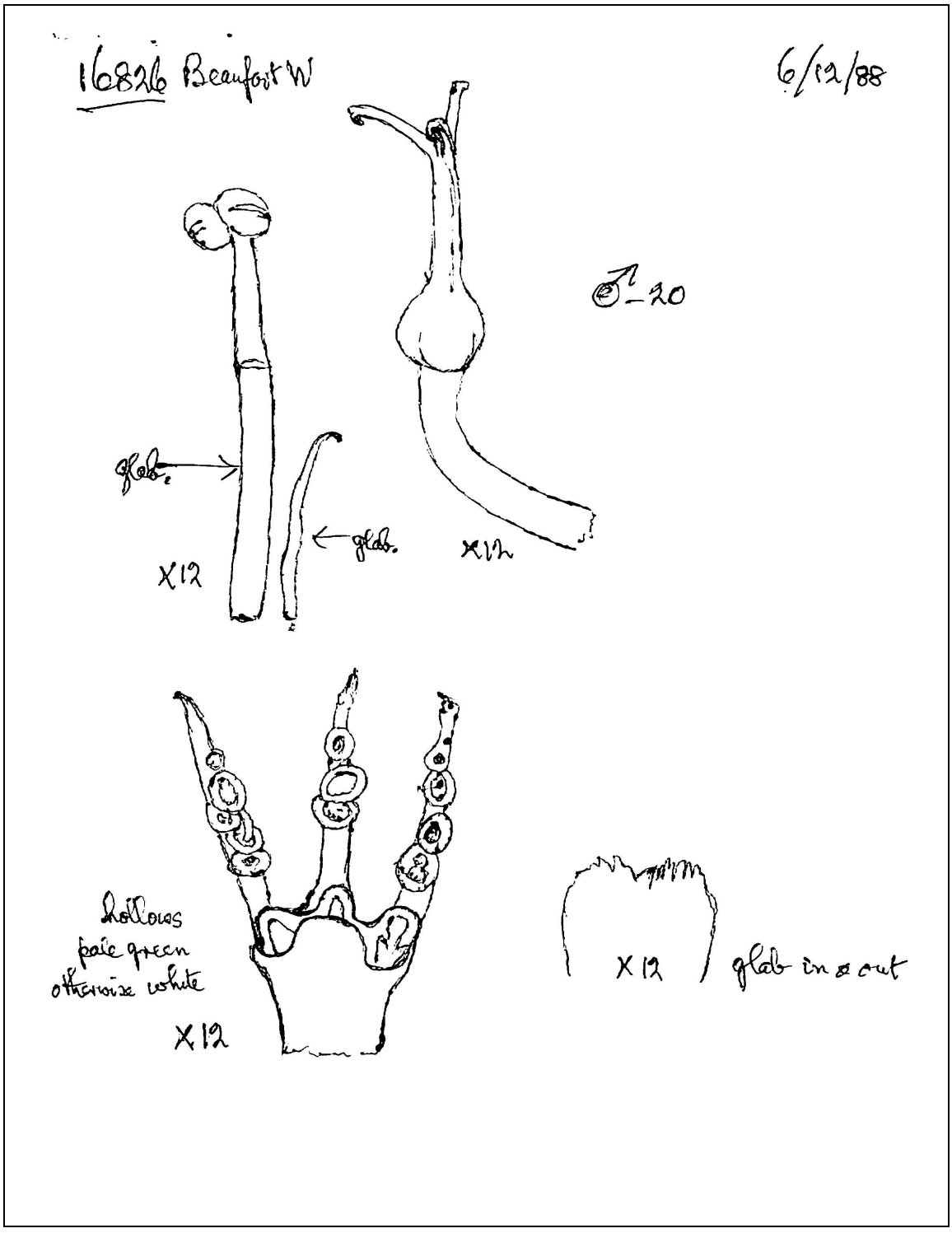


Fig. 51d. Drawings made by L. C. Leach showing stamen, style, gland and lobe of coll. nr. LCL16826, dated 6th Dec. 1988.

Note. Only future research may reveal to what extent "*Euphorbia branchii* nom. nud." is related to the species of our interest as discussed in this monograph.

3.7. The Riversdale plants.

On the occasion of another trip to South Africa we, the second author (RvV), accompanied by his travel companion Jaap Keijzer, on November 16, 2003 investigated a densely overgrown hillside east of Riversdale.

In the shade of bushes we found numerous plants of *Haworthia magnifica* Poelln., some *Euphorbia ecklonii* (Klotzsch & Garcke) A. Hässl but also a bright green *Euphorbia* with a large tuberous root and in all parts quite a large plant body. It was indeed so much different that at first we were puzzled about the identity of the plant; but bearing in mind the plants we found south of Cradock, we soon were convinced we had found *Euphorbia tridentata* Lam. (coll. nr. J&R374).

Fig. 52. Growing east of Riversdale in humus-rich soil *Euphorbia tridentata* Lam., coll. nr. J&R374, is surrounded by *Haworthia magnifica* plants.

In cultivation, some germinated seeds grew very well, but rather slowly. Even when grown in full sunlight directly under glass, they retained their bright green colour. Although producing elongated branches, nice spherical branches were also made. The characteristic features of the plant coll. nr. J&R374 are listed as follows:

(1) The bright green branches are well over one cm in diameter and considerably tuberculate; new leaves are spatula-shaped and relatively large.

(2) Remarkably thick stems and tuberous roots are produced.

(3) The cyathia are quite large, up to 1.5 cm in diameter and shaped like a flat saucer; they mostly possess 4 glands, but even 5 glands can be observed on one and the same plant.

(4) The glands are provided with 3 to 4 large teeth, varying in number, even on one and the same cyathium, they are strikingly white coloured; the white coloured glands appear in beautiful contrast compared to the purple colour of the central parts of the cyathium.

(5) The peduncles of the flowers are rather thick and stiff, sometimes rebranching; the length of the peduncles may vary.

Fig. 53. A bisexual cyathium of *Euphorbia tridentata* Lam., coll. nr. J&R374, as frequently found in the Riversdale population with four glands.

Fig. 54. A five-glanded cyathium of *Euphorbia tridentata* Lam., coll. nr. J&R374, in a very young state before the male flowers emerge, with glands not yet fully developed.

Soon we realized that the plants we found growing near Riversdale must be *Euphorbia tridentata* Lam., by being quite different when compared with the plants we found south of Cradock four years earlier. However, the flowers of our "Riversdale" *Euphorbia tridentata* proved to be a good match with the flowers of the species we are cultivating by the name *Euphorbia wilmaniae* Marloth. Whereas in fact *Euphorbia wilmaniae* has its habitat about 700 km to the north, namely in Griqualand West, in the wild state it bears only solitary cyathia without peduncles (White, Dyer & Sloane, 1941; Carter, 2002). But in cultivation plants commonly labelled *Euphorbia wilmaniae* have flowers which are not only sessile but occasionally sit on rather short, straight peduncles; these species also may develop cymose inflorescences. Comparing the "Riversdale" *Euphorbia tridentata*

plants with the cultivated so-called *Euphorbia wilmaniae* specimens, all features match perfectly. Because of these observations, we are convinced that a lot of plants which are in cultivation labelled "*Euphorbia wilmaniae*" are in fact *Euphorbia tridentata* species.

Fig. 55. The cyathium of a cultivated, incorrectly labelled "*Euphorbia wilmaniae*", is fully identical with the cyathium of coll. nr. J&R 374, *Euphorbia tridentata* Lam., cf. Fig. 53 and Fig. 54.

Fig. 56. In cultivation labelled "*Euphorbia wilmaniae*", but in fact it should correctly be identified as *Euphorbia tridentata*. This plant shows a young cyme in progress with a central, bisexual, five-glanded cyathium on short peduncles.

Fig. 57. A few weeks later the same cyme as pictured in Fig. 56 shows that the central flower is nearly aborted, the lateral bisexual, four-glanded cyathia have formed on peduncles, which are - in contrast with *Euphorbia ornithopus* - relatively short.

3.8. The Alicedale plants.

In 2001 we found on a north-facing slope east of Alicedale, some 50 km west of Grahamstown in the Eastern Cape, a spot extremely rich in succulents; species like *Pachypodium succulentum* (Jacq.) Sweet, *Pachypodium bispinosum* A.DC., *Faucaria hooleae* L.Bolus, *Gasteria bicolor* Haw. and *Aloe striata* Haw. were easily found. No less than eight *Euphorbia* species and three different hybrids were observed at this locality, namely *Euphorbia fimbriata* Scop. (according to Bruyns, 2012, to be included as synonym of *Euphorbia mammillaris* L.), *Euphorbia caterviflora* N.E.Br. (according to Bruyns, 2012, to be included as synonym of *Euphorbia rhombifolia* Boiss.), *Euphorbia ledienii* A.Berger (according to Bruyns, 2012, to be included as synonym of *Euphorbia caerulescens* Haw.), *Euphorbia mauritanica* L., *Euphorbia pentagona* Haw., *Euphorbia polygona* Haw., *Euphorbia squarrosa* Haw. (according to Bruyns, 2012, to be included as synonym of *Euphorbia stellata* Willd.) and *Euphorbia tridentata* Lam. One of the hybrids seemed to have *Euphorbia ledienii* and *Euphorbia squarrosa* as parents; the other two hybrids most likely had *Euphorbia polygona and Euphorbia fimbriata* as parents involved. At this spot *Euphorbia tridentata* Lam. grew abundantly under the protection of stones and bushes in an otherwise open vegetation. Plants were mostly found growing in clumps, but also stolons popped up above soil level as single heads. In a more shaded position branches became elongated, but not as much as in cultivation. In all parts, including the size of the flowers, these plants looked smaller compared to

the ones we had earlier seen near Riversdale. This finding confirms the previous records of *Euphorbia tridentata* growing in the Grahamstown area.

Fig. 58. A clump of *Euphorbia tridentata* Lam., coll. nr. J&R194, east of Alicedale; note the somewhat elongated growth of the branches in shaded conditions.

Fig. 59. *Euphorbia tridentata*, coll. nr. J&R194, east of Alicedale just popping up above soil level.

Fig. 60. *Euphorbia tridentata* Lam., coll. nr. J&R194, and *Euphorbia squarrosa* Haw. growing side by side.

Fig. 61. *Euphorbia tridentata*, coll. nr. J&R194, emerging from the sandy soil level and about to flower.

Fig. 62. *Euphorbia tridentata*, coll. nr. J&R194 from east of Alicedale, producing a short-pedicelled dichasial cyme. Note the developing saucer-shaped cyathia with whitish-toothed glands.

Fig. 63. Among the population of *Euphorbia tridentata*, coll. nr. J&R194, east of Alicedale, one specimen was found bearing a single flower with twofold to threefold forked teeth on the glands, the teeth appearing greenish-marbled coloured.

In cultivation these *Euphorbia tridentata* species maintain their habit growing in clumps, in all aspects remaining small sized. No particularly sessile flowers were observed; however, perhaps due to the conditions with which European collectors have to cope, once starting to flower the cultivated plants showed either single, bisexual five-glanded cyathia on short 5 mm long peduncles or one or more typical cymes with a central, bisexual five-glanded cyathium and three lateral, bisexual four-glanded flowers.

Fig. 64. A flowering *Euphorbia tridentata*, coll. nr. J&R194, cultivated from seeds collected east of Alicedale. Note that the glands are pure white.

Fig. 65. A developing cyme of *Euphorbia tridentata*, coll. nr. J&R194, in cultivation.

3.9. The Heidelberg plants.

In 2006 the second author (RvV) found *Euphorbia tridentata* plants in the vicinity of Heidelberg, 30 km west of Riversdale. The species is fairly common in the area along the coast, south-east of the Langeberg Mountains, from Heidelberg towards Mosselbay. At the locality near Heidelberg *Euphorbia tridentata* Lam. grows together with *Euphorbia clandestina* Jacq. and *Euphorbia pseudoglobosa* Marloth. Up to now cultivated specimens have not flowered.

Fig. 66. *Euphorbia tridentata*, coll. nr. R&W446, growing near Heidelberg from stolons appearing between pebbles.

3.10. The Hartenbos plants.

Another locality of *Euphorbia tridentata* Lam. can be found near Hartenbos, a small town just north of Mosselbaai. From this habitat seeds were collected by the German *Haworthia* collector and nurseryman Ingo Breuer, who sent cuttings of a cultivated plant (coll. nr. IB13759) to the authors. Upon closer inspection, no difference in vegetative parts was found compared to the plants we found east of Riversdale. However, as soon as the plant started to flower a striking difference could be noticed: only solitary, sessile cyathia were produced, bisexual, all five-glanded, identical to the few five-glanded ones produced by the plants found east of Riversdale (coll. nr. J&R374). Remember that of this latter population the five-glanded cyathia are remarkably outnumbered by four-glanded ones. Nevertheless, we conclude that both localities host the same species.

Fig. 67. A lushly grown *Euphorbia tridentata* Lam. from cuttings received from Ingo Breuer (coll. nr. IB 13759; locality near Hartenbos) with only solitary, sessile cyathia.

Fig. 68. The same plant as in Fig. 67 showing a bisexual cyathium with five glands.

Chapter 4. Field notes made by the late L. C. Leach.

4.1. Introduction.

The South African botanist the late Leslie (Larry) Charles Leach (1909-1996) made numerous field notes about the succulent species he studied, accompanied by meticulously hand-written plant descriptions. All his material, including his notebooks (memorandum books), field notes, drawings, photographs, herbarium species on spirit, plants in culture, etcetera, is today kept in The Leach Archive at the University of Limpopo, Polokwane (previously Pietersburg), South Africa (Becker & Moller, 2010).

Thanks to Rolf Becker and Alma Moller, who digitized the complete Leach legacy, we were able to study Leach's notebooks and field notes pertaining to the species of our interest, namely *Euphorbia tridentata*, *E. ornithopus*, *E. polycephala* and a undescribed species which Leach provisionally named *E. branchii*. In his notebooks Leach recorded in numerical sequence his collections and plants found in habitat or brought to him for the Limpopo herbarium, provided with brief, abbreviated annotations; in his field notes he discussed his findings in greater detail.

About the species of our interest we meet a number of designations which Leach provided with a question mark or wherein he added to the epithet a prefix, for instance "aff." (affinis = akin to) or "cf." (confer = compare with); sometimes he added to the complete name the suffix "complex", obviously in case he was not sure about the correct name.

4.2. Leach' notebooks.

A. From Leach' notebooks we quote the following LCL collection numbers concerning the species of our interest. Crossed out words are done by Leach himself; our comments are between straight brackets.

(1) LCL12033, BS1897. *E. ornithopus*. 6/1/64. Radley near Calitzdorp.

(2) LCL12559. *E.* sp. cf. *globosa* / *tridentata*. 22/12/64. Vaalvlei, 10-12 miles SE of Grahamstown.

(3) LCL15663. *E.* ?~~*stapelioides*~~ *tridentata*. 7/4/76. 3 km E of Hankey. Planted.

(4) LCL16178, Stayner 263/62. *E. tridentata*? [no date, Dec. 1978?] Cradock. Dense cushion, long branches, exceptional, see also [LCL]16920. Seed.

(5) LCL16179. *E. tridentata*. Calitzdorp. As above [i. e. LCL16178], no photo.

(6) LCL16663, Lavr. 21005. *E.* ?*tridentata*, Riversdale. 14/1/83. Live LCL. Plant sterile, branches reminiscent of *E. wilmaniae*, etc. but stouter and more tapering. B&W photo.

(7) LCL16798, Bayer 3576. ?*E. tridentata*. 8/9/83. 3 km SE of Riversdale.

(8) LCL16826, W. R. Branch (Port Elizabeth Museum) 297, Karoo National Park, Beaufort W., 27/9/83. 15/10/83. *E. wilmaniae complex*. Grootplaat lower plateau. Contour mudstone outcrops. Growing in deep soil at base of bushes & under stones. [For Leach' field notes about this species: see Figs 51a/b/c/d]

(9) LCL16843. *E. tridentata*. 8/4/85. Riversdale. Rhenosterveld hillside, N facing. Fl.?

(10) LCL16920. *E. tridentata*. Calitzdorp? 10/2/84. Cult KGW 263/62. Fl. 12/12/83, fr. 21/12/83. Pollen whitish yellow. Seeds 2. See also [LCL]16178.

(11) LCL16921. *E. ornithopus*?. 21/12/83. Cult KGW 708/77. Kei Road.

(12) LCL 16922. *E. globosa*? KGW 90/81. 21/12/83. Kommadagga.

(13) LCL16929, Bayer 2677. *E. tridentata*, 4/1/84. Riversdale. Pollen 10/2/84, yellow. Seed.

(14) LCL16981A. *E.* ~~?~~ *tridentata*. Stayner 263/62. KGW 6/2/84. ~~Cradock,~~ supposed to be ~~*E. polycephala* from Cradock.~~

(15) LCL17062, 2817CD, E. van Jaarsveld 6987. Deleted. *E.* cf. *globosa*. [no date, March 1984?]. Sp. nov.? Blasberge, Richtersveld, white quartz. Seed.

(16) LCL17230. *E. globosa*. KGW 706/77. 20/10/84; 25/10/84. Uitenhage. Full notes filed. White pollen (scarcely snow).

(17) LCL17283, Herbert Leistner 8201 (PRE). *E. wilmaniae*. [no date, Dec.1984?].

(18) LCL17284, McEwan (PRE 13059). ~~*E. ?ornithopus*~~ *E. globosa*? [no date, Dec.1984?] Uitenhage.

(19) LCL17299, Bayer 4617. [notebooks:] *E. sp. tridentata group*, Jan. 1985? / [field notes:] *E. polycephala complex*, 3/1/86. 1 km S of Marlow Stn. (approx. 3 km N of Cradock). Seeds. Photos of plants. Initial notes filed.

(20) LCL17310, Koutnik 2045. *E. polycephala*. [no date, 10/2/85?]. "Grassridge", N of Cradock. Rocky habitat, approx. 1 km W of Grassridge Dam [most likely *E. leachii* is meant here (Authors)].

(21) LCL17459, ex Bruce Bursey. *E.* ?*ornithopus*. 18/11/85. Honeykop Halt (Grahamstown).

(22) LCL17460, 3325 DC, Marx 19. *E. globosa*, giant form. Oct. 1985. Redhouse on road from Swartkops.

(23) LCL17461, Marx 20. *E. globosa*/*ornithopu*s / ?*tridentata*. [no date, Oct. 1985?]. 2 km S of Salem on dirt road to Alexandria.

(24) LCL17466, 3326AB, Marx 21. *E. ornithopus*? 3/11/85. Brakkloof, 20 km NW of Grahamstown, wedged among rocks on high N slope. *E. squarrosa* / *micracantha* nearby.

(25) LCL17524, 3326BA, Marx 47, 12/3/86. *E.* cf. *tridenta*a. 22/3/86, Botha's Ridge, approx. 17 km. NW of Grahamstown, approx. 600 m. alt. Grassy flat - dense population of small plants. Transitional between Grassveld / "Fish River" scrub & Karroid. Seeds close to [LCL]17464 [= *E.* ?*pugniformis*] and [LCL]17374 [= *E.* cf. *gatbergensis*].

(26) LCL17811, Marx 145. *E.* ?*ornithopus* / *tridentata*. [no date, Jan., 1990?]. Approx. 7 km S of Adelaide. Sterile plants for cultivation only, fl. 8/3/90.

(27) LCL17812, Marx144. *E.* ?*tridentata*. [no date, Jan., 1990?]. Coombs road, approx. 5 km. SW of Fraser's Camp, near Honeykop Halt. Plant sterile only.

B. From Leach's notebooks and field notes we retrieved a list of collections he put together when he was studying *Euphorbia wilmaniae*, collections possibly belonging to this species:

(1) Muir3070, ?*E. wilmaniae*. Riversdale. Sterile.

(2) Acocks11933, as *E. ornithopus*. 25/10/45. 2300′ [= 2300 feet alt.]. 13 miles NNE of Cookhouse. Karroid bushveld (*E. globosa*?).

(3) Acocks16320, *E.* ?*polycephala*. Cradock. 27/2/52. 3000′ [= 3000 feet alt.]. 5¼ miles N of Cradock. False Karroid Broken Veld - very stony hillside, fairly frequent. "See Acocks 2571".

(4) Shoesmith in M.5295 as *E. polycephala*. Aug. 1913. Mortimer, Cradock. Flowers & leaves only.

(5) James40, as *E. ornithopus*. 26/1/40. Cradock. good flowering & fruiting. Halesowen, approx. 8 miles S of Cradock.

(6) James41 [no species name mentioned]. 26/1/40. Halesowen, Cradock, "Riverview", approx. 3 miles S of M40 in bare veld between Karoo bushes, underground & tufts, not mats as in *E. globosa*. Flowering.

(7) Dyer858 (also 1210). 25/3/27 & 10/1/28. 12 miles from Grahamstown on Piggott Bridge Road. Flowers in terminal cymes (umbels), 4 & 5 glands.

