

Maytenus oleosa (Celastraceae), a new species from southern Natal and Pondoland

A.E. van Wyk* and R.H. Archer

H.G.W.J. Schweickerdt Herbarium, Department of Botany, University of Pretoria, Pretoria, 0002 Republic of South Africa

Accepted 4 December 1986

Maytenus oleosa Van Wyk & Archer, a small riverine tree endemic to the sandstone region of southern Natal/Pondoland is described. It is allied to *M. undata* (Thunb.) Blakelock from which it differs in a combination of characters, some of the more significant being the narrowly elliptic leaves which in dried specimens are green and glossy above, dull yellowish-green with the venation (including the reticulation) dark green or brownish and very conspicuous below; mesophyll and stomatal subsidiary cells of lamina with a profusion of relatively large oil droplets; black spots of an unknown substance nearly always appearing along veins of the lamina during preservation in FAA; pedicels articulated at or very near the base; sepals markedly unequal; petal margins ciliolate and the stigma subcapitate and not distinctly rugose or papillate. *M. oleosa* is a rare species, at present recorded only from watercourses between the Umtamvuna and Mzamba Rivers.

Maytenus oleosa Van Wyk & Archer, 'n kleinerige boom wat langs riviere groei en endemies is tot die sandsteengebied van Suid-Natal/Pondoland word beskryf. Dit is naverwant aan *M. undata* (Thunb.) Blakelock waarvan dit ten opsigte van 'n kombinasie van kenmerke verskil, waaronder van die belangrikste die volgende is: smal elliptiese blare wat in gedroogde eksemplare aan die bokant glansend groen en aan die onderkant dof geelgroen vertoon, met opvallende donkergroen of bruinerige bearing (insluitende die retikulasie) aan die onderkant; blaarlamina met talryke opvallende oliedruppels in die mesofil en die hulpsele van stomas; swart spikkels van 'n onbekende stof wat langs die are verskyn van blare wat in FAA gepreserveer is; blomstele wat by of naby die basis geartikuleer is; kelkblare wat opvallend ongelyk uitgebeeld is; gesilioleerde kroonblaarrande en die subspeldkopvormige stempel wat nie duidelik gepapilleer is nie. *M. oleosa* is 'n seldsame spesie, tans slegs aangeteken langs waterlope tussen die Umtamvuna- en Mzambariviere.

Keywords: Anatomy, Celastraceae, endemism, *Maytenus*, taxonomy

*To whom correspondence should be addressed

Introduction

Members of the Celastraceae form a conspicuous component of the flora endemic to the southern Natal/Pondoland sandstone region. Two endemic species of *Maytenus* Molina, namely *M. bachmannii* (Loes.) Marais and *M. abbottii* Van Wyk, have already been described from this region. Extensive plant collecting and careful field observations mainly by H.B. Nicholson and A.T.D. Abbott, have now revealed another undescribed species of *Maytenus* endemic to this area. The new species is a small riverine tree at present recorded only from some of the previously botanically unexplored forested ravines between the Umtamvuna and Mzamba Rivers. Superficially it is somewhat similar to the widespread and variable *M. undata* (Thunb.) Blakelock, but it differs in several important characters. The aim of this paper is to describe the new species and to discuss its possible taxonomic affinities.

Description

Maytenus oleosa Van Wyk & Archer, sp. nov., *M. undatae* affinis, a qua imprimis differt laminis foliorum anguste ellipticis et in statu sicco plerumque supra viridibus atque nitidis, infra opace flavo-virentibus et nervatura tota atro-viridi ad brunneola atque conspicua, mesophyllo et cellulis subsidiariis stomatum continentibus corpora oleosa copiosa atque relative grandia; pedicellis ad vel iuxta basim articulatis; sepalis valde inaequalibus et marginibus paris intimi valde laciniatis; marginibus petalorum ciliolatis; stigmatate comparate laevi et subcapitato.

TYPUS. — Transkei: Hlolweni River Gorge near confluence with Icwaka River, 11 June 1985, *Abbott 2664* (PRU, holotypus; PRE, isotypus).

