

# The genus *Acacia* Miller in South Africa. I. Stipules and spines

P. J. ROBBERTSE\*

## ABSTRACT

A large number of seedlings and young twigs of South African *Acacia* species was sectioned and the vascularization of the nodes and internodes studied. The nodes of all the species examined are trilacunate and the vascular tissue of the stipules originates from the lateral leaf traces. The Gummiferae species all have spinescent stipules, while stipules of the Vulgares species are membranous. Prickles containing no vascular tissue are found on the nodes and in some species also on the internodes of the Vulgares species. These prickles always occur on the ridges formed on the stem by leaf traces.

## INTRODUCTION

The genus *Acacia* in South Africa is represented by only two of the six subgenera or series recognized by Bentham (1875), viz. the Vulgares and the Gummiferae. The Gummiferae species all have spinescent stipules and no other spines or spinescent outgrowths occur on the stem, while the Vulgares species have membranous stipules together with prickles at the nodes and/or on the internodes.

Vassal (1969) describes the external morphology of the stipules and spines in seedlings of African *Acacia* species. Nothing, however, is mentioned about the nodal anatomy or the vascularization of the seedlings. Vassal also bases the phyllotaxy of these seedlings on their external morphology alone.

A study of the stipules and spines of the South African *Acacias* cannot be regarded as complete without a good knowledge of the vascularization of the nodes and leaf bases. It was therefore necessary to study the anatomy of the stem, in particular the anatomy of the nodes and the vascularization of the whole seedling axis.

## MATERIALS AND METHODS

Seeds of all the South African *Acacia* species (see

p. 476-479 for list of all specimens used in this and following studies, series I-V) were germinated and seedlings were fixed in F.A.A. after they had reached the four- to eight leaf stages. Serial sections were made of the root, hypocotyl, cotyledonary node and nodes of the first two vegetative leaves. For the study of the nodal anatomy of young twigs on mature trees, material of *A. caffra* (Robbertse 851, PRU) was used.

## RESULTS AND DISCUSSION

Sketches of the serial sections of the seedling axis of *A. kraussiana* from the root to the second vegetative leaf are shown in Fig. 1. Apart from differences in length of the internodes and other small differences, the basic anatomy of seedlings of the different species is the same.

In Fig. 1a, the first vegetative leaf is sectioned through the petiole, while the second leaf is sectioned through the pulvinus. In the pulvinar region, the vascular tissue of the leaf forms a closed cylinder. Proximally, the cylinder breaks up to form the three leaf traces, Fig. 1c-e. From the lateral leaf traces vascular tissue branches off to the stipules (Fig. 1f and g).

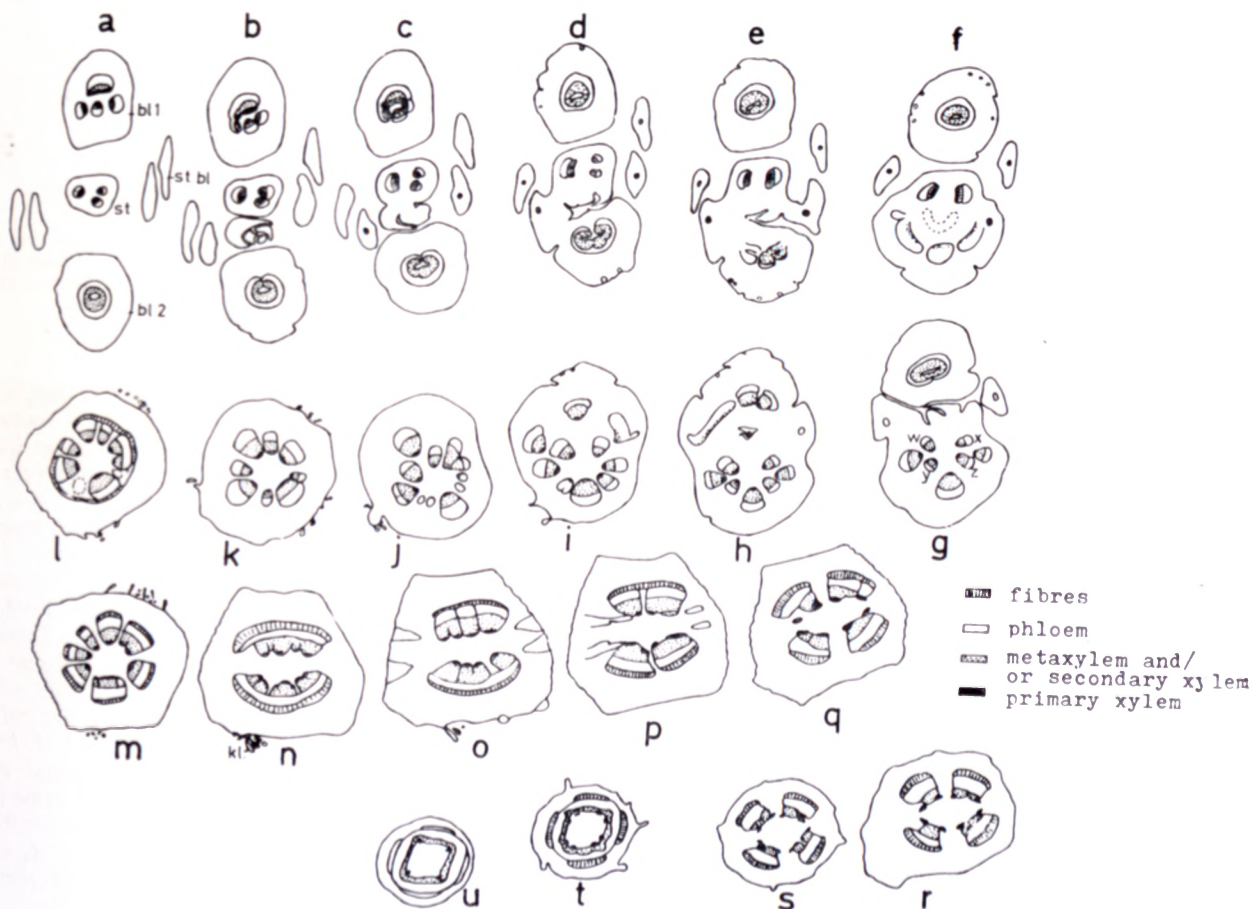


FIG. 1.—Line diagrams of a series of cross sections of the seedling axis of *Acacia kraussiana*, taken from attachment of the first two vegetative leaves, down to the root. bl. 1, first vegetative leaf; bl. 2, second vegetative leaf; st, stem; st. bl., stipules; w, x, y, z, vascular bundles of the stem.

