Dovyalis keniensis (Salicaceae), a new species from the coastal forests of Kenya

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Summary. *Dovyalis keniensis* E. V. Williams (Salicaceae) is described as a new species from the coastal forests of Kenya. The species is illustrated, its distribution mapped and conservation status assessed. It is compared with *D. mollis* (Oliv.) Warb. and *D. hispidula* Willd. A key to the four species of *Dovyalis* in Kenya is presented.

Key Words. conservation, hotspot, new taxa, red list.

Introduction

The genus *Dovyalis* E. Mey. ex Arn. contains 18 species. It is in the family Salicaceae but was previously placed in Flacourtiaceae (Chase *et al.* 2002). *Dovyalis* is found primarily in subtropical and tropical Africa, with one species *D. hebecarpa* (Gardner) Warb. found in Sri Lanka. The genus was revised by Sleumer (1972) who recognised 15 species and one imperfectly known species. Cheek & Ngolan (2006) described a new species *D. cameroonensis* from Cameroon and Nigeria and resurrected *D. macrocarpa* Bamps. The *Flora of Tropical East Africa* (F.T.E.A.) account of *Dovyalis* (Sleumer 1975) contains six species and one species named *Dovyalis* sp. A. This latter species was described in F.T.E.A. from three herbarium specimens as “imperfectly known, should be observed and collected again more completely” (Sleumer 1975: 66). These three specimens were from female plants from three localities along the Kenya coast (Arabuko-Sokoke forest, Gede and Mrima Hill). Since 1975, more specimens have been collected along the Kenya coast, mainly by Quentin Luke and Anne Robertson. The most recent specimen from 2009 was collected by the “Seeds For Life” seed conservation project, a collaboration between the Millennium Seed Bank Partnership at the Royal Botanic Gardens, Kew and five Kenyan government organisations. There are now thirteen specimens of *Dovyalis* sp. A at EA and K herbaria, from seven localities along the coast of Kenya, including one specimen from a male plant. With material available from female and male plants it is timely to formally describe *Dovyalis* sp. A. as a new species.

***Dovyalis keniensis* E. V. Williams sp. nov.** Type: Kenya, Kilifi Distr., Gede, 15 m, 30 March 1955, *Trump* 109 (holotype EA!, isotype K! K001087120).

<http://www.ipni.org/urn:lsid:ipni.org:names:77165408-1>

Dovyalis sp. (nov?) sensu Sleumer (1972: 89).

Dovyalis sp. A sensu Sleumer (1975: 66).

Dovyalis sp. nov. sensu Beentje (1994: 106).

Dioecious spiny shrub or tree, 1.5 – 3.5 m tall. Branches bearing axillary spines up to 5 cm long; flowering and fruiting stems c. 3 mm diam., when dry dark grey-brown; young branchlets puberulous, older parts glabrescent and lenticellate. Leaves pale green (when dry) with pale brown-yellow midrib, alternate, blade papery when dry, lanceolate, (1.5 –) 2 – 5 (– 6.6) × (1 –) 1.5 – 2.5 cm, with attenuate apex, entire margin and obtuse to rounded base, sparsely puberulous with white hairs on upper and lower surface especially along the midrib, veins and leaf margin; midrib reaching apex, secondary veins 3 (– 4) pairs, tertiary reticulation inconspicuous. Petiole (1 –) 2 – 3 (– 5) mm long, densely pubescent with white hairs. Female inflorescences axillary, flowers solitary or paired; pedicels 2 mm long, tomentose with yellow hairs. Female flowers yellow, 4 – 5 (– 6) tepals, elliptic, 2.5 – 3 × 1 mm, densely tomentose on both faces with yellow hairs; disk hairy, ovary globose 1.5 – 2 mm diam., 2 styles (occasionally 3), 0.5 mm long, straight, with bifurcate stigma, ovary and styles densely tomentose. Male inflorescences of 2 – 5 flowered axillary fascicles; pedicels 4 – 7 mm, densely tomentose with yellow hairs. Male flowers yellow, 5 tepals, elliptic, 1.5 – 2 × 1 mm, densely tomentose on both faces with yellow hairs;