Slender evergreen tree up to 6 m high, unarmed, glabrous, without elastic threads in bark and leaves; bark greyish, fairly

smooth or minutely cracked into fine, generally longitudinal lines. *Branchlets* often drooping, green, weakly 4-lined when young, becoming terete, greyish- or purplish-brown to brown and finely longitudinally striated with age. *Leaves* alternate, internodes usually 5–10 mm long; lamina narrowly elliptic, rarely elliptic or lanceolate, (25–)30–60(–90) mm long, (5–)7–12(–23) mm wide, base attenuate, apex acuminate, margin glandular crenulate-denticulate, denticles (4–)6–7(–8) on each side, subcoriaceous, dark green and shiny above, yellowish-green below (particularly noticeable in fresh material); venation in fresh and dried leaves (including the reticulation) very conspicuous below owing to its dark green (occasionally brownish in dried material) coloration contrasting with the yellowish-green areolar regions; midrib in fresh leaves sharply raised above but only slightly raised or ± flush with the leaf surface below; principal lateral veins alternate or opposite, usually 4–6 pairs, ± flush with leaf surface in fresh material, raised in dried specimens; reticulation flush with leaf surface or slightly raised in fresh and dried material; petiole 2–6 mm long, semi-terete, ± plane above in fresh and dried leaves; stipules minute, ± deltoid, brownish black, marcescent. *Inflorescences* composed of fasciculate cymes, axillary, sessile or with peduncle up to 2 mm long, 2–8-flowered. *Flowers* bisexual, pentamerous, c. 5 mm diam.; pedicels c. 3–5 mm long, articulated at or very near the base (usually concealed by the bracts). *Sepals* creamish green to green, unequal, the outer pair fleshy, ± deltoid with the apex acuminate and often shortly mucronate, venation obscure, margin sparingly brownish ciliate, the inner pair membranous, ± subrotund, enlarged, c. 1 mm long, 1.5 mm wide, margin conspicuously and sharply laciniate, remaining sepal ± intermediate between outer and inner pairs. *Petals* cream, broadly obovate, c. 2.1 mm long, 2 mm wide, sessile, margin plane and densely ciliolate. *Stamens* spreading; fi-



Figure 1 *Maytenus oleosa*. 1. flowering branchlet, $\times 1$; 2. inflorescence and leaf (basal half showing the adaxial and apical half the abaxial surface), $\times 3$; 3. flower, $\times 12,5$; 4. calyx viewed from below, $\times 21$; 5. fruit starting to dehisce, $\times 5$; 6. seed completely enveloped by an aril, $\times 5$ (1-4 from Abbott 2687; 5 & 6 from Van Wyk 7383).

laments 0,3–0,7 mm long, terete, united with the margin of the disc; anthers c. 0,3 mm long, dorsifixed, versatile, introrse, dehiscent by longitudinal slits. *Disc* subtire, \pm flat or occasionally with a narrow, free, slightly upturned margin. *Ovary* c. 1/3-immersed in and adnate to the disc, 3-locular, with 2 erect collateral ovules in each locule; style c. 0,5 mm long, terete; stigma subcapitate, flattened and slightly trigonous when viewed from above, more or less smooth surfaced with 1–3(–4) interconnected shallow grooves on top. *Fruit* capsular, whitish-green, rarely yellowish-green, \pm smooth, dehiscing loculicidally to the base, 1–2(–3)-locular, obovoid to subglobose, slightly lobed between the locules, apex slightly concave, c. 8–10 mm long and in diam. *Seeds* 1–2 per locule, ellipsoid, orange-brown to brown, post-chalazal vascular branches not observed; fleshy endosperm present; embryo erect, with cotyledons \pm fleshy; aril bistreyellow at dehiscence, darkening to lemon on exposure and appears to stay orange-yellow after 12 hours (colours according to Stanley Gibbons Colour Key), completely enveloping the seed, surface glabrous (Figure 1).

Flowering mainly May–August. Ripe fruits collected during late winter and in spring.

Distribution

Maytenus oleosa has hitherto only been recorded from forested ravines between the Umtamvuna River on the Natal/Transkei border and the Mzamba River in Pondoland (Figure 2). The trees resemble willows at a distance and are particularly common on the banks of the Icwaka River, with fair numbers also recorded along the Hlolweni and Sikuba Rivers. It may also occur along some of the botanically less explored watercourses further south, particularly the Mplane, Mnyameni, Mtentu, Mkambati and Msikaba Rivers and their tributaries. It does not appear to range north of the Umtamvuna River. The species is strictly bound to sandstone of the Natal Group and is nearly always confined to the extremely rocky banks and beds of rivers.

Often associated with *M. oleosa* is *M. bachmannii*, a shrubby species usually found between rocks in the beds of fast flowing rivers. Other commonly encountered associates are the two sandstone endemics *Syzygium pondoense* Engl. and *Eugenia simii* Dummer.