\* Department of General Botany, University of Pretoria.

In all the *Vulgares* species, the ground tissue of the stipules, as seen in the serial cross sections, fuses with that of the stem before it fuses with the ground tissue of the leaf base. In all the *Gummiferae* species the ground tissue of the stipules fuses with the leaf base before the latter joins the stem.

The nodes of all the leaves are trilacunar and the "stele" of the stem consists of four collateral vascular

In the lower part of the hypocotyl the vascular cylinder breaks up into four vascular bundles. The primary xylem of each bundle again divides into two groups. Each of these primary xylem groups turns through  $180^\circ$  in the direction of the nearest medullary ray where it pairs with a second group of primary xylem originating from an adjacent vascular bundle. Thus a tetrarch stele is formed (Fig. 1 r-u).

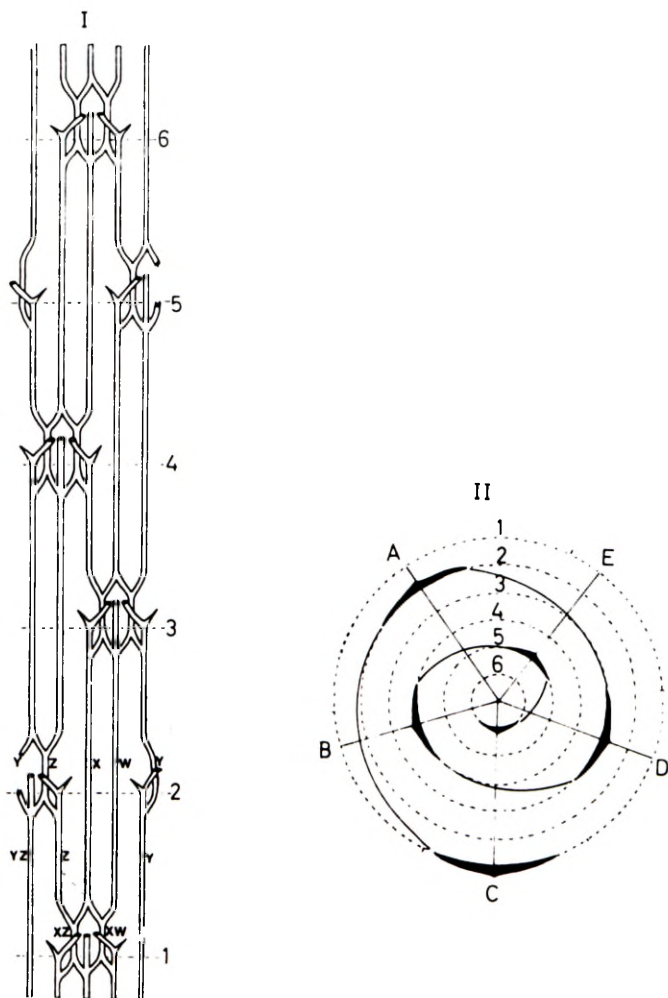


FIG 2.—The phyllotaxy and vascularization of a young stem of *Acacia caffra* I, schematic diagram of the primary vascular bundles; II, diagram of the phyllotaxy. 1-6, trilacunar nodes.

bundles. The central leaf trace of leaf No. 2 enters the "stele" of the stem between vascular bundles *y* and *z* (Fig. 1g), while the two lateral leaf traces enter through the leaf gaps between vascular bundles *w* and *y*, and *x* and *z* respectively. The central leaf trace of leaf No. 1 enters the "stele" of the stem between vascular bundles *xw* and *xz*, while the lateral traces enter through the leaf gaps between bundles *yz* and *xz*, and *xw* and *y* respectively (Fig. 2).

It is clear from this investigation that the first and second leaves are alternate, even though, organographically, they may appear to be opposite or subopposite.

Below the nodes of insertion of the cotyledons, the vascular tissue of the axis divides into two sections, forming two lacunae through which the vascular tissue of the cotyledons enters the stele. In Fig. 1 m-q the cotyledons have been removed, but the two leaf traces from each cotyledon can be seen entering the lacunae. This region is, in fact, a compound node consisting of two monolacunar nodes, each with two leaf traces. Vassal (1969) has dealt with the ramifications of the vascular tissue in the cotyledons and this will therefore not be repeated in this paper.

The same type of vascularization as in the nodes of the first and second vegetative leaves is found in the nodes of the third, fourth and succeeding leaves of the seedling and in nodes of young leaves on mature trees. The resulting phyllotaxy is  $2/5$  (Fig. 2). In this type of vascularization there are five prominent vascular bundles in the internodes and, apart from the leaf traces, four prominent bundles in the nodes. The five prominent bundles in the internodes form five ridges on the surface of young stems. Three of these ridges below each node lead to three leaf traces (Figs. 2 and 3). In the *Vulgares* species where prickles are found, they occur only on the ridges. In *Acacia schweinfurthii*, *A. kraussiana* and *A. brevispica* the prickles occur in five longitudinal rows along the five ridges on the internodes. The same type of distribution of prickles is also found on seedlings of *A. hereroensis*, young coppice shoots of *A. hereroensis* and *A. caffra*. In *A. caffra* and *A. hereroensis*, however, prickles are also found on the nodes.

In most other Southern African *Vulgares* species two prickles are found on the nodes (Fig. 3), while in the case of *A. senegal*, three prickles are found at each node. In species where two prickles are

found, they originate on the ridges leading to the two lateral leaf traces (Figs. 3 and 4). In *A. senegal* with

three prickles at each node, they originate on the ridges leading to the three leaf traces.

