

Flowering Plants of Africa

Volume 63

June 2013



Flowering Plants of Africa

Since its inception in 1921, this serial, modelled on the former *Curtis's Botanical Magazine*, has published well over 2 000 colour plates of African plants prepared by some 80 artists.

The object of the serial is to convey to the reader the beauty and variety of form of the African flora, to stimulate an interest in the study, conservation and cultivation of African plants and to advance the science of botany as well as botanical art.

The illustrations are mostly prepared by artists on the staff of the South African National Biodiversity Institute, but we welcome other contributions of suitable artistic and scientific merit. Please see *Guide for authors and artists* on page 145.

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History of this series

(note Afrikaans translation and changes in title)

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Cover illustration: *Erica verticillata* (Plate 2296)

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Flowering Plants of Africa

A magazine containing colour plates with descriptions of
flowering plants of Africa and neighbouring islands

Edited by

A. Grobler

with assistance of

G.S. Condy

Volume 63



Pretoria
2013

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Crotalaria agatiflora subsp. *agatiflora*

Leguminosae

East and northeast Africa

Crotalaria agatiflora Schweinf. subsp. *agatiflora*, Schweinfurth: 13 (1892); Taubert: 206 (1895); Baker: 315 (1914); Brenan: 414 (1949); Polhill: 205 (1968). Polhill: 72-74 (1982).

Crotalaria L. is a large genus in the Leguminosae family with approximately 690 species (Lewis *et al.* 2005; Le Roux & Van Wyk 2012). The genus is distributed in the tropical and subtropical areas of the world with the majority of species found in Africa and Madagascar (Polhill 1968; Polhill 1982; Lewis *et al.* 2005). Polhill (1968) studied the genus extensively after Milne-Redhead (1961) and recognised 432 species for the African continent. About 54 indigenous species are found in southern Africa (Nkonki & Swelankomo 2003) of which four are exotic species and declared invasive alien species or weeds (Germishuizen *et al.* 2006). Other species in the genus are also known to occur in India, America and China (Lewis *et al.* 2005; Le Roux *et al.* 2011). The genus shows a remarkable diversity in its morphology, which greatly facilitates the differentiation of individual species, but variation between the species is of a markedly reticulate nature precluding any simple division of the genus into sections (Polhill 1968). *Crotalaria agatiflora* has five subspecies and subsp. *agatiflora* differs from the other four by its bracteoles which are less than 2.0(–3.5) mm long and its ovate-elliptic leaflets that are less than twice as long as broad, usually glabrous beneath. There are various common names for *C. agatiflora* subsp. *agatiflora* including bird flower, canary bird bush, rattlebox, Queensland bird flower and *voëltjebos*. The common name, rattlebox, is derived from the fact that the seeds become loose in the pod as they mature and rattle when the pod is shaken.

The plant illustrated here is indigenous to tropical East Africa and northeast Africa (Tanzania and Kenya). In southern Africa it occurs in Namibia, South Africa (Gauteng, North West, Limpopo, Mpumalanga, KwaZulu-Natal and the Western and Eastern Cape) and has become naturalised in Australia (Queensland), New Zealand and South America. Distribution of *Crotalaria agatiflora* subsp. *agatiflora* in Africa, based on the PRE Computerised Information System (PRECIS), Southern African Plant Invaders Atlas (SAPIA 2011) and Global Biodiversity Information Facility (GBIF 2013) databases, is presented in Figure 1. Canary bird bush was first introduced into South Africa as an ornamental plant. The earliest known record in the Pretoria National Herbarium is from the Johannesburg Railway Horticulture Garden dated 1921 in the Johannesburg area. According to SAPIA, the earliest record of its establishment in the wild is from the Rustenburg and Brits area in North West. It has escaped from cultivation into natural areas and has been recorded in conservation areas and reserves in Pretoria such as the Colbyn conservancy area, and Faerie Glen, Groenkloof and Wonderboom Nature Reserves (Henderson & Musil 1987; SAPIA 2011).