Because of its very restricted distributional range, *M. oleosa*

is a vulnerable species. The rapid human population increase associated with various developments currently under way in north-eastern Pondoland poses a potential threat not only to this species, but also to the many other rare sandstone endemics of this region.

Discussion

Maytenus oleosa is clearly allied to the closely-knit *M. undata* group of species, comprising *M. undata* s.l., *M. chasei* N.K.B. Robson, *M. procumbens* (L.f.) Loes. and *M. lucida* (L.) Loes. Its affinity is substantiated by a combination of characters including the lack of spines and short shoots, bark and leaves without elastic ('latex') threads when broken, leaves which are never fascicled and with the lower surface often conspicuously yellowish-green when fresh, and inflorescences of sessile or very shortly pedunculate (very rarely exceeding 2 mm) axillary fascicles. With Robson's (1965) key to the species of the *M. undata* group, the new species keys out to *M. undata* on account of its capsule valves which are smooth with a whitish- or yellowish-green colour, broadly obovate petals, absence (usually) of secondary peduncles, and the leaf margins which are more or less plane and not indurated.

Maytenus undata s.l. (*sensu* Robson 1965 & 1966) is a polymorphic species. In southern Africa many of its forms have previously been treated as distinct species (for example in Davison 1927). Variations of *M. undata* are widespread in other parts of Africa and, according to Robson (1966), also Madagascar and the Comoro Islands. Although the native forms of *M. undata* can mostly be correlated with specific geographical distribution and ecological conditions, the distinction between forms is mainly based on differences in the size, shape, texture, colour and degree of marginal serration of the foliage leaves. These distinctive characters tend to intergrade and we therefore support the concept of one aggregate species for all these forms as adopted by local herbaria in recent years. However, some of the more extreme variations are vegetatively so strikingly different that, at least for horticultural reasons, some kind of formal infraspecific delimitation is strongly desirable.

Maytenus oleosa is undoubtedly very closely related to *M. undata* from which it appears to be yet another derivative. In the field it is nevertheless a distinctive plant, unlikely to be confused with the latter species. The distributional range of *M. oleosa* is shared by two, more widespread, forms of *M. undata*. One is a small bushy tree with coriaceous and relatively small elliptic leaves, usually confined to forest margins or bush clumps in grassveld (e.g. *Abbott 183, 255, 2009 & 2539; Van Wyk 6050* — all in PRU). The other is a tall and rather rare canopy tree with large, broadly elliptic or ovate leaves confined to climax forest (e.g. *Abbott 99 & 1222; Van Wyk 6083* — all in PRU). Variation between *M. oleosa* and the aforementioned two forms of *M. undata* is essentially discontinuous and no significant intergradation between the two species has been recorded. A selection of diagnostic features (most reliable if used in combination) to differentiate between the two species is supplied in Table 1. Some of these are illustrated in Figures 3–7. As far as we have ascertained, these distinctive characters (unless specifically restricted) are applicable to *M. undata* as a whole. However, comparing *M. oleosa* with a polymorphic species such as *M. undata* gives rise to many difficulties. The majority of specimens of *M. undata* examined during the present study represented native forms of this species. Consequently character states recorded for *M. undata* in Table 1 may still vary — particularly in other parts of Africa. Since the characters

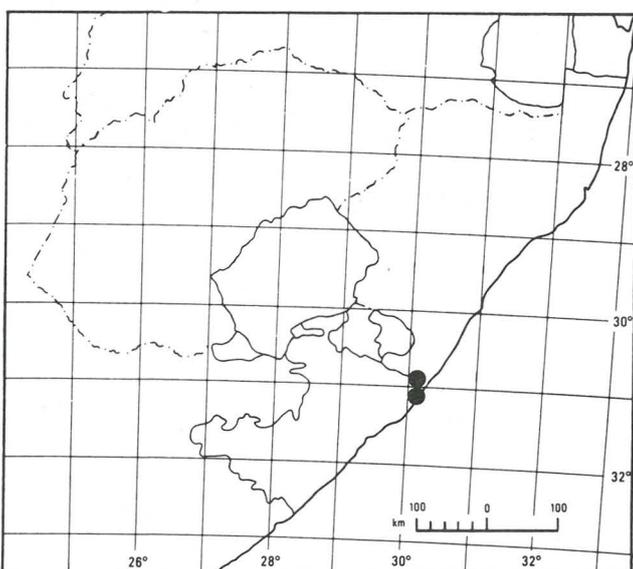


Figure 2 The known distribution of *Maytenus oleosa*.

