A taxonomic revision of Rafnia (Fabaceae, Crotalariaceae)

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Rafnia Thunb. is a relatively poorly known papilionaceous genus of the tribe Crotalariaceae, and is endemic to the fynbos region of the Western and Eastern Cape Provinces of South Africa, with one species extending into KwaZulu-Natal. Characters of the habit, leaves, inflorescences, flowers, pods and seeds are useful for distinguishing among the 19 species, and variations in morphological characters are discussed. A cladistic analysis of 26 characters produced a cladogram with two distinct groups, which form the basis of the division of Rafnia into two sections (described in the taxonomic part of the paper). Five new species, namely R. rostrata G.J. Campbell & B-E. van Wyk, R. vlokii G.J. Campbell & B-E. van Wyk, R. alata G.J. Campbell & B-E. van Wyk, R. inaequalis G.J. Campbell & B-E. van Wyk and R. globosa G.J. Campbell & B-E. van Wyk are described. Four species are divided into subspecies, seven of which are described for the first time. The nomenclature, synonymy and typification of the 31 taxa are presented, as are descriptions, illustrations and distribution maps.

Introduction

Rafnia (tribe Crotalariaceae) has been a relatively poorly known genus of papilionoid legumes. Rafnia is endemic to the fynbos region of South Africa, with one species extending into KwaZulu-Natal, and is distinguished from the rest of the Crotalariaceae in that the species are totally glabrous (except for minute hairs on the inner surfaces of the calyces and on the bracts, bracteoles and sterile rachis extensions), the leaves are simple and sessile and the plants often turn black when dried (Van Wyk and Schutte 1995). Rafnia belongs to the 'Cape group' of the Crotalariaceae, being most closely allied to the genera Aspalathus L., Lebeckia Thunb. and Wiborgia Thunb. (Dahlgren 1970, Van Wyk 1991a).

Of the 11 genera of the mainly African Crotalariaceae, only Rafnia and Lebeckia have not been revised in recent years. The most recent published treatment of Rafnia dates back to Harvey (1862). The taxonomy of Rafnia is problematic due to the relatively poor herbarium record, complex geographical patterns and misleading superficial similarities between distantly related taxa. As a result, there is much confusion concerning the identity and correct nomenclature of the taxa of Rafnia. This is evident from the herbarium record which shows a large percentage of misidentified specimens. A better understanding of the relationships among the taxa is important not only for the circumscription of species and infraspecific taxa, but also for gaining insight into relationships with other genera of the Crotalariaceae, in particular Aspalathus, which is supposedly closely related to Rafnia (Van Wyk 1991a).

The aim of this paper is to present the results of a taxonomic revision of Rafnia, based on morphological evidence, in order to update the taxonomy and nomenclature.

Material and methods

Morphological data were gathered from in situ studies, preserved material and herbarium specimens, which were loaned from BOL, NBG (including SAM and STE) and PRE (standard herbarium abbreviations as in Holmgren et al. 1990) and specimens housed in J and JRAU were also studied. Lists of voucher specimens of all the material used to study the different characters are given in Campbell (1998). Authorities for names are given in the section dealing with taxonomy and will not be repeated elsewhere in the text.

Field work was undertaken in the distribution area of Rafnia in order to study the taxa in their natural habitats and to collect fresh and preserved vegetative, flowering, fruit and seed material at a number of different localities. Several populations were visited up to three times in order to obtain adequate material and to record data regarding habitat, substrate, habit, fire-survival strategy, mode of flowering, pollination syndrome and flowering and fruiting phenology, to supplement data from specimen labels. All the taxa, except R. racemosa subsp. pumila, R. rostrata subsp. pluriflora, R. angulata subsp. ericifolia, R. angulata subsp. humilis, R. crispa, R. lancea and R. capensis subsp. elsiæae were studied in the field.

In order to facilitate investigation of the often exceptional geographical variation in morphology, the herbarium material was divided into regional forms (Table 1), which served as operational taxonomic units. As many characters as possible were examined and the genus Aspalathus was included as an outgroup.

Characters included in the phenetic analysis were selected following the suggestions of Sneath and Sokal (1973). The programme NTSYS–PC 2.01 was used for the analysis and
Table 1: List of geographically variable taxa of *Rafnia* which have distinct regional forms. These forms were used as operational taxonomic units throughout this study. In the cladistic analysis, however, these forms were merely used to decide the polarity of variable characters at species level.

*R. angulata* subsp. *angulata*—Form 1: Cedarberg form; Form 2: Typical form (Piquetberg, Tulbagh); Form 3: Matroosberg form; Form 4: Narrow-leaf Malmsbury form; Form 5: Broad-leaf Malmsbury form; Form 6: Boland Mountains form; Form 7: Narrow-leaf Peninsula form; Form 8: Broad-leaf Peninsula form; Form 9: Hermanus form; Form 10: Swellendam form.

*R. alata*—Form 1: Typical form (Swartberg); Form 2: Outeniqua Mountains form; Form 3: Bredasdorp form.

*R. triflora*—Form 1: Typical form; Form 2: Caledon form.

*R. acuminata*—Form 1: Typical form; Form 2: Northern form (Piquetberg, Cedarberg).

*R. diffusa*—Form 1: Northern form (Vanrhynsdorp, Nieuwoudtville, Gifberg); Form 2: Wupperthal form; Form 3: Citrusdal form; Form 4: Pakhuis Pass form; Form 5: Piquetberg form; Form 6: Malmsbury form.

*R. capensis* subsp. *capensis*—Form 1a: Typical form (Oudtshoorn, George); Form 1b: Typical form (Laingsburg to Rooiberg); Form 2: Anysberg/Swartberg form; Form 3: Bredasdorp form; Form 4: Broad-leaf Peninsula form; Form 5: Hex River Valley form; Form 6: Ceres form.

*R. capensis* subsp. *dichotoma*—Form 1: Northern form (Cedarberg, Olifantsrivier Valley); Form 2: Typical form (Caledon, Jonaskop, Greyton, Genadendal); Form 3: Montagu form; Form 4: Riversdale form; Form 5: Prospect Peak form.

*R. capensis* subsp. *ovata*—Form 1: Nieuwoudtville form; Form 2: Ceres form (Clanwilliam, Ceres, Cedarberg, Piquetberg, Tulbagh); Form 3a: Typical form (Stellenbosch); Form 3b: Typical form (Worcester); Form 3c: Typical form (Franschhoek, Paarl); Form 4: Hermanus form.

Various coefficients of similarity were applied in order to construct several phenograms, from which the best result is included below.

Characters and character states used for the cladistic analysis are given in Table 4. Character states were polarised using the method of outgroup comparison. Phylogenetic analyses were conducted using the computer software package Hennig86 (Farris 1988). The 'ie' algorithm was applied to produce a tree(s) of minimal length. Autapomorphies for the species were omitted from the analyses, since they serve no purpose as grouping characters.

Morphological characters

Habit

The morphology and complex relationships within the Crotalariaeae have been studied by Dahlgren (1963a, 1967, 1970, 1975), Polhill (1976), Van Wyk (1991a) and Van Wyk and Schutte (1989, 1995). According to Van Wyk (1991a), few characters in the Crotalariaeae are mutually exclusive or really characteristic for any specific genus, hence morphological patterns may be confusing.

The taxa in *Rafnia* are resprouting shrubs with many stems or flowering shoots developing from underground lignotubers. Habit is very variable in *Rafnia* (Figure 1). The taxa may be robust, much-branched woody shrubs or large suffrutescent such as some Cedarberg forms of *R. angulata* subsp. *angulata* (Figure 1, 2a) and *R. vlokii* (Figure 1, 8). *R. angulata* subsp. *angulata*, *R. angulata* subsp. *thunbergii*, *R. elliptica* and *R. ovata* are large, virgate suffrutescent (often more than 1m high), usually with all the stems herbaceous, sometimes becoming woody towards the base with age.

The remaining taxa are herbaceous rather than woody...

Shrublets, varying in branching pattern. They may be virgate like R. capensis subsp. capensis (Figure 1, 20), erect, like R. inaequalis (Figure 1, 14) and R. globosa (Figure 1, 23) or procumbent, such as R. lancea and R. alata. R. racemosa subsp. pumila, R. angulata subsp. montana and R. spicata may form dense, widely spreading clumps and R. capensis subsp. elisae (Figure 1, 22) is a small, prostrate shrublet. R. acuminata (Figure 1, 15) is unusual in Raffia in that it is prostrate and trailing.

Branching is generally alternate in the Crotalariaeae, but in Raffia, branching may be opposite (Polhill 1976). The woody taxa are often much-branched, e.g. R. racemosa subsp. racemosa, R. triflora and R. amplifica. The stems may be unbranched for most of their length, for example R. angulata subsp. thunbergii, and they may be chiefly branched from the base, as in R. lancea. Branching is often dichotomous in the upper parts and this is pronounced in R. inaequalis, R. acuminata, R. amplifica, R. schlechteriana, R. capensis subsp. dichotoma and R. globosa.

Different regional forms or populations within species may
have specific recognisable growth forms. For example, the Cedarberg form of *R. angulata* subsp. *angulata* may be a low-growing shrublet (0.3m high) or a large suffrutex up to 1.5m high. The typical form of *R. triflora* is a large, much-branched woody shrub, while the Caledon form is an erect shrublet.

Despite the variation in *Rafnia*, habit is useful for distinguishing between species which appear to be very similar on herbarium sheets, but differ markedly in habit. Examples include *R. ovata* and *R. schlechteriana*, which appear similar as dried specimens but differ in habit. *R. acuminata* and *R. amplexicaulis* are easily confused on herbarium sheets, but differ in that *R. acuminata* is prostrate and trailing while *R. amplexicaulis* is a large woody shrub.

**Fire-survival strategy**

The taxa of *Rafnia* are resprouters, and sprout from a woody rootstock after fire, while non-sprouters reproduce by seed after fire (Schutte et al. 1995). In sprouting taxa, coppice shoots are produced from an underground lignotuber causing the plants to appear multi-stemmed at ground level. Non-sprouting taxa can only regenerate from seed after fire and are recognised by a single main stem at least at ground level. Many of the populations visited during field excursions occurred in areas that had recently burnt and the plants were resprouting profusely in such areas.

The finding that all *Rafnia* species are resprouters is unusual in the Fabaceae, especially since the sprouter:non-sprouter ratio for fynbos legumes has been reported as less than 25% (Schutte et al. 1995). *Aspalathus*, for example, has more non-sprouters than sprouters. The resprouting habit could be considered an advanced adaptation to fire-survival, but the polarity of this character is not clear. Sprouting has been described as an ancestral character by James (1984), but this does not automatically mean that lignotubers are ‘primitive’ because their evolutionary history is unknown. There is evidence, however, suggesting that some species with lignotubers may have originated relatively recently (James 1984).

Results from population genetic studies in *Aspalathus linearis* (Van der Bank et al. 1999) imply that seeders are ancestral and that sprouting has developed from seeding as a fire-survival strategy. It is possible that a switch to sprouting and back to seeding may occur. In *Aspalathus*, it has yet to be proved whether the change from seeding to sprouting was a single evolutionary event.

**Mode of flowering**

The mode of flowering is intricately linked to habit in *Rafnia* and is especially interesting since a number of species may have flowering branches that persist as vegetative structures in the following season. In these species, the flowering branch has a distinct architecture, e.g. globose in *R. globosa* and pyramidal in *R. schlechteriana*, resulting from the secondary aggregation of the synflorescence. The whole structure remains on the plant after flowering and fruiting, so that vegetative and flowering branches can be distinguished. Species that do not display this mode of flowering are either small to prostrate perennials or woody shrubs, in which case the new growth arises from existing branches (above the ground) rather than from the lignotuber.

**Leaves**

In *Rafnia*, the leaves are simple, sessile, stipulate and very variable (Figure 2). Margins are entire and often cartilaginous. The leaves are mostly glaucous (distinctly grey in *R. rostrata* subsp. *rostrata*) and often turn black upon drying, or they may rarely be bright green and remain so, even when dry (e.g. *R. crassifolia* and sometimes *R. spicata*).

Leaf arrangement in *Rafnia* may be invariably alternate, in which case the cauleine leaves and the leaves on the flowering branches are alternate. This usually occurs in species with multi-flowered racemes, e.g. *R. racemosa* subsp. *racemosa* and *R. capensis* subsp. *pedicellata*. Most commonly, the cauleine leaves are alternate, while the leaves on the flowering branches are subopposite or opposite, or the leaves on the flowering branches may be invariably opposite. The latter condition is less common, and is associated with single-flowered racemes, as in *R. inaequalis*, *R. acuminata*, *R. amplexicaulis*, *R. schlechteriana* and *R. globosa*. The more derived condition seems to be that in which the leaves are invariably opposite.

When the leaves on the flowering branches are subopposite or opposite, they form leaf pairs which subdivide the single-flowered inflorescences, superficially resembling large bracts. These bract-like leaves may be similar to the vegetative leaves or they may be highly reduced ( *R. ovata*) or absent ( *R. crispa* and *R. lancea*). The state of these leaves (‘pseudobracts’) proved to be a useful character in the phenetic and cladistic analyses.

Leaf size and shape are taxonomically valuable to some extent. In *Rafnia*, the leaves of mature plants may differ markedly from those of coppicing plants or seedlings (this is pronounced in *R. inaequalis*, *R. diffusa*, *R. schlechteriana*, *R. capensis* subsp. dichotoma and some forms of *R. capensis* subsp. *ovata*). Much of the taxonomic confusion of the past was due to a poor understanding of the difference between coppice and mature leaves, so that many herbarium specimens have been misidentified. The character is too variable to reveal any significant discontinuities for it to be logically polarised for the cladistic analysis.

The basal cauleine leaves are often much larger than the leaves higher up on the flowering branches and they may also differ in shape, as in *R. triflora* and *R. schlechteriana*. The basal leaves may, however, be smaller than the leaves higher up, e.g. *R. rostrata* subsp. *pluriflora*.

Leaf shape in *Rafnia* varies from ericoid to linear to elliptic to obovate or rarely cordate, with the apex acute to obtuse or acuminate. Cordate leaf shape is a useful synapomorphy for *R. inaequalis*, *R. acuminata* and *R. amplexicaulis*. Leaf venation is usually indistinct in *Rafnia* or sometimes penninerved, as in *R. crispa*. Reticulate venation is a useful synapomorphy for *R. acuminata* and *R. amplexicaulis*. Leaf arrangement, size, shape and venation patterns are useful taxonomic characters and are helpful for distinguishing the regional forms in some species.
Inflorescence

In *Rafnia*, inflorescence structure is variable. The basic type of inflorescence is a raceme which may be single-flowered, multi-flowered (with up to 45 flowers) or between the two, then usually considered few-flowered (2–9 flowers). The various structural types of racemes (Figure 3) may each have numerous modifications, specialisations or degrees of reduction.

The multi-flowered raceme (Figure 3, 1a–c) is usually terminal, or sometimes growth may continue from the apex of the raceme (e.g. *R. racemosa* subsp. racemosa). In *R. capensis* subsp. pedicellata, the inflorescence consists of 20 or more flowers with elongated pedicels.

A compressed axis, which makes the flowers appear clustered on the rachis (Figure 3, 1c), occurs in *R. rostrata* subsp. pluriflora, some forms of *R. angulata* subsp. angulata, *R. capensis* subsp. dichotoma, *R. capensis* subsp. ovata and *R. capensis* subsp. elseae. There are usually two to six flowers per inflorescence in *R. capensis* subsp. eliseae, rarely up to nine flowers in *R. capensis* subsp. ovata.

The inflorescence axis is variously defined in *Rafnia*. This axis may consist of a rachis and a peduncle, as in the multi-flowered raceme of *R. racemosa* subsp. racemosa. Alternatively, the axis may constitute a rachis only, in which case the peduncle is absent, e.g. *R. capensis* subsp. pedicellata, or a peduncle only, in which case the rachis is suppressed, e.g. *R. vlokii*.

The multi-flowered raceme may be reduced to a single flowered raceme (Polhill 1976), which is terminal and axillary and may be variously modified or reduced. This is the most common type of inflorescence in *Rafnia*.

The last internode of the stem, directly below the single-flowered raceme, may be elongated to form a so-called ‘pseudopseuduncle’ in *Rafnia*, which varies in length. Single-flowered racemes may also be pedunculate, in which case the peduncle arises beyond the pair of subtending leaves: below the flower, e.g. *R. vlokii*, or directly from the axil of the leaf on the flowering branch, as in *R. elliptica*, *R. crispa* and *R. lancea*. In the single-flowered racem of *R. crassifolia* (Figure 3, 2e), flowers emerge directly from the leaf axils of the flowering branches, as a result of the partial or complete suppression of the peduncle.

The peduncle or pseudopseuduncle often continues as a short, sterile process beyond the point of attachment of the pedicel of the flower (sterile extension of the rachis). The pseudopseuduncle may terminate in a single-flowered raceme in which case a sterile process is present, or growth may continue from the axes of the leaves subtending the inflorescence, in which case a sterile process is absent. This continued growth gives rise to a dichotomous branching pattern, which, when extensively developed, may form secondary aggregations of inflorescences into more complex structures (flowering branches) which may take on a globosse structure (as in *R. globosa*) or a pyramidal structure (as in *R. schlechteriana*). These secondary aggregations are large, terminal, leafy structures formed by single-flowered racemes.

*R. elliptica* and *R. ovata* usually have an axillary, single-flowered, pseudopseudunculate raceme, but the inflorescence may sometimes have two to four flowers occurring on an axillary peduncle.

The inflorescences in *Rafnia* are often subtended by a pair of leaves, which may be opposite or subopposite, and they may be similar to the leaves of the main stem or variously reduced (Polhill 1976). When reduced in size, these leaves may simulate bracts and have previously been mistaken for foliaceous bracteoles (Polhill 1976). This pair of leaves is highly reduced in *R. triflora* and *R. ovata* and sometimes *R. elliptica* and is absent in *R. crispa* and *R. lancea*.

*R. triflora* has an unusual inflorescence, of which the ontogenetic development is unclear. Three to five single-flowered inflorescences appear to emerge from the axis of a pair of reduced opposite leaves. The central inflorescence emerges first, followed by two or rarely four lateral inflorescences. This appears to be a lateral axillary inflorescence, in turn with two axillary inflorescences developing from it. This inflorescence is so highly reduced that it is difficult to interpret the exact origin of the lateral inflorescences.

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**Figure 3:** Variation in inflorescence structure in *Rafnia*. 1a–c. Terminal, multi-flowered racemes: a. 35 flowers or more, e.g. *R. capensis* subsp. pedicellata; b. elongated inflorescence axis, e.g. *R. racemosa*; c. compressed inflorescence axis, e.g. *R. capensis* subsp. ovata. 2a–e. Terminal, axillary, single-flowered racemes: a. pseudopseudunculate, e.g. *R. amplexicaulis*; b. pedunculate, with the peduncle arising beyond the subtending leaves, e.g. *R. vlokii*; c. pedunculate, with more than one flower per axillary peduncle, e.g. *R. elliptica*; d. pedunculate, with the subtending leaves highly reduced or absent, e.g. *R. crispa* and *R. lancea*; e. axillary flower, resulting from complete suppression of the inflorescence axis, e.g. *R. crassifolia*. 3. Three axillary, pedunculate single-flowered racemes of *R. triflora*.
As was shown by cladistic analyses, the inflorescence is more valuable at species level than at sectional level, because terminal racemes (interpreted as plesiomorphic) are sporadically present in distantly related species (e.g., in forms of *R. angulata* and *R. capensis*). This implies that the reduction of the multi-flowered raceme to a few- or single-flowered inflorescence was not a single event in *Rafnia*, but occurred repeatedly in several different lineages, or, perhaps less likely, reversed in some lineages.

**Flowers**

The flowers in *Rafnia* are typically papilionoid, and size and shape are very variable (Figure 4). The pedicel gradually merges with the calyx base and is not intrusive as in some Podalyrieae. The pedicel is generally short and shorter than the flower or may be elongated in *R. crassiloba* and *R. capensis* subsp. *pedicellata*, in which it is 15mm long or more.

Flower size in *Rafnia* has some value at sectional level, since the flowers of section *Rafnia* are usually large (15mm long or more) and those of section *Colobotropis* are usually smaller. The flowers are totally glabrous in *Rafnia*, except for the inviable presence of hairs on the inner surfaces of the calyces and minute cilia on the upper and/or lower margins of the wing petals of some species and the keel petals of most species. *Rafnia* flowers are always yellow and may remain so or fade to various shades of orange, pink or red-brown with age, and this is said to discourage flower visits to already pollinated flowers (Arroyo 1981).

In *Rafnia*, two basic types of flower structure are distinguished here, including flowers with a rostrate keel (Figure 9), belonging to section *Rafnia*, and those with an obtuse or truncate to emarginate keel (Figure 9), of section *Colobotropis*. Polhill (1976) does not refer to the type of flower with a truncate or emarginate keel.

The flowers in section *Rafnia* have thin petals, sculptured wing petals and a keel that is beaked (rostrate). The beak may be strongly developed in some species, but in most species of the section, the beak is not very strongly developed. A broad standard petal with basal callosities is characteristic for most species with strongly developed beaks, e.g., *R. amplexicaulis*. The flowers of *R. diffusa* and *R. spicata* are a transition from a rostrate to a truncate keeled type of flower. These flowers are thinly textured, the standard is sometimes folded in slightly along the lower edges, the wings are not always sculptured (*R. spicata*) and the keel may be beaked or obtuse.

The flowers with a truncate or emarginate keel (section *Colobotropis*), which may be considered more specialised than the strongly rostrate flower referred to by Polhill (1976), do not seem to occur in related genera and may be considered unique to *Rafnia*. These flowers are generally smaller and more firmly constructed than those with a rostrate keel. The calyx usually has a broad lateral sinus and tends to form a trifid lower lip. The petals are thickly textured and the claws often rigid and calloused. The standard petal is folded along the edges, and often reflexed far back from the other petals at anthesis. The oblong wings invariably lack petal sculpturing and have a broad central fold. The keel petals are variable in shape, but basically truncate or emarginate with a distinct lateral pocket (spur) on the basal central part which fits into the fold of the wing.

Field observations showed that the two types of flowers in *Rafnia* have different pollination mechanisms. In rostrate keeled flowers, the bee uses the wings as a landing platform, taking hold of the pockets and petal sculpturing. The standard is pressed back and pollen from the anthers within the keel comes into contact with the abdomen of the bee. In
trimuncate keeled flowers, the bee uses the standard petal instead of the wings as a landing platform. The standard is borne upright, often reflexed away from the other petals, and is strengthened by the folded edges and thicker texture. The keel faces upwards, and while the bee’s head strikes the keel apex, pollen from within the keel comes into contact with the head or dorsal surface of the thorax of the bee. It was observed that these types of flowers in Rafnia are pollinated by Xylocopid bees which have hairy thoraces, convenient for the pollen to cling to, whereas ordinary Apis have smooth thoraces, hence the pollen must cling to the legs or abdomen. The truncate or emarginate keeled type of flower is specifically adapted for a different pollination mechanism.

Flower morphology presented taxonomically useful characters at the sectional, specific and subspecific levels. The basic type of flower, whether having a rostrate or truncate keel, is useful for dividing the species into sections and combinations of flower characters are useful for identifying numerous species and subspecies.

**Bract and bracteoles**

Bracts are invariably present in Rafnia, simple and situated at the base of the pedicel. The bracts are commonly narrowly triangular or subulate (Figure 5), but may be broader as in R. angulata subsp. angulata or rarely very large and leaf-like in R. alata. Bracts are mostly subglabrous, with hairs towards the apex. Two small, linear to triangular simple bracteoles (Figure 5), which resemble the bracts, are generally borne on the pedicel, higher up on either side above the bract. The bracteoles may be strongly reduced (minute) or even absent (as in the Ooteniqua form of R. alata and R. amplexicaulis) and also often have hairs towards the apex.

**Calyx**

The variable calyx is an important character in Rafnia (Figure 6) and is useful at the sectional, generic, specific and subspecific levels. Rafnia plants were previously considered to be totally glabrous, but in this study it was found that hairs occur on the inner surfaces of the calyces in all the species. Within the Crotalariaeae, this is a useful synapomorphy for the genus.

The calyx is commonly subequally lobed and the carinal lobe is usually distinctly narrower than the other lobes. The carinal lobe is very narrow in R. elliptica, R. triflora and R. capensis subsp. calycina and filiform in R. vlokii and R. inequalis. When Aspalathus or Lebeckia are taken as outgroup, the pleisiomorphic type of calyx appears to be that of R. racemosa subsp. racemosa, in which the lobes are subequal and about as long as the tube.

The calyx lobes may be shorter or much shorter than the corolla. The calyx lobes are very long and as long as the corolla, or extend beyond the corolla in R. vlokii, R. alata, R. crassifolia, R. inequalis and R. capensis subsp. calycina and the relatively long calyx lobes are considered apomorphic.

Another useful character is the ratio between length of calyx lobes and length of calyx tube. R. vlokii and R. crassi-
than the lateral lobes. The latter includes *R. alata*, *R. elliptica*, *R. triloba*, *R. inaequalis* and *R. acuminata*, especially the Northern form. Broad upper lobes are considered apomorphic and this character was useful in the cladistic analysis. A character useful as a synapomorphy for *R. vlokii* and *R. alata* is the broad lateral calyx lobe, where the mean value is more than 4.5mm.

The upper sinus is usually as deep as the other sinuses, or at least the lateral sinuses, but it may be slightly shallower than the other sinuses only in *R. lancea*, or deeper, in at least some individuals, in *R. angulata* subsp. *angulata*, *R. rostrata* subsp. *rostrata*, *R. elliptica* and rarely in *R. racemosa* subsp. *racemosa* and *R. globosa*. The upper sinus is much deeper than the lateral sinuses in *R. triloba* and *R. ovata* and this character proved to be a useful synapomorphy.

