A REVISION OF THE GENUS TULBAGHIA (LILIACEAE)

R. B. BURBIDGE

ABSTRACT. A complete taxonomic revision of *Tulbaghia* Linn. (Liliaceae) recognizing 21 species is presented. Two new species, *T. poetica* R. B. Burbidge and *T. carnosa* R. B. Burbidge, are described.

INTRODUCTION

There have been two previous accounts of the genus *Tulbaghia* considering all the then known species*. Baker (1871) recognised seven species, three with two varieties (excluding the type) and one species with one variety. The second taxonomic account (Uphof, 1943) was a review of the available literature and unfortunately served to perpetuate earlier taxonomic errors without clarifying the many problems already existing in the genus. It does, however, serve as a convenient list of names and descriptions.

The name *Tulbaghia* was coined by Linnaeus in 1771 (*Mantissa Plantarum* 2:184) as a tribute to Van Tulbagh who was at that time governor of the Cape Colony and who was responsible for sending much South African material to Europe. Linnaeus described a single species, *T. capensis*, and Linnaeus filius (*Suppl. Pl.*, 1781) added a further two species, *T. cepacea* and *T. alliacea*, the former including the type of *T. capensis*. This initiated a series of nomenclatural misapplications which will be discussed under the species concerned. Eighteen species names were published before 1871 (the date of Baker's monograph) and a further twenty-five after this date.

EARLY NOMENCLATURAL PROBLEMS IN TULBAGHIA

The generic description of *Tulbaghia* appeared in the *Mantissa Altera* of Linnaeus (1771). This description is almost certainly based on material sent by Van Tulbagh in 1769 from the Cape, as in Linnaeus' list of these plants number 168 bears the following notes:— "During rains, brown flowers, August" to which Linnaeus has added the name *Tulbaghia capensis*. The names given by Linnaeus were evidently written on first examination of the plants: many were changed before publication and others remain unnamed. About 25% of the species names were published in the *Mantissa Altera*.

The generic description is given on page 148 of the *Mantissa Altera*, the following being the more important parts:—"*petala sex, lanceolata, longitudine nectarii, insidentia tubo, tria in medio, tria pone limbum: Stam. 3 in fauce; 3 intra tubum; stigma turbinatum, cavum.*" The description of *T. capensis* on page 223 adds the following:—"*Scapus foliis duplo longior; Spatha floribus 5–7, pedunculatis, purpureis*".

In the Linnaean herbarium there are four *Tulbaghia* specimens (numbered 411.1 to 411.4). The first is labelled *Tulbaghia capensis* by Linnaeus to which J. E. Smith has added the word "*alliacea*"; the second is labelled *alliacea* by Linnaeus; the third has no notes in Linnaeus' handwriting but only the word *alliacea* followed by a question mark in the handwriting of Smith; the fourth again only bears a note by Smith which reads:—"*Tulbaghia cepacea . . . cepacea ex descr*".

* But see note added in proof p. 103.

In Edition 13 (by Murray) of Linnaeus' *Systema Vegetabilum* (1774) the description of *T. capensis* contains a reference to an illustration in Jacquin's *Plantarum Horti Botanici Vindobonensis* (1772–1773) which depicts a plant corresponding accurately to specimen 411.1 in the Linnaean herbarium.

The problems begin in 1781 with the publication by Linnaeus filius of the *Supplementum Plantarum* which describes two *Tulbaghia* species, *T. alliacea* and *T. cepacea*. The first (*T. alliacea foliis subfiliformibus*), is a new species and describes specimen 411.2 in the Linnaean herbarium. The second (*T. cepacea foliis lanceolato linearibus*) describes specimen 411.4 (a purple-flowered specimen with a corona of three separate lobes) but includes Linnaeus' *T. capensis* as a synonym. The description does not, however, embrace this latter species and it seems likely that he relied on the description of Linnaeus (which possibly could include both *capensis* sensu Linnaeus and *cepacea* sensu Linn. fil.) and did not examine the specimen. It is possible that Linn. fil. was giving two contrasting names to his two species (*alliacea* vs. *cepacea*, i.e. onion vs. leek) and considered the Linnaean epithet *capensis* to be inappropriate when both species came from the Cape. Whatever the explanation, the name *T. cepacea* Linn. fil. is illegitimate and must be replaced, in this case by the later name *T. simmleri* Beauverd. Unfortunately authors subsequent to the Supplementum Plantarum took *T. alliacea* as the name for *T. capensis* Linn. thus further complicating the situation.

In 1844 Avé-Lallemant noticed this confusion of names and in a neglected paper (possibly little-known on account of its obscure place of publication—*Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint Pétersbourg* sér. 3:13.) made an effort to rectify the problem. This he did by giving yet more names to existing species. The following are the most important features of this paper:–

a. He renamed *T. capensis* Linn. as *T. pulchella* Avé-Lall.

b. He accepted but redefined *T. alliacea* Linn. fil.

c. He included *T. alliacea* var *a.* Drège and *T. ludwigiana* Harv. as synonyms of a new species *T. cernua* Avé-Lall.

d. Under what he calls *T. cepacea* (Linn. fil.) Smith he included the recently described *T. violacea* Harv.

Baker (1871) allowed this confusion to continue uncorrected, as did Uphof (1943) and it has remained until the present. It is hoped that the present account will clarify the early nomenclature of *Tulbaghia*.

SPECIES LIMITS IN TULBAGHIA

In a genus as morphologically homogeneous as *Tulbaghia* it is very difficult to maintain a uniform concept of what constitutes a species. The optimum classification seems to result from the time-honoured method of grouping specimens by overall similarity into a number of heaps, and then searching the literature for names to apply to the heaps. Those for which no legitimate names could be found are described as new species.

When living material has been available it has been utilised in the construction of the taxonomic system, but keys and descriptions use only those characters which are available on herbarium material.

Variability below the species level is very complex, and where morphological discontinuities correlate with distribution the rank of subspecies has been used. The reticulate nature of infraspecific variability made formal recognition of taxa within some species impossible. *T. cameronii* displays this

reticulate variation to an exaggerated degree, and though it appears to consist of a number of distinct entities, these are not amenable to formal treatment. In *T. violacea* it has been necessary to split up a very variable species into a number of varieties which differ from one another mainly in size. There appears to be some correlation between large size and a semi-woodland habitat and between small size and a regularly burnt savannah habitat, but more extensive collections and annotated herbarium material are needed.

It must be emphasised that the allocation here of ranks below the species level is made without much conviction, but it serves the practical function of subdividing an otherwise unwieldy amount of variable material.

At the species level many problems occur, particularly in species which can be distinguished from one another in one country, but grade into one another in a neighbouring country. In this account it has been necessary to treat these "species" as being conspecific, whereas regional floras would reach different conclusions and perhaps reflect more accurately the evolutionary situation in the genus.

It was not considered desirable to "cram" every specimen into a species: a quantity of poorly pressed and inadequate material remains undetermined. Adequate collections which are difficult to place are discussed under the species to which they seem most closely related.

Only two subgenera are recognised between the species and genus level (although *T. fragrans* and *T. rhodesica* are near the dividing line between the two). Within subgenus *Tulbaghia*, however, the species were placed in informal groups labelled A to F. These groups cannot be accurately delimited and relations between the groups are of a reticulate nature. They merely associate together species which appear to have more in common with one another than with species from other groups, and were used only for convenience when naming herbarium material.

THE POSITION OF TULBAGHIA WITHIN THE LILIACEAE/AMARYLLIDACEAE

A cursory examination of any species of *Tulbaghia* suggests a gamopetalous *Allium* with the addition of a corona, either in cylindrical form or as a number (3 or 6) of scales mounted at the throat of the perianth tube. Also suggesting affinity with *Allium* is the garlic or onion smell which emanates from the crushed parts of *Tulbaghia* plants; even material collected in the middle of the eighteenth century retains this smell.

The rootstock can be a rhizome, a corm or a bulb, though traditionally it has been described as rhizomatous only, an error partly accounting for the association of *Tulbaghia* and *Agapanthus* in the tribe *Agapantheae*.

Tulbaghia is one of about thirty genera in the Liliaceae (sensu Bentham and Hooker) which possess both a superior ovary (the single character traditionally used to distinguish between the Liliaceae and the Amaryllidaceae) and an umbellate inflorescence which is characteristic of the Amaryllidaceae (sensu Hutchinson). These genera were placed by Bentham and Hooker (1883) in a single tribe, the Allieae, which was further divided into four subtribes: Agapantheae, Euallieae, Gillieseae and Massonieae. Hutchinson (1959 & 1973) transferred three of these subtribes, the Agapantheae, Allieae and Gillieseae, to the Amaryllidaceae, raising them to tribal rank but left the Massonieae as a tribe of the Liliaceae, noting that it

was a "climax group showing a close approximation to Amaryllidaceae". In edition 12 of Engler's *Syllabus* (1964) the Agapantheae, Gillieseae and Allieae appear together, constituting the subfamily Allioideae of the Liliaceae. In all the accounts dealing with the Liliales there is general agreement that wherever these three tribes are put, they should be put together, and except for Hutchinson (1959 & 1973), Traub (1957) and Huber (1969) they are placed in the Liliaceae, despite the umbellate inflorescence. Data on the Liliales, particularly in the fields of phytochemistry and karyology, is increasing rapidly, and a reassessment of the whole order is needed, the last comprehensive treatment being by Krause (1930), though Traub (1957) has assembled much data on the Amaryllidaceae. Huber (1969) in a very complex and detailed paper attempted a classification of the whole of the Lilioid monocotyledons (in the broadest sense). Using to a great extent characters from the seeds only, he suggested that the Amaryllidaceae should become a "family group" (Familiengruppe) comprising the Hemerocallidaceae (one genus: *Hemerocallis*), the Alliaceae (with the tribes Brodiaeae, Allieae and Gilliesieae), the Agapanthaceae (with the genera *Agapanthus* and *Tulbaghia*) and the Hyacinthaceae (with the tribes Chlorogaleae, Bowieae and Scillieae). Classification based on more than seed characters indicate a less narrow view of the families than Huber suggests. It is interesting that he maintains *Agapanthus* and *Tulbaghia* together in the Agapanthaceae, for evidence suggests that they are distantly related. Wendelbo (1967) summarises the evidence for and against placing *Allium* in the Amaryllidaceae and concludes that "there is very little reason left for transferring *Allium* to the Amaryllidaceae. Similarities in the inflorescence may well be due to convergency."

The genera comprising the Allieae have been examined in considerable detail, and the only factors which conflict with the hypothesis that the tribe is homogeneous are the chromosome numbers found in the various genera. *Tulbaghia* has a basic number of $x = 6$ in all species examined to date, but all other genera in the Allieae have been found to posesss $x = 7$, 8 or 9.*

The other genera in the Allieae have the following basic numbers:—

Allium	$x = 7$, $x = 8$, $x = 9$
Nectaroscordum	$x = 8$
Caloscordum	$x = 8$
Nothoscordum	$x = 8$, $x = 9$
Leucocoryne	$x = 9$
Stemmatium	No counts available
Tristagma	No counts available

Cryptostephanus has been suggested as a close relative of *Tulbaghia* by Wilsenach (1967); it possesses a corona of separate lobes similar to *Tulbaghia violacea*, but it differs among other characters in having an inferior ovary, and a berry rather than a capsule. Wilsenach also suggests that its $2n = 24$

* A complication occurs in the case of *Ipheion uniflorum* Lindl. if one accepts its transference to the Allieae as a species of *Tristagma* by Traub (1963); Saez (1949) records a count of $2n = 12$ for this species under the synonym *Brodiaea uniflora* Engler, but a misidentification has almost certainly occurred since the specimens examined by Saez were growing 'spontaneously' in the suburbs of Montevideo (Uruguay) while *Brodiaea* only occurs in N America.

could have evolved from a 2n = 12 ancestor by polyploidy. While it is difficult to refute this hypothesis, the possession of a corona and possibly x = 6 are the only characters which unite these otherwise dissimilar genera, and their close relationship is therefore unlikely.