(8) Dyer1043. Sept. 1927. 15 miles N of Cradock - Baroda, on Allan's Farm. Karoo soil. Stems cylindric or globose. 3100′ [= 3100 feet alt.]. Sterile. Slightly reminiscent of Richtersveld dwarfs [most likely *E. miscella* is meant here (Authors)].

By the way, an inventory as quoted above is an example how poorly these species are understood by botanists and how they struggle to put them in a convenient concept. Evidently Leach was also struggling to organize these plants into a correct arrangement, often adding a question mark to the species name or adding the prefixes "aff." (affinis) or "cf." (confer) to an epithet for later research, as he was very conscientious of correctly naming the plants observed by him or by others.

4.3. Comparing Leach' notes from the field and our own field work.

4.3.1. The Cradock plants.

Over the years only a couple of botanists have made carefully documented collections in the vicinity of Cradock about the plants of our interest. In the meantime, almost every botanist has handled the plants growing in that area by a different name, like *Euphorbia tridentata, E. ornithopus*, *E. polycephala*, *E. patula* or *E. wilmaniae*. We can only wonder why they never recognized the plants, as we observed in the field along the Great Fish River, to be a new species; an explanation may be the fact that the plants were known already in cultivation for such a very long time, however, labelled by one of the names cited above, although in retrospect incorrectly …

From Leach's field notes and notebooks we retrieved four LCL collection numbers referring to the Cradock area and this particular group of plants, namely LCL16178, LCL17299, LCL17310 and LCL16981A. Concerning collection nr. LCL16178 Leach adds in his notebooks "*dense cushion, long branches, exceptional*", but he also notes: "*see 16920*", the latter being a collection named "*E.* ?*tridentata*", recorded from "*Calitzdorp?*" (question marks by Leach, this location later on crossed out for "*Cradock*").

Collection nr. LCL17299, in his notebooks designated by Leach as "*E. sp. tridentata group*", but in his field notes as "*E.* ?*polycephala*" or "*E. polycephala* complex", may doubtless be linked to our new Cradock plants. Describing the plants, located 1 km S of Marlow Station, ca. 3 km N of Cradock, Leach describes the inner lip of the glands as white-pinkish brown as well as the "*fingers*" of the glands as "*green to pale green encrusted, not white*". Although Leach annotates "*photos of plants*", we could not find in The Leach Archive any pictures of coll. nr. LCL17299.

Collection nr. 17310 was labelled by Leach as "*E. polycephala*" in his notebooks, but he provided the name with a question mark in his field notes. Reported from north of Cradock, growing in rocky habitat, but no details are given.

Identifying more precisely collection nr. LCL16981A, regarding plants according to Leach located near Cradock, proves to be difficult. On the four sheets in his field notes about coll. nr. LCL16981A, Leach refers on two sheets to "*E. tridentata*", on the two other sheets as "*E. tridentata*?" with a question mark, but according to the enumeration in his note books he had not only the question mark crossed out, but also the site "*Cradock*". It seems that initially Leach was opting for a true *Euphorbia tridentata*, because he mentions the glands being "*thickly white encrusted*" and referring to the typical purple color of some parts of the flower.

However, we have never found such plants in the Cradock area, visiting this location for a considerable number of times; although, of course, we may not rule out for sure it does not grow there. But Leach also wrote the number of a picture on one of the four sheets, namely "*photo 200:20*". Studying the photograph, according to our opinion, this picture shows indeed a flower resembling the flower of a true *Euphorbia tridentata*; however, the picture does not refer to coll. nr. LCL16981A but concerns coll. nr. LCL17459, see Figs 72-74.

Box 1. ***Summarized from five consecutive field notes, coll. nr. LCL16981(A),*** **E. *cf.* tridentata,** ***Cradock 263/62, KGW 06/02/84; 25/10/84; 12/12/84; 07/09/85; 12/12/85; 09/04/86.***

- Peduncle strong, shiny green obscurely ribbed, glabrous very minutely patchily pubescent or with a few scattered minute white hairs.
- Bracts below the involucre green, pink to red rimmed/margined/edged, sparsely finely minutely white ciliate above & less beneath, otherwise glabrous beneath.
- Involucre glabrous, septa ribbed, green becoming maroon-brownish at underside of glands and fingers.
- Lobes tapering, orbicular imbricate, khaki (pale greenish, minutely red-flecked) to pale maroon-brown, fimbriate toothed, teeth micro red-flecked, densely silky white ciliate, the central teeth largest, appearing almost bifid.
- Cyathium initially with 5 glands, with 3x2 & 2x3 or 4x3 & 1x2 processes, the subsequent with 4 glands, with 3x3 & 1x2 processes.
- Glands thickly "woven" and heavily white encrusted (perforated) on processes, on margin and on crenulate, obtuse to truncate inner lip, maroon in the pits; with a crenulate, obtuse, closely infolded, funnel-like maroon-brownish cavity (nectar pocket). Glands with a narrow, crest-like tuft of hairs on the inside ending in the sinus between the lobes.
- Male pedicels glabrous, brownish pale green to pinkish, with a few very fine hairs towards apex, filaments pale maroon orange-red, anthers dull green becoming dark maroon-purplish-brown, pollen pale yellow.
- Gynoecium far exserted to one side.
- Female pedicel glabrous green, pink at perianth, calyx glabrous, green, red-rimmed, ovary brownish-red-purplish, 3-ribbed on angles, surface somewhat bullate rugulose. Styles orange-red-brown. Stigmas simple, recurved-emarginate, spreading, deeply rugose orange-red (free parts of styles paler, more greenish).

4.3.2. The Springbokvlakte plants.

In The Leach Archive we could not find any reference about a *Euphorbia* species belonging to the subsection *Dactylanthes* originating from the Springbokvlakte area. As far as we know there exist only two references about *Euphorbia tridentata* growing in this area. One is cited by Gerhard Marx (Marx, 1992), mentioning that *Euphorbia tridentata* is reported from the Steytlerville area, although he himself has never seen it there. The other reference is a special offer by the International Succulent Institute (I. S. I.), viz. *Euphorbia tridentata* ISI 1656, cuttings of plants said to be collected in the Springbokvlakte, South of Kleinpoort.

4.3.3. The Calitzdorp plants.

Three of Leach' collections, which we consider related to the species initially labelled *Euphorbia* sp. aff. *tridentata*, currently *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., can be found in the vicinity of Calitzdorp, namely collection nrs LCL12033, LCL16179 and LCL16920.

Collection nr. LCL12033, recorded in 1964, has been erroneously named by Leach "*E. ornithopus*", an incorrect naming, for in fact *Euphorbia ornithopus* is only found in the vicinity of Grahamstown. In 1978 (?) Leach registered a *Euphorbia tridentata* from Calitzdorp (coll. nr. LCL16179) without giving further details.

For collection nr. LCL16920, allegedly also from Calitzdorp, several descriptions of the flowering habit can be found. Concerning the description of the cyme of this species Leach repeatedly notes: "*initial cyathium with 5 glands, not necessarily abortive, subsequently with 4 glands*". In the field we only found plants with a single cyathium on the top of the small stems; moreover, this way of flowering we also observed on plants of *Euphorbia tridentata* and *Euphorbia ornithopus* as well as on the new *Euphorbia leachii* plants from the Cradock area. Observe that in his notebooks Leach compares coll. nr. LCL16920 to coll. nr. LCL16178 from Cradock. But a word of caution is needed here. In 1984, at first Leach noted about coll. nr. LCL16920: "*E.?tridentata, located at "Calitzdorp?",* with question marks. But on 3 other (later) sheets from his notebooks, albeit from the same year, Leach is no longer so sure about this site, for he notifies about coll. nr. LCL16920 "*E.*?*tridentata*" and "*E.* cf. *tridentata*", crossing out "*Calitzdorp?*", now giving as location "*Cradock*". Clearly Leach doubted where coll. nr. LCL16920 exactly could be found in nature. So, by describing the flowering habit, Leach notified: "*could they be different species?*".

Box 2. ***Summarized from four consecutive field notes, coll. nr. LCL16920, noted*** **E.*?*tridentata** ***(Calitzdorp?) as well as*** **E.** ***cf.*** **tridentata** ***(Cradock), 263/262, KGW 29/1/84; 25/10/84.***

- Branches stout, flowering once from apex.
- Leaves ovate-acute, thick and fleshy, lightly folded, caducous, very small.
- Inflorescence terminal on a short, stout bracteate peduncle.
- Peduncle green minutely white pubescent.
- Bracts elliptic-oblong acute, glabrous beneath, pubescent above, initially lightly folded (pseudo-keeled) brownish-green, white ciliate.
- Initial involucre bisexual, not necessarily abortive; involucre buff (pale yellow-brown) or glabrous green becoming red-brown or yellowish above.
- Lobes imbricate fimbriate, irregularly denticulate scarcely dentate, appearing almost bifid, densely silky, more or less red / khaki (greenish, red-flecked); lobes can also be obtusely truncate emarginated, glabrous in & out.
- Cyme branches white pubescent.
- Cyathium initially with 5 glands, the subsequent cyathia with 4 glands.
- Glands red-brown or yellowish beneath, at early stage brownish inside with a thick white rim also on upper side of processes [= 'fingers'], on glands fingers 2-3, some mostly 3, rarely 1; the rim and fingers developing pustule-like craters and the inner lip developing and becoming folded over the inner, hollow, initially funnel-like pit, brownish to red deep down. Processes forming from well below with white encrusted outer margin. Initially glands more or less peltate, concave conventional, with short stubby pustulate processes.
- Male pedicels glabrous, pinkish, filaments bright carmine red, anthers dark brown, pollen translucent yellowish white to very pale yellow.
- Gynoecium far exserted to one side.
- Female pedicel greenish, buff-red flecked very sparsely pubescent, enlarging at apex but ecalyculate, pink perianth. Capsule glabrous. Styles more or less orange-reddish to brownish. Stigmas reddish.

4.3.4. The Beaufort West plants.

For collection nr. LCL16826 Leach recorded a plant that the herpetologist W. R. Branch found in the Karoo National Park near Beaufort West on Sept. 27, 1983. According to his field notes, initially Leach gave the name "*Euphorbia* aff. *tridentata*" to the species, but some years later he preferred to designate it as *Euphorbia branchii*. Leach obviously intended to describe it as a new species, but he never completed and published a valid description. Therefore this species must be noted as "*Euphorbia branchii* nomen nudum".

From his field notes we learn that Leach liked to compare the species, provisionally named *Euphorbia branchii*, to *Euphorbia wilmaniae* from Griqualand West. In the pictures we see a plant with a far larger body part below soil level than above. The stems appear pronouncedly tuberculate (see drawing Fig. 51c). The resemblance with *Euphorbia wilmaniae* is indeed striking, whereas the species seems to us really differing from the plants of our interest in the Calitzdorp area. The stems of the plants at that area surely are less tuberculate; but whether they share the same root system as with *Euphorbia branchii*, we do not know, because we ourselves did not dig up any plants at the Calitzdorp location. From The Leach Archive we reproduce here some photographs, giving an impression of the extensive root system.

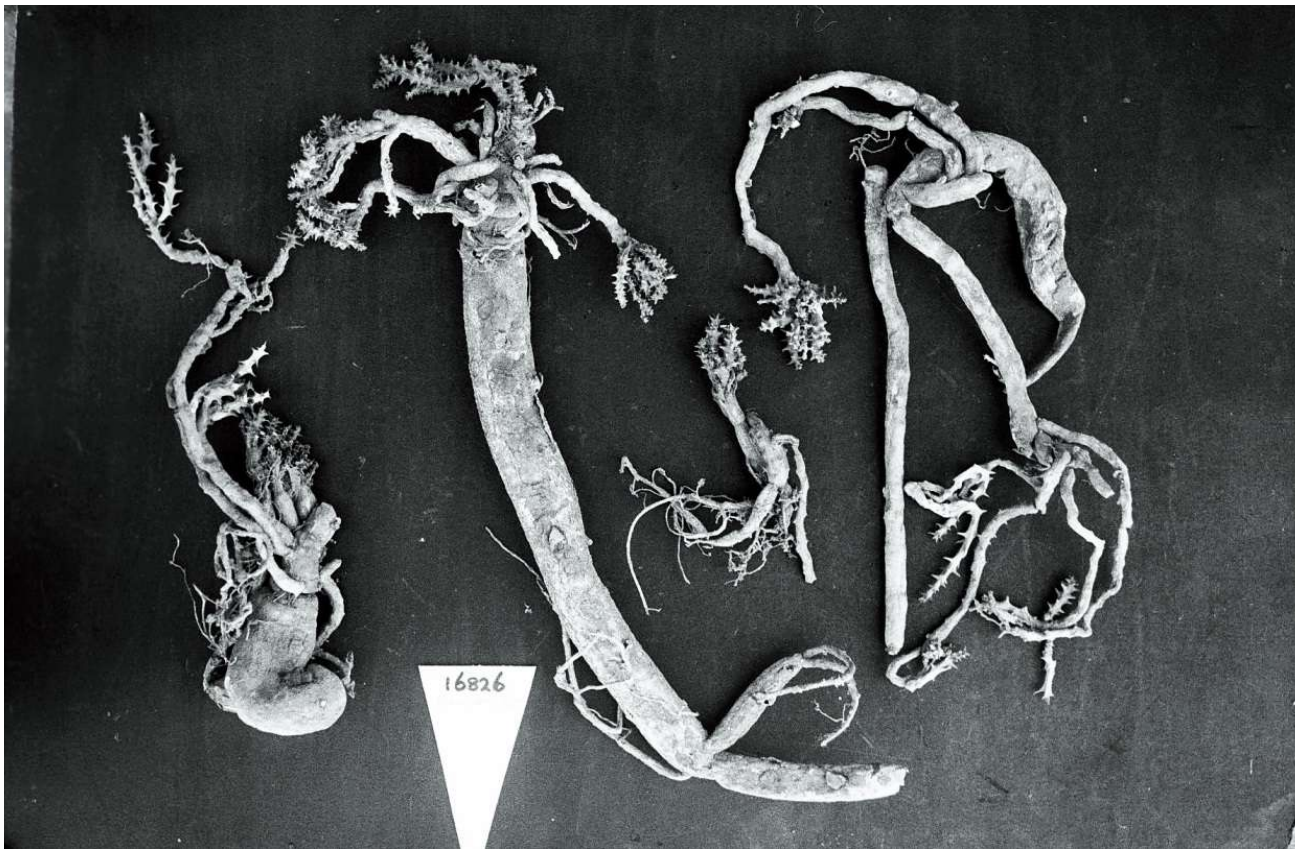


Fig. 69. Plants of *Euphorbia branchii* nom. nud., coll. nr. LCL16826, showing the extensive root system.

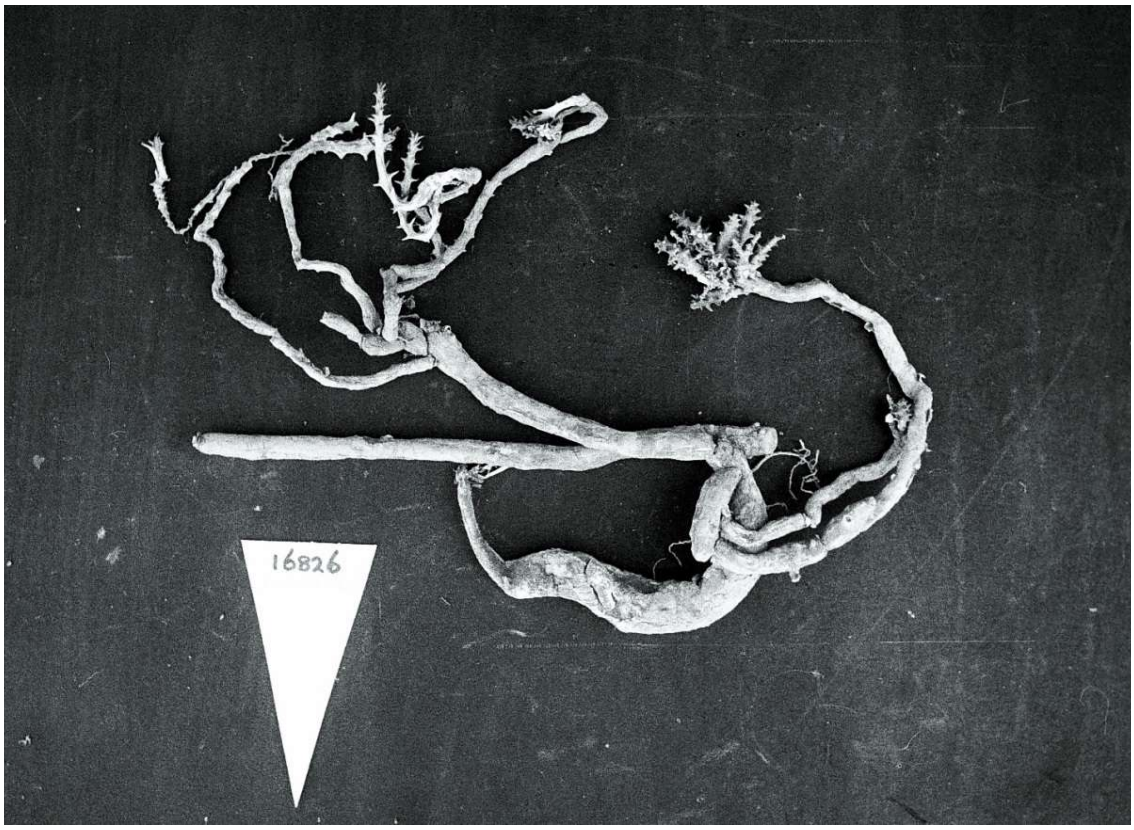


Fig. 70.This specimen of coll. nr. LCL16826 shows the plant can also spread through stolons.

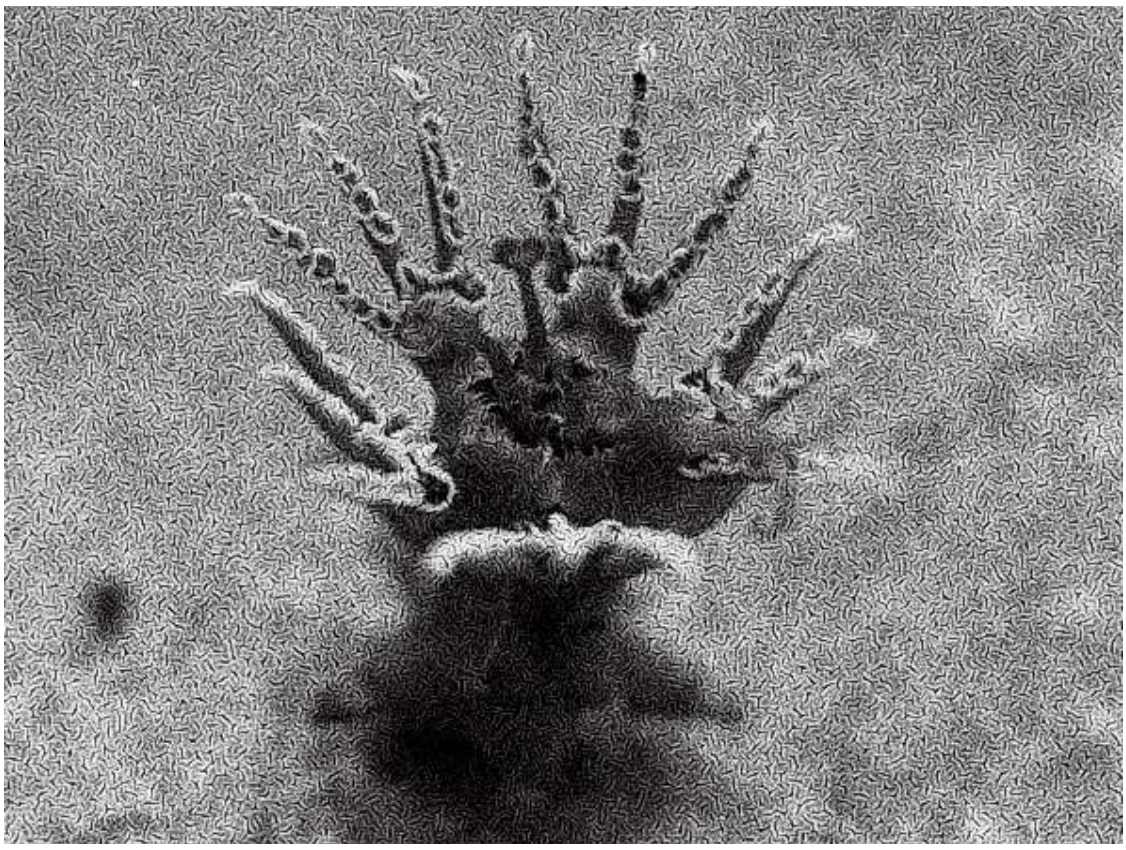


Fig. 71. Flower of *Euphorbia branchii* nom. nud., coll. nr. LCL16826, pictured by L. C. Leach.