Table 1 Organographic and anatomical differences between *Maytenus oleosa* and *M. undata* (characters to be used in combination — those regarded as most significant are marked with an asterisk)

	<i>M. oleosa</i>	<i>M. undata</i>
Leaves		
Shape	narrowly elliptic, rarely elliptic or lanceolate	very variable, but rarely narrowly elliptic
Colour (fresh)	dark green and glossy above, yellowish-green below; never whitish glaucous	variable, but often whitish glaucous below or on both surfaces
*Colour (dried)	green and glossy (almost waxy) above, often remaining dull yellowish-green below	nearly always dull grey- or silver-green or dull whitish glaucous on one or both surfaces; rarely glossy above or yellowish-green below
Margin	crenulate-denticulate, (4–)6–7(–8) denticles on each side	usually denticulate, spinose-dentate or subentire; number of denticles very variable but (9–)10–15(22) in the distributional range of <i>M. oleosa</i>
*Venation (abaxially in dried, mature leaves)	usually dark green or brownish and conspicuous (including the reticulation); sharply contrasting with the yellowish-green areolar regions	nearly always obscure (particularly the reticulation); often variously raised but not with a colour differentiation
*Mesophyll	oil droplets abundantly present; relatively large	oil droplets absent or occasionally present in small to moderate quantities; relatively small
*Subsidiary cells	conspicuous oil droplets present	oil droplets usually absent; if present relatively small
Black spots (see text for explanation)	nearly always appearing along veins during preservation in FAA	only observed in one of several samples of FAA-preserved material — however, more samples should be tested as this appears to be a promising differentiating character
Flowers		
*Pedicels (position of articulation)	articulated at or very near the base (usually concealed by the bracts)	in southern Africa usually articulated well above the base (lower 1/4–1/2), rarely concealed by the bracts
*Sepals	markedly unequal; inner pair membranous, notably enlarged with margin conspicuously and sharply lacinate	unequal; inner pair slightly enlarged with the margin erose or weakly lacinate
*Petal margin	ciliolate	usually even or minutely erose; rarely weakly ciliolate
Stamens	spreading, often almost horizontal; relatively short (filaments 0,3–0,7 mm long)	more or less upright or moderately spreading; very rarely almost horizontal; relatively long (filaments usually 0,7–2 mm long)
*Stigma	subcapitate; ± even surfaced; shallowly grooved on top	usually 2–3-lobed; surface rugose or coarsely and irregularly papillate
Aril		
Colour (when fresh)	bistre-yellow at dehiscence, darkening to lemon on exposure and appears to stay orange-yellow after 12 hours (colours from Stanley Gibbons Colour Key)	white (for colour illustration see Coates Palgrave <i>et al.</i> 1985 p. 63); often reported as yellowish in the literature, but this requires confirmation
Size	completely enveloping the seed	partly or completely enveloping the seed

on which the separation between *M. undata* and *M. oleosa* is based, are quantitatively and qualitatively more marked than those currently being used to distinguish between *M. undata*, *M. procumbens* and *M. lucida* (Marais 1960; Robson 1965 & 1966), we have decided to allocate specific rather than subspecific rank to the new taxon.

The anatomical structure of the leaves of *M. undata* and *M. oleosa* is fairly similar. Mutual features include a dorsoventral lamina with the mesophyll composed of 2–3(–4) layers of palisade cells (the outer often inclined towards a crystaliferous hypoderm). Secondly a spongy parenchyma with, below the inner palisade layer and confined to the areolar regions, an extensive system of intercellular air spaces, separated from the lower epidermis by a more compact zone of parenchyma cells (Figure 5). The development of these air cavities is at least partly lysigenous as is suggested by the remnants of torn cell walls which occur abundantly in this region. It is clear that the characteristic yellowish-green colour

of the lower leaf surface is at least partly due to optical effects caused by the presence of this unusual intralaminar zone of air cavities. Druse crystals are usually abundantly present in the mesophyll of both species — particularly in the palisade layers.