PLATE 2287.—1, flowering stem × 1. Voucher specimen: *Condy 251* in National Herbarium, Pretoria.
2, fruiting branch × 1. Voucher specimen: *Condy 253* in National Herbarium, Pretoria. Artist: Gillian Condy.



PLATE 2287 *Crotalaria agatiflora* subsp. *agatiflora*

Crotalaria species are widely used in Chinese traditional medicine to treat several types of internal cancers. In the United States of America some species, such as *C. pumila*, are used to treat yellow fever and skin rashes. In the Siaya area, Kenya, the roots are used as a remedy for gastrointestinal discomfort (Kokwaro & Johns 1998). *Crotalaria agatiflora* subsp. *agatiflora* is used as a medicinal plant in several African countries for the treatment of bacterial infections and cancer (Le Roux *et al.* 2011). In Ecuador *C. agatiflora* subsp. *agatiflora* is also traditionally used as a decoction to treat cancer. The above ground parts of *C. agatiflora* subsp. *agatiflora* are used in its native range to treat otitis media, a bacterial infection of ears, as well as for treatment of sexually transmitted diseases (Le Roux *et al.* 2011). In India other species of *Crotalaria* has similar uses, where it is used to treat eczema and the leaves are placed on cuts or wounds to aid the healing process. Sharma *et al.* (1967) found that *C. agatiflora* subsp. *agatiflora* relieves spasms in dogs, found to be a good relaxant, and lowered blood pressure during treatment.

A few *Crotalaria* species are consumed by humans in some parts of the world, however, many species are known to be toxic to humans and livestock. Examples include (but are not limited to) *C. oridicola*, *C. barkae*, *C. berteroana* and *C. retusa*. Toxicity has been proven in the genus *Crotalaria* to be due to the presence of pyrrolizidine alkaloids in plants and seeds (Pilbeam & Bell 1979). All plant parts of *C. agatiflora* subsp. *agatiflora* have been reported not to be toxic or poisonous.

In South Africa *Crotalaria agatiflora* subsp. *agatiflora*, is a declared category 1a species according to the National Environmental Management: Biodiversity Act (2004) and listed as a proposed invader in the Conservation of Agricultural Resources Act (1983). This species was previously misidentified as *C. agatiflora* subsp. *imperialis* (Macdonald *et al.* 2003). It grows in watercourses in Grassland and Savanna biomes; potentially invasive in forest margins and also occupies cleared grassy areas in South Africa. In some parts of the world where it has been introduced, it is regarded as an agricultural, environmental and garden weed. For example in Australia it is regarded as a minor environmental weed that has escaped cultivation and invading grasslands and areas with sandy soils (Cooperative Research Center for Australian Weed Management 2013). This is also the case in South Africa where the species has escaped cultivation and has established itself in the wild. According to herbarium material in the National Herbarium, Pretoria, *C. agatiflora* subsp. *agatiflora* is frequently collected along roads and railways, near rivers, gardens and natural habitats. Ecological data was compiled from herbarium specimens (collected from

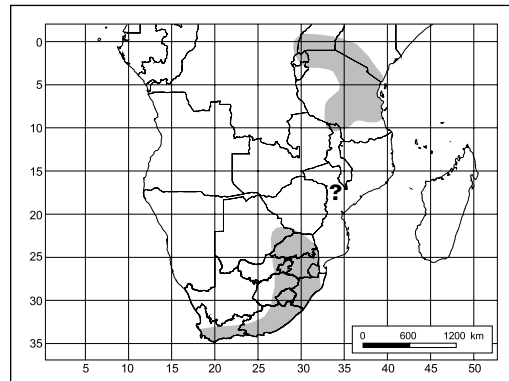


FIGURE 1.—Distribution range of *Crotalaria agatiflora* subsp. *agatiflora* based on herbarium records in the National Herbarium, Pretoria, and SAPIA and GBIF databases. The question mark (?) indicates regions of possible occurrence where records were not found.

1921–2011) and SAPIA records. Sixty-five percent were recorded near road sides, five percent along rivers, 10 percent in natural areas (including nature reserves) and 18 percent in urban areas including gardens.