Agapanthus, though classically placed with *Tulbaghia* in the Agapantheae, is even less likely to be a close relative. The rhizome present in *Agapanthus* and in some species of *Tulbaghia* has traditionally united the two, though they otherwise differ in more character than most other genera considered here. Several authors, Traub (1963), Cheadle (1969), Vosa (*in litt.*) and Wilsenach (1967), have already recognised this difference and comment that they are unlikely to be close relatives.

The pressing need for a complete revision of the Allioideae is illustrated by the difficulty in assigning species to a genus. The generic synonomy accepted by various authors differs wildly and, to give an extreme example of this, *Ipheion uniflorum* has at some time been assigned to the genera *Triteleia*, *Ipheion*, *Milla*, *Brodiaea*, *Beauverdia*, *Leucocoryne* and *Hookera*.

CYTOLOGY

As part of the study the limited living material of the genus was examined cytologically. The species studied all have a basic number of x = 6 and a superficially similar complement comprising large meta- or submetacentric chromosomes. All are diploid apart from *T. alliacea*, in which diploid and tetraploid stocks occur, and *T. capensis*, until recently represented in cultivation only by a hexaploid clone (Dr Vosa has now collected diploid plants near Cape Town which may belong to *T. capensis*).

In view of the more extensive studies and collections of Vosa (1966 et seq.), which are continuing, it seems sensible to leave discussion of the karyology of the genus to him. It will be interesting to see in what way different species limits and affinities are suggested by his studies.

Synopsis of Classification

GENUS TULBAGHIA

SUBGENUS TULBAGHIA

Group A.	1.	*capensis*
Group B.	2.	*alliacea*
	3.	*carnosa*
	4.	*ludwigiana*
	5.	*campanulata*
	6.	*dregeana*
Group C.	7.	*natalensis*
	8.	*friesii*
	9.	*poetica*
Group D.	10.	*aequinoctialis*
	11.	*tenuior*
	12.	*calcarea*
Group E.	13.	*leucantha*
	14.	*cameronii*
	15.	*dieterlenii*
	16.	*acutiloba*

Group F. 17. *fragrans*
18. *rhodesica*

SUBGENUS OMENTARIA

19. *simmleri*
20. *galpinii*
21. *violacea*

Key to Species

1. Corona of three or six free scales 2
+ Corona forming a complete but sometimes deeply laciniate cylinder at the mouth of the perianth tube 5
2. Anthers inserted on perianth tube at same level as perianth segments; perianth green; corona brown . . . 1. *capensis*
+ Anthers inserted on perianth tube below perianth segments; perianth purple or pink (rarely white); corona white or purple . 3
3. Corona lobes 6 . . . . . 20. *galpinii*
+ Corona lobes 3 4
4. Corona lobes obtuse, emarginate; margins of perianth segments incurved . . . . . 19. *simmleri*
+ Corona lobes acute, rarely slightly retuse at tip; margins of perianth segments not incurved . . . . . 21. *violacea*
5. Corona deeply split into 3 laciniae, each segment frequently retuse-emarginate 6
+ Corona more or less entire with a crenate or serrate margin, rarely slightly trifid 8
6. Umbel (15–)20–40-flowered, flowers purplish (rarely white); leaves 2–2·5 cm broad . . . . . 17. *fragrans*
+ Umbel 6–15-flowered; flowers green, yellow or brown; leaves less than 1·5 cm broad 7
7. Corona lobes brown, retuse; style with a capitate stigma . 1. *capensis*
+ Corona lobes bright yellow, more or less entire; style and stigma forming a thick, apically depressed column . . 4. *ludwigiana*
8. Anthers conspicuously exserted from mouth of corona . . 9
+ Anthers not exserted from mouth of corona 10
9. Perianth segments acute; corolla tube urceolate . 16. *acutiloba*
+ Perianth segments obtuse; corolla tube cylindrical-campanulate 12. *calcarea*
10. Corona less than 2 mm long 11
+ Corona more than 6 mm long 18
11. Perianth tube campanulate, about 1½ times as long as broad . 5. *campanulata*
+ Perianth tube cylindrical or urceolate, at least twice as long as broad 12
12. Perianth segments less than 5 mm long; corona annular and laterally expanded . . . . . 6. *dregeana*
+ Perianth segments more than 5 mm long; corona not laterally expanded 13

13. Leaves filiform, less than 2·5 mm broad 14
\+ Leaves linear more than 3 mm broad 17
14. Perianth segments 8–12 mm long . . . . . 11. *tenuior*
\+ Perianth segments less than 8 mm long 15
15. Perianth white, segments obtuse 16
\+ Perianth green, segments acute . . . . . 10. *aequinoctialis*
16. Umbel 6–9 flowered; corona greenish . . . . . 8. *friesii*
\+ Umbel 3–5-flowered; corona yellow . . . . . 9. *poetica*
17. Perianth tube cylindrical; perianth purplish; corona rose-pink . 18. *rhodesica*
\+ Perianth tube urceolate; perianth green; corona orange or red . 16. *acutiloba*
18. Leaves filiform, less than 3 mm broad 19
\+ Leaves linear, more than 3 mm broad 20
19. Corona orange or scarlet, cylindrical and with a serrate margin . 13. *leucantha*
\+ Corona brownish, of irregular shape and with an obscurely crenate margin . . . . . 15. *dieterlenii*
20. Perianth white; corona campanulate with a serrate or incised margin 21
\+ Perianth green; corona cylindrical with an entire or slightly crenate margin 22
21. Perianth segments acute; perianth tube 6–8 mm long 14. *cameronii*
\+ Perianth segments obtuse; perianth tube 3–4 mm long 7. *natalensis*
22. Perianth segments lanceolate, acute 23
\+ Perianth segments spathulate, obtuse . . . . . 3. *carnosa*
23. Leaves less than 6 mm broad; corona orange or brown . 2. *alliacea*
\+ Leaves more than 8 mm broad; corona yellow . 4. *ludwigiana*

Tulbaghia Linn., Mant. 2:148 (1771) (*nomen conservandum*) non Heister., Descr. Brunsv. 10 (1753) ex Kuntze, Rev. Gen. Pl. 718 (1891) = *Agapanthus* L'Hérit.
Syn.: *Omentaria* Salisb., Gen. Pl. 87 (1866).
Type species: *T. capensis* Linn.
Generic characters: *Whole plant* with an alliaceous smell. *Rootstock* a corm or rhizome. *Leaves* 4–8, lorate-filiform, frequently distichously arranged. *Scape* solitary, erect. *Involucral bracts* 2, ovate-acuminate to narrowly lanceolate. *Umbel* 3–40-flowered, flowers usually opening in succession. *Perianth segments* united into a tube for about half their length; tube surmounted by a corona of 3 or more free scales or a fleshy tube. *Anthers* sessile, in 2 whorls. *Ovary* superior. *Nectaries* on septa. *Style* short. *Stigma* capitate. *Capsule* trilocular, dehiscing loculicidally, surrounded by marcescent perianth. *Seeds* black, triangular. *Basic Chromosome number* x = 6.

Subgenus **Tulbaghia**
Syn.: Genus *Tulbaghia* L. *sens. strict*; Salisb., Gen. Pl. 87 (1866).
Type species: *T. capensis* Linn.
Subgeneric characters: *Corona* a ring of fleshy tissue at the mouth of the perianth tube, entire, crenate, serrate or deeply 3-fid. *Anthers* in 2 whorls, one whorl usually inserted on the corona.

1. Tulbaghia capensis Linn., Mant. 2:223 (1771).
Syn.: *T. pulchella* Avé-Lall. in Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petérsbourg, Sér. 3:204 (1844).
Type: Described by Linnaeus from the Cape. Linn. Herb.
Ic.: Jacquin, Hort. Bot. Vindob. 2: t. 115 (1770–1776); Bot. Mag. 21: t. 806 (1805) sub *T. alliacea*; Fig. 1.

Roots fleshy, up to 15 cm long. *Rootstock* rhizomatous, surrounded by the scarious remains of leaf bases. Leaves 10–45 × 0·4–1·2 cm, linear. *Scape* 15–30 cm long. *Involucral bracts* up to 20 mm × 7 mm, broadly lanceolate. *Umbel* (4–)6–10-flowered; flowers opening in succession. *Pedicels* up to 2 cm long. *Perianth tube* 7 mm long, olive green tinged with purple, cylindrical-campanulate. *Perianth segments* 2–4 mm × 2 mm, oblong-obtuse, olive green; whorls set 0·5 mm apart. *Corona* up to 5 mm long, trisect, each lobe ± deeply bifid; lobes acute, brown-purplish. *Anthers* in 2 whorls, the upper whorl at the base of the corona lobes, and opposite the upper perianth segments, the lower whorl inserted about 1 mm lower. *Ovary* 2–3 mm long, ovoid. *Style* 1 mm long. *Stigma* capitate. *Capsule* 6–8 mm long, obcordate.
Flowering—August (& April?).
Distribution—Southern Cape.
Habitat—Rocky hillsides and rock crevices, 0–1000 m.
Selected list of specimens seen:*
CAPE. 27S19E: Tigerberg, De Grenedl, *Esterhuysen* 23060; Tigerberg, viii 28, *Zuccarini* s.n.; 29S18E: Little Namaqualand, Hardeveld, *Zeyhr* 4268; 32S26E: Katberg, Stockenstron, *Drége*; 33S18E: Monte Tabularis, *Ecklon* 94; Uitkamp, *Gillett* 3111; 33S22E: 18 miles east of George, *Salter* 3188; 34S19E: Cape peninsula, west of Muizenberg, *R. Primos* s.n.; 34S20E: Bredasdorp, *C. A. Smith* 3017; Heidelberg, *Rogers* 4379; 34S21E: Riversdale, *Muir* 4887; Bottelliersfontein, Albertina, *Muir* 1900; 34S23E: Knysna Heads, *Franklin* 27; Cape, no locality, *Brehm* 1820.

A variable species, but readily distinguished from all other species of *Tulbaghia* by the fleshy trisect corona, each lobe of which is deeply bifid. The corolla shape varies from campanulate to cylindrical with all intermediates. Baker used the name *T. capensis* var. *gracilis* for small specimens, but this distinction does not seem justified in the light of the more abundant material now available. The plate in Bot. Mag. 21 (t. 806) is mistakenly labelled *T. alliacea*. This error has been responsible for much of the confusion over the identity of *T. capensis*.

