

# External morphology of the species of the South African Velloziaceae including a key based on external morphological characteristics

HESTER COETZEE\*, H. P. VAN DER SCHIJFF AND E. STEYN  
Department of General Botany, University of Pretoria.

## INTRODUCTION

According to Hutchinson (1960) the Velloziaceae is distributed in Brazil, Southern and East Africa and Arabia. Smith (1971, personal communication) maintains that the family consists of five genera, three of which are found in South America, e.g. *Vellozia* Vand., *Barbacenia* Vand. and *Barbaceniopsis* L. B. Smith. *Xerophyta* Jussieu is represented in Africa and Madagascar only, while the monotypic species *Talbotia elegans* Balf. is found in South Africa only. According to Huber (1969) South America is the centre of development of the family.

Sölch (1969) put the South African species in the taxon *Xerophyta* Jussieu and although Smith (1962) has initially regarded this genus as a synonym of *Vellozia* Vand., he now acknowledges *Xerophyta* Jussieu as a separate genus.

Perrier (1946) was the first author who clearly circumscribed the various genera. He acknowledged *Xerophyta* as a separate genus with three species in Madagascar. According to him the flowers of all the representatives of the genus have a short perianth tube upon and at the base of which six stamens are inserted. The lower parts of the stamens are united by means of a membrane. The anthers have auricles but are without linear appendages. The style is undivided and its upper half at least is covered by stigmatoid bands. All the Velloziaceae of South Africa and South West Africa, except *Talbotia elegans*, have these characteristics.

According to information revealed by this investigation, *Xerophyta equisetoides* and *X. wentzeliana* are regarded as varieties of *X. retinervis*. The Velloziaceae of South Africa and South West Africa is thus represented by seven species and two varieties, e.g.

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*Xerophyta retinervis* Baker var. *retinervis*  
*Xerophyta retinervis* Baker var. *equisetoides* (Baker)  
 Coetzee: Comb. et stat. nov.  
*Xerophyta retinervis* Baker var. *wentzeliana* (Harms)  
 Coetzee: Comb. et stat. nov.  
*Xerophyta clavata* Baker  
*Xerophyta villosa* (Baker) Dur. & Schinz  
*Xerophyta squarrosa* Baker  
*Xerophyta viscosa* Baker  
*Xerophyta humilis* (Baker) Dur. & Schinz  
*Talbotia elegans* Balf.

## EXTERNAL MORPHOLOGY

The plants are either shrubs or herbs and may be branched or unbranched. Perrier (1930) maintains that branching is caused by external factors, e.g. dryness of the habitat and veld fires. The terminal bud dies and the plant branches dichotomously. Weber (1954) on the other hand thinks that branching in the Velloziaceae does not involve dichotomy but represents the outgrowth of a lateral shoot, as he has also found branches in three directions which appear to be trichotomous.

*Xerophyta retinervis* var. *retinervis* (fig. 1), *X. retinervis* var. *equisetoides* (fig. 2), *X. viscosa* (fig. 3), *X. villosa* (fig. 4) and *Talbotia elegans* (fig. 5) may be branched or unbranched, while only branched representatives of *X. retinervis* var. *wentzeliana* (fig. 6) and *X. squarrosa* (fig. 7) were found. Examined material of *X. clavata* had either unbranched stems or branching started just above the soil surface even in areas regularly exposed to veld fires. The stemlike structure of the latter species is relatively thick with very compact internodes and is usually thicker at the top than at the base.

*X. humilis* (fig. 9) is a herb measuring a few centimetres in height and has virtually no erect stem. The erect, rosetlike leaves are borne terminally by a plagiotropous rhizome which may reach seven centimetres in length, while a number of adventitious roots is found on the ventral side of the stem. The dead leaf bases are fibrouslike and frayed and are borne on the older parts of the rhizome as well as around the leaves.

The stem of *T. elegans* (fig. 5) is thin and runnerlike, up to 19 cm in length and is covered by the remains of leaves which are penetrated by adventitious roots arising from the stem.

*X. viscosa* usually has a very short, unbranched stem, covered by the remains of leaves and a few adventitious roots, but examples with long and even branched stems were also found.

The shrublike species have leaves borne in clusters near the apex and on small lateral branches among the leaf bases. The older lateral branches with abscised leaves remain as scars or small knobs on the "branches" and "trunk". The leaf-bearing lateral branches of *X. villosa* (fig. 4) and *X. clavata* (fig. 8) occur immediately beneath the apex, but some other species have leaves nearly up to the

base of the stemlike structure. Regular veld fires probably are responsible for the death of lateral branches.

The stems and lateral branches of all the shrublike species are covered by a thick mantle of closely packed leaf bases and adventitious roots which occur against the stem. Among the leaf bases negatively geotropic roots are present which lie close to the leaf bases. At the base of the stem the mantle of roots becomes so thick that the leaf bases are shed. The stemlike structure consists in this region of a mass of densely packed adventitious roots. The mature lamina and sheath are separated by a localised macroscopically discernible abscission zone, consequently all the leaf bases of a plant are more or less of similar length when abscission of the laminae takes place at the end of the growing season. Relatively long leaf bases are found in *X. viscosa*, *T. elegans* and representatives of *X. retinervis*. The latter may vary locally. When the laminae are destroyed by fire during the growing season, they grow again at the base, so that the original abscission zone are pushed out. These leaves probably have an intercalary meristem at the proximal part of the sheath. At the conclusion of the growing season a new abscission zone develops. This phenomenon may be cleared up by an ecological-physiological investigation.

In most cases the leaves are linear, but *X. humilis* (fig. 9), *T. elegans* and some representatives of *X. squarrosa* have linear-lanceolate shaped leaves. A distinct keel is formed abaxially by the median vein, so that the leaf appears V-shaped in a cross section. This shape probably helps to canalize the flow of rain drops to the leaf bases.

The leaf margin and keel of *X. squarrosa* and the varieties of *X. retinervis* may be entire, or short spines may occur on these parts. According to Harms (1902) the leaf base of *X. retinervis* var. *wentzeliana* may be slightly dentate.

The leaf margin and keel of *X. clavata* always have long spines. The leaf surface may be smooth or has spiny outgrowths on the adaxial side.

In *X. retinervis* var. *retinervis* spines may occur near the median vein, while in *X. retinervis* var. *equisetoides* spines may be present either on both surfaces or on the adaxial surface only. According to Fries (1914) the adaxial leaf surface in *X. retinervis* var. *wentzeliana* may be hairy, while Harms (1902) maintains that it may be hairy or partially smooth.

In *X. villosa* the short, narrow leaves which are about 0,3 cm wide have a thick covering of long, white or tawny hairs, while the longer, broader leaves of about 0,9 cm in width are covered by shorter hairs. Both leaf types occur on the same plant. The older leaves are broad and long and the younger leaves which appear later in the season are short and narrow.

The leaf margin and keel of *X. viscosa* are finely sagittate with sunken, scattered glands on the adaxial surface. In *X. humilis* and *T. elegans* the leaf margin and keel of the young leaves especially are dentate, so are the tips of older leaves. The leaf surface is always smooth.

The hairyness, length and width of the leaves vary considerably in the same plant. The age and vitality of the plant may probably be important.