A striking anatomical feature of *M. oleosa* is the profusion of relatively large oil droplets in the leaf mesophyll, parenchyma cells associated with vascular bundles and the subsidiary cells of stomata (Figures 6 & 7). These droplets were constantly present in all investigated samples of this species — still detectable in even the oldest known herbarium specimen (*Nicholson 1242*, collected in 1972). The dried leaf yields to hexane extraction almost 11,5 % of a non-volatile oil (the composition which is currently being studied by researchers at the Division Oils and Fats of the N.F.R.I., C.S.I.R.). A histochemical survey for lipids in a large number of *M. undata* leaves (mostly rehydrated) from various parts of Africa revealed the presence of lipids in the mesophyll of all the

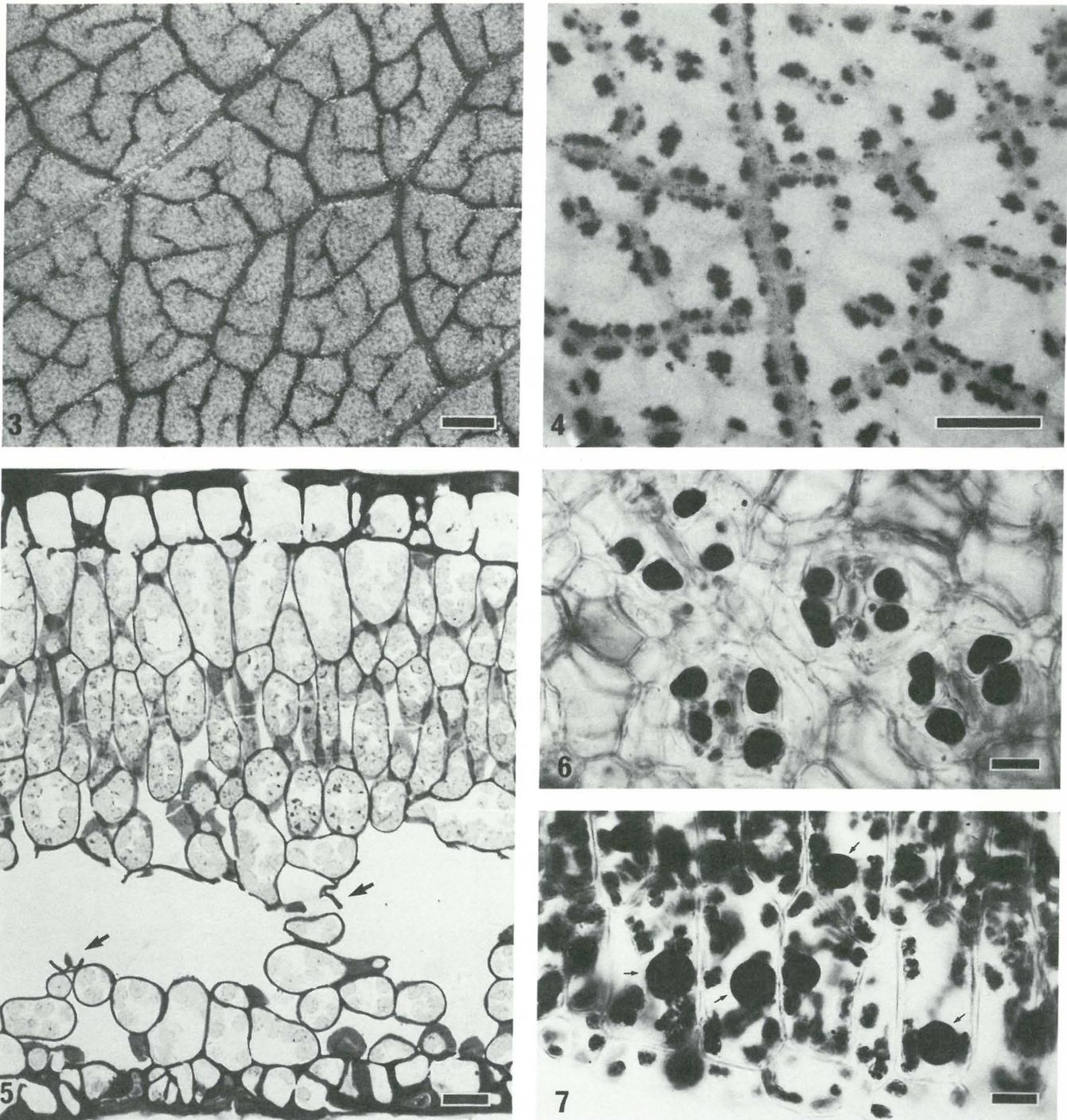


Figure 3–7 *Maytenus oleosa* (Van Wyk 7383). 3. Abaxial surface of dried leaf blade showing conspicuous venation; 4. FAA-preserved leaf illuminated by transmitted light showing spots of an unknown black substance associated mainly with the veins; 5. Transverse section of the leaf blade showing the structure of the mesophyll — note well-developed air cavities with the remnants of torn cell walls (some arrowed); 6. Abaxial epidermis stained with Sudan Black B, showing oil droplets in subsidiary cells; 7. Transverse section of palisade cells stained with Sudan Black B, showing chloroplasts and stained oil droplets (some arrowed). Scale line = 0,5 mm (Figures 3 & 4), 20 μm (Figure 5) or 10 μm (Figures 6 & 7).