2. Tulbaghia alliacea Linn. fil., Suppl. Pl. 193 (1781).
Syn.: *T. narcissiflora* Salisb., Prodr. Stirp. 219 (1796).
T. brachystemma Kunth, Enum. Pl. 4:483 (1833).
T. inodora Gaertner, De Fruct. et Sem. Pl. 1:57 (1791).
T. cernua [Avé-Lall. ex] Fisch., Mey. et Avé-Lall. in Ind. Sem. Hort. Petrop. 9, Suppl. 25 (1844).
Type: Described by Linn. fil. from the Cape (Herb. Linn 411.2!).

* In this revision specimens have been cited by degree squares rather than by administrative division. Degree squares are identified by the nearest 'corner' to the equator and to the Greenwich meridian. The degree squares are cited from north to south and west to east in numerical order.

Ic.: Marloth., Fl. S Africa 4:27 (1915); Fl. Pl. S Africa 17:653 (1937); Fig. 1.

Rootstock rhizomatous; rhizome often up to 10 cm long, swollen. *Leaves* 15–20(–25) × 0·3–0·5 cm broad, linear. *Scape* 15–30 cm long. *Involucral bracts* 1·3–2·0 cm long, up to 7 mm broad, broadly lanceolate. *Umbel* 6–10-flowered, flowers opening in succession. *Pedicels* up to 2 cm long. *Perianth tube* 6 mm long, 3–4 mm broad, cylindrical-campanulate, green. *Perianth segments* 2–4 × 1·5–2·0 mm, lorate-lanceolate; in 2 whorls 1 mm apart; apex acute to rounded, green. *Corona* 2–3 mm long, slightly broader than the perianth tube, cylindrical, fleshy, obscurely 3 or 6 crenate, orange-brown. *Anthers* 1·3–1·5 mm long; upper whorl inserted on the corona 1 mm below mouth; lower whorl inserted at junction of corona and corolla tube, or on corolla tube. *Ovary* 2–3·5 mm high, ovoid. *Style* 0·5–1·0 mm long. *Stigma* capitate. *Capsule* up to 8 mm long, obcordate.

Flowering—August–January.

Distribution—Southern Africa, extending northwards along the higher ground in the east to central S Rhodesia.

Habitat—"Catholic", occupies a variety of habitats from swampy lowland to barren ground, 0–2000 m.

Selected list of specimens seen:

S RHODESIA. 17S31E: Salisbury, *Lewis* 6260; 18S32E: Inyanga, *Martineau* 896; 19S32E: Umtali, *Mrs Evelyn Cecil* 53.

BOTSWANA. 25S25E: Mathethe, *Hillary & Robertson* 697.

SWAZILAND. 26S31E: Mbabane, *Compton* 30562.

NATAL. 28S28E: Drakensberg, Cathedral area, *Schelpe* 867; 29S29E: Nottingham, *Buchanan* 6/76; 29S30E: Pietermaritzburg, Scotsville, *Lawson* 273; Inanda, *Medley-Wood* 257.

LESOTHO. 28S28E: Leribe, *Dieterlen* 702.

TRANSVAAL. 23S30E: Letaba, Duiwelskloof, *Scheepers* 1016; 24S28E: Leeuwpoort, Waterberg, *Rogers* 21810; 25S28E: Pretoria, *McLea* 3091; 25S30E: Lydenburg, *Wilms* 1475; 26S28E: Witwatersrand, Doornpoort, *Pole-Evans* 13222.

CAPE. 27S28E: Kaalfontein, *Pole-Evans* 13011; 28S21E: Albany, *Cooper* 3279; 29S17E: Namaqualand, Kosies Mts, *Dyer* 3668; 32S26E: Katberg, *Drège* 1840; 33S18E: Malmerbury, Groene Kloof, *Bolus* 4347; Middleburgh, Grootfontein, *Theron* 942; Table Mountain, *Dummer* 698 & 1081; 33S25E: Port Elisabeth, *Bayliss* 1567; 34S19E: Muizenberg, *Bolus* 4649; Muizenberg, False Bay, *MacOwan* 1885.

This species can be associated with the following three to form an apparently natural group. The material included in *T. alliacea* shows a wide range of variability, and may consist of a number of taxonomically "good" entities. Unfortunately many diagnostically useful characters are lost in the process of drying, and examination of herbarium material does not allow the allocation of specimens to groupings below the species level. Were copious field notes on colour and shape of the corona available, the task would be much easier. Species such as *T. ludwigiana* Baker, originally described from living, cultivated material, were later sunk into *T. alliacea* by their authors due to an inability to separate preserved material. Nevertheless a number of correlated differences have been found in a comparison of herbarium material.

T. alliacea remains something of a "dumping ground" of what may subsequently prove to be genetically very diverse units.

3. Tulbaghia carnosa R. B. Burbidge, **sp. nov.** Fig. 1. affinis *T. alliaceae* Linn. fil., sed corona crassiore (6 mm longa, 4–5 mm lata), et segmentis perianthii spathulatis 6 mm longis, 2·5 mm latis recedit. Etiam scapo plus quam 40 cm longo, et corona flavovirente maturescente aurantiaca differt. *Floret* xii–i.
Type: Transkei, 32S28E: Willowvale dist. Msendo Halt, between Mpozolo school and Mendu, 520 m, in slightly marshy ground, 27 i 1966, *R. Wood* 161. University of Natal Herbarium No. 36321. (holo NU).

Roots fleshy, up to 10 cm long. *Rootstock* rhizomatous, frequently extending in the ground for 10–20 cm. *Leaves* 15–30 × 0·5–0·8 cm, linear. *Umbel* 7–12-flowered, flowers opening in succession. *Pedicels* up to 3 cm long. *Perianth tube* 7 mm long, cylindrical, light green with whitish stripes. *Perianth segments* 4–7 × 2–3 mm, oblong-spathulate, whitish with a green nerve. *Corona* 4–6 mm long, thick and very fleshy, yellow to deep orange; margin entire or obscurely crenate. *Anthers* in 2 whorls, the upper whorl inserted on the corona, lower whorl on the perianth tube. *Ovary* 3–4 mm long, ovoid. *Style* 1 mm long. *Stigma* capitate. *Capsule* 6–10 mm long, obcordate.
Flowering—December–January.
Habitat—marshy ground.
Distribution—extreme E Cape (Transkei).
Further specimens seen: (cultivated) under *T. capensis* viii 1965 (K!); Cult. C. G. Vosa, Botany School, Oxford. 2056/65. Cultivated material is also lodged in E.

This species has been in cultivation in the Botanic Gardens at Kew, Oxford and Edinburgh for an uncertain number of years. The material was of clonal origin from a single introduction to Kew, and has appeared in the herbaria of these three botanic gardens under a variety of names. *T. capensis* and *T. alliacea* have been frequently used, but in recent years the epithet *dregeana* has become fairly firmly attached, particularly following the cytological papers of Vosa (1966a and 1966b). Unfortunately the name *dregeana* has been misapplied, and as the species is distinct from any so far published, it is presented here as a new species.

4. Tulbaghia ludwigiana Harvey in Bot. Mag. 64: t. 3547 (1837).
Type: Described from cultivated material in the Ludwigsburg garden, Cape of Good Hope, collected by a Mr Zier from the borders of Caffer-land.
Ic.: Bot. Mag. *l.c.*; Fig. 1.

Similar to *T. alliacea* but distinguished by the lorate leaves, 1–2 cm broad which have a conspicuously distichous arrangement and by the distinctly 3-lobed corona which is bright yellow. The ± acute perianth lobes and the apically depressed thick style also serve to separate this species from both *T. carnosa* and *T. alliacea.*
Flowering—August–December.
Distribution—Central and SE Cape, Natal.
Habitat—Grassy hillsides, 0–1400 m.

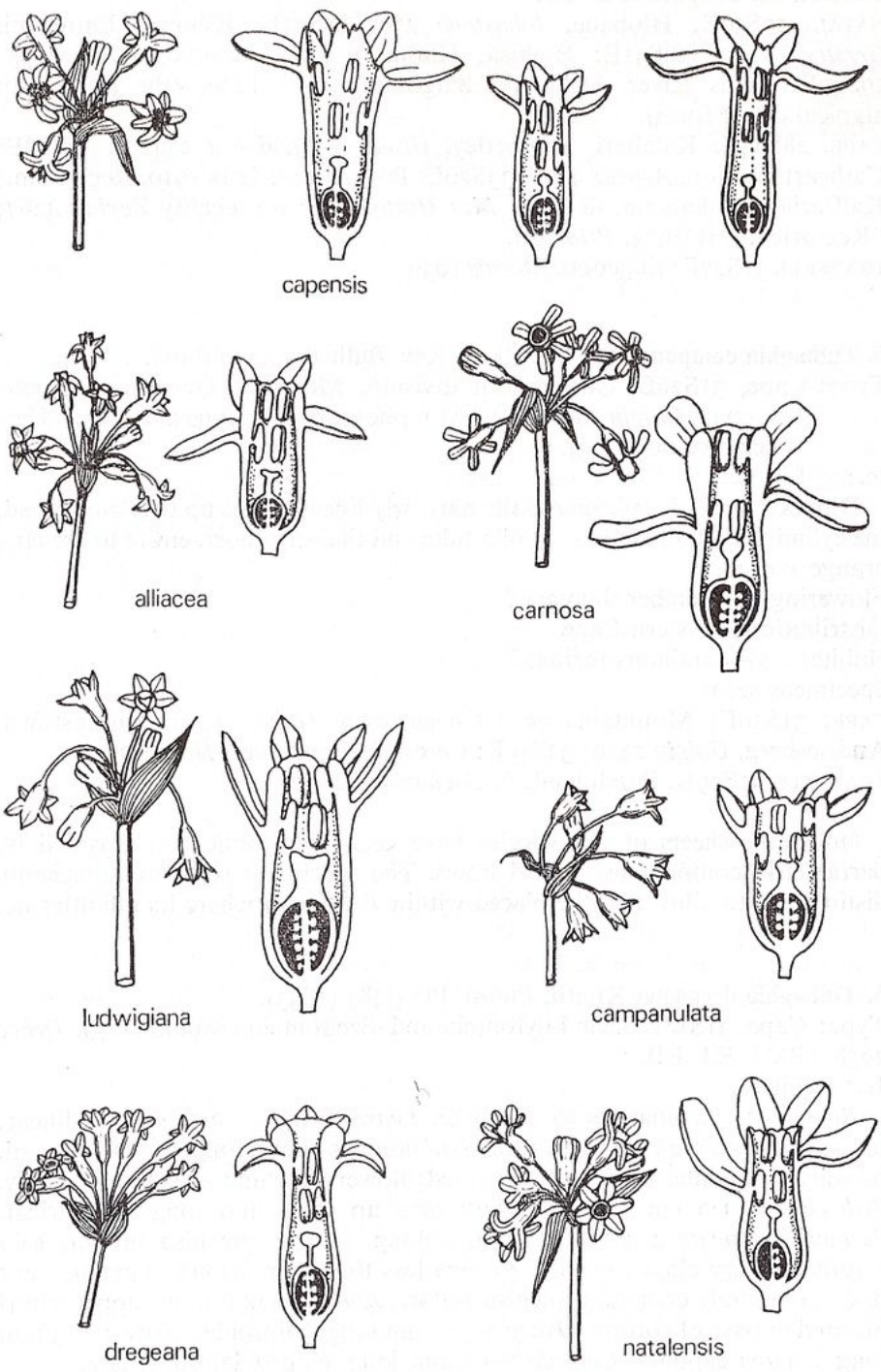

FIG. 1. Inflorescences and flowers of *Tulbaghia* species. Flowers × 3, Inflorescences × ¾

Selected list of specimens seen:
NATAL. 27S30E: Hlobane, *Johnstone* 439; 28S31E: Eshowe, Entumeni, *Gerstner* 2263; 28S31E: Hlabisa, Hluhluwe game reserve, *Ward* 4335; 29S30E: Lions River, Millbank, Balgowan, *Moll* 1209—(the last is an atypical dwarf form).
CAPE. 28S24E: Kalahari, Kimberley, *Grant & Blenkiron* 234/28; 32S27E: Cathcart division, *Acocks* 9206; 33S26E: Port Alfred, 12 ix 1910, *Rogers* s.n.; Kaffraria, Keiskamma, iii 1868, *Mrs Hutton* s.n.; no locality *Zeyher* 4267; "Reg orient", iv 1903, *Prior* s.n.
TRANSKEI. 31S27E: Engcobo, *Marais* 1036.