Perrier (1930) does not take into account characteristics like hairs, scales or

spines present on the leaves and sheaths in his circumscription of the *Xerophyta*-species of Madagascar. Greves (1921), however, bases her key mainly on these characteristics.

The leaves show regular, longitudinal grooves, which are absent in *T. elegans*. *X. humilis* and *X. viscosa* have grooves on the abaxial surface only.

The flowers are actinomorphic and bisexual and are borne separately at the apices and on small lateral branches. *X. viscosa* and *X. elegans* usually have only one or two flowers per plant, while a great many flowers are found in other species.

The colour of the flower varies in different species from dark purple to white and even on the same plant the colours of the flowers may differ according to age.

The lengths of the pedicels and sizes of the flowers vary in plants of the same species according to age and locality.

The pedicel of *Talbotia elegans* is smooth and triangular (fig. 12D), while those of *Xerophyta retinervis* and *X. clavata* have hairy outgrowths at the top, below the ovary (figs. 10E and 11C). The remainder of the pedicel is smooth. The pedicel of *X. villosa* is for its whole length covered with long, white hairs (fig. 11D) while the pedicels of *X. squarrosa* (fig. 11F), *X. viscosa* (fig. 11E) and *X. humilis* (fig. 11G) have stalked glands which are closely packed, especially at the top of the pedicels.

The ovary is inferior and triangular with many anatropous ovules in each ovary chamber (figs. 10A and 12A). The surface covering of the ovaries was used by Greves (1921) to distinguish between the African species. Greves regarded these outgrowths as "hairs" although they are of subepidermal origin.

In *X. retinervis* the covering of the ovary varies from closely packed white spines in *X. retinervis* var. *retinervis* (fig. 10E), through a soft covering of fine, brown hairs in *X. retinervis* var. *equisetoides* (fig. 11B) to shorter hairs or even star-shaped hairs in *X. retinervis* var. *wentzeliana* (Norlinth, 1948). The typical covering of each variety is easily distinguishable, but transitions occur which indicate that these plants can not be distinguished as separate species according to hair covering only. Sterile specimens of these varieties can by no means be distinguished.

The ovary of *X. clavata* may have either closely packed, white spines or branched hairs with broad bases (fig. 11C), while the ovary of *X. villosa* has long, white or tawny hairs (fig. 11D).

Long stalked glandular hairs occur on the ovaries of *X. squarrosa* (fig. 11F) and *X. viscosa* (fig. 11E), while the glandular hairs *X. humilis* are shorter and appear globular in a surface view. The ovary of *T. elegans* (fig. 12D) is smooth and sharply triangular.

The perigone consists of six ununited segments arranged in two whorls. Perrier (1946) regarded the perigone of *Xerophyta* of Madagascar as united at the extreme base, probably because of the presence of the filament membrane and the inferior ovary.

The outermost perigone segments in *X. villosa* have long hairs on the abaxial surface, especially in the vicinity of the median vein (fig. 11D), while in *X. squarrosa* (fig. 11F), *X. viscosa* (fig. 11E) and *X. humilis* (fig. 11G) the segments have glands. The latter species also has a single row of glands along the main vein on the abaxial surface of the innermost perigone segments.

In *X. retinervis* and *X. clavata* the hairy covering of the ovary reaches up to the bases of the outermost perigone segments.

There are always six stamens present which are inserted upon the perigone. The short, cylindrical filaments are united at their bases by means of a thin membrane, except in *T. elegans* where a membrane may be present, but it is not united with the filaments.

The filaments are relatively short and may have two lateral appendages, e.g. in *X. retinervis* var. *retinervis* (figs. 10C & D), *X. clavata* and some representatives of *X. squarrosa*. The presence or absence of such appendages is used by Smith to distinguish between the South American species of the Velloziaceae. In *X. squarrosa* the appendages may be lacking in some cases (fig. 10B) and Smith's key cannot be applied to the representatives of the Velloziaceae of South Africa and South West Africa.

Except for *T. elegans* which has basifix anthers (figs. 12B & C) the anthers are either dorsifix or subdorsifix (figs. 10B, C & D) and seven or eight times longer than the filaments. The anthers are introrse with two lateral longitudinal slits. The style is short (figs. 10A & E) and the stigma columnar with three stigmatoid bands, except in *T. elegans* which has a long style and a knobshaped, slightly three lobed stigma (figs. 12A & D).

The fruit is a capsule which opens with three pores at the base to release many seeds.

The seed is small (1 to 2,25 mm long) and conical with a wrinkled testa (fig. 10F), except the seeds of *T. elegans* which are more or less rod shaped with white dots on the testa (fig. 12E). The colour of the seeds of all the other species varies from white to yellowish-brown, depending on age and vitality.

## KEY BASED ON EXTERNAL MORPHOLOGICAL CHARACTERISTICS.

1. Ovary triangular without multicellular hairs on the ovary wall . . . . .  
*Talbotia elegans*  
 Ovary spherical or slightly three lobed, ovary wall covered with multicellular hairs . . . . . 2
2. Hairs on ovary wall spines or curled or branched but not glandular; ovary not sticky . . . . . 5  
 Hairs on ovary wall with spherical head and stalk, glandular; ovary sticky 3

3. Shrubs, richly branched, with prominent stem covered with a mantle of closely packed leaf bases and roots . . . . . *Xerophyta squarrosa*  
 Herbs, seldomly branched, with short stem or plageotropous rhizome, without a mantle of closely packed leaf bases . . . . . 4
4. Leaves shorter than 6 cm, plants with plageotropous rhizomes, leaves not sticky . . . . . *Xerophyta humilis*  
 Leaves longer than 6 cm, plants with short, erect stem seldom branched dichotomously, leaves sticky especially at their bases . . . . . *Xerophyta viscosa*
5. Leaves with both surfaces covered by closely packed hairs, spines lacking on leaf margin or on abaxial side of median vein . . . . . *Xerophyta villosa*  
 Leaves with short spines on adaxial surface, or leaves smooth, spines may be present on leaf margin and on abaxial side of median vein . . . . . 6
6. All leaves with spines on leaf margin and on abaxial side of median vein . . . . . *Xerophyta clavata*  
 Only young leaves or tips of mature leaves with spines on leaf margin and on abaxial side of median vein . . . . . *Xerophyta retinervis* 7
7. Ovary with long, closely packed spiny hairs, tawny or brown in colour . . . . . *Xerophyta retinervis* var. *retinervis*  
 Ovary with short, spiny or starshaped hairs . . . . . 8
8. Ovary with short, spiny hairs, widely spaced . . . . . *Xerophyta retinervis* var. *equisetoides*  
 Ovary with short spines or starshaped hairs . . . . . *Xerophyta retinervis* var. *wentzeliana*

ABSTRACT

The external morphology of the roots, leaves and flowers of the seven species and two varieties of Velloziaceae in South Africa and South West Africa have been studied. All the representatives, except one of the species, are placed in the genus *Xerophyta*. *Talbotia elegans* is a monotypic species found only in South Africa. All the species of *Xerophyta* possess xerophytic characteristics. Intervaginal roots, forming a thick layer around the stem, are present in all the shrubs.

A key for the identification of the species was compiled and the hairy covering of the ovary is regarded as an important distinguishing characteristic.