The calyces of taxa in section *Colobotropis* have a trifid lower lip. This character is a useful synapomorphy for the section. The trifid lip is most pronounced in *R. diffusa*, *R. spicata*, *R. capensis* subsp. *capensis* and *R. capensis* subsp. *ovata* and is less well developed in *R. schlechteriana* and *R. globosa*.

The carinal lobe is often longer than the other lobes where a trifid lower lip is present. This rarely occurs where the lower lobes do not form a trifid lip, e.g. *R. angulata* subsp. *hummilis*. Cladistic analyses showed that this is probably a convergent occurrence in distantly related species. The carinal lobe is rarely shorter than the other lobes, as in some forms of *R. angulata* subsp. *angulata* and in *R. angulata* subsp. *thunbergii*, *R. triloba* and *R. inaequalis*. The short carinal lobe often occurs where the upper calyx sinus is deeper than the lateral sinuses.
The calyx tube may have a thickening, ridge or wing-like extension on the tube between the upper lobes. Thickenings occur on the tubes of R. vlokii, R. crassifolia, R. elliptica, R. triflora and R. ovata. A ridge-like extension may be present in R. angulata subsp. humilis, R. rostrata subsp. rostrata, R. acuminata, R. schlechteriana and R. capensis subsp. pedicellata. In R. angulata subsp. montana and R. inaequalis, the extension is wing-like and wing development is taken to its extreme in R. alata, which has five distinct wings occurring below each of the sinuses. This character is an autapomorphy for R. alata.

In terms of calyx variation, the Piquetberg is particularly interesting because the calyces of several taxa found there differ from the normal calyces of these taxa elsewhere. This is possibly because the Piquetberg is a centre of species diversity for Rafnia (see Distribution and geographical patterns). For example, in the form of R. acuminata that occurs on the Piquetberg, the upper lobes are much broader than the lateral lobes, and there is a ridge-like thickening between the upper lobes. The calyx of R. capensis subsp. calycina (which may be considered the Piquetberg form of R. capensis subsp. dichotoma) has long, narrow, reflexed lobes, whilst R. capensis subsp. dichotoma has shorter, broader lobes. The calyx of R. inaequalis, which is endemic to the Piquetberg, has an unusual shape, with large, falcate upper lobes, a wing-like extension on the tube and a filiform lower lobe.

Unique calyx characters useful for identifying certain species and subspecies include the unusual shape of the calyx of R. lancea, in which the upper and lateral lobes are fused higher up in pairs on either side, the large size of the calyx of R. vlokii, which completely envelopes the flower bud so that it looks like a leaf (this similarly occurs in R. angulata subsp. montana), the extreme zygomorphy of the calyx of R. inaequalis, the long, thin, greatly reflexed lobes of R. capensis subsp. calycina and the lobes which curl backwards after flower senescence in R. globosa.

Calyx morphology is taxonomically important in Rafnia and useful at all hierarchical levels, and it is even useful for identifying certain regional forms within species and subspecies.

**Corolla**

Corolla morphology is an important taxonomic character in Rafnia, being useful at the species and subspecies levels. Variation in petal structure is shown in Figures 7 (standard petals), 8 (wing petals) and 9 (keel petals). The standard may be ovate to broadly ovate or elliptic to broadly elliptic or round. The apex may be acuminate, rounded, retuse or folded to make an almost closed pocket (apical cusp). The apical cusp in R. angulata subsp. angulata is usually small, and R. capensis subsp. dichotoma and R. capensis subsp. elsineae have a larger, more distinctive cusp.

Some of the larger, broader standards have basal calllosities or ridges near the attachment of the claw, which are often disc-shaped, e.g. R. racemosa subsp. racemosa (Figure 7, 1), R. alata, R. ovata and R. amplexicaulis (Figure 7, 20). The lower half or lower two thirds of the edges of the standard blade are folded inwards to varying degrees in taxa of section Colobotropis. The folded standard is strongly correlated with a truncate or emarginate keel and a distinct lack of petal sculpturing on the wings. This forms part of the pollination syndrome of the flowers with truncate or emarginate keels.

The petal claws are generally well developed, and may be rather short, broad and somewhat calloused or long, nar-
rower and softer-textured. The claws of *R. lancea* are unusually very long relative to the petal blade.

The wings in *Rafinia* are generally elongate, oblong or ovate to obovate, or even obliquely triangular in *R. angulata* subsp. humilis. The distal part may be round and extended in *R. crispa* and *R. alata*, or the wing may be compressed and round, as in *R. capensis* subsp. capensis. The upper and/or lower basal wing margins may be minutely ciliated in a number of taxa of section *Rafinia*.

Wing petal sculpturing is invariably present in all taxa of section *Rafinia* and also in *R. diffusa*. It may be present or absent in *R. spicata* and is invariably absent in the remaining taxa of section *Colobotropis*. According to Stirton (1981), there is a general trend towards a reduction in sculpturing as flowers become more specialised, and this may also apply to *Rafinia*, since the flowers with truncate keels, which we consider specialised, completely lack petal sculpturing. The five to seven rows of petal sculpturing in *Rafinia* are usually situated on the upper basal and sometimes upper central parts of the wings [terminology of Stirton (1981)]. There may be from two rows in *R. spicata* to 12 rows in *R. angulata* subsp. thunbergii.

The wings in section *Rafinia* are usually broadly pocketed to fit the keel, which is also broadly pocketed. The wings in section *Colobotropis* have a more pronounced central fold which usually extends from the basal to the distal part of the wing blade. These folds in the wing blade often have the effect of keeping the wings and keel more firmly together (Dahlgren 1963a).

There are two basic keel shapes in *Rafinia*, namely rostrate or beaked and truncate (including obtuse and emarginate shapes). These shapes form the basis of the division of *Rafinia* into two sections, since the two monophyletic groups on the cladogram (Figure 16) may be distinguished by keel shape. Section *Rafinia* contains taxa with rostrate keels (Figure 9, 1–20) and section *Colobotropis* has taxa with obtuse or truncate to emarginate keels (Figure 9, 21–31).

In *Rafinia*, rostrate keels are generally lunate, and the beaked apex is often upcurved to varying degrees. The apex may be long, strongly beaked and upcurved in *R. crispa* and *R. ampl Diceus*, or shortly beaked and not upcurved as in *R. angulata* subsp. *angulata* and *R. inaequiloba*. It seems that *R. diffusa* and *R. spicata* have keel shapes that are transitional between the rostrate and truncate types. Keel shape is very variable in these species.

The keel is slightly lobed below the apex in *R. capensis* subsp. *carinata* and *R. globosa* and is thus neither truly rostrate nor truncate. Truncate keels are oblong and usually have a large lobe below the apex, and the size of the lobe (whether large or small) was a useful character in the cladistic and phenetic analyses.

The keel may be emarginate, as in *R. capensis* subsp. *elisae*, in which there is an indentation between the apex and the lobe below. A rather unusual keel shape is that of the Malmesbury form of *R. diffusa*, in which the keel is upcurved with a slightly extended, square-shaped apex (Figure 9, 21d). This keel shape is found in some species of *Aspalathus* (Dahlgren 1963a).

Polhill (1975, 1981) described keel shape in the Crotalariae as obtuse, pointed or beaked, with no reference to the truncate or emarginate keel found in *Rafinia*. The latter type appears to be unique to *Rafinia* and is not found to the same extent in related genera. *Aspalathus patens* Garab. ex Dahl., there is an extra lobe below the convex upper-apical margin, but Dahlgren (1963a) considered this a sporadic peculiarity developed at a relatively late stage. Like

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the wings, the keel blades have minute cilia on the upper and/or lower basal margins. All the keels seem to be ciliate to a certain extent, while only some wing petals are ciliate.

All taxa of section Colobotropis have a distinct, callous auriculate pocket on the central basal part of the keel. This was a useful character in both phylogenetic and cladistic analyses. There is no such pocket on the rostrate keels, but most of the surface of the blade forms a large, broad pocket, e.g. R. racemosa subsp. racemosa and R. rostrata subsp. pluriflora. The prominent basal bulges are also often lacking in Aspalathus when the keel is rostrate (Dahlgren 1963a).

Stamens

The 10 stamens (Figure 10) are fused into a sheath (usually for about two thirds of the length of the filaments) which is open on the upper side. The sheath may be straight and relatively thinly textured, or widened towards the base and thicker-textured. The latter occurs in most taxa of section Colobotropis, excluding R. diffusa and R. spicata. The widened sheath is a useful synapomorphy for R. schlechteriana, R. capsensis and R. globosa.

In Rafnia the free parts of the filaments may be more than half as long as the fused part of the staminal sheath, as in R. angulata subsp. angulata and R. acuminata. The longer free parts of the filaments are usually correlated with a strongly beaked keel and a greater degree of anther dimorphism. The free parts of the filaments may be less than half as long as the fused part of the staminal sheath in R. lancea, R. amplexicaulis and taxa of section Colobotropis. Shorter free parts of the filaments are usually correlated with a truncate or emarginate keel and a lesser degree of anther dimorphism. Since this character occurs independently in both sections, and is not correlated with the other characters in the same way, it may be considered a convergence in the two sections.

The stamens are almost always monadelphous in Rafnia, but may rarely and sporadically be diadelphous. In R. diffusa, the vexillary filament, bearing a dorsifixed anther, is inserted about half way into the staminal sheath, and in R. capsensis subsp. capensis, the filament is inserted only at its base. Diadelphous was also observed in R. angulata subsp. thunbergii and R. capsensis subsp. dichotoma.

The anthers in Rafnia are almost always distinct in dimorphism (Figure 11), with four long, oblong to linear basifixated anthers alternating with five (or six) short, ovate dorsifixed ones. The degree of dimorphism is more marked in the anthers of taxa with strongly beaked keels. The carinal anther is usually intermediate in size and shape, and may closely resemble the larger anthers or the smaller anther, or it may be intermediate between the two. The carinal anther may be identical to the smaller anther in some taxa of section Colobotropis, e.g. R. spicata, R. schlechteriana and R. capsensis subsp. pedicellata.

Pistil

The pistil in Rafnia (Figure 12) may be short-stipitate as in R. angulata subsp. eriocolla, R. alata and R. ovata or less often long-stipitate, e.g. R. angulata subsp. angulata and R.
diffusa. The stipe is always shorter than the ovary. Ovaries may have many ovules, with up to nine ovules per ovary in R. racemosa subsp. pumila and up to seven ovules per ovary in R. ovata. However, most taxa have two to four ovules per ovary, as in Aspalathus (Van Wyk and Schutte 1995).

The glabrous, generally slender, tapering style is either sharply or gently upcurved and the style tip is sometimes slightly incurved, e.g. R. capensis subsp. calycina and R. capensis subsp. dichotoma. The style may be longer than the ovary, especially in the Hermanus form of R. angulata subsp. angulata, more or less as long as the ovary, e.g. the Cedarberg form of R. angulata subsp. angulata, or shorter than the ovary, especially in taxa of section Colobotropis. A long style is generally correlated with strongly rostrate flowers and a short style with truncate keeled flowers or flowers with shortly beaked apices.

The stigma is terminal and may be small (in most taxa) or less often capitate (in taxa of section Colobotropis). The small stigma is usually glabrous, and the capitulate stigma, fibrillose. The fibrillose stigma is covered with small papillae, the peripheral elements of which may be developed as hairs (Dahlgren 1968a). The stigma is fibrillose in all taxa of section Colobotropis and therefore a useful synapomorphy for this section.

Pods

Van Wyk and Schutte (1995) included some pod characters in their generic analysis of the Crotalariaeae, but infrageneric variation complicated polarity decisions. Useful pod characters included the asymmetrically convex shape of the upper suture and that at least the upper suture is winged (in some species). The shape of the upper suture was one of the two synapomorphies which grouped Aspalathus and Rafnia as sister genera on the cladogram; the other was the absence of a petiole.

The pods of Rafnia (Figure 13) may be sessile or stipitate. Sessile pods occur in e.g. R. racemosa subsp. racemosa lancea and R. crassifolia. Stipitate pods occur in R. inaequalis and taxa of section Colobotropis with the exception R. schlechteriana, which is sessile. The stipes may be long and is usually shorter than the pod, as in R. globo or more or less as long as the pod, e.g. R. capensis subsp. capensis and R. capensis subsp. calicoma. The stipes of the latter subspecies is the longest in the genus and some form of R. capensis subsp. ovata have the shortest stipes. The broad-leaf Malmsbury form of R. angulata subsp. angulata is rarely stipitate, but this stipe is non-homologous with the stipe found elsewhere in the genus. The presence of a stipe is a useful synapomorphy for section Colobotropis, with the exception of R. schlechteriana in which it is a reversal. The character is apparently convergent in R. inaequalis.

The pods of Rafnia are obliquely lanceolate to oblanceolate or narrowly to broadly oblong. The pods may be broadest proximally and tapering, e.g. R. crassifolia and R. elliptica, or nearly oblong and broadened distally, e.g. R. vlokii. The pods of most subspecies of R. angulata are narrow proximally and broadened distally, with the upper margin asymmetrically convex and the lower margin more or less straight. The pods of R. schlechteriana are obliquely subtriangular, and broadest in the genus (up to 18mm wide). The pods of R. amplexicaulis have the upper margin proximally convex as opposed to the usually lower margin being proximally convex.

The upper suture is often developed into a narrow or rather broad wing. The upper suture is narrowly winged (1–2mm wide) in R. racemosa subsp. racemosa, R. rostrata subsp. rostrata, R. rostrata subsp. pluriflora, R. vlokii and most taxa of section Colobotropis. The upper suture is broadly winged in R. ovata and R. schlechteriana, in which the wing is up to 5mm wide.

Seeds

Seed characters that are significant in Rafnia include shape and features of the testa (texture and cell patterns).

The seeds of Rafnia range from 2–6mm long and 1–5mm wide and colour is very variable, ranging from greyish-white or pale yellow, through various shades of brown, to black. The hilar region may be the same colour as the rest of the testa or the testa may be pale or dark brown to black in the hilar region. There may be a distinct dark ring around the hilarum in R. angulata subsp. angulata and R. elliptica or a distinct pale ring in R. diffusa.

The seeds of section Rafnia are mostly similar to those of Aspalathus, in which they are narrowly oblong to obliquely oblong-reniform, e.g. R. angulata subsp. angulata. The seeds of section Colobotropis may be broadly oblong to oblique-cordiform, e.g. R. schlechteriana, reniform or discoidal or oblong-cordiform, as in R. capensis subsp. ovata, almost subtriangular, as in R. capensis subsp. dichotoma or suborbicular, e.g. R. globosa.

The prominence of the incurved radicular and micropylar lobes varies in Rafnia, giving rise to shallow or deep sinus-

es. *R. triflora* and *R. inaequalis* have shallow sinuses, while those of *R. schlechteriana* and *R. globosa* have deep, apparently gaping sinuses, in which the small elliptic to round exarillate hilum is sunken. A deep seed sinus is a useful synapomorphy for the species *R. schlechteriana*, *R. capensis* and *R. globosa* of section *Colobotrops*. In most taxa, the testa is slightly swollen around the hilum, and there is a large, distinct swollen ring around the hilum in *R. vlokii*, which distinguishes it from the other taxa.

There are two characters of the seed testa that should not be confused, each of which will be discussed separately below. Firstly, the texture of the testa surface may be smooth or covered with protuberances. The pattern of protuberances formed by several cells that are raised above the general surface of the seed gives the testa a tuberculate appearance. The texture is smooth, i.e. without protuberances in *R. racemosa* subsp. *racemosa*, *R. angulata* subsp. *angulata*, *R. angulata* subsp. *angulata*, *R. elliptica*, *R. triflora*, *R. inaequalis* and *R. acuminata*. The texture may be slightly tuberculate in *R. alata*, *R. ovata*, *R. amplexicaulis*, *R. spicata*, and *R. capensis* subsp. *dichotoma* and is distinct tuberculate in *R. diffusa*, *R. schlechteriana*, *R. capensis* subsp. *capensis*, *R. capensis* subsp. *calycina*, *R. capensis* subsp. *ovata* and *R. globosa*. *R. vlokii* is unique in having longitudinally striate seed surface.

Secondly, the testa cell pattern is a pattern formed by the cell walls of individual cells of the testa, and it can only be observed using scanning electron microscopy. The Papilionoideae has a particularly wide range of testa cell patterns (Manning and Van Staden 1987). The supposedly pleiomorphic rugose pattern is widespread throughout the family and the only pattern common to all three subfamilies of the Fabaceae (Manning and Van Staden 1987).

The closely related tribes Podalyrieae [now also including the Lipariaceae (Schulte and Van Wyk 1998) and Crotalariaeae share a predominantly multi-reticulate pattern.

Richardson and Cross (1991) studied the testa cell patterns of the seeds of 18 species of *Rafnia*. These patterns revealed interesting differences that were used to construct a key for the identification of species. Richardson and Cross (1991) used the nine categories of testa cell patterns proposed by Lerenst (1981), but these were found to be difficult to interpret as the different types seem to merge, with no distinct discontinuities between them. There are, however, basically two types of testa cell patterns in *Rafnia*, namely reticulate and foveolate patterns. This character is of limited taxonomic value as a species diagnostic character in *Rafnia*.

A detailed comparison between the testa cell patterns described by Richardson and Cross (1991) and the results obtained by Campbell (1998) is given in Campbell (1998).

The patterns broadly follow phylogenetic trends in the genus and the strongest evidence for this is that all taxa of section *Colobotrops* (except *R. schlechteriana*) have multi-reticulate patterns (the most common in *Rafnia*). However, this pattern is also found sporadically in taxa of section *Rafnia*. The remaining taxa mostly have a foveolate testa cell pattern, which is basically a pattern of single or multiple cell ends isolated by grooves (Richardson and Cross 1991), e.g. *R. elliptica* and *R. triflora*.

Seed characters have limited taxonomic value in *Rafnia*, since there is much uncertainty surrounding their interpretation, especially regarding testa cell patterns. In summary, seeds of section *Rafnia* may be described as oblong, often with a distinct ring around the hilum and a smooth surface. Seeds of section *Colobotrops* are generally broader than those of section *Rafnia* and they have extended lobes, a deeper sinus, a tuberculate surface and a multi-reticulate testa cell pattern. These seeds lack a distinct ring around the hilum.
Distribution and geographical patterns

The Crotalariaeae is mainly restricted to Africa with most of the diversity centred in southern Africa (Van Wyk 1991a). *Rafinia* forms part of a temperate element of the Crotalariaeae and is distributed in the Western and Eastern Cape Provinces and southern KwaZulu-Natal (between 31° and 35°S and 18° and 30°E). *Rafinia* extends from Nieuwoudtville and Vanrhynsdorp in the northwestern part of the Western Cape Province down through the southwestern and southern parts of the fynbos region, eastwards to Grahamstown and further up into Pondoland, in the southeastern parts of KwaZulu-Natal [see distribution map of *R. elliptica* (Figure 27), the only species not restricted to the fynbos biome].

The main centres of species diversity in *Rafinia* appear to be the Cedarberg, Piqueberg, Worcester and Stellenbosch districts, and numerous species also occur on the Cape Peninsula and Swartberg (Figure 14). The highest concentration of taxa (11 taxa) occurs on the Piqueberg, including representatives from both sections. *R. inaequale* is endemic to the Piqueberg and *R. capensis* subsp. *calycina* occurs only on the Piqueberg and in the Olifantsriver mountains. *Aspalathus* also shows diversity on the Piqueberg, with approximately 35 species occurring there, four of which are endemic (Dahlgren 1963b).

*Rafinia* is characterised by complex geographical patterns which are similar to those of *Aspalathus* (Dahlgren 1963b). There is exceptional geographical variation in *Rafinia*, particularly in the widespread species. Some forms are so distinct that the rank of subspecies seems appropriate.

Even when no formal taxonomic recognition is given, the regional forms may be so characteristic that the geographical origin (sometimes even the exact locality) of a specimen can be told from its appearance. This is true for many other Cape genera of the Fabaceae. Since the genetic basis for the geographical variation is not known, we use the term 'form' in an informal way, merely to describe the extreme variability.

Numerous taxa in *Rafinia* are local endemics and some are very rare, being known only from one locality. The latter include *R. racemosa* subsp. *pumila*, *R. crispa* and *R. inaequale*. Locality details are given in the taxonomic part of the paper. Other local endemics include *R. angulata* subsp. *thunbergii*, *R. angulata* subsp. *humilis*, *R. angulata* subsp. *ericifolia* and *R. angulata* subsp. *montana*, as well as *R. lancea*, *R. rostrata* subsp. *pluriflora*, *R. alata*, *R. crassifolia*, *R. capensis* subsp. *carinata*, *R. capensis* subsp. *calycina*, *R. capensis* subsp. *alsieae*, *R. capensis* subsp. *pedicellata* and *R. globosa*.

Geographical distribution patterns in *Rafinia* contribute to a better understanding of the variation patterns within the variable species. It may even give clues about possible vicariance events which may have resulted in some of the major clades.

Phenetic analysis

The advantages and disadvantages of phenetic methods of

Figure 14: Concentrations of species and subspecies within the distribution area of *Rafinia*—the number of taxa present within each quarter degree square is shown. The arrow indicates that one species continues into KwaZulu-Natal (Figure 27)
Table 2: Characters and character states used for the phenetic analysis

<table>
<thead>
<tr>
<th>Character</th>
<th>States</th>
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<tbody>
<tr>
<td>Leaf arrangement on flowering branches</td>
<td>1 = invariably alternate; 2 = subopposite or opposite; 3 = opposite</td>
</tr>
<tr>
<td>Leaf pair below flower</td>
<td>1 = similar to vegetative leaves; 2 = reduced or absent</td>
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<td>Maximum flowering branch leaf length (mm)</td>
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<td>Mean flowering branch leaf length (mm)</td>
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<td>Maximum basal leaf length (mm)</td>
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<td>Mean basal leaf length (mm)</td>
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<td>Maximum flowering branch leaf width (mm)</td>
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<td>Maximum floral branch leaf length:maximum flowering branch leaf width</td>
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<td>Mean basal leaf length:maximum basal leaf width</td>
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<td>Maximum calyx length (mm)</td>
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<td>Mean calyx length (mm)</td>
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<td>Maximum calyx length: mean corolla length</td>
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<td>Maximum calyx lobe length (mm)</td>
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<td>Calyx lobe length: calyx tube length</td>
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<td>Wing-like extension on calyx tube between upper lobes</td>
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<td>Maximum upper calyx lobe width (mm)</td>
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<td>Maximum calyx lobe width:maximum calyx lobe width</td>
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<td>Mean calyx lobe width:maximum calyx lobe width</td>
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<td>Maximum carinal calyx lobe width (mm)</td>
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<td>Mean carinal calyx lobe width (mm)</td>
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<td>Carinal calyx lobe (1 = shorter than or as long as other lobes; 2 = longer than other lobes)</td>
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<td>Upper calyx lobe width:maximum calyx lobe width</td>
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<td>Maximum depth of upper calyx sinus (mm)</td>
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<td>Mean depth of upper calyx sinus (mm)</td>
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<td>Maximum depth of lateral calyx sinus (mm)</td>
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<td>Mean depth of lateral calyx sinus (mm)</td>
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<td>Depth of upper calyx sinus:depth of lateral calyx sinus</td>
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<td>Maximum standard length (mm)</td>
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<td>Mean standard length (mm)</td>
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<td>Standard (1 = not folded in along edges; 2 = folded in along edges)</td>
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<td>Basal callosities on standard (1 = absent; 2 = present)</td>
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<td>Maximum wing length (mm)</td>
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<td>Mean wing length (mm)</td>
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<td>Wing sculpturing (1 = invariably present; 2 = present or absent; 3 = invariably absent)</td>
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<td>Maximum number of rows of wing sculpturing</td>
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<td>Maximum keel length (mm)</td>
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<td>Mean keel length (mm)</td>
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<td>Pocket on keel (1 = indistinct; 2 = distinct)</td>
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<td>Keel shape (1 = non-rostrate; 2 = rostrate)</td>
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<td>Keel shape (1 = not lobed below apex; 2 = slightly lobed below apex; 3 = markedly lobed below apex)</td>
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<td>Standard length:keel length</td>
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<td>Wing length:keel length</td>
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<td>Standard length:calyx length</td>
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<td>Wing length:calyx length</td>
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<td>Keel length:calyx length</td>
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<td>Stigma (1 = small; 2 = capitulate)</td>
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<td>Stigma (1 = glabrous; 2 = fibrolose)</td>
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<td>Style (1 = shorter than ovary; 2 = as long as or longer than ovary)</td>
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<td>Maximum length of basifixed anthers (mm)</td>
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<td>Mean length of basifixed anthers (mm)</td>
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<td>Maximum length of carnal anther (mm)</td>
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<td>Mean length of carnal anther (mm)</td>
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<td>Maximum length of dorsifixed anthers (mm)</td>
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<tr>
<td>Mean length of dorsifixed anthers (mm)</td>
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<td>Length of basifixed anthers:length of dorsifixed anthers</td>
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<td>Length of basifixed anthers:length of carnal anther</td>
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<td>Length of dorsifixed anthers:length of carnal anther</td>
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analysis of the genus *Dictichus DC.*, the five resulting groups corresponded to the five species recognised in *Dictichus* which are phenetically quite distinct (Schutte and Van Wyk 1990). González-Andrés and Ortiz (1996) undertook a morphometric analysis of the genus *Cytisus* L. and its allies. The result showed four distinct groups within *Cytisus*, which agreed with the grouping obtained by other seed morphometry and biochemical studies, and supported the proposed generic arrangement.