5. Tulbaghia campanulata N.E. Br. in Kew Bull. 175:136 (1901).
Type: Cape, 31S26E, Queenstown division, Mts near Queenstown, 900–1200 m, *Galpin* 1660 (K!). (Also photograph of type available—Kew negative no. 1223).
Ic.: Fig. 1.

Differs from *T. ludwigiana* in the narrowly linear leaves up to 3 mm broad, the cylindrical-campanulate corolla tube and the very short, entire to crenate, orange corona.
Flowering—December–January?
Distribution—Eastern Cape.
Habitat—Mountainous regions?
Specimens seen:
CAPE: 31S26E: Mountains near Queenstown, *Galpin* 1660; Queenstown, Andriesberg, *Galpin* 2229; 33S19E: Ceres, Wabomsriver, *Hanekom* 780.
TRANSKEI. 31S29E: Pondoland, *F. Bachman* 284.

Only four sheets of this species have been seen, none accompanied by particularly comprehensive field notes. The specimens seen are sufficiently distinct not to allow it to be placed within *T. alliacea* where its affinities lie.

6. Tulbaghia dregeana Kunth, Enum. Pl. 4:483 (1843).
Type: Cape, 31S18E, near Lilyfontein and Ezelfontein (Kamiesberg), *Drège* 2658 (BM! K! E!).
Ic.: Fig. 1.

Rootstock rhizomatous to cormlike. *Leaves* 8–15 × 0·3–0·4 cm, linear, obtuse. *Scape* 15–25 cm long. *Involucral bracts* 5–9 mm long, 3–5 mm broad, broadly lanceolate. *Umbel* 5–9-flowered; flowers opening ± simultaneously. *Pedicels* 0·8–1·0 cm long. *Perianth tube* up to 9 mm long, cylindrical. *Perianth segments* 4–4·5 × 2 mm, oblong, obtuse, greenish brown; two whorls set very close together. *Corona* less than 2 mm long, annular, very fleshy, obscurely crenate, brownish yellow. *Anthers* 1 mm long; upper whorl inserted at base of corona. *Ovary* 2–3·5 mm long, ellipsoidal. *Style* 1–1·5 mm long. *Stigma* capitate. *Capsule* 8–15 mm long, ellipsoidal-obcordate.
Flowering—August–September.
Distribution—Confined to the Western Cape.
Habitat—Shallow soil and rock crevices, possibly predominantly on doleritic soils.

Selected list of specimens seen:
CAPE: 29S17E: Namaqualand, Kosies Mts, *Dyer* 3668; 30S17E: Kamieskroom, *Salter* 1487; 31S18E: Van Rhynsdorp, Klaver, *Bolus & Lewis* 1858; 31S19E: Calvinia, *A. A. Schmidt* 152; Kareetkom, *Leistner* 463; between Oorlog's Kloof and Papkuilsfontein, *Leipoldt* 1858; Calvinia, Kreekam, *Acocks* 18562; 33S18E: Table Mountain, *Ecklon* 94.

7. Tulbaghia natalensis Baker in Gard. Chron. ser. 3, 9:668 (1891).
Type: Described by Baker from Natal (see below).
Ic.: Medley Wood, Natal Plants 1: t. 29 (1899); Fl. Pl. S Africa 25:979 (1945); Fig. 1.

Rootstock a rhizomatous corm. *Leaves* up to 25 cm long, 4–7 mm broad, linear. *Scape* 15–40 cm long. *Involucral bracts* 1·5–2·5 cm long, 5–8 mm broad, lanceolate. *Umbel* 6–10-flowered; flowers opening in succession. *Pedicels* up to 2 cm long. *Perianth tube* 3–4 mm long, 2–3 mm broad, campanulate-cylindrical, white, often tinged with purple. *Perianth segments* 5–7 × 4–5 mm, oblong-elliptical, obtuse or sometimes irregularly emarginate; margin slightly curved; whorls set 1–2·5 mm apart. *Corona* 3–4·5 mm long, subcampanulate, irregularly 3-lobed, each lobe emarginate-serrate, green to yellowish orange. *Anthers* 1·5 mm long; upper whorl near to mouth of corona, but not exserted. *Ovary* 3 mm long, elliptical. *Style* 1 mm long. *Stigma* capitate. *Capsule* 6–7 mm long, obcordate.
Flowering—August–October (December).
Distribution—Natal, endemic.
Habitat—Rocky ground and shallow soil, particularly near water, 800–1800 m.
Selected list of specimens seen:
NATAL. 29S29E: Giant's Castle Game Reserve, *Edwards* 2174, *Trauseld* 405, *Symons* 58; Estcourt, Bushman's River, *Schelpe* 17; Impendhle, *Marais* 2158, *Huntly* 73; Culvers Weenen, *Rogers* 28154; Thabamhlope, *West* 834, *Van der Merwe* 2585; between Bulwer and Nottingham Road, *Mauve* 4480; 29S30E: Nottingham Road, *Galpin* 9446; Zwartkop, Maritzburg, *Fisher* 722, *Medley-Wood* 10451; Lions River, Millbank, Balgowan, *Moll* 1191; Mooi River, *Medley-Wood* 4045, 5475, 6185, *Stainbank* 3845, *Johnston* 50, 199.

The type citation refers to a specimen "Baker in Herb. Kew" but no sheet was seen to which this could be attributed. As the description was made from living material sent by Medley Wood, a neotype, if needed, should be selected from the Kew cultivated material.

8. Tulbaghia friesii Suesseng. Trans. Rhodes. Sci. Assoc. 43:76 (1957).
Syn.: *T. rhodesica* Weimarck in Bot. Not. 90:169 (1937) *nom. illegit.*
Type: S Rhodesia, 18S32E, Inyanga, in monte Inyanga in campo saxoso c. 2000 m, *Fries et al.* 3553 (BM! M!).
Ic.: Weimarck, *l.c.* 169; Fig. 2.

Rootstock a corm 2–2·5 cm long, 1–1·5 cm in diam. *Leaves* 10–15 × 0·1–0·2 cm broad, filiform. *Scape* 12–25 cm long. *Involucral bracts* 0·7–1·5 cm long. *Perianth tube* 4–6 mm long, cylindrical, greenish white. *Perianth segments* 4–4·5 × 1·5–2 mm, obtuse, white, sometimes tinged with purple.

Corona 1·5–2 mm long, cylindrical, entire-slightly crenate, green. *Anthers* 0·7–0·9 mm long. *Ovary* 2–3 mm long, broadly elliptical. *Style* 0·5 mm long. *Stigma* capitate.
Flowering—August-December.
Distribution—S Rhodesia, Inyanga, endemic.
Habitat—Damp mountain grassland, 1500–2100 m.
Selected list of specimens seen:
S RHODESIA. 18S32E: All collections from the Inyanga Mts, *Brain* 7312, *Eyles* 8515, *Leach* 70197, *Miller* 4677 & 3796, *Drummond & Robson* 5829; & 6 miles north of Troutbeck, 1670 m, *Robinson* 1990, *Sturgeon* Govt. Herb. 6942, *Whellan* 2063.

9. Tulbaghia poetica R. B. Burbidge **sp. nov.** Fig. 2. affinis *T. friesii* a qua imprimis statura minore, foliis angustioribus (minus quam 1 mm latis) et corona breviore (1–2 mm alta) differt. *Floret* x–xii.
Type: Transvaal, 24S30E, Pilgrim's Rest, "Op die Berg", 20 miles north of Graskop, grassland on shallow moist soil, 4300 ft., 22 xi 1951, *L. E. Codd* 6746 (holo PRE, iso K).

Rootstock a corm, 2 cm long, 0·5–0·9 cm in diam. *Leaves* 5–15 cm long, less than 1 mm broad, filiform. *Scape* 12–15 cm long. *Involucral bracts* up to 10 × 2–4 mm. *Umbel* 3–5-flowered, flowers opening ± simultaneously. *Pedicels* up to 0·8 cm long. *Perianth tube* 4–5 × 1·2–1·5 mm, cylindrical, whitish green. *Perianth segments* 4–5 × 2 mm, oblong-subspathulate, white (sometimes lilac). *Corona* 1–2 cm long, cylindrical, 3-crenate to 3-lobed, each lobe crenate bright yellow. *Anthers* 0·8 mm long, upper whorl at base of corona. *Ovary* 1–1·5 mm high, ovate. *Stigma* capitate. *Capsule* 4–5 mm long obcordate.
Distribution—Transvaal, Pilgrim's rest, endemic.
Habitat—Damp or marshy grassland, 1300–1400 m.
Specimens seen:
TRANSVAAL. 24S30E: Pilgrim's rest, Graskop, 1400 m, *L. E. Codd* 6733; Pilgrim's rest, marshy ground, *Davidson* 68, 2396; Graskop, near Lisbon falls, *R. Brent* 134.

This is an attractive small species with flowers (and smell) reminiscent of *Narcissus poeticus*. Morphologically it appears to be most closely related to *T. natalensis* and *T. friesii*.

10. Tulbaghia aequinoctialis [Welwitsch ex] Baker in Trans. Linn. Soc. London, Bot. ser. 2, 1:246 (1878).
Ic.: Fig. 2.

Rootstock a corm, 3 cm long. *Leaves* 10–15 cm long, filiform. *Scape* 15–20 cm long. *Involucral bracts* 1–1·5 cm long, lanceolate. *Umbel* 4–6-flowered. *Pedicels* 1–2 cm long. *Perianth tube* 4–5 × 2 mm, cylindrical, greenish yellow. *Perianth segments* 4–5 × 1 mm, lanceolate acute. *Corona* 1 mm long, irregularly 3-lobed or crenate. *Anthers* 0·5–0·8 mm long; upper whorl at the corona mouth, sometimes ± exserted. *Ovary* ovoid or ellipsoidal.
Flowering—February–April.
Distribution—Angola.
Habitat—Damp meadows and thickets, 700–1200 m.

Key to subspecies:

1a. Corona 3-lobed, each lobe c. 0·5 mm long; ovary ovoid . . subsp. *aequinoctialis*

1b. Corona crenate; ovary ellipsoidal . . . . subsp. *monantha*

subsp. **aequinoctialis**

Type: Angola, 9S15E, Pungo Andongo in dumetis humidiusculis, 2400–3800 ft., *A. M. Reis 43* (Exped. No. 3745) (K!, BM!).

