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Research note

Taxonomic notes on the genus *Cocculus* (Menispermaceae) in southern Africa

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ABSTRACT

A review of the genus *Cocculus* in southern Africa is presented. Two species occur in Africa with only *Cocculus hirsutus* distributed in southern Africa. This review gives a complete synonymy and a formal description of the species, and the taxon account is supplemented with a detailed geographical distribution record within southern Africa and notes on the ecology and known traditional uses. *C. hirsutus* is a woody climber with slender stems, and is distinguished from other southern African members of the family by its heteromorphic leaves, male flowers with three rudimentary carpels and stamens surrounded by an auricle situated at the base of the petals, an endocarp with a sharp dorsal ridge and a circular condyle with conspicuous perforations.

1. Introduction

The Menispermaceae comprises approximately 70 genera and 500 species of herbaceous or woody, dioecious climbers with small inconspicuous flowers (Kessler, 1993; Ortiz et al., 2007). It is distributed throughout the tropical regions of the world with a few species extending their distribution into the temperate regions (Kessler, 1993; Ortiz et al., 2007).

Cocculus DC. is the fourth largest genus in the tribe Menispermaceae (Kessler, 1993) with approximately ten species distributed from tropical to temperate North America, Africa, Socotra, Asia and Australia (Jordaan, 2000). They are climbers, shrubs or small trees with leaves that are either entire or lobed. Male and female flowers occur in few- to many-flowered cymes (Kessler, 1993). *Cocculus* has been used in folk medicine in Africa and India for the treatment of hypertension and its related symptoms; the roots as antipyretic, diuretic and cholagogue and the leaves as an ingredient of fertility medicine for women (Iwu, 1993). In Arabia the fruits are used to make an intoxicating drink (Iwu, 1993).

Two species of *Cocculus*, *C. hirsutus* (L.) Diels and *C. pendulus* (J.R. Forst. & G. Forst.) Diels, occur in Africa (Klopper et al., 2006), with only *C. hirsutus* occurring in southern Africa (Germishuizen et al., 2006). *Cocculus* has not received taxonomic attention in southern Africa since the revision of the southern African Menispermaceae in the unpublished thesis of Botha (1975). The aim of this short paper is to revise the genus in southern Africa and to present a complete synonymy, formal description, notes on the ecology and all known traditional uses, as well as a detailed geographical distribution record.

2. Materials and method

Morphological data was gathered during field trips and from herbarium specimens from the following herbaria: BLFU, BM, BOL, GRA, K, LISC, LMU, NH, NBG, PRE, PRU, SRGH, and ZULU (acronyms according to Holmgren et al., 1990). Distribution records and habitat information were obtained from herbarium specimens and observations made during field trips.

3. Taxonomy

Cocculus DC. in Syst. Nat. 1: 515 (1817), *nomen cons.*, in Prodr. 1: 96 (1824); Miers, Ann. Mag. Nat. Hist. 2 (7): 41 (1851); Benth. in Benth. & Hook f., Gen. Pl. 1: 36 (1862); Miers in Contr. Bot. 3 (1): 249, t. 124 (1871); Prantl in Engl. & Prantl, Nat. Pflanzenfam. 3 (2): 84 (1894); Diels in Engl., Pflanzenr. 46 (IV–94): 227 (1910); Troupin in Fl. trop. E. Africa: 10 (1956), in F.Z. 1: 163 (1960), in Mém. Acad. Roy. Sci. Outre-Mer, Cl. Sci. Nat. Méd. 13: 221 (1962); Friedr.-Holzh. in Prodr. Fl. S.W. Afr. 38: 3 (1968); Troupin & Gonçalves in Flora de Moçambique 7: 16 (1973); Benv. in Webbia 29: 35 (1975); Kessler in Kubitzki et al.,

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0254-6299/

Fam. Gen. Vasc. Pl. 2: 417 (1993); Thulin, Fl. Somalia 1: 26 (1993); Jordaan in Strelitzia 10: 358 (2000). Type: Cocculus *hirsutus* (L.) Diels.

Cebatha Forssk., Fl. Aegypt.-Arab.: 171 (1775), *nom. rejic*. Type *Cocculus cebatha* DC.

Leaeba Forssk., Fl. Aegypt.-Arab.: 172 (1775), *nom. rejic*. Type: *Leaeba dubia* J.F. Gmelin.

Epibaterium J.R.Forst. & G.Forst in Charact. Gen.: 107 (1776), *nom. rejic*. Type: *Epibaterium pendulum* J.R.Forst. & G.Forst.