Crotalaria agatiflora subsp. *agatiflora* reproduces and spreads exclusively by seeds. The average number of pods produced per plant is 50 and number of seeds per pod is 28. Seeds germinate in early summer.

Although no studies have focused on its effects on natural ecosystems, canary bird bush may affect the ecology of invaded areas in several ways for example through the enhancement of nitrogen levels in the soil. The species threatens watercourses in Grassland and Savanna biomes where it has been introduced. Furthermore, it has the potential to invade forest margins and often occupies cleared grassy areas and disturbed sites.

Description—Perennial woody herb, 0.3–2 m high, usually much branched, glabrous. *Leaves* 3-foliolate; leaflets ovate-elliptic, 25–90 × 10–35 mm, glabrous to densely hairy; petioles 30–120 mm long, mostly longer than leaflets. *Stipules* linear and caducous or absent, 4–12 mm long. *Racemes* stoutly pedunculate, many-flowered; flowers 40–50 mm long; bracts linear to attenuate-lanceolate, up to 16–20(–24) × 1–6(–9) mm; bracteoles filiform, 0.5–3.5 mm long. *Calyx* 18–30 mm long, with upper and lateral lobes joined almost to tips on either side, ± twice as long as tube; pedicels about 15 mm long, glabrous-glaucous or villose. *Standard* ovate, lemon-yellow to greenish yellow, sometimes medially pubescent outside; wings half to two-thirds as long as keel; keel broadly rounded, with a relatively short, projecting, often greenish or purplish beak, 11–55 mm long. *Pod* oblong-clavate, narrowed to a 15–25 mm long stipe, ± 75–100 mm long, glabrous. *Seeds* tumid, 6–7(–9) mm long, ± smooth. *Flowering time*: January–December in South Africa. Plate 2287.

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Turnera oculata var. *oculata*

Turneraceae

Namibia, Angola

Turnera oculata Story var. *oculata* in *Bothalia* 7: 493 (1961).

Turnera oculata Story var. *oculata* is a rare, sparingly to much branched rather slender shrub bearing densely hairy leaves and striking yellow flowers. The flowers have dark shiny circular parts with light centres, resembling an eye. The Latin specific epithet (*oculata* = eye) alludes to this distinct feature. It grows in dry sandy streambeds and on mountain plateaus in the desert and arid savanna regions of the lower Kunene River (Kaokoveld in Namibia and adjacent southern Angola). Plateaus include those of Okahukumune and the southern margin of the Otjihipa Mountains in arid savanna near Orukatuwo, Namibia. The var. *paucipilosa* usually grows on the western escarpment mountains.

During a visit to the Kaokoveld in July 2004, investigating the cliffs of the high twin-peaked Okahukumune Mountain (just below 2 000 m), a tall shrub was encountered resembling a species of *Hibiscus*. The plant was later identified as *Turnera oculata* var. *oculata* by Braam van Wyk of the H.G.W.J. Schweickerdt Herbarium, University of Pretoria. Plants were found growing in a dry sandy gravel stream bed just south of Okahukumune, together with *Colophospermum mopane*, *Acacia reficiens*, *Sesamothamnus benguellensis* and *Tamarix usneoides*. Upon further investigation it was found that this attractive species grow widespread in the Namib Desert along both sides of the lower Kunene River valley, from the western end of the Baynes Mountains towards the coast. The vegetation in the western part of its distribution consists of hot desert and most trees and shrubs are confined to dry river beds or rocky outcrops. Apart from the aforementioned companion species, the mustard tree (*Salvadora persica*) and *Commiphora virgata* shrubs are relatively common in this area. Rainfall is mainly during summer and autumn, ranging from 75–100 mm per annum.