Further specimens seen:

ANGOLA. 12S13E: Benguela, *Gossweiler* 2280 & 2140.

Subsp. **monantha** (Engler & Gilg) Burbidge, **comb. et stat. nov.**

Syn.: *T. monantha* Engler & Gilg in Warburg, Kunene-Sambesi Exped., 192 (1903).

Type (and only specimen seen): Angola, 16S17E, Kubango river, Kabindere (Cabinda), *H. Baum* 351. (K!).

The types of *T. aequinoctialis* and *T. monantha* have been examined and although they differ in characters of the corona and ovary (see key to subspecies above) in the present state of knowledge it seems best to reduce *T. monantha* to a subspecies of *T. aequinoctialis*. With the availability of more material, or the opportunity to examine living material, reassessment may prove necessary.

11. Tulbaghia tenuior Krause & Dinter in Bot. Jahrb. Syst. 45:141 (1910).

Syn.: *T. huebbertiana* Engler & Krause in Bot. Jahrb. Syst. 45:145 (1910).

Type: SW Africa, 25S18E, Grootfontein auf quelligem Grund zwischen Kalkgeroll, *Dinter* 790 *n.v.*

Ic.: Fig. 2.

Rootstock a corm, 2–3 cm long. *Leaves* 10–15 × 0·2–0·3 cm, linear. *Scape* 15–20 cm long. *Involucral bracts* 1·5–2 cm long, 3–4 mm broad, lanceolate. *Umbel* 4–6-flowered; flowers opening in succession. *Pedicels* up to 2 cm long. *Perianth tube* 7–8 mm long, cylindrical-urceolate, light reddish brown. *Perianth segments* 0·8–1·2 cm long, linear, acute; whorls set very close together. *Corona* 0·5–0·9 mm long, cylindrical, irregularly serrate *Anthers* 0·5–1 mm long; upper whorl inserted in mouth of corona. *Ovary* 2 mm long ovoid.

Flowering—December–February.

Distribution—South West Africa and Central and Western Cape.

Habitat—Damp rocky places.

List of specimens seen:

CAPE. 29S19E: 2·5 miles N by E of Pofadder, *Acocks* 21797; 29S22E: Prieska, *E. G. Bryant* 576.

SW AFRICA. 20S16E: Otjiwarango, Ohaweha, *O. H. Volk* 2817; 20S17E: Waterberg Plateau, *G. Boss* 35077; 24S16E: between Helmeriphasen and Maltowe, *Name illegible* 337; 25S16E Namaqualand, *E. C. MacDonald* 313; 25S18E: Grootfontein, *Schoenfelder* 454, 955, *O. H. Volk* 25736, 1 xi 39, *S. Rehm* s.n.

Also listed in Merxmüller (1969) from SW Africa at Windhoek (22S17E).

The type of *T. tenuior* has not been seen but Merxmüller states (personal communication) that he has seen the type and that the specimens cited here belong to *T. tenuior*. He has also seen the type of *T. luebbertiana* (*Lübbert* 44) which species he considers to be synonymous with *T. tenuior* despite the fact that *Lübbert* 44 was collected without flowers.

12. Tulbaghia calcarea Engler & Krause in Engler, Bot. Jahrb. 45:142 (1910).
Syntypes: SW Africa, Grootfontein, 25S18E, *Dinter* 761 & 761a.
Ic.: Fig. 2

Rootstock unknown. *Leaves* 10–20 × 2–2·5 mm. *Scape* 15–20(–40) cm long. *Involucral bracts* 1·5–2·5 cm long, whitish. *Umbel* 7–9-flowered; flowers opening in succession. Pedicels up to 2 cm long. *Perianth tube* 2·5–3·5 × 1 mm cylindrical, brownish green. *Perianth segments* 4·5 × 1 mm, obtuse, set 0·5 mm apart, greenish. *Corona* 3–4 mm long, cylindrical, obscurely lobed, reddish or yellowish brown. *Anthers* 0·6–0·9 mm long; upper whorl usually exserted. *Ovary* 1–2 mm long, ovoid. *Style* 0·5–0·8 mm long. *Stigma* capitate.
Flowering—December.
Distribution—South West Africa.
Habitat—Unknown.
Specimen seen:
SW AFRICA. 25S18E: Grootfontein, *Schoenfelder* 956.

Only a single specimen (*Schoenfelder* 956) of this species has been seen, but Merxmüller (in *Prodr. Fl. Sudwestafrica*, 1969) cited this specimen under *T. calcarea* and had seen the type material. He cites only one other collection, *Volk* 1569. For this reason, *T. calcarea* is described here and not placed in the list of species insufficiently known at the end of this account.

13. Tulbaghia leucantha Baker in Dyer, Fl. Capensis 6:404 (1896).
Syntypes: Natal. Transkei border, 30S29E: Zuurberg, 3500 ft., *MacOwan & Bolus*, Herb. norm. Austr. Afr. 1208 (K!); 29S30E: Umzinyati falls, *Medley Wood* 1200 (K!); 29S31E: near Tugela river, *Medley Wood* 4408 (K!); Transvaal: 25S28E: Bosch Veldt between Kleinsmit and Kamel Poort, *Rehmann* 4842 (K!).
Ic.: Fig. 2.

Rootstock a corm. *Leaves* linear 5–15 cm × 0·3–0·6 mm. *Scape* 10–30 cm long. *Involucral bracts* 1–2 cm long, 3·6 mm broad, lanceolate. *Umbel* 4–8-flowered. *Pedicel* 1–1·5 cm long. *Perianth tube* 4–5 mm long, 2–3 mm broad, cylindrical, light green. *Perianth segments* 4 mm long, 1–2 mm broad, conspicuously rolled in flower, whitish green; whorls set 1–2 mm apart. *Corona* 4–5(–6) mm long, cylindrical, orange-crimson. *Anthers* 1·5–2 mm long; upper whorl in mouth of corona, not exserted; lower whorl level with upper whorl of perianth segments. *Ovary* 2 mm high, ovoid. *Style* 1 mm long. *Stigma* capitate. *Capsule* 10 mm long, obcordate.
Flowering—September–December.
Distribution—Eastern Cape and on high ground north to Southern Rhodesia.
Habitat—Shallow soil, dry grassland and rocky areas.

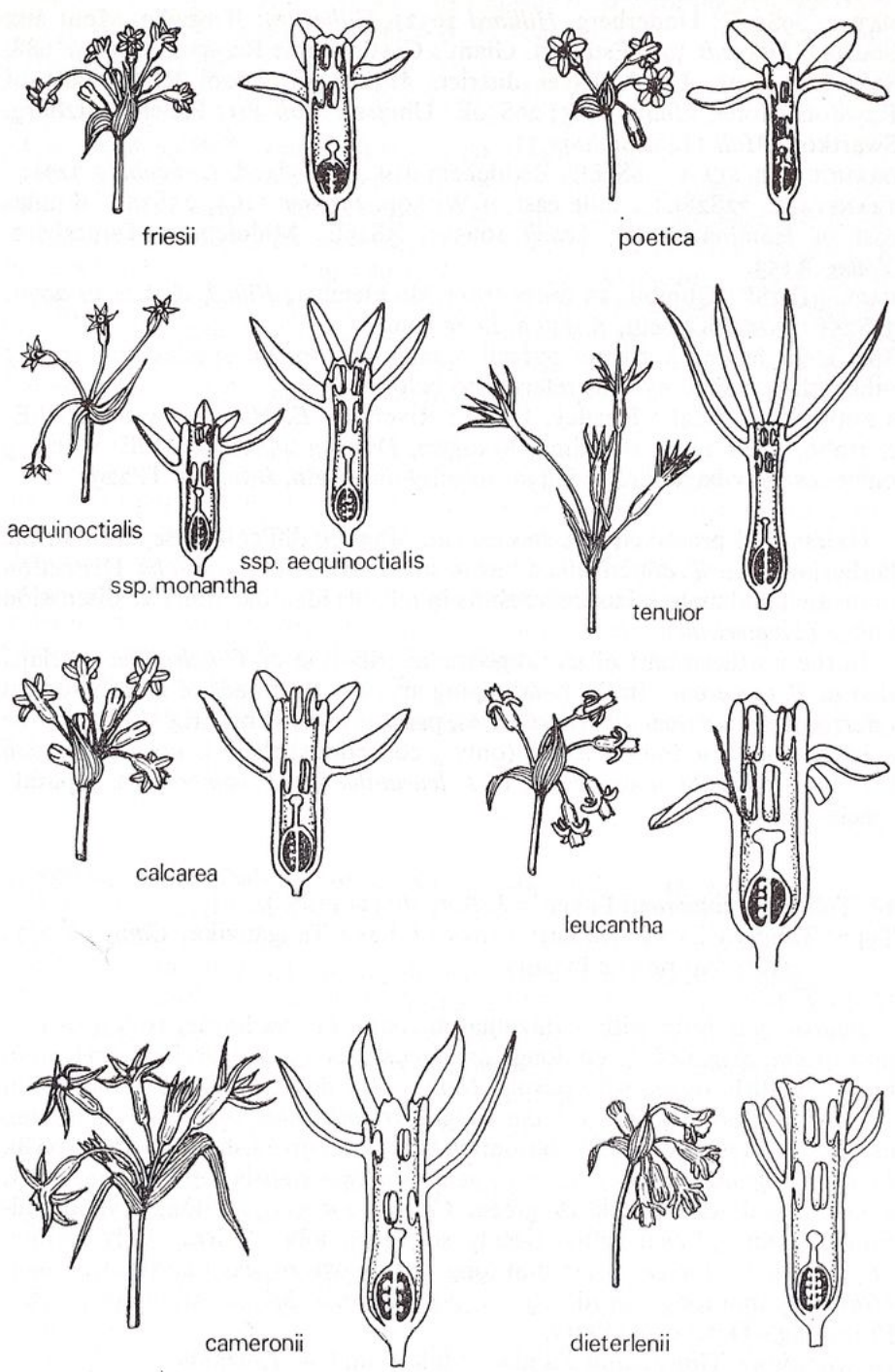

FIG. 2. Inflorescences and flowers of *Tulbaghia* species. Flowers × 3, Inflorescences × $\frac{3}{4}$.

Selected list of specimens seen:
NATAL. 29S29E: Underberg, *Hilliard* 26321, *Gillies* 75; Bergville, Mont aux Sources, *Edwards* 308; Estcourt, Giant's Castle Game Reserve, *Trauseld* 688, 836; Inhluzane, Lion's River district, *Moll* 1288; Mooi River, East of Rawdons Hotel, *Mauve* 4365; 29S30E: Umgeni, *Moll* 991; Pietermaritzburg, Swartkop, *Moll* 1140, *Stanton* 37.
ORANGE FREE STATE. 28S28E: Bethlehem dist., Hoogland, *Leibenberg* 7291.
TRANSVAAL. 22S28E: 1 mile east of Witkop, *Prosser* 1164; 25S28E: 6 miles east of Hammanskraal, *Leach* 10659; 25S29E: Middleberg, Tantesberg, *Young* A153.
CAPE. 31S28E: Qumbu, 15 miles from Mt Fletcher, *Killick & Marais* 2076; 33S25E: Port Elisabeth, Karsten, *Long* 509.
Specimens having a greater overall resemblance to this species than to any other (the possible hybrids referred to below):
S RHODESIA. 18S29E: Hartley, Umfuli River, *H. E. Hornby* 2422; 20S28E: Matobo, *West* 2491; Bulalima, Mangwe, *Friertag* 45418; 20S30E: Chibi, 5 miles east of village, *Leach* 11330; locality uncertain, *Bradfield* T. 229.