samples. However, rarely did we find a similar accumulation of oil droplets as in *M. oleosa*. Hence the choice of specific epithet for the new species. Lipid accumulation has subsequently also been confirmed in leaves of *M. procumbens* and *M. lucida*. This character clearly reflects the close affinity between the species of the *M. undata* complex.

Freshly picked leaves of *M. oleosa* preserved in formalin–acetic acid–alcohol (FAA) (Johansen 1940) usually display a rather unconventional diagnostic feature. In the first month (usually days) after being placed in preservative, numerous small black spots appear in the lamina (Figure 4). The spots are usually closely associated with the veins (in-

cluding the reticulation) and appear in sections through the lamina as a black amorphous mass apparently deposited between the cells in the mesophyll next to the vascular bundles. The origin and composition of these black spots are unknown. No evidence for the presence of this amorphous material could be found in freshly collected material. Various standard histochemical tests were performed in an attempt to identify the chemical nature of the black substance, but without success. None of the results were positive and in no instance did the substance take up any of the stains. By placing freshly picked leaves in different mixtures of the FAA components, it was established that both acetic acid and ethanol (but not

formalin) have to be present in a solution for the black spots to appear. Black spots also tended to be more noticeable in leaves that were mainly exposed to the FAA vapours in bottles partly filled with the preservative, than in those leaves that were constantly kept submerged. Only once did we encounter a similar phenomenon in a sample of FAA preserved leaves of *M. undata*. Although very few black spots were present, it at least shows that the ability to form the spots is not unique to *M. oleosa*. The expression of this character requires closer scrutiny in more samples of *M. undata*, as well as the other members of this species complex.

Specimens examined

—3030 (Port Shepstone): Hlolweni River Gorge near confluence with Icwaka River (–CC), *Abbott 2664* (PRU, PRE) & *2687* (PRU, NH), *Van Wyk 7216* (PRE, PRU); Icwaka River Gorge, c. 1 km north of confluence with Hlolweni River (–CC), *Abbott 2660* (PRU, NH), *Van Wyk 7198* (PRE, PRU).

—3130 (Port Edward): Umtamvuna Nature Reserve [UNR] (–AA), *Venter 1007* (PRE); UNR, Umtamvuna River c. 10 miles upstream from Port Edward (–AA), *Nicholson 1242* (PRE); UNR, Umtamvuna River below Iron Crown (–AA), *Abbott 2081* (PRU, NH); UNR, Nek Forest (–AA) *Abbott 251* (PRE, PRU); Sikuba River Gorge, tributary of the Mzamba River (–AA), *Abbott 3175* (PRU), *Van Wyk 7383* (K, NH, PRE, PRU).

Acknowledgements

We are greatly indebted to Tony Abbott for assistance during field work and for providing us with valuable research material of the new species. We thank Thea van Rensburg and Emsie du Plessis for their constructive criticism of the manuscript, and Paul Hasse, Latin Department, University of Pretoria, for help with the Latin diagnosis. The first author is indebted to the Natal Parks, Game and Fish Preservation Board and the Department of Agriculture and Forestry of Transkei for plant collecting permits. This study was partly financed by the University of Pretoria and the Foundation for Research Development of the C.S.I.R.

References

- COATES PALGRAVE, K., COATES PALGRAVE, P. & COATES PALGRAVE, M. 1985. Die Suid-Afrikaanse Boomgids. Central News Agency, Johannesburg.
- DAVISON, J.D. 1927. Celastraceae R. Br. *Bothalia* 2: 289–346.
- JOHANSEN, D.E. 1940. Plant microtechnique. McGraw-Hill Book Co. Inc., New York.
- MARAIS, W. 1960. An enumeration of the *Maytenus* species of southern Africa. *Bothalia* 7: 381–386.
- ROBSON, N.K.B. 1965. Taxonomic and nomenclatural notes on Celastraceae. *Bolm Soc. broteriana* 39: 5–56.
- ROBSON, N.K.B. 1966. Celastraceae. In: Flora Zambeziaca 2(2): 355–418, Crown Agents for Overseas Governments and Administration, London.