An interesting feature of *Turnera oculata* is the pair of extrafloral nectaries just below the leaf blade and at the top of the petiole (abaxial surface). The nectaries secrete a sweet clear nectar droplet utilised by local ants, which in turn protect the plant. This mutualism benefits both plant and insect. Deserts hold little moisture and food resources, and competition is intense among insects and other herbivores. The protection from ants is vital for the plant's survival. At Iona Peak (north of the Kunene River in Angola) one of us (EJVJ) deliberately placed his hand on *T. oculata* var. *paucipilosa*. Within seconds ants were crawling all over his hand, biting viciously. A notable exception is *Acraea brainei* of which both butterflies and larvae feed from

PLATE 2291.—1, flowering branch, × 1. Voucher specimen: Van Jaarsveld 19527 in Compton Herbarium, Kirstenbosch. 2, capsule, × 2. Voucher specimen: De Winter & Leistner 3770 in National Herbarium, Pretoria. Artist: Gillian Condy.



PLATE 2291 *Turnera oculata* var. *oculata*

T. oculata, seemingly unmolested by ants. Extrafloral nectaries are well known in some other local plants groups such as *Rogeria* (Pedaliaceae) and *Adenia* (Passifloraceae).

Turnera oculata var. *oculata* belongs to the family Turneraceae (which in modern classification systems is usually placed in the Passifloraceae) which is not well represented in southern Africa. Turneraceae *s.str.* is a small family consisting of 10 genera and about 120 species of which most occur in South America (Willis 2005). Of these, most (about 60) belongs to the genus *Turnera*. Therefore, it is somewhat surprising to find *T. oculata* with its two

subspecies occurring in Namibia and Angola. In southern Africa only four genera and 11 species of the Turneraceae have been recorded (Bredenkamp 2003; Thulin *et al.* 2012). The genus is also represented in northeast Africa by a closely related species, *T. thomasi*, presenting a rare case of both trans-Atlantic, as well as African arid corridor disjunction in the genus (Thulin *et al.* 2012). *Tricliceras* Thonn. ex DC. (previously known as *Wormskioldia* Thonn.) is the best represented with six known species mainly confined to the northern savanna regions of South Africa and into Namibia. The other genera locally recorded, includes a newly described monotypic genus *Afroqueta* Thulin & Razafim., and *Streptopetalum* Hochst. with one species in southern Africa.

Turnera oculata var. *oculata* was discovered by Dr Bernard de Winter and Dr Otto Leistner at Otjinungua during their expedition to Koakoveld in 1957 (Gunn & Codd 1981). Two varieties have been recorded; the other variety, var. *paucipilosa* grows on regions of the Baynes Mountains, usually above 1 000 m, in arid savanna. This is a much smaller and sparingly hairy shrublet with distinctly longer floral bracts. This variety was named by Amelia Obermeyer (Mrs Mauve) in 1974 from plants collected by Wilhelm Giess [1910–2000], a botanist from Windhoek, Namibia and the specific epithet alludes to its sparse indumentum in comparison to the var. *oculata*. Subsequently, populations of *T. oculata* var. *paucipilosa* have also been found on the northern side of the Kunene River on the Iona Mountain in Angola.

Turnera oculata var. *oculata* is an attractive shrub with horticultural potential. The plant is easily grown and flowers freely. Flowering specimens in the Botanical Society Conservatory at the Kirstenbosch National Botanical Garden always attract a lot of attention from visitors. The plant is best grown in desert gardens (Van Jaarsveld 2010). Semi-hardwood cuttings can be prepared during the warmer summer months in a mixture of peat and polystyrene or sand. Rooting is rapid and the plant will flower after the third year.

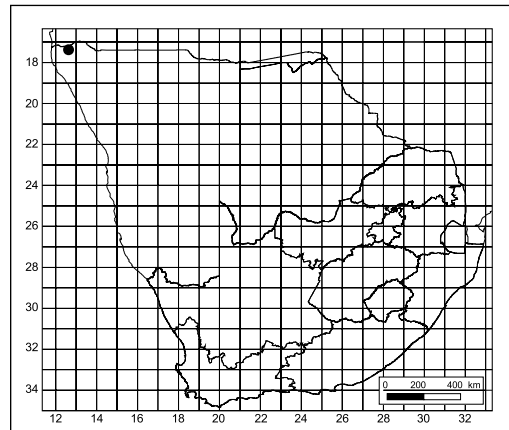


FIGURE 1.—Distribution of *Turnera oculata* var. *oculata* based on specimens in the National Herbarium, Pretoria.