Nephroia Lour., Fl. Cochinch. 539 (1790), *nom. rejic*.; *Nephroia* Miers in Ann. Mag. Nat. Hist. 2 (7): 37, 42 (1851). Type: *Nephroia sarmentosa* Lour.

Baumgartia Moench, Meth.: 652 (1794), *nom. rejic*. Type: *Baumgartia scandens* Moench.

Androphylax Wendl., Bot. Beob. 37: 38 (1798), *nom. rejic*. Type: *Androphylax scandens* J.C.Wendl.

Wendlandia Willd., Sp. Pl. 2: 275 (1799), *nom. rejic*. Type: *Wendlandia populifolia* Willd.

Cocculidium Spach in Hist. Nat. Vég. Phanér. 8: 16 (1839). Type: *Cocculidium populifolium* (Willd.) Spach.

Adenocheton Fenzl. in Flora 27: 231 (1844), *nom. nud*.

Holopeira Miers in Ann. Mag. Nat. Hist. 2 (7): 42 (1851). Type: *Holopeira villosa* (Lam.) Miers.

Bricchettia Pax in Ann. di Bot. (Roma) 6: 181 (1897). Type: *Bricchettia somalensis* Pax.

Scandent shrubs or climbers, dioecious, young branches pubescent, becoming glabrescent. *Leaves* simple, petiolate, ovate to ovate-oblong, entire or lobed, 3- to 5-veined at base, pubescent, sometimes falling before flowering. *Male inflorescence* of many-flowered cymules which are either axillary and clustered 1–3 together, or solitary and arising from leafless branches. *Male flowers* small; sepals 6 or 9, in 2 or 3 whorls, outer smaller; petals 6, entire or bifid, with an inflexed auricle at the base surrounding the stamen, yellowish; stamens 6 or 9, free; anthers transversely dehiscent. *Female inflorescence* similar to male inflorescence but more simple or reduced to solitary or clustered flowers. *Female flowers* similar to male but with the base of the petals much less inflexed; staminodes 6 or 0; carpels 3(4)–6, ± ovoid; ovule solitary; style cylindrical, erect or recurved; stigmas recurved-spathulate. *Fruit* a drupe; obovate or subspherical-compressed with persistent style or stigma; purple; endocarp bony, horseshoe-shaped, transversely ridged; condyle ± circular, septum usually perforated. *Seed* curved; endosperm present as a thin layer, not ruminate.

3.1. Diagnostic characters

Cocculus is distinct from other members of the southern African Menispermaceae and is not easily confused. *Cocculus* can be easily identified by its heteromorphic leaves, with those on the lower part of the branches 3- to 5-lobed (Fig. 2c) and those on the upper part of the branches entire (Fig. 2b). The male flower is unique amongst the southern African Menispermaceae in that it has three rudimentary carpels and stamens surrounded by an auricle situated at the base of the petals (Fig. 2k). The endocarp also differs from the other southern African genera in that it has a sharp dorsal ridge, separated from the lateral ridges by a girdle of irregular ridges (Fig. 2m). The condyle is circular with conspicuous perforations (Fig. 2m). Keys to distinguish the genera of the southern African Menispermaceae were published by Botha (1980) and Jordaan (2000).

3.2. C.hirsutus (L.) Diels

Engl., Pflanzenr. 46 (IV–94): 236 (1910); Burtt Davy, Fl. Transv. 1: 113 (1926); Exell & Mendonça in Consp. Fl. Angol. 1: 41 (1937), 1: 358 (1951); Troupin in F.Z. 1: 163 (1960); Troupin in Mém. Acad. Roy. Sci. Outre-Mer, Cl. Sci. Nat. Méd. 13: 225 (1962); Benv. in Webbia 29: 41 (1975). *Menispermum hirsutum* L., Sp. Pl. 1: 341 (1753). *Menispermum villosum* Lam. in Encycl. 4: 97 (1797), *nom. superfl.* *Cocculus villosus* (Lam.) DC., Sys. Nat. 1: 525 (1817), *nom. illeg.* Holopeira *villosa* (Lam.) Miers in Ann. Mag. Nat. Hist. 3(19): 28 (1867), *nom. illeg.* *Cebatha hirsuta* (L.) Kuntze, Rev. Gen. Pl. 1: 9 (1891); *Cebatha villosa* (Lam.) C.Chris., Dansk Bot. Arkiv. 4 (3): 37 (1922), *nom. illeg*. Type: Plukenet, Amalth. Bot. 61, t. 384, fig. 7 (1705) (lecto., designated by Troupin, 1956). Note: This illustration was based on specimen “Indes Orientales” in Herb. Sloane 93: 107 (BM-SL!).