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# Uitwendige morfologie van die spesies van Velloziaceae in Suid-Afrika en 'n sleutel gebaseer op uitwendige morfologiese kenmerke

HESTER COETZEE\*, H. P. VAN DER SCHIJFF AND E. STEYN  
Departement Algemene Plantkunde, Universiteit van Pretoria.

## INLEIDING

Die familie Velloziaceae kom volgens Hutchinson (1960) voor in Brasilië, Suidelike en Oos-Afrika en Arabië. Smith (1971, persoonlike mededeling) beweer dat die familie uit vyf genera bestaan, waarvan drie nl. *Vellozia* Vand., *Barbacenia* Vand. en *Barbaceniopsis* L. B. Smith in Suid-Amerika voorkom. *Xerophyta* Jussieu kom in Afrika en Madagaskar voor, terwyl die monotipiese soort, *Talbotia elegans* Balf. slegs in Suid-Afrika aangetref word. Volgens Huber (1969) is die ontwikkelingsentrum van die familie in Suid-Amerika.

Die Suid-Afrikaanse soorte word deur Sölch (1969) in die takson *Xerophyta* Jussieu geplaas en hoewel Smith (1962) hierdie genus aanvanklik as 'n sinoniem van *Vellozia* Vand. beskou, erken hy dit nou (1971, persoonlike mededeling) as 'n afsonderlike genus.

*Talbotia elegans* word op grond van verskille in organografie en anatomie met al die ander genera, as 'n monotipiese soort beskou; 'n mening waarmee Smith (1971) ook saamstem.

Perrier (1946) is die eerste outeur wat die onderskeie genera duidelik omgrens het en wat *Xerophyta* as 'n afsonderlike genus met drie soorte in Madagaskar erken het. Volgens hom het die blomme van alle verteenwoordigers van die genus 'n periant wat 'n verkorte buis vorm en ses meeldrade wat op die basis van die periantbuis ingeplant is en waarvan die helmstrate aan die basis vergroei is deur 'n membraan wat hulle verbind. Die helmknoppe met ore is sonder lynvormige aanhangsels en die onverdeelde styl besit drie stigmatiese bande wat ten minste die boonste helfte van die styl bedek. Hierdie kenmerke is almal van toepassing op die Velloziaceae van Suid-Afrika en Suidwes-Afrika met uitsondering van *Talbotia elegans*.

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Na aanleiding van informasie wat met hierdie ondersoek aan die lig gekom het, is besluit om *Xerophyta equisetoides* en *Xerophyta wentzeliana* as variëteite van *Xerophyta retinervis* te beskou. Volgens hierdie benadering word die Velloziaceae dus in Suid-Afrika en Suidwes-Afrika verteenwoordig deur sewe spesies en twee variëteite, nl.

- Xerophyta retinervis* Baker var. *retinervis*
- Xerophyta retinervis* Baker var. *equisetoides* (Baker)  
Coetsee: Comb. et stat. nov.
- Xerophyta retinervis* Baker var. *wentzeliana* (Harms)  
Coetsee: Comb. et stat. nov.
- Xerophyta clavata* Baker
- Xerophyta villosa* (Baker) Dur. & Schinz
- Xerophyta squarrosa* Baker
- Xerophyta viscosa* Baker
- Xerophyta humilis* (Baker) Dur. & Schinz
- Talbotia elegans* Balf.

#### UITWENDIGE MORFOLOGIE :

Die plante is struik of kruide en mag vertak of onvertak wees. Perrier (1930) beweer dat vertakking plaasvind as gevolg van uitwendige faktore soos die dorheid van die habitat en veldbrande. Die eindknop sterf dan af en die plante vertak digotoom. Weber (1954) daarenteen, beweer dat die vertakking by die Velloziaceae niks met digotomie te doen het nie, maar dat dit alleen die uitgroei van 'n sytak verteenwoordig. Hy tref ook driedelige vertakkings aan wat „trigotoom” daar uitsien.

*Xerophyta retinervis* var. *retinervis* (fig. 1), *X. retinervis* var. *equisetoides* (fig. 2), *X. viscosa* (fig. 3), *X. villosa* (fig. 4) en *Talbotia elegans* (fig. 5), mag vertak of onvertak wees, terwyl slegs vertakte plante van *X. retinervis* var. *wentzeliana* (fig. 6) en *X. squarrosa* (fig. 7) aangetref is. Die plante van *X. clavata* (fig. 8) wat ondersoek is, se stingels is onvertak of vertak net bokant die grondoppervlakte, selfs in dele waar hulle gereeld aan veldbrande blootgestel word. Die stingelagtige struktuur van lg. spesie is relatief dik met baie gedronge litte en is oor die algemeen dikker by die punt as aan die basis.

*X. humilis* (fig. 9) is 'n kruid van 'n paar sentimeter hoog wat feitlik geen regop-groeiende stingel besit nie. 'n Plageotrope wortelstok, wat tot 7 cm lank mag wees, dra die regop-groeiende, rosetvormige blare terminaal, terwyl 'n hele aantal bywortels ventraal aan die stingel voorkom. Die dooie blaarbasisse is veselagtig en uitgerafel en word op die ouer dele van die wortelstok, sowel as om die blare, gedra.

Die stingel van *T. elegans* (fig. 5) is dun en rankerig, tot 19 cm lank en bedek met blaarreste. Bywortels ontstaan uit die stingel en groei deur die blaarreste.

*X. viscosa* (fig. 3) besit oor die algemeen 'n baie kort onvertakte stingel, bedek met blaarreste en 'n klein aantal bywortels, maar voorbeelde is ook aangetref waar die stingel lank en selfs vertak mag wees.



By die struikagtige soorte word die blare in groepies aan die groeipunte en op klein sytakkes tussen die blaarbasisse gedra. Die ouer sytakkes, waarvan die blare reeds afgesnoer is, bly as littekens of knoppies aan die „takke” en „stam” agter. By *X. villosa* (fig. 4) en *X. clavata* (fig. 8) kom die blaardraende sytakkes net agter die groeipunt voor, terwyl dit by ander soorte tot feitlik aan die basis van die stingelagtige struktuur nog blare besit. Gereelde veldbrande is moontlik verantwoordelik vir die afsterwe van die sytakkes.

Die stingels en sytakke van al die struikagtige soorte is bedek met 'n dik mantel van dig-opmeekaargepakte blaarbasisse en bywortels wat teen die stingel voorkom. Tussen die blaarbasisse kom negatief geotrope wortels voor wat baie dig teen die blaarbasisse lê. Aan die basis van die stam word die wortelmantel so dik dat die blaarbasisse heeltemal afgestoot word (fig. 1). Die ware stingel kan ook aan die basis afsterf, sodat die stingelagtige struktuur net uit 'n massa diggepakte bywortels bestaan.

Die volwasse blaarlamina en blaarskede word deur 'n gelokaliseerde makroskopies-waarneembare afsnoeringsone geskei, sodat al die blaarbasisse van 'n plant min of meer dieselfde lengte het wanneer die blaarlaminas aan die einde van die groeiseisoen afgesnoer word. Relatiewe lang blaarbasisse word aangetref by *X. viscosa*, *T. elegans* en verteenwoordigers van *X. retinervis*. By lg. mag lokale variasies voorkom. Wanneer die blaarlaminas gedurende die groeiseisoen afgebrand word, groei hulle weer aan die basis uit, sodat die oorspronklike afsnoeringsone uitgestoot word. Hierdie blare besit waarskynlik 'n interkalêre meristeem aan die basis van die blaarskede. Aan die einde van die groeiseisoen ontstaan daar dan 'n nuwe afsnoeringsone. 'n Ekologiese-fisiologiese ondersoek mag 'n verklaring bied vir hierdie verskynsel.