Both phenetic and cladistic methods were used to explore the intricate relationships among the taxa of *Rafinia*. The genus was analysed phenetically in order to quantify the similarities among species, using the package NTSYS-PC 2.01. A number of phenograms were constructed at the sub-species and species levels.

As many meaningful quantitative characters as possible, and some qualitative characters were included in the analysis (Table 2). A data matrix of 63 characters and 19 species (Table 3) was constructed for the species level phenogram, the result of which is presented below (Figure 15). Morphometric values for all OTU's and subspecies of *Rafinia* were included in the final measurements presented for the species. Various coefficients of similarity were applied to each of the phenograms that were constructed. A satisfactorily result was obtained using the Unweighted Pair Group Method of Analysis (UPGMA) and the Simple Matching Coefficient was applied, being the most suitable coefficient for the type of data available (a mixture of qualitative and quantitative characters).

The taxonomic structure shows two definite groups in *Rafinia*. These groups correspond exactly with the two monophyletic clades of the cladogram (Figure 16), showing that the arrangement of species based on similarity agrees closely with the arrangement of species on the cladogram. The main differences between the phenogram and cladogram are in section *Rafinia*, where relationships are as yet unresolved.

Infrageneric phylogeny

Bentham (1843) provided a sectional classification for *Rafinia* and his ideas were followed by Harvey (1862). Due to the discovery of several new species and subspecies of *Rafinia* and an improved understanding of relationships among the taxa, these classifications have been outdatet, hence a re-evaluation of relationships in *Rafinia* is necessary.


The work of Polhill (1976) provided new insight into characters within the Crotalarieae. Van Wyk and Schutte (1995) explored relationships in the tribes Podalyrieae, Liparieae and Crotalarieae and the cladistic approach led to a better understanding of relationships and improved evaluation of circumscriptions of taxa.
### Table 3: Matrix of 19 species and 83 characters used for constructing the phenogram for *Rafinia* in Figure 15. (Characters and character states are given in Table 2)

<table>
<thead>
<tr>
<th>Species</th>
<th>Character number</th>
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<tbody>
<tr>
<td>R. rieberi</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>R. angelata</td>
<td>2 3 4 5 6 7 8</td>
</tr>
<tr>
<td>R. crassipes</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>R. tenuis</td>
<td>2 3 4 5 6 7 8</td>
</tr>
<tr>
<td>R. rostrata</td>
<td>2 3 4 5 6 7 8</td>
</tr>
<tr>
<td>R. vibla</td>
<td>2 3 4 5 6 7 8</td>
</tr>
<tr>
<td>R. altata</td>
<td>2 3 4 5 6 7 8</td>
</tr>
<tr>
<td>R. caespitosa</td>
<td>2 3 4 5 6 7 8</td>
</tr>
</tbody>
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### Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Character number</th>
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<tbody>
<tr>
<td>R. rieberi</td>
<td>22 23 24 25 26 27 28</td>
</tr>
<tr>
<td>R. angelata</td>
<td>22 23 24 25 26 27 28</td>
</tr>
<tr>
<td>R. crassipes</td>
<td>22 23 24 25 26 27 28</td>
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<tr>
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<td>R. caespitosa</td>
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<thead>
<tr>
<th>Species</th>
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<tbody>
<tr>
<td>R. rieberi</td>
<td>43 44 45 46 47 48 49</td>
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<tr>
<td>R. angelata</td>
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</tr>
<tr>
<td>R. crassipes</td>
<td>43 44 45 46 47 48 49</td>
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<tr>
<td>R. caespitosa</td>
<td>43 44 45 46 47 48 49</td>
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The cladogram (Figure 16) provides a summary of the probable order of character development in Rafnia and represents a first explicit hypothesis of phylogenetic relationships at species level. The patterns in character state distributions were used to formulate a classification for Rafnia.

The outgroup method was used for the polarization of character states. Aspalathus was chosen as outgroup since it shares a number of characters with Rafnia and is considered to be the sister genus of Rafnia (Van Wyk and Schutte 1995). All discontinuous and logically polarizable characters in Rafnia were initially included in the analysis (Table 4). Variable characters (where the plesiomorphic and apomorphic states co-occur) were encoded for the plesiomorphic state and autapomorphies and invariable characters were omitted from the analysis.

Nineteen species and 26 characters were included in the final analysis (Table 5). The 'ie' and 'nelsen' commands of Hennig86 (Farris 1988) were used, since these guarantee the shortest possible consensus tree or trees.

Various alternatives were investigated, using different combinations of characters and various polarisations, since there was often character conflict. Characters which created much homoplasmy were removed from the analysis in various combinations, after investigating the 'x steps c' command of Hennig86, resulting in improved tree topologies. In a final analysis, a tree with a length of 39 steps, a retention index of 87 and a consistency index of 71 was obtained—shown in the cladogram in Figure 16.

The monophyly of Rafnia is supported by three apomorphies, namely simple, sessile leaves, the leaves and petals that are totally glabrous and the presence of minute hairs on the inner surfaces of the calyx and towards the apex of the bracts, bracteoles and sterile extensions of the rachis. The close relationship between Rafnia and Aspalathus is most evident in the species of Aspalathus group 7 (Borboiniae), that also have simple, sessile and glabrous leaves. However, the vestiture of the standard petal (hair in Aspalathus) and inner surface of the calyx (glabrous in Aspalathus) are the most reliable diagnostic characters.

There are two monophyletic groups within Rafnia which are formally treated here as sections Rafnia (rostrate keels), including species from R. racemosa to R. amplicaulis on the cladogram, and Colobotrops (truncate keels), including species from R. diffusa to R. globosa on the cladogram. Within section Rafnia, the 'acuminata' clade, i.e. R. inaequalis, R. acuminata and R. amplicaulis, was always well resolved, proving to be a convincing group. Within section Colobotrops, the 'capensis' clade, i.e. R. diffusa, R. spicata, R. schlechteriana, R. capensis and R. globosa, was similarly well resolved.

There was poor resolution in the basal part of the cladogram within section Rafnia, which may well be a paraphyletic assemblage, rather than monophyletic. There is still uncertainty about the true relationships among these species because overall similarities may confuse the real relationships. Since relationships in section Rafnia were not fully resolved, and to facilitate the arrangement of species, this rather diverse section was divided into four informal groups. These include the paraphyletic 'racemosa' group (including R. racemosa, R. angulata, R. crispa, R. lancea and R. rostrata), which has strongly rostrate keels and oblongolate pods; the 'elliptica' group (including R. vlokii, R. alata, R. crassifolia and R. elliptica), with calyx characters to support it; the 'triflora' group (including R. triflora and R. ovata), based on inflorescence structure; and the 'acuminata' group (including R. inaequalis, R. acuminata and R. amplicaulis), based on corollate, reticulate leaves.

Comparisons of graphic summaries of quantitative characters with the topology of the cladogram improved our confidence in the cladogram, since phenetic trends compared favourably with phylogenetic trends. This is an independent indication that the cladogram may be considered a close representation of phylogenetic trends in Rafnia (as far as it is possible to extrapolate these from the limited information presently available).

1 This result of a strongly monophyletic group (e.g. section
Colobotropis) within an apparently paraphyletic assemblage (e.g. section Rafnia), is also found in other plant groups, with examples in the Bossiaeeae and Mirbelieae of the Fabaceae, the Apiaceae and Araliaceae, Lamiaeae and Verbenaceae. The merits for or against recognising paraphyletic groups have been extensively debated in recent issues of Taxon, e.g. Van Welzen (1997).

The cladistic analysis of Rafnia provided insight into the previously misinterpreted relationships among the taxa, in spite of the extreme variation in characters and character states, as reflected in the new classification.

Since the best cladograms were only partially resolved, it is concluded that the true infrageneric phylogeny of Rafnia seems too complex to be reconstructed from morphological characters alone. The proposed cladogram nevertheless provides a working hypothesis for future studies, possibly using chemical and/or molecular techniques. Without this basic taxonomic framework, no sensible sampling strategy would be possible.

Conclusions

Results show that Rafnia has been relatively poorly known, collected and understood. There are numerous taxonomically valuable morphological characters in Rafnia. Characters unique to Rafnia include the standard petal which is folded in along the edges and the truncate or emarginate shape of the keel in section Colobotropis. Habit, leaves, inflorescences, flowers, pods and seeds proved to be taxonomically valuable characters. Of particular interest are the highly derived inflorescences, which are often similar in appearance yet different in structure (non-homologous), and the mode of flowering in which the flowering branches persist to the following season.

In spite of the exceptional regional variation among the different forms, and combinations of characters and character states in Rafnia, a clear hypothesis of phylogenetic relationships among the species was obtained using the cladistic approach. This approach also led to new interpretations of character development in the genus.

Taxonomic history

A detailed overview of the taxonomic history of Rafnia is given in Campbell (1998). The most important contributions to the taxonomy of Rafnia will be highlighted here.

Bentham (1843) reunited the genera Vascoa and Pelecythis with Rafnia since he believed that Rafnia was a very natural genus. He argued that the genus 'could well be divided into four sections, by characters of nearly equal value, but scarcely of importance enough to break up into distinct genera, so natural, and at the same time so small a group'. He distinguished Rafnia from the simple-leaved Genisteae by the lack of hairs, glaucous leaves and the fact that the plants turn black when dry. Bentham's four sections were Vascoa, Eu-Rafnia, Pelecythis and Caminotropis.

Harvey (1859) described the new species R. crassifolia Harv. and R. thunbergii Harv. and in his Flora Capensis (1862) he distinguished the four sections of Bentham, including 19 species. The work of Harvey (1862) is the most recent, complete published revision of Rafnia. Later contributions include the descriptions of R. ericifolia Saltler (1946) and R. crispa C.H. Stirton (1982).

In a preliminary unpublished revision of Rafnia, Richardson (1986) distinguished 21 species. Unfortunately, there are some serious interpretative errors in this work and the nomenclature and circumscription of species leave much
Table 4: Characters and character states used for the cladistic analysis

1. Leaf pair below flowers: 0 = similar to vegetative leaves; 1 = reduced or absent. 2. Leaf shape: 0 = non-cordate; 1 = cordate. 3. Width of basal leaves: 0 = narrow (mean less than 40mm); 1 = broad (mean equal to or more than 40mm). 4. Leaf venation: 0 = reticulate; 1 = pinnate. 5. Calyx lobe length: corolla length (maximum ratio): 0 = less than 10; 1 = equal to or more than 10. 6. Calyx lobes: calyx tube (mean ratio): 0 = short (less than 3); 1 = long (equal to or more than 3). 7. Calyx (trifid lower lip): 0 = absent; 1 = present. 8. Calyx (upper lobe shape): 0 = non-falcate; 1 = falcate. 9. Calyx (upper lobe width): 0 = narrow (mean less than 3.5mm); 1 = broad (mean equal to or more than 3.5mm). 10. Calyx (lateral lobe width): 0 = narrow (mean less than 4.5mm); 1 = broad (mean equal to or more than 4.5mm). 11. Calyx (carinal lobe): 0 = shorter than or equal to other lobes; 1 = longer than other lobes. 12. Calyx (wing-like extension on tube between upper lobes): 0 = absent; 1 = ridge-like extension present; 2 = wing-like extension present. 13. Calyx (upper sinus): 0 = not much deeper than lateral sinus; 1 = much deeper than lateral sinus. 14. Calyx (depth of lower sinus): 0 = shallow (mean less than 9mm); 1 = deep (mean equal to or more than 9mm). 15. Standard petal: 0 = not folded in along edges; 1 = folded in along edges. 16. Wing petal sculpturing: 0 = invariably present; 1 = present or absent; 2 = invariably absent. 17. Keel petal shape: 0 = non-rostrate (beaked); 1 = rostrate (beaked). 18. Keel petal shape: 0 = not lobed below apex; 1 = slightly lobed below apex; 2 = markedly lobed below apex. 19. Keel petal: 0 = pocket indistinct; 1 = pocket distinct. 20. Staminal sheath: 0 = even width; 1 = widened towards base. 21. Free parts of filaments: 0 = more than half as long as fused part; 1 = less than half as long as fused part. 22. Stigma: 0 = glabrous; 1 = fibrosillose. 23. Stigma: 0 = small; 1 = capitulate. 24. Pods: 0 = non-stipitate; 1 = stipitate. 25. Pod length: pod width (mean ratio): 0 = less than 6; 1 = equal to or more than 6. 26. Seed sinus: 0 = shallow; 1 = deep

Glabrous, multi-stemmed resprouting shrubs or suffrutes, rarely small trees up to 2.5m high; stems erect, procumbent or prostrate, often dichotomously much-branched in the upper parts. Leaves simple, sessile, invariably glabrous, stipulate, variable in shape, linear to round, venation usually indistinct or less often distinctly reticulate or pinnervenated; cauline leaves alternate; leaves on flowering branches mostly opposite or subopposite or rarely alternate; basal leaves often much larger than upper leaves; cuppice leaves often larger and different in shape from mature leaves. Inflorescences variable, terminal or axillary racemes, mostly single-flowered and pseudopendunculate or less often few to multi-flowered and pendunculate, occasionally the racemes secondarily aggregated towards branch ends into spike-like, pyramidal or globose flowering branches. Flowers variable in size, invariably yellow, sometimes fading pink, orange or brown; bracts and bracteoles simple, often with a few hairs towards the apex; bracts narrowly triangular, often minute, rarely ± leafy; paired bracteoles narrowly triangular to subulate, minute or absent (reduced leaves below inflorescence sometimes mistaken for bracteoles). Calyx subgually lobed or sometimes forming a trifid lower lip; upper lobes falcate or non-falcate, sometimes much broader than lateral lobes; lateral lobes sometimes falcate; carinal lobe invariably narrowest; wing-like ridges or extensions sometimes present on calyx tube. Standard ovate to elliptic or suborbicular, sometimes with basal callosities; apex sometimes with an apical cusp or obtuse or rarely reflex if not cuspid; edges of lamina sometimes folded inwards, or upper two thirds reflexed at anthesis. Wings oblong, shorter or longer than the keel, sometimes minutely ciliate near the base; sculpturing present, invariably upper basal, or absent. Keel rostrate or obtuse, without a lobe below the apex, sometimes symmetrically or asymetrically truncate, or emarginate, with a lobe below the apex; with or without a lateral pocket (spur); sometimes minutely ciliate near the base. Stamens fused into a sheath open on the upper side, rarely diadelphous (variably stamens partially or completely free from staminal sheath); anthers distinctly dimorphic, 4 long, basifixed anthers alternating with 5 ovate, dorsifixed anthers, carinal anther usually intermediate in size and shape. Pistil usually short-stipitate or sometimes long-stipitate; ovary with 2–9 ovules; style upcurved, slender, tapering; stigma terminal, small or capitulate, glabrous or fibrosillose. Pods usually compressed, sometimes slightly inflated, sessile to long-stipitate, obliquely lanceolate to oblanceolate or narrowly to broadly oblong; upper margin usually narrowly winged, sometimes broadly winged; 1–5-seeded; dehiscent. Seeds exarillate, oblong-reniform to oblique-cordiform; radicular lobe prominent; colour variable, pale yellow to brown or black; hilum small, elliptic to round, often sunken; testa surface smooth to rough. 2n = 16.

Diagnostic characters

Rafnia species are practically glabrous, resprouting shrubs or suffrutes with simple, sessile leaves. The basal or cop-
Table 5: Characters and polarisation of character states in Rafnia

| Species | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
|---------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Outgroup | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| R. racemosa | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
| R. angulata | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  |
| R. crispa | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| R. lancea | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| R. rostrata | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| R. loddonii | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| R. alata | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| R. crassifolia | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| R. elliptica | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| R. triloba | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| R. ovata | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| R. loddonii | 0  | 1  | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| R. acuminata | 0  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| R. amplexicaulis | 0  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| R. diffusa | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| R. capensis | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| R. globosa | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |

pice leaves are often larger and different in shape from the upper leaves. The plants usually turn black when dry and are totally glabrous (even on the back of the standard petal), except for minute hairs on the inside of the calyx (and also on the bract, bracteoles and sterile extension of the rachis).

**Distribution and habitat**

*Rafnia* species occur throughout the fynbos region, from Nieuwoudtvile in the northwest, through the entire Western and Eastern Cape Provinces, and into the coastal KwaZulu-Natal. The species occupy diverse habitats, from dry or semi-arid montane, coastal or grassy fynbos, to sandveld or renosterveld. They occur in low-lying coastal areas or high mountainous areas and are often found in disturbed places and particularly in recently burnt veld. The species grow on gentle or steep rocky, bouldery slopes, on fynbos sand flats and are associated with shallow or deep soils that are derived from Table Mountain Sandstone, or granitic or limestone soils. Some species have been found on shale flats and exposed quartzitic outcrops.

**Key to the sections**

1a Keel petals rostrate (tapering to a sharp point), without lobes near the apex or a calloused lateral pocket (spur); lower calyx lobes not fused higher up to form a trifid lip; edges of standard petal flat; wing petals invariably sculptured; staminal sheath straight, not widening towards the base (except occasionally in *R. elliptica* and *R. amplexicaulis*); free parts of filaments long..............................................Section 1. *Rafnia*

1b Keel petals obtuse or truncate to emarginate, or rarely rostrate (in *R. diffusa* and *R. capensis*, but then other characters not combined as above), or sometimes apparently rostrate but then with a slight lobe below the apex, and a calloused lateral pocket (spur); lower calyx lobes fused higher up to form a trifid lip; edges of standard petal folded in; wing petals usually without sculpturing (except in *R. diffusa* and occasionally in *R. ovata*); staminal sheath usually widening towards the base (except in *R. diffusa*, *R. capensis* and some forms of *R. capensis* subsp. capensis); free parts of filaments long..............................................Section 2. *Colobotropsis*
7a Terminal racemose 5–12(–19)-flowered or 2–5-flowered; leaves elliptic or lanceolate; erect, much-branched woody shrub up to 1.5m high or a procumbent, mat-like shrublet up to 0.2m high; wing petals longer than the keel petals. 1. *R. racemosa* (see Key, p. 112)

7b Axillary racemes single- or 2–3-flowered, or invariably single-flowered; leaves linear, or ericoid or filiform; erect suffrutex, not much-branched except at ground level, up to 1.5m high or a virgate shrublet up to 0.5m high; wing petals shorter than the keel petals. 2. *R. angulata* (see Key, p. 114)

5b Lateral calyx sinuses distinctly shallower than the others:

8a Leaf margins distinctly crisped; standard claw 3mm long; style strongly upcurved; leaf venation pinnerved; basal leaves relatively large, 41–55 x 11–15mm; flowers relatively small, 13–15mm long; standard petal ovate. 3. *R. crispa*

8b Leaf margins not distinctly crisped; standard claw 7–10mm long; style proximally downcurved, distally upcurved; leaf venation indistinct; basal leaves smaller, 22–32(–40) x 4–10mm; flowers relatively large, 18–24mm long; standard petal elliptic or round

4b Upper calyx lobes falcate:

9a Leaf base cuneate or tapering to a narrow base:

10a Inflorescences 2–6-flowered:

11a Leaves linear; pod obliquely ob lanceolate, with the upper margin asymmetrically convex and lower margin ± straight (broadest part near the apex); keel petals shortly rostrate, tapering towards the apex; restricted to the Stanford district. 2. *R. angulata* (see Key, p. 114)

11b Leaves lanceolate to obovate-lanceolate; pod obliquely lanceolate, with the upper margin straight and lower margin proximally convex (broadest part near the base); keel petals long-rostrate, strongly upcurved towards the apex; restricted to the Swartberg 5. *R. rostrata* (see Key, p. 120)

10b Inflorescences invariably single-flowered, or predominantly single-flowered with some inflorescences 2–3-flowered:

12a Leaves on flowering branches narrow, 1–5mm wide

12b Leaves on flowering branches broader, 6–34mm wide

13a Pod obliquely ob lanceolate (broadest part near the apex), 15–36 x 4–8mm; north of Citrusdal 2. *R. angulata* (see Key, p. 114)

13b Pod obliquely lanceolate (broadest part near the base), or if obliquely ob lanceolate then 40–53 x 10–13mm; near Citrusdal (*R. triflora*), or southwards and eastwards:

14a Calyx lobes long, as long as the corolla, or extending beyond the corolla:

15a Pedicel situated directly on the stem (inflorescence without a peduncle or pseudopoduncle); standard petal obovate to subpanduriform, tapering towards the claw; pedicel long, 12–16(–18)mm long 8. *R. cassinifolia*

15b Pedicel situated on a peduncle or pseudopoduncle; standard petal round or ovate or broadly elliptic, not tapering towards the claw; pedicel up to 8mm long:

16a Calyx tube without wing-like extensions between the lobes; erect, robust suffrutex up to 2m high; p obliquely ob lanceolate, 40–53 x 10–13mm; carr calyx tube filiform. 6. *R. vloei*

16b Calyx tube with wing-like extensions between the lobes; procumbent, mat-like shrublet up to 0.4m high pod narrowly ob lanceolate, 20–30 x 3–5mm carinal calyx lobe triangular 7. *R. alai*

14b Calyx lobes shorter than the corolla:

17a Leaves silvery-grey, obovate to angular-oblanceolate on flowering branches relatively small 13–20(–24)mm long; basal leaves relatively small 16–32 x 5–16(–24)mm; ovules 4–5. 5. *R. rostrata* (see Key, p. 120)

17b Leaves green or bluish-green, lanceolate or elliptic c obovate or ovate; leaves on flowering branches relatively large, 23–55mm long; basal leaves large, 43–12 x 16–110mm; ovules 2:

18a Inflorescences single in each leaf axil (each with 1 or rarely 2–3 flowers); upper leaves diverging; pedicel long, 7–11mm long; pod relatively large, 30–49 x 8–11mm. 9. *R. elliptica*

18b Inflorescences three in each leaf axil (each with 1 flower); upper leaves closely appressed to the stems; pedicel shorter, 2–5mm long; pod smaller, 18–33 x 3–8mm. 10. *R. triflora*

9b Leaf base cordate:

19a Inflorescences in threes; flowers relatively large, 16–21mm long; wing petals 13–16mm long; keel petals 12–14mm long. 10. *R. triflora*

19b Inflorescences single; flowers smaller, 9–17mm long; wing petals 7–13mm long; keel petals 7–11mm long:

20a Leaves not reticulately veined, not embracing the stem; carinal calyx lobe minute, filiform; calyx tube with a wing-like extension between the upper lobes; pod oblong, stipitate; pedicel 7–9mm long; young leaves recurved at the edges. 12. *R. inaequalis*

20b Leaves reticulately veined, often embracing the stem; carinal calyx lobe triangular; calyx tube often with a ridge between the upper lobes or without a ridge or a wing-like extension between the upper lobes; pod narrowly or obliquely lanceolate, sessile; pedicel 2–6mm long; young leaves flat at the edges:

21a Prostrate shrub up to 0.3m high; bracteoles minute; standard petal elliptic or suborbicular; leaves cordate or oblanceolate-cordate; seed tests smooth. 13. *R. acuminata*

21b Erect shrub more than 1m high; bracteoles absent; standard petal broadly ovate or broadly elliptic; leaves cordate or reniform; seed tests rough. 14. *R. amplexicaulis*

1b Keel petals obtuse or truncate to emarginate, or if apparently rostrate, then with a slight lobe below the apex:

22a Wing petals with sculpturing:

23a Wing petals with 4–6 rows of sculpturing; sparse, erect or trailing shrublet; inflorescences sparsely arranged, not secondarily aggregated towards the branch ends into spike-like flowering branches. 15. *R. diffusa*

23b Wing petals with 2–4 rows of sculpturing; dense, mat-like shrublet; inflorescences secondarily aggregated
towards the branch ends into spike-like flowering branches........................................16. R. spicata
22b Wing petals without sculpturing:
24a Inflorescences secondarily aggregated towards the branch ends into spike-like flowering branches; seed sinus shallow; petal texture soft..............16. R. spicata
24b Inflorescences not secondarily aggregated towards the branch ends, or if aggregated then flowering branches pyramidal or globose, not spike-like; seed sinus deep; petal texture firm:
25a Inflorescences 2- or more-flowered.................................................................18. R. capensis (see Key, p. 138)
25b Inflorescences predominantly single-flowered:
26a Inflorescences never secondarily aggregated into multi-flowered branches.................................18. R. capensis (see Key, p. 138)
26b Inflorescences invariably secondarily aggregated into multi-flowered flowering branches:
27a Multi-flowered flowering branches pyramidal in shape, along most of the length of the branches; basal leaves large, 46–76 × 29–60mm; calyx lobes sometimes slightly reflexed at anthesis; pod broadly obliquely lanceolate (appears obliquely triangular), sessile, relatively large, 30–40 × 14–18mm, with the upper suture broadly winged, wing 4–5mm wide; standard petal oblong........................................17. R. schlechteriana
27b Multi-flowered flowering branches globose in shape at the branch ends; basal leaves smaller, 25–44 × 14–26mm; calyx lobes strongly reflexed in old flowers; pod oblong, stipitate, relatively small, 14–16 × 5–8mm, with the upper suture not winged; standard petal broadly ovate........................................19. R. globosa

Section 1: Rafinia. Walp. in Linnaea 13: 463 (1839); 579 (1843).

Vascon DC.: 119 (1825); 186 (1826); Harv.: 74 (1838).

Section Vascon (DC.) Walp.: 462 (1839); 578 (1843); Benth.: 464 (1843); Harv.: 31 (1862); Schinz: 198 (1894).

Section Eu-Rafinia Benth.: 465 (1843); Harv.: 31 (1862); Schinz: 198 (1894). Type: Rafinia ovata E. Mey.