4.3.5. The Riversdale plants.

There are a couple of collections in The Leach Archive which are recorded from Riversdale. Some are provisionally designated by the name "?*Euphorbia tridentata*" (question mark prefixed by Leach), namely collection nr. LCL16798 and coll. nr. LCL16663. About coll. nr. LCL16798 we found no additional information, except for "*3 km SE of Riversdale*". Concerning coll. nr. LCL16663 it is only said: "*?Euphorbia tridentata (...) branches reminiscent of E. wilmaniae, but stouter and more tapering*". A very poor picture of coll. nr. LCL16663 turned up in The Leach Archive, which indeed most likely represents *Euphorbia tridentata*, see Fig. 72. Other collections in the Leach's field notes, also recorded from Riversdale, are directly labelled "*Euphorbia tridentata*", namely coll. nr. LCL16843 and coll. nr. LCL16929.

Fig. 72. A poor reproduction of most likely *Euphorbia tridentata* Lam., coll. nr. LCL16663, from Riversdale.

About collection nr. LCL16843 Leach notes: "*glands: processes white encrusted, green towards apex, inner lip infolded*". The annotation "green towards apex" is puzzling, because commonly only the top of the gland is definitely white encrusted. Fortunately we found a picture of coll. nr. LCL16843, which presents us with a flower matching *Euphorbia tridentata* in all details. See Fig. 73.

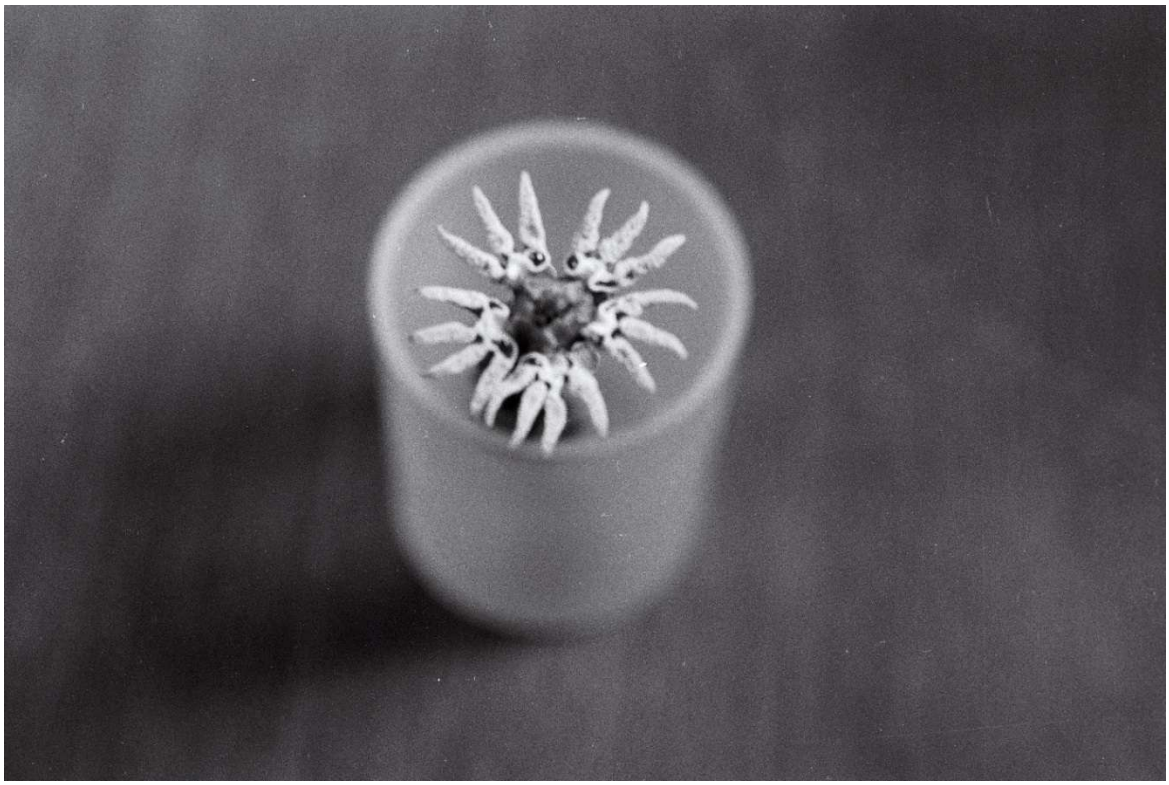


Fig. 73. Flower of *Euphorbia tridentata*, coll. nr. LCL16843, from Riversdale. Photo by L. C. Leach.

Box 3. ***Summarized from four consecutive field notes, coll. nr LCL16843,*** **E. tridentata,** ***Riversdale, Leach & Forrester 06/11/83; KGW 08/04/85.***

- Peduncle a terminal extension of a tuberculate stem, green, sparsely micro puberulous (pubescent), ribbed to the base of the bracts.
- Bracts more or less obovate or oval, base truncate, glabrous, green and pinkish margined (edged), soon changing to brownish cream, finely white ciliate.
- Involucre glabrous, green, becoming brownish on underside of glands and towards apex of lobes.
- Lobes glabrous, beige, broadly obtuse or subtruncate, irregularly fimbriate toothed, finely white micro ciliate.
- Glands with 3-4 processes, rarely forked towards apex, more or less flat in upper half, covered all over with "batter crust", heavily white coated but greenish towards apex, pale green in holes, sometimes a little lumpy, processes widely flat spreading, underside brown to yellow-beige, inside pale green; inner lip more or less truncate strongly incurved (much infolded), laterally up curved, making a deep channel at the centre apex; cavity orange-brown with copious nectar.
- Male pedicels glabrous, brown-maroon to orange-brown, filaments red-orange-brown, anthers green, red margined (edged), red-brown lipped. Pollen pale yellow.
- Female pedicel glabrous, yellow-green, flushed red. Ovary 3-lobed, deep red-orange-brown, pale striped in sinus. Styles and stigmas paler red-orange-brown

Regarding collection nr. LCL16929, Leach describes the glands of the flowers as follows: "*glands green-brown, heavily or thickly white encrusted, inner lip truncate, or more or less obtuse, slightly minute crenulate, processes 3 or 4, some forked*". Applied to the species *Euphorbia*

tridentata, this is a very good description of the pustule-like coverage of the glands, lying over the green to sometimes brownish surface of the gland. In his field notes Leach compares *Euphorbia tridentata* coll. nr. LCL16929 from Riversdale with *E.* cf. *tridentata* LCL16920 from Cradock, now questioning the differences. About the collection LCL16929 from Riversdale he observes: "*branches longer, more tapered, involucre more shallow* [i. e. more flat]*, flower diameter larger, glands 5, more fleshy, processes shorter and fatter, stigmas larger*".

Box 4. ***Summarized from five consecutive field notes, coll. nr. LCL16929,*** **E. tridentata,** ***Riversdale, KGW 14/01/84; 25/01/84; 25/10/84. Bayer 2677.***

- Branches short, stout, apparently flowering only from apex.
- Flower shortly pedunculate, sometimes pubescent on the broad adherent "petiole" [quotation marks by Leach].
- Bracts spreading, concave, green pinkish-whitish margined (edged), convex beneath, micro-white ciliate.
- Involucre glabrous inside, dull, becoming brownish green on underside of glands, prominent septal ridges with bracteole at apex.
- Lobes dull green to dark brown, white ciliate, irregularly fimbriate rag-toothed, imbricate.
- Glands 5, brown-green but thickly white encrusted with 3-4 (mostly 4) processes or 3x3 & 2x4 fingers on 2nd flower, some processes forked, irregularly lumpy (arthritic) and pitted (green in pits). Inner lip truncate or more or less obtuse, slightly minute crenulate.
- Male pedicels glabrous, brown-orange, pale below more reddish above, filaments pinkish to brownish-orange to red-brown, anthers dull green at base to orange-brown above, dark maroon lipped, anthers curved horizontally facing outwards. Pollen pale to clear deep yellow.
- Female pedicel glabrous green, perianth glabrous, negligible green. Ovary glabrous green with hint of orange-brown above. Styles glabrous, paler, pale green with hint of orange-brown becoming brownish orange on stigmas.

Note. About the western natural distribution area of *Euphorbia tridentata* it is interesting to remark that in his archive Leach does not refer to other localities except for Riversdale, whereas we found these plants also at Heidelberg, west and east of Riversdale and near Mosselbay. But *Euphorbia tridentata* has an eastern natural distribution area too, namely in the Albany District. This disjunct natural distribution is also known for *Euphorbia pugniformis*. The distribution area is divided in two parts by the area surrounding Port Elizabeth, which is the natural habitat for *Euphorbia globosa*, whereas in the case of *Euphorbia pugniformis* the gap is filled by the near relative *Euphorbia gorgonis*.

However, there is one collection made by Leach, namely coll. nr. LCL15663, that he located 3 km east of Hankey, which is just west of Port Elizabeth. In his notebooks he named this collection "*E.* ?*stapeloides* / *tridentata*" (with a question mark), but later on he crossed out the epithet "? *stapeloides*", this correction rightly done for this particular species grows around Alexander Bay, in the Richtersveld, in the far NW corner of South Africa. We assume that most likely coll. nr. LCL15663 must be considered related to *Euphorbia globosa* Sims; as in the same way Leach rectified another (later) record, namely coll. nr. LCL17284, initially named "?*E. ornithopus*", but later on correctly classified as "*E. globosa*".

4.3.6. The Albany District plants.

On the whole the eastern natural distribution area of *Euphorbia tridentata* comprises the Albany District; but here we also find another taxon, namely *Euphorbia ornithopus*. To be pointed out, flowering by a cymose inflorescence proves not to be only a feature reserved concerning *Euphorbia ornithopus*, it can also be observed in *Euphorbia tridentata*. In our opinion, maintaining *Euphorbia tridentata* and *Euphorbia ornithopus* as separate species may not be upheld, the latter even to be considered a variety of *Euphorbia tridentata* Lam., as argued by us in section 2.50.2.

By the way, Leach did not consider the cyme a distinguishing feature to have these species separately identified. But it remains unclear what other characters he precisely used to distinguish them correctly; sometimes he coupled both names within the same designation.

About the correct identification of some species of our interest found in the Albany District Leach was definitely not sure, as can be seen from the following inventory:

- Coll. nr. LCL12559 - "*E.* sp. cf. *globosa* / *tridentata*".
- Coll. nr. LCL17461 (Marx20) - "*E. globosa* / *ornithopus* / ?*tridentata*".
- Coll. nr. LCL17524 (Marx47) - "*E.* cf. *tridentata*".
- Coll. nr. LCL17812 (Marx144) - "*E.* ?*tridentata*".

Regarding coll. nr. LCL12559, from Vaalvlei, about 18 km SE of Grahamstown, in the Leach Archive only one colour slide was found. It definitely depicts a *Euphorbia tridentata* species (Fig. 74).

Fig. 74. Reproduction of part of a colour slide from the Leach archive, coll. nr. LCL12559, clearly representing *Euphorbia tridentata*, located SE of Grahamstown.

Concerning the find of coll. nr. LCL 17524 (Marx47), designated as "*E.* cf. *tridentata*", located on Botha Ridge, about 17 km NW of Grahamstown, in his field notes Leach did not describe its

flowering habit. But remarkably the flowers may be studied on a photograph made by R. A. Dyer in the 1930's regarding a plant found about 16 km from Grahamstown on Botha Ridge, obviously in the same area. In this picture, published by A. C. White, R. A. Dyer and B. L. Sloane (1941, Fig. 524), we clearly see the short-peduncled, single, saucer-shaped flowers with the white glands, which are typical for the true *Euphorbia tridentata* Lam.

Of interest are the habitat observations for the LCL17524 collection written down by Leach in his field notes: "*flat ground with grass - dense population of small plants - one withered flower seen - could be E. tridentata - square truncate lip, 5 glands (2 with 5 processes, 2 with 4 and 1 with 2) - ecologically between grassveld and karroid Fish River scrub*".

Next, Leach cites a remark given by Gerhard Marx: "*believed to be the population which Dyer was convinced representing E. tridentata*". When Leach described coll. nr. LCL17812 (Marx144) from Honeykop Halt, wondering about its true identity by designating it "*E. tridentata / ornithopus*?" (with a question mark), he surpassed himself by producing, in our opinion, the best possible compressed description of the unique flower of the species *Euphorbia tridentata* Lam. We quote:

"*Glands with 3 to 5 rather obtuse, recurved, rather fleshy, cream processes with holes (green inside), irregular and sometimes confluent, and an incurved dorsal "flap" bowing a "well" at the base of the gland (as reminiscent of E. globosa).*

Lobes greenish to brown, irregularly long fimbriate, fimbria ciliate in lower half, overlapping over the ovary and lower part of the united styles, united to approx. half way, yellowish red streaked, appearing red-brownish, stigmas pale yellow, entire at this stage.

Involucre glabrous bluish green, somewhat funnel-shaped gland processes etc. all white to pale, brownish beneath".

One important addition to this description of *Euphorbia tridentata* Lam. must be made. The processes of the glands are recurved when the flower is still young, when maturing they become straight; but when withering the flowers are folding inwards, so at this moment the flower looks cup-shaped, a feature not to be confused with the usual flowering habit of the plants in the Cradock area, currently named *Euphorbia leachii* Lawant & van Veldhuisen sp. nov.

In describing the flower of coll. nr. LCL17461 (Marx20), found 2 km S of Salem, Leach designated it as belonging to a "*E. globosa complex*", but he uses descriptive words which are typical for *Euphorbia tridentata*. For instance, about the glands he writes: "*glands green, heavily white encrusted, inner lip more or less truncate (...) apparently flowering once only from a branch apex*".

According to Leach the branches of this specimen often may extend to 6.5 inches [16 cm].

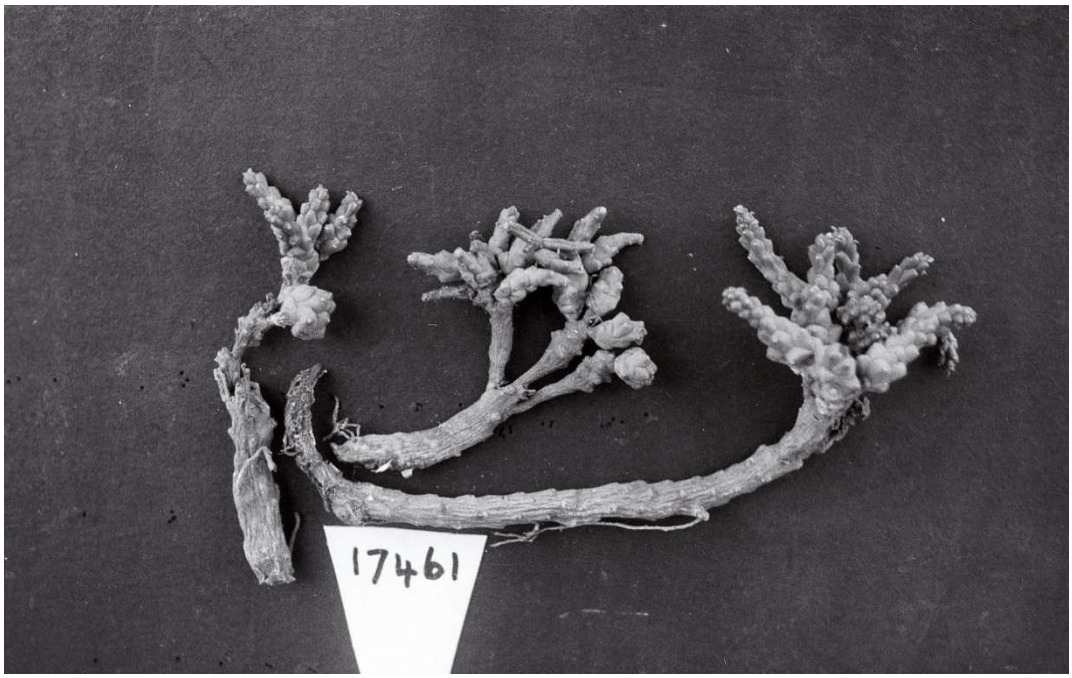


Fig. 75. A picture from the Leach archive of *Euphorbia tridentata*, coll. nr. LCL 17461, once collected by Gerhard Marx.

4.3.7. Leach' observations about "*Euphorbia ornithopus*".

In his notebooks Leach listed four "*Euphorbia ornithopus*" collections as follows: collection nr. LCL16921 from Kei Road, coll. nr. LCL17459 from Honeykop Halt (Grahamstown), coll. nr. LCL17466 (Marx21) from Brakkloof at 20 km NW of Grahamstown and coll. nr. LCL17811 (Marx145) approx. 7 km S of Adelaide. Naming the first three collections Leach added a question mark to the epithet: "*E. ornithopus*?". Coll. nr. LCL17811 (Marx145) entered the notebooks as "*E.* ? *ornithopus / tridentata*", which is the way Leach did when a plant was not yet in flower; however, Gerhard Marx later called it *Euphorbia ornithopus*, so we include it under this heading.

In the field notes for coll. nr. LCL16921 we find the glands described as follows: "*glands dead-white, green markings (...) whole inflorescence more or less crested*". No mention has been made of a cyme, so we may not accurately decide whether this collection concerns *Euphorbia tridentata* Lam. or *Euphorbia ornithopus* Jacq.

Collection nr. LCL17466 (Marx21), designated by Leach as "*E. ornithopus*?", from Brakkloof at 20 km NW of Grahamstown, is typified by the description of the glands: "*white encrusted on fingers, with inner lip and surround white*". Leach's observation of a central cyathium as a single, pubescent pedicelled 5-glanded male flower surrounded by lateral 4-glanded female flowers leaves very little doubt about the identity of the species, namely *Euphorbia ornithopus* Jacq. The more so since, on one of our trips in the same area we found similar *Euphorbia ornithopus* species in the road reserve 20 km NW of Grahamstown, along the Bedford road (e. g. coll. nr. RVV22).

Collection nr. LCL17811 (Marx145), according to Marx *Euphorbia ornithopus* (see above) from a location approx. 7 km S of Adelaide, comprises sterile plants for cultivation only, so presumably Leach did not note any details about its habit in the field.

Regarding collection nr. LCL17459, according to Leach "*E.* ?*ornithopus*" from Honeykop Halt (east of Grahamstown), we find a description as well as some pictures in The Leach Archive. About the glands Leach writes: "*processes heavily white crusted, brownish or greenish in the holes*". In the pictures we see, concerning the flower, the true *Euphorbia tridentata* Lam. species, but the habit of this interesting plant is quite different for having a cushion of branching and rebranching spherical stems. Leach did not comment about this rather atypical habit. However, it is interesting to note that the second author (RvV) grows a plant, labelled *Euphorbia tridentata*, which also possesses this atypical habit: the stems are much smaller than usual, remaining short, whereas the whole plant adopts a cushion-shaped habit, exactly like Leach must have met in the field.

Fig. 76. Collection nr. LCL17459 from Honeykop Halt, east of Grahamstown, is a very interesting form of *Euphorbia tridentata* for growing in dense clusters, just like *Euphorbia polycephala* does.

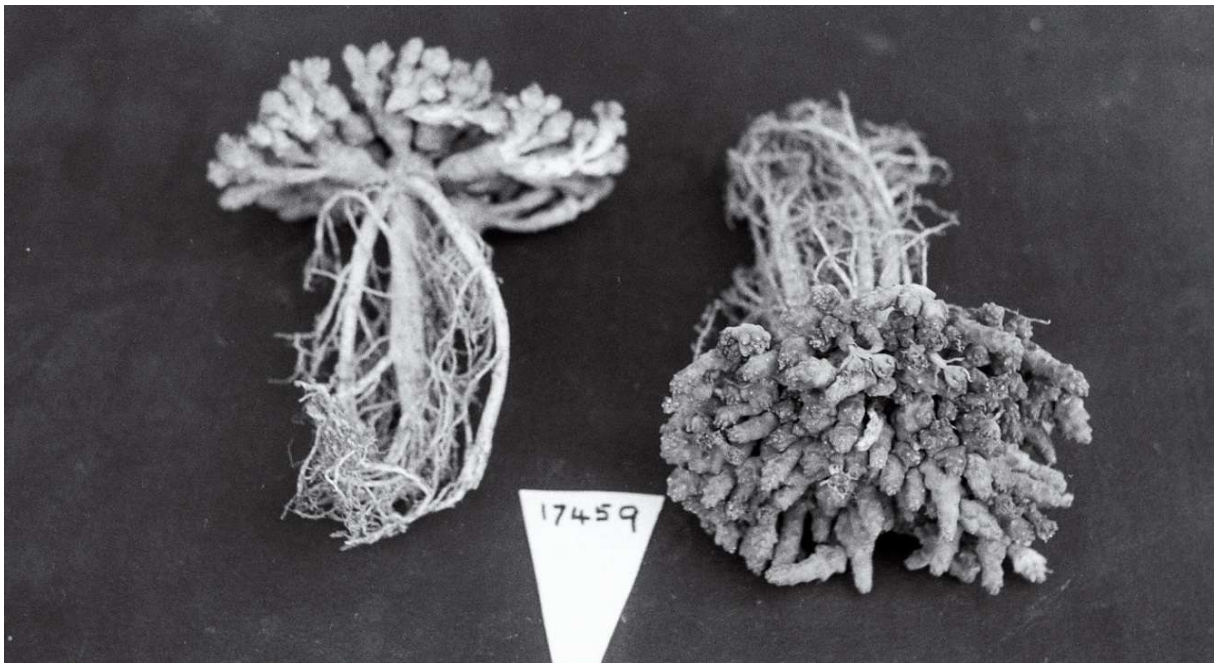


Fig. 77. Two plants of *Euphorbia tridentata* Lam., coll. nr. LCL17459, showing the densely clustering habit.