In die meeste gevalle is die blare liniêr, maar by *X. humilis* (fig. 9), *T. elegans* en sommige verteenwoordigers van *X. squarrosa* is die blare liniêr-lansetvormig.

'n Duidelike kiel word aan die abaksiale kant deur die mediane aar gevorm, sodat die blare in 'n dwarsdeursnee V-vormig vertoon. Moontlik speel hierdie blaarvorm 'n rol om die water wat op die blare val, te kanaliseer na die blaarbasisse.

By *X. squarrosa* en die variëteite van *X. retinervis* mag die blaarrand en kiel gaaf wees, of kort stekels mag hier voorkom. Volgens Harms (1902) mag die blaarrand van *X. retinervis* var. *wentzeliana* ook effens getand wees.

Die blaarrand en kiel van *X. clavata* besit altyd lang stekels. Die blaaroppervlakte van lg. spesie mag glad wees of kort stekelrige uitgroeisels op die adaksiale oppervlakte besit. By *X. retinervis* var. *retinervis* mag stekels naby die mediane aar voorkom, terwyl dit by *X. retinervis* var. *equisetoides* op albei oppervlakte of net op die adaksiale oppervlak mag voorkom. Volgens Fries (1914) mag die adaksiale blaaroppervlak by *X. retinervis* var. *wentzeliana* behaard wees, terwyl Harms (1902) beweer dat dit behaard of halfglad mag wees.

*X. villosa* besit 'n digte bedekking van lang, wit of vaal hare op die kort, smal blare wat ongeveer 0,3 cm breed is, terwyl die langer breër blare van ongeveer 0,9 cm breed, bedek is met korter hare. Beide tipes blare kom aan dieselfde plant voor. Die ouer blare is breed en lank en die jonger blare, wat later in die seisoen gevorm word, kort en smal.

Die blaarrand en kiel van *X. viscosa* is fyn gesaag met ingesinkte verspreide kliere op die adaksiale oppervlak. By *X. humilis* en *T. elegans* is die blaarrand en kiel van veral die jong blare getand, asook die punte van die ouer blare. Die blaaroppervlak is altyd glad.

Die beharing, blaarlengte en -breedte wissel baie by dieselfde plant. Die ouderdom en lewenskragtigheid van die plant speel hier waarskynlik ook 'n rol.

Perrier (1930) laat eienskappe soos die hare, skubbe, en stekels wat op die blare en blaarskedes voorkom, buite rekening by die omgrensing van die *Xerophyta*-spesies van Madagaskar. Greves (1921) baseer haar sleutel egter hoofsaaklik op hierdie eienskappe.

Die blare vertoon reëlmatige, lengteverlopende groewe, wat by *T. elegans* ontbreek. *X. humilis* en *X. viscosa* besit slegs op die abaksiale oppervlakte groewe.

Die blomme is aktinomorf en tweeslagtig en word enkelvoudig op die groeipunte en op die klein sytakies gedra. By *X. viscosa* en *T. elegans* kom gewoonlik net een of twee blomme aan 'n plant voor, terwyl 'n groot aantal by die ander spesies aangetref word.

Die blomkleur varieer by die verskillende spesies van donkerpers tot wit en blomme van verskillende ouderdomme op dieselfde plant verskil selfs aansienlik in kleur.

Die blomsteellengte en blomgrootte varieer by plante van dieselfde spesie volgens ouderdom en lokaliteit.

Die blomsteel van *Talbotia elegans* is glad en driehoekig, (fig. 12D), terwyl dié van *Xerophyta retinervis* en *X. clavata* haaragtige uitgroeiels aan die bopunt, onderkant die vrugbeginsel besit (fige. 10 E en 11C). Die res van die blomsteel is glad. By *X. villosa* is die blomsteel oor sy hele lengte bedek met lang, wit hare (fig. 11D), terwyl dié van *X. squarrosa* (fig. 11F), *X. viscosa* (fig. 11E) en *X. humilis* (fig. 11G) oor die hele blomsteellengte gesteelde kliere besit wat veral aan die bopunt dig opmekaar voorkom.

Die vrugbeginsel is onderstandig en driehoekig met baie anatrope saadknoppe in elke hok (fige. 10A en 12A). Die oppervlakte-bedeeking van die vrugbeginsels is deur Greves (1921) gebruik om tussen die Afrikaanse spesies te onderskei. Greves noem hierdie uitgroeiels „hare” hoewel hulle subepidermaal in oorsprong is.

By *X. retinervis* varieer die vrugbeginselbedekking vanaf digte, wit stekels by *X. retinervis* var. *retinervis* (fig. 10E) deur 'n sagter bedekking van fyn bruin hare by *X. retinervis* var. *equisetoides* (fig. 11B) tot korter hare of selfs ster-vormige hare by *X. retinervis* var. *wentzeliana* (fig. 11A) en *X. retinervis* var. *equisetoides* (Norlinth, 1948). Die tipiese bedekking van elke variëteit is maklik onderskeibaar, maar oorgange kom voor wat aandui dat hierdie plante nie op grond van haarbedekking as aparte spesies onderskei kan word nie. Steriele monsters van hierdie variëteite is glad nie van mekaar te onderskei nie.

*X. clavata* se vrugbeginsel mag met digte, wit stekels bedek wees of met vertakte hare wat breë basisse besit (fig. 11C), terwyl dié van *X. villosa* lang, wit of vaal hare het (fig. 11D).

Lang gesteelde klierhare kom voor op die vrugbeginsels van *X. squarrosa* (fig. 11F) en *X. viscosa* (fig. 11E), terwyl die klierhare by *X. humilis* (fig. 11G) korter

is en in 'n oppervlakte-aansig bolvormig vertoon. Die vrugbeginsel van *T. elegans* (fig. 12D) is heeltemal glad en skerp driehoekig.

Die perigoon bestaan uit ses onvergroeide segmente in twee kranse gerangskik. Perrier (1946) beskou die perigoon van *Xerophyta* van Madagaskar as heel aan die basis vergroei, waarskynlik as gevolg van die teenwoordigheid van die helm-draadmembraan en die onderstandige vrugbeginsel.

Die buitenste perigoonkrans van *X. villosa* besit lang hare op die abaksiale oppervlak, veral in die omgewing van die hoofaar (fig. 11D), terwyl dié van *X. squarrosa* (fig. 11F), *X. viscosa* (fig. 11E) en *X. humilis* (fig. 11G) kliere besit. Laasgenoemde spesie besit ook een ry kliere op die hoofaar van die abaksiale oppervlakte van die binneste perigoonkrans.

By *X. retinervis* en *X. clavata* mag die haarbedekking van die vrugbeginsel tot aan die basis van die buitenste perigoonsegmente strek.

Die meeldrade is altyd ses en perigoonstandig met kort, silindriese helm-drade wat aan die basis sydelings verbind is deur 'n dun membraan met die uitsondering van *T. elegans* waar 'n membraan wel aanwesig mag wees, maar nie verbind is met die helm-drade nie.