stamens 15 – 27, filaments 1 – 2 mm long, anthers 0.5×0.5 mm. Fruit orange-brown to yellow, globular, velvety hairy, (0.8 –) 1 – 1.5 cm diam. when dry, fruiting pedicel 2 – 3 mm long, tepals persistent 2 – 3 mm long, styles persistent. Seeds 2 – 3 per fruit, densely woolly, 6×3 mm. Fig. 1.

RECOGNITION. Morphologically similar to *Dovyalis mollis* (Oliv.) Warb. from Angola and the Democratic Republic of Congo but differs in longer axillary spines up to 5 cm (vs up to 2.5 cm long in *D. mollis*), smaller leaves $1.5 - 6.6 \times 1 - 2.5$ cm (vs $6 - 11 \times 2.4 - 4.5$ cm), male flowers with longer pedicel 4 – 7 mm (vs 3 – 5 mm), male tepals smaller 1.5 – 2 mm (vs 3 mm) and styles normally 2 (vs 3 – 4).

DISTRIBUTION. Africa: coastal Kenya. Map 1.

SPECIMENS EXAMINED. KENYA. Coastal Province: Kilifi Distr.: Arabuko, fr. April 1930, *Donald* 2324 (K!); Gede, 15 m, fr. 30 March 1954, *Trump* 109 (holotype EA!; isotype K!); Gede, $3^{\circ}18'S$ $40^{\circ}1'E$, 15 m, 15 June 1994, *Robertson & Ngonyo* 6951 (K!) & 6952 (K!, MO); Gede, 12 km from the Gede KEFRI station on the way to Jilore, $3^{\circ}16'48"S$ $39^{\circ}58'73"E$, 47 m, fr. 26 June 2009, *Kimeu, Meso & Otieno* KEFRI 599 (EA!, K!); Kakoneni $3^{\circ}10'S$ $39^{\circ}52'E$, 100 m, female fl. & fr., 28 June 1994, *Robertson & Okeyo* 6963 (EA!, K!); Kwale Distr.: Diani Forest, $4^{\circ}10'S$ $39^{\circ}34'E$, 5 m, male fl., 28 April 1992, *Luke* 3098A (EA!, K!, MO); Diani Forest, $4^{\circ}19'S$ $39^{\circ}33'E$, 15 m, fr., 14 July 1993, *Luke* 3563 (EA!); Dzombo Hill $4^{\circ}26'S$ $39^{\circ}13'E$, 150 m, *Robertson, Beentje, Luke & Khayota* MDE 225 (EA!); Mrima Hill, about halfway between Msambweni and Lungalunga, $4^{\circ}29'S$ $39^{\circ}16'E$, 70 – 290 m, fr., 25 June 1970, *Faden* 70/244 (EA!); Mrima Hill, $4^{\circ}29'S$ $39^{\circ}15'30"E$, 165 m, female fl., 5 March 1977, *Faden & Faden* 77/770 (EA!, K!); Mrima Hill, $4^{\circ}29'S$ $39^{\circ}16'E$, 170 m, 4 Feb. 1989, *Robertson, Beentje, Luke & Khayota* MDE 55 (EA!, K!); Shimba Hills, Kidongo area, $4^{\circ}19'S$ $39^{\circ}19'E$, 140 m, fr., 9 May 1992, *Luke* 3150 (EA!, K!, MO, US).

HABITAT. Coastal forest on coral rag, lowland moist evergreen forest; alt. 5 – 290 m.