Diagnostic characters

Section Rafinia differs from section Colobotropis in the rostrate (beaked) keel petals, which do not have a lobe below the apex or a calloused lateral pocket (spur), the absence of a trifid lower calyx lip, the edges of the standard petal which are not folded in, the invariably present sculpture on the wing petals, the staminal sheath not widening towards the base and the long free parts of the filaments (fused much higher up in Colobotropis). The pods are sessile (except in R. ovata and R. inaequalis), not stipitate as in Colobotropis (apart from R. schlechteriana, which has sessile pods).


Pelecythys racemosa (Eckl. & Zeyh.) Walp.: 579 (1843).

Robust, woody shrub up to 1.5m high or a procumbent, mat-like shrublet up to 0.2m high. Leaves elliptic (in subsp. race- mosa) or lanceolate (in subsp. pumila); leaves on flowering branches invariably alternate, 25–45 × 6–16mm; basal leaves 13–60 × 5–24mm. Inflorescences 2–19-flowered. Flowers 11–19mm long. Pedicel 4–7mm long. Bract 1–2mm long. Bracteoles 0.5–1mm long. Calyx subequal lobed; lobes triangular or narrowly triangular, as long as or longer than the tube, 4–7mm long; upper sinus rarely deeper than the others; tube 3–6mm long. Standard ovate or broadly elliptic, (9–)13–18 × 11–15mm, sometimes with basal cala- losities; claw 2–4mm long. Wings oblong, longer than the keel, (9–)12–14 × 5–6mm, with 5–6 rows of sculpturing; apex obtuse or obliquely obtuse; claw 3–5mm long. Keel shortly rostrate, 8–13 × 4–6mm, with a broad or narrow basal claw; claw 4–6mm long. Pistil short- or long-stipitate; ovary oblong to narrowly ovate; style shorter than the ovary, strongly upcurved; ovules 4–many. Pods obliquely lanceolate, (27–)30–36 × 6–10mm; upper margin straight; lower margin proximally convex. Seeds narrowly oblong to broadly reniform, 3–5 × 3–4mm; testa smooth. Mature pods and seeds unknown in subsp. pumila.

Key to the subspecies of R. racemosa

1a Inflorescences 5–12(–19)-flowered; erect, robust woody shrub up to 1.5m high; leaves elliptic; basal leaves larger than the upper leaves; calyx lobes as long as the tube; pistil short-stipitate; east of Worcester, from Montagu to Willowmore.....1a. subsp. racemosa

1b Inflorescences 2–5-flowered; procumbent, mat-like shrublet up to 0.2m high; leaves lanceolate; basal leaves smaller than the upper leaves; calyx lobes longer than the tube; pistil long-stipitate; restricted to Worcester, between Goudini Sneeukop and Deception Peak....................................................1b. subsp. pumila

1a. Rafinia racemosa Eckl. & Zeyh. subsp. racemosa

Erect, robust, much-branched woody shrub up to 1.5m high. Leaves elliptic; leaves on flowering branches 9–16mm wide; basal leaves 41–60 × 14–24mm. Inflorescences 5–12(–19)-flowered. Calyx lobes triangular, as long as the tube. Wings with the apex obliquely obtuse. Keel mostly with a broad basal pocket. Pistil short-stipitate.

Diagnostic characters

R. racemosa subsp. racemosa (Figure 23a) is distinguished by the erect, woody habit, the invariably alternate leaves and the terminal, multi-flowered racemes. It differs from R. angu- lata and R. rostrata in the lanceolate or elliptic leaves (eri- cord or linear to broadly obovate in R. angulata; obovate in R. rostrata subsp. rostrata). It also differs from R. rostrata in
the calyx lobes which are ± as long as the tube (the lobes are longer than the tube in *R. rostrata*) and the short, rostrate keel, which is not strongly upcurved (the keel is long-rostrate and strongly upcurved in *R. rostrata*).

**Distribution and habitat**

*R. racemosa* subsp. *racemosa* is mostly restricted to mountainous areas, from the Montagu district in the west to Willowmore in the east (Figure 17). It occurs in dry to semiarid montane fynbos, or renosterbos, and occupies various habitats, from rocky slopes to flat sandy plains, occurring mostly in soils derived from Table Mountain Sandstone and occasionally in deep soils.

**Flowering time**

*R. racemosa* subsp. *racemosa* flowers throughout the year.

Selected specimens examined
- 3320 (Montagu): Anysberg (-BC), Van Wyk 3186 (JRAU); between Montagu and triangle, Kochmans Kloof (-CC), Mitchell 43 (BOL, PRE); Touwsberg (-DB), Wurts 1335 (NBG); Tradouw’s Pass (-DO), Levy & Levy 827 (NBG); Boomsmansbos wilderness area, Langeberg, upper reaches of Brandrivier northeast of Grootberg, near path between Grootberg and Witbooisrivier (-DD), McDonald 1243, 1558 (NBG, PRE).
- 3321 (Ladismith): Rietvlekklip, Laingsburg division (-AC), Bond 242 (NBG); Seweweekspoort mountains (-AD), Barnard s.n. sub SAM 46319 (SAM); Die Nek, Gamskatsberg Reserve, Calitzdorp (-BC), Boshoef P285 (NBG); Klaphuysrivle, Swartberg (-BD), Laughton 139 (BOL); Rooiberg, Bailey Peak (-CB), Oliver 5455 (NBG, PRE); Garcia’s Pass, north of toll house (-CC), Van Wyk 2976 (JRAU); top of Rooiberg Pass (-DA), Acoks 20373 (PRE) in arenosis (alt. III) collium inter ‘Hassaquaskloof’ [Attaquaskloof] et Breederivier’ (Swellendam) (-DD), Ecklor & Zeyher 1188 (SAM).
- 3322 (Oudtshoorn): Swartberg Pass, Prince Albert district (-AC), Acoks 22145, 22146 (BOL, PRE).
- 3323 (Willowmore): Uniondale, 11 miles (17.6km) west of Avontuur (-CA), Acoks 16036 (BOL, PRE).


Procumbent, mat-like shrublet, much-branched from the base, up to 0.2m high. Leaves lanceolate; leaves on flowering branches 25–35 × 6–10mm; basal leaves (13–)17–22 × 5–7mm. Inflorescences 2–5-flowered. Flowers 14–16mm long. Pedicel 5–6mm long. Bracteoles 1–1.5mm long. Bracteoles ± 0.5mm long. Calyx lobes narrowly triangular, longer than the tube, 4–5mm long; upper sinus as deep as the others; tube ± 3mm long. Standard broadly elliptic, 13–18 × ± 14mm, without basal calllosities. Wings 12–14 × ± 5mm, with 5 rows of sculpturing; apex obtuse. Keel 11–13mm long, with a narrow basal pocket. Pistil long-stipitate; ovary obtlong.

**Diagnostic characters**

*R. racemosa* subsp. *pumila* differs from subsp. *racemosa* in the procumbent, mat-like habit, the smaller, lanceolate leaves (leaves elliptic in subsp. *racemosa*), the basal leaves which are smaller than the upper leaves (basal leaves are larger than the upper leaves in subsp. *racemosa*), the longer, narrowly triangular calyx lobes (longer than the tube in subsp. *pumila*; as long as the tube and triangular in subsp. *racemosa*) and the long-stipitate pistil (short-stipitate in subsp. *racemosa*). There is only a single, incomplete collection of this subspecies and it may be useful to examine this taxon more closely, through field studies, in order to confirm our judgement that it is merely a subspecies of *R. racemosa*.

**Distribution and habitat**

*R. racemosa* subsp. *pumila* is geographically isolated from subsp. *racemosa* and known only from the Worcester area, between Goudini Sneeukop and Deception Peak (Figure 17), where it grows in montane fynbos on sandy, rocky slopes.

**Flowering time**

*R. racemosa* subsp. *pumila* flowers in December. Specimen examined
- 3319 (Worcester): Between Goudini Sneeukop and Deception Peak (-CD), Esterhuysen 33444 (BOL).

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**Figure 17:** The known geographical distributions of *R. racemosa* subsp. *racemosa* (dots) and *R. racemosa* subsp. *pumila* (square).
2. Rafinia angulata Thunb., Genera Nova Plantarum: 147 (1800a); 123 (1800b); Willd.: 951 (1802); Thunb.: 564 (1823); DC.: 119 (1825); Eckl. & Zeyh.: 162 (1836); E. Mey.: 13 (1836); Walp.: 464 (1839); 579 (1843); Benth.: 467 (1843); Harv.: 35 (1862); Schinz: 200 (1894). Type: ‘e Cap. b. spei’, Thunberg s.n. sub THUNB-UPS 16425 (UPS, microfichel, lecto., here designated).

Rafinia angulata var. latifolia Harv.: 35 (1862), non. superfl. Type as above.

Rafinia angustifolia Thunb.: 147 (1800a); 123 (1800b); Willd.: 951 (1802); Thunb.: 564 (1823); DC.: 119 (1825); E. Mey.: 148 (1832); Eckl. & Zeyh.: 162 (1836); Presl: 474 (1845). Type: ‘e Cap. b. spei’, Thunberg s.n. sub THUNB-UPS 16428 (UPS, microfichel, lecto., here designated). [Note: We intentionally choose this specimen as lectotype to avoid confusion with Rafinia thunbergii Harv. (q.v.), which was based on one of the three sheets in the Thunberg Herbarium.]

Rafinia angulata var. filifolia (Thunb.) E. Mey.: 13 (1836); Walp.: 464 (1839); 579 (1843); Harv.: 35 (1862).

?Rafinia erecta Thunb.: 149 (1800a); 123 (1800b); Willd.: 951 (1802); Thunb.: 565 (1823); DC.: 119 (1825); Walp: 463 (1839); 579 (1843); Harv.: 38 (1862). Type: ‘e Cap. b. spei’, Thunberg s.n. sub THUNB-UPS 16433 (UPS, microfichel). [Note: As Harvey (1862) pointed out, it is virtually impossible to decide on the identity of this species, because the type specimen is a mere fragment.]

Robust, virgate suffrutex up to 2.2m high or a virgate shrublet up to 0.5m high or a procumbent shrublet up to 0.3m high. Leaves variable, ericoid or linear or obovate; leaves on flowering branches usually subopposite to opposite or rarely invariably alternate, 6–46 × 0.5–14mm; basal leaves 9–45 × 0.5–18mm. Inflorescences single- or less often 2–6-flowered. Flowers 8–20mm long, Pedicel 4–11mm long. Bract narrowly triangular, ± leafy or not ± leafy, 0.5–2mm long. Bracteoles 0.2–1mm long. Calyx lobes much shorter to much longer than the tube, 1–7mm long; upper lobes non-falcate to broadly falcate, often broader or much broader than the others; lateral lobes triangular or falcate; carinal lobe shorter or longer than others; upper sinus often deeper than the others; tube 2–6mm long. Standard ovate or obovate or elliptic or round, 6–17 × 5–18mm, often with an acipular cusp; claw 1–5mm long. Wings oblong or subtriangular or obliquely triangular, shorter than or ± as long as the keel, 5–15 × 2–7mm, with 4–12 rows of sculpturing; apex narrow or obtuse or obliquely obtuse; claw 2–7mm long. Keel shortly rostrate to long-rostrate, 6–15 × 3–7mm, with a broad upper basal pocket; claw 2–5mm long. Stamens usually monadelphous or rarely diadelphous. Pistil with the ovary oblong or linear; style shorter to longer than the ovary, strongly upcurved; ovules 2–5; stigma usually glabrous or rarely fimbriose. Pods obliquely oblate-cylindrical or rarely obliquely lanceolate or ± oblong, 15–35 × 4–8mm; upper margin asymmetrically convex; lower margin ± straight. Seeds narrowly oblong to broadly reniform, 3–6 × 2–4mm; testa smooth.

Key to the subspecies of R. angulata

1a Erect, virgate shrublets or suffrutices, 0.5–2.2m high:

2a Leaves filiform or ericoid (rolled in at the margins); pod oblong, with the upper margin ± straight; restricted to the Paarl and Durbanville districts..................................................2b subsp. ericifolia

2b Leaves linear or obovate or suborbicular; pod obliquely oblong-cylindrical, with the upper margin asymmetrically convex; not restricted to the above districts:

3a Calyx lobes minute, much shorter than the tube; inflorescences secondarily aggregated towards the branch ends into spike-like flowering branches; leaves bright green; restricted to the upper Hex River Valley..................................................3b subsp. thunbergii

3b Calyx lobes usually about as long as or longer than the tube; inflorescences not secondarily aggregated towards the branch ends into spike-like flowering branches; leaves glaucous; widely distributed.................................................2a subsp. angulata

1b Procumbent, mat-like shrublets up to 0.2m high:

4a Upper calyx lobes broadly falcate, much broader than the others; calyx tube with a wing-like extension between the upper lobes; wing petals oblong; leaves narrowly obovate; leaves on flowering branches relatively small, 12–18mm long; basal leaves relatively small, 9–12mm long; restricted to the Seweweekspoort mountains near Ladismith.................................................2e subsp. montana

4b Upper calyx lobes falcate, slightly broader than the others; calyx tube without a wing-like extension between the upper lobes; wing petals obliquely triangular; leaves linear; leaves on flowering branches longer, 20–35–(46)mm long; basal leaves longer, 14–22–(29)mm long; restricted to the Cape Peninsula and Cape Flats...............................................2c subsp. humilis

2a. Rafinia angulata Thunb. subsp. angulata

Erect, virgate suffrutex up to 2.2m high to a procumbent shrublet up to 0.3m high. Leaves narrowly to broadly linear or narrowly to broadly obovate or suborbicular; leaves on flowering branches 9–32 × 1–14mm; basal leaves 9–43 × 1–18mm. Flowers 8–17mm long. Pedicel 4–11mm long. Bract ± leafy. Calyx lobes slightly shorter than, ± as long as or longer than the tube, 2–7mm long; upper lobes falcate, often broader than the others; carinal lobe sometimes shorter than the others. Standard ovate or elliptic or round, 6–14 × 7–13mm. Wings oblong, shorter than the keel, 3–5mm wide, with 4–8 rows of sculpturing; apex narrow or obtuse. Keel 6–15 × 3–7mm, sometimes long-rostrate. Pistil with ovary oblong to linear; style ± as long as or more often longer than the ovary. Pods obliquely oblate-cylindrical.
20–35mm long, rarely proximally gradually tapering into a narrow stipe. Seeds narrowly oblong to oblong.

Diagnostic characters

*R. angulata* subsp. *angulata* (Figure 23b) differs from the other species of *Rafnia* in the upper calyx sinus which is often deepest, the strongly rostrate keel which often tapers towards the apex and the pods which are usually obliquely oblanceolate with the upper margin asymmetrically convex and the lower margin more or less straight.

Distribution and habitat

This subspecies is relatively widely distributed in the Western Cape Province, from the Gilberg near Varnhynsdorp in the north, southwards to the Cape Peninsula and eastwards to Swellendam and the Seweweekspoort mountains (Figure 18). *R. angulata* subsp. *angulata* grows in coastal or montane fynbos or fynbos on sand dunes, or dry sandveld, and occupies a wide range of habitats, from gentle foothills to steep granite slopes near the coast, or river valleys, often on dry, sandy, rocky slopes. It is usually associated with soils derived from Table Mountain Sandstone and is occasionally found in deep sand.

Flowering time

*R. angulata* subsp. *angulata* flowers throughout the year.

Regional variation

*R. angulata* subsp. *angulata* is variable, with numerous geographical forms. The geographical variation is represented by morphological differences between the forms in different localities. The Cedarberg form is very variable; on the Gilberg, the shrubs may be 2m high, and the basal leaves may be very large and broadly obovate to suborbicular while the upper leaves are much smaller and obovate; Kriedouw in the Cedarberg, a robust form occurs, which has large, obovate leaves. The typical form of the subspecies virgate and has narrowly to broadly linear leaves. An unusual form has been collected on the Matroosberg, which resembles *R. globosa* in appearance, but has flowers typical of *R. angulata*. In Malmesbury and on the Cape Peninsula there are broad- and narrow-leaved forms, which vary in size, and very small-leaved forms occur in the Boland mountains. The Hermanus form has up to 6-flowered racemes and the form in Swellendam resembles the typical form, b is generally smaller.

Selected specimens examined

—3118 (Varnhynsdorp): Gilberg (–DC), Esterhuysen 2214 (BOL, 1 & 2).
—3119 (Calvia): Glenridge, Nieuwoudtville (–AC), Bark 9648 (NBG).
—3218 ( Clanwilliam): Olfantsrivier valley, national road north of Clanwilliam (–BD), Barker 10339 (NBG, 1 & 2 Citrusdal district, Kriedouw farm, Algeria road, eastern slope of Graskop (–BD), Van Wyk 3679 (K, NBG, PRE); half way between Vredenburg and Hopefield (–CC), Grobbelaar 2193 (PRE); Piquetberg, Versfeld Pass (–DC), Campbell & Van Wyk 25, 1 & 2, 76 (JRAU).
—3219 (Wupperthal): Langberg, Cedarberg, Clanwillia district (–AC), Bond 1396 (NBG); Apollo Peak, southern Cedarberg (–CA), Taylor 11157 (NBG); Dwarsberg, Ceres between Koue Bokkeveld mountains and Ceres-Karoo (–CB), Hanekom 985 (PRE); Ceres district, Bokkeveld Tafelberg (–CD), Compton 10078 (NBG); Rietrivier, on road to Zuurvlak (–DC), Bean & viers 1977 (BOL).
—3318 (Cape Town): 8.8km west northwest of Hopefield (–AB), Acocoo 24470 (PRE); about 10 miles (16km) south of Darling (–AD), Grobbelaar 290 (PRE); Eiebeka Kasteel Malmesbury division (–BD), Zinn s.n. sub SAM 5423 (SAM); Springfontein, Malmesbury (–CB), Aexels 378 (NBG); Camp’s Bay (–CD), Alexander-Prior s.n. sub PRE 53123 (PRE); Malmesbury district, near Pella, Burger’s Post farm (–DA), Boucher & Shepherd 4288 (PRE); Paarlberg Nature Reserve (–DB), Campbell & Van Wyk 2 (JRAU, 1 & 2); Vykerkraal (–DC), Wolley-Dod 724 (BOL); Bottelary, Stellenbosch division (–DD), Compton 1293 (NBG).
—3319 (Worcester): Ceres division, Huisiesberg (–AB), Compton 16709 (NBG); Tulbagh waterfall (–AC), Ecklon & Zeyher 1195 (SAM); Matroosberg, near Lakenveld, Ceres division (–BC), Phillips 1929 (SAM); 1km along national road from Jan du Toit bridge to Worcester (–CB), Campbell & Van Wyk 20 (JRAU, 1–3, NBG, PRE); Wemmershoek, Paarl district (–CC), Compton 10142 (NBG).
—3320 (Montagu): Swellendam division, Langeberg, Strawberry Hill (–DD), Stokoe s.n. sub NBG 9901 (NBG).
—3418 (Simonstown): Wynberg Hill (–AB), Bolus 7554 (BOL); between Buffelsfontein and Cape Point (–AD), Bolus s.n. sub BOL 50520 (BOL); veld near Strand road (–BB), Anon. 367 (NBG).

![Figure 18: The known geographical distribution of *R. angulata* subsp. *angulata*](image-url)
—3419 (Caledon): Swartberg (–AB), Elbrecht s.n. sub TM 19008 (PRE); Happy Valley, Riviersonderend mountains, near Greyton (–BA), Estethusyen 20807 (NBG, PRE); Stanford district, 10km from Stanford along gravel road to Salmonsdam Nature Reserve (–BC), Campbell 161 (JRAU, K, PRE).

Precise locality unknown: ‘e Cap. b. spei’, Thunberg s.n. sub THUNB-USPS 16425 (UPS) [microfiche only].


R. thunbergii Harv. in Harv. & Sond., Flora Capensis 2: 36 (1862).

*Rafnia filifolia* Thunb.: 148 (1800a) pro parte minore, excluding THUNB-USPS 16435 and 16436; 123 (1800b); Wild.: 951 (1802); Thunb.: 565 (1823); DC.: 119 (1825); Eckl. & Zeyh.: 162 (1836); Presl: 474 (1845).

Erect, robust suffrutex, often with all stems herbaceous and not much-branched, up to 1.5m high. Leaves linear, bright green, often remaining so when dry; leaves on flowering branches subopposite to opposite, 9–20–27 × 1–2mm; basal leaves: 20–35(–45) × 1–5mm. Inflorescences single or 2–3-flowered, secondarily aggregated towards branch ends into spike-like flowering branches. Flowers 12–20mm long. Pedicel 4–8mm long. Bract not ± leafy. Bracteoles 0.3–0.8mm long. Calyx lobes minute, ± triangular, much shorter than the tube, 1–2mm long; corolla lobe often shorter than others. Standard ovate, 10–13(–17) × 7–12(–18) mm; claw 3–5mm long. Wings oblong or subtriangular, shorter than the keel, with 8–12 upper and central basal rows of sculpturing; apex narrow to obtuse. Keel rostrate, 10–15mm long. Pistil with the ovary oblong; style long, longer than the ovary; ovules 2–4; stigma glabrous. Pods obliquely oblong, 20–22 × 7–8mm. Seeds 3–5 × ± 3mm.

**Diagnostic characters**

*R. angulata* subsp. *thunbergii* (Figure 23c) differs from the typical subspecies in the unbranched stems, the bright green leaves (mostly glaucous in subsp. *angulata*), the spike-like flowering branches constituting secondary aggregations of inflorescences (inflorescences not aggregated into spike-like flowering branches in subsp. *angulata*), the minute calyx lobes (much shorter than the tube in subsp. *thunbergii*; usually ± as long as or longer than the tube in subsp. *angulata*; up to 12 rows in subsp. *thunbergii*; up to 8 rows in subsp. *angulata*).

**Distribution and habitat**

*R. angulata* subsp. *thunbergii* is limited to the Worcester area, in the Hex River valley near De Doorns and Breede Rivier (Figure 18). It frequently occurs along disturbed road sides and on foothills, in stony soil derived from Table Mountain Sandstone. We consider this taxon to be too closely related to *R. angulata* to justify species rank, but future genetic studies could possibly indicate otherwise.

**Flowering time**

*R. angulata* subsp. *thunbergii* flowers from October to December.

**Selected specimens examined**

—3319 (Worcester): Hex River valley, near De Doorns (–BC), Bolus 13080 (BOL, PRE, 1–3), Van Breda 4218 (PRE), Van Wyk 2908 (JRAU, 1 & 2), Walters 1331 (NBG); 7.2km from Sandhills turn-off to De Doorns (–BC), Campbell, Van Wyk & De Castro 130 (JRAU, NBG, PRE); near De Doorns, about 3 miles (4.8km) north of Worcester (–BC), Schlieben & Van Breda 9933 (PRE), Thorne s.n. sub NBG 14263 (NBG); De Doorns, about 75m before turn-off to Orchard from Touwsrivier road (–BC), Van Wyk 3015 (JRAU); near Worcester, Breede Rivier (–CB), Bayliss BRI B 1240 (PRE), Compton 24446 (NBG, 1–4); Breede Rivier, 4 miles (6.4km) south of Worcester (–CB), Gentry 18981 (PRE); 12–14 miles (19.2–22.4km) northeast of Worcester (–CB), Gentry, Barclay & Van Breda 18722 (PRE), 9 miles (14.4km) west of Worcester (–CB), Lewis 3983 (SAM, 1 & 2); Breede Rivier bridge, national road from Cape Town to Worcester (–CB), Rycroft 2094 (NBG, 1–3); Rawsonville (–CB), Walters 147 (NBG); Wagenheim farm, Rawsonville (–CB), Walters 677 (NBG); Three Bridges, road from Worcester to Rawsonville (–CB), Walters 1440 (NBG).

Precise locality unknown: ‘e Cap. b. spei’, Thunberg s.n. sub THUNB-USPS 16434 (UPS) [microfiche only].

2c. Rafnia angulata Thunb. subsp. humilis (Eckl. & Zeyh.) G.J. Campbell & B-E. van Wyk stat. nov. Type:
Western Cape Province, in lateribus montis 'Tafelberg' prope
'Constantia', Ecklon & Zeyher 1198 (SAM!, lecto., here des-
nignated).

*Rafnia humilis* Eckl. & Zeyh., Enumeratio Plantarum
Afriecae Australis Extratropicae 2: 162 (1836); Walp.: 464
(1839); 579 (1843); Benth.: 467 (1843); Presl: 474 (1845);
Harv.: 35 (1862).

*Rafnia ecklonis* E. Mey.: 13 (1836); Harv.: 35 (1862). The
protologue suggests that this is either a narrow-leaved form of
*R. angulata* or more likely *R. angulata* subsp. *humilis*.

Procumbent shrublet, much-branched from the base, up to
0.2m high. Leaves linear; leaves on flowering branches sub-
opposite to opposite, 20–35 (46) × 1–2mm; basal leaves
14–22 (27) × 1–2mm. Inflorescences single-flowered, few
per plant. Flowers 9–11mm long. Pedicel 7–11mm long.
Bract not ± leafy, 0.6–0.9mm long. Bracteoles 0.3–0.5mm
long. Calyx lobes narrowly triangular, longer than the tube,
5–6mm long; upper lobes falcate, slightly broader than oth-
ers; carinal lobe slightly longer than the others; tube 3–4mm
long. Standard obovate or elliptic, 8–9 × 6–7mm; claw
1–3mm long. Wings obliquely triangular, shorter than the
keel, 5–7 × 2–3mm, with 4–5 rows of sculpturing; apex nar-
row; claw 3–4mm long. Keel rostrate, 7–8 × 3–4mm; claw
3–4mm long. Stamens monadelphous. Pistil with the ovary
oblong; style long, ± as long as or longer than the ovary;
ovules 2; stigma glabrous. Mature pods and seeds unknown.