Fig. 78. *Euphorbia tridentata*, coll. nr. LCL17459, has the typical flat, saucer-shaped white flowers. This is the picture which Leach annotated "*Photo 200:20*" on one of his field note sheets about coll. nr. LCL16981A.

Box 5. ***Summarized from three consecutive field notes, coll. nr. LCL17459,*** **E. *?*ornithopus** ***Honeykop Halt (near Grahamstown), 18/11/85.***

- Peduncle: ?
- Leaves [= bracts] ellipsoid, acute, glabrous green.
- Involucre glabrous, greenish becoming greyish-greenish, cream above and underside of glands and processes. Septa whitish, obtuse ribbed. Involucre greenish, glabrous inside.
- Lobes greyish greenish, cream pink tinged, shortly ciliate fimbriate with whitish, long subspathulate obtuse fimbria, lobes imbricate.
- Bracteoles filamentose, a few almost hair-like, glabrous, unbranched.
- Cyathium. Gland inner lip broadly obtuse rounded, closely infolded. Processes heavily white-iced, encrusted, brownish or greenish in the holes.
- Male pedicels sparsely minutely puberulous, maroon red.
- Female pedicel pale green very minutely puberulous.
- Gynoecium. Ovary and styles maroon.

Note. A collection of *Euphorbia ornithopus*, in March 1927 made by R. A. Dyer, is also listed in the Leach archive, namely coll. nr. Dyer858, found on Pigott Bridge Road, 12 miles from Grahamstown (Dyer, 1931). A. C. White, R. A. Dyer and B. L. Sloane (1941) determine for the Albany District the distribution of *Euphorbia ornithopus* as "*12 miles (20 km) from Grahamstown on Piggott Bridge Road*"; they also reproduce a picture (Fig. 528), labelled "*plant collected by R. A. Dyer near Grahamstown*"; no doubt this must be coll. nr. Dyer858. We see a *Euphorbia ornithopus* plant showing one of its typical aspects, namely flowering in cymes with rather large, white, heavily encrusted flat cyathia. However, the authors notice that cyathia of *Euphorbia ornithopus* are not only produced in cymes that each develop a sessile, 5-glanded, male cyathium accompanied by lateral, 4-glanded, bisexual cyathia, but that this species also produces solitary, 4-glanded flowers (White, Dyer and Sloane, 1941, pp. 511-512, Figs 532-533). White, Dyer and Sloane try to illustrate the contrast between *Euphorbia ornithopus* and *Euphorbia tridentata,* the former bearing on a long peduncle a cyme of three pedicelled lateral flowers, whereas in case of the latter a group of three equally long pedicelled cyathia sprout directly from the top of a branch (White, Dyer and Sloane, 1941, Fig. 531). As indicated before, we are not convinced that the authors present a distinguishing feature between these species. Either feature may occur with both species. Note that even White, Dyer and Sloane argue that solitary flowers also can be found with *E. ornithopus*, in the same way as seen regarding *E. tridentata*.

Already a decade before, R. A. Dyer hinted on the close relationship between *Euphorbia ornithopus* and *Euphorbia tridentata* , when writing about his finds in the field, he remarks: "*the possibility of Dyer858, Euphorbia ornithopus, being derived from Dyer885, Euphorbia tridentata, must not be overlooked*" (Dyer, 1931).

4.4. Summary of Leach' observations about the species of our interest.

L. C. Leach knew very well nearly all plant species from Southern Africa, except - we have to note - for the plants from the Springbokvlakte. He particularly studied the plants from the areas Calitzdorp and Beaufort West, and concerning the latter location he initially was convinced one special *Euphorbia* species must be considered a new species, provisionally naming it "*Euphorbia branchii*"; but he never validated it by publishing it. Most likely, later on he thought it might be identical to *Euphorbia wilmaniae* Marl. from Griqualand West, but alas!, we will never know.

From his field notes, we conclude that Leach remained puzzled about the exact identity of the *Euphorbia* species from the Cradock area, not only concerning *Euphorbia ornithopus* Jacq. but also about the plants he provisionally designated by the name "*Euphorbia polycephala complex*" (see for instance his field notes about coll. nr. LCL17299, quoted above). In addition, although describing different flowering habits of the commonly known *Euphorbia tridentata* Lam., regretfully he never worked his presuppositions out by finally concluding they must be regarded as different species. Studying all Leach's observations from the field, it becomes clear that he certainly distinguished between a "*tridentata-like species*" found at Cradock and a "*true Euphorbia tridentata species*" located at Riversdale. In summary, according to Leach the plants he met at Cradock bear a terminal, cymose inflorescence on a stout peduncle, the initial, central bisexual cyathium of the cyme 5-glanded, not necessarily abortive, the subsequent cyathia on "*white pubescent cyme branches*" [= pedicels] having 4 to 5 glands. On the other hand, Leach observed that *Euphorbia* species from the Riversdale site possess solitary cyathia, sessile or nearly sessile on top of the branches, with glands widely spreading.

4.5. Summary of the observations from the field.

Surveying the field work that we, the second author (RvV) together with his travel companions, conducted during the years 1999-2012, it became clear that by the commonly known name "*Euphorbia tridentata*" in fact two different species were involved. Many years of careful observation of cultivated plants lead to the same conclusion. On the one hand, we meet along the Great Fish River species for which we initially adopted the name "*Euphorbia* sp. aff. *tridentata*". This species proved to possess cyathia with remarkable upward pointed glands with greenish marbled or greenish-yellow teeth, the whole cyathium cup-shaped; we found them growing south of Cradock, south of Cookhouse, south-west of Mortimer and east of Steytlerville. Particularly we refer to collection nr. J&R108 and coll. nr. J&R110 found south of Cradock; coll. nr. J&R561 found south of Cookhouse (in cultivation developing a cymose inflorescence with a sessile, bisexual five-glanded central cyathium), coll. nr. RBAM1326 south of Cradock and coll. nr. J&R223 from Springbokvlakte, east of Steytlerville. As discussed in section 2.50.1 this species required a new name, namely "*Euphorbia leachii* Lawant & van Veldhuisen, sp. nov.", honouring L. C. Leach.

On the other hand we encountered species on two disjunct localities, namely (a) growing east and west of Riversdale and (b) east of Alicedale, about 50 km west of Grahamstown, in the vicinity of Heidelberg and near Hartenbos; these plants we recognized to be the "true" *Euphorbia tridentata* Lam. When maturing, these plants possess quite large, widely spreading, almost saucer-shaped cyathia with very white, conspicuously pitted four to five glands, 3- to 4-toothed. Although mostly the plants possess solitary, sessile or nearly sessile cyathia in the field, nevertheless they are able to develop cyathia which are peduncled, sometimes seen in their natural habitat but particularly when they are cultivated for quite a long time, especially in the northern hemisphere in European countries and in the U. S. A. In cultivation the length of the peduncle that bears the cyathium, can vary considerably, sometimes it even rebranches; also the forming of a cymose inflorescence may be observed. Representative of these plants are coll. nr. J&R374 from Riversdale, coll. nr. J&R194 from east of Alicedale, coll. nr. R&W 446 and coll. nr. IB13759 from near Hartenbos.

About what is said about the flowering habit of *Euphorbia tridentata*, namely showing solitary, (nearly) sessile cyathia or cyathia which are peduncled (even rebranching) as well as developing cymose inflorescences, in this respect the species commonly labelled *Euphorbia ornithopus* Jacq. does not differ from *Euphorbia tridentata* Lam. The only way in which *Euphorbia ornithopus* differs from *Euphorbia tridentata*, regards the sexuality of the flowering habit; particularly when a cymose inflorescence is developing the difference regards the sexuality of the central, sessile cyathium of the cyme. With *Euphorbia ornithopus* it is always male, with *Euphorbia tridentata*

Lam. and *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. always bisexual. As we already discussed in section 2.50.2, we consider that the species "*Euphorbia ornithopus* Jacq." should be reduced to variety status below *Euphorbia tridentata* Lam., subsequently naming it "*Euphorbia tridentata* (Lam.) var. *ornithopus* (Jacq.) van Veldhuisen & Lawant comb. & stat. nov.".

Finally, we conjecture that the minute *Euphorbia* species, which the South-African photographer Mrs. Maddy Lehmann pictured in the vicinity of Calitzdorp and we next discovered in the field near Calitzdorp (coll. nr. J&R 564), represents a variety of *Euphorbia tridentata* Lam. This taxon shows back-bent spreading cyathia with small glands which have thin teeth which bear pure white pustules upon them. Possibly the same assumption regards the heavily tuberculate species which L. C. Leach prematurely described from inside the Karoo National Park near Beaufort West (coll. nr. LCL16826), a species provisionally named by him *Euphorbia branchii*.

So in both cases a lot of future research is urgently needed.

A survey of all localities resulting from ca. 14 years of field work is summarized in the following distribution map:

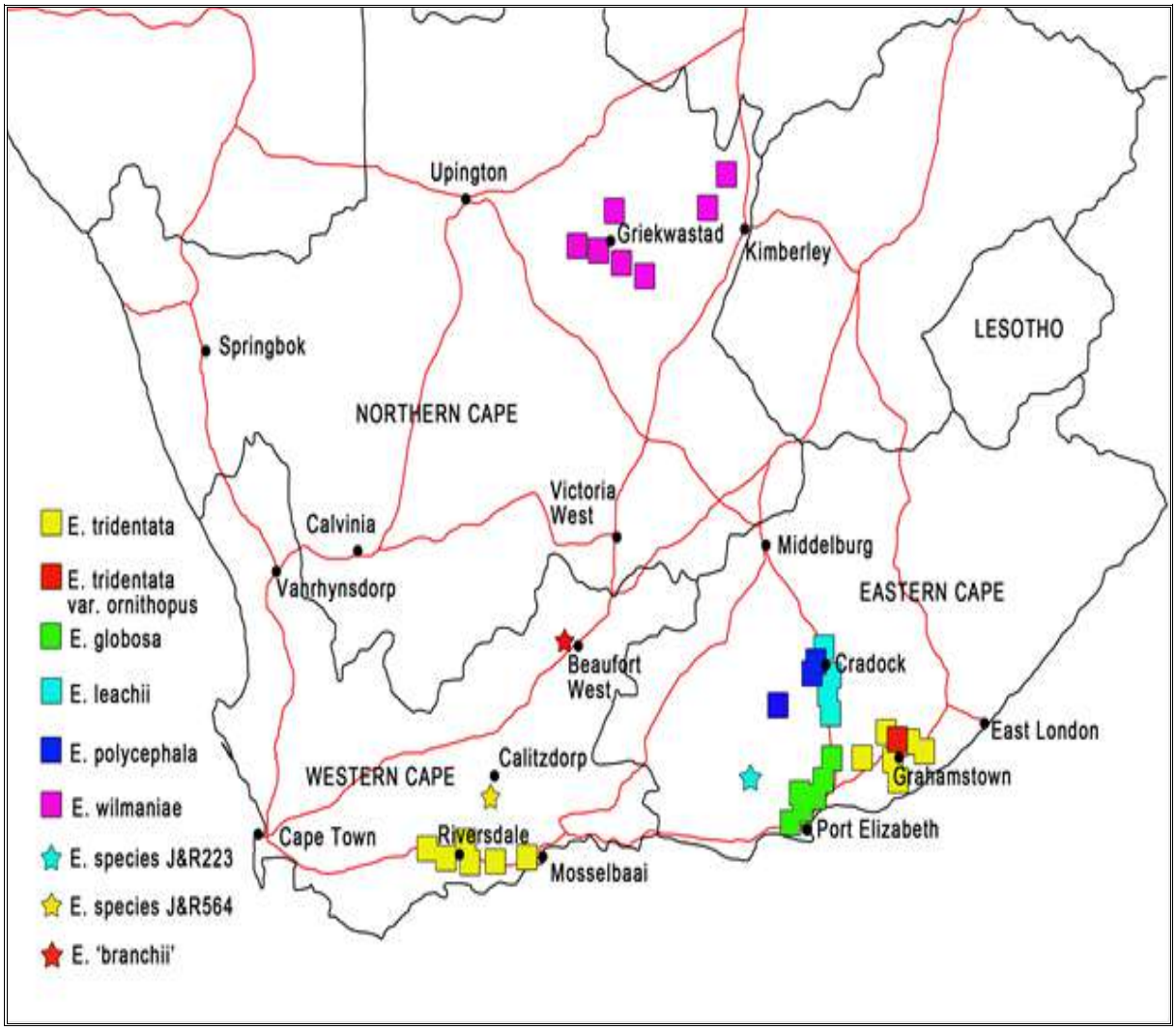


Fig. 79. Distribution map of southern Africa with the findings by the second author (RvV), during the years 1999-2012 regarding the range of *Euphorbia* species discussed in the text.

Chapter 5. Findings from history in retrospect.

5.1. Method.

Comprising a time period of about 330 years, studying the 90 descriptions we retrieved from history for *Euphorbia tridentata* Lam., *Euphorbia ornithopus* Jacq., *Euphorbia patula* Mill., *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. We assembled these documents from the writings of 46 botanists or of a collective of botanists, and we carefully investigated whether differences regarding some morphological features are different enough to conclude whether new species could be involved.

The two research questions concerning the morphological habit are:

(a) Whenever an author describes a species, and she or he is referring to one or more earlier published descriptions, is there any resemblance or consistency to notice between her or his original description and the earlier description(s) to which the aforementioned author refers?

(b) Whenever the author sub (a) is quoted by another, later author in her or his very own description, is there any resemblance or consistency to observe between the description by this later author and the quoted, earlier, original description?

Surveying our results from history, for the first two thirds of the mentioned time span striking details about the general morphological plant habit proved to be relatively sparse. Nevertheless, particularly concerning the flowering habit we found a lot of detailed descriptions about the way in which the flower or a cluster of flowers is growing on or from the branches, often specifying the outward appearance of the cyathium itself. Although some authors give only a superficial specification about this morphological characteristic, many other botanists specified this feature by observing remarkable detail. Therefore, looking at our findings from a historical perspective, we decided to restrict ourselves to examine the differences or similarities regarding the flowering habit.

5.2. Definitions.

With respect to *Euphorbia* species, here we define (cf. Prenner, Vergara-Silva & Rudall, 2009) an **inflorescence** as the flowering and fruiting part of the plant; on a main stem or stalk the inflorescence bears either a solitary flower or a group of flowers that grow from a common main axis, often in a characteristic arrangement. When an axis ends in a flower, it is called closed or determinate (if not: open or indeterminate). A **simple inflorescence** is regarding a single, unbranched axis bearing a flower, the axis usually subtended by a leaf-like phyllome, called a **bract**. A **compound inflorescence** pertains to a branching axis bearing flowers, which are preceded (rather than subtended) by a pair of lateral, leaf-like phyllomes, called **bracteoles**. Although in botany different types of compound inflorescences are distinguished, e. g. a raceme, thyrse, panicle or cyme, only a **cyme** is here of importance. Particularly the **cymose inflorescence** is a closed inflorescence in which the main axis as well as each side branch (axis) determinately terminates in a flower. A cymose inflorescence in which the initial (mostly sessile) central flower opens first, later on followed by peripheral flowers on axes to the side of it, all almost equally pedicelled, we therefore define a true **cyme**. In this way flower-bearing axes develop in the axils of the bracteoles of the initial central flower, whereas the bracteoles become subtending bracts. When in each of the axils of the paired, lateral bracteoles of a central cyathium a new flower develops, we call the cyme a **dichasial cyme**; if three or more flowers at the side of the initial, central cyathium become developed, the inflorescence is called a **pleiochasial cyme**. The whole process of rebranching into flower-bearing side axes may be repeated.

By the way, in the context of our paper the term **umbel** is not relevant, for an umbellate inflorescence is, according to Prenner et al. (2009), derived from a raceme. Because an "umbel" bears a cluster of flowers on pedicels which are equal in length, all arising from a common point on the main stem, it resembles the flowering habit of an onion. In case of a true umbel the flowers are opening all at the same time or from within to the outside of the umbel or just the reverse. Only when within a cymose inflorescence the central cyathium aborts and vanishes, the remaining, pedicelled cyathia at first sight *may resemble* an umbel (like J.-B de Lamarck, 1788, pp. 416-417 concerning *Euphorbia tridentata* obviously presupposed), but in fact, they do *not* represent a real "umbellate inflorescence". A true "umbel" is not known within the genus *Euphorbia*.

The main stem holding the inflorescence, we call the **peduncle**; the stalk of each single cyathium is called the **pedicel**. When a cyathium sits on top of a single, unbranched, main axis, usually subtended by one or usually two bracts, it is defined **solitary**. When the main axis (peduncle) is hardly discernible or at least minuscule, the cyathium is named **sessile**; when a solitary flower has a (very) short peduncle, it may be also called **short-peduncled** or **nearly sessile**. Otherwise cyathia may be called long-peduncled.

5.3. Flowering habit.

Heuristically, or, according a strategy to discover problems methodically and to solve problems systematically, we classified the 90 descriptions about the flowering habit, given by 46 botanists or a collective of botanists, in 9 separate categories each representing a specific morphology, namely:

Cat. A: In the original description no specifications or no discriminating particulars about the flowering habit are given (in brief "*no data known*") ;

Cat. B: The original description is ambiguous and therefore confusingly composed concerning the flowering habit (in brief "*ambiguous composed*");

Cat. C: The original description concerns plants with solitary flowers, sessile or nearly sessile c. q. very short peduncled (in brief "*solitary, sessile or nearly sessile*");

Cat. D: The original description concerns plants with separately developing, short-peduncled flowers growing together in a cluster (in brief "*short-peduncled, clustered*");

Cat. E: The original description concerns plants with solitary, sessile flowers combined with peduncled flowers, but not with a cymose inflorescence (in brief "*combined sessile and peduncled, no cymes*");

Cat. F: The original description concerns plants with flowers on relatively long, lengthened or elongated peduncles, simple or forked or clustered together, but not as a cymose inflorescence (in brief "*long-peduncled, simple (forked) or clustered, no cymes*");

Cat. G: The original description concerns plants with solitary, sessile flowers combined with cymose inflorescences (in brief "*sessile and cymose combined*");

Cat. H: The original description concerns plants with peduncled flowers, simple or growing together in a cluster combined with cymose inflorescences (in brief "*simply peduncled or clustered and cymose combined*");

Cat. I: The original description concerns plants with mainly cymose inflorescences (in brief "*cymose inflorescences*").

Retrieving from history all specifics about the flowering habit of *Euphorbia tridentata* Lam., *Euphorbia ornithopus* Jacq., *Euphorbia patula* Mill. and *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., we classified each original plant description (Table 1, column 1-2) in one of the nine categories A to I inclusive, as outlined above (column 3), whereas the same classification in

nine categories we applied to the earlier description(s) (column 4-13) to which an author or a collective of authors, as mentioned in column 1-3, refers in her, his or their original description.

Next, we classified in in one of the nine categories A to I inclusive (column 14-23) the description of a later author who quotes the description by the earlier author or collective of authors which is mentioned in column 1-3.

Let us reiterate our research question: is there any consistency to ascertain regarding the particulars of the flowering habit between an original description and the earlier description(s) to which an author or a collective of authors refers as well as between the description of a later author, who quotes an earlier description, and this original description? The results are discussed on pp. 169 sqq.

Table 1. Analysis of the flowering habit.

Legend:

- cat. = category; n.d. = no data included.
- column 1: reference to number of section in main text.
- column 2: name of author(s) including the name of the species.
- column 3: classification in category A to I incl. (see p. 163 for specification) regarding the original species description of the author(s) mentioned in column 1-2.
- column 4-13 regards the description of earlier authors to which author(s) from column 1-2 in his, her or their original description refer(s), the earlier description to which is referred is classified according to category A to I incl. (see p. 163 for specification); per specific category only the number of times it occurs, is recorded (column 4: no data included, indicated by an asterisk).
- column 14-23 regards the description of later authors who quote the earlier author(s) from column 1-2, the description of the later authors is classified according to category A to I incl. (see p.163 for specification), per specific category only the number of times it occurs, is recorded (column 14: no data included, indicated by an asterisk).