CONSERVATION STATUS. The species is known from seven locations along the Kenya coast; Arabuko-Sokoke forest, Diani forest, Dzombo Hill, Gede forest, near Kakoneni town, Mrima Hill and Shimba Hills (Map 1). The estimated extent of occurrence (EOO) is 3600 km^2 and the estimated area of occupancy (AOO) is 40 km^2 (calculated with GeoCat tool using a cell size of $2 \times 2 \text{ km}$, Bachman *et al.* 2011). All the localities for *D. keniensis* are within Conservation International's Eastern Arc and Coastal Forests Hotspot (Mittermeier *et al.* 2005). This hotspot is threatened by illegal logging, charcoal production, firewood collection and overharvesting of wood for carving (BirdLife International 2013). Mining may become a risk in the near future as titanium has been found underneath Arabuko-Sokoke forest and there are plans to

begin mining an area of 64 km^2 in Kwale district (BirdLife International 2013). There is also an open cast mine at Mrima Hills for Niobium Ore, which is expected to expand in the near future (Q. Luke pers. comm. 2015). Diani forest is threatened by clearance for tourist infrastructure, with only 30% of forest remaining at present (Q. Luke pers. comm. 2015).

Six locations for this species are Important Bird and Biodiversity Areas; one has been rated by BirdLife International as under medium threat (Gede Ruins National Monument), three as high threat (Arabuko-Sokoke forest, Dzombo Hill and Mrima Hill) and one as under very high threat (Shimba Hills) (BirdLife International 2016). The main threats listed are drought (Arabuko-Sokoke forest and Mrima Hill), increase in fire frequency and intensity (Dzombo Hill and Shimba Hills), disturbance by recreational activities (Gede) and small scale logging (Shimba Hills). Diani Forest's threat status has not yet been assessed by BirdLife International.

The threats at the remaining location, near to Kakonei town are unknown but the area is developed with housing and some agricultural land.

With the ongoing and future threats to the Kenya coastal forests and restricted EOO and AOO *Dovyalis keniensis* is assessed using IUCN (2012) criteria as Vulnerable VU B1ab(i,ii,iii,v), B2ab(i,ii,iii,v). There are seven locations and due to the reported threats to coastal forests in Kenya, a continued decline of area, extent and quality of habitat leading to an inferred decline in EOO, AOO and number of mature individuals.

There are some conservation measures as seeds are conserved in *ex situ* seed banks (at the Royal Botanic Gardens, Kew UK and the Kenya Agricultural Research and Livestock Organisation) and the species occurs in protected areas (Arabuko-Sokoke Forest Reserve, Shimba Hills National Reserve, Dzombo Hill Forest Reserve, Gede Ruins National Monument and Mrima Hill Forest Reserve).

PHENOLOGY. Flowering specimens from March to April. Fruiting specimens from March to July with most specimens from June.

VERNACULAR NAME. “Mdunga – tunda” in Giriama language cited in Beentje (1994) and on one herbarium specimen (*Trump* 109). “Mnao-Mnao” in Swahili recorded on another herbarium specimen (*Donald* 2324) but not cited in Beentje (1994).

USES. The fruits are reported to be “edible and said to make excellent jam” according to notes on one specimen (*Donald* 2324).

NOTES. In Sleumer's (1972) revision *Dovyalis keniensis* would be placed within sect. *Dovyalis* which is defined by an ovary with 2 – 3 placentas, each placenta bearing 1 ovule and styles 2 – 3 (rarely 4). Using Sleumer's (1972) key for the genus, *D. keniensis* would be in a couplet with *D. lucida* Sim. and *D. mollis*. *D. keniensis*, with sparsely pubescent leaves, is most similar to *D. mollis* as *D. lucida*

Fig. 1. *Dovyalis keniensis*. A habit; B leaf base; C female flower; D ovary; E stem with male flowers; F male flower; G stamen; H fruit, J seed. A, B, H, J from Kimeu et al. KEFRI 599; C, D from Faden & Faden 77/700; E – G from Luke 3098A. DRAWN BY JULIET WILLIAMSON.