Unless well preserved this species can often be difficult to separate in the herbarium from *T. dieterlenii* and from small forms of *T. acutiloba*. Dissection of resuscitated material usually results in reliable identification (see discussion under *T. dieterlenii*).

In the northern part of its range the distribution of *T leucantha* overlaps that of *T. cameronii*. In the overlapping area are a number of morphological intermediates between the two species, probably of hybrid origin. Despite the existence of these intermediates (only 5 collections) there is no valid reason for questioning the maintenance of *T. leucantha* and *T. cameronii* as separate species.

14. Tulbaghia cameronii Baker in J. Bot. 16:321 (1878).
Type: Tanganyika (Tanzania): banks of Lake Tanganyika, *Cameron* 2/75 (K!). No precise locality.
Ic.: Fig. 2.

Rootstock a corm with a rhizomatous base. *Leaves* linear, 10–15(–20) × up to 1 cm. *Scape* 15–20 cm long. *Involucral bracts* 2·5–3 cm long, up to 1cm broad, whitish, tinged with purple. *Umbel* 7–12-flowered; flowers opening in succession. *Pedicels* up to 2 cm long. *Perianth tube* 6–8 × 2·5–3·5 mm, cylindrical in young flowers, becoming urceolate, greenish white or purplish. *Perianth segments* 6–10 × 2 mm, acute, in two whorls set 2–3 mm apart, white, tinged with purple or green. *Corona* 2·5–3·5 mm long, cylindrical-campanulate, 3-lobed (often deeply so), each lobe ± irregularly serrate, bright yellow. *Anthers* 1–1·2 mm long; upper whorl near mouth of corona. *Ovary* 2–3 mm long, ovoid. *Style* 1·5–2 mm long. *Stigma* capitate.
Flowering—October–January.
Distribution—Throughout Zambia, Malawi and W Tanzania.
Habitat—Savannah and open woodland.
Selected list of specimens seen:
TANZANIA. 04S29E: Kigoma district, Ikola, *Richards* 11693, 11702, *Procter* 601; 05S34E: Manyoni district, Kuzitako, *B. D. Burtt* 3526; Ndarambwe

village, *B. D. Burtt* 3499; 06S36E: Mpwapwa, *H. G. Hornby* 436, *Persberg* 628; 08S32E: Lake Rukwa, Mbeya, *A.W.* 184; 09S34E: Njombe, Makambako, *Procter* 1695.
MALAWI. 10S33E: Rumpi, *Robinson* 6288; 11S33E: *Maimba, M. E. Rees* xi 1951.
MOÇAMBIQUE. 14S35E: Mandimba, *A. J. W. Hornby* 3461.
ZAMBIA. 09S30E: Mporokoso district, *Richardson & Livingstone* xi 1960, *Gamwell* 217; 11S24E: Mwinilunga, Kabompo Gorge, *Richards* 16885 & 17454; 12S28E: Mujulira, *Cruse* 411; 12S33E: Lundazi River, *Robson & Fanshawe* 673; 13S28E: Luanshya, *D. B. Fanshawe* 2629; 13S32E: Fort Jameson, *Stewart* 76; 14S24E: Mankoya, *D. B. Fanshawe* 8983; 15S27E: Mumbwa, *Macaulay* 982; Mazabuka, *Trapnell* 514; 15S28E: south of Chisawba, north of Lusaka, *Benson* 210; 16S27E: 12 miles north of Choma, *Robinson* 968; Batoka Plateau, Katamo, *Allen* 212.

T. cameronii is a very variable species which has taken up more time in this study than any other species: it is perhaps surprising that no previous authors have described other species from the material included here as a single species. There is a great variation in leaf size, flower size, shape of corona and indentation of corona. Many attemps were made to split the available material into two or more fairly homogeneous morphological types, grouped as much by overall resemblance as possible.

The conclusion reached is that *T. cameronii* s.l. is best treated as a single variable species, though as in *T. alliacea* this decision may not stand the test of time.

15. Tulbaghia dieterlenii Phillips in Ann. S African Mus. 16:300 (1917).
Type: Basutoland (Lesotho), 28S28E, Leribe, 5–6000 ft., *Dieterlen* 361 (BM!).
Ic.: Fig. 2.

Rootstock a corm, 2–2·5 cm long, 0·8–1·5 mm in diam. *Leaves* 10–25 cm × 1–1·5 mm. *Scape* 10–30 cm long. *Involucral bracts* 1–1·5 cm × 4–4·5 mm, ovate-acuminate. *Umbel* 4–6-flowered. *Pedicels* up to 2·5 cm long. *Perianth tube* 4·5 × 2 mm, cylindrical-subcampanulate, green. *Perianth segments* 4–5 × 2·5–3 mm, obtuse, greenish white, not convolute. *Corona* 3–4 mm long, cylindrical, margin entire-obscurely crenate, orange brown. *Anthers* in two whorls, upper whorl reaching almost to mouth of corona. *Ovary* 1·5 mm long, 2 mm in diam., suborbicular. *Style* 1 mm long. *Stigma* capitate. *Capsule* 4–5 mm in diam., suborbicular.
Flowering—August–November.
Distribution—Lesotho, Natal and S Transvaal.
Habitat—Stony hillsides, 1200–2100 m.
Selected list of specimens seen:
TRANSVAAL. 23S29E: near Pietersburg, *B. L. Burtt* 2908; 24S28E: Warm Bath, Waterberge, *Bolus* 12390; 24S30E: Pretoria, Rietondale, *Trapnell* 538.
NATAL. 27S30E: Utrecht, *Devenish* 715.
LESOTHO. 29S27E: Berea district, Teyateyaneng Reserve, *A. J. Guillarmod* 4637.

Herbarium material of this species is liable to be confused with both *T. acutiloba* and *T. leucantha*, particularly with the latter. While living plants are easily distinguished, there is no absolutely certain way of distinguishing dried material of *T. leucantha* and *T. dieterlenii*, but an examination of the flower shape in carefully resuscitated material may help. In *T. leucantha* the corona dries to a crimson colour and in *T. dieterlenii* it is usually a brownish red. The separation of *T. dieterlenii* from *T. acutiloba* (except in very small specimens of the latter) is not so difficult and the acute perianth lobes in *T. acutiloba* are usually sufficient. The longer, more entire corona, and the non-exsertion of the anthers in *T. dieterlenii* are also of help.

16. Tulbaghia acutiloba Harvey in Thes. Cap. 2:51 (1854).

Syntypes: Cape, 31S26E, Queenstown, *T. Cooper* 463 (K!, TCD!); 32S25E, Somerset East, Boschberg, *MacOwan* 1582 (K!). Natal, 29S31E, Durban, *Gerrard & McKen* 740 (TCD!); Without locality, *J. Sanderson* 1860 (TCD!).

Ic.: Harvey, *Op. cit.* t. 180; Fig. 3.

Rootstock a corm with a rhizomatous base, *Leaves* 5–25 cm × 3–8 mm. *Scape* 15–30 cm long. *Involucral bracts* 1–2·5 cm long, 4–6 mm broad, lanceolate. *Umbel* 4–6-flowered. *Pedicels* 1–4 cm long. *Perianth tube* 8 mm long, 4 mm broad, ± triangular in cross section, green. *Perianth segments* 4–5 mm long, 1–1·5 mm broad, narrowly triangular, green; whorls set 1–1·5 mm apart (segments usually conspicuously recurved and flowers pendulous). *Corona* 1·5–2 mm long, broadly 3-crenate, orange or red-brown. *Anthers* 1–1·2 mm long; upper whorl near, and frequently exserted from the corona mouth. *Ovary* 2–3 mm long. *Style* 1 mm long. *Stigma* capitate. *Capsule* 8–12 mm long, ovoid.

Flowering—August–November.

Distribution—Eastern Cape, Natal, Orange Free State, Swaziland.

Habitat—Dry grassland and rocky areas.

Selected list of specimens seen:

SWAZILAND. 26S31E: Mbabane, *Compton* 27997; Forbes reef, *Compton* 30562

ORANGE FREE STATE. 28S27E: Ficksburg, *Galpin* 14051; 28S28E: Fouriesberg, *Roberts* 15907.

NATAL. 27S29E: Majuba mountains, *Mogg* 9594; 27S30E: Hlobane, *Huntley* 438; 28S29E: Bergville district, *Killick* 1041; Drakensberg, Van Reenen, *Medley Wood* 7455; 28S32E: Charters Creek, *Lawson* 510; 29S30E: Lion's River district, Howick, *Moll* 1063; Pinetown district, Gillitts, Chelmsford Park, *Hilliard* 4834; Zwartkop, *Medley Wood* 10451; Greytown, viii 1934, *J. Wylie* s.n.; Pietermaritzburg, *Bagshaw* 96, *D. J. B. Killick* 178; 29S31E; Phoenix near Verulam, *Schlechter* 2889; Durban Flat, *Medley Wood* 1888; 30S30E: Alexandria, Dumisa, *Rudatis* 292.

Frequently a "hopeless" species from the point of herbarium identification. The distinctive appearance of the flowers in living material is usually completely obscured on drying.

17. Tulbaghia fragrans Verdoorn in Fl. Pl. S Africa 11: t. 438 (1931).
Syn.: *T. pulchella* Barnes in S African Gard. 20:185 (1930) non Avé-Lall. (1834); *T. daviesii* C. H. Grey, Hardy Bulbs 2:572 (1938).
Type: Transvaal, 25S30E, Lydenburg Dientje farm, Nat. Herb. Pretoria No. 8894 (holo PRE!, iso K!).
Ic.: Verdoorn (1931). Fl. Pl. S Afr. 11, t. 438; C. H. Grey *l.c.*; Fig. 3.

Rootstock a bulb 3–4 cm in diam. *Leaves* lorate, 30–60 × 1·5–2·5 cm. *Scape* up to 60 cm long, 8 mm in diam. at base. *Involucral bracts* 2–2·5 × 1–1·5 mm. *Umbel* 20–40-flowered; flowers opening in succession. *Pedicels* up to 2·5 cm long. *Perianth tube* 8–9 × 3–4 mm, cylindrical, light purple. *Perianth segments* 6–8 × 3–3·5 mm, ovate-elliptical, often with ragged and slightly inrolled margins; whorls set 1–1·5 mm apart. *Corona* 3–4 mm long, campanulate, split into 3 serrate lobes, purple with a rose tinge (rarely white). *Anthers* 1–1·5 mm long; upper whorl inserted at base of corona. *Ovary* ovoid. *Style* 2 mm long. *Stigma* subcapitate.
Flowering—January–May.
Distribution—Eastern Transvaal, endemic.
Habitat—Unknown, but almost certainly a mountain plant.
Selected list of specimens seen:
TRANSVAAL. 23S30E: Letaba, Cyprus farm, *Codd* 9455; 24S30E: Pilgrim's Rest, *Knox Davies* 731.
CULTIVATED. Univ. Pretoria farm, *Hodge* A-68; this clone appears in the recent literature as *T. pulchella* (see Dyer, 1963, & Vosa, 1966a & 1966b).