Example, copied from Table 1; note: between brackets column nrs as shown in Table 1.

column	2	3	4	5	6	7	8	9	10	11	12	13		14	15	16	17	18	19	20	21	22	23
			re. description to which author(s) from col. 2 refer(s)											re. description of author who cites author(s) in col. 2									
section	author(s) + publ. year + species name	cat.	n.d.	A	B	C	D	E	F	G	H	I		n.d.	A	B	C	D	E	F	G	H	I
2.13	W. Aiton (1789) - Euphorbia anacantha	C		1		1						1			4	1	4	5	2				

(1) Section 2.13; (2) W. Aiton (1789) - *Euphorbia anacantha*; (3) W. Aiton's original description of the flowering habit belongs to cat. C, or, *the original description concerns plants with solitary flowers, sessile or nearly sessile c. q. very short peduncled*; W. Aiton refers (5) once to an author from cat. A, or, *in this description no specifications or no discriminating particulars about the flowering habit are given*; (7) once to an author from cat. C, or, *this description concerns plants with solitary flowers, sessile or nearly sessile c. q. very short peduncled* and (13) once to an author from cat. I, or, *this description concerns plants with mainly cymose inflorescences*.

W. Aiton's *Euphorbia anacantha*, described according to cat. C, or, *the original description concerns plants with solitary flowers, sessile or nearly sessile c. q. very short peduncled*, is quoted (15) 4 times by authors from cat. A, or, *in this description no specifications or no discriminating particulars about the flowering habit are given*, (16) once by an author from cat. B, or, *this*

description is ambiguous and therefore confusingly composed concerning the flowering habit, (17) 4 times by authors from cat. C, or, *this description concerns plants with solitary flowers, sessile or nearly sessile c. q. very short peduncled*, (18) 5 times by authors from cat. D, or, *this description concerns plants with separately developing, short-peduncled flowers growing together in a cluster* and (19) 2 times by authors from cat. E, or, *this description concerns plants with solitary, sessile flowers combined with peduncled flowers, but not with a cymose inflorescence*.

column 1	2	3	4	5	6	7	8	9	10	11	12	13		14	15	16	17	18	19	20	21	22	23
			re. description to which author(s) from col. 2 refer(s)											re. description of author who cites author(s)								in col. 2:	
section	author(s) + publ. year + species name in original description	cat.	n.d.	A	B	C	D	E	F	G	H	I		n.d.	A	B	C	D	E	F	G	H	I
2.2.1	**S. van Beaumont** (sent between 1690-1716 to H. Boerhaave) -																						
	African Tithymalus with a scaly stem	A	*												1								
2.3.	**C. Commelin** (compiled 1692-1731; lost) - *Tithymalus Africanus*																						
	aizoides, multiplici squamato caule non folioso, minor	A	*														1						
2.4.	**H. Boerhaave** (1720) - *Euphorbium* [No.] *7. Euphorbium,*																						
	Afrum, caule squamoso, tuberoso, minus, ex Horto Beaumont	A		1												2		2						1
2.7.1	**J. Burman** (1738) - *Tithymalus aizoides, Africanus, simplici,*																						
	squammato caule	A		1														1					
2.8.	**J. Ph. Breyne** *fil.* (1739) - *Euphorbium anacanthum, angusto*																						
	polygoni folio	A		1												1		1					
2.9.1	**Ph. Miller** (1731, 1733, 1735, 1743, 1745) - *Euphorbium* [No.] *7*																						
	Euphorbium Afrum, caule squamoso tuberoso, minus	A		1													2	2					
2.9.2	**Ph. Miller** (1752; 1754) - *Euphorbia* [No.] *9, Euphorbia*																						
	humilis, ramis patulis tuberculatis	A		1										*									
2.9.3	**Ph. Miller** (1759) - *Euphorbia* [No.] *11, Euphorbia inermis,*																						
	patulis simplicibus teretibus, foliolis linearibus instructis	A		1										*									
2.9.4	**Ph. Miller** (1768) - *Euphorbia* [No.] *11, Euphorbia (Patula)*																						
	inermis, ramispatulis simplicibus teretibus foliolis linearibus	A		1											3		1	1		2			
2.10.1(a)	**C. Linnaeus** (1737) - *Euphorbium afrum, caule squamoso,*																						
	tuberoso minus of H. Boerhaave (1720)	A		1										*									
2.10.1(b)	**C. Linnaeus** (1737) - *Euphorbium* [No.] *12. Euphorbium*																						
	anacanthum, squamosum, lobis florum tridentatis of A.-T.																						
	Danty d'Isnard (1720, reprint 1722)	A										1		*									
2.25.1	**R. Sweet** (1818) - *Euphorbia* [No.] *22: patula*	A				1												1		1	1	1	
2.25.2	**R. Sweet** (1818) - *Euphorbia* [No.] *23: anacantha*	A					2							*									
2.25.3	**R. Sweet** (1818) - *Euphorbia* [No.] *29: Ornithopus*	A							2					*									
2.26.1(a)	**R. Sweet (1826)** - *Euphorbia* [No.] *28: patula*	A		1					1												1		
2.26.2(a)	**R. Sweet** (1826) - *Euphorbia* [No.] *29: anacantha*	A				1	1							*									
2.26.3(a)	**R. Sweet** (1826) - *Euphorbia* [No.] *33: Ornithopus*	A							2					*									
2.26.1(b)	**R. Sweet** (1830) - *Euphorbia* [No.] *35: patula*	A		1					1					*									
2.26.2(b)	**R. Sweet** (1830) - *Euphorbia* [No.] *36: anacantha*	A				1	1							*									
2.26.3(b)	**R. Sweet** (1830) - *Euphorbia* [No.] *41: Ornithopus*	A							2					*									
2.27.1	**J. H. F. Link** (1822)-*Euph.* [No.] *81. Euphorbia anacantha* Wd	A				1	1							*									
2.27.2	**J. H. F. Link** (1822)-*Euph.* [No.] *82. Euphorbia ornithopus* Jq	A							2					*									
2.29.	**H. G. L. Reichenbach** (1828 publ. 1829) - *Euphorbia* subg.																						
	Athymalus, nomen nudum	A		1												1							
2.30.1	**J. F. Klotzsch & C. A. F. Garcke** (1859; 1860) - *Medusea*																						
	tridentata	A				2	1								1	1	1	3					
2.30.2	**J. F. Klotzsch & C. A. F. Garcke** (1859; 1860) - *Medusea*																						
	patula	A							1									1		1	1	1	
2.32.	**A. Terracciano** (1905) - *Euphorbia anacantha Aiton*	A				1																	
2.35.1	**N. E. Brown** (1915) - *Euphorbia patula* Mill.	A		1																1			
2.37.1	**G. A. Frick** (1930) - *Euphorbia ornithopus*	A								1												1	
2.42.	**P. V. Bruyns** (2000) - *Euphorbia tridentata* Lam.	A					1									1							

			re. description to which author(s) from col. 2 refer(s)										re. description of author who cites author(s) in col. 2									
section	author(s) + publ. year + species name in original description	cat.	n.d.	A	B	C	D	E	F	G	H	I	n.d.	A	B	C	D	E	F	G	H	I
2.43.1	**R. Govaerts, D. G. Frodin & A. Radcliffe-Smith** (2000) -																					
	Euphorbia patula Mill., syn. = *Euphorbia tridentata* Lam.	A	*										*									
2.43.2	**R. Govaerts, D. G. Frodin & A. Radcliffe-Smith** (2000) -																					
	Euphorbia ornithopus Jacq.	A	*										*									
2.45a	**P. V. Bruyns, R. J. Mapaya & T. Hedderson** (2006) - *Euphorbia*																					
	tridentata Lam.	A	*										*									
2.45b	**P. V. Bruyns, R. J. Mapaya & T. Hedderson** (2006) - *Euphorbia*																					
	ornithopus Jacq.	A	*										*									
2.47.	**IPNI** - *Euphorbia patula* Mill., *Euphorbia tridentata* Lam. and																					
	Euphorbia ornithopus Jacq.	A	*										*									
2.48.1	**Kew World Checkl. of Sel. Pl. Families** (Govaerts, 2000-mid-2013)																					
	Euphorbia patula Mill., syn. = *Euphorbia tridentata* Lam.; and																					
	Euphorbia ornithopus Jacq.	A	*										*									
2.48.2	**Kew World Checkl. of Sel. Pl. Families** (Govaerts, mid-2013 sqq.)																					
	Euphorbia patula Mill., syn. = Euphorbia ornithopus Jacq. ; and																					
	Euphorbia tridentata Lam.	A	*										*									
Subtot.A	**n = 40 descriptions by n = 19 authors or a collective of authors**		**9**	**12**	**0**	**7**	**7**	**0**	**11**	**1**	**0**	**1**	**20**	**7**	**4**	**7**	**10**	**0**	**5**	**3**	**3**	**1**

			re. description to which author(s) from col. 2 refer(s)										re. description of author who cites author(s) in col. 2									
section	author(s) + publ. year + species name in original description	cat.	n.d.	A	B	C	D	E	F	G	H	I	n.d.	A	B	C	D	E	F	G	H	I
2.10.3	**C. Linnaeus** (1762) - *Euphorbia caput medusae, Euphorbia*																					
	[No.] *8.6, Euphorbium anacanthum squamosum, lobis florum*																					
	tridentatis	B		1								1	*									
2.14.	**N. J. de Necker**(1790) - "*species naturalis Athymalus*", nom. rej.	B			1									1								
2.34	**I. B. Pole Evans**, Ed. (1925), **E. P. Phillips** (text) & **K. A.**																					
	Lansdell (drawing) - *Euphorbia tridentata* Lam.	B					2									1	1					
2.44.1	**P. V. Bruyns** (2012) - *Euphorbia tridentata* Lam.	B		1		3	1						*									
2.49.	**J. A. Peirson et al.** (2013) - *Euph.* subg. *Athymalus* Neck. ex Rchb.	B			1																	1
Subtot.B	**n = 5 descriptions by n = 5 authors or a collective of authors**		**0**	**2**	**2**	**3**	**3**	**0**	**0**	**0**	**0**	**1**	**2**	**1**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**1**

			re. description to which author(s) from col. 2 refer(s)										re. description of author who cites author(s) in col. 2									
section	author(s) + publ. year + species name in original description	cat.	n.d.	A	B	C	D	E	F	G	H	I	n.d.	A	B	C	D	E	F	G	H	I
2.1	**H. Claudius** (1686 or 1687) - *Tithymalus afr. minor*	C	*										*									
2.6.	**R. Bradley** (1727) - *Euphorbium Africanum caule squamoso,*																					
	tuberoso, minus - The Large White flower'd African Spurge	C		1												2	1					
2.7.2	**J. Burman** (1738) - *Euphorbium erectum, aphyllum, ramis*																					
	rotundis, tuberculis quadragonis	C		2								1			1	6	5	1				
2.10.2(b)	**C. Linnaeus** (1753) - *Euphorbia caput medusae 8.γ, Euphor-*																					
	bium erectum aphyllum,ramis rotundis, tuberculis tetragonis	C				1											2					
2.11.2	**G. Bonelli & L. Sabbati** (1772) - *Tithymalus* [No.] *21.*																					
	Tithymalus, seu Euphorbium, aizoides, caule crasso, et ramoso	C	*										*									
2.13	**W. Aiton** (1789) - *Euphorbia anacantha*	C		1		1						1		4	1	4	5	2				
2.17.	**Chr. H. Persoon** (1807) - *Euphorbia* [No.] *18. Anacantha*	C				2	2									1						
2.20.	**W. T. Aiton** (1811) - *Euphorbia anacantha*	C				1	2									2						
2.22.2	**A. H. Haworth** (1812) - *Dactylanthes anacantha*	C				5	1							4		3	4	2				

			re. description to which author(s) from col. 2 refer(s)											re. description of author who cites author(s) in col. 2									
section	author(s) + publ. year + species name in original description	cat.	n.d.	A	B	C	D	E	F	G	H	I		n.d.	A	B	C	D	E	F	G	H	I
2.23.	**C. L. Loddiges & Sons** (1819, date on t. p. 1818) - *Euphorbia*																						
	anacantha	C		1													1	1		2			
2.24.	**J. Sims** (1824) - *Euphorbia anacantha. Scaly Finger-flowered*																						
	Spurge	C				4	3					1			2		1	2		2			
2.28.1	**K. Sprengel** (1826) - *Euphorbia* [No.] *26. Anacantha*	C				1												1					
2.31.1	**P. E. Boissier** (1862) - *Euphorbia* [No.] *328. Euphorbia*																						
	anacantha (Aiton)	C		2		5	2		1									1					
2.39.	**H. W. R. Marloth** (1931) - *Euphorbia tridentata* Lam. versus																						
	Euphorbia ornthopus Jacq.	C					1											1					
2.41.1	**G. Marx** (1992) - *Euphorbia tridentata* Lam.	C					1											1					
Subtot.C	**n = 15 descriptions by n = 15 authors or a collective of authors**		**2**	**7**	**0**	**20**	**12**	**0**	**1**	**0**	**0**	**3**		**2**	**10**	**2**	**20**	**24**	**5**	**4**	**0**	**0**	**0**

			re. description to which author(s) from col. 2 refer(s)											re. description of author who cites author(s) in col. 2									
section	author(s) + publ. year + species name in original description	cat.	n.d.	A	B	C	D	E	F	G	H	I		n.d.	A	B	C	D	E	F	G	H	I
2.11.1	**G. Bonelli & L. Sabbati** (1772) - *Tithymalus* [No.] *19. Tithymalus*																						
	Euphorbium dictus (...) florum petalis e candido roseis, bidentis,																						
	& tridentis	D		1										*									
2.12	**J.-B. de Lamarck** (1788) - *Euphorbia tridentata*	D		1		1	1					1			6	2	4	6	2				
2.15.	**C. L. Willdenow** (1799) - *Euphorbia anacantha*	D		1		2	1					1			4		3	3					
2.16.	**A. P. de Candolle** (1804) - *Euphorbe à trois dents. Euphorbia*																						
	tridentata [Lam.]	D		1		2	2					1			1		4	2	2				
2.21.1	**J. L. M. Poiret** (1812) - *Euphorbia tridentata n°.11*	D				1	1											1					
2.35.2	**N. E. Brown** (1915) - *Euphorbia* [No.] *77. Euphorbia tridentata*																						
	(Lam.)	D		1		8	4	1				1				1		1	1				
2.40.1	**A. C. White, R. A. Dyer & B. L. Sloane** (1941) - *Euphorbia*																						
	tridentata Lam.	D		1	1	6	4	1				2						1					
2.44.2	**S. Carter** (2002) - *Euphorbia tridentata* Lam.	D		3		4	2		1			1								1			
Subtot.D	**n = 8 descriptions by n = 8 authors or a collective of authors**		**0**	**9**	**1**	**24**	**15**	**2**	**1**	**0**	**0**	**7**		**1**	**11**	**3**	**11**	**14**	**5**	**1**	**0**	**0**	**0**

			re. description to which author(s) from col. 2 refer(s)											re. description of author who cites author(s) in col. 2									
section	author(s) + publ. year + species name in original description	cat.	n.d.	A	B	C	D	E	F	G	H	I		n.d.	A	B	C	D	E	F	G	H	I
2.33.1	**A. Berger** (1905) - *Euphorbia anacantha* Aiton	E				4	1							*									
2.34.2	**A. Berger** (1906, date on t. p. 1907) - *Euphorbia* [No.] *87.*																						
	Euphorbia anacantha [Aiton]	E				5	2											1					
2.38.1	**R. A. Dyer** (1931) - *Euphorbia* [No.] *35. Euphorbia tridentata*	E					2											1					
Subtot.E	**n = 3 descriptions by n = 2 authors**		**0**	**0**	**0**	**9**	**5**	**0**	**0**	**0**	**0**	**0**		**1**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**

			re. description to which author(s) from col. 2 refer(s)											re. description of author who cites author(s) in col. 2									
section	author(s) + publ. year + species name in original description	cat.	n.d.	A	B	C	D	E	F	G	H	I		n.d.	A	B	C	D	E	F	G	H	I
2.18.	**N. J. von Jacquin** (1809) - *Euphorbia ornithopus*	F	*												8					7	2	3	1
2.19.	**C. L. Willdenow** (1809) - *Euphorbia* [No.] *6. Euphorbia*																						
	Ornithopus	F							1						4					1	1		
2.21.2	**J. L. M. Poiret** (1812) - *Euphorbia* [No.] *111. Euphorbia*																						
	ornithopus Jacq.	F							2												1		
2.22.1	**A. H. Haworth** (1812) - *Dactylanthes patula*	F		1											5		1	1		3			

			re. description to which author(s) from col. 2 refer(s)										re. description of author who cites author(s) in col. 2									
section	author(s) + publ. year + species name in original description	cat.	n.d.	A	B	C	D	E	F	G	H	I	n.d.	A	B	C	D	E	F	G	H	I
2.28.2	**K. Sprengel** (1826) - *Euphorbia* [No.] *27. Ornithopus Jacq.*	F							1											1		
2.31.2	**P. E. Boissier** (1862) - *Euphorbia* [No.] *329. Euphorbia*																					
	Ornithopus (Jacq.)	F							1											1		
2.33.2	**A. Berger** (1905) - *Euphorbia ornithopus* Jacq.	F				2			2											1		
2.34.1	**A. Berger** (1906, date on t. p. 1907) - *Euphorbia* [No.] *86.*																					
	Euphorbia ornithopus [Jacq.]	F				2			2											1		
2.35.3	**N. E. Brown** (1915) - *Euphorbia* [No.] *78. Euphorbia*																					
	ornithopus (Jacq.)	F		3					8												1	
2.46.2	**P. V. Bruyns (2012)** - *Euphorbia patula* Mill., syn. = *Euphorbia*																					
	ornithopus Jacq.	F		2					2				*									
Subtot.F	**n = 10 descriptions by n = 9 authors**		**1**	**6**	**0**	**4**	**0**	**0**	**19**	**0**	**0**	**0**	**1**	**17**	**0**	**1**	**1**	**0**	**11**	**8**	**4**	**1**

			re. description to which author(s) from col. 2 refer(s)										re. description of author who cites author(s) in col. 2									
section	author(s) + publ. year + species name in original description	cat.	n.d.	A	B	C	D	E	F	G	H	I	n.d.	A	B	C	D	E	F	G	H	I
2.44.1	**S. Carter** (2002) - *Euphorbia ornithopus* Jacq.	G							1		1	1	*									
Subtot.G	**n = 1 descriptions by n = 1 author**		**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

			re. description to which author(s) from col. 2 refer(s)										re. description of author who cites author(s) in col. 2									
section	author(s) + publ. year + species name in original description	cat.	n.d.	A	B	C	D	E	F	G	H	I	n.d.	A	B	C	D	E	F	G	H	I
2.38.2	**R. A. Dyer** (1931) - *Euphorbia* [No.] *36. Euphorbia ornithopus*	H							1	1											1	
2.39.2	**H. W. R. Marloth** (1931) - *Euphorbia ornithopus* Jacq.	H							1												1	
2.40.2	**A. C. White, R. A. Dyer & B. L. Sloane (1941)** - *Euphorbia*																					
	ornithopus Jacq.	H		4					3	1	2									1		
2.50.2	**R. van Veldhuisen & Pj. Lawant** (2014) - *Euphorbia tridentata*																					
	var. *ornithopus* comb. & stat. nov.	H							4	1	2		*									
Subtot.H	**n = 4 descriptions by n = 4 authors or a collective of authors**		**0**	**4**	**0**	**0**	**0**	**0**	**9**	**3**	**4**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**2**	**0**

			re. description to which author(s) from col. 2 refer(s)										re. description of author who cites author(s) in col. 2									
section	author(s) + publ. year + species name in original description	cat.	n.d.	A	B	C	D	E	F	G	H	I	n.d.	A	B	C	D	E	F	G	H	I
2.5	**A.-T. Danty d'Isnard** (1720, repr. 1722) - *Euphorbium*																					
	anacanthum, squamosum, lobis florum tridentatis	I		1										2		3	5		1			1
2.10.2	**C. Linnaeus** (1753) - *Euphorbia caput medusae β*, *Euphorbium*																					
	anacanthum squamosum, lobis florum tridentatis	I										1					2					
2.41.2	**G. Marx** (1992) - *Euphorbia ornithopus* Jacq.	I							1				*									
2.50.1	**Pj. Lawant & R. v.Veldhuisen** (2014) - *Euphorbia leachii* sp. nov.	I		2	1		1					2	*									
Subtot. I	**n = 4 descriptions by n = 4 authors or a collective of authors**		**0**	**3**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**3**	**2**	**2**	**0**	**3**	**7**	**0**	**1**	**0**	**0**	**1**

			re. description to which author(s) from col. 2 refer(s)										re. description of author who cites author(s) in col. 2									
		cat.	n.d.	A	B	C	D	E	F	G	H	I	n.d.	A	B	C	D	E	F	G	H	I
Tot. A-I	**n = 90 descriptions by n = 46 authors or a collective of authors**		**12**	**43**	**4**	**67**	**43**	**2**	**43**	**4**	**5**	**16**	**31**	**48**	**9**	**43**	**59**	**10**	**22**	**12**	**9**	**4**

column 1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*

5.4. Interpretation of the results shown in Table 1.

Surveying Table 1 we will discuss some remarkable results about the description of the flowering habit, as divided in nine different morphological specifications and as such classified in nine corresponding categories, see pp. 163-164. A detailed analysis can be obtained from the authors on request.