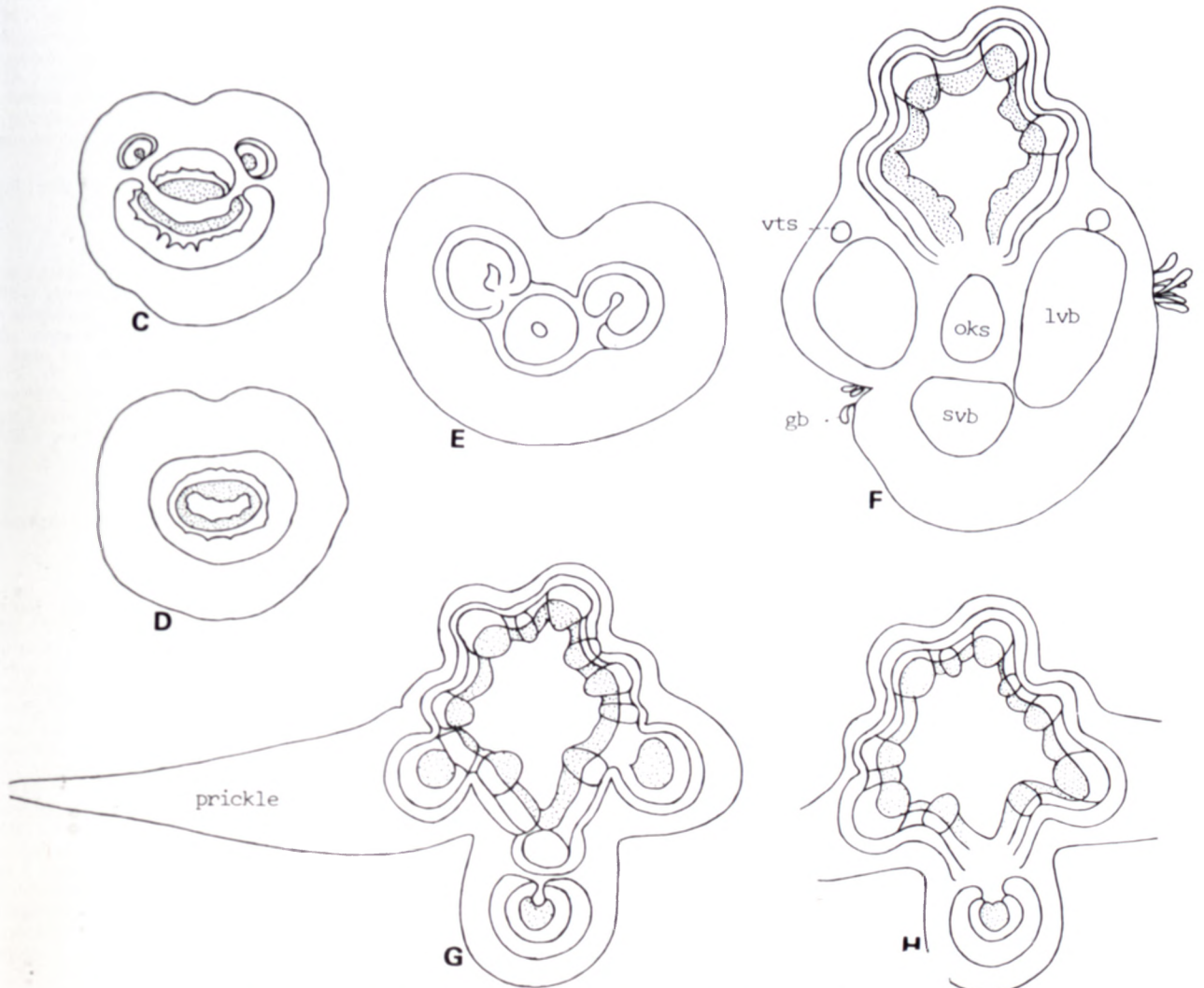


FIG. 3.—Line diagram of a series of cross sections through the petiole and node of *Acacia caffra*. C, section of proximal part of petiole; D, E, section of pulvinus; F, G, H, section of node. fl, phloem; gb, glandular body; lvb, lateral vascular bundle; oks, vascular tissue of axillary bud; svb, central vascular bundle; v, fibre cap; vts, vascular tissue of stipule; x, xylem.

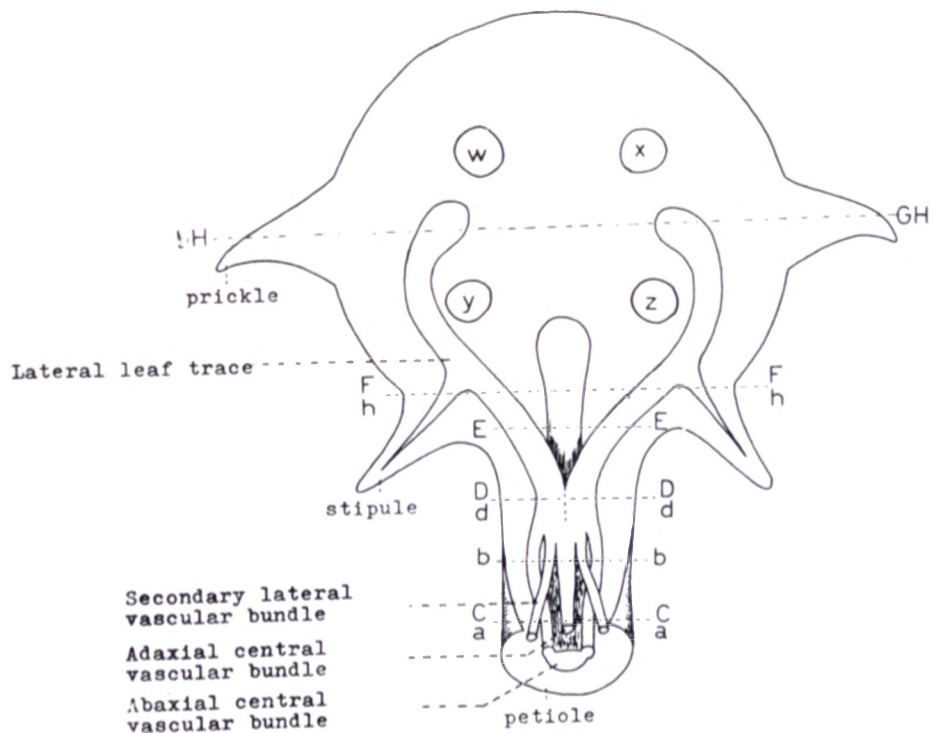


FIG. 4.—Schematic reconstruction of the course of the primary vascular tissue in the node of the stem of *Acacia caffra*. Small letters, a-h, refer to Fig. 1 and capital letters, A-H, to Fig. 3.

In no South African *Acacia* species have prickles ever been found between ridges as they are always situated on the ridges. Prickles on the nodes do not always appear at the same level, but one may be placed lower down on the internode and in some cases one or both may be lacking. Prickles are often found on the leaf rachis and rachillae of certain species, but even in these cases they occur opposite the extension of the central leaf trace into the rachis or ramifications of the central leaf trace.