**Diagnostic characters**

*R. angulata* subsp. *humilis* differs from the typical sub-
species in the longer, very narrow leaves, the basal leaves
which are smaller than the upper leaves (basal leaves are
larger than the upper leaves in subsp. *angulata*), the pres-
ence of few inflorescences per plant, the sometimes obo-
vate standard petal (ovate or elliptic or round in subsp.
*angulata*) and the obliquely triangular wing petals (wings oblong
in subsp. *angulata*).

**Distribution and habitat**

This subspecies occurs on the Cape Peninsula (Figure 19)
and Cape flats and grows on sand dunes. The trailing stems
suggest that the plant is adapted to moving sand and possi-
ble to a different niche from the other subspecies of *R. angu-
lata*.

**Flowering time**

*R. angulata* subsp. *humilis* flowers from October to
December.

Specimens examined
—3318 (Cape Town): Rapenburg, near Cape Town (–DC),
Bolus 7072 (BOL), Guthrie 188 (BOL); in lateribus montis
'Tafelberg' prope 'Constantia' (–CD), Ecklon & Zeyher 1198
(SAM); 0.5 miles (0.8km) north of Pineland's station (–CD),
Salter 8271 (BOL, 1 & 2); near Modderdam (–DC), Leighton
1474 (BOL); Paarl, road near Kraaifontein (–DC), Salter
3988 (BOL); Young 176 (BOL), s.n. sub TM 27329 (PRE);
between Uitvlugt and Vygerkraal (–DC), Woldy-Dod 2091
(BOL).
—3418 (Simonstown): Flats west of Klaasjagersberg (–AB),
Salter 2875 (BOL); flats below Steenberg (–AB), Salter 4013
(BOL).

2d. *Rafnia angulata* Thunb. subsp. *ericifolia* (Salter) G.J.
Campbell & B-E. van Wyk stat. nov. Type: Western Cape
Province, near Hercules Pillar, Salter 6567 (BOL, holotype;
BM!, K!, iso., PRE!, isotype.).

*R. ericifolia* Salter in Journal of South African Botany 12:
40 (1946).

Virgare, much-branched shrublet up to 0.5m high. Leaves
very small, encoid or filiform; leaves on flowering branches
subopposite to opposite, 6–14 × 0.5–1mm; basal leaves
(5–9)–16 × 0.5–1.5mm; cippice leaves 19–23 × 2–5mm.
Inflorescences single-flowered. Flowers 8–11mm long.
Pedicel 7–10mm long. Bract not ± leafy, ± 0.6mm long.
Bracteoles 0.3–0.4mm long. Calyx lobes narrowly triangular,
as long as or longer than the tube, 4–6mm long; tube
3–4mm long. Standard ovate or elliptic, 7–9 × 5–7mm; claw
± 2mm long. Wings oblong, shorter than the keel, 6–7
× 2–3mm, with 6–7 rows of sculpturing; apex obtuse; claw
2–3mm long. Keel shortly rostrate, 6–8 × ± 3mm; claw
± 3mm long. Pistil with the ovary oblong; style longer than
the ovary; ovules 3–4; stigma glabrous. Pods ± oblong, 18–22
× 6–7mm; upper margin ± straight; lower margin convex.
Seeds unknown.

**Diagnostic characters**

*R. angulata* subsp. *ericifolia* differs from subsp. *angulata*
in the smaller, narrower ericoid leaves (leaves linear to ob-
voate in subsp. *angulata*), the narrower standard petal, the
obtuse standard apex (acute or narrow in subsp. *angulata*),
the shortly rostrate keel petal (keel sometimes long-rostrate
in subsp. *angulata*), and the smaller, oblong pods (pods
obliquely oblanceolate in subsp. *angulata*).

**Distribution and habitat**

*R. angulata* subsp. *ericifolia* occurs in the Paarl area (Figure
20), in fynbos or vegetation that is a transition from fynbos to
renosterveld, on gentle slopes, in sandy, quartzitic or clay
soils.

**Flowering time**

*R. angulata* subsp. *ericifolia* flowers from September to
March.

Specimens examined
—3318 (Cape Town): Klipheuwel radio station (–DA),
Boucher 3535 (PRE), Oliver 8665 (PRE); Bulela, Agter-
Paarl (–DB), Van Zyl 3583 (NBG, PRE, 1 & 2); Durbanville
Nature Reserve (–DC), Vlok & Schutte 108 (JRAU);
Klipspruit, Paarl (–DD), Barker 8862 (NBG, 1 & 2);
Figure 20: The known geographical distributions of *R. angulata* subsp. *ericifolia* (dots) and *R. angulata* subsp. *montana* (squares).

Joostenberg farm, Muldersvlei, Stellenbosch (DD), Burt-Davy s.n. sub PRE 12516 (PRE); near Paarl, road to Cape Town (DD), Esterhuysen 28056 (BOL); between Durbanville and Paarl, Hercules Pillar (DD), Salter 4346 (BOL); near Hercules Pillar (DD), Salter 6567 (BM, BOL, K, PRE).


Procumbent, mat-like shrublet up to 0.15m high, 1m wide. Leaves narrowly obovate; leaves on flowering branches subopposite to opposite, 12–18 x 2–3mm; basal leaves 9–12 x 1–2mm. Inflorescences single-flowered. Flowers 10–11mm long; buds leaf-like. Pedicel 6–8mm long. Bract not ± leafy, 0.5–0.7mm long. Bracteoles 0.2–0.4mm long. Calyx lobes longer than the tube, 5–6mm long; upper lobes broadly falcate, much broader than the others; lateral lobes falcate; carinal lobe longer than the others; tube with a wing-like extension between the upper lobes, 3–5mm long. Standard elliptic, 8–9 x 8–9mm; claw 1–2mm long. Wings oblong, ± as long as the keel, 7–8 x ± 3mm, with 4–5 rows of sculpturing; apex obliquely obtuse; claw 2–3mm long. Keel shortly rostrate, ± 7 x 4mm; claw 2–3mm long. Pistil with ovary oblong; style shorter than the ovary; ovules 2–3. Pods obliquely lanceolate, 15–16 x ± 7mm; upper margin ± straight; lower margin ± straight, proximally convex. Seeds unknown.

**Diagnostic characters**

*R. angulata* subsp. *montana* differs from the typical subspecies in the much smaller, procumbent, mat-like habit, the smaller, narrowly obovate leaves, the basal leaves which are smaller than the upper leaves (basal leaves are larger than the upper leaves in subsp. *angulata*) and the long carinal calyx lobe (longer than the other lobes in subsp. *montana* and shorter than or as long as the other lobes in subsp. *angulata*). In subsp. *montana*, the broadly falcate upper calyx lobes are much broader than the other lobes (not broadly falcate and usually only slightly broader than the other lobes in subsp. *angulata*). The calyx tube has a wing-like extension between the upper lobes (wing absent in subsp. *angulata*) and the pods are smaller and obliquely lanceolate (obliquely oblongeolate in subsp. *angulata*).

**Distribution and habitat**

*R. angulata* subsp. *montana* is the only subspecies that is geographically isolated from *R. angulata*—the other subspecies fall within the distribution of *R. angulata*. It is known only from the Seweweekspoort mountains in the Ladismith area (Figure 20) and occurs on flat areas or mountain peaks and frequents burnt slopes.

**Flowering time**

*R. angulata* subsp. *montana* flowers from December to February.

**Specimens examined**

——3321 (Ladismith): Prince Albert district, Seweweekspoort mountains, northern side of Ridge Peak (AD), Andreae 1245 (BOL, PRE); Klein Swartberg, crest of mountain above Sand River, on flat area about 2.5km west of Seweweekspoort Peak (AD), Van Wyk & Schutte 3323 (NBG).


Procumbent shrublet, much-branched from the base, up to 0.4m high. Leaves lanceolate, pinnennerved; margins crisped, distinctly cartilaginous; leaves on flowering branches invariably alternate, (43–)50–63(–70) x 7–13mm; basal leaves 41–55 x 11–15mm. Inflorescences single-flowered, pedunculate. Flowers 13–15mm long. Pedicel 1–2mm long. Bract ± 2mm long. Bracteoles ± 1mm long. Calyx subequally lobed; lobes triangular, ± as long as or shorter than the tube, ± 3mm long; carinal lobe shorter than the others; upper sinus deeper than others; lateral sinus shallower and narrower than the others; tube ± 4mm long. Standard ovate, 14–15 x 14–15mm; claw ± 3mm long. Wings broadly oblong.
claw ± 6mm long. Keel long-rostrate, strongly upcurved, ± 14 ° 7mm; claw ± 5mm long. Pistil with the ovary ± narrowly ovate; style ± as long as the ovary, strongly upcurved; ovules 2. Mature pods and seeds unknown.

**Diagnostic characters**

*R. crispa* is similar to *R. lancea* but differs in the larger, distinctly pinnerved leaves (venation indistinct in *R. lancea*), which have markedly crisped margins (margins not crisped in *R. lancea*), the basal leaves which are shorter and broader than the upper leaves (basal leaves are slightly shorter than but as broad as the upper leaves in *R. lancea*), the smaller flowers and the calyx in which the lateral sinus is shallower and narrower than the other sinuses (the lateral lobes do not appear to be paired, however, as in *R. lancea*). In *R. crispa*, the carinal calyx lobe is shorter than the others (as long as the others in *R. lancea*), the standard blade ovate (elliptic or round in *R. lancea*), the petal claws are shorter than in *R. lancea*, the wing apex is obovate (obtuse in *R. lancea*), the ovary narrowly ovate (± oblong in *R. lancea*) and the style is strongly upcurved (basally downcurved, distally upcurved in *R. lancea*).

**Distribution and habitat**

*R. crispa* has been collected only at Kluitjeskraal in the Worcester area (Figure 22), growing on sandy, stony flats or gentle slopes.

**Flowering time**

*R. crispa* flowers in December.

Specimen examined

—3319 (Worcester): Southwest of Wolseley, on flats at Kluitjeskraal (–AC), Stirling 8439 (PRE).

4. *Rafnia lancea* (Thunb.) D.C., Prodrum Systematis Naturalis Regni Vegetabilis 2: 119 (1825); E. Mey.: 147 (1832); Eckl. & Zeyh.: 161 (1836); E. Mey.: 12 (1836); Walp.: 464 (1839); 579 (1843); Benth.: 466 (1843); Pers.: 474 (1845); Harv.: 45, t. 72 (1859); 34 (1862); Walp.: 671 (1866); Schinz: 200 (1894). Type: 'e Cap. b. spei', *Thunberg s.n. sub THUNB-UPS 16348* (UPS, microfich., lect., here designated).

*Oedemia lancea* Thunb.: 137 (1800a); 122 (1800b); 561 (1823).

Procumbent shrublet, much-branched from the base, up to 0.3m high. Leaves lanceolate; leaves on flowering branches invariably alternate, 32–46 ° 5–10mm; basal leaves 22–32(–40) ° 4–10mm. Inflorescences single-flowered, pedunculate. Flowers 18–24mm long. Pedicel 2–3mm long. Bract 1–2mm long. Bracteoles 0.5–1mm long. Calyx with upper and lateral lobes fused higher up in pairs on either side; lobes triangular, shorter than or ± as long as the tube, 5–7mm long; upper lobes sometimes slightly falcate; upper sinus shallower than the lower sinuses; tube 5–8mm long. Standard elliptic or round, ± 14 ° 11–14mm; claw long, 7–10mm long. Wings oblong, 12–13 ° 5–7mm, with 6–10 rows of sculpturing; apex obtuse; claw long, 6–10mm long. Keel sometimes long-rostrate, ± strongly upcurved, 11–12 ° 5–6mm, with central pocket ± indistinct; claw long, 7–8mm long. Pistil with the ovary ± oblong; style long, longer than the ovary, basal part gently downcurved, distal part upcurved; ovules 2–4. Pods obliquely oblong, 16–23 ° 5–7mm; upper and lower margins straight, proximally curved. Seeds unknown.

**Diagnostic characters**

*R. lancea* is distinguished from all the other species of *Rafnia* by the calyx in which the upper and lateral lobes are fused higher up in pairs on either side, the long petal claws, which are rather long relative to the petal blades in comparison with the other species, the curvature of the style, which is proximally downcurved and distally upcurved and the proximally curved pod.

**Distribution and habitat**

This species occurs in the northwest near Wupperthal, and continues south through Malmsbury, Paarl and Worcester to Faure (Figure 21). It grows in coastal renosterveld, on gentle or steep slopes or sand flats, often in clay sands.

**Flowering time**

*R. lancea* flowers from September to November.

Selected specimens examined

—3219 (Wupperthal): Wupperthal, Clanwilliam (–AC); Leipoldt 3401 (SAM).

—3318 (Cape Town): Malmsbury (–BC); Anon. s.n. sub BOL 50553 (BOL); Paarl district, 6.4km west northwest of Windmill (–DB); Acocks 24579 (PRE); Paarl division, 2 miles...
(3.2km) south of Joostenberg (–DD), Pillans 9259 (BOL, NBG, PRE).
—3319 (Worcester): Tulbagh Kloof (–AA), Boulus s.n. sub BOL 42987 (BOL); Ceres division, Gydo (–AB), Leipoldt 4023 (BOL); Romansrivier, railway crossing between Bainskloof and Mitchell’s Pass (–AC), Johnson 487 (NBG, 1 & 2), Lewis 3587 (SAM); Ceres road station (–AD), Guthrie 3382 (BOL, NBG); Doornrivier (–BB), Walters 203, 948 (NBG).
—3418 (Simontown): Faure (–BB), Esterhuysen 11936 (BOL).
Precise locality unknown: ‘e Cap. b. spei’, Thunberg s.n. sub THUNG-UPS 16348 (UPS) [microfiche only].


TYPUS.—Western Cape Province: Swartruggens, Swartruggen division road to Ceres-Karoo, Katbakkies Pass, 5.9km from turn-off to Kagga Kamma, 8/12/1995, Campbell & Van Wyk 145 (NBGI, holotypus; BOL, JRAU, K, MO, NBGI, PRE, UPSI, isotypi).

Erect or procumbent shrublet, much-branched from the base, up to 0.4m high. Leaves obovate to angular-obovate, or lanceolate to obovate-lanceolate; leaves on flowering branches invariably alternate or subopposite to opposite, 13–40 α 3–15mm; basal leaves 16–32 α 3–24mm. Inflorescences single-flowered or 2–5-flowered. Flowers 12–19mm long. Pedicel 5–8mm long. Bract 0.5–2mm long. Bracteoles triangular or narrowly triangular, longer than the tube, 5–8mm long; upper lobes falcate, broader than the others; lateral lobes sometimes falcate; carinal lobe often slightly longer than the others; upper sinus sometimes slightly deeper than the others; tube 4–6mm long. Standard ovate or elliptic or suborbicular, 10–15 α 10–15mm; claw 2–5mm long. Wings oblong, ± as long as the keel, 8–13 α 3–5mm, with 4–6 rows of sculpturing; apex obliquely obtuse or tapering; claw 3–5mm long. Keel ± long-rostrate, strongly upcurved, 9–13 α 4–6mm; claw 3–5mm long. Stamens monadelphous or rarely diadelphous. Pistil with ovary oblong-ovate; style ± as long as or shorter than the ovary, strongly upcurved; ovules 4–5. Pods obliquely lanceolate, 21–30 α 7–9mm; upper margin ± straight; lower margin proximally convex. Seeds unknown.

Key to the subspecies of R. rostrata

1a Leaves silvery-grey, obovate to angular-obovate; inflorescences single-flowered, in axillary racemes; erect shrublet; basal leaves larger than the upper leaves; leaves on flowering branches subopposite to opposite; bract ± 0.5mm long; Swartruggens mountains, extending eastwards to Laingsburg, not in the Swartberg..........................5a. subsp. rostrata

1b Leaves bluish-green, lanceolate to obovate-lanceolate; inflorescences 2–5-flowered, in terminal racemes; procumbent, mat-like shrublet; basal leaves smaller than the upper leaves; leaves on flowering branches invariably alternate; bract 1–2mm long; restricted to the Swartberg...........................................5b. subsp. pluriflora

5a. Rafinia rostrata G.J. Campbell & B-E. van Wyk subsp. rostrata

Erect shrublet. Leaves distinctly grey, obovate to angular-obovate; leaves on flowering branches subopposite to opposite, 13–20 α 6–15mm; basal leaves 5–16 α 24mm wide. Inflorescences single-flowered. Bract ± 0.5mm long. Bracteoles minute, 0.2–0.3mm long. Calyx lobes narrowly triangular; upper lobes slightly broader than the others; lateral lobes sometimes slightly falcate; upper sinus deeper than the others. Standard ovate or elliptic, 10–13mm wide. Wings with apex obliquely obtuse. Pistil with style ± as long as the ovary.

Diagnostic characters

R. rostrata subsp. rostrata (Figure 23d) is similar to R. racemosa but differs in the smaller, obovate leaves (leaves lanceolate or elliptic in R. racemosa), the single-flowered racemes (few- to multi-flowered in R. racemosa), the falcate upper calyx lobes which are broader than the other lobes (lobes triangular and subequal in R. racemosa), the wings which are as long as the keel (longer than the keel in R. racemosa) and the long-rostrate, strongly upcurved keel petal (shortly rostrate and straight in R. racemosa). It also differs from R. racemosa subsp. racemosa in the subopposite to opposite leaf arrangement on the flowering branches (invariably alternate in R. racemosa) and the long calyx lobes (lobes longer than the tube in subsp. rostrata and as long as the tube in subsp. racemosa).

Distribution and habitat

R. rostrata subsp. rostrata is geographically isolated from R. racemosa and occurs in the Swartruggens mountains in the north as far east as the Laingsburg area (Figure 22). It grows in dry fynbos, on sand dunes, sandy or dry shale flats or rocky mountain slopes.

Flowering time

R. rostrata subsp. rostrata flowers from October to January.

Selected specimens examined
—3219 (Wupperthal): Rietrivier valley, on track to Zuurvlak (–DC), Bean & Viviers 1976 (BOL); Swartruggens, Swartruggen division road to Ceres-Karoo, Katbakkies Pass, 5.9km from turn-off to Kagga Kamma (–DC), Campbell & Van Wyk 145 (BOL, 1 & 2, JRAU, 1–4, K, 1 & 2, MO, 1 & 2, NBG, 1–3, PRE, 1 & 2, UPS, 1 & 2); Swartruggens, Ceres district, 5.4 miles (8.6km) along farm road north from summit of Katbakkies Pass (–DC), Taylor 6087 (NBG, PRE); 15–20km before Katbakkies turn-off to Ceres-Calvina road (–DC), C.M. van Wyk 486 (NBG, PRE) [coppice].
Pistil with style shorter than the ovary. Pods 25–30mm long.

**Diagnostic characters**

*R. rostrata* subsp. *pluriflora* differs from the typical sub species in the procumbent, mat-like habit, the invariable alternate leaf arrangement on the flowering branches (sub opposite to opposite in subsp. *rostrata*), the basal leaves which are smaller than the upper leaves (basal leaves larger than the upper leaves in subsp. *rostrata*), the larger lanceolate leaves (leaves obovate in subsp. *rostrata*), the 2–5-flowered racemes (single-flowered in subsp. *rostrata*), the triangular calyx lobes (lobes narrowly triangular in subsp. *rostrata*), the tapering wing apex (apex obliquely obtuse in subsp. *rostrata*) and the short style (shorter than the ovary in subsp. *pluriflora* and as long as the ovary in subsp. *rostrata*). It also differs from *R. racemosa* in the shape of the keel petal and the generally lower number of flowers (up to 5 flowers in subsp. *pluriflora* and up to 19 flowers in *R. racemosa*).

**Distribution and habitat**

*R. rostrata* subsp. *pluriflora* is geographically isolated from subsp. *rostrata*, and is limited to the Swartberg (Figure 22). The subspecies occupies montane or open grassy fynbos and grows on gentle or steep, dry rocky, sandy slopes.

**Flowering time**

*R. rostrata* subsp. *pluriflora* flowers from November to February.

Specimens examined

—3322 (Oudtshoorn): Prince Albert, Swartberg, Blouberg Peak (–AC), Bean & Viviers 1991 (BOL); Swartberg, Botha’s road (–AC), Bond 1622 (NBG); Swartberg Pass, along summit ridge (–AC), Esterhuysen 28833 (BOL); Swartberg, summit ridge southeast of Blouberg (–AC), Thompson 2211 (NBG, PRE, 1 & 2); forestry track near Blouberg on crest of mountain (–AC), Viok 892 (PRE, 1 & 2); Spitzkop, about 5 miles (8km) west of Meiringspoort (–AD), Thorne s.n. sub SAM 50193 (SAM); Swartberg, main peak in ridge east of Blesberg (–BC), Oliver 5640 (NBG).


Erect, robust, much-branched suffrutex up to 2m high. Leaves lanceolate to elliptic; leaves on flowering branches...
30–55 ° (7–)10–15(–18)mm; basal leaves 45–55(–87) ° 14–27(–33)mm. Inflorescences single-flowered, pedunculate. Flowers large, 19–25mm long; buds leaf-like. Pedicel 5–6mm long. Bract ± 1mm long. Bracteoles ± 0.3mm long. Calyx long, very large; lobes much longer than the tube, 13–15mm long; upper lobes broadly falcate, much broader than the others; lateral lobes falcate; carinal lobe very narrow, shorter than the others; tube 4–5mm long with a ridge between the upper lobes. Standard round, ± 17 ° 17mm; claw ± 3mm long. Wings oblong, ± as long as the keel, ± 13 ° 7mm, with 7 rows of sculpturing; apex obtuse; claw ± 5mm long, Keel ± 13 ° 7mm; claw ± 4mm long. Pistil with the ovary oblong; style ± as long as the ovary, strongly upcurved; ovules 2. Pods obliquely ob lanceolate, 40–53 ° 10–13mm; upper margin asymmetrically convex; lower margin ± straight. Seeds cordate-reniform to subtriangular or broadly oblong-reniform, 5–6 ° 4–5mm; hilum surrounded by a swollen ring; testa longitudinally striate.

Diagnostic characters

*R. vlokii* is similar to *R. alata* and *R. elliptica* but differs in the invariably pedunculate inflorescences (pseudopedunculate in *R. alata* and mostly in *R. elliptica*), the filiform carinal calyx lobe (triangular in *R. alata* and *R. elliptica*), the larger, obliquely ob lanceolate pod (obliquely lanceolate in *R. alata* and *R. elliptica*), the 6mm long seeds (3–5mm long in *R. alata* and *R. elliptica*), the seed hilum with a swollen ring (without a swollen ring in *R. alata* and *R. elliptica*) and striate testa surface (rough in *R. alata* and smooth in *R. elliptica*).

Distribution and habitat

*R. vlokii* is known only from the Outeniqua mountains and Moerasrivier (Figure 24) and its distribution in the Outeniqua mountains coincides with that of the Outeniqua form of *R. alata*. It grows in vegetation that is a transition from renosterveld to dry grassy fynbos, along disturbed roadsides or on lower slopes in dry, rocky, loamy or sandy soil.

Flowering time

*R. vlokii* is known to flower in June.

Specimens examined

3322 (Oudtshoorn): 4km from Moerasrivier bridge to Mossel Bay (–CC), Campbell & Van Wyk 156 (K, PRE); Moerasrivier farm (–CC), Van Wyk 3172 (JRAU, NBG); George, northern slopes of Outenikwas at eastern end of Waboomskraal (–CD), Vlok 534 (NBG, PRE); Outeniqua mountains next to forestry track along Groot Doringrivier (–CD), Vlok 623 (PRE).


TYPUS.—Western Cape Province: Oudtshoorn, Swartberg Pass, 1.3km along Gamkaskloof Road towards Prince Albert side, 11/12/1995, Campbell, Van Wyk & Schutte-Vlok 154 (NBG!, holotype; BOLI, JRAU, K, MO!, NBG!, PRE!, UPS!, isotypi).

Procumbent, mat-like shrublet up to 0.4m high. Leaves obovate to round or lanceolate; leaves on flowering branches 25–51 ° 7–19mm; basal leaves 18–54 ° 3–32mm. Inflorescences single-flowered. Flowers 14–25mm long. Pedicel 3–8mm long. Bract narrowly lanceolate, large, leaf-like or narrowly triangular or absent, 1–5mm long. Bracteoles 0.3–0.9mm long. Calyx long; lobes longer than the tube, 7–16mm long; upper lobes broadly falcate, much broader or not much broader than the others; lateral lobes slightly falcate; tube with wing-like extensions between all the lobes, 3–8mm long. Standard ovate or broadly elliptic, 11–19 ° 12–23mm, often with basal calliosties; apex obtuse or retuse; claw 2–5mm long. Wings oblong or obovate, 8–15 ° 4–10mm, with 4–6 rows of sculpturing; claw 3–5mm long. Keel rostrate, often ± strongly upcurved, 8–11 ° 4–6mm; claw 4–6mm long. Pistil with the ovary oblong; style shorter than or ± as long as the ovary, upcurved or strongly upcurved; ovules 2. Pods narrowly obliquely lanceolate, 20–30 ° 3–5mm; upper margin straight; lower margin proximally convex.

Diagnostic characters

*R. alata* (Figure 23e) differs from *R. vlokii* and *R. elliptica* in the smaller, procumbent, mat-like habit and the large, wing-like extensions between the calyx lobes (extensions absent in *R. vlokii* and *R. elliptica*).

Flowering time

*R. alata* flowers from October to January.
Regional variation

Three regional forms of R. alata are distinguished, namely the Swartberg, Outeniqua mountains and Bredasdorp forms. The Cape Infanta locality is unique to R. alata, while the other two forms coincide geographically with R. vlokii and R. elliptica to a certain extent.