Menispermum myosotoides L., Sp. Pl. 1: 341 (1753). Type: Plukenet, Amalth. Bot. 62, t. 384, fig. 3 (1705) (lecto., designated here). Note: This illustration was based on specimen “Indes Orientales” in Herb. Sloane 94: 182 (BM-SL!).

Holopeira torrida Miers in Ann. Mag. Nat. Hist. 3 (19): 29 (1867). Type: Africa, *Cunon s.n.* (K! holo.; BM!, iso.).

Cocculus *villosus* (Lam.) DC. var. *glabratus* Schweinf. in Bull. Herb. Bioss. 4 (11): 180 (1896). Type: Eritrea, *Schweinfurth* & *Riva 1434* (G!, lecto. designated by Benvenuto (1975); FT, K!, P, iso.).

Scandent shrubs or lianas, woody; young stems yellow-brown and densely tomentose, becoming scabrous and glabrate. *Leaves* simple, alternate; petiole 5–20 mm, tomentose; lamina narrowly or broadly ovate to ovate-oblong, 40–80 × 25–55 mm, heteromorphic, lower leaves 3- to 5-lobed, upper leaves entire; venation palmate, 3 to 5 veins clearly visible on both sides; apex obtuse to rounded, mucronulate; base truncate or slightly cordate to rounded; dark green, shiny adaxially, lighter, dull green abaxially; young leaves densely pubescent, becoming glabrescent. *Inflorescence* a many-flowered cymule, 60–300 mm long, paired or solitary; inflorescence leaves usually smaller than rest of plant, 5 × 3 mm; bracts linear, 0.6–1.5 mm long, tomentose. *Male flowers* small; pedicels 0.5–1.0 mm long; sepals free, pubescent, in 2 or 3 whorls with 3,3 or 2,3,3 sepals (outside to inside), outer sepals oblong to lanceolate, 0.5–1.2 × 0.2–0.9 mm, inner sepals elliptical to obovate, 1.6–2.5 × 1.3–1.8 mm; petals 6, ovate–oblong, 0.7–1 × 0.4–0.6 mm, in 2 whorls, free, sparsely pubescent to glabrescent, furnished at the base with a fleshy inflexed auricle surrounding the stamen, apex often bifid or deeply emarginated; stamens 6, in 2 whorls, filaments free, slightly fleshy, anthers dorsifix, dehiscence transverse; 3 rudimentary carpels often present. *Female flowers* small; pedicels 1–1.8 mm long, pubescent; sepals free, in 2 or 3 whorls with 2,3 or 3,3 or 2,3,3 sepals (outside to inside); oblong to lanceolate, 0.9–1.8 × 0.3–0.9 mm, inner sepals obovate, 1.5–2.4 × 1.2–1.5 mm, sparsely tomentose; petals 6, ovate–oblong, 0.9–1.4 × 0.4–0.7 mm, in

Fig. 1. Slender stems and dimorphic leaves of *Cocculus hirsutus*. Photograph: B-E. Van Wyk.

2 whorls, free; staminodes 6, opposite petals, slightly fleshy, 0.3–0.4 mm long; carpels 3, free, style with stigma bending backwards. *Fruit* a drupe, obovate to rotund, 4–8 × 4–5 mm, purple when ripe; endocarp bony, horseshoe-shaped, dorsal ridge sharp, prominent, lateral ridges often inconspicuous and separated from the dorsal ridge by a girdle of irregular ridges; condyle circular, septum perforated, edge of condyle involute, composed of many radial ridges. *Seed* endosperm present as a thin layer; embryo curved; cotyledons plane. Figs. 1 & 2.

3.2.1. Distribution and habitat

C. hirsutus is widely distributed from southern China to Central Arabia and from Sudan and Eritrea south to South Africa (Troupin, 1960; Leistner, 2005). Within southern Africa, the species occurs in the northern parts of Namibia and Botswana, the north eastern parts of South Africa and Swaziland (Fig. 3). In South Africa this species has previously been considered to be a naturalized exotic (Germishuizen et al., 2006), however the authors find no reason for such a conclusion