Like most plants grown from specimens collected in the wild, cultivation of *Turnera oculata* var. *oculata* is a rather complex procedure. Furthermore, non-succulent plants, such as *T. oculata* var. *oculata*, are generally more difficult to grow than succulent plants. Vegetative material was gathered in the field using a sharp pair of secateurs or knife. When non-succulent cuttings are prepared, plants require 'frail care' for at least the first month, from the time of collecting until the roots appear. The cuttings of *T. oculata* var. *oculata* were first stored in moist cloth or newspaper (to prevent desiccation in hot and dry weather) and placed in a cool box. Time is crucial and the collected material must ideally reach a nursery mist bed within a week, as the foliage may drop. Foliage is vital in sequestering energy from the sun through photosynthesis for root production. Upon arrival at Kirstenbosch, the cuttings were prepared. Each branch was cut just below a node, the lower leaves removed and the basal portion of the cutting prepared with hormonal rooting powder Seradix (indolebutyric acid) to stimulate root formation. This is not essential, as plants should root without the hormone, however, it could take twice as long and is often less effective. The cuttings were then placed in a container in rooting medium, which can be pure sand or a mixture of sand, peat and polystyrene. The latter provides aeration and good drainage, which is essential for root formation. Sufficient light is very important. Rooting under controlled conditions (controlled heat and occasional misting) is usually rapid, after which the plants are transplanted and transferred to individual containers and placed in a warm but shady position to harden off. The hardening process is a crucial part of the procedure, as a sudden change to full sun will damage the leaves and can lead to death. Once well-rooted the plants were planted out in the Botanical Society Conservatory. The plant used for figuring the accompanying plate reached maturity and first flowered during 2007. Presently it stands 2 m high. Plants flower almost throughout the year and their striking flowers attracting much attention. It is also interesting to note that the pair of extrafloral nectaries quickly attracted local ants.

Little is known about the dispersal of its seeds. At this stage without evidence, one can only speculate. The seeds are relatively small and have arils, which suggest dispersal by ants (Van der Pijl 1982). Availability of water could also play a role as these dry streambeds are sometimes subject to flash floods.

Key to the varieties of *Turnera oculata*

- 1a Plants erect, slender shrubs, 1 m and taller; pubescence velvety; bracts 8–10 mm long var. *oculata*
 1b Plants small, shrublets less than 1 m tall; pubescence sparse; bracts 11 mm or longer var. *paucipilosa*

Description.—Plants slender, fairly fast growing, erect and sparingly branched shrubs to 2 m tall, the vegetative young stems and leaves are densely velvet pubescent. *Surface indumentum* consists of stellate and simple silvery hairs. *Leaves* ovate to obovate, up to 25–35 × 12–20 mm; apex acute; base cuneate; petiole 7 mm; leaf margin dentate, the lower margin interrupted at the junction of petiole and leaf margin by two oblong circular, reddish-rimmed extrafloral, nectar-secreting glands about 1.5 mm across; stipules minute. *Petiole* and veins on lower surface pale whit-

ish green. *Flowers* solitary, axillary; pedicles fused to the petioles; bracts 2, filiform 8–9(–10) mm long. *Calyx* tubular, 12 × 9 mm, 10-nerved, lobes linear lanceolate 20–25 × 8 mm. *Petals* convolute, inserted on calyx throat, spreading, broadly obovate, 45 × 25 mm; apex obtuse to subacute, base cuneate, bright yellow, the inner portion purplish-black, shiny with a whitish centre. *Stamens* 5, exserted, filaments 30 mm long, arcuate, margins shortly winged, adhering to calyx tube below; anthers basifixed, introrse. *Ovary* cylindrical, obtuse, pubescent, ovules pluriseriate, numerous. *Styles* 3, 35 mm long; stigmas fimbriate. *Capsule* 3-valved, ovoid, about 9 mm long, pubescent and pustulate. *Seed* cylindrical curved, 4 mm long, cream, reticulate with membranous aril. Plate 2291.

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