No vascular tissue is found in the prickles (Fig. 4). They consist only of ground tissue covered by an epidermis.

In the Gummiferae species and *A. albida* the spines are modified stipules. As in the stipules of the Vulgares species, stipules of Gummiferae species are supplied by vascular tissue branching from the lateral leaf traces (Fig. 3f and 4). The stipules of the Vulgares species are caducous, but those of the Gummiferae species develop into long, straight or curved persistent spines.

Spines of *A. erioloba* (— *A. giraffae sensu auct. mult. fide* Ross, 1975) are inflated at their bases and *A. luederitzii* var. *retinens* also develops occasional inflated spines. Monod & Schmidt (1968) have commented on the pseudo-galls found in African *Acacias*, but in this study, no further attention has been given to this aspect.

The vascularization of the leaf in South African *Acacia* species will be dealt with in a subsequent paper.

#### ACKNOWLEDGEMENTS

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#### UITTREKSEL

*Sneë van 'n groot aantal kiemplante en jong stingels van Suid-Afrikaanse Acacia-spesies is gemaak en die verloop van die vaatweefsel in die knope en litte is bestudeer. Die knope van al die ondersoekte soorte is trilakunêr en die vaatweefsel van die steunblare ontspring uit die laterale blaarspore. Al die Gummiferae-soorte se steunblare is dorings terwyl die steunblare van die Vulgares-soorte membraanagtig is. Haakdorings wat geen vaatweefsel bevat nie kom op die knope en by sekere soorte ook op die litte van die Vulgares-soorte voor. Laasgenoemde dorings word steeds op riewe op die stam, wat deur die blaarspore veroorsaak word, aangetref.*

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#### SPECIMENS USED

##### *A. albida*

SOUTH WEST AFRICA.—1714 (Ruacana Falls): Ruacana Falls on the Kunene River (—AC), *Robbertse* 327.

TRANSVAAL.—2230 (Messina): Tshipise rest camp (seed only) (—CA), *Robbertse* 215; 2430 (Pilgrim's Rest): at tomato canning factory, near Hoedspruit (—BD), *Robbertse* 139; 2528 (Pretoria): between Rooiwal power station and Hammanskraal (—CA), *Robbertse* 153 A.

##### *A. arenaria*

SOUTH WEST AFRICA.—1816 (Namutoni): 66 km north of Namutoni in Ovamboland (—BC), *Robbertse* 321.

##### *A. ataxacantha*

TRANSVAAL.—2427 (Thabazimbi): Waterberg, Nylstroom district (—DD), *Robbertse* 797; 2428 (Nylstroom): between Nylstroom and Vaalwater (—CB), *Robbertse* 250 (a); 2527 (Rustenburg): Hartebeespoort Dam (—DD), *Robbertse* 387; 2528 (Pretoria): Springbok Park, Pretoria (—CA), *Robbertse* 237; 2529 (Witbank): western bank of Loskop Dam (—AD), *Robbertse* 246; 2530 (Lydenburg): Lydenburg (—AB), *Robbertse* 134; 2530 (Lydenburg): Schoeman's Kloof (—AD), *Robbertse* 106; 2530 (Lydenburg): at 16,9 km mark between Machadodorp and Nelspruit (—CB), *Robbertse* 805.

CAPE PROVINCE.—3129 (Port St John's): 16 km from Port St. John's on road to Umtata (—CB), *Robbertse* 876.

##### *A. borleae*

TRANSVAAL.—2431 (Acornhoek): between Ngwanedzi and Letaba, 11 km from Ngwanedzi-Satara cross roads (—BB), *Robbertse* 225; 2431 (Acornhoek): 11 km from Ngwanedzi on road to Letaba, Kruger National Park (—BD), *Robbertse* 276; 2531 (Komatipoort): 8 km from Pretoriuskop on road to Skipberg, Kruger National Park (—AB), *Robbertse* 281; 2531 (Komatipoort): Skipberg near Pretoriuskop (—AB), *Robbertse* 807; 2531 (Komatipoort): 20 km outside Malelane Rest Camp at turn-off to Pretoriuskop, Kruger National Park (—BC), *Robbertse* 173.

##### *A. brevispica*

Fixed material provided by Dr J. H. Ross of Pietermaritzburg.

##### *A. burkei*

TRANSVAAL.—2229 (Waterpoort): Johanna Uys Nature Reserve, beyond Soutpansberg (—DC), *Robbertse* 212; 2426 (Mochudi): Derdepoort, Rustenburg district, 16 km from the Limpopo River (—CB), *Robbertse* 188; 2427 (Thabazimbi): 45 km from Warmbad on road to Beestekraal (—DD), *Robbertse* 164; 2428 (Nylstroom): at the foot of hill, north of Warmbad (—CD), *Robbertse* 203; 2430 (Pilgrim's Rest): near Echo Caves (—DB), *Robbertse* 136; 2431 (Acornhoek): between Tsokwane and Satara, Kruger National Park (—DB), *Robbertse* 123; 2431 (Acornhoek): Leeupan, Kruger National Park (—DC), *Robbertse* 228; 2431 (Acornhoek): 30,5 km from Skukuza on road to Tsokwane near Leeupan, Kruger National Park (—DD), *Robbertse* 175; 2526 (Zeerust): 77 km from Rustenburg via Mabieskraal (—BB) *Robbertse* 184; 2527 (Rustenburg): 6 km south of Northam (—AB), *Robbertse* 795; 2527 (Rustenburg): Hartebeespoort Dam (—DD), *Robbertse* 386; 2529 (Witbank): Loskop Dam (—AD), *Robbertse* 245; 2531 (Komatipoort): 34 km from Pretoriuskop on road to Skukuza, Kruger National Park (—BA), *Robbertse* 813.

##### *A. caffra*

TRANSVAAL.—2327 (Ellisras): Ellisras (—DB), *Robbertse* and v. d. Walt 879; 2428 (Nylstroom): 26 km from Nylstroom on road to Ellisras (—CB), *Robbertse* and Van der Walt 882; 2429 (Zebediela): Zebediela (—AD), *Robbertse* 738; 2526 (Zeerust): 77 km from Rustenburg via Mabieskraal (—BB), *Robbertse* 182; 2528 (Pretoria): at 33 km mark north of Pienaarsrivier (—AB), *Robbertse* 333; 2528 (Pretoria): Campus, University of Pretoria (—CA), *Robbertse* 179; 2528 (Pretoria): Brummeria, Pretoria (—CA), *Robbertse* 823; 2528 (Pretoria): Pienaarsrivier Dam, near Pretoria (seed only) (—CB), *Robbertse* 17.