Die helm-drade is relatief kort en mag twee sydelingse aanhangsels, soos by *X. retinervis* var. *retinervis* (fige. 10C en D), *X. clavata* en sommige verteenwoordigers van *X. squarrosa*, besit. Die aan- of afwesigheid van sulke aanhangsels word deur Smith (1962) gebruik om tussen die Suid-Amerikaanse genera van die Velloziaceae te onderskei. By *X. squarrosa* mag die aanhangsels in sommige gevalle ontbreek (fig. 10B) en Smith se sleutel kan dus nie op die verteenwoordigers van Suid-Afrika en Suidwes-Afrika toegepas word nie.

Behalwe by *T. elegans*, waar die helmknoppe basifiks is (fige. 12B en C), is hulle dorsifiks of subdorsifiks (fige. 10B, C en D) en tot sewe of agt maal langer as die helm-drade. Die helmknoppe is intrors met twee laterale lengtesplete.

Die styl is kort (fige. 10A en E) en die stempel kolomvormig verleng met drie stigmatiese bande met die uitsondering van *T. elegans* waar die styl lank en die stempel knopvormig en effens drielobbig is (fige. 12A en D).

Die vrug is 'n kapsule wat aan die basis met porieë oopgaan om 'n groot aantal sade vry te stel.

Die saad is klein (1 tot 2,25 mm lank) en konies met 'n verrimpelde testa (fig. 10F), behalwe dié van *T. elegans* wat min of meer staafvormig is met 'n witgespikkelde testa (fig. 12E). Die saadkleur van al die ander soorte wissel van wit tot geel-bruin, afhangende van die ouderdom en lewenskragtigheid daarvan.

## SLEUTEL GEBASEER OP UITWENDIGE MORFOLOGIESE KENMERKE

1. Vrugbeginsel driehoekig sonder meersellige hare op die buitewand . . . . .  
*Talbotia elegans*  
Vrugbeginsel rond of effens drielobbig, buitewand bedek met meersellige hare . . . . . 2

2. Hare op vrugbeginselwand stekels of gekrul of vertak maar nooit klieragtig nie; vrugbeginsel nie taai nie . . . . . 5  
Hare op vrugbeginselwand met ronde kop en steel, klieragtig; vrugbeginsels taai . . . . . 3
3. Struik, ryklik vertak, met duidelike stingel bedek met digte blaarbasis- en wortelmantel . . . . . *Xerophyta squarrosa*  
Kruide, selde vertak, met kort stingel of plageotrope wortelstok, sonder digte blaarbasismantel . . . . . 4
4. Blare korter as 6 cm, plante met plageotrope wortelstok, blare nooit taai nie  
*Xerophyta humilis*  
Blare langer as 6 cm, plante met regopgroeiende, kort stingel wat baie selde digotoom vertak, blare taai veral aan die basis . . . . . *Xerophyta viscosa*
5. Blare dig behaard op albei oppervlaktes of selde net op adaksiale oppervlakte, geen stekels op blaarrand of abaksiale kant van mediane aar nie . . . . .  
*Xerophyta villosa*  
Blare met kort stekels op adaksiale oppervlakte, of blare glad, stekels mag op blaarrand en abaksiale kant van mediane aar voorkom . . . . . 6
6. Alle blare besit stekels op blaarrand en abaksiale kant van mediane aar . . . . .  
*Xerophyta clavata*  
Slegs jong blare of punte van volwasse blare met stekels op blaarrand en abaksiale kant van mediane aar . . . . . *Xerophyta retinervis* 7
7. Vrugbeginsel met lang, digte, stekelrige vaal of bruin hare . . . . .  
*Xerophyta retinervis* var. *retinervis*  
Vrugbeginsel met kort, stekelrige of stervormige hare . . . . . 8
8. Vrugbeginsel met kort, yl, stekelrige hare . . . . .  
*Xerophyta retinervis* var. *equisetoides*  
Vrugbeginsel met kort stekels of stervormige hare . . . . .  
*Xerophyta retinervis* var. *wentzeliana*

## OPSOMMING

Die uitwendige morfologie van die wortels, stingels, blare en blomme van die sewe spesies en twee variëteite van Velloziaceae in Suid-Afrika en Suidwes-Afrika is ondersoek. Die plante word onder die genera *Xerophyta* en *Talbotia* geklassifiseer, waarvan laasgenoemde 'n monotipiese soort is.

Al die *Xerophyta*-spesies vertoon uitgesproke xerofitiese eienskappe. Intervaginale wortels, wat deur 'n digte blaarbasismantel om die stingel afwaarts groei, kom by al die struikagtige soorte voor. Hierdie wortelmantel word so dik dat die blaarbasisse eers geskeur en mettertyd afgestoot word.

Die bedekking van die vrugbeginsel word as 'n belangrike onderskeidende kenmerk by die samestelling van die sleutel beskou.

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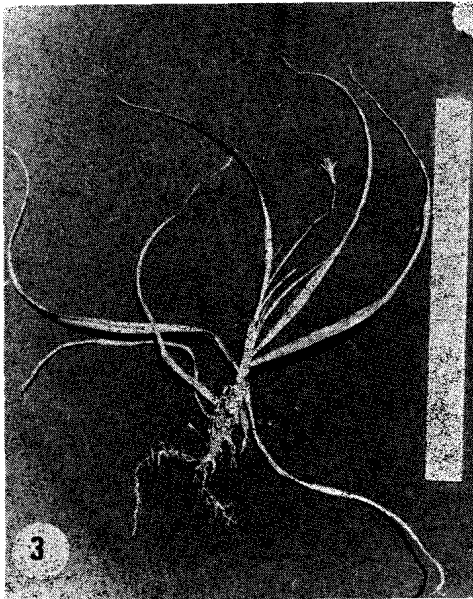
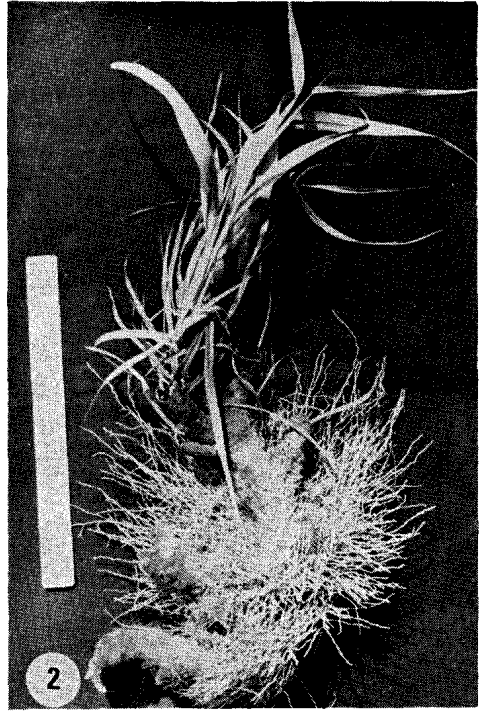
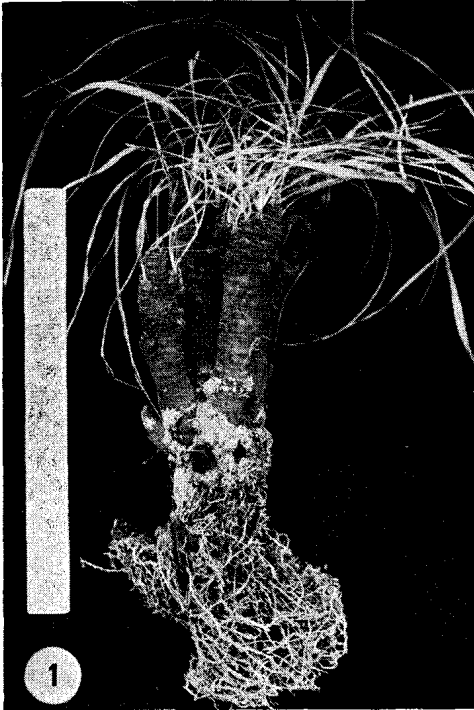


Fig. 1. Photograph of *Xerophyta retinervis* var. *retinervis* from the Loskopdam Nature Reserve.