18. Tulbaghia rhodesica R. E. Fries in Wiss. Ergebn. Schwed. Rhod.-Kongo Exped. 1911–1912. 1:227 (1916).
Type: Zambia, 09S29E, Kalungwisi river south of Katwe, *R. E. Fries* 1911. (B, *n.v.*).
Ic.: Fl. Pl. S Africa 35: t. 1383 (1962); Fig. 3.

Rootstock a corm with a rhizomatous base. *Leaves* 10–20 × 0·4 cm, linear. *Scape* up to 20 cm long. *Involucral bracts* up to 2·5 cm long, 8 mm broad, tinged with purple. *Umbel* of 6–10 flowers; flowers usually produced before the leaves. *Pedicels* up to 2·5 cm long. *Perianth tube* 6–7(–8) × 2–3 mm, cylindrical or slightly campanulate, rose-purple (rarely pure white). *Perianth segments* 6–8 × 3·5–4·5 mm, ovate-acute; whorls set very close together. *Corona* 1 mm long, obscurely 3-lobed, each lobe separated from the next by a minute bright red, secondary lobe. *Anthers* 1 mm long, upper whorl inserted. on perianth tube. *Ovary* 2 mm long ovoid. *Style* 1 mm long. *Stigma* capitate. *Capsule* obovate.
Flowering—October–December.
Distribution—Northern Zambia and South Tanzania.
Habitat—Open rocky places and open bush in dry soil, 100–1500 m.
Selected list of specimens seen:
TANZANIA. 06S36E: Mungwi (Munguwi), *Robinson* 4135; 08S31E: Ufipa, *Richards* 16841.
ZAMBIA. 08S29E: Mweru, *M. Jones* 29, *Bullock* 1357; 09S30E: Mporokoso, Kabwe, *Richards* 13717; 10S31E: Kasama, *Lawton* 316; 12S31E: Chilongwelo, *Richards* 2196, 2210, 2313 (the last is a pure white form).

Subgenus **Omentaria** (Salisb.) Baker in J. Linn. Soc. Bot. 11:370 (1871).
Syn.: Genus **Omentaria** Salisb., Gen. Pl. 87 (1866).
Type Species—*T. simmleri* Beauv. (First legitimate name for *T. cepacea* Linn. fil. excluding the synonyms).
Subgeneric characters: *Corona* of 3 or 6 separate fleshy scales attached to inner perianth segments, entire or emarginate. *Anthers* in 2 whorls, not inserted on corona.

19. Tulbaghia simmleri Beauverd in Bull. Herb. Boissier sér. 2, 8:988 (1908).
Syn.: *T. cepacea* Linn. fil., Suppl. Pl. 194 (1781) *quoad descr. excl. syn. Omentaria cepacea* (Linn. fil.) Salisb., Gen. Pl. 89 (1866), *quoad descr.*
Type: Transvaal, no locality, *G. Beauverd* ad nat. del., in Bull. Herb. Boiss. sér. 2, 8:988 (1908).—illustration only: no specimen.
Ic.: Beauverd, *l.c.*; Fig. 3.

Rootstock rhizomatous. *Leaves* 10–18 × 2·5–4 mm. *Scape* 25–30 cm long. *Involucral bracts* 10–15 mm long, up to 5 mm broad. *Pedicels* 1–1·8 cm long. *Umbel* 6–9-flowered. *Perianth tube* 6–9 mm long, 1·6–2·2 mm broad, cylindrical–slightly urceolate, rose–purple. *Perianth segments* 6–8 × 2–3 mm, oblong, subacute or obtuse, concave, rose purple. *Corona* 1·5–2·2 mm long, of 3 scales, almost united at the base, emarginate, usually of a deeper colour than the perianth segments. *Anthers* 0·7–0·9 mm long; upper whorl inserted below insertion of corona. *Ovary* ellipsoid. *Capsule* 5–7 mm long, obcordate.
Flowering—January–February.
Distribution—Southern Cape.
Habitat—Grassland (open).
Selected list of specimens seen:
CAPE. 32S27E: King William's Town, Tamacha, *Commins* 1718 (white form); 33S21E: Zwartkop, *Theron* 1138; 33S23E: Prince Alfred's Pass, *Ryder* 92; 33S25E: Uitenhage, *Zeyher* s.n.; Parsons Vlei, 10 miles from Port Elisabeth, *Long* 522; 33S26E: Alexandria, *Archibald* 3994, 6178; *Drège* s.n.

Although Linn. fil. described this species, he included *T. capensis* in the synonomy and his name is therefore illegitimate. The next available name, *T. simmleri* is typified by the illustration of Beauverd (loc. cit.). Unfortunately this illustration is not accompanied by a locality more exact than "the Transvaal". This locality is a little odd when compared with the localities of specimens cited.

20. Tulbaghia galpinii Schlechter in J. Bot. 35:282 (1894).
Type: Cape, 31S26E, Queenstown, Andriesberg, 6300′, *E. E. Galpin* 2179. (2 sheets, one with fruiting material.) (K!).
Ic.: Fig. 3.

Rootstock rhizomatous. *Leaves* 5–10 cm × 1–2 mm. *Scape* 8–15 cm long. *Involucral bracts* 5–9 × up to 2 mm. *Pedicels* 4–15 mm long. *Umbel* 2–4-flowered. *Perianth tube* 4–5 × 1·2–2 mm, cylindrical-urceolate, rose pink. *Perianth segments* 4–6 × 2–3 mm, oblong, obtuse, rose pink or light pink. *Corona* 1·5–2·5 mm long, of 6 ± equal subulate scales, pink or white.

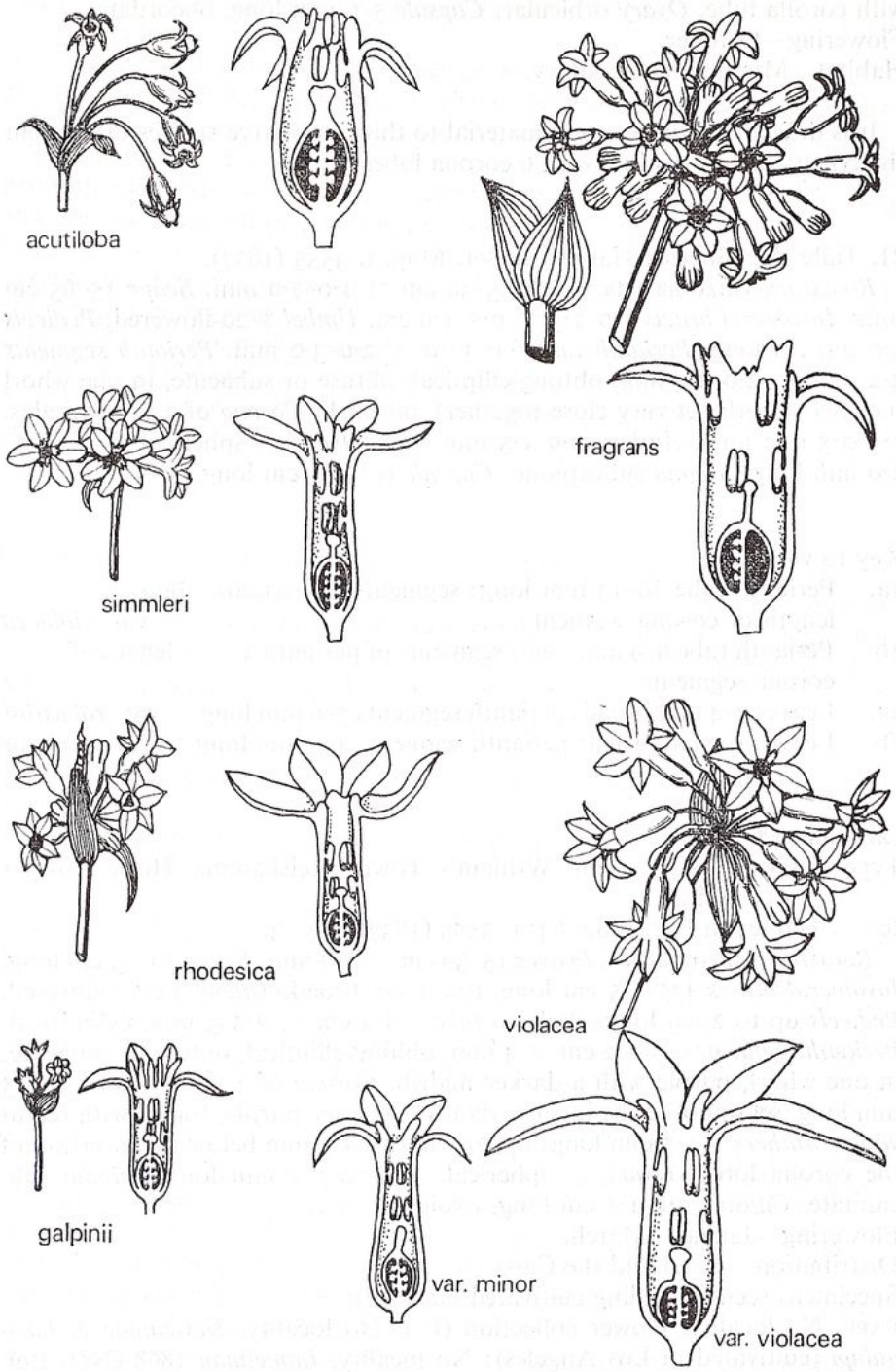

FIG. 3. Inflorescences and flowers of *Tulbaghia* species. Flowers × 3, Inflorescences × ⅔.

Anthers 0·2–0·6 mm long; upper whorl inserted at junction of corona lobes with corolla tube. *Ovary* orbicular. *Capsule* 5–6 mm long, obcordate.
Flowering—October.
Habitat—Mountainous country.

It is difficult to allocate any material to this diminutive species other than the type (which is distinct with 6 corona lobes).

21. Tulbaghia violacea Harvey in Bot. Mag. t. 3555 (1837).

Rootstock rhizomatous. *Leaves* 5–30 cm × 1·0–7·0 mm. *Scape* 15–65 cm long. *Involucral bracts* 1·0–2·5 × 0·5–1·0 cm. *Umbel* 8–20-flowered. *Pedicels* 1·0–2·0 cm long. *Perianth tube* 6·0–13·0 × 2·0–3·0 mm. *Perianth segments* 4·0–12·0 × 2·0–2·4 mm, oblong-elliptical, obtuse or subacute, in one whorl (i.e. two whorls set very close together), purplish. *Corona* of 3 fleshy scales, 1·5–2·5 mm long. *Anthers* 0·9–1·5 mm long. *Ovary* ± spherical. *Style* 0·5–1·0 mm long. *Stigma* subcapitate. *Capsule* 0·5–1·1 cm long, ovoid.

Key to varieties:

1a. Perianth tube 10–13 mm long; segments of perianth about 4 × length of corona segments . . . . . var. *violacea*
1b. Perianth tube 6–9 mm long; segments of perianth 2–3 × length of corona segments 2
2a. Leaves 2–4 mm broad; perianth segments 5–6 mm long var. *robustior*
2b. Leaves 1–2 cm broad; perianth segments 4–5 mm long . var. *minor*

var. **violacea**

Type: Cape, 32S27E, King William's Town, Keiskamma Hoek, *Cooper* 544 (K!).
Ic.: Harvey in Bot. Mag. 64: t. 3555 (1837); Fig. 3.