NATAL.—2729 (Volksrust): southern foothills of Drakensberg, 26 km from Newcastle on road to Volksrust (—DB), *Robbertse* 367.

CAPE PROVINCE.—3227 (Stutterheim): Fort Cox (—CC), *Robbertse* 851; 3227 (Stutterheim): King William's Town (—CD), *Robbertse* 781.

##### *A. clavigera* (see *A. robusta*)

##### *A. davyi*

TRANSVAAL.—2230 (Messina): 40 km north of Louis Trichardt on road to Sibasa (—CD), *Robbertse* 803; 2330 (Tzaneen): at 26,6 km mark north of Louis Trichardt, on road to Sibasa (—AA), *Robbertse* 274; 2521 (Komatipoort): mountain pass between Nelspruit and Malelane (—CB), *Robbertse* 103; 2530 (Lydenburg): at 49,9 km mark between White River and Nelspruit (—BD), *Robbertse* 806.

##### *A. erioloba*

TRANSVAAL.—2229 (Waterpoort): 8 km north of Vivo (—CD), *Robbertse* 802; 2526 (Zeerust): 77 km from Rustenburg via Mabieskraal (—BB), *Robbertse* 183; 2527 (Rustenburg): between Hartebeespoort Dam and Rustenburg (—DA), *Robbertse* 144(a); 2528 (Pretoria): At 4,8 km mark, north of Pienaarsrivier (—AB), *Robbertse* 332.

CAPE PROVINCE.—2722 (Olifantshoek): 80 km north of Kuruman (—BB), *Robbertse* 340.

**A. erioloba** × **A. haematoxylon**

CAPE PROVINCE.—2623 (Morokweng): 80 km north-north-west of Kuruman (—CC), *Robbertse 339*.

**A. erubescens**

SOUTH WEST AFRICA.—2116 (Okahandja): 10 km west of Okahandja (—DD), *Robbertse 305*.

TRANSVAAL.—2229 (Waterpoort): Johanna Uys Nature Reserve, beyond Soutpansberg (—DC), *Robbertse 211*; 2426 (Mochudi): Derdepoort Hospital on banks of Limpopo River (—CB), *Robbertse 189*; 2426 (Mochudi): Dwarsberg district of Swartruggens (—DC), *Robbertse 185*; 2427 (Thabazimbi): 14.5 km north-east of Thabazimbi on road to Thabazimbi (—CB), *Robbertse 196*; 2528 (Pretoria): 22.5 km from Warmbad, on road to Beestekraal, Brits (—AA), *Robbertse 160*; 2528 (Pretoria): 101 km from Warmbad on road to Brits (—CA), *Robbertse 165*.

**A. exuvialis**

TRANSVAAL.—2426 (Mochudi): 32 km from Dwarsberg on road to Derdepoort (—CB), *Robbertse 187*; 2431 (Acornhoek): Olifants Rest Camp, Kruger National Park (—BB), *Robbertse 224*; 2431 (Acornhoek): 5 km from Ngwanedzi-Satara cross roads, on road to Tshokwana, Kruger National Park (—DB), *Robbertse 226*; 2431 (Acornhoek): Skukuza Rest Camp, Kruger National Park (—DC), *Robbertse 174*; 2431 (Acornhoek): Skukuza Rest Camp, Kruger National Park (seed only) (—DC), *Robbertse 278*; 2531 (Komati-poort): Between Pretoriuskop and Skukuza, Kruger National Park (—AB), *Robbertse 112*; 2531 (Komati-poort): Skipberg near Pretoriuskop, Kruger National Park (—AD), *Robbertse 809*; 2531 (Komati-poort): between Malelane gate and Rest Camp, Kruger National Park (—CB), *Robbertse 171*.

**A. fleckii**

SOUTH WEST AFRICA.—1816 (Namutoni): 11 km north of Namutoni, Etosha Pan Game Reserve (—DB), *Robbertse 320 (a)*.

TRANSVAAL.—2327 (Ellisras): between Ellisras and Stockpoort (—DA), *Robbertse and Van der Walt 878*; 2426 (Mochudi): 32 km north of Dwarsberg Post Office on road to Derdepoort (—CB), *Robbertse 186*; 2426 (Mochudi): 30.5 km mark between Derdepoort and Rooibokkraal (—DC), *Robbertse 191*; 2427 (Thabazimbi): at 65.8 km mark between Northam and Makoppa (—AC), *Robbertse 285*.

**A. galpinii**

TRANSVAAL.—2427 (Thabazimbi): Thabazimbi, in the town (—CB), *Robbertse 289*; 2428 (Nylstroom): at 33 km mark north of Nylstroom (Bad-syn-loop) (—CB), *Robbertse 334*; 2528 (Pretoria): Campus, University of Pretoria (—CA), *Robbertse 34*; 2528 (Pretoria): Campus, University of Pretoria (—CA), *Robbertse 389*.

**A. gerrardii**

TRANSVAAL.—2428 (Nylstroom): at 30.5 km mark north of Nylstroom (—CB), *Robbertse 238*; 2428 (Nylstroom): Bad-syn-loop, 30.5 km north of Nylstroom (—CB), *Robbertse 798*; 2429 (Zebediela): Potgietersrust (—AA), *Robbertse 392*; 2529 (Witbank): Loskop Dam (—AD), *Robbertse 242*; 2531 (Komati-poort): Pretoriuskop, Kruger National Park (—AB), *Robbertse 109*; 2531 (Komati-poort): between Skukuza and Pretoriuskop on road to Skipberg, Kruger National Park (—AB), *Robbertse 229*; 2531 (Komati-poort): 24 km from Pretoriuskop on road to Skukuza, Kruger National Park (—AB), *Robbertse 811*.

**A. giraffae** (see *A. erioloba*)**A. grandicornuta**

TRANSVAAL.—2327 (Ellisras): at junction of road from Villa Nora between Vaalwater and Tom Burke (—DB), *Robbertse 256*; 2426 (Mochudi): between Derdepoort and Rooibokkraal (—DA), *Robbertse 190*; 2531 (Komati-poort): 47 km from Pretoriuskop on road to Skukuza, Kruger National Park (—BA), *Robbertse 815*; 2531 (Komati-poort): between Skukuza and Lower Sabie, Kruger National Park (—BB), *Robbertse 118*.