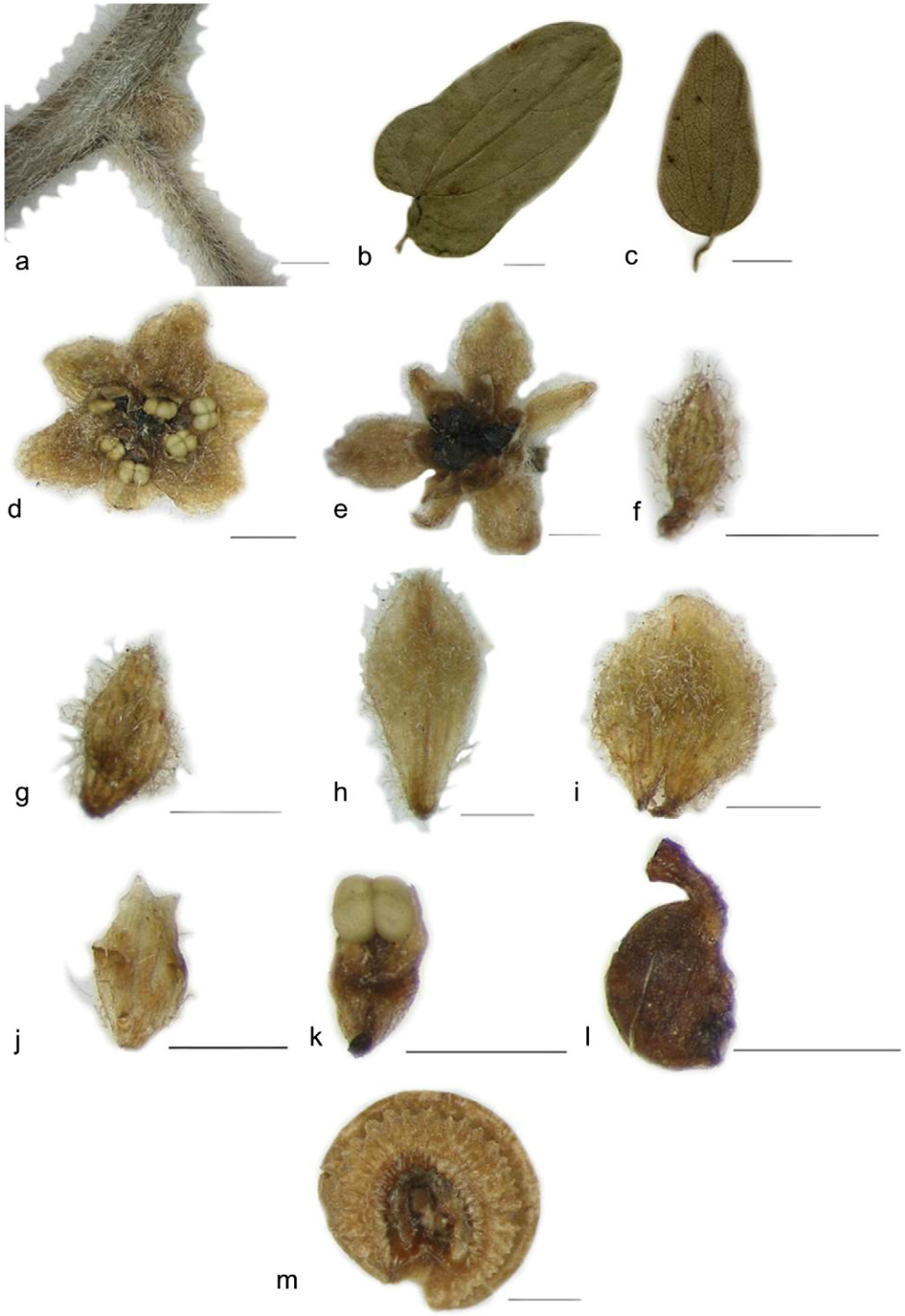

Fig. 2. *Cocculus hirsutus* (a) young, hairy stem; (b) lobed leaf on the lower part of stem; (c) ovate leaf on upper part of stem; (d) male flower; (e) female flower; (f) floral bract; (g) outer sepal; (h) middle row of sepals; (i) inner sepal; (j) petal; (k) stamen enclosed by petal; (l) carpel; and (m) endocarp. Scale bars: (a–k, m) 1 mm; (l) 0.7 mm. Vouchers: (a) *Van Wyk 4063* (JRAU); (b) *Giess 8980* (JRAU); (c) *Buitendag 588* (JRAU); (d, f, g, i, k) *Stalmans 1711* (JRAU); (e, h, j, l) *Menezes 3020* (JRAU); and (m) *Smith 2475* (JRAU). Photographs: H. de Wet.