Swartberg form (Typical form). Leaves obvate to round; leaves on flowering branches 25–35(40) ° 10–15(19)mm; basal leaves 30–50 ° 15–25(32)mm. Flowers 14–18(21)mm long. Pedicel 5–8 mm long. Bract large, narrowly lanceolate, leaf-like, 4–5mm long. Bracteoles 0.7–0.9mm long. Calyx lobes 7–12mm long; upper lobes much broader than the others; tube 5–8mm long. Standard broadly elliptic, 14–16 ° (12–17)–19mm; apex retuse; claw 2–3mm long. Wings oblong, (8–)12–13 ° 4–6mm. Keel not strongly upcurved. Pistil with the style shorter than the ovary, strongly upcurved. Pods (20–)23–25mm long. Seeds broadly oblong to broadly reniform, 3–4 ° 2–3mm; testa rough.

Diagnostic characters

The typical form of R. alata differs from the other forms in the obovate to round leaves (leaves lanceolate in the other forms), the large, narrowly lanceolate, leaf-like bracts (bracts small and narrowly triangular in the Outeniqua form and absent in the Bredasdorp form) and the long calyx tube (5–8mm long in the typical form, 3mm long in the Outeniqua form and 3–5mm long in the Bredasdorp form).

Distribution and habitat

This form occurs only on the Swartberg (Figure 25) in grassy montane fynbos on low or higher slopes, in dry, sandy soil or deep, moist, loamy soil.

Outeniqua form. Leaves lanceolate; leaves on flowering branches 35–43 ° 7–9mm; basal leaves 18–29 ° 3–7mm. Flowers 17–18mm long. Pedicel 3–5 mm long. Bract narrowly triangular, ± 1mm long. Bracteoles ± 0.3mm long. Calyx lobes 8–9mm long; upper lobes much broader than the others; tube ± 3mm long. Standard broadly elliptic, ± 11 ° 13mm; apex obtuse; claw ± 3mm long. Wings oblong, ± 9 ° 4mm; claw ± 3mm long. Keel not strongly upcurved; ± 8mm long. Pistil with the style shorter than the ovary, strongly upcurved. Mature pods and seeds unknown.

Diagnostic characters

The Outeniqua form of R. alata differs from the other forms in the basal leaves which are smaller than the upper leaves (basal leaves larger than the upper leaves in the other forms), the smaller flowers, the very small bracteoles (large in the typical form and absent in the Bredasdorp form) and the obtuse standard apex (apex retuse in the other forms).

Distribution and habitat

This form occurs in the Outeniqua mountains (Figure 25), in a locality similar to that of R. vlokii (Figure 24), and grows on foothills in dry, rocky, sandy soil.

Bredasdorp form. Leaves lanceolate; leaves on flowering branches 7–12mm wide; basal leaves 6–15mm wide. Flowers 22–25mm long. Bract and bracteoles absent. Calyx lobes 12–16mm long; upper lobes not much broader than the lateral lobes; tube 3–5mm long. Standard ± 19 ° 23mm; apex retuse; claw ± 5mm long. Wings obovate, ± 15 ° 10mm; apex very broad. Keel ± strongly upcurved, ± 11mm long. Pistil with the style upcurved. Pods 25–30mm long. Seeds unknown.

Diagnostic characters

The Bredasdorp form of R. alata differs from the other forms in the large flowers, the absence of bracts and bracteoles (these are present in the other forms), the upper calyx lobes which are not much broader than the other lobes (upper lobes much broader than the other lobes in the other forms), the obovate wings (wings oblong in the other forms) and the strongly upcurved keel (keel not strongly upcurved in the other forms).

Distribution and habitat

This form is known only from the Potberg and Cape Infanta (Figure 25). It grows on plains in coastal fynbos, on Table Mountain Sandstone gravel flats or in deep, moist, sandy soil.

Specimens examined

—3322 (Oudtshoorn): Prince Albert division, Swartberg Pass (–AC), Bolus s.n. sub BOL 61264 (BOL), Esterhuysen 28622 (BOL), Pocock 5136 (PRE), Stokoe 8782 (BOL), s.n. sub SAM 55811, s.n. sub SAM 65712 (SAM), s.n. sub SAM 68744 (PRE, SAM); Swartberg Pass, 1.3km along

Figure 25: The known geographical distribution of R. alata
Gamkaskloof road towards Prince Albert side (–AC), Campbell & Van Wyk 8 (JRAU), Campbell, Van Wyk & Schutte-Vlok 154 (BOL, JRAU, K, MO, NGB, 1 & 2, PRE, 1 & 2, UPS); Swartberg, next to track behind Olievenhoutbos (–AC), Vlok 1246 (PRE); Groot Swartberg, Biesberg (–BC), Vlok 108 (NGB, PRE), 1761 (PRE); Outeniqua mountains, near Groot Doringrivier (–CD), Vlok 736 (PRE, 1 & 2).

—3420 (Bredasdorp): De Hoop, Potberg Nature Reserve, Potberg near Boskloof (–BC), Burgers 1404 (PRE); Cape Infanta, about 1km north of town (–BD), Vlok 1713 (PRE, 1 & 2).

8. Rafinia crassifolia Harv., Thesaurus Capensis 1: 45, t. 71 (1859); 34 (1862); Walp.: 670 (1868); Schinz: 200 (1894). Type: Western Cape Province, in latenibus (altit. III) montium 'Hottenroltschnolandsberge' prope 'Palmietrivier' et ad 'Klynniersberge' (Stellenbosch, Caledon), Ecklon & Zeyher 1192 (SAM!); lecto., here designated.


Procumbent shrublet, stems not much-branched, up to 0.6m high. Leaves lanceolate, bright green, often remaining so when dry; leaves on flowering branches 28–44 x 8–13mm; basal leaves (25–)35–55 x 7–17mm. Inflorescences single-flowered, without a peduncle or pseudopeduncle. Flowers 13–16–(20)mm long. Pedicel elongate, 12–16–18mm long. Bract 0.7–0.8mm long. Bracteoles subulate to linear-triangular, 0.5–0.7mm long. Calyx long; lobes much longer than the tube, 10–13mm long; upper lobes falcate, slightly broader than the others; lateral lobes slightly falcate; carinal lobe sometimes shorter than the others; tube with a ridge between the upper lobes, 4–5mm long. Standard obovate to subapandiform, tapering towards the claw, 13–18 x 9–14mm; claw 1–2mm long. Wings oblong, ± as long as or longer than the keel, 9–11 x 3–5mm, with 5–7 rows of sculpturing; apex obovate to broadly obtuse; claw 3–4mm long. Keel 9–11 x ± 5mm; claw ± 4mm long. Pistil with the ovary ± oblong; style long, ± as long as or longer than the ovary, upcurved; ovules 2. Pods obliquely lanceolate, 34–39 x 8–11mm; upper margin straight; lower margin proximally convex. Seeds obliquely oblong-reniform, ± 4 x 3mm; testa rough.

Diagnostic characters

R. crassifolia (Figure 23f) is distinguished from the other species of Rafinia by the somewhat succulent, often bright green leaves which have red margins, the inflorescence which lacks a peduncle or pseudopeduncle, the elongated pedicels (about as long as the flowers) and the subapandiform standard petal which tapers into the claw.

Distribution and habitat

R. crassifolia is limited to the Cape Peninsula, Palmietrivier and Hermanus areas (Figure 26). This species grows in montane or coastal fynbos, in disturbed areas, on moist sand flats near rivers, or gentle to moderate sandy, rocky slopes, in Table Mountain Sandstone and quartzitic shallow or deep soils.

Flowering time

R. crassifolia flowers from October to March.

Selected specimens examined

—3418 (Simonstown): Simon's Bay (–AB), Alexander-Prior s.n. sub PRE 53116 (PRE); Cape of Good Hope Nature Reserve, road to Olifantsbos (–AB), Campbell & Van Wyk 107 (JRAU), 150 (JRAU, K, NGB, PRE); between Klaasjagersberg and Hestersdam (–AB), Galpin 12547 (PRE); Klawer valley, near Simonstown (–AB), Moss 7734 (J), Salter 7830 (NGB), Wolley-Dod s.n. sub BOL 42925 (BOL); Kromrivier (–AB), Taylor 6751 (NGB, PRE); near Smith's farm (–AD), Acockes & Hafström 711 (PRE), Moss 6102 (J), Sirkelsvlei (–AD), Baker 1175 (NGB), Barker 3953 (NGB); Smitwinkel (–AD), Barker 4302 (NGB), Phillips s.n. sub PRE 53114 (PRE), s.n. sub SAM 27584 (SAM); Rooihoogte (–AD), Leighton 868 (BOL); Sir Lowry's Pass, slopes north of Steenbras siding (–BB), Andreea 20 (PRE); Highlands, Caledon (–BB), Bond 1525 (NGB); Elephant Rock Estates, near Palmietrivier (–BD), Boucher 1039 (NGB, PRE); Buffelsniersdam (–BD), Boucher 1823 (NGB, PRE); Hangklip, Caledon (–BD), Compton 6089 (NGB), Lavanos 12059 (PRE), Pillans 8246 (BOL); Caledon division, Palmietrivier mouth (–BD), Esterhuysen s.n. sub BOL 42923 (BOL); Kleinmond, Kogelberg State Forest, about 1km north of Oudebosch homestead (–BD), Kruger 861 (NGB, PRE), Vlok & Schutte 258 (JRAU); road to reservoir behind Pringle Bay, Caledon (–BD), Levyns 10387 (BOL); Betty's Bay (–BD), A.E. van Wyk 229 (PRE).

—3419 (Caledon): Palmietrivier, Grabouw (–AA), Stokoe s.n. sub PRE 53120 (PRE), s.n. sub STE 32071 (NGB); Hermanus (–AC), Compton 23224 (NGB); Kleinmond (–AC), De Vos 364 (NGB), Goldblatt 7630 (NGB, PRE).

Figure 26: The known geographical distribution of R. crassifolia
Leaves lanceolate to elliptic, pinninerved, sometimes involute when young; leaves on flowering branches (37–)45–75 × 9–20 mm; basal leaves 53–85–(98) × 16–31 mm. Inflorescences single or rarely 2–3-flowered, sometines pedunculate. Flowers large, (12)–15–23 mm long. Pedicel 7–11 mm long. Brady 1.5–2.0 mm long, Bracteoles 0.3–1.1 mm long. Calyx lobes longer than the tube, 6–10 (13) mm long, upper lobes falcate to broadly falcate, broader than the others; upper sinus sometimes deeper than the others; tub with a ridge between the upper lobes, 5–6 mm long. Standard ovate or broadly elliptic or suborbicular, 13–19 × 13–19 mm, often with basal calllosities; apex obtuse or subacute; base cordate; claw 2–4 mm long. Wings oblong-tubular, ± as long as the keel, 10–17 × 4–8 mm, with 6–9 rows of sculpturing; apex obliquely obtuse; lower margin broadly convex; claw 5–7 mm long. Keel narrowly rosulate, sometimes ± strongly upcurved, 9–17 × 4–7 mm; claw 5–7 mm long. Pistil with the ovary oblong to narrowly ovate, style shorter than the ovary, gently to strongly upcurved; ovules 2. Pods obliquely lanceolate, 30–49 × 8–11 mm, sur face often prominently veined; upper margin straight; lower margin straight, proximally convex. Seeds broadly oblong-reniform, 4–5 × 3–4 mm; tests smooth.

Diagnostic characters

R. elliptica (Figure 32a) is similar to R. vlokii but differs in the longer pedicels, the smaller calyx, the broader carinal lobes which is about as long as the other lobes (not very narrow and shorter than the other lobes in R. vlokii), the basal calllosities on the standard petal (basal calllosities absent in R. vlokii), the broadly convex lower margin of the wing petal (margin more or less straight in R. vlokii), the style that is shorter than the ovary (about as along as the ovary in R. vlokii), the obliquely lanceolate pods (obliquely ob lanceolate in R. vlokii) and the smaller seeds which have a smooth testa (seeds with a striate tests in R. vlokii). R. elliptica also differs from R. alata in the much larger size and presence of a ridge between the upper lobes on the calyx tube (wing-like extensions between all the lobes in R. alata).

Distribution and habitat

R. elliptica is the most widely distributed species and has a much wider distribution than R. vlokii or R. alata. It occurs from the Langeberg in the east, through the Eastern Cape Province to southern KwaZulu-Natal (Figure 27). The species grows in sandy, grassy coastal fynbos, in vegetation that is a transition between renosterveld and dry fynbos, and mostly occupies foothills or gentle slopes and is often associated with Table Mountain Sandstone.

Flowering time

R. elliptica flowers from September to April.

Selected specimens examined
—3030 (Port Shepstone); Black Trail, Oribi (–CB), Davidson 2589 (J); south coast, Marina Beach (–CD), Mogg 13245 (PRE).
—3129 (Stanger): Transkei, Mkambate Game Reserve.
(–BD), Shackleton 154 (PRE); Port St John’s district, Lusikisiki, Egoso forest (–BC), Blenkinsorn s.n. sub J 16138 (J, 1–3).
—3228 (Butterworth): Kei mouth, Komga district (–CB), Flanagan 1816 (BOL, PRE, 1 & 2, SAM).
—3320 (Montagu): Langeberg wilderness area (–DD), Van der Merwe 162 (NBG, PRE).
—3321 (Ladismith): Waterkloof (–BD), Gillett 1937 (BOL, 1 & 2).
—3322 (Oudtshoorn): 0.3km after road stall on Oudtshoorn-George road (–CB), Campbell & Van Wyk 157 (JRAU, 1–3); Robinson Pass (–CC), Taylor 10060 (BOL); Outeniqua mountains, near Leeukloof (–CC), Vlok 1661 (PRE); Swartrivier Gorge, George (–CD), Acocks 21531 (PRE); Buffelsdrif, Kamanassie mountains, Mannetjesberg (–DB), Vlok 1314 (PRE), Vlok & Schutte 352 (JRAU); 33km from Oudtshoorn-George road to Uniondale (–DC), Campbell & Van Wyk 158 (JRAU, 1–3, NBG); Ruitgeveli near Sedgefield (–DD), Hugo 2010 (NBG, PRE).
—3323 (Willowmore): Keurboomsrivier heights (–CD), Fourcade 4800 (BOL, NBG).
—3324 (Steytlerville): Smitskraal, Kouga mountains, next to track near Graskop (–CB), Vlok 1196 (PRE); 19km from Kareedouw to Joubertina (–CC), Stirtion 6359 (PRE); Kareedouw, Humansdorp (–CD), Compton 4609 (BOL, NBG); Elandsberge, south of Cockscomb above Erasmuskraal (–DB), Oliver 9363 (NBG).
—3325 (Port Elizabeth): Suurberg National Park, Superbus area (–AD), Van Wyk & C.M. van Wyk 615 (JRAU); Suurberg National Park, Lot 16, along Brandrug (–BC), Van Wyk & C.M. van Wyk 1066, 1443, 2044 (JRAU) in montibus ad van Stadens river (–CC), Zeyher s.n. sub SAM 15205 (SAM); Baakensrivier valley, Fairview (–DC), Oliver 1263 (NBG, PRE).
—3326 (Grahamstown): Highlands road 10km from Grahamstown (–AB), Bayliss 8176 (PRE); Albany, between Boomsmansrivier and Assegaaivier (–AC), Leighton 2613 (BOL); near Coldspring, Albany division (–AD), Acocks 12100 (PRE); Grahamstown (–BC), Bayliss 3078 (NBG);
Round Hill, Albany (–BD), Bolus 32550 (BOL).
—3423 (Knysna): Knysna (–AA), Zeyher s.n. sub SAM 15206 (SAM).

10. Rafnia triflora (L.) Thunb., Genera Nova Plantarum: 145 (1800a); 123 (1800b); Wild.: 950 (1802); Thunb.: 563 (1823); DC.: 118 (1825); E. Mey.: 147 (1832); Eckl. & Zeyh.: 159 (1836); E. Mey.: 12 (1836); Walp.: 463 (1839); 579 (1843); Bent.: 465 (1843); Presl.: 474 (1845); Harv.: 33 (1862); Schinz.: 200 (1894). Type: ‘e Cap. b. spei’, LINN 895.16 (LINN, microfichel, lecto., here designated).

Crotalaria triflora L.: 1004 (1753); 440 (1767); Berg.: 193 (1767).


Rafnia cordata (L.) Mart.: 189 (1820); DC.: 118 (1825); Eckl. & Zeyh.: 159 (1836); Walp.: 466 (1839); 579 (1843).

Rafnia alpina Eckl. & Zeyh.: 160 (1836); Walp.: 466 (1839); 579 (1843). Type: Western Cape Province, inter saxa (altit. V) verticis montis ‘Tafelberg’, Ecklon & Zeyher 1184 (SAM, lecto., here designated).

Rafnia fastigiata Eckl. & Zeyh.: 160 (1836); Walp.: 466 (1839); 579 (1843); Bent.: 465 (1843); Harv.: 33 (1862); Presl.: 474 (1845). Type: Western Cape Province, in locis petrosis (altit. V) montium altarum prope ‘Puspasvalley’ (Swellendam), Ecklon & Zeyher 1182 (SAM, lecto., here designated).

Icones: Andr.: 31, t. 31 (1797).

Erect woody shrub up to 2.4m high or an erect suffrutex up to 0.7m high. Leaves lanceolate or elliptic to broadly elliptic or obovate or ovate, pinninerved; base round or cordate; leaves on flowering branches 23–50 mm 10–34mm; basal leaves 43–121 mm 16–110mm. Inflorescences single-flowered, 1–3 flowers emerging together from axils. Flowers 16–21mm long. Pedicel 2–5mm long. Bract triangular, 1–2mm long. Bracteoles triangular, 0.5–1mm long. Calyx lobes ± as long as or longer than the tube, 4–11mm long; upper lobes falcate or broadly falcate, broader or much broader than the others; lateral lobes triangular or slightly falcate; carinal lobe shorter than or ± as long as the others; upper sinus often deeper or much deeper than the others; tube with a ridge between the upper lobes, 5–6mm long. Standard ovate or elliptic or suborbicular, 13–18–13mm, often with basal calllosities; claw 3–5mm long. Wings oblong or elliptic, 13–16 mm 5–8mm, with 5–7 rows of sculpturing; apex narrow or ± obovate; claw 4–8mm long. Keel shortly rostrate, 12–14 mm 6–7mm; claw 4–6mm long. Pistil with the ovary oblong; style shorter than the ovary, strongly upcurved; ovules 2; stigma usually glabrous, rarely fibrilllose. Pods obliquely lanceolate, 18–33 mm 3–8mm; upper margin proximally slightly convex; lower margin straight. Seeds narrowly to broadly oblong or broadly reniform, 3.5–2–4mm; testa smooth (seeds unknown in Caledon form).
Diagnostic characters
*R. triflora* (Figure 32b) is recognised by its often subtriangular, cordate-based upper leaves which are closely appressed to the stem, the very large, elliptic to round basal leaves and the inflorescences in which three single-flowered racemes emerge from the leaf axils, giving the appearance of a 3-flowered inflorescence.

Distribution and habitat
*R. triflora* is widespread, occurring from Clanwilliam and the Piquetberg in the north, to the Cape Peninsula and Palmitrivierv areas in the south and it continues eastwards to Tsitsikamma and Knysna (Figure 28). This species occurs in montane or coastal fynbos and occupies various habitats, from mountain peaks to river mouths, and is typically associated with soil derived from Table Mountain Sandstone or deep, dry reddish soil.

Flowering time
*R. triflora* flowers from September to March.

Regional variation
Two regional forms are distinguished in *R. triflora*, and they differ in habit, calyx structure and type of substrate that they occupy. The Caledon form is often associated with limestone ridges.

Typical form. Erect, robust, much-branched woody shrub up to 2.4m high. *Leaves* elliptic to broadly elliptic or obovate; leaves on flowering branches 33–50 ° 18–30(–34)mm; basal leaves 57–121 ° 28–83(–110)mm. *Bracteoles* ± 1mm long. Calyx lobes ± as long as the tube, 4–6mm long; upper lobes falcate, broader than the others; carinal lobe shorter than the others; upper sinus often deeper than the others. *Wings* oblong; apex narrow. *Pistil* with the style shorter than or ± as long as the ovary.

Diagnostic characters
The typical form of *R. triflora* differs from the Caledon form in that it is a large, robust woody shrub (the Caledon form is a smaller, herbaceous suffrutex) and the leaves are larger.

Caledon form. Erect suffrutex up to 0.7m high. *Leaves* lanceolate or elliptic or ovate; leaves on flowering branches 10–15(–18)mm wide; basal leaves (43–)50–67(–93) ° 16–23(–45)mm. *Bracteoles* 0.5–2mm long. Calyx lobes longer than the tube, 8–11mm long; carinal lobe sometimes shorter than the others; upper sinus often much deeper than the others. *Wings* with the apex ± obovate. *Pistil* with the style long, ± as long as or longer than the ovary. *Pods* 27–33 ° 7–8mm.

Diagnostic characters
The Caledon form of *R. triflora* differs from the typical form in the larger calyx lobes which are longer than the tube (lobes are as long as the tube in the typical form), the upper calyx lobes which are usually broadly falcate and much broader than the other lobes (upper lobes falcate and broader than the others in the typical form) and the obovate wing apex (apex narrow in the typical form).

Distribution and habitat
The Caledon form (collected at Caledon, Palmitrivierv, Kleinrivier mountains, Stanford and De Hoop) occurs in montane or coastal fynbos, adjacent streams, or on sand flats, gentle foothills or steep mountain slopes. It is often associated with limestone outcrops, and may occur in rocky, peaty soil, granite-derived soil, soil derived from Table Mountain Sandstone or clay.

Selected specimens examined
—3218 (Clanwilliam): Piquetberg, 8.6km along Langeberg division road, western boundary of Rheeboksfontein farm (–DC), Campbell & Van Wyk 116 (JRAU, 1–3).
—3219 (Wupperthal): 12.3km along road from Citrusdal to The Baths (–CA), Campbell & Van Wyk 123 (JRAU); Clanwilliam division, hills at Keerom (–CC), Pilans 9202 (BOL).
—3318 (Cape Town): Table Mountain (–CD), Alexander-Prior s.n. sub PRE 53109 (PRE); Stellenbosch division, Uitkyk (–DD), Gillett 564 (NBG).
—3320 (Montagu): Swellendam (–CD), Mundt s.n. sub SAM 15204 (SAM).
—3322 (Oudtshoorn): George (–CD), Guthrie 4301 (NBG).
—3323 (Willowmore): Flats at Ratelbosch, Tsitsikamma (–DD), Fourcade 707 (BOL, 1 & 2); Stormsrivierv (–DD), Taylor 3730 (NBG).
—3418 (Simonstown): Between Hout Bay and Chapman’s Peak (–AB), Barker 3284 (NBG); Smitswinkel Bay, Partridge Point (–AD), Van Wyk 3010 (JRAU, 1 & 2); Caledon division,
Kogel Bay (BB), Boucher 2050 (NBG, PRE), Leighton 2472 (BOL); between Rooiels and Kogel Bay (BD), Campbell & Van Wyk 149 (JRAU).

—3418 (Caledon): Kleinmond (–AC), De Kock 67 (NBG, PRE, 1 & 2); Stanford (–AD), Chambers & Chambers s.n. sub NBG 85107 (NBG).

—3420 (Bredasdorp): Near Puspas valley, Swellendam (–AB), Ecklon & Zeyher 1182 (SAM); De Hoop, Potberg Nature Reserve, above Droonkiei (–AD), Burgers 1342 (NBG, PRE).

—3421 (Riversdale): Korintjervier farm, Riversdale district (–AA), Muir 61 (PRE); Riversdale, Langeberg, Aandevelsriaier farm (–AB), Vlok 2679 (JRAU, 1 & 2); Rietvlei, near Still Bay (–AD), Bohnen 8112 (NBG); near Ystervarkfontein, Riversdale division (–BC), Muir 618 (PRE).

—3423 (Knysna): Springfield plantation (–AA), Keet 414 (NBG, PRE).

Precise locality unknown: ‘e Cap. b. spei’, LINN 895.16 [LINN] [microfiche only].


Rafinia meyeri Schinz: 200 (1894). Type: Western Cape Province, inter saxa (alit. IV) laterum montium prope ‘Klompnus’ (Stellenbosch), Ecklon & Zeyher 1180 (SAM), lecto., here designated).

Erect, robust suffrutex, stems not much-branched, up to 1.2m high. Leaves broadly elliptic or broadly obovate or oval or round, penninerved; apex acuminate; leaves on flowering branches 35–60–(63) (11–17–37)mm; basal leaves 52–118 (28–40)–92mm. Inflorescences single-flowered or rarely 2–4–flowered, sometimes pedunculate. Flowers large, 17–22mm long. Pedicel 3–5mm long. Bracteoles ± 1mm long. Bracteoles ± 0.5mm long. Calyx lobes triangular, shorter than tube, 3–5mm long; upper lobes broader than the others; carinal lobe sometimes slightly shorter than the others; upper sinus much deeper than the others; tube with a ridge between the upper lobes, 3–6mm long. Standard ovate or broadly elliptic or suborbicular, 15–20 (16–21)–23mm, often with basal calllosities; claw 3–4mm long. Wings oblong to oblong-elliptic, 15–19 × 8–10mm, with 7–9 rows of sculpturing; apex obtuse; claw 4–6mm long. Keel sometimes ± strongly upcurved, (11–)14–16 (7–8)mm; claw 5–7mm long. Pistil with the ovary oblong to narrowly ovate; style shorter than the ovary, strongly upcurved; ovules many (up to 7). Pods obliquely lanceolate, 37–44–(52) × 10–13mm, short-stipitate; stipe 10–16mm long; upper margin slightly convex, broadly winged; wing ± 2mm wide; lower margin straight, proximally convex, upcurved into stipe. Seeds broadly oblong-reniform, 5–6 × 3–4mm; testa rough.