1. Regarding category A (in brief: *no data known*) we noted 40 descriptions by 19 authors or a collective of authors; in their descriptions the authors did not specify the flowering habit. In 12 cases they referred to botanists who did not give any or only scanty information, but in 25 specified cases they referred to descriptions spread across the categories C, D, F and once concerning category G and I each. Regarding those botanists who quote authors with descriptions categorized in category A, in 33 specified cases their own plant descriptions are distributed across the categories B, C, D, F, G, H and I, mainly for one third in category D (*short-peduncled, clustered*).

2. To category B (in brief: *ambiguously composed*) belong 5 descriptions by 5 authors or a collective of authors, namely the annotation in the *second* edition of the *Species Plantarum* by C. Linnaeus (1762) about the species of Danty d'Isnard (1720), the "*species naturalis Athymalus*" (nom. rejec.) by N. J. de Necker (1790a, b), the representation of *Euphorbia tridentata* by I. B. Pole Evans (1925) - the text and the accompanying drawing being very contradictory - as well as the description of *Euphorbia tridentata* Lam. by P. V. Bruyns (2012), for missing additional particulars about the flowering habit. J. A. Peirson et al. (2013), referring to N. J. de Necker (1790b), interpret the cyathia copied by N. J. de Necker from the original engraving by A.-T. Danty d'Isnard (1720) as picturing *Euphorbia tridentata* Lam. and consequently adopting this species as the type of *Euphorbia* subg. *Athymalus* - a conclusion we seriously doubt (see section 2.49 and 2.50.1).

3. Concerning category C (in brief: *solitary, sessile or nearly sessile*) we note 15 authors or a collective of authors producing 15 descriptions categorized in category C. They chiefly refer (out of 36 specified cases) to 20 descriptions in the same category, but also to 12 descriptions within category D (*short-peduncled, clustered*), specifying the flowering habit as characterized by separately developing, short-peduncled flowers growing together in a cluster. Looking at the original descriptions by authors who quote other botanists categorized in category C, describing solitary, (nearly) sessile flowers, in 20 from 55 specified cases the same category C is maintained, but markedly in 24 cases these authors describe the flowering habit of their own plants within category D, i. e. short-peduncled flowers growing in a cluster!

4. In category D (in brief: *short-peduncled, clustered*) give 8 authors or a collective of authors 8 descriptions; they refer (out of 50 specified cases) to 15 descriptions in the same category, but strikingly also to 24 descriptions within category C which designates the flowering habit only as solitary, (nearly) sessile. Concerning the original descriptions of the flowering habit by botanists who quote authors belonging to category D, in 14 from 34 specified cases these are classified in the same category D, but nevertheless one third (11 cases) also in category C (*solitary, sessile or nearly sessile*), besides 5 in category E and one in category F.

5. Concerning category E (in brief: *combined sessile and peduncled, no cymes*), in 3 descriptions by 2 authors, namely A. Berger (1905; 1906 - date on t. p. 1907) re. *Euphorbia anacantha* and R. A. Dyer (1931) re. *Euphorbia tridentata*, the flowering habit is observed as a definite combination of solitary, sessile and peduncled flowers, but markedly they refer (out of 14) to 9 descriptions within category C with sessile or nearly sessile flowers only, and to 5 descriptions within category

D with peduncled, clustered flowers only. When quoted by other botanists, their own descriptions belong to category D, not to category E.

6. Regarding category F (in brief: *long-peduncled, simple (forked) or clustered, no cymes*) in 10 descriptions by 9 authors, chiefly pertaining to *Euphorbia ornithopus* Jacq. and *Euphorbia patula* Mill., in 19 cases (out of 23 specified cases) is indeed by two third referred to category F, but regarding the botanists who quote them, in 26 specified cases their descriptions are distributed across the categories C, D, F, G, H, I, although with the main point quite right on category F (11 cases).

7. In category G (in brief: *sessile and cymose combined*) we only classified S. Carter (2002) who, regarding *Euphorbia ornithopus* Jacq., considers the flowering habit a combination of solitary, sessile flowers as well as of cymose inflorescences. Besides, to category F which specifies long-peduncled, simple (forked) or clustered flowers only, Carter refers to category H which concerns peduncled flowers, simple or growing together in a cluster combined with cymose inflorescences and to category I, cymose inflorescences only. Carter (2002) is not quoted by other botanists.

8. To be classified in category H (in brief: *simply peduncled or clustered and cymose combined*), the botanists R. A. Dyer (1931), H. W. R. Marloth (1931) and A. C. White, R. A. Dyer & B. L. Sloane (1941) note regarding "*Euphorbia ornithopus* Jacq." a combination of peduncled flowers, simple or growing together in a cluster combined with cymose inflorescences, but they refer only in 2 cases to category H, in 2 cases to category G (*sessile and cymose combined*) and even in 5 cases to category F which describes the flowering habit as flowering with long-peduncled flowers, simple or forked or clustered together, but not as a cymose inflorescence. When botanists are quoting these authors sub category H, in 2 cases out of 3 their descriptions of the flowering habit pertains to the category H. Regarding the reinstated combination *Euphorbia tridentata* var. *ornithopus* by R. van Veldhuisen & Pj. Lawant (2014), we consider the flowering habit of the variety *ornithopus* also belonging to category H.

9. With regard to category I (in brief: *cymose inflorescences*), to this category pertain the descriptions by Danty d'Isnard (1720) and C. Linnaeus (1753) as well as the observations by G. Marx (1992, concerning *Euphorbia ornithopus* Jacq.), but their references diverge: by Danty d'Isnard to H. Boerhaave (1720), by C. Linnaeus to Danty d'Isnard and by G. Marx to N. J. von Jacquin (1809). Pj. Lawant & R. van Veldhuisen class their references for *Euphorbia leachii* sp. nov. in category A (2 times), B (once), D (once) and I (2 times). In 14 cases Danty d'Isnard (1720) and C. Linnaeus (1753) are quoted by botanists who in their own descriptions characterize the flowering habit twice to be classified within category A (*no data known*), three times within category C (*solitary, sessile or nearly sessile*), seven times within category D (*short-peduncled, clustered)* and once in category F (*long-peduncled, simple (forked) or clustered, no cymes*) as well as once in category I (*cymose inflorescences*).

Note. About category F, viz. "*The original description concerns plants with flowers on relatively long, lengthened or elongated peduncles, simple or forked or clustered together, but not as a cymose inflorescence*", four species of our interest deserve a closer look. They are all based on the species which A. H. Haworth (1812) described as a tuberculate *Dactylanthes patula* with (we cite) "*flowers solitary on exceptionally long peduncles*" (see section 2.22.1); Haworth based (we think erroneously) his description on the non-tuberculate species which Ph. Miller in 1768 published in the 8th Edition of *The Gardeners Dictionary* as *Euphorbia* [No.] *11 (Patula)*, or simply *Euphorbia patula* Mill. The British botanist R. Sweet, in 1818 recording *Euphorbia patula*, referred to

Haworth's *Dactylanthes patula*, as also did J. F. Klotzsch & C. A. F. Garcke when presenting *Medusea patula* in the *Monatsberichte, etc.* (1859) c. q. the *Abhandlungen, etc.* (1860). However, because Ph. Miller explicitly described his species as non-tuberculate ("*not scaly*", he says), N. E. Brown (1915), A. C. White, R. A. Dyer & B. L. Sloane (1941, p. 508) and S. Carter (2002) doubted about its true identity; N. E. Brown supposed it may be *Euphorbia mauritanica* (see section 2.35.1). Nevertheless, S. Carter (2002) classifies all three species as mentioned above in the synonymy regarding the species *Euphorbia tridentata* Lam., but A. C. White, Dyer & Sloane (1941) consider them synonyms of *Euphorbia ornithopus* Jacq. P. V. Bruyns (2012) confirms the non-tuberculate *Euphorbia patula* of Ph. Miller (1768) as a valid species for based on a herbarium sheet of a tuberculate species in Haworth's herbarium, named by A. H. Haworth himself *Euphorbia patula* Mill.; Bruyns consequently reduces *Euphorbia ornithopus* Jacq. into its synonymy (see section 2.46.2). However, we (authors) did not agree with these taxonomic designations and paid attention to this problem in section 2.50.3.

5.5. Conclusion.

Inspecting our results, we have to conclude that hardly any consistency is to note regarding the particulars of the flowering habit between the original description, the description to which the author of the original description refers and the original description of the botanist(s) who quote(s)the original description and its author. The spreading or distribution of the various categories concerning the descriptions of the flowering habit to which an author in his original treatise refers, is too large to get a clear-cut image whether uniform flowering habits are at stake; the same regards the particular descriptions of the authors who quote another original description. Furthermore, the descriptions supplied by the various botanists about this feature are sometimes incomplete or too vague in details; sometimes a precise wording of this feature is far from unambiguous.

For instance, in some descriptions the length of the peduncles, as given by botanists in their descriptions of the same plants, can vary considerably. For instance, on the one hand, Rudolf Marloth (1931, see section 2.39.1) writes: "*Euphorbia tridentata (...) bears a solitary flower immediately at the end of a shoot without any peduncle or with a short one only*"; on the other hand, Robert A. Dyer (1931, see section 2.38.1) notes, from his experience in the field, "*Euphorbia tridentata (...) peduncles 0-2 inches* [0-50 mm] *long, arising gradually from the apex of the branches*". Even when it concerns a short-peduncled inflorescence, the length of the peduncles of *Euphorbia tridentata* varies from 4 mm (Brown, 1915; White, Dyer & Sloane, 1941) or 4.5 mm (De Lamarck, 1788) to 7-15 mm (Willdenow, 1799).

Another example regards the results we found about "*Euphorbia ornithopus* Jacq." in historical context. A conspicuous fact is that for a long time there is not any talk of a cymose inflorescence after the first description of the species in 1809 by N. J. von Jacquin. He described the inflorescence of "*Euphorbia ornithopus* Jacq." as a simple inflorescence, namely a solitary flower on a relatively long peduncle, or consisting of several, separate peduncles, each arising from the axil of branch leaflet (see Fig. 11). The same flowering habit concerning *Euphorbia ornithopus* Jacq. is mentioned by C. L. Willdenow (1809), J. L. M. Poiret (1812), R. Sweet (1818; 1826, 1830), J. H. F. Link (1822), K. Sprengel (1826), P. E. Boissier (1862), A. Berger (1905; 1906, date on t.p. 1907) and N. E. Brown (1915) regarding the "short-jointed branch form". The length of the peduncle as noted by N. J. von Jacquin, namely c. 5 cm, is repeated by P. E. Boissier (1862); N. E. Brown (1915) noted the length of the peduncles of the long-jointed form 3.8-7.6 cm long, but it was considered much variable by R. A. Dyer (1931) namely 1.3-10.2 cm, and 1.2-10 cm long by A. C. White, R. A. Dyer & B. L. Sloane (1941) and S. Carter (2002). The botanist N. E. Brown (1915) mentions, concerning a "long-jointed branch form" of *Euphorbia ornithopus* Jacq., two types of inflorescence, namely a

simple inflorescence with a solitary flower besides a cymose inflorescence (see section 2.35.3); R. A. Dyer (1931), H. W. R. Marloth (1931), A. C. White, R. A. Dyer & B. L. Sloane (1941), G. Marx (1992) and S. Carter (2002) also record the existence of both types, even on the same plant. According to Dyer, a simple inflorescence occurs more often than a cymose inflorescence; but as soon as it pertains to a cymose inflorescence White, Dyer & Sloane and Carter report the existence of dichasial cymes or 3-rayed, 4-rayed or 5-rayed pleiochasial cymes. In summary, much confusing!

Summarized, we decide that the morphological characteristic of the flowering habit cannot be regarded a discriminating, distinguishing mark to determine the extent to which distinct taxa might be at stake. Our analysis demonstrates how incomplete and imperfect the flowering habit of the species belonging to the subsection *Dactylanthes* is understood (cf. J. A. Peirson et al., 2013).

5.6. Are typical characteristics of the cyathia critically discriminating features?

Surveying in historical perspective the descriptions of the botanists who reviewed the species of our interest, namely *Euphorbia tridentata* Lam., *Euphorbia ornithopus* Jacq., *Euphorbia patula* Mill. and *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., we studied the specific form, size and colouring of the cyathia involved. Here we present a concise analysis, but a detailed analysis can be obtained from the authors on request. In first instance, we had to conclude that 45 descriptions by 22 botanists or a collective of botanists did not contain enough specified details about the cyathium; but from 45 descriptions and/or illustrations by 24 botanists or a collective of botanists we were able to infer more or less specified details about the cyathium.

Describing the cyathium, some botanists only note the general characteristic "*petalis palmatis*", i. e. the flowers possess glands like the (five) fingers of an outspread hand, as noted by W. Aiton (1789) re. *Euphorbia anacantha*; Chr. H. Persoon (1807) re. *Euphorbia anacantha*; A. H. Haworth (1812) re. *Dactylanthes anacantha* and *Dactylanthes patula* and K. Sprengel (1826) re. *Euphorbia anacantha*. Many scientists only mention the number of the glands, or the number of glands can be retrieved from an accompanying illustration: three to four by G. Marx (1992) re. *Euphorbia ornithopus*; four by G. Bonelli & L. Sabbati (1772) re. *Tithymalus* [No.] *19. Euphorbium dictus*, N. J. von Jacquin (1709) re. *Euphorbia ornithopus*, A. Berger (1905; 1906 d. on t. p. 1907) re. *Euphorbia ornithopus*, N. E. Brown (1915) re. *Euphorbia ornithopus*, and by R. A. Dyer (1931), H. W. R. Marloth (1931) and S. Carter (2002) all re. *Euphorbia ornithopus*, especially concerning the cyathia surrounding the 5-glanded central cyathium as well regarding the cyathia on simple peduncles. Four to five glands are found with C. L. Willdenow (1799) re. *Euphorbia anacantha*, Messrs C. L. Loddiges & Sons (1819, d. on t. p. 1818) re. *Euphorbia anacantha*, J. Sims (1824) re. *Euphorbia anacantha*, H. W. R. Marloth (1931) re. *Euphorbia tridentata*, A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia tridentata* and G. Marx (1992) re. *Euphorbia tridentata*. Five glands can be seen on the plant portraits by H. Claudius (1686/1687) re. *Tithymalus africanus minor*, by R. Bradley (1727) re. *The Large White flower'd African Spurge* and by J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*; furthermore five glands are reported by J.-B. de Lamarck (1788) re. *Euphorbia tridentata*, A. P. de Candolle (1804) re. *Euphorbia tridentata*, J. L. M. Poiret (1812) re. *Euphorbia tridentata*, A. Berger (1905; 1906 d. on t. p. 1907) re. *Euphorbia anacantha* and N. E. Brown (1915) re. *Euphorbia tridentata*. Even five to six glands are noted by R. A. Dyer (1931) re. *Euphorbia tridentata*. Concerning the new species *Euphorbia leachii* Lawant & van Veldhuisen the authors found 5 glands pertaining to the central, sessile cyathium of the cyme and 4-5 glands on the lateral cyathia.

The number of the teeth on each gland varies considerably. Two to three teeth are found with A. P. de Candolle (1804) re. *Euphorbia tridentata*, G. Bonelli & L. Sabbati (1772) re. *Tithymalus* [No.] *19. Euphorbium dictus* and A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia tridentata*; three with J.-B. de Lamarck (1788) re. *Euphorbia tridentata*, N. J. von Jacquin (1709) re. *Euphorbia ornithopus*, C. L. Willdenow (1809) re. *Euphorbia ornithopus*, J. L. M. Poiret (1812) re. *Euphorbia tridentata* and *Euphorbia ornithopus*, J. Sims (1824) re. *Euphorbia anacantha*, P. E. Boissier (1862) re. *Euphorbia anacantha* and *Euphorbia ornithopus*, A. Berger (1905; 1906 d. on t. p. 1907) re. *Euphorbia anacantha* and H. W. R. Marloth (1931) re. *Euphorbia tridentata*. Three to four teeth on each gland are found on the pictures by H. Claudius (1686/1687) re. *Tithymalus africanus minor*, by R. Bradley (1727) re. *The Large White flower'd African Spurge* and by J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*; furthermore three to four teeth are also reported by C. L. Willdenow (1799) re. *Euphorbia anacantha*, Messrs C. L. Loddiges & Sons (1819, d. on t. p. 1818) re. *Euphorbia anacantha*, A. Berger (1905; 1906 d. on t. p. 1907) re. *Euphorbia ornithopus*, N. E. Brown (1915) re. *Euphorbia tridentata* and *Euphorbia ornithopus* and by S. Carter (2002) re. *Euphorbia tridentata* and *Euphorbia ornithopus*. G. Marx (1992) saw in the field re. *Euphorbia tridentata* glands with three-four-five teeth. About the new species *Euphorbia leachii* Lawant & van Veldhuisen, observations in the field in general recorded three teeth for the central cyathium of the cyme, but occasionally two, generally three or sometimes even four teeth can be found regarding the lateral cyathia.

The cyathium itself is sometimes called "rather large" by J.-B. de Lamarck (1788) re. *Euphorbia tridentata*, "spreading" by P. E. Boissier (1862) re. *Euphorbia anacantha*, by A. Berger (1906, date on t.p. 1907) re. *Euphorbia anacantha*, by N. E. Brown (1915) re. *Euphorbia tridentata* and by A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia tridentata*; its diameter is measured by N. E. Brown (1915) re. *Euphorbia tridentata*: 13-17 mm; by P. V. Bruyns in P. Goldblatt & J. Manning, Eds (2000) re. *Euphorbia tridentata*: 12-17 mm and by S. Carter (2002) re. *Euphorbia tridentata*: to 17 mm. On the pictures by H. Claudius (1686/1687) re. *Tithymalus africanus minor*, by R. Bradley (1727) re. *The Large White flower'd African Spurge* and by J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis* the cyathia can be discerned as horizontally spreading, on the plant portrait published by Messrs C. L. Loddiges & Sons(1819, d. on t. p. 1818) re. *Euphorbia anacantha* we also consider the cyathia rather large, spreading. When not notified as "large" or spreading", the involucre or "calyx" is sometimes designated as obconical, top-shaped, tubular; but especially A.-T. Danty d'Isnard (1720, reprint 1722) observes the cyathia of his *Euphorbium* [No.] *12.Euphorbium anacanthum, squamosum, lobis florum tridentatis* like a "*un cône renversé & un peu tronqué*", or, "*a cone upside down, a little bit truncated*". Concerning the new species *Euphorbia leachii* Lawant & van Veldhuisen the authors want to stipulate the upwards pointing, cup-shaped cyathia being in remarkably contrast to the widely spreading, saucer-shaped cyathia of *Euphorbia tridentata* Lam.

Few botanists only give an overall impression of the colour of the cyathium in its totality, like white by R. Bradley (1727) re. *The Large White flower'd African Spurge*. However, the colour of particularly the glands is indicated in various ways: white turning into red by J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, reddening glossy white by G. Bonelli & L. Sabbati (1772) re. *Tithymalus* [No.] *19*, whitish by A. P. de Candolle (1804) re. *Euphorbia tridentata*, white with greenish dots by A. Berger, 1906, date on t.p. 1907) re. *Euphorbia anacantha*, dark and purple with very white teeth by J.-B. de Lamarck (1788) re. *Euphorbia tridentata*, white tinged with purple toothed by J. Sims (1824) re. *Euphorbia anacantha*, purple by P. E. Boissier (1862) re. *Euphorbia anacantha*, corrugated white by N. E. Brown (1915) re. *Euphorbia tridentata*" and by A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia tridentata*, and pale yellow to white by P. V. Bruyns in P. Goldblatt & J. Manning, Eds, (2000) re.

Euphorbia tridentata. Looking at the plant portraits we see on the watercolour by Hendrik Claudius (1686 or 1687) cyathia in their totality showing a pale yellowish-white colour; the same colour we observe on the plant portrait made re. *Euphorbia tridentata* by K. A. Lansdell in I. B. Pole Evans, Ed. (1925). On the engravings presented by C. L. Loddiges & Sons (1819, date on t.p. 1818) re. *Euphorbia anacantha* and J. Sims (1824) re. *Euphorbia anacantha* the cyathia are greenish-white coloured; the cyathia photographed by G. Marx (1992) re. *Euphorbia tridentata* are greenish-white to brightly white. The new species *Euphorbia leachii* Lawant & van Veldhuisen attracts the attention for its conspicuously green-coloured, upward pointing cyathia, covered with pustule-like craters, which contrast with the more corrugated, horizontally spread, sparkling white glands of *Euphorbia tridentata*.