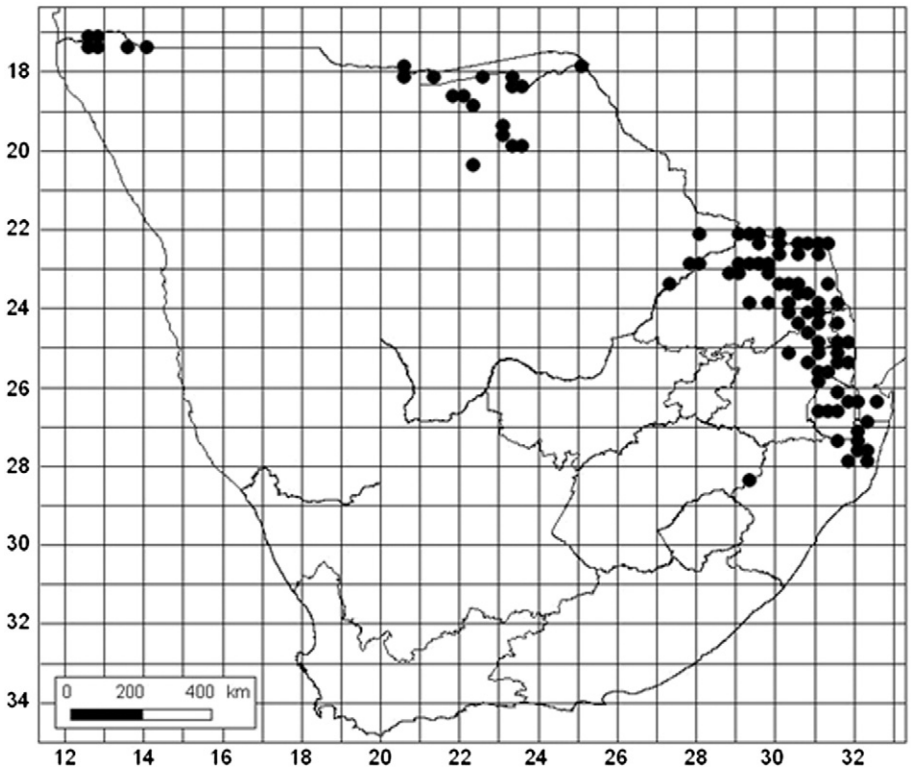

Fig. 3. Known geographical distribution of *Cocculus hirsutus* in southern Africa.

and consider the populations in South Africa to be natural.*C. hirsutus* grows in full sunlight in savanna and open areas and often forms a dense cover on top of other plants.

3.2.2. Phenology

C. hirsutus flowers from late summer through winter and spring into early summer (February to November).

3.2.3. Etymology and common names

The specific epithet, *hirsutus*, refers to the pubescence of the plant, especially on young branches and leaves. It has been named monkey rope on herbarium specimens [*Smith 2474* and *Polwier 88* (PRE)]. In the Tsonga culture it is known as 'risotse' or 'xootso', while in Botswana the names 'lexhi' (Seyei) and 'motsoketsane' (Thimbukushu) have been recorded (De Wet and Van Wyk, 2008; Van Wyk and Gericke, 2000). In India it is called the broom creeper (Satish et al., 2010).

3.2.4. Traditional uses

In the Limpopo province of South Africa, the stems are used for weaving baskets, such as the conical *xirundzu* basket of the Tsonga people (Liengme, 1981) and exceptionally strong flat baskets in Venda, an example of which is shown in Van Wyk and Gericke (2000, p. 301). In Ngamiland (Northern Botswana) the stems are used to form the central core or coil of overstitched Hambukushu baskets (Van Wyk and Gericke, 2000). The purple berries are used for dying the basket material and are eaten by the Shangaan people (De Wet and Van Wyk, 2008). In Botswana, a plant extract is given to babies to cure unspecified diseases (De Wet and Van Wyk, 2008). The leaves are an important herb in the diet of Tsonga people (Liengme, 1981).

3.2.5. Diagnostic characters

C. hirsutus can be distinguished from other species in the genus by the rounded leaf apex and endocarp with the dorsal and lateral ridges separated by a girdle of irregular ridges. The leaf apices of *Cocculus diversifolius* DC. are similarly rounded, but this species is restricted to North America (Rhodes, 1997). *C. hirsutus* might also be confused with *madagascariensis* Diels which shares a similar leaf shape with a lobed base, although the leaves of this species are much narrower (5–10 mm) (Diels, 1910) than that of *C. hirsutus* (25–55 mm). A key to the seven species of *Cocculus* based on the morphology of the endocarp was constructed by Forman (1974).