Rootstock rhizomatous. *Leaves* 15–30 cm × 4–7 mm. *Scape* 30–65 cm long. *Involucral bracts* 1·5–2·5 cm long, 0·8–1 cm broad. *Umbel* 12–30-flowered. *Pedicels* up to 2 cm long. *Perianth tube* 1–1·3 cm × 2·5–3 mm, cylindrical. *Perianth segments* 0·9–1·2 cm × 4 mm, oblong-elliptical, obtuse or subacute, in one whorl, purple with a darker midrib. *Corona* of 3 fleshy scales, 2–2·5 mm long, set opposite the inner perianth segments, purple, tinged with red or white. *Anthers* 1–1·5 mm long; upper whorl 1–1·5 mm below the insertion of the corona lobes. *Ovary* ± spherical. *Style* 0·7–1 mm long. *Stigma* subcapitate. *Capsule* 0·8–1·1 cm long, ovoid.
Flowering—January–March.
Distribution—Natal and the Cape.
Specimens seen (including cultivated material):
CAPE. No locality, Gower collection (E!); No locality, *Newcombe & Bacigalupi* (cultivated in Los Angeles); No locality, *Immelman* 1868 (Nat. Bot. Gardens No. 1869/29); Cult. in Kirstenbosch Botanic Garden from which material went to the Oxford Botanic Garden.
NATAL. 28S29E: Van Reenen, 1670 m, *Medley Wood* 10750; 30S30E: Isipingo Beach, *Ward* 624 (possibly an escape from cultivation).

var. **robustior** (Kunth) Burbidge **comb. nov.**

Syn.: *T. violacea* Harvey var. *obtusa* Baker in J. Linn. Soc. Bot. 11:372 (1871).

T. cepacea Linn. fil. var. *robustior* Kunth, Enum. Pl. 4:484 (1833).

Type: Cape, 32S25E, Somerset division between Zuurberg and Klein Bruntjes Hoogte, 2000–2500 ft., *Drège* (K!).

Similar to var. *violacea* but plant less robust, umbel 8–12(–14)-flowered, perianth tube 7–8(–9) mm long, perianth segments elliptical, 5–6 mm long and corona lobes entire-emarginate, 2·5–3·5 mm long.

Specimens seen:

TRANSVAAL. Zoutpansberg, *name illegible* 8121 (PRE!). The locality, Zoutpansberg, is ambiguous.

CAPE. 32S27E: King Williamstown, *T. R. Sim* 597; 32S28E: Kentari, *A Pegler* 276, *L. Chippindall* 323; 33S18E: Colbert, *Frazer* s.n.; 33S23E: Prince. Alfred's Pass, *Acocks* 21647; 33S27E: East London, *J. Wood* 3208.

CULTIVATED. Edinburgh *C*4727 (Origin uncertain).

Var. **minor** Baker in J. Linn. Soc. Bot. 11:372 (1871).

Type: Transkei, Kaffraria ad montes, *Barber* 41 (K!) (see discussion below).

Similar to var. *obtusa* but smaller. *Leaves* up to 10 cm × 1–2·2 mm. *Scape* 15–25(–30) cm long. *Perianth tube* 6–7 mm long. *Perianth segments* 4–5 mm long. *Corona lobes* 1·5–2 mm long.

Ic.: Fig. 3.

Specimens seen:

CAPE. 33S25E: Uitenhage, *Long* 1413; 33S27E: King Williamstown, *T. R. Sim* 596.

TRANSKEI. Kaffrarian Mountains (no precise locality), *Bowker* s.n.

T. violacea shows great variability, possibly due to extensive hybridisation between the varieties, or to ecological diversification. The sympatric ranges of the possible taxa within this species suggest their recognition at the varietal level. The distribution, however, of the three varieties is poorly known due to the majority of available material being from cultivated sources. In many cases only nebulous terms such as "C.B.S." (Caput Bonae Spei) are available to localise the material.

In Baker's description of *T. violacea* it is not stated in what way *T. simmleri* differs from var. *obtusa* and var. *minor* of *T. violacea*. In an examination of the specimens cited under these species, one is forced to the conclusion that Baker was uncertain how to treat this polymorphic group. In this current examination it seemed better to maintain in *T. violacea* those specimens which have ± entire corona lobes, broadest at the base and obclavate or obcuneate in shape, and ± plane perianth segments. *T. simmleri* has been kept for those specimens with retuse corona lobes, narrowest at the base and distinctly wider at the apex and with strongly concave perianth segments.

There is a minor point worth noting concerning the typification of var. *minor*. Baker cites the type specimen as *Barber* 41, but the sheet itself has the collector's name as *Bowker* (Mrs Barber's maiden name).

SPECIES OF UNCERTAIN AFFINITIES

Tulbaghia sp. nov.?

Two similar collections from Tanzania (*Shabani* 76 and *Bullock* 1901) in the Kew herbarium were examined and it was found difficult to determine their affinities. Early in this study they were grouped as a new subspecies of *T. friesii* with the following diagnosis: Subsp. *friesii* aemulans sed flores pauciores (4–6) habet. Etiam a subsp. *friesii* segmentis perianthii subacutis differt.

During a second examination of the available material the similarity with *T. aequinoctialis* was noticed. To describe these two rather inadequate collections as a subspecies either of *T. friesii* or of *T. aequinoctialis* produced rather strange distributions of the two subspecies (in the former case, Tanzania and S Rhodesia and in the latter Tanzania and Angola) neither of which seemed probable in the light of the distributions of the other species. The material available is inadequate to form the basis of a species in its own right. The holotype would have to be *Shabani* 76 which is a poor specimen, though a number of dissectable flowers are present.

INSUFFICIENTLY KNOWN SPECIES

Tulbaghia bragae Engler, Pflanzenw. Ost. Afr. 141 (1895) described from Beira-Braga (Moçambique).

Tulbaghia hypoxidea Smith in Rees. Cycl. 36 (1819). The note accompanying this description states that *T. hypoxidea* "flowered in the garden of Messrs Lee & Kennedy in Hammersmith who received a root from Holland. Mr Sowerby drew this, but the drawing is now mislaid."

Tulbaghia hockii De Wild. in Feddes Rep. 11:564 (1913). Described from Elizabethville, Cong. Belg., xi 1911, *Hock*. From the description it is possibly conspecific with, or at least closely related to *T. cameronii*.

Tulbaghia krakasbergensis Glover in Ann. Bolus Herb. 1:104 (1915), described from SW Africa. Merxmüller in *Prodr. Fl. Sudwestafrica* (1969) maintains this as a distinct species but has seen no material.

Tulbaghia pauciflora Baker in Bot. Jahrb. Syst. 15, Beiblatt 35:6 (1892). From the Cape.

Tulbaghia australis Link in Steud., Nom. Bot., ed. 1:857 (1821).
Name published without description and deleted in the second edition.

Tulbaghia affinis Link, Enum. Pl. Berol. 310 (1821). Described from the Cape, no locality. From the description, possibly *T. dregeana*.

ACKNOWLEDGMENTS

The material presented here is part of a thesis accepted for the degree of Ph.D. in the University of Edinburgh and I am grateful for financial support from the Science Research Council which made the work possible. I am indebted to Dr P. H. Davis and Dr A. F. Dyer who supervised the work and to Mr B. L. Burtt for advice and help particularly with African localities and nomenclatural problems. I also wish to express my thanks to the directors of the following herbaria who loaned the material on which this account is based: BM, E, K, LD, M, NU, PRE, TCD, UPS.

References

AVÉ-LALEMANT, J. E. L. (1844). Tulbaghiae species quae hucusque innotuerunt *Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg* 3, 13:1–11.

BAKER, J. G. (1871). A revision of the genera and species of herbaceous capsular gamophyllous Liliaceae. *J. Linn. Soc. Bot.* 11:394–436.

BENTHAM, G & HOOKER, J. D. (1883). *Genera Plantarum*. London.

CHEADLE, V. I. (1969). Vessels in the Amaryllidaceae and Tecophilaeaceae. *Phytomorphology* 19:8–16.

DYER, A. F. (1963). Allocyclic segments of chromosomes and the structural heterozygosity they reveal. *Chromosoma* (Berl). 13:545–576.

ENGLER, A. (1954). *Syllabus der Pflanzenfamilien* (ed. 12). Berlin.

HUTCHINSON, J. (1959 & 1973). *The Families of Flowering Plants* (eds. 2 & 3). Oxford.

HUBER, H. (1969). Die Samenmerkmale und Verwandtschafsverhaltnisse der Liliifloren. *Mitt. Bot. München* 8:219–538.

KRAUSE, K. (1930). The Liliaceae in Engler, A. and Prantl, K. *Die Naturlichen Pflanzenfamilien* ed. 2:15a. Leipzig.

SAEZ, F. A. (1949). Los cromosomas de Brodiaea uniflora. *Lilloa* 19:106–110.

TRAUB, H. P. (1957). Classification of the Amaryllidaceae. *Plant Life* 13:76–83.

UPHOF, J. C. T. (1943). Review of Agapanthus and Tulbaghia. *Herbertia* 10:40–51.

VOSA, C. G. (1966a). Chromosome variation in Tulbaghia. *Heredity* 21:205–312.

——(1966b). Tulbaghia hybrids. *Heredity* 21:675–687.

WENDELBO, P. (1967). The genus Allium. *Lily Year Book* 30:86–100.

WILSENACH, R. (1967). On the karyology and phylogeny of Tulbaghia. *Plant Life* 23:75–83.

NOTE ADDED IN PROOF. Dr C. G. Vosa has recently (Jan. 1978) distributed reprints of 'The Cytotaxonomy of the Genus *Tulbaghia*', *Ann. Bot.* (*Roma*) 34:47–121. Despite the date (1975) given on the separate, vol. 34 of the journal has not yet appeared, at least in this country (at 1 iii 78), although distribution of reprints constitutes valid publication for nomenclatural purposes.

Dr Vosa and I agree on the delimitations of the following species: *capensis*, *alliacea*, *ludwigiana*, *dregeana*, *acutiloba*, *fragrans*, *galpinii*, *natalensis*, *tenuior* and *rhodesica*. I also have no quarrel with his new species, *macrocarpa*. I cannot accept his use of the names *cepacea* Linn. fil. and *cernua* Avé-Lall, both of which are illegitimate (see page 77 et seq of this account). The correct name for *cepacea* is *simmleri* Beauvend but Vosa's usage also embraces *violacea* Harvey, while *cernua* fits within my concept of *alliacea* Linn. fil. despite its karyotype with heterochromatic segments.

His new species *T. verdoornia* and *coddii* equal my *T. carnosa* and *poetica* and have priority over my names. I am attributed as co-author of *verdoornia* and *coddii* although I have not seen or accepted the descriptions. My own descriptions of these species have remained unpublished in my PhD thesis, known to Dr Vosa, since 1971.

Taxonomically I see the group including *cameronii*, *leucantha*, *nutans*, *montana* and *transvaalensis* in a different way, taking a broader view of *cameronii* and *leucantha*. A comparison of my treatment of *violacea* and Dr Vosa's treatment of *cepacea* will also show many differences of opinion.