**A. haematoxylon**

CAPE PROVINCE.—2623 (Morokweng): 80 km north-north-west of Kuruman (—CC), *Robbertse 341*; 2721 (Tellyer Pan): 37 miles from Van Zyl's Rust on road to Aroab (—AA), *Robbertse 296(a)*; 2722 (Olifantshoek): 63 km from Kuruman on road to Van Zyl's Rust (—BB), *Robbertse 295*; 2821 (Upington): 8 km outside Upington on road to Keimoes (—CA), *Robbertse 198*.

**A. hebeclada** subsp. **hebeclada**

TRANSVAAL.—2329 (Pietersburg): 34.6 km mark between Pietersburg and Vivo (—CB), *Robbertse 800*; 2528 (Pretoria): 32 km north of Pretoria on road to Warmbad (—AC), *Robbertse*

330; 2528 (Pretoria): 8 km from Rooiwal power station on road to Warmbad (—CA), *Robbertse 145*; 2528 (Pretoria): between Rooiwal power station and Hammanskraal, nearby Pretoria. (—CA), *Robbertse 154*.

CAPE PROVINCE.—2722 (Olifantshoek): 63 km from Kuruman on road to Van Zyl's Rust (—BB), *Robbertse 294*.

**A. hebeclada** subsp. **tristis**

SOUTH WEST AFRICA.—1715 (Ondangua): 140 km from Namutoni in Ovamboland (—DD), *Robbertse 324*.

**A. hereroensis**

SOUTH WEST AFRICA.—2217 (Windhoek): 21 km south of Windhoek on southern slope of hill (—CA), *Robbertse 301*.

TRANSVAAL.—2526 (Zeerust): Lindley's Poort (—BC), *Robbertse 881*; 2527 (Rustenburg): at 34.5 km mark north of Rustenburg on road to Thabazimbi (—AD), *Robbertse 794*; 2527 (Rustenburg): 33.7 km north of Rustenburg on road to Thabazimbi (—AD), *Robbertse 284*; 2528 (Pretoria): Zeiler Street between Mitchell and Church Streets Pretoria (—CA), *Robbertse 153*; 2528 (Pretoria): Zeiler Street between Mitchell and Church Streets, Pretoria (—CA), *Robbertse 236*.

CAPE PROVINCE.—2624 (Vryburg): at 146 km mark between Mafeking and Vryburg (—DD), *Robbertse 29*.

**A. karroo**

TRANSVAAL.—2527 (Rustenburg): Tweerivier, Rustenburg district (seed only) (—CA), *Robbertse 29*; 2528 (Pretoria): between Pienaarsrivier and Warmbad (—AB), *Robbertse 158*; 2528 (Pretoria): between Hammanskraal and Pienaarsrivier (—AC), *Robbertse 148*; 2528 (Pretoria): Brummeria, Pretoria (—CA), *Robbertse 824*; 2528 (Pretoria): Brummeria, Pretoria (—CA), *Robbertse 234*; 2529 (Witbank): Loskop Dam (tall drooping growth habit) (—AD), *Robbertse 247*; 2530 (Lydenburg) Schoeman's Kloof, Nelspruit (—AD), *Robbertse 105*; 2530 (Lydenburg): between Nelspruit and Barberton (—DB), *Robbertse 168*.

CAPE PROVINCE.—2817 (Vioolsdrif): Vioolsdrif on banks of Orange River (—DC), *Robbertse 199*; 3118 (Vanhynsdorp): at foot of Van Rhyne's Pass, Vanhynsdorp (—DB), *Robbertse 203*; 3227 (Stutterheim): 8 km north of King William's Town (—CD), *Robbertse 782*; 3228 (Butterworth): Kei Mouth (—CB), *Robbertse 875*.

**A. kirkii**

SOUTH WEST AFRICA.—1817 (Tsitib): 8 km from the gates of Etosha Pan Game Reserve, Between Namutoni and Tsumeb (—CC), *Robbertse 329*.

**A. kraussiana**

NATAL.—2732 (Ubombo): Makatini Flats (seed only) (—CA), *Robbertse 24*; 2930 (Pietermaritzburg): Pietermaritzburg (—CB), *Robbertse and Reyneke 880*.

**A. luederitzii** var. **retinens**

TRANSVAAL.—2426 (Mochudi): 39.6 km mark between Derdepoort and Rooibokkraal (—DC), *Robbertse 192*; 2528 (Pretoria): between Pienaarsrivier and Warmbad (—AB), *Robbertse 149*; 2528 (Pretoria): between Pienaarsrivier and Warmbad (—AB), *Robbertse 156*; 2528 (Pretoria): 27.5 km from Warmbad on road to Beesterkraal (—AB), *Robbertse 163*; 2528 (Pretoria): at 57 km mark between Pretoria and Pienaarsrivier (—AD), *Robbertse 249*.

**A. luederitzii** var. **luederitzii**

SOUTH WEST AFRICA.—1715 (Ondangua): Oshikango, Ovamboland (—BD), *Robbertse 325*; 1816 (Namutoni): Namutoni Rest camp, Etosha Pan Game Reserve (—DD), *Robbertse 319*.

**A. mellifera**

TRANSVAAL.—2228 (Maasroom): 16 km from Mogalakwena River on road to Alldays (—DD), *Robbertse 262*; 2428 (Nylstroom): At 12 km mark between Vaalwater and Villa Nora (—AA), *Robbertse 253*; 2428 (Nylstroom): at 49 km mark between Pienaarsrivier and Warmbad (—CD), *Robbertse 202*; 2527 (Rustenburg): 24 km outside Rustenburg on road to Zwarttruggens (—CA), *Robbertse 239*; 2528 (Pretoria): Pienaarsrivier (—AB), *Robbertse 331*; 2528 (Pretoria): Pienaarsrivier, near Warmbad (—AB), *Robbertse 155*; 2528 (Pretoria): at 49.8 km mark between Pretoria and Pienaarsrivier (—AD), *Robbertse 248*.

CAPE PROVINCE.—2723 (Kuruman): 11 km west of Kuruman (—AD), *Robbertse 342*.