3.2.6. Additional specimens from southern Africa examined

Namibia. **1712 (Posto Velho)**: Kunene River on bank (–BA), *Hall 469* (BOL, NBG); *Compton 469* (NBG); Quelle Okonbambi, Baines Mountain (–BB), *Giess 8980* (PRE); 15 km up the Kapupa River, Otjihipa Mountain (–BC), *Davies, Thompson & Miller 68* (PRE); Otjomborombonga, main kloof to the south (–BD), *Leistner, Oliver, Steenkamp & Vorster 177* (PRE); Otjipemba, Baines Mountain (–BD), *Meyer 1305* (PRE). **1713 (Swartbooisdrif)**: SE of Ombepera on the Kunene River (–BC), *Leistner, Oliver, Steenkamp & Vorster 290* (PRE). **1714 (Ruacana Falls)**: Ruacana, small tributary of Kunene, 6 km SW of falls (–AC), *Leistner, Olivier, Steenkamp & Vorster 12* (PRE); *Giess & Lieppert 7603* (NBG, PRE). **1720 (Sambio)**: Nyangana, Okavango (–DC), *Schoenfelder S173* (PRE); Nyangana, SE of Runtu, Okavango (–DC), *Maguire 1651* (BOL, PRE). **1820 (Tarikora)**: Nyangana, Okavango (–BA), *Schoenfelder S173* (PRE). **1821 (Andara)**: On road from Andara to Bagani (–AB), *Merxmüller & Giess 1997* (PRE); Andara Missionary (–AB), *Watt 33* (PRE); E from Cuando River (–BC), *Curson 1175* (PRE). **1822 (Kangara)**: Nyangana, E from Runtu (–BA), *Maguire 1651* (PRE). **1823 (Siambisso)**: E of Kwando River (–AB), *Curson 1175* (PRE).

Botswana. **1725 (Livingstone)**: Chobe River, Kasane (–CC), *Van Son sub TRV 28945* (PRE). **1821 (Andara)**: Tsodilo Hills, Ngamiland (–DB), *Banks 23* (PRE). **1822 (Kangara)**: Nyanzana, Okavango N Reserve (–CA), *Maguire 1651* (NBG); Banks of Okavango at Seronga (–CD), *Story 4744* (PRE). **1823 (Siambisso)**: Floodplains (–AD), *Smith 2474* (PRE); Near the Ngamiland/Chobe district boundary road (–BC), *Smith 4338* (PRE). **1923 (Maun)**: Moremi National Park (–AC), *Van Wyk BSA96* (PRU); Island, Boro floodplain (–CA), *Biggs M630* (PRE); Maun (–CD), *Lambrecht 281* (PRE); *Van Son 27092* (NH), *28946* (PRE);

Maun Camp, banks of the Thamalalan River (–DC), *Erens 313* (K, PRE, SRGH); Maun, 7 km downstream on Thamalakane River (–DC), *Cole 842* (PRE). **2022 (Lake Ngami)**: Banks of the Thaoge River, Gomare (–AD), *Erens 246* (PRE). **2227 (Palapye)**: Groblersbridge Border Post: Bank of Limpopo River, 5 km from border post (–DD), *Venter 2033* (PRE). **2228 (Maasstroom)**: Maiswe, 15 km SW of Bobonong (–AA), *Woollard & Kgathi 2211* (PRE); Tuli block, 20 km NE of Sherwood, Limpopo River (–CC), *Cole 816* (PRE).