Map 1. Distribution of *Dovyalis keniensis* based on specimen data (•). A in Kenya; B in Kenya Coastal Province. Map created with SimpleMappr. <http://www.simplemappr.net/>

has glabrous, coriaceous leaves. *D. mollis* is from north-west Angola (Cabinda and Cuanza Norte provinces) and western Democratic Republic of Congo (Mayumbe area) in forest and mixed thickets up to 1300 m (Sleumer 1972). *D. mollis* and *D. keniensis* are widely separated geographically and differ by leaf, spine and flower characters (Table 1). However they share some characters, for example, similar fruits (both velvety hairy and pubescence (laxly hairy leaves and flowers densely yellow tomentose). Genetic studies are suggested to clarify the relationship between *D. keniensis* and *D. mollis*.

In Kenya, *Dovyalis keniensis* has sometimes been mistakenly identified as *D. hispidula* Willd., also found

in forests along the coast. However there are many differences between these two species (Table 1), for example, in leaf shape, colour of hairs on flowers and fruit pubescence. In F.T.E.A. (Sleumer 1975) *D. keniensis* would key out in the couplet with *D. hispidula* and *D. xanthocarpa* Bullock. However *D. xanthocarpa* is a Tanzanian endemic from forests and bushland at 630 – 1370 m., has larger leaves (5 – 8 × 2.5 – 5 cm) and tepals accrescent in fruit to 12 mm (in *D. keniensis* tepals are not accrescent and remain 2 – 3 mm long in fruit). Four species of *Dovyalis* are now found in Kenya, *D. keniensis*, *D. hispidula*, *D. abyssinica* (A. Rich.) Warb. and *D. macrocalyx* (Oliv.) Warb. A new key based on F.T.E.A. is presented below:

Table 1. Comparison of selected characters between *Dovyalis keniensis*, *D. mollis* and *D. hispidula*.

Character	Taxon		
	<i>D. keniensis</i>	<i>D. mollis</i>	<i>D. hispidula</i>
Distribution and altitude	Kenya, 5 – 290 m	Angola and DRC, 50 – 1,300 m	Kenya, Tanzania, Mozambique and Zimbabwe, 25 – 850 m
Habitat	Coastal forest	Forest and mixed thicket	Riverine thickets and <i>Brachystegia</i> woodland
Spines length (cm)	up to 5	up to 2.5	up to 4
Leaf apex shape	attenuate	shortly acuminate	obtuse, rounded or retuse
Leaf size (cm)	1.5 – 6.6 × 1 – 2.5	6 – 11 × 2.4 – 4.5	0.8 – 3.5 × 0.6 – 2.3
Petioles length (mm)	1 – 5	3 – 4	3 – 8
Male flower pedicel length (mm)	4 – 7	3 – 5	2 – 3 (– 6)
Male flower hairs	yellow tomentose	yellow tomentose	white hispid hairs
Male flower tepal length (mm)	1.5 – 2	3	2
Female flowers hairs	yellow tomentose	yellow tomentose	glabrescent
Ovary hairs	yellow tomentose	yellow? tomentose	sparsely hispid to glabrous
Style number	2, occasionally 3	3 – 4	2 – 3
Fruit	velvety hairy	laxly hairy	glabrous

Key to Kenyan species of *Dovyalis* (modified from Sleumer 1975)

1. Female flowers with 4 or 5 (rarely 6) styles **D. abyssinica**
 Female flowers with 2 or 3 styles 2
2. Tepal lobes accrescent (up to 20 mm long × 10 mm wide) and in female flowers with numerous sessile or stipitate marginal glands **D. macrocalyx**
 Tepal lobes not accrescent and without marginal glands 3
3. Leaves 0.8 – 3.5 cm long, 0.6 – 2.3 cm wide, leaf apex obtuse to rounded, male flowers white hispid, ovary and fruit practically glabrous (sometimes with a few scattered hispidulous hairs) **D. hispidula**
 Leaves 1.5 – 6.6 cm long, 1 – 2.5 cm wide, leaf apex attenuate, male flowers densely yellow tomentose, ovary and fruit densely velvety hairy **D. keniensis**

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