**A. montis-usti**

SOUTH WEST AFRICA.—2014 (Welwitschia): on the farm Goedgedgun on road to Twyfelfontein (—DB), *Robbertse 316*; 2114 (Uis): Witvroukloof, Brandberg (—BA), *Robbertse 315*.

**A. nebrownii**

SOUTH WEST AFRICA.—2618 (Keetmanshoop): 80 km west of Aroab on road to Keetmanshoop (–DB), *Robbertse* 298.

TRANSVAAL.—2228 (Maasstream): 16 km from Mogalakwena River on road to Alldays (–DD), *Robbertse* 261; 2229 (Waterpoort): at 4.7 milestone between Vivo and Alldays (–CD), *Robbertse* 208; 2229 (Waterpoort): 13 km north of Vivo on road to Alldays (–CD), *Robbertse* 337; 2229 (Waterpoort): western edge of Soutpan, north of Soutpansberg (–DC), *Robbertse* 213; 2230 (Messina): Farm Adieu on the Ngwanedzi River, near Tshipise (–CA), *Robbertse* 217.

**A. nigrescens**

TRANSVAAL.—2231 (Pafuri): 0.8 km from Punda Milia Rest Camp, Kruger National Park (–CA), *Robbertse* 818; 2431 (Acornhoek): Satara Rest Camp, Kruger National Park (–BD), *Robbertse* 124; 2528 (Pretoria): Campus, University of Pretoria (–CA), *Robbertse* 201; 2528 (Pretoria): Campus, University of Pretoria (–CA), *Robbertse* 388.

**A. nilotica**

TRANSVAAL.—2528 (Pretoria): Derdepoort, Pretoria (–CA), *Robbertse* 391; 2528 (Pretoria): Wonderboom, Pretoria (–CA), *Robbertse* 791; 2528 (Pretoria): Pienaarsrivier Dam, Pretoria (seed only) (–CB), *Robbertse* 18, 2529 (Witbank): Loskop Dam (–AD), *Robbertse* 243.

**A. permixta**

TRANSVAAL.—2329 (Pietersburg): at 52.3 km mark between Pietersburg and Vivo (–AD), *Robbertse* 205; 2329 (Pietersburg): between Vivo and Pietersburg (–AD), *Robbertse* 264; 2329 (Pietersburg): at 43.5 km mark north west of Pietersburg on road to Vivo (–CA), *Robbertse* 270; 2329 (Pietersburg): at 42.6 km mark between Pietersburg and Vivo (–CA), *Robbertse* 801; 2427 (Thabazimbi): between Rooibokkraal and Thabazimbi (–AC), *Robbertse* 196; 2427 (Thabazimbi): at 106.2 km mark between Sentrum and Thabazimbi (–AD), *Robbertse* 288; 2527 (Rustenburg): 56 km from Brits on road to Beestekraal (–BC), *Robbertse* 166.

**A. polyacantha**

TRANSVAAL.—2230 (Messina): 50 km from Louis Trichardt on road to Punda Milia (–CD), *Robbertse* 804; 2230 (Messina): 32 km from Punda Milia on road to Louis Trichardt (–DD), *Robbertse* 220; 2230 (Messina): 66.7 km mark between Sibasa and Punda Milia (–DD), *Robbertse* 275; 2231 (Pafuri): Punda Milia Rest Camp, Kruger National Park (–CA), *Robbertse* 819; 2231 (Pafuri): Punda Milia, Kruger National Park (–CA), *Robbertse* 177.

**A. rehmanniana**

TRANSVAAL.—2329 (Pietersburg): Louis Trichardt (north of town) (–BB), *Robbertse* 178; 2329 (Pietersburg): Louis Trichardt (north of town) (–BB), *Robbertse* 821; 2329 (Pietersburg): 8 km outside Pietersburg on road to Vivo on banks of Blood River (–CD), *Robbertse* 204; 2329 (Pietersburg): Blood River, just outside Pietersburg (–CD), *Robbertse* 265; 2329 (Pietersburg): 16 km mark from Pietersburg on road to Potgietersrus (–CD), *Robbertse* 269; 2329 (Pietersburg): Pietersburg (–CD), *Robbertse* 338; 2329 (Pietersburg): 4 km west of Pietersburg (–CD), *Robbertse* 799.

**A. reficiens**

SOUTH WEST AFRICA.—2114 (Uis): 3.2 km east of Uis (–BB), *Robbertse* 312; 2116 (Okahandja): 3.2 km north of Wilhelmstal (–CD), *Robbertse* 307; 2116 (Okahandja): 4.8 km west of Okahandja (–DD), *Robbertse* 304; 2217 (Windhoek): 22.5 km north of Windhoek (–AC), *Robbertse* 302.

**A. robusta**

TRANSVAAL.—2528 (Pretoria): Campus, University of Pretoria (–CA), *Robbertse* 35; 2528 (Pretoria): Campus, University of Pretoria (–CA), *Robbertse* 180; 2530 (Lydenburg): Schoemanskloof, near Nelspruit (–AD), *Robbertse* 100.

CAPE PROVINCE.—3227 (Stutterheim): near bridge over Kei River (–DB), *Robbertse* 869; 3227 (Stutterheim): near bridge over Kei River (–DB), *Robbertse* 873; 3228 (Butterworth): 16 km from Kei Mouth (–CB), *Robbertse* 870.

**A. robynsiana**

SOUTH WEST AFRICA.—2014 (Welwitshia): 38.6 km from Goedegun on road to Twyfelfontein (–DB), *Robbertse* 317 and 317 (a).

**A. schweinfurthii**

TRANSVAAL.—2230 (Messina): Farm Adieu beside Ngwanedzi River near Tshipise (–CA), *Robbertse* 218; 2231 (Pafuri): Punda Milia Rest Camp, Kruger National Park (–CA), *Robbertse* 221; 2231 (Pafuri): Punda Milia Rest Camp, Kruger National Park (–CA), *Robbertse* 820; 2430 (Pilgrim's Rest): petrol station on banks of Blyde River near Hoedspruit (–BD), *Robbertse* 138; 2431 (Acornhoek): Skukuza, Kruger National Park (–DC), *Robbertse* and *Reyneke* 877.