As can be concluded from the citations quoted above, the cyathium is not unequivocally treated by the botanists as we consulted in retrospect. For many of them give too few specified details, or their description of the cyathia must be regarded ambiguously. Our aim, to look for critically discriminating characteristics between species, especially regarding the cyathia, in first instance seemed not to be promising. However, some conspicuous differences we met, namely between the description in 1720 conceived by A.-T. Danty d'Isnard (acknowledged by C. Linnaeus, 1753, re. *Euphorbia caput-medusae β*) and the descriptions presented by the other botanists. Except for the recent description of the cyathium of *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. (Lawant & van Veldhuisen, 2014), in historical perspective it is Danty d'Isnard who minutely "fillets" the cyathium. He is the only botanist who gives an extensive explanation of the cymose inflorescence which adorns the species he presents, moreover, he describes the cyathia as particularly cup-shaped. Most scientists describe solitary, sessile or peduncled flowers (or at the least separately clustered on top of a branch), if necessary in combination with a cyme; whereas cyathia are mostly described as spreading. As said, Antoine-Tristan Danty d'Isnard (1720, reprint 1722, *Pl. 11*, see Fig. 2a), presenting a real cymose inflorescence, describes the cyme to consist of four cyathia. A central, sessile cyathium, 5-glanded and bisexual opens first, surrounded by three 4-glanded, bisexual cyathia on pedicels of equal length. The glands of all four cyathia are 3- to 4-toothed. Of importance is the notion, Danty d'Isnard designates each cyathium as a cone upside down. Summarizing his description (see section 2.5), the outside of this cup-shaped cyathium is green, covered with fine hairs. Enveloping the ovary, at its base each of the five lobes starts dark-green coloured with a wash of red-brown, then blackish-green passing into a white, chiselled gland. The teeth are on top white, their bottom green-brown, washed with purpurine. Whereas the stalkless, sessile central cyathium does not possess any bracts, the other three equally pedicelled cyathia, which form a perfect triangle, own opposite, fleshy bright-green, purpurine bordered bracteoles. From the plant portrait *Tab. 27* (see section 2.11.1, Fig. 6) presented by Giorgio Bonelli & Liberato Sabbati (1772) we could probably infer the same result. Also Carl Linnaeus (1753) acknowledges the species described by Danty d'Isnard as a particular one: "*Euphorbia caput-medusae β; Euphorbium anacanthum squamosum, lobis florum tridentatis*", or, "*A spineless Euphorbia, covered with scales, with 3-toothed flower-lobes*". With relation to the new validated species *Euphorbia leachii* Lawant & van Veldhuisen, the authors found the description of the flowering habit of this species and particularly of its cyathia in full agreement with the observations recorded by Danty d'Isnard (see section 2.5).

Note. In general, since the first description of *Euphorbia ornithopus* by N. J. von Jacquin (1809) the number of glands on a simple peduncled flower numbers four, each with three teeth. About the teeth, C. L. Willdenow (1809) prefers to designate the glands as "*divided in threes*" and not "*three-toothed*"; A. Berger (1905; 1906, date on t. p. 1907), N. E. Brown (1915) and S. Carter (2002) record 3 to 4 teeth. In case a cymose inflorescence is involved, the pedicelled cyathia (2- to 5-rayed according to S. Carter, 2002) are always 4-glanded, however, the central, sessile cyathium, when

not aborted, is always 5-glanded (R. A. Dyer, 1931; H. W. R. Marloth, 1931; A. C. White, R. A. Dyer & B. L. Sloane, 1941; S. Carter, 2002). This central, sessile cyathium is described by R. A. Dyer (1931), by H. W. R. Marloth (1931) and A. C. White, R. A. Dyer & B. L. Sloane (1941) as always male. Reviewing the botanists who recorded *Euphorbia ornithopus* Jacq., the description of a cyathium itself does not differ much from that of *Euphorbia tridentata* Lam.: glands wrinkled/pitted, china-white; A. Berger (1905) notes the cyathia "*conical, relatively large*" and S. Carter (2002) estimates the diameter to 12 mm wide. Therefore, the authors of this monograph decided to reduce *Euphorbia ornithopus* Jacq. into a variety status of *Euphorbia tridentata* Lam., see section 2.50.2.

In conclusion, studying in historical perspective the species of our interest about the form, size and colour of the cyathia, it becomes clear that we meet two groups implying a much different morphology: species with rather large, horizontally, widely spread cyathia with very white glands and species with cup-shaped cyathia with upward pointed, green coloured, marbled glands. Both habits prove to be very stable when found in the field as well as in cultivation.

Chapter 6. Some relevant subjects in historical retrospect.

6.1. About the earliest plant portraits retrieved.

Comparing Hendrik Claudius' watercolour, produced in 1686 or 1687 (*IPA collection, Fol. 188*, see Fig. 1), with the engraving (*Tab.7, Fig. 2*, see Fig. 4), which Johannes Burman published in 1738 when describing his "*Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*", a lot of similarities are striking. The number of branches is equal, and no rebranching along the stems happens; especially the picturing of some colourless branches behind the plant, probably withering, is remarkable; the rather large, solitary cyathia are obviously pictured. Clearly, Burman had Claudius' watercolour before him, next he had it redrawn and consequently engraved. Note that the resulting engraving is of course a mirror image, for instance observe that the globular capsule that Claudius painted on top of the second branch from left, on the copper plate has moved to the second branch from right. However, some minor differences are also discernible; note the capsule has its three valves now pictured. In the accompanying description, see section 2.7, Burman gives some measures about the length and width of the branches, therefore we assume he did not only have Claudius' watercolour at hand, but also a living specimen as well. According to J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis* the length of the branches is c. 11.5 cm; this equals more or less data given in later centuries: A. P. de Candolle (1804) re. *Euphorbia tridentata* [Lam.] 20 cm, Messrs C. L. Loddiges & Sons (1818) re. *Euphorbia anacantha* 15-20 cm, A. Berger (1906, date on t. p. 1907) re. *Euphorbia anacantha* 10-20 cm, N. E. Brown (1915) re. *Euphorbia tridentata* Lam. 2.5-15 cm, A. C. White, R. A. Dyer & B. L. Sloane (1941) re. *Euphorbia tridentata* Lam. 15 cm, P. V. Bruyns in P. Goldblatt & J. Ch. Manning (2000) re. *Euphorbia tridentata* Lam. 15 cm and S. Carter (2002) re. *Euphorbia tridentata* Lam. 15 cm. Width of branches, 19 mm as noted by J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis* is the same with J.-B. de Lamarck (1788) re. *Euphorbia tridentata*, P. E. Boissier (1862) re. *Euphorbia tridentata* and A. Berger (1906, date on title page 1907) re. *Euphorbia anacantha,* but a little bit more than the 8-12 mm recorded by the other botanists regarding these species.

P. V. Bruyns (2012, p. 242) designates the engraving (*Tab.7, Fig. 2*, see Fig. 4), which Johannes Burman published in 1738, as the earliest illustration of *Euphorbia tridentata* Lam., naming the engraving its lectotype, although the holotype, at P-LAM, is not missing. However, we consider the watercolour, manufactured by Hendrik Claudius in 1686 or 1687 (*IPA collection, Fol. 188*, see Fig. 1), the earliest illustration of *Euphorbia tridentata* Lam., worthwhile to be the lectotype.

6.2. About conflicting references made by J. Burman (1738).

Of great interest are the references given by J. Burman (1738), we cite (summarized): "*It is called by Commelin in the Catalogus Manuscripto ad Codex Witsenii a Lesser succulent & evergreen African Tithymalus with a multiple branched and scaly, not-leafy stem, and in the Codex Witsenii* [it is called] *a Lesser erect African Tithymalus (...) insofar it surely regards the spineless Euphorbium covered with coarse scales, with 3-toothed flower lobes* [which is published as *Euphorbium No. 12* by A.-T. Danty d'Isnard] *in Acta de l'Académie Royale des Sciences 1720, p. 502* [i. e. 1722], *indeed it is this much-branched* [species] *but at the same time it also concerns the Small African Euphorbium* [No. 7] *with a tuberous, scaly stem of H. Boerhaave in the Index alter Plantarum quae in Horto Academico Lugduno-Batavo aluntur, pars I, p. 258, No. 7* [1720]".

In first instance, it seems enigmatic why J. Burman refers, besides to H. Boerhaave (1720), also to A.-T. Danty d'Isnard (1720, reprint 1722). For when we study the description of "*Euphorbium* [No.] *12. Euphorbium anacanthum, squamosum, lobis florum tridentatis*" by A.-T. Danty d'Isnard and the engraving which he included in his paper (*Pl. 11*, see Fig. 2a), we read: "*From the neck of*

the most stout stock of this Euphorbia successively appear several round stems of which the longest ones are 3-4 feet [97-130 cm], *bending to the ground (...) from the far end of some of the strongest branches and principal stems appear two, three, sometimes four or five branchlets, arranged on all sides, which from a narrow base are increasing in thickness, but next gradually diminishing towards their top, which is obtuse*". This habit we do not meet when looking at the pictures of H. Claudius and J. Burman: no rebranching along the branches can be observed. The most remarkable is the mention by Danty d'Isnard; the longest branch comes up to four old-French feet (i. e. 130 cm, see p. 16) long; although on the picture you can see, it even had to be tied up onto a stick, according to Danty d'Isnard it must otherwise bend to the ground. At first sight, taken from Danty d'Isnard's perspective and because of the remarkable length of the main stem, nearly one and a half metre long, and the habit of rebranching along the main stem, the species looks like a different kind of plant, surely not a dwarf succulent!

However, note that botanists who refer to the "much-branched" species of A.-T. Danty d'Isnard (1720) re. *Euphorbium* [No.] *12. Euphorbium anacanthum, squamosum, lobis florum tridentatis* combine this particular reference with a reference to "dwarf" ones described by J. Burman (1738) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, by J.-B. de Lamarck (1788) re. *Euphorbia tridentata*, by W. Aiton (1789) re. *Euphorbia anacantha*, by C. L. Willdenow (1799) re. *Euphorbia anacantha*, by A. P. de Candolle (1804) re. *Euphorbia tridentata*, by J. Sims (1824) re. *Euphorbia anacantha*, by N. E. Brown (1915) re. *Euphorbia tridentata* and by A. C. White, R. A. Dyer & B. L. Sloane (1941) *re. Euphorbia tridentata*. But Chr. H. Persoon (1807) re. *Euphorbia anacantha*, A. H. Haworth (1812, re. "*Dactylanthes anacantha*", P. E. Boissier (1862) re. *Euphorbia anacantha* and A. Berger (1906, date on t.p. 1907) re. *Euphorbia anacantha* only quote Burman's *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*, being clearly a "dwarf" species. Note that R. Bradley (1727), who described *The Large White flower'd African Spurge* as a dwarf species (*Fig. 45*, see Fig. 3), only refers to H. Boerhaave (1720) re. *Euphorbium* [No.] *7. Euphorbium Afrum caule squamoso, tuberoso, minus*; and it is H. Boerhaave who sent a specimen of this *Euphorbium* to Danty d'Isnard to be described and portrayed.

The question arises: are much branched or dwarf succulents differing species, or not? It is commonly known that succulent Euphorbia species, imported from Southern Africa, as soon as they became cultivated in Europe, developed gradually elongating growth, because of the different climatological and ecological circumstances. The species which Danty d'Isnard presents, he received from H. Boerhaave in about the year 1716 who for some time before had nursed the plant in his Academic Medical Garden in Leiden. Boerhaave got it in turn from Simon van Beaumont who had it imported into his Dutch exotic garden from the Cape. For about 4 years, Danty d'Isnard cultivated the species in the Jardin du Roi, before describing and picturing it in 1720. It could be guessed that the specimen of Danty d'Isnard developed much elongated branching and rebranching during the long period it was cultivated in Europe. Even to today, we exactly see the exact same feature in European and U. S. A. plant collections.

We, authors, therefore assume that the plant, as presented by A.-T. Danty d'Isnard, in fact belongs to a group of dwarf succulent euphorbias, as found in habitat. In support of this statement, we quote the reference which accompanies the description by Danty d'Isnard; he clearly refers (see section 2.5) to: "*Euphorbium, Afrum, caule squamoso, tuberoso, minus. Boerh. Ind. Alt. I. 258. No. 7*", or, "*Small African Euphorbia, with a stem covered with scales and with a tuberous root* [Boerhaave, 1720]". Note that H. Boerhaave indicates the species as "*minus*", i. e. "*small*"; also observe that Boerhaave's "*Euphorbium No. 7*", is quoted by R. Bradley (1727, see Fig. 3) re. *The Large White flower'd African Spurge*, by J. Burman (1738, see Fig. 4) re. *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis* and by Ph. Miller (1731; 1733, 1735, 1743. 1745)

re. *Euphorbium* [No.] *7. Euphorbium, Afrum, caule squamoso, tuberoso, minus*, which are all representative of "small", i. e. dwarf species.

Summarized, J. Burman clearly understood that Danty d'Isnard's plant *in reality* represented a dwarf succulent as can be found in nature at its original habitat.

Probably the same can be said about the species "*Tithymalus* No. *21*", presented by G. Bonelli & L. Sabbati (1772, *Tab. 29*; see Fig. 7) as: "*Tithymalus, seu Euphorbium, aizoides, caule crasso, & ramoso*", or, "*Tithymalus, or Euphorbium, succulent & evergreen, with a thick and much-branched stem*", without giving details or specific references. Their hand-coloured engraving shows prolific rebranching half-way a sturdy stem; on its top we see some nearly sessile or at most short-peduncled, cuplike white cyathia which seem to be 5-glanded, 2- or 3-toothed. Nevertheless, the possibility remains that the succulent depicted by Bonelli & Sabbati concerns quite another species, so far not identified.

6.3. About the distinction Linnaeus made between Danty d'Isnard's and Burman's species.

Regarding the plants of our interest is of much importance the distinction that Carl Linnaeus made in the *Species Plantarum* (1753) between the species described by Antoine-Tristan Danty d'Isnard (1720, reprint 1722, *Pl.* [No.] *11*, see Fig. 2a) and the species presented by Johannes Burman (1738, *Tab. 7, Fig. 2*, see Fig. 4). The first one Linnaeus catalogues as "*Euphorbia Caput medusae β*", describing it as "*Euphorbium anacanthum squamosum, lobis florum tridentatis. Isnard. act. 1720. p. 502. t.11.*", or, "*A spineless Euphorbium, covered with scales, with 3-toothed flower-lobes*"; but referring to J. Burman, he distinguishes another "variety", namely "*Euphorbia Caput medusae γ. Burm. afr. 16. t. 7. f. 2.*", describing it as "*Euphorbium erectum aphyllum, ramis rotundis, tuberculis tetragonis*", or, "*An erect leafless Euphorbium, with almost circular branches and 4-angled tubercles*".

We know that Carl Linnaeus resided in Holland during the years 1735-1738 to obtain his doctorate title, to serve the banker and VOC administrator George Clifford III as physician and horticulturist, cataloguing the collection of living and dried plants in Clifford's possession, and to prepare his own publications (outlined in Jarvis, 2007). Linnaeus regularly stayed at the house of Johannes Burman, with whom he became friends. Burman helped Linnaeus by the publication of his works, for instance the *Systema Naturae* of 1735 and the *Hortus Cliffortianus* of 1737; quid pro quo Linnaeus assisted Burman by sorting out his library and herbarium to help with the publication of Burman's *Thesaurus Zeylanicus* (1737) and *Rariorum Africanarum Plantarum ad vivum delineatarum* (1738-1739). In 1736 Linnaeus visited Philip Miller, studying the collection of plants in the Chelsea Physick Garden, London and in 1738 Carl Linnaeus paid a visit to Antoine-Tristan Danty d'Isnard in Paris, admiring the plant collection in the Jardin du Roi and extensively studying his library (Jarvis, 2007).

As said above, to have it inserted in the *Rariorum Africanarum Plantarum*, Johannes Burman copied *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis* from a watercolour made in 1686 or 1687 by the VOC botanical artist Hendrik Claudius, a painting most probably part of a once complete codex in three volumes (compiled in 1692, now largely lost), but which in its totality must have been in the keeping of Burman himself; we assume that Linnaeus has seen and studied this codex of paintings in Burman's house. So he surely became acquainted with the fact, that Burman considered Danty d'Isnard's much-branched *Euphorbium anacanthum, squamosum, lobis florum tridentatis* mostly identical to his own dwarf succulent *Euphorbium erectum,*

aphyllum, ramis rotundis, tuberculis quadragonis, as Burman states in the description of the species.

Nevertheless, assuming Carl Linnaeus had all the relevant material on hand when preparing the first edition (1753) of the *Species Plantarum*, for all that he must have concluded that in fact two completely different species were involved. Besides Burman's *Euphorbium erectum aphyllum, ramis rotundis, tuberculis tetragonis*, Linnaeus explicitly classified Danty d'Isnard's *Euphorbium anacanthum, squamosum, lobis florum tridentatis* as a distinct species, quoting Danty d'Isnard's publication in the *Acta de l'Académie Royale des Sciences 1722*, a reprint of the *Mémoires de l'Académie Royale des Sciences de France du 10. Décembre 1720*.

The question arises, is Linnaeus' distinction between these two species also acknowledged by other botanists? Oddly enough, none of the botanists who after 1753 published about the species of our interest, refer to the specific distinction made by Linnaeus. Only G. Bonelli & L. Sabbati presented in 1772, twenty years after the publication of the Species Plantarum, a "*Tithymalus No. 19*" which resembles Danty d'Isnard's *Euphorbium anacanthum, squamosum, lobis florum tridentatis* very well. But almost two centuries later A. C. White, R. A. Dyer & B. L. Sloane (1941) classified Linnaeus' "varieties" β and γ both together as synonyms of the species *Euphorbia tridentata* Lam. In addition, another sixty years later, S. Carter (2002) also considered both Linnaeus' "varieties" synonyms of the the same species, viz. *Euphorbia tridentata* Lam.; but we wonder: are these taxonomic decisions correct?

We think Carl Linnaeus (1753) was quite right when he explicitly recognized Danty d'Isnard's *Euphorbium anacanthum, squamosum, lobis florum tridentatis* a distinct species. Although once described by Danty d'Isnard from cultivation as a tall plant that is clearly branching along the main stem and producing "strong" branches, it nevertheless has to be considered as belonging to the group of dwarf succulents that in the wild only branch from a central stub, as we have seen from the field observations by the second author (RvV). Because it was cultivated in Europe for such a long time, it got the much elongated habit which Danty d'Isnard described in his treatise.

6.4. Why we consider Danty d'Isnard's "*Euphorbium anacanthum, squamosum, lobis florum tridentatis*" a distinct species.

Studying all species labelled *Euphorbia tridentata* Lam., *Euphorbia ornithopus* Jacq, and *Euphorbia patula* Mill., Danty d'Isnard's *Euphorbium anacanthum, squamosum, lobis florum tridentatis* is, except possibly *Tithymalus* [No.] *19* of G. Bonelli & L. Sabbati (1772), the only species which has explicitly a cymose inflorescence with a notably bisexual, central, sessile cyathium appearing first. Although the characteristic "cymose inflorescence" is partly nowadays reserved mainly for *Euphorbia ornithopus* Jacq. (partly because the species may possess, besides a cyme, also solitary flowers on simple or forked peduncles), we consider Danty d'Isnard's species displaying a novel, pioneering aspect. Whereas Danty d'Isnard notes a sessile, 5-glanded central bisexual cyathium, provided by an ovary surrounded by stamens, persistenting and soon followed by a triangle of bisexual cyathia, equally in length pedicelled, on the contrary the central, sessile 5-glanded flower of *Euphorbia ornithopus* Jacq. is always male and if not soon is aborts.

A second feature that distinguishes Danty d'Isnard's *Euphorbium anacanthum, squamosum, lobis florum tridentatis* as a distinct species concerns the morphology of the cyathium. Danty d'Isnard described it explicitly as cup-shaped, not widely horizontally spread and (fairly) large as in *Euphorbia tridentata* Lam. In this way comparing Danty d'Isnard's *Euphorbium anacanthum, squamosum, lobis florum tridentatis* with the species commonly called "*Euphorbia tridentata*

Lam.", we have to conclude we have a species taxonomically different enough to justify it as a valid new species.

About the confusion that *Euphorbia tridentata* Lam. is considered a synonym of *Euphorbia patula* Mill. in the Kew World Checklist of Selected Plant Families by R. Govaerts (2000 until mid-2013) and next *Euphorbia ornithopus* Jacq. is considered a synonym of the same *Euphorbia patula* Mill. by P. V. Bruyns (2012) and R. Govaerts (mid-2013 sqq.), we state in section 2.50.3. Also note that P. V. Bruyns (2012, p. 242) regards the engraving by A.-T. Danty d'Isnard (*Pl.* [No.] *11*, see Fig. 2a) as (we cite) "*somewhat more suggestive of Euphorbia patula Mill*.". J. A. Peirson et al. (2013) identify as belonging to *Euphorbia tridentata* Lam. the cyathia copied by N. J. de Necker (1790a, b) from the original engraving by A.-T. Danty d'Isnard (1720) to illustrate his "species naturalis *Athymalus*" (nom. rejec.), adopting this *Euphorbia tridentata* Lam. as the type of *Euphorbia* subg. *Athymalus* - a conclusion to be rejected (see section 2.14, 2.49, 2.50.1).