Foto van *Xerophyta retinervis* var. *retinervis* van die Loskopdam Natuurreservaat.

Fig. 2. Photograph of *Xerophyta retinervis* var. *equisetoides* from Punda Milia, Kruger National Park.

Foto van *Xerophyta retinervis* var. *equisetoides* van Punda Milia, Nasionale Krugerwildtuin.

Fig. 3. Photograph of *Xerophyta viscosa* from the Loskopdam Nature Reserve.

Foto van *Xerophyta viscosa* van die Loskopdam Natuurreservaat.

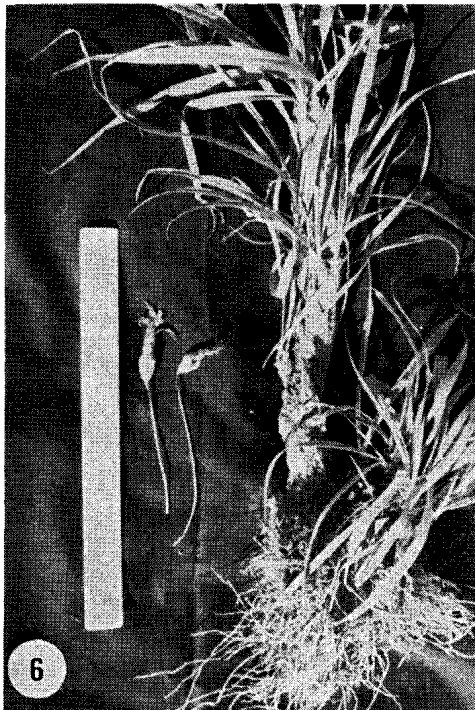
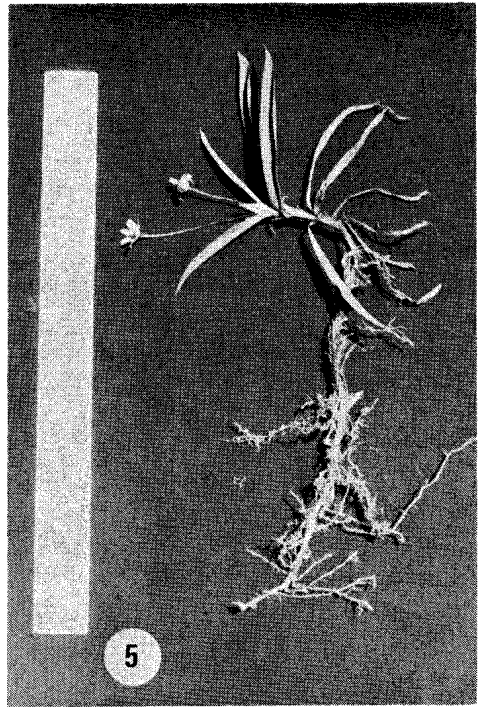
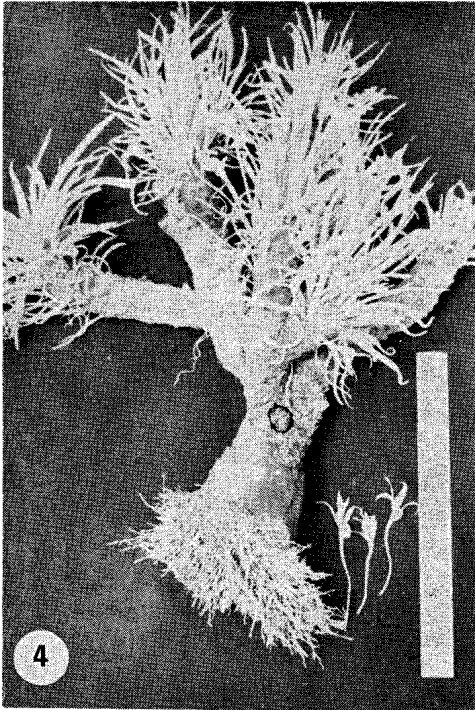


Fig. 4. Photograph of *Xerophyta villosa* in the vicinity of Verena, Transvaal.  
Foto van *Xerophyta villosa* in die omgewing van Verena, Transvaal.

Fig. 5. Photograph of *Talbotia elegans* from Mariepskop, Transvaal.  
Foto van *Talbotia elegans* vanaf Mariepskop, Transvaal.

Fig. 6. Photograph of *Xerophyta retinervis* var. *wentzeliana* from Fransfontein, South West Africa.  
Foto van *Xerophyta retinervis* var. *wentzeliana* vanaf Fransfontein, Suidwes-Afrika.

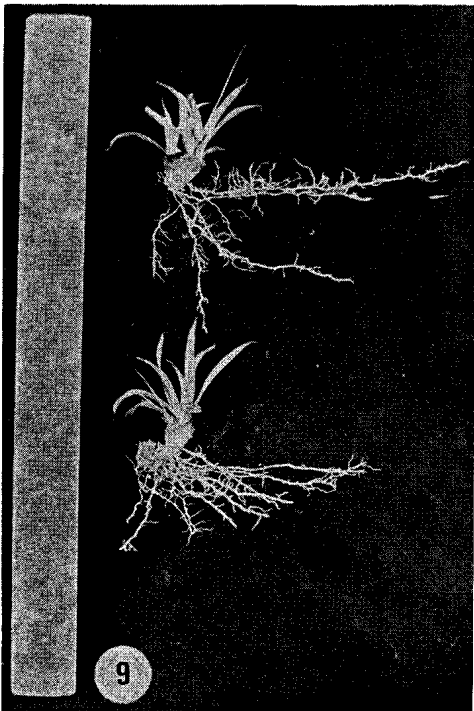
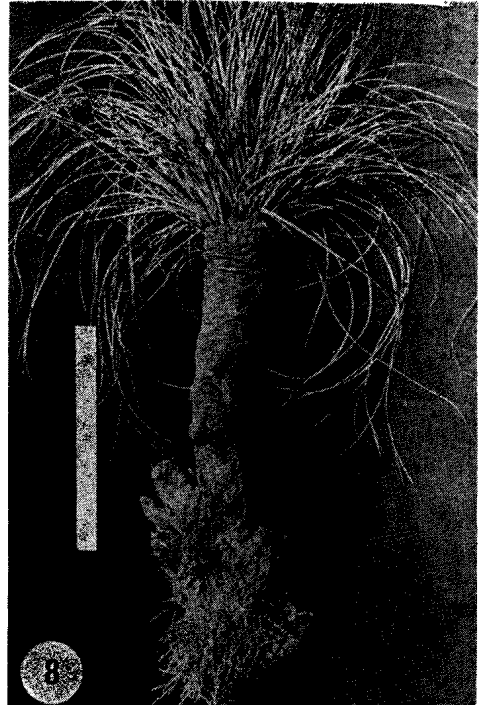
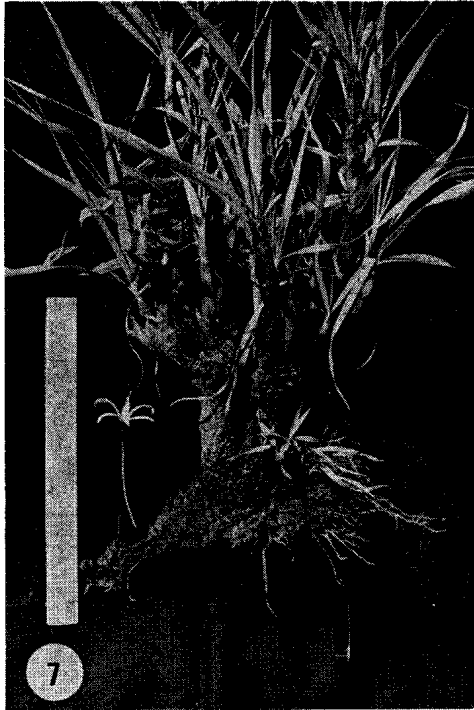