South Africa. LIMPOPO PROVINCE. **2229 (Waterpoort)**: Breslau (–AA), *Polwier 88* (PRU); Greefswaldt (–AB), *PRU Plant Hons. Students 167* (PRU); Greefswaldt, Mapungubwe River (–AB), *Eicker 377* (PRU); Greefswaldt, Hill above Limpopo River (–AB), *PRU Plant Hons. Students 146* (PRU, PRE); Overvlakte, Limpopo Valley (–BA), *Pole Evans 4446(26)* (PRE); Farm Little Muck 604, Galampies River, Dongola Reserve (–BC), *Codd 4181* (PRE); Langjan Nature Reserve (–CC), *Zwanziger 812* (PRE); Soutpan, Soutpansberg (–CD), *Bremekamp & Schweickerdt 314* (PRE), *Galpin 15131* (PRE), *Hardy 410* (PRE); Farm "Scott", Soutpansberg, 6 km E from Soutpan, Vivo distr. (–CD), *Scott 298* (PRE); Farm Soutpan, near pan and homestead (–DC), *Obermeyer, Schweickerdt & Verdoorn 284* (PRE); Wyliespoort (–DC), *Rodin 4223* (BOL); Waterpoort (–DC), *Rogers 21551* (PRE), *Van der Vyver sub PRE 32089* (PRE); Delamere 731 MS (–DD), *Raal 583A* (PRE); Close to Tshirolwe against north cliff of Soutpansberg (–DD), *Van Wyk 2774* (PRU, PRE). **2230 (Musina/Messina)**: Messina (–AA), *Acocks & Häfstrom 501* (PRE); *Galpin 9190* (PRE); Farm Klein Bulai, 15 km W from Messina (–AC), *Gerstner 5451* (PRE); Flood bed of Limpopo River, near the gorge (–AC), *Young sub TRV 26916* (PRE); Messina, Venda (–BC), *Van Wyk 3592* (PRU); Shabin, Kruger National Park (–BD), *Van der Schijff 673* (PRU); Tsipise (–CA), *Verdoorn 2001* (PRE); 40 km NE from Sibasa, near Sambandou (–DA), *Codd 6906* (PRE). **2231 (Pafuri)**: Kruger National Park, Look-out point at Pafuri (–AC), *Botha 626* (BLFU); Banks of Pafuri River, near its junction with Limpopo River (–AC), *Obermeyer sub TRV 28330* (PRE); Pafuri, Levubu River, Kruger National Park (–AD), *Van Rooyen & Bredenkamp 607* (PRU); Punda Maria, Kruger National Park (–CA), *Lang sub TRV 32252* (PRE). **2327 (Lephalale/Ellisras)**: Tuli block, 25 km SW of Sherwood (–AD), *Cole 771* (PRE). **2328 (Baltimore)**: Blouberg (–BB), *Van Wyk 899* (PRE). **2329 (Polokwane)**: Kibbi (–AA), *Schlechter 4623* (NBG, PRE, PRU); Louis Trichardt (Makhado) (–BB), *Stayt 12* (PRE); Magalawin (–CD), *Van der Schijff 6634* (PRE, PRU); Pietersburgrylaan, Houtbos (–DD), *Burtt Davy 2598* (BOL). **2330 (Tzaneen)**: Giyani distr. Rotterdam (–AD), *Liengme 189* (PRE); 4 km S of Giyani, Ngobe (–BC), *Liengme 89* (PRE); 19 km NE from Duiwelskloof (–CA), *Botha 871* (BLFU); 0.5 km on road to Modjadi from Duiwelskloof to Soekmekaar direction (–CA), *Botha 872* (PRU), *Davison 14/75* (NBG); Letsitele town, railway bridge (–CD), *Van Wyk & De Wet 4062* (ZULU); 70 km N of Gravelotte station on banks of Letaba River (–DA), *Galpin 13522* (PRE); Silwane Township (–DB), *Breijer sub TRV 17581* (PRE). **2331 (Phalaborwa)**: Banks of Tsendespruit, Kruger National Park (–AD), *Botha 604* (PRU); Malopeni, just outside Kruger National Park (–CC), *Jacobs 8600* (PRE); Mashangani on road to Blauwkop (–CC), *Breijer sub TRV 16025* (PRE); Letaba Rest Camp (–DC), *Lang sub TRV 30936* (PRE). **2430 (Pilgrims Rest)**: Farm Zwin (–AB), *Fourie 7/132* (PRE); Legalameetse Nature Reserve, Ballon, SE corner of reserve (–AB), *Stalmans 1711* (PRE); 6 km W of Mica on granite hill (–BB), *Van Rooyen 319* (PRU); Abel Erasmus Pass (–BC), *Botha 882* (PRU); Strydom tunnel (–BC), *Van Wyk 357* (BLFU); *Simon & Leach 2244* (PRE); Farm Grovedale 239KU, 5 km west of Hoedspruit (–BD), *Zambatis 1435* (PRE). **2431 (Acornhoek)**: Sheila 10KU, 14 km S from Phaloborwa (–AA), *Retief 190* (PRE); Klaserie, Farm Charloscar (–AA), *Zambatis 1620* (PRE); Klaserie River (–AC), *Smuts 2379* (PRE); Mwanetzi, between Olifants River and Satara, Kruger National Park (–BC), *Van der Schijff 630* (PRE); Seekoeigat, Sabie River (–CC), *Van der Schijff 3932* (PRE); Skukuza, Kruger National Park (–DC), *Codd 6124* (PRE); *Van der Schijff 2160* (PRE); Skukuza Rest Camp (–DC), *Codd 6124* (PRE); Splenic Fever Research Institute on bank of Levubo River, Kruger National Park (–DC), *Botha 643* (PRU); 20 km from Skukuza on road to Tshokwane (–DD), *Botha 884* (PRE), *Buitendag 80* (PRE); *588* (PRE).