Diagnostic characters

R. ovata (Figure 32c) is recognised by the herbaceou stems which are not much-branched, the acuminate leaves (the basal leaves are often very large, comparable in size to those of R. triflora), the inflorescence, which is sub-tended by highly reduced opposite leaves that often appear to be absent, the large flowers, the calyx lobes that are shorter than the calyx tube and the large and stipitate pod that are broadly winged on the upper suture.

Distribution and habitat

R. ovata occurs as far north as Nieuwoudtville and continue southwards through the Cedarberg to Stellenbosch area, eastwards to Tweedia in the Laingsburg area (Figure 29). This species grows in montane fynbos, often in disturbed areas, on fynbos or mountain slopes or sandy flats near rivers, often in soil derived from Table Mountain Sandstone.

Flowering time

R. ovata flowers from August to January.

Selected specimens examined

—3119 (Calvina): Glenridge, Nieuwoudtville (–AC), Barker 9212, 9568, 1 & 2 (NBG); Vanrhynsdorp, top of Vanrhyn’s Pass (–AC), Van Breda 1401 (PRE).

—3218 (Clanwilliam): Skimmelberg (–BD), Pillans 9093 (BOL); Piquetberg, Waboom farm, Zebrakop (–DB), Taylor 5347 (PRE); Piquetberg, 2.1km along New Caledonia road (–DC), Campbell & Van Wyk 34, 1 & 2, 122, 1 & 2 (JRAU).

—3219 (Wupperthal): Cedarberg State Forest, Heuningvlei, Groot Koupoort (–AA), Esterhuysen 12130 (BOL); 2 miles (3.2km) south of Wupperthal (–AC), Rycroft 2253 (NBG); Sneeuwberg, Cedarberg (–CA), Barnard s.n. sub SAM 44109 (SAM); Ceres, Wydekloof, opposite turn-off to Donkerbos.

Figure 29: The known geographical distribution of R. ovata

TYPUS.—Western Cape Province: Piquetberg, 7.5 km along Langeberg division road, western boundary of Rheeboksfontein farm, 18/10/1995, Campbell & Van Wyk 119 (NBGI, holotypus; BOLI, JRAU, K, MOI, NBGI, PRE!, UPS!, isotypi).

Erect shrublet up to 1 m high. Leaves broadly elliptic or obovate-elliptic or oblong or rounded, pinninnerv, revolute when young; base cordate, leaves on flowering branches opposite, 22–37 × 14–25 mm; basal leaves (26–)50–50 × 15–36 mm; coppice leaves ovate to round, 23–33 × 19–28 mm. Inflorescences single-flowered. Flowers 12–15 mm long. Pedicel 7–9 mm long. Bract 1–2 mm long. Bracteoles shortly triangular, ± 0.25 mm long. Calyx relatively long; lobes much longer than the tube, 7–10 mm long; upper lobes broadly falcate, much broader than the others; lateral lobes falcate; carinal lobe very narrow, shorter than the others; upper sinus deeper than the others; tube with a wing-like extension between the upper lobes, ± 4 mm long. Standard ovate to broadly ovate or broadly elliptic, 12–14 × 12–14 mm; apex acute; claw ± 3 mm long. Wings oblong, shorter than the keel, 7–9 × 3–4 mm, with 6–7 rows of sculpturing; apex obtuse, base gradually tapering into claw; claw ± 3 mm long. Keel 10–11 × 4–6 mm; claw 3–4 mm long. Stamens usually monadelphous or rarely diadelphous. Pistil long-stipitate; ovary ± oblong; style long, longer than the ovary, strongly upcurved; ovules 1–2. Pods oblong, 16–17 × ± 4 mm, stipitate; stipe 8–9 mm long, often curved; upper and lower margins slightly convex. Seeds narrowly to broadly reniform or oblong, 3–4 × 2–3 mm; testa smooth.

**Diagnostic characters**

R. inaequalis (Figure 32d) is similar to R. acuminata and R. amplexicaulis but differs in the revolute young leaves (the young leaves are flat or slightly cupular in R. acuminata and R. amplexicaulis), the pinninerved leaf venation (venation is reticulate in R. acuminata and R. amplexicaulis), the minute, filiform carinal calyx lobe (the lobe is larger and triangular in R. acuminata and R. amplexicaulis), the wing-like extension on the tube between the upper lobes (such an extension is absent in R. acuminata and R. amplexicaulis) and the small, stipitate pod (the pod is sessile in R. acuminata and R. amplexicaulis).

**Distribution and habitat**

R. inaequalis is known only from the Piquetberg (Figure 30), where it co-occurs with its presumably closely related species, R. acuminata and R. amplexicaulis. The species occurs in montane fynbos, in disturbed areas in deep sand.

**Flowering time**

R. inaequalis flowers from October to January.

Specimens examined:

-3218 (Clanwilliam): Piquetberg, 7.5 km along Langeberg division road, western boundary of Rheeboksfontein farm, 18/10/1995, Campbell & Van Wyk 119 (BOL, JRAU, K, MO, NBG, 1–3, PRE, 1 & 2, UPS); Piquetberg (–DC?), Compton 23005 (NBG).

13. *Rafnia acuminata* (E. Mey.) G.J. Campbell & B-E. van Wyk comb. nov. Type: ‘e Cap. b. spei’, Drège s.n. (P?, to be chosen as lectotype); Drège s.n. sub Herb. Benth. (K!)

Vascoa acuminata E. Mey. in Linnaea 7: 148 (1832); Ekcl. & Zeyh.: 162 (1836).

*Vascoa perfoliata* (Thunb.) DC. var. acuminata (E. Mey.) Walp.: 462 (1839).

*Borbonia perfoliata* Thunb.: 122 (1800b), non Lam. (1785), nom. illeg. Type: ‘e Cap. b. spei’, Thunberg s.n. sub THUNB-UPS 16390 (UPS, microfiche!, specimen marked α).

*Vascoa perfoliata* (Thunb.) DC.: 119 (1825); 187 (1826); E. Mey.: 148 (1832); Ekcl. & Zeyh.: 162 (1836), nom. illeg.

*Rafnia perfoliata* auct. non (L.) Willd.: 949 (1802); E. Mey.: 12 (1836); Walp.: 462 (1839); 579 (1843); Benth.: 464 (1843); Harv.: 32 (1862); Schinz: 201 (1894).

**Note:** Borbonia perfoliata Thunb. was apparently described as new without reference to Crotalaria perfoliata of Linnaeus (1753) or *B. perfoliata* of Lamarck (1785). *C. perfoliata* L. is the basionym of *Baptisia perfoliata* (L.) R. Br., and was lectotyfied in this sense, on the Dilleniaceae plate [Dill., Hort. Elth.: 122, t. 102. f. 122 (1732)] in Turland & Janvis (1997).

If *B. perfoliata* Thunb. (1800b) was perhaps not intended as a new name but merely the use of the earlier *B. perfoliata* Lam. (1785) by Thunberg, then ‘*B. perfoliata* Thunb.’ does not exist as a name. If ‘*B. perfoliata* Thunb.’ is a newly described species, then it is a later homonym of *B. perfoliata*.
Prostrate, much-branched trailing shrublet to 0.3m high, 1m wide. Leaves cordate to oblanceolate, reticulately veined, often embracing the stem; leaves on flowering branches opposite, 20–30(–40) x 18–25(–36)mm; basal leaves 20–40 x 15–30(–35)mm. Inflorescences single-flowered. Flowers 9–14mm long. Pedicel 2–4mm long. Bract 0.5–2mm long. Bracteoles minute, 0.1–0.2mm long. Calyx lobes relatively long or not relatively long; lobes ± as long as or much longer than the tube, 2–9mm long; upper lobes falcate or broadly falcate, broader or much broader than the others; lateral lobes narrowly triangular or slightly falcate; carinal lobe sometimes slightly shorter than the others; lateral sinus sometimes deeper than the lower sinus; tube often with a ridge between the upper lobes, 2–3mm long. Standard elliptic or suborbicular, 8–14 x 6–14mm, often with basal calliostyly; claw 2–3mm long. Wings oblong, 8–13 x 3–6mm, with 5–7 rows of sculpturing; apex narrow; lower margin sometimes convex; claw 2–3mm long. Keel rostrate to ± long-rostrate, sometimes ± strongly upcurved, 7–11 x 4–6mm; apex narrow to slightly obtuse; claw 2–4mm long. Pistil with the ovary ± narrowly ovate to oblong; style ± as long as or longer than the ovary, strongly upcurved; ovules 2–3. Pods narrowly lanceolate, 20–28 x 6–9mm; upper margin slightly convex; lower margin ± straight to proximally convex. Seeds broadly reniform to oblong, ± 5 x 3mm; testa smooth.

**Diagnostic characters**

*R. acuminata* (Figure 32a) is similar to *R. amplexicaulis* but differs in the prostrate, trailing habit (*R. amplexicaulis* is a large, erect, robust woody shrub) and the proximally narrow pod (the pod is proximally broad and the upper margin convex in *R. amplexicaulis*). *R. acuminata* is distinguished from the remaining species by its cordate, reticulately veined leaves.

**Flowering time**

*R. acuminata* flowers from September to February.

**Regional variation**

Two regional forms are distinguished in *R. acuminata*, on the basis of calyx structure and distribution.

**Typical form.** Bract 0.5–0.7mm long. Calyx not relatively long, lobes ± as long as the tube, 2–5mm long; upper lobes falcate, broader than the others; lateral lobes narrowly triangular. Standard 8–10 x (6)–9–11mm. Wings 8–9 x 3–4mm. Keel rostrate, 7–9mm long.

**Northern form.** Bract 1.5–2mm long. Calyx relatively long; lobes much longer than the tube, 6–9mm long; upper lobes broadly falcate, much broader than the others. Standard 13–14 x 13–14mm. Wings 12–13 x 5–6mm. Keel ± long-rostrate, 10–11mm long.

**Diagnostic characters**

The northern form of *R. acuminata* differs from the typical form in the larger bracts, the calyx lobes which are much longer than the tube (lobes about as long as the tube in the typical form) and the broadly falcate upper calyx lobes which are much broader than the other lobes (upper lobes falcate and not as much broader than the other lobes in the typical form). The standard, wing and keel petals of the northern form are larger than those of the typical form and the keel is long-rostrate (rostrate in the typical form).

**Distribution and habitat**

The typical form of *R. acuminata* occurs from the Cedarberg in the north to the Bredasdorp area in the south (Figure 30). The northern form is restricted to the Piquetberg and Algeria in the Cedarberg. *R. acuminata* occurs in coastal, montane and grassy fynbos and grows on gentle or steep, dry, rocky slopes. It is often associated with stony shaly, dry soil derived from Table Mountain Sandstone or clay or granitic soil.

Selected specimens examined


—3219 (Wupperthal): Algeria, Cedarberg (–AC), Compton 4786 (NBG); boundary between Breakenrands and Kromrivier (–CB), Taylor 11432 (NBG, PRE, 1 & 2); Clanwilliam division, Keerom, above Olifantsrivier valley (–CC), Esterhuysen 17929 (BOL).

—3318 (Cape Town): Piquetberg division, Porterville (–BB), Loubsker 798 (BOL); Jonkershoek, Stellenbosch (–DD), Compton 15309 (NBG, PRE).

—3319 (Worcesters): Tulbagh division, Wiltsberg, Sneugat valley (–AA), Stokoe 7408 (BOL); Skunweberge, near Gydo (–AB), Bulus 7570 (BOL); Rooodesandsberg, Tulbagh (–AC), Compton 6498 (NBG); Eendracht farm, Waaioek (–AD), Pica Survey 6 pmp PRE 871 (PRE); near De Doorns, about 3 miles (4.8km) north of Worcester (–BC), Schlieben & Van Breda 9335 (NBG, PRE); Paarl, Drakenstein mountains, Du Toitskloof (–CA), Campbell & Van Wyk 22 (JRAU); Botha (–CB), Compton 18690 (NBG); Franschhoek, Paarl (–CC), Barker 4164 (NBG); Onklarberg, isolated mountain 20 miles (32km) south of Worcester (–CD), Stokoe 1152a (PRE, 1 & 2); Jonaskop, Villiersdorp (–DC), Campbell & De Castro 97 (JRAU); McGregor, Robertson (–DD), Compton 11894 (NBG).

—3320 (Montagu): Montagu Baths (–CA), Page s.n. smp PRE 53093 (PRE).

—3418 (Simonstown): Stellenbosch, Hottentotsholland mountains (–BB), Alexander-Prior s.n. smp PRE 53087 (PRE); Groen Hangklip (–BD), Boucher 759 (NBG, PRE).

—3419 (Caledon): Houtkooi mountains (–AA), Bulus 5007 (BOL); 14.8km southeast of Greyton (–AB), Acoks 24423
Figure 30: The known geographical distributions of *R. inaequalis* (star) and *R. acuminata* (dots)

(PRE); Hermanus (–AC), Barker 1628 (NBG, PRE); McGregor, Rivieronderend mountains on road to Skilpadkop (–BA), Campbell & Van Wyk 17 (JRAU); Saloonsdam Nature Reserve (–BC), Matthews 102 (PRE); Bredasdorp, Napier (–BD), Jordaan 510 (NBG); Hagelkraal (–DA), Stirling & Zantovska 11321 (NBG, PRE); Elim (–DB), Bolus s.n. sub NH 13620 (PRE).

—3420 (Bredasdorp): Heuningberg Nature Reserve (–CA), Schutte 537 (JRAU).


14. *Rafenia amplexicaulis* (L.) Thunb. (1800b); Willd.: 949 (1802); Thunb.: 563 (1823); E. Mey.: 11 (1836); Walp.: 462 (1839); Benth.: 464 (1843); Harv.: 32 (1862); Schinz.: 200 (1894). Type: ‘e Cap. b. spei’, LINN 895.5 (LINN, micro-fiche!, lecto., here designated, see note below).

*Crotalaria amplexicaulis* L.: 1003 (1753); 16 (1760); Lam.: 194 (1785).

*Vascoa amplexicaulis* (L.) DC.: 119 (1825); 187 (1826); E. Mey.: 148 (1832); Eckl. & Zeyh.: 162 (1836).

*Crotalaria reniformis* Lam.: 194 (1785); DC.: 118 (1825) [as a synonym of *R. amplexicaulis*]. Type: P?

*Rafenia virgins* E. Mey.: 11 (1836); Walp.: 462 (1839); 578 (1843); Benth.: 464 (1843); Harv.: 32 (1862). Type: Western Cape Province, Dutotolkhof in montibus inter saxa altit. 1500 ped. (III, A, 2), Drège s.n. (P, photo!, lecto., here designated; K!, iso.).

[Note: The protologue of *Crotalaria amplexicaulis* clearly shows that the plant currently known as *Rafenia amplexicaulis* is referred to. Linnaeus referred to the plate in Seba (Loc. pl. Rer. Nat. Thes. 1: t. 24, f. 5 (1734)). This figure clearly depicts *R. acuminata* (E. Mey.) G.J. Campbell & B-E. van Wyk, previously erroneously known as *Rafenia perforata* auct. non (L.) Wild. We thus choose LINN 895.5 as lectotype instead of the Seba plate ("Genista, africana, perforata, flore luteo") because the latter does not clearly reflect the statement of intent in the protologue, ‘foliis ... oppositis reniformibus.’]

Erect, robust, much-branched woody shrub up to 2.5m high, 3m wide. Leaves reniform to cordate, reticulately veined, embracing the stem; leaves on flowering branches opposite, 22–37(–42) × 24–44mm; basal leaves 27–77 × 31–68(–88)mm. Inflorescences single-flowered. Flowers 12–17mm long. Pedicel 4–6mm long. Bracteoles 0.2–0.7mm long. Bracteoles absent. Calyx lobes short, broadly triangular, shorter than or as long as the tube, 2–4mm long; upper lobes falcate, broader than the others; carinal lobe broadly triangular, sometimes slightly longer than the others; tube 3–6mm long. Standard broadly ovate or broadly elliptic, (10–)13–16 × (13–)16–17(–21)mm, often with basal callosities; claw 3–6mm long. Wings oblong-elliptic, 10–13 × 5–8mm, with 6–7 rows of sculpturing; apex obtuse to broadly oblong; claw 4–6mm long. Keel long-rostrate, strongly upcurved towards the apex, 9–11 × 5–7mm; claw 4–6mm long. Pistil with the ovary ± ovate, oblong; style shorter than or ± as long as the ovary, strongly upcurved; ovules 2–4. Pods obliquely lanceolate, 22–27 × 7–10mm; upper margin proximally convex; lower margin straight. Seeds narrowly oblong to reniform, 4–6 × 2–4mm; testa rough.

**Diagnostic characters**

*R. amplexicaulis* (Figure 32f) differs from *R. acuminata* in that the leaves may also be reniform (not only cordate, as in *R. acuminata*) and are often pale green (dark green to glaucous in *R. acuminata*). *R. amplexicaulis* also differs from *R. acuminata* in the shape of the standard petal which is broadly ovate or broadly elliptic in the former and elliptic or suborbicular in the latter. *R. amplexicaulis* differs from the remaining species in the reticulate, cordate to reniform leaves and the pod shape, as well as the absence of bracteoles.

**Distribution and habitat**

*R. amplexicaulis* has a similar distribution to that of *R. acuminata* but is more concentrated in the north. It reaches from Nieuwoudtville in the north to Worcester in the south and includes Elim, near Bredasdorp (Figure 31). This species grows in coastal fynbos, sandveld or renosterveld, on sand flats, foothills, gentle or steep, rocky mountain slopes and is associated with deep or shallow dry sand from Table Mountain Sandstone or granitic soil.

**Flowering time**

*R. amplexicaulis* flowers from September to February. Selected specimens examined
Section 2: Colobotropis E. Mey., Commentarius de plantis africane australios 1(1): 13 (1836); Walp.: 464 (1839); 579 (1843). Type: Pelacythin rhomboidea E. Mey. [now Rafnia capensis (L.) Schinz].

Section Hybotropis E. Mey.: 14 (1836); Walp.: 465 (1839); E. Mey. ex Steud.: 780 (1841); Walp.: 580 (1843). Type: Pelacythin gibba E. Mey. [now R. capensis (L.) Schinz].

Section Caminrotropis E. Mey.: 14 (1836); Walp.: 465 (1839); 580 (1843); Benth.: 469 (1843); Harv.: 31 (1862); Schinz: 198 (1894). Type: Pelacythin retroflexa (Thumb.) E. Mey. [now Rafnia capensis (L.) Schinz].

Section Pelacythin (E. Mey.) Walp.: 464 (1839); Benth.: 467 (1843); Harv.: 31 (1862); Schinz: 198 (1894). Type: Rafnia rhomboidea Walp. [now Rafnia capensis (L.) Schinz].

Diagnostic characters

Section Colobotropis differs from section Rafnia in the lower lobes of the calyx which are fused slightly higher up to form a trilobed lip, with the carinal lobe longer than the other lobes, the incurved edges of the standard petal and the absence of petal sculpturing on the wing petals (all except R. diffusa and sometimes R. spicata), which have a broad longitudinal central pocket. It also differs from section Rafnia in the obtuse to truncate or emarginate keel petals, which have a distinct basal, lateral, usually calloused pocket (spur), the staminodial sheath widening towards the base, the shorter free parts of the stamens (fused higher up than in section Rafnia), the style which is strongly upcurved and shorter than the ovary and the pods which are stipitate except in R. schlechteriana, in which they are sessile.

Common to all taxa of section Colobotropis are the narrowly triangular to ± linear bracts and bracteoles, the latter of which are often minute or absent. The calyx lobes are triangular to narrowly triangular, ± as long as or shorter than the tube and the upper lobes are triangular, symmetrical (non-falcate) and usually broader than the others. The carinal anther is usually similar to the small, dorsifixed anthers, and sometimes even identical in size and shape. The pistil is stipitate, the ovary oblong and the stigma fibrillose and mostly capitulate, or less often simple. The seeds are broadly oblong to cordate-reniform and the seed sinus is mostly deep or less often shallow.

15. Rafnia diffusa Thunn., Genera Nova Plantarum: 149 (1800a); 123 (1800b); Willd.: 952 (1802); Thunb.: 565 (1823); DC.: 119 (1825); Zeyh.: 160 (1836); Walp.: 465 (1839); Benth.: 470 (1843); Harv.: 38 (1882); Schinz: 200 (1894). Type: 'e Cap. b. speci', Thunberg s.n. sub
Pelecythis diffusa (Thunb.) E. Mey.: 15 (1836); Walm.: 580 (1843).

Pelecythis retroflexa sensu E. Mey.: 15 (1836); Walm.: 580 (1843).

Rafnia retroflexa sensu Benth.: 469 (1843).

Prostrate or decumbent, much-branched shrublet up to 0.6m high. Leaves often pinninerved; leaves on flowering branches variable, linear to narrowly lanceolate or elliptic or obovate, subopposite to opposite, 9–24 x 4–15mm, sometimes bright green, remaining so when dry; basal leaves obovate or ovate to round, 13–35 x ± 20mm; coppice leaves broadly obovate or round, 20–47 x 14–50mm. Inflorescences single-flowered. Flowers small, 6–9mm long. Pedicel 1–4mm long. Bract narrowly triangular to linear, 0.3–0.8(–1.2)mm long. Bracteoles subulate to minute, 0.1–0.3mm long. Calyx lobes triangular to narrowly triangular, ± as long as or shorter than the tube, 0.5–2mm long; upper lobes often broader than the others; carinal lobe ± as long as or longer than the others; tube 0.8–2mm long. Standard rounded or rarely ovate, sometimes folded in along the lower half of the edges, 6–9 x 5–10mm, with or without an apical cusp; claw 1–3mm long. Wings oblong to narrowly oblong, ± as long as the keel, 5–8 x 2–3mm, with 4–6 rows of sculpturing invariably present; apex obtuse; claw minute, not broadly attached to the blade, 1–2mm long (form 3: claw 3–4mm long). Keel variable, rostrate or obtuse or truncate (form 3: keel rostrate, with upper margin concave, apex acuminate; form 6: keel ± obtuse, apex acuminate and ± square, 5–7 x 3–4mm); upper margin straight; claw ± 2mm long (form 3: claw 3–5mm long). Stamens usually monadelphous or rarely diadelphous; staminal sheath straight, not widening towards the base. Pistil with the style sometimes incurved towards the apex; ovules 2–4; stigma small, bilobulate. Pods oblong, 9–12 x 3–4mm; stipe 5–10mm long; upper margin ± straight; lower margin proximally convex, incurved towards the stipe. Seeds broadly reniform to narrowly oblong, 2–4 x 1–3mm; sinuses shallow; testa rough.

Diagnostic characters

R. diffusa (Figure 41a) is distinguished from the other species of section Colobotropis by the coppicce leaves which are different in size and shape from the upper leaves, the very small flowers (similar in size to R. spicata and some forms of R. capensis subsp. capensis), the round standard blade and the invariable presence of wing sculpture. It also differs from R. capensis in the softer-textured flowers (the flowers are usually tougher-textured in R. capensis), the keel shape which is usualy obtuse or rarely ± truncate (distinctly truncate in R. capensis), the very small calyx which is usually much shorter than the corolla (calyx larger in R. capensis and not as much shorter than the corolla) and the very variable leaf shape (more variable than in R. capensis).

Distribution and habitat

R. diffusa occurs from Vanrhynsdorp in the north to the Malmsbury district in the south. Only R. angulata subsp. angulata and R. diffusa occur in the Malmsbury area (Figures 18 and 33). R. diffusa occurs in montane fynbos or sandveld and grows on deep, dry sand flats or low or high mountain slopes and is associated with limestone outcrops on loamy soil, soil derived from Table Mountain Sandstone or hard karoo soil.

Flowering time

R. diffusa flowers from August to January.

Regional variation

R. diffusa is rather variable, and six geographical forms are distinguishable. The northern, Wupperthal and Pakuist Pass forms are typical forms and relatively similar, but separated geographically. The Citrusdal form differs from the other forms in the narrower leaves, the usually broader, triangular calyx lobes which are often shorter than the tube (lobes mostly narrower, longer and about as long or slightly shorter than the tube in the other forms), the smaller, distinctly rostrate keel (the keel is obtuse to truncate in the other forms) and the longer wing and keel claws. This form occurs in Citrusdal and in the Clanwilliam area, including Keerom, Grasruggens and Elandskloof. The Piquetberg form has narrower leaves which are elliptic or lanceolate or linear, not ovate or round as in the typical forms. The Malmsbury form differs from the other forms in the often densely leafy appearance and the shape of the keel petal, in which the raised, truncate apex appears square.