Fig. 7. Photograph of *Xerophyta squarrosa*, approximately 34 km from Otavi, South West Africa.

Foto van *Xerophyta squarrosa*, ongeveer 34 km vanaf Otavi, Suidwes-Afrika.

Fig. 8. Photograph of *Xerophyta clavata* from Barberton.

Foto van *Xerophyta clavata* vanaf Barberton.

Fig. 9. Photograph of *Xerophyta humilis*, approximately 88 km from Okahandja, South West Africa.

Foto van *Xerophyta humilis*, ongeveer 88 km vanaf Okahandja, Suidwes-Afrika.



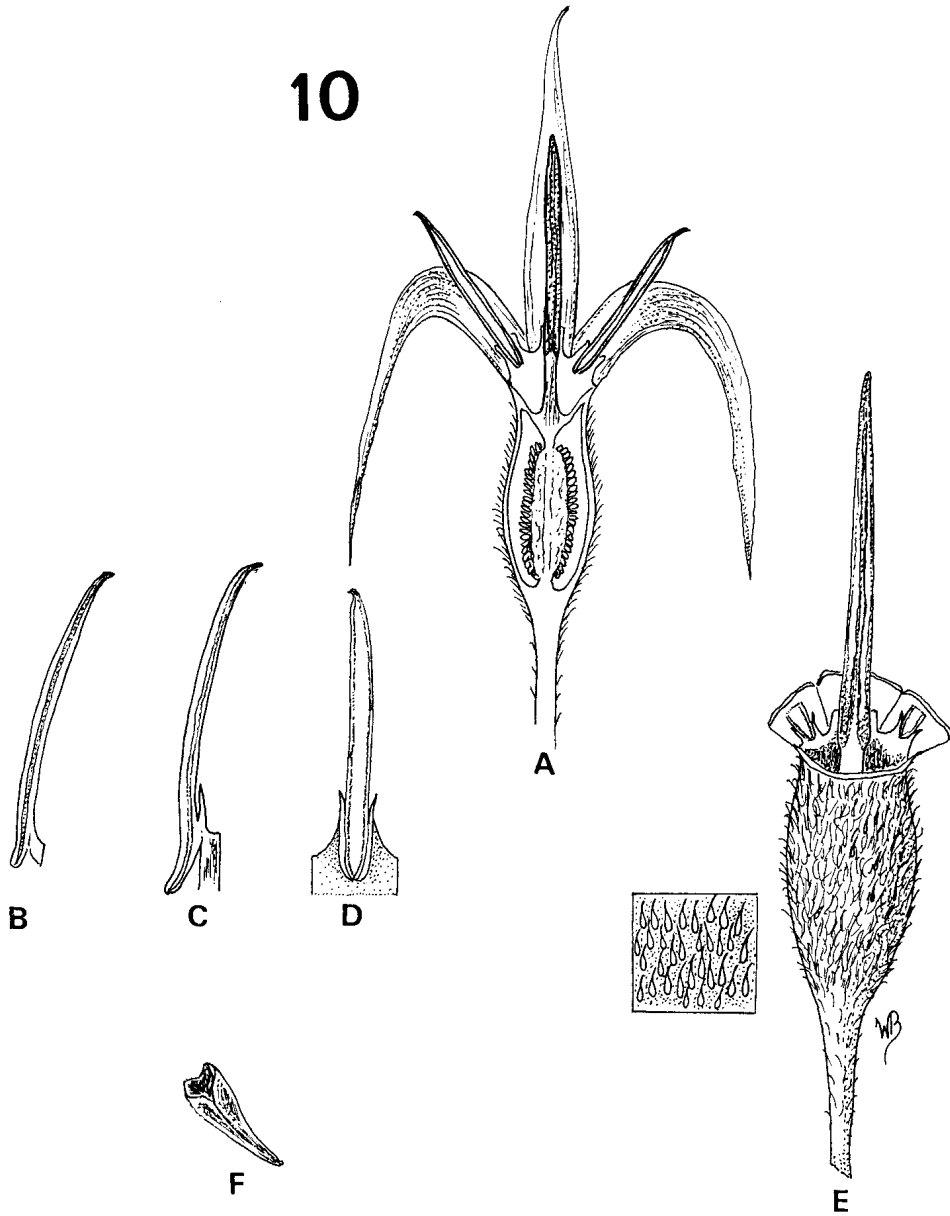


Fig. 10. A, longitudinal section of a flower of *Xerophyta retinervis* var. *retinervis*; B, lateral view of a stamen of *X. squarrosa*; C, lateral view of a stamen of *X. retinervis* var. *retinervis*; D, front view of a stamen of *X. retinervis* var. *retinervis*; E, flower of *X. retinervis* of which the perigone and stamens were removed; F, seed of *X. retinervis* var. *retinervis*.

A, lengtedeursnee van 'n blom van *Xerophyta retinervis* var. *retinervis*; B, laterale aansig van 'n meeldraad van *X. squarrosa*; C, laterale aansig van 'n meeldraad van *X. retinervis* var. *retinervis*; D, vooraansig van 'n meeldraad van *X. retinervis* var. *retinervis*; E, blom van *X. retinervis* waarvan die perigoon en meeldrade verwyder is; F, saad van *X. retinervis* var. *retinervis*.