MPUMALANGA. **2430 (Pilgrims Rest)**: Swadini Nature Reserve, along road to dam wall (–DB), *Herman 758* (PRE); Near Blyderiver picnic spot (–DB), *Van der Schijff 6123* (PRE). **2529 (Witbank)**: Aasvoëlkrans, Witbank distr. (–CB), *Smit 2351* (PRU). **2530 (Lydenburg)**: Bayersfort, Farm Bothashoek (–AB), *Repton 5960* (PRE); Lowveld Botanic Garden, Nelspruit (–BD), *Buitendag 80* (NBG, PRU, PRE), *588* (NBG, PRE); Research station, Nelspruit (–BD), *Liebenberg 2690* (PRE). **2531 (Komatipoort)**: Turnoff to Hazyview Station (–AA), *Botha 883* (PRE); Sabie Valley, Hot Springs (–AA), *Fisher 1646* (PRU); Sabie River, close to hippopotamus pool (–AA), *Van der Schijff 3932* (PRE); 25 km from Skukuza to Malelane, Kruger National Park (–BA), *Van der Schijff 2160* (PRE); Crocodile River, Malelane, Kruger National Park (–BC), *Van Rooyen & Bredenkamp 728* (PRU); Komatipoort (–BD), *Rogers 20339* (GRA), *sub TRV 19208* (PRE), *20329* (PRE); 6 km E of Noordkaap, Barberton distr. (–CA), *Acocks 12871* (PRE); 16 km on Kaapmuiden road from Barberton turnoff (–CA), *Germishuizen 3287* (PRE); *Gorge of Crocodile Poort* (–CA), *Rogers 23912* (PRE); On the road from Barberton to Nelspruit, 13 km S from Nelspruit (–CA), *Teichman 87* (PRU, PRE); Clutha N of Barberton (–CA), *Thorncroft 588* (NH); Low's Creek (–CB), *Botha 888*, *Wager sub TRV 22433* (PRE); Nlambana Dam, Malelane, Kruger National Park (–CB), *Brynard & Pienaar 4448* (PRE); Ross Siding, Singerton, Barberton (–CC), *Burtt-Davy 8036* (PRE); 18 km NE from Barberton, between Barberton and Kaapmuiden (–CC), *Codd 1630* (PRE); Barberton distr. (–CC), *Pole Evans 2943* (PRE); Lomati Valley, Barberton (–CC), *Thorncroft 2138* (PRE).

FREE STATE. **2829 (Harrismith)**: Van Reenen Pass (–AD), *Schlechter 6979* (GRA).

KWAZULU-NATAL. **2632 (Bela Vista)**: Mavilo Hill, Pongola floodplain (–CD), *Moll 4267A* (NH, PRE); Ndumo Game Reserve (–CD), *Pooley 545* (NH); *Van Wyk BSA 360* (PRU); *Ward 2355* (NH). **2731 (Louwsburg)**: Pongola River Bridge (–BC), *Botha 300* (BLFU, PRE, PRU); Pongola River *Botha 889* (PRE, PRU); 40 km north of Hlabisa (–DD), *Edwards 2539* (PRE). **2732 (Ubombo)**: 30 km N of Josini, on the way to Ingwavuma (–AA), *Botha 309* (PRU); Ubombo Mountain, S from Josini (–AC), *Botha 303* (PRU); 8 km SE from Josini (–AC), *Botha 329* (PRU); Otobotini (–AC), *Gerstner 6685* (BOL); Near Mkuze on Lebombo flats (–AC), *Galpin 13336* (BOL, PRE); Mkuze Station (–CA), *Gerstner 5127* (PRE); Bartlow Combine (–CA), *Ward 3453* (NH, PRE); Ubombo Mountians (–CA), *Venter 1753* (ZULU); Ubombo Mountains, eastern slope (–CA), *Venter 1753* (PRE); Mkuze Game Reserve (–CB), *Ward 3143* (NH, PRE); False Bay Park, western boundary near main gate (–CD), *Ward 7136* (PRE).

Swaziland. **2631 (Mbabane)**: Blue Hay Ranch, Lebombo Mountains, 6 km W and upstream from Mozambique border in gorge of Black Mbuluzi River (–BA), *Culverwell 902* (PRE); Near Croydon, Manzini (–BA), *Compton 27032* (NBG, NH, PRE); Balegane, Manzini (–BA), *Compton 29025* (NBG, NH, PRE); Umtintegwa, Stegi-Sipofaneni road (–BD), *Compton 28035* (NBG, NH, PRE); Near Ngwempisi River, Mankaiana (–CA), *Compton 28926* (NBG, PRE); Croydon, Manzini (–CB); *Compton 2076* (PRE); Maphikane, Manzini (–CB), *Karsten sub PRE 32090* (PRE); Siphofaneni (–DA), *Kemp 935* (PRE); Sihadla River crossing, Swamp forest (–DD), *Strey & Moll 3910* (NH, PRE). **2632 (Bela Vistan)**: Farm Mlawula, Lebombo Mnt. 7 km SSE of Mlawula station in valley of Nkumbane stream (–AC), *Culverwell 917* (PRE).

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