More mystery remains. When publishing *Euphorbium anacanthum, squamosum, lobis florum tridentatis* in December 1720, A.-T. Danty d'Isnard reports he got the specimen directly from Herman Boerhaave, who had it already in the course of that same year, 1720, catalogued as *Euphorbium* [No.] *7: Euphorbium Afrum, caule squamoso, tuberoso, minus* (Boerhaave, 1720). As appears from Danty d'Isnard's reference to the species, he was very well acquainted with Boerhaave's catalogue. Possibly the species Boerhaave nursed in the Hortus Medicus of Leiden, exactly matched the species *Euphorbium anacanthum, squamosum, lobis florum tridentatis* of Danty d'Isnard – but, alas!, we will never know. The same question arises regarding the "*Large white flower'd African Spurge*" which Richard Bradley (1727, *Fig. 45*, see Fig. 3) described, referring to Boerhaave's *Euphorbium* [No.] *7*; likewise this question concerns the *Euphorbium* [No.] *7: Euphorbium Afrum, caule squamoso, tuberoso, minus* presented by Philip Miller in 1731, 1733, 1735, 1743 and 1745 (see section 2.9.1).

Chapter 7. Conclusion.

Comparing (a) the numerous observations conducted by the second author (RvV) in the field and (b) the results from a historical search of more or less interpretable 90 descriptions by 46 botanists or a collective of botanists, and focussing on the interpretations outlined in the previous chapters, we conclude that two different species must be distinguished, up to now amalgamated under the names "*Euphorbia tridentata* Lam." or previously "*Euphorbia patula* Mill., syn. *Euphorbia tridentata* Lam." (Govaerts, 2000 until mid-2013). One species we identify as a "dwarf plant with sessile or nearly sessile or short-peduncled fairly large, widely outspread, saucer-shaped cyathia with spreading pure white glands", and another species as a "dwarf plant with cymose inflorescences with remarkable cup-shaped cyathia with upward pointing greenish-marbled glands". This conclusion we consider in accordance with recent observations conducted in the field and with the descriptions by botanists made in historical perspective during a period of about 330 years.

As argued above, Linnaeus was quite correct when he distinguished in the first edition (1753) of the *Species Plantarum* between (1) a "*Euphorbia caput-medusae β*", *Euphorbium anacanthum squamosum, lobis florum tridentatis*", or, "*A spineless Euphorbium, covered with scales, with 3-toothed flower-lobes*", referring to A.-T. Danty d'Isnard (1720, reprint 1722, *Pl. 11*, see Fig. 2a), and (2) a "*Euphorbia caput-medusae γ*, *Euphorbium erectum aphyllum, ramis rotundis, tuberculis tetragonis*", or, "*An erect leafless Euphorbium, with almost circular branches and 4-angled tubercles*", referring to J. Burman (1738, *Tab. 7, Fig. 2*, see Fig. 4). Linnaeus was very well acquainted with the plant species grown by J. Burman as well as by A.-T. Danty d'Isnard (Jarvis, 2007), and we like to express here that we have complete confidence about his expertise. Therefore, to designate as synonyms both "varieties" of Linnaeus within the one single species "*Euphorbia tridentata* Lam.", as done by A. C. White, R. A. Dyer & B. L. Sloane (1941) and S. Carter (2002), we consider erroneous. Our investigations present evidence that the material we researched involves two different species, previously known under the single name. Summarized, actual findings in the field compared with results retrieved from history realize a solid justification to confirm the existence of a "true" *Euphorbia tridentata* Lam. along with a new species named *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. In section 2.50.1, this species was validated.

Chapter 8. Concordance.

Here we present a concordance with regard to species enumerated in historical retrospect as well as from field collections on the one hand and *Euphorbia leachii* Lawant & van Veldhuisen sp. nov., *Euphorbia tridentata* Lam. var. *ornithopus* (Jacq.) van Veldhuisen & Lawant comb. & stat. nov., *Euphorbia tridentata* Lam. var. *tridentata* and *Euphorbia patula* Mill. on the other hand.

Note: left column: sections in main text; right column: page number(s).

***Euphorbia leachii* Lawant & van Veldhuisen sp. nov.**

2.50.1.	Pj. Lawant & R. van Veldhuisen (2014). *Euphorbia leachii* Lawant & van Veldhuisen sp. nov.	87
3.3.	Coll nr. RBAM1326 - south of Cradock, holotype	114-115
	Synonyms:	
2.5.	A.-T. Danty D'Isnard (1720, reprint 1722). *Euphorbium* [No.] *12. Euphorbium anacanthum, squamosum, lobis florum tridentatis*	10
2.10.1.	C. Linnaeus (1737; Hortus Cliffortianus). [Category] *Euphorbia* [No.] *6. Euphorbia inermis, tecta tuberculis imbricatis, foliolo lineari instructis,* [subcategory] *6 β, Euphorbium anacanthum squamosum, lobis florum tridentatis*	27-28
2.10.2.a	C. Linnaeus (1753; Species Plantarum). *Euphorbia caput-medusae 8.β, Euphorbium anacanthum squamosum, lobis florum tridentatis*	28
2.10.3.	C. Linnaeus (1762; Species Plantarum, Editio secunda). *Euphorbia caput-medusae 8.β, Euphorbium anacanthum squamosum, lobis florum tridentatis*	29
2.11.1	G. Bonelli & L. Sabbati, L. (1772). *Tithymalus* [No.] *19. Tithymalus Euphorbium dictus, Euphorbio-Tithymalus aizooides, caule ramoso, procumbente, tetro, et nodoso, foliis nudo, florum petalis e candido roseis, bidentis et tridentis*	30
2.4.	Possible synonym: H. Boerhaave (1720). *Euphorbium* [No.] *7. Euphorbium; Afrum; caule squamoso;tuberoso; minus*	10
2.9.1.	Possible synonym: Ph. Miller (1731, 1733, 1735, 1743, 1745). *Euphorbium* [No.] *7. Euphorbium Afrum, caule squamoso, tuberoso*	24
	(from field observations)	
3.3.	Coll nr. J&R 108 - south of Cradock	97-105
3.3.	Coll nr. J&R 110 - south of Cradock	97; 106-108
3.3.	Coll nr. J&R 561 - south of Cookhouse	98; 109-113
3.4.	Possible related: coll. nr. J&R223 - Springbokvlakte, east of Steytlerville	115-118
4.3.1.	Coll. nr. LCL16178 - Cradock	148
4.3.1.	Coll. nr. LCL17299 - north of Cradock	148
4.3.3.	Possible synonym: coll. nr. LCL16920 - firstly 'Calitzdorp', next 'Cradock'	149-150
4. 2.	Possible synonyms to be evaluated: Acocks11933; Acocks16320; Shoesmith in M.5295; James40; James41; Dyer1043	147-148

***Euphorbia tridentata* Lam. var. *tridentata*.**

2.12.	J.-B. A. P. de Monnet Le Chevalier de Lamarck (1788). *Euphorbe* [No.] *11. Euphorbe à trois dents, Euphorbia tridentata*	32
	Synonyms:	
2.1.	H. Claudius (1686 or 1687). *Tithymalus africanus, minor*	5
2.6.	R. Bradley (1727). *Euphorbium Africanum caule squamoso, tuberoso, minus: The Large White flower'd African Spurge.*	18
2.7.2.	J. Burman (1738). *Euphorbium erectum, aphyllum, ramis rotundis, tuberculis quadragonis*	20
2.10.1.	C. Linnaeus (1737; Hortus Cliffortianus). [Category] *Euphorbia* [No.] *6. Euphorbia inermis, tecta tuberculis imbricatis, foliolo lineari instructis,* [subcategory] *6 β, Euphorbium afrum, caule squamoso, tuberoso, minus*	27-28
2.10.2.b	C. Linnaeus (1753; Species Plantarum). *Euphorbia caput-medusae 8.γ, Euphorbium erectum aphyllum, ramis rotundis, tuberculis tetragonis*	28-29
2.10.3.	C. Linnaeus (1762; Species Plantarum, Editio secunda). *Euphorbia caput-medusae 8.γ, Euphorbium erectum aphyllum, ramis rotundis, tuberculis tetragonis*	29
2.13.	W. Aiton (1789). *Euphorbia anacantha*	35
2.15.	C. L. Willdenow (1799). *Euphorbia anacantha*	38
2.16.	A. P. de Candolle (descr.) & P.-J. Redouté (dessins) (1804) *Euphorbia tridentata*.	39
2.17.	Chr. H. Persoon (1807). *Euphorbia anacantha*	42
2.20.	W. T. Aiton (1811). *Euphorbia anacantha*	45
2.21.1.	J. L. M. Poiret, Éd. (1812). *Observations: L'euphorbia tridentata, n°. 11, est l'euphorbia anacantha Willd. & Ait*.	46
2.22.2.	A. H. Haworth (1812). *Dactylanthes anacantha*	49
2.23.	C. L. Loddiges & Sons (1819, date on t. p. 1818). *Euphorbia anacantha*	49
2.24.	J. Sims, Ed. (1824). *Euphorbia anacantha*	51
2.25.2.	R. Sweet (1818). *Euphorbia* [No.] *23: anacantha*	53
2.26.2(a)	R. Sweet (1826). *Euphorbia* [No.] *29: anacantha*	54
2.26.2(b)	R. Sweet (1830). *Euphorbia* [No.] *36: anacantha*	54
2.27.1.	J. H. F. Link (1822). *Euphorbia* [No.] *81. Euphorbia anacantha* Willd.	54
2.28.1.	K. Sprengel (1826). *Euphorbia* [No.] *26. Anacantha*	55
2.30.1.	J. F. Klotzsch & C. A. F. Garcke (1859; 1860). *Medusea tridentata* Klotzsch et Garcke	56
2.31.1.	P. E. Boissier (1862). *Euphorbia* [No.] *328. Euphorbia anacantha (*Aiton)	57
2.32.	A. Terracciano (1905). *Euphorbia anacantha* Aiton	59
2.33.1.	A. Berger (1905). *Euphorbia anacantha* Aiton	60

2.34.2.	A. Berger (1906, d. on t. p. 1907). *Euphorbia* [No.] *87*. *Euphorbia anacantha* Aiton	63
2.35.2.	N. E. Brown (1915). *Euphorbia* [No.] *77*. *Euphorbia tridentata* Lam.	65
2.36.	I. B. Pole Evans, Ed. (1925). *Euphorbia tridentata* Lam. (E. P. Phillips, description; K. A. Lansdell, drawing)	67
2.37.2.	G. F. Frick (1930). *Euphorbia tridentata* [Lam.]	69
2.38.1.	R. A. Dyer (1931). *Euphorbia* [No.] *35*. *Euphorbia tridentata* [Lam.].	71
2.39.	H. W. R. Marloth (1931). *Euphorbia tridentata* Lam.	72
2.40.1.	A. C. White, R. A. Dyer & B. L. Sloane (1941). *Euphorbia tridentata* Lam.	73
2.41.1.	G. Marx (1992). *Euphorbia tridentata* Lam.	78
2.42.	P. V. Bruyns *Euphorbia tridentata* Lam. in P. Goldblatt & J. Ch. Manning, Eds (2000)	79
2.44.2.	S. Carter (2002). *Euphorbia tridentata* Lam.	80
2.45.	P. V. Bruyns, R. J. Mapaya & T. Hedderson (2006). *Euphorbia* subg. *Rhizanthium*: *Euphorbia tridentata* Lam.	81
2.46.1.	P. V. Bruyns (2012). *Euphorbia tridentata* Lam.	81
2.47.	International Plant Names Index (IPNI). *Euphorbia tridentata* Lam.	85
2.48.2.	R. H. A. Govaerts: Kew World Checklist of Selected Plant Families (mid-2013 sqq.). *Euphorbia tridentata* Lam.	85
	(from field observations)	
3.5.	Coll. nr. J&R564 - near Calitzdorp, a possible variety	119-124; 163
3.7.	Coll. nr. J&R374 - Riversdale	129-134
3.8.	Coll. nr. J&R194 - east of Alicedale	134-142
3.9.	Coll. nr. R&W446 - near Heidelberg	142-143
3. 10.	Coll. nr. IB13759 - near Hartenbos	143-145
4.3.5.	Coll. nr. LCL16663 - Riversdale	153
4.3.5.	Coll. nr. LCL16843 - Riversdale	153-154
4.3.5.	Coll. nr. LCL16929 - Riversdale	154-155
4.3.5.	Coll. nr. LCL12559 - Vaalvlei, southeast of Grahamstown	156

***Euphorbia tridentata* (Lam.) var. *ornithopus* (Jacq.) van Veldhuisen & Lawant comb. & stat. nov.**

2.50.2.	R. van Veldhuisen & Pj. Lawant (2014). *Euphorbia tridentata* (Lam.) var. *ornithopus* (Jacq.) van Veldhuisen & Lawant comb & stat. nov.	91
	Synonyms:	
2.18.	N. J. von Jacquin (1809). *Euphorbia ornithopus*	42
2.19.	C. L. Willdenow C. L. (1809). *Euphorbia* [No.] *6. Ornithopus*	45

2.21.2.	J. L. M. Poiret, Éd. (1812). *Euphorbia* [No.] *111. Euphorbe pied d'oiseau*	46
2.22.1.	A. H. Haworth (1812). *Dactylanthes patula*	47
2.25.1.	R. Sweet (1818). *Euphorbia* [No.] *22: patula* H. S.	53
2.25.3.	R. Sweet (1818). *Euphorbia* [No.] *29: Ornithopus*	53
2.26.1(a)	R. Sweet (1826). *Euphorbia* [No.] *28: patula* Mill.	53
2.26.1(b)	R. Sweet (1830). *Euphorbia* [No.] *35: patula* Mill.	54
2.26.3(a)	R. Sweet (1826). *Euphorbia* [No.] *33: Ornithopus*	54
2.26.3(b)	R. Sweet (1830). *Euphorbia* [No.] *41: Ornithopus*	54
2.27.2	J. H. F. Link (1822). *Euphorbia* [No.] *82. Euphorbia ornithopus*	55
2.28.2.	K. Sprengel (1826). *Euphorbia* [No.] *27. Ornithopus* Jacq.	55
2.30.2.	J. F. Klotzsch & C. A. F. Garcke (1859; 1860). *Medusea patula* Klotzsch et Garcke	57
2.31.2.	P. E. Boissier (1862). *Euphorbia* [No.] *329. Euphorbia ornithopus* (Jacq.)	58
2.33.2.	A. Berger (1905). *Euphorbia ornithopus* Jacq.	60
2.34.1.A.	Berger (1906, date on t. p. 1907). *Euphorbia* [No.] *86. Euphorbia ornithopus* Jacq.	62
2.35.1.	N. E. Brown (1915). *Euphorbia* [No.] *69. Euphorbia patula* Mill.	64
2.35.3.	N. E. Brown (1915). *Euphorbia* [No.] *78. Euphorbia ornithopus* Jacq.	66
2.37.1.	G. F. Frick (1930). *Euphorbia ornithopus* [Jacq.]	69
2.38.2.	R. A. Dyer (1931). *Euphorbia* [No.] *36. Euphorbia ornithopus* [Jacq.] .	71
2.39.	H. W. R. Marloth (1931). *Euphorbia ornithopus* [Jacq.]	72
2.40.2.	A. C. White, R. A. Dyer & B. L. Sloane (1941). *Euphorbia ornithopus* Jacq.	76
2.41.2.	G. Marx (1992). *Euphorbia ornithopus* Jacq.	79
2.43.2.	R. Govaerts, D. G. Frodin & A. Radcliffe-Smith (2000). *Euphorbia ornithopus* Jacq.	79
2.44.1.	S. Carter (2002). *Euphorbia ornithopus* Jacq.	80
2.45.	P. V. Bruyns, R. J. Mapaya & T. Hedderson (2006). *Euphorbia* subg. *Rhizanthium*: *Euphorbia ornithopus* Jacq.	81
2.47.	International Plant Names Index (IPNI). *Euphorbia ornithopus* Jacq.	85
2.48.1.	R. H. A. Govaerts: Kew World Checklist of Selected Plant Families (2000 until mid-2013). *Euphorbia ornithopus* Jacq.	85
	(from field observations)	
4.3.7.	Coll. nr. LCL 16921 - Kei Road	158
4.3.7.	Coll. nr. LCL 17466 (Marx21) - Brakkloof (northwest of Grahamstown)	158
4.3.7.	Coll. nr. LCL 17459 - Honeykop Halt (Grahamstown)	159-161

Species not specified enough to be identified correctly (species incertae sedis).

2.2.1.	S. van Beaumont	8
2.2.2.	F. Kiggelaer (1690). *Horti Beaumontiani exoticarum plantarum catalogus, etc*.	9
2.2.3.	Anonymus (1726). Catalogus Horti Beaumontiani (auction catalogue)	9
2.3.	C. Commelin (between 1692 and 1731). *Tithymalus Africanus aizoides, multiplici squamato caule non folioso, minor*	9
2.7.1.	J. Burman (1737). *Tithymalus aizoides, Africanus, simplici, squammato caule*	20
2.9.2.	Ph. Miller (1752, 1754). *Euphorbia* [No.] *9. Euphorbia humilis, ramis patulis tuberculatis*	25
2.11.2	G. Bonelli & L. Sabbati (1772). *Tithymalus* [No.] *21. Tithymalus seu Euphorbium, aizoides, caule crasso, & ramoso*	31
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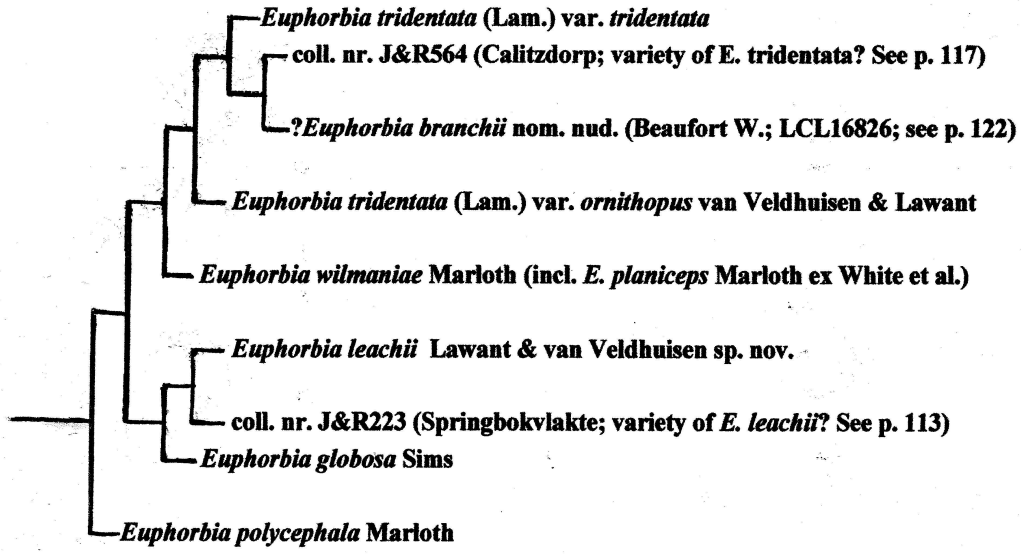
Chapter 9. A final phylogenetic assumption.

Surveying all morphological data of the subsection *Dactylanthes*, a preliminary phylogenetic tree may be conceived, to clarify the position of *Euphorbia leachii*, *Euphorbia tridentata* var. *tridentata*, *Euphorbia tridentata* var. *ornithopus* and possibly related species:



To corroborate this assumption, of course a lot of future investigations have to be done.

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Fig. 37. Not until seen in flower can one correctly recognize coll. nr. J&R561 to be the new *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. by the cup-shaped cyathium with the greenish-white marbled teeth on the glands.

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Fig. 41. On behalf of the Euphorbia Planetary Biodiversity Inventory (PBI), an international collaborative project to research all possible information on the genus *Euphorbia*, the South-African botanists Rolf Becker and Alma Moller regularly conducted intensive field work. In recent years they found at the roadside of the N10 just south of Cradock *Euphorbia* species which they initially labelled as *Euphorbia ornithopus* Jacq. (coll. nr. RBAM1326), but currently named it *Euphorbia leachii* Lawant & van Veldhuisen sp. nov. At this particular locality the plants grow on large boulders which form a wall due to past road construction activities. Plants show a very lush growth, as in cultivation, forming dense patches with long trailing thin stems.

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Fig. 79. Distribution map of southern Africa with the findings by the second author (RvV) during the years 1999-2012 regarding the range of *Euphorbia* species discussed in the text.

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Contents.

The composition of this monograph and the discussions comprised in the various parts are wholly authors' own responsibility. Plant photographs from cultivation and from the field, unless otherwise specified, by the second author, Rikus van Veldhuisen.