11

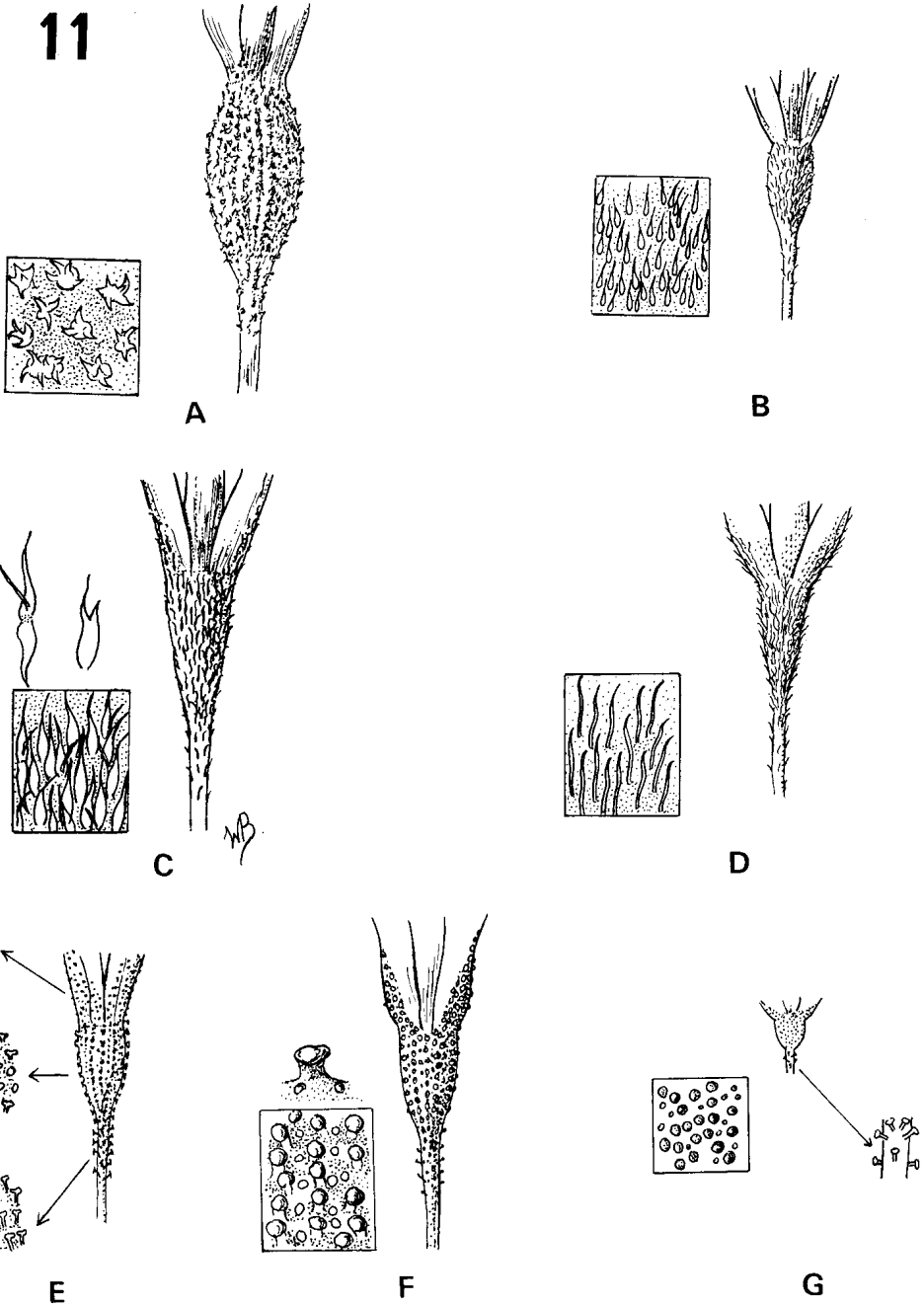


Fig. 11. Ovaries and details of ovary surfaces.

Vrugbeginsels en besonderhede van vrugbeginsel-oppervlaktes.

A, *Xerophyta retinervis* var. *wentzeliana*; B, *X. retinervis* var. *equisetoides*; C, *X. clavata*; D, *X. villosa*; E, *X. viscosa*; F, *X. squarrosa*; G, *X. humilis*.

12

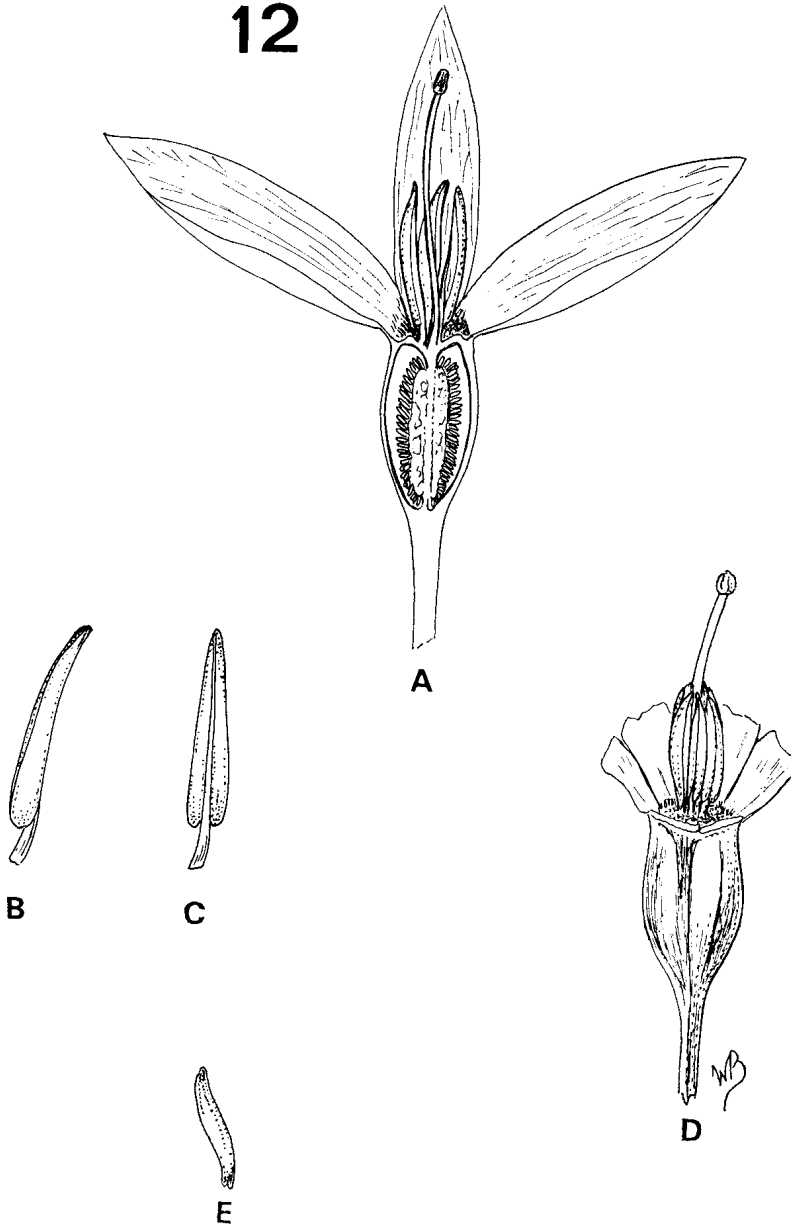


Fig. 12. *Talbotia elegans*. A, longitudinal section of a flower; B, lateral view of a stamen; C, front view of a stamen; D, flower of which the perigone was removed; E, seed.  
*Talbotia elegans*. A, lengtedeursnee van 'n blom; B, laterale aansig van 'n meeldraad; C, vooraansig van 'n meeldraad; D, blom waarvan die perigoon verwyder is; E, saad.