**A. senegal var. leiorrhachis**

TRANSVAAL.—2229 (Waterpoort): at 51.2 km mark between Louis Trichardt and Messina (–DB), *Robbertse* 214; 2230 (Messina): at foot of hill near Tshipise Rest Camp (–CA), *Robbertse* 216; 2329 (Pietersburg): Vivo (–AB), *Robbertse* 207; 2329 (Pietersburg): Vivo (–AB), *Robbertse* 238; 2329 (Pietersburg): 11 km south of Vivo between Pietersburg and Vivo (–AB), *Robbertse* 335.

**A. senegal var. rostrata**

SOUTH WEST AFRICA.—2217 (Windhoek): 22.5 km north of Windhoek (–AC), *Robbertse* 303.

TRANSVAAL.—2328 (Baltimore): 14.5 km from Villa Nora on road to Marnitz (–AC), *Robbertse* 257; 2426 (Mochudi): 60 km mark between Derdepoort and Rooibokkraal (–DA), *Robbertse* 193; 2531 (Komatipoort): between Pretoriuskop and Skukuza, Kruger National Park (–AB), *Robbertse* 115; 2531 (Komatipoort): 3.2 km outside Malelane Rest Camp, on road to Skukuza, Kruger National Park (–BC), *Robbertse* 172; 2531 (Komatipoort): 32 km from Pretoriuskop on road to Skukuza, Kruger National Park (–BA), *Robbertse* 812.

**A. sieberana var. woodii**

TRANSVAAL.—2529 (Witbank): Dennilton near Loskop Dam (–AC), *Robbertse* 241; 2528 (Pretoria): Campus, University of Pretoria (–CA), *Robbertse* 31; 2528 (Pretoria): Campus, University of Pretoria (–CA), *Robbertse* 235; 2530 (Lydenburg): Schoemanskloof, near Nelspruit (–AD), *Robbertse* 101.

**A. swazica**

TRANSVAAL.—2531 (Komatipoort): east of Skipberg, Kruger National Park (–AD), *Robbertse* 230; 2531 (Komatipoort): 14.5 km from Pretoriuskop at Skipberg (–AD), *Robbertse* 282; 2531 (Komatipoort): Skipberg near Pretoriuskop, Kruger National Park (–AD), *Robbertse* 810; 2531 (Komatipoort): 45 km outside Barberton on road to Malelane (–CB), *Robbertse* 170; 2531 (Komatipoort): 5 km outside Barberton on road to Malelane (–CC), *Robbertse* 169.

**A. stuhlmannii**

TRANSVAAL.—2228 (Maasstream): at Groblersdrif across Limpopo River near Swartwater (–CC), *Robbertse* 260; 2328 (Baltimore): 21 km from Villa Nora on road to Marnitz (–AC), *Robbertse* 240; 2328 (Baltimore): 21 km from Villa Nora on road to Marnitz (–AC), *Robbertse* 259; 2329 (Pietersburg): 3.2 km north of Vivo (seed only) (–AB), *Robbertse* 271; 2329 (Pietersburg): At 3.2 km mark north of Vivo on road to Alldays (–AB), *Robbertse* 336.

**A. tortilis subsp. heteracantha**

SOUTH WEST AFRICA.—2116 (Okahandja): 19 km from Wilhelmstal on road to Omaruru (–CA), *Robbertse* 308; 2116 (Okahandja): Wilhelmstal (–CD), *Robbertse* 306.

TRANSVAAL.—2431 (Acornhoek): Skukuza Rest Camp between camp and living quarters, Kruger National Park (–DC), *Robbertse* 816; 2527 (Rustenburg): 29 km north of Rustenburg on road to Thabazimbi (–AD), *Robbertse* 793; 2527 (Rustenburg): Tweerivier, Rustenburg district (–CA), *Robbertse* 144; 2528 (Pretoria): 22.5 km from Warmbad on road to Beestekraal (–AB), *Robbertse* 162; 2528 (Pretoria): 8 km from Rooiwal power station on road to Warmbad (–CA), *Robbertse* 147; 2528 (Pretoria): at 47.5 km mark between Pretoria and Hammanskraal (–CA), *Robbertse* 266; 2529 (Witbank): Loskop Dam (–AD), *Robbertse* 244.

**A. tortilis subsp. spirocarpa**

SOUTH WEST AFRICA.—1714 (Ruacana Falls): Ombalantu, Ovamboland (–DB), *Robbertse* 326.

**A. tenuispina**

TRANSVAAL.—2328 (Baltimore): Turflaagte, 17.5 km from Villa Nora (–AC), *Robbertse* 258; 2426 (Mochudi): Rooibokkraal (–BB), *Robbertse* 286; 2426 (Mochudi): at Rooibokkraal in pan (–BB), *Robbertse* 195; 2426 (Mochudi): at 30.5 km mark between Derdepoort and Rooibokkraal (–DC), *Robbertse* 194;

2527 (Rustenburg): 10,5 km north of Rustenburg on road to Thabazimbi (-CB), *Robbertse* 283; 2527 (Rustenburg): 5 km north east of Rustenburg on road to Thabazimbi (CB), *Robbertse* 792; 2528 (Pretoria): between Pienaarsrivier and Warmbad (-AB), *Robbertse* 150; 2528 (Pretoria): between Pienaarsrivier and Warmbad (AB), *Robbertse* 159; 2528 (Pretoria): 9,7 km mark between Pienaarsrivier and Warmbad (-AB), *Robbertse* 250; 2528 (Pretoria): at 9,7 km mark between Pienaarsrivier and Warmbad (AB), *Robbertse* 257.

#### A. *welwitschii*

TRANSVAAL—2431 (Acornhoek): Gomondwane, Kruger National Park (seed only) (DC), *Robbertse and Van Wyk* 232; 2431 (Acornhoek): Lecupan, Kruger National Park (DC),

*Robbertse* 227; 2431 (Acornhoek): Lecupan, Kruger National Park (DC), *Robbertse* 277; 2431 (Acornhoek): Lecupan, Kruger National Park (DC), *Robbertse* 817.

#### A. *xanthophloea*

TRANSVAAL—2230 (Messina): on farm of Department of Agricultural Technical Services, west of Messina on banks of Limpopo River (-AA), *Robbertse* 273; 2230 (Messina): Messina, west of bridge over Limpopo River (-AC), *Robbertse* 222; 2231 (Pafuri): Pafuri, Kruger National Park (-AD), *Robbertse* 223; 2431 (Acornhoek): 8 km outside Satara on road to Letaba, Kruger National Park (-BD), *Robbertse* 176; 2528 (Pretoria): Pretoria North (cultivated) (-CA), *Robbertse* 390.