Selected specimens examined
—3118 (Vanrhynsdorp): Sandkraal (–DA), Compton 20815 (NBG); Gilberg (–DC), Van Wyk 2881 (JRAU, 1 & 2).
—3119 (Calvinia): Arendskaal farm, near Nieuwoudtville (–AC), Barker 9776 (NBG); Loenburg, 21 miles (33.6km) south of Nieuwoudtville (–AC), Acocks 17080 (PRE).
—3218 (Clanwilliam): Olfantsrivier valley, national road north of Clanwilliam (–BB), Barker 10332 (NBG, 1 & 2); Boekenberg (–BC), Leighton 21600 (BOL); Piquetberg, 8 miles (12.8km) northwest of Aurora turning (–CB), Acocks 19805 (PRE); Piquetberg, eastern foot of mountain near northern end (–DA), Van Wyk 3508 (JRAU, 1 & 2).
—3219 (Wupperthal): Clanwilliam, Pakhuis Pass, below Faith, Hope and Charity Peaks (–AA), Campbell & Van Wyk 124 (BOL, JRAU, K, MO, NBG, PRE); Wupperthal (–AC), Taylor 11145 (NBG, PRE); Citrusdal, 12.3km along road from Citrusdal to The Baths (–CA), Campbell & Van Wyk 140 (NBG); Clanwilliam, Keerom flats (–CC), Esterhuysen 17940 (BOL, PRE).
—3318 (Cape Town): Koperfontein, near Hopefield (–AB), Bachmann 5976 (BOL); Malmesbury, Darling Flora Reserve (–AD), Winkler 168 (NBG, 1 & 2); Malmesbury, opposite Abbotsdale (–BC), Goldblatt 511f (PRE); 45km from Cape
Figure 33: The known geographical distribution of *R. diffusa*

Town to Malmesbury (–DA), Grobbelaar 2869 (PRE); near Vissershok (–DC), Compton 16367 (NBG).
Precise locality unknown: ’e Cap. b. spei’, Thunberg s.n. sub *THUNB-UPS 16432* (UPS) [microfiche only].

16. *Rafinia spicata* Thunb., Genera Nova Plantarum: 147 (1800a); 123 (1800b); Wild.: 951 (1802); Thunb.: 564 (1823); DC.: 119 (1825); E. Mey.: 148 (1832); Eckl. & Zeyh.: 161 (1836); Harv.: 38 (1862). Type: ’e Cap. b. spei’, *Thunberg s.n. sub THUNB-UPS 16441* (UPS, microfiche, lecto., here designated).

Procumbent, mat-like shrublet, much-branched from the base, up to 0.3m high, 1.5m wide. *Leaves* narrowly lanceolate to lanceolate or narrowly obovate to ovate, bright green, often remaining so when dry; leaves on flowering branches subopposite to opposite, (11–)17–26 × 2–6(–10)mm; basal leaves 18–40 × 4–18mm. *Inflorescences* single-flowered, secondarily aggregated towards branch ends into spike-like flowering branches. *Flowers* very small, 6–8mm long. *Pedicel* 2–3mm long. *Bract* linear to narrowly triangular, 0.4–0.6–(0.9)mm long. *Bracteoles* minute to subulate, 0.2–0.3mm long. *Calyx* lobes triangular to narrowly triangular, ± as long as or shorter than the tube, 1–2mm long; upper lobes broader than the others; tube 1–2mm long. *Standard* broadly elliptic to suborbicular, lower half of the edges often folded in, 5–7 × 5–7mm, without an apical cusp; claw 2–3mm long. *Wings* oblong, 5–7 × 2–3mm, sometimes with 2–4 rows of sculpturing; apex obtuse; claw not broadly attached to the blade, 2–3mm long. *Keel* variable; ± acute to almost rostrate or obtuse or sometimes slightly asymetrically truncate or emarginate, 5–6 × 2–3mm; claw 2–3mm long. * Stamens* monadelphous, with sheath straight, not widening towards the base. *Pistil* with the stigma small, filiform; ovules 2. *Pods* narrowly oblong, 10–15 × 3–4mm; stipe 4–6mm long; upper margin straight; lower margin straight, proximally sharply tapering into the stipe. *Seeds* oblong to broadly reniform, almost oblique-cordiform, 2–3 × 1–2mm; sinus shallow; testa rough.

**Diagnostic characters**

*R. spicata* (Figure 41b) is similar to *R. capensis* subsp. *capensis* (particularly the Ceres form, from which it is frequently difficult to distinguish), but differs in the inflorescences which are often secondarily aggregated towards the branch ends into spike-like flowering branches (inflorescences not aggregated in subsp. *capensis*), the smaller, softer-textured flowers and the wing petals which may or may not be sculptured (sculpturing invariably absent in subsp. *capensis*). It also differs from *R. diffusa* in the smaller, procumbent, mat-like habit (diffuse and much-branched in *R. diffusa*).

**Distribution and habitat**

*R. spicata* is limited to the Cedarberg area (Figure 34), where it occurs in dry fynbos on sand dunes, sand flats or mountain slopes and is often associated with soils derived from Table Mountain Sandstone, shale soils or shallow, rocky sand.

**Flowering time**

*R. spicata* flowers from September to January.

Selected specimens examined
—3218 (Clanwilliam): Clanwilliam (–BB), Leipoldt s.n. sub *SAM 31329* (SAM).
—3219 (Wupperthal): Clanwilliam, Heuningvlei (–AA), *Stokoe s.n. sub SAM 55788* (SAM); Cedarberg Forest Reserve, Rondeheuwel, near Drieheoek (–AC), *Emond 203* (NBG); Wolfberg (–AD), *Esterhuyse 22458* (BOL); Middelberg plateau (–CA), *Compton 12729* (NBG); Gideonkloof, northwestern border of Ceres division (–CB), *Oliver 9042* (NBG); Die Posie, Waboomsrivier, Koue Bokkeveld mountains (–CC), *Hanekom 2541* (PRE); Skurweberge, Citrusdal-Ceres road, 18.2km from Donkerbos turn-off at Wydekloof to Ceres (–CD), *Campbell & Van Wyk 127.141* (JRAU, K, NBG, PRE); Swartruggens, 21km along Swartruggs division road to Ceres-Karoo (–DC), *Campbell & Van Wyk 142* (JRAU, K, NBG, PRE).
—3319 (Worcester): Groot Winterhoek, path to Perdevlei (–AA), *Low 1254* (NBG); Skurweberge, near Ceres (–AB), *Bolus 7337* (BOL, PRE, & 2); Baviansberg, Ceres (–BA), *Stokoe s.n. sub SAM 52723* (SAM).
Precise locality unknown: ’e Cap. b. spei’, *Thunberg s.n. sub THUNB-UPS 16441* (UPS) [microfiche only].


Erect, much-branched, virgate suffrutex or shrublet up to 0.6m high. Leaves ovate or round or obovate or broadly elliptic, often pinnerved; apex sometimes acuminate.
base often round; leaves on flowering branches invariably opposite, 31–45 × (12–)16–34mm; basal leaves 46–76 × 29–60mm. Inflorescences single-flowered, secondarily aggregated towards branch ends into large, pyramidal flowering branches. Flowers 11–14(–17)mm long. Pedicel 5–7mm long. Bract linear to narrowly triangular, 1–2mm long. Bracteoles ± 0.5mm long. Calyx lobes triangular to narrowly triangular, ± as long as or shorter than the tube, 3–6mm long; upper lobes broader than the others; tube 3–4mm long. Standard oblong, 8–12 × 8–12mm, with or without an apical cusp; claw 3–5mm long. Wings oblong, 8–11 × 5–6mm; apex obtuse; claw broadly attached to the blade, 4–5mm long. Keel symmetrically truncate, without a broad lobe below apex, 7–10 × 4–6mm; claw 4–5mm long. Stamens monadelphous. Pistil short-stipitate; ovary ± oblong to narrowly ovate; style not incurved towards the apex; ovules 2; stigma small, fibrillose. Pods sessile, broadly obliquely lanceolate, 30–40 × 14–18mm; upper margin slightly asymmetrically convex, broadly winged; wing 4–5mm wide; lower margin straight, proximally convex, very broad. Seeds cordate-reniform or broadly oblong to oblique-cordiform, 4–5 × 4–5mm; sinus shallow; testa rough.

**Diagnostic characters**

*R. schlechteriana* (Figure 41c) is distinguished from the other species of Rafnia by the leaves on the flowering branches which are invariably opposite, the large basal leaves that are distinctly cartilaginous and much larger than the upper leaves and sometimes acuminate, the inflorescences that are secondarily aggregated towards the branch ends into large, pyramidal flowering branches, the symmetrically truncate keel petal (as in *R. capensis* subsp. pedicellata) and the broad, obliquely lanceolate, sessile pod which is broadly winged on the upper suture. *R. schlechteriana* and *R. ovata* are easily confused on herbarium sheets, but the flowers differ markedly.

**Distribution and habitat**

*R. schlechteriana* occurs on the Piquetberg and in the Olifantsrivier mountains, south of the Cedarberg (Figure 35), where it grows in montane fynbos, on foothills or high slopes, in soil derived from Table Mountain Sandstone.

**Flowering time**

*R. schlechteriana* flowers from September to January.

Selected specimens examined


—3219 (Wupperthal): Clanwilliam, Keerom hills at eastern foot of Vier-en-Twintigriviers mountains (−CC), Esterhuysen 17875 (BOL, NBG); Graspugens, Olifantsrivier mountains, Porterville (−CC), van Zyl 3035 (NBG, PRE).

—3319 (Worcester): Ceres division, between Rosendalfontein and Vispat (−AA), Pillans 9861 (BOL, PRE); Skurweberg near Gydo (−AB), Bolus 7569 (BOL); Hantslieberg, Ceres (−AB), Compton 16672 (NBG), Olivier 6042 (NBG); Ceres district, Mitchells Pass (−AD), Schutte & Van Wyk 555 (JRAU), Thorne s.n. sub SAM 51227 (SAM). Doubtful locality: Table Mountain, Schlechter 73 (P) [photograph only].

18. *Rafnia capensis* (L.) Schinz in Bulletin de l'herbier Boissier 2: 199 (1894); Druce: 422 (1914). Type: Western Cape Province, Cape Peninsula, Cape of Good Hope Nature Reserve, c. 0.9km from entrance gate on gravel slope along roadside near resting place, Campbell & Van Wyk 151 (NBG!, typ. cons. prop.; K!, MO!, PRE!, isoneotype).

*Spartium capense* L.: 995 (1753); 14 (1760) ("Spartium")

*Liparia opposita* L.: 269 (1771) nom. illeg. superfl. [Note: Linnaeus illegitimately renamed *S. capense* to *Liparia opposita* in Mant. Pl. Alt. in 1771.]

*Rafnia opposita* (L.) Thunb.: 146 (1800a) nom. illeg.: 123 (1800b) excluding synonyms; Wild.: 950 (1802); Thunb.: 564 (1823); DC.: 119 (1825) excluding synonyms; E. Mey.: 148 (1832); Eckl. & Zeyh.: 161 (1836); Walp.: 465 (1839); Benth.: 467 (1843); Harv.: 36 (1862).

*Pelecyphtholis opposita* (L.) E. Mey.: 14 (1836); Walp.: 579 (1843); Schinz: 200 (1894).

*Crotalaria opposita* sensu L. f.: 322 (1782).

[Note: The original material of *Spartium capense* is the plant currently known as *Rafnia angulata* [LINN 895.22, specimen on right hand side of sheet (LINN)], LlNN 895.23 (LINN), LINN 297.19 (S) and Anon. s.n. sub Herb. Burman (G). We have proposed the conservation of the current use of the name *R. capensis* by also proposing the conservation of a type chosen to fix the current application of the name (Campbell-Young et al. 1999).]

*Cytisus capensis* Berg.: 217 (1767). Type: 'e Cap. b. spei',
Pedicel 2–18 mm long. Bract narrowly triangular to linear, 0.3–3 mm long. Bracteoles subulate or linear to narrowly triangular or minute or absent, 0.1–0.7 mm long. Calyx lobes triangular to narrowly triangular or upper and lateral lobes sometimes slightly falcate, shorter than or \( \pm \) as long as or longer than or much longer than the tube, 1–9 mm long; upper lobes broader than the others; tube 1–4 mm long. Standard oblong or elliptic to broadly elliptic or ovate to broadly ovate, 5–13 \( \times \) 5–12 mm, with or without an apical cusp; claw 1–4 mm long. Wings oblong or obovate or oblong-obovate or oblong-elliptic or suborbicular, shorter than, \( \pm \) as long as or longer than the keel, 4–11 \( \times \) 2–5 mm; apex obtuse to obturate; claw often broadly attached to the blade, 2–6 mm long. Keel obnute or almost rostrate, slightly lobed below the apex or symmetrically truncate without a broad lobe below the apex or asymmetrically truncate to emarginate with a broad lobe below the apex, 5–9 \( \times \) 3–5 mm; claw 2–5 mm long. Stamens usually monadelphous or rarely diadelphous. Pistil with the style incurved or not incurved towards the apex; ovules 2–4; stigma small or capitate, fimbriate. Pods oblong to broadly oblong or \( \pm \) obliquely lanceolate, 12–40 \( \times \) 4–12 mm; stipe 2–16 mm long; upper margin straight or slightly convex; lower margin straight, proximally convex, upcurved towards the stipe. Seeds variable in shape, oblong to cordiform or reniform or suborbicular, 3–5 \( \times \) 2–4 mm; sinus deep; testa rough.

Key to the subspecies of *R. capensis*

1a Inflorescences predominantly single-flowered, or rarely 2–3-flowered:

1b Leaves narrow to broad, but not as above; copicce or lower leaves smaller, not as above; standard petal elliptic or ovate or oblong; inflorescences invariably single-flowered:

3a Leaves often linear; calyx lobes very small, 1–2 mm long; wing claw not broadly attached to the wing blade; style straight, not incurved towards the apex; widely distributed..........................18a. *subsp. carinata*

3b Leaves never linear; calyx lobes usually larger, 3–9 mm long, or less often very small; wing claw broadly attached to the wing blade; style incurved towards the apex; with restricted distributions:

4a Keel petals apparently rostrate, but with a slight lobe below the apex (Figure 9, 25); restricted to the Cedarberg.................................18b. *subsp. carinata*

4b Keel petals asymmetrically truncate to emarginate, with a broad lobe below the apex; not restricted to the Cedarberg:

5a Calyx lobes as long as the corolla or extending beyond the corolla, 7–9 mm long; lateral and lower calyx lobes greatly reflexed at anthesis; pod stipe (10–)13–16 mm long; wing petals shorter than the keel; restricted to the Piquetberg and Olifantsrivier mountains.................................

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*Grubb s.n. sub SBT (! lecto., here designated). [Note: Bergius annotated the only available specimen 'Cytisus mihi capensis' in his own hand.]*

*Rafnia retroflexa* Thunb.: 148 (1800a) nom. nov.; 123 (1800b); Willd.: 951 (1802); Thunb.: 565 (1823); DC.: 119 (1825); Walp.: 465 (1839); Presl: 474 (1845); Harv.: 37 (1862); Schinz: 199 (1894). Type: 'e Cap. b. spei', Thunberg s.n. sub THUNB-UPS 16439 (UPS, microlitch, holo., here designated). [Note: We choose this specimen because it is the only one available in the Thunberg Herbarium.]

*Rafnia pasciflora* Eckl. & Zeyh.: 162 (1836); Walp.: 465 (1839); Benth.: 470 (1843); Presl: 474 (1845). Type: Western Cape Province, in lapidosis (altit. III) laterum monotium vallis 'Tulbagh' prope 'Waterfall' (Worcester), Ecklon & Zeyher 1195 (SAM!, lecto., here designated, specimen on far right hand side of sheet).

*Pelczynska corymbosa* E. Mey.: 14 (1836); Walp.: 579 (1843). Type: Paarlberg, Drège s.n. (B†?). [Note: We have not seen the type specimen but the protologue and locality leave little doubt that this is *R. capensis* subsp. capensis.]

*Rafnia corymbosa* (E. Mey.) Walp.: 464 (1839); Benth.: 468 (1843). Type as above.

Much-branched woody shrub up to 1 m high or an erect or procumbent shrublet up to 0.4 m high or a prostrate, decumbent shrublet up to 0.3 m high. Leaves variable, linear or lanceolate or elliptic to transverse-elliptic, or narrowly to transverse obovate or \( \pm \) angular-obovate or ovate or round, often penninerved; leaves on flowering branches invariably alternate or subopposite to opposite or invariably opposite, 9–42 \( \times \) 1–19 mm; basal leaves 9–60 \( \times \) 1–34 mm. Inflorescences 1–45-flowered. Flowers 7–14 mm long.
5b Calyx lobes shorter than the corolla, 1–6mm long; lateral and lower calyx lobes sometimes slightly reflexed at anthesis; pod stipe 2–4mm long; wing petals as long as or longer than the keel; from the Hottentots Holland mountains to Riviersonderend..............18e. subsp. ovata

1b Inflorescences 2– or more-flowered:

6a Inflorescences 2–9-flowered; leaves on flowering branches subopposite to opposite; pod stipe 2–4mm long; widely distributed..........................18e. subsp. ovata

6b Inflorescences 4–8-flowered or 20–45-flowered; leaves on flowering branches invariably alternate; pod stipe 5–11mm long; with restricted distributions:

7a Pedicels 4–7mm long, shorter than the flowers; prostrate, decumbent shrublet up to 0.3m high; basal leaves small, 9–15 × 3–6mm; restricted to Waalhove Peak and Milner Peak in Worcester.................18f. subsp. elsiæ

7b Pedicels 13–18mm, longer than the flowers; erect or procumbent shrublet up to 0.5m high; basal leaves large, (29–)33–60 × 7–30(–34)mm; from Hangklip to Bredasdorp....................................18g. subsp. pedicellata

18a. Rafnia capensis (L.) Schinz subsp. capensis

Erect, robust shrub up to 1.2m high or a procumbent shrublet up to 0.4m high. Leaves linear to lanceolate or elliptic or narrowly obovate to obovate; leaves on flowering branches subopposite to opposite, (9–)12–34 × 1–10mm; basal leaves 12–48(–53) × 1–12(–22)mm. Inflorescences single-flowered. Flowers often very small, 7–11mm long. Pedicel 2–5mm long. Bract 0.3–0.9mm long. Bracteoles minute, 0.1–0.3mm long, or absent. Calyx lobes triangular to narrowly triangular, as long as the tube, 1–2mm long; tube 1–2mm. Standard elliptic or ovate, 5–9 × 5–9mm. Wings oblong-elliptic to suborbicular, shorter than the keel, 4–8mm long; apex obtuse; claw 2–4mm long, not broadly attached to the blade. Keel obtuse or symmetrically truncate without a broad lobe below apex or asymmetrically truncate or emarginate with a broad lobe below the apex. Pistil with the style not incurved towards the apex; ovules 2–3. Pods ± oblong, 13–19(–22) × 4–7mm; stipe 3–12mm long. Seeds oblong to reniform.

Diagnostic characters

R. capensis subsp. capensis is very similar to subsp. dichotoma and subsp. ovata, with which it merges in numerous geographical forms, but differs from these subspecies in the narrower leaves, which are often linear (elliptic or obovate but never linear in the other two subspecies), the generally smaller bracts and calyx lobes, the wings that are shorter than the keel (wings as long as the keel in subsp. dichotoma and as long as or longer than the keel in subsp. ovata), the wing claws that are not broadly attached to the blade (claws broadly attached to the blade in the other two subspecies), the style that is not incurved towards the apex (style incurved in subsp. dichotoma and slightly incurved in subsp. ovata), and the generally longer pod stipe.

Distribution and habitat

The typical subspecies is widespread from the Caju Peninsula in the southwest to the Oudtshoorn district in the east (Figure 36). It occurs in dry, grassy fynbos or renoste veld and grows on sand flats, foothills and gentle or steep rocky, stony or sandy slopes. R. capensis subsp. capensis associated with deep or shallow Table Mountain Sandstone quartzitic, shale or limestone-derived soils.

Flowering time

R. capensis subsp. capensis flowers throughout the year.

Regional variation

R. capensis subsp. capensis is widespread and variable an has many regional forms. The forms merge into each other with every possible intermediate form. Forms of subsp. capensis also merge with R. spicata and forms of subsp. dichotoma and subsp. ovata so that it is often difficult to distinguish between the species and subspecies. The typical form of subsp. capensis occurs east as far as Oudtshoorn George and the Laingsburg area, as well as the Rooiberg and Swartberg. This form may be a large, densely leafy shrub up to 1m high, with very small, obovate leaves. These plants are distinctly glaucous and become totally black up on drying. The Bredasdorp and broad-leaf Peninsula forms are smaller shrublets, but have larger, lanceolate leaves that may be bright green and remain so when dry, and are very similar to the Hermanus form of subsp. ovata. The Hex River valley form has sparse, often linear leaves, as does the Ceres form which is very similar to R. spicata.

Selected specimens examined

—3318 (Cape Town): Table Mountain (–CD), Andreæa s.n. sub BOL 50562 (BOL); Malmesbury district, Burger’s Post farm near Pella (–DA), Boucher & Shepherd 4908 (NBG, PRE); Paarl district, 6.4km west northwest of Windmill (–DB), Acocks 24518 (PRE); Kraaifontein, Stellenbosch (–DC), Compton 4847 (NBG); Klakmut, Paarl (–DD), Bolus s.n. sub BOL 32549 (BOL).

—3319 (Worcester): Winterhoek mountains near Tulbagh (–AA), Bolus 5010 (BOL); about 3km from top of Gydo Pass to Agter-Witsen (–AB), Grobbelaar 2682 (PRE); Tulbagh, near waterfall (–AC), Ecklon & Zeyher 1195 (SAM); Ceres (–AD), Bolus 8371 (BOL, NBG, 1 & 2, PRE, 1 & 2); Baviaansberg, Ceres (–BA), Compton 12882 (NBG); Sandhills turn-off to De Doorns (–BC), Campbell, Van Wyk & De Castro 131 (JRAU); Bontebok (–BD), Compton 10000 (NBG); Breederivier valley near Darling bridge (–CA), Compton 9007 (NBG); Hex River kloof (–CB), Sidey 1862 (PRE); Louwsheukloof (–CD), Esterhuysen 17650 (BOL, PRE); Hex River Pass (–DA), Compton 22839 (BOL, NBG); Naudeusbarg, Koo, Montagu (–DB), Lewis 5707 (NBG); Viliersdorp, Jonaskop (–DC), Campbell 99 (JRAU).

—3320 (Montagu): Poort north of Pienaarshoek (–AA), Acocks 23706 (PRE); Cabilu, Laingsburg (–AB), Barker 6778 (NBG); Fisantekraal, Laingsburg (–BC), Compton 21106 (NBG); plantation below Tieuurkoppie, Swellendam (–CD), Wurts 547 (NBG); Anysberg (–DA), C.M. van Wyk...
1018 (NBG, PRE).

—3321 (Ladismith): Witteberg, Laingsburg (–AC), Compton 21143 (NBG); Seweweekspoort mountains (–AD), Primos 45 (BOL); Gamkaberg Nature Reserve, Calitzdorp district (–BC), Vlok & Schutte 406 (BOL, JRAU, K, MO, NBG, PRE); Swartberg, northwest of Waboomsberg (–BD), Oliver 5551 (NBG); ridge between Rooiberg and Bailey Peak (–CB), Oliver 5426 (NBG, PRE); Riversdale district, Muiskraal (–CC), Oliver & Fellingham 9142 (NBG); Klein Karoo, Gamkaberg Reserve, road south of Keurkloof (–DB), Alardice 1706 (NBG); Klein Karoo, Langkloof farm against Langeberg (–DC), Bohnen 8370 (PRE); Attaquaskloof, footpath east of Fouriesberg, Paardevallei (–DD), Bond 1637 (NBG, PRE).

—3322 (Oudtshoorn): Swartberg Pass, Prince Albert district (–AC), Campbell, Van Wyk & Schutte-Vlok 153 (JRAU, 1 & 2, NBG, PRE); Kleinmoerasrivier spruit (–CC), Barker 7711 (NBG, 1 & 2); Montagu Pass (–CD), Schlechter 5825 (BOL, PRE); Kamanassie mountains (–DA), Vlok 371 (NBG); Buffelsrivier, west of Kamanassie mountains (–DB), Thompson 1389 (NBG, PRE).

—3418 (Simonstown): Fishhoek mountains (–AB), Barker 3260 (NBG); Cape Peninsula, Cape of Good Hope Nature Reserve, c. 0.9km from entrance gate on gravel slope along roadside near resting place (–AD), Campbell & Van Wyk 151 (K, MO, NBG, PRE); Lourensford Estate, Stellenbosch division (–BB), Barker 3949 (BOL, NBG, PRE).

—3419 (Caledon): Haasvlakte, near Lebanon plantation (–AA), Grobbelaar 1025 (PRE); Appelskraal, Riviersonderend mountains (–BA), Stokoe s.n. sub SAM 61412 (SAM); Paardeberg, Papiersvlie, 8.1 miles (13km) east of Stanford (–BC), Taylor 4295 (PRE); Jan Swartskraal farm, Napier, Bredasdorp mountains (–BD), Bilton 8222 (PRE); Havenga farm near Strandkloof, Bredasdorp (–CB), Martin 354 (NBG); Hagelkraal, between Danger Point and Quoin Point (–DA), Lewis 3588 (SAM); Rietfonteinpoort near Elim (–DB), Schlechter 9695 (BOL).

—3420 (Bredasdorp): De Hoop, Oulande (–AD), Fellingham 812 (NBG); Suurbraak (–BA), Schlechter 5688 (BOL); 1.7 miles (2.7km) west of Hamerkop (–BC), Acoccs 23163 (PRE); Swellendam district, hillside near Cape Infanta, Frans Rietfontein (–BD), Estenhuysen 29361 (BOL).

18b. Rafnia capensis (L.) Schinz subsp. carinata G.J. Campbell & B-E. van Wyk subsp. nov., a subspeciesibus ceteris petalo caurinali paeno rostrato, infra apicem cum lobo exigu (in subspeciesibus ceteris truncato, infra apicem cum lobo magno) differt.


Erect or procumbent, much-branched shrublet up to 0.4m high. Leaves lanceolate or elliptic or obovate to broadly obovate; leaves on flowering branches subopposite to opposite, 14-25(–35) × 6-15mm; basal leaves 15-38 × 6-17(–23)mm. Inflorescences single-flowered. Flowers 9-12mm long. Pedicel 4-7mm long. Bract 0.7-1.4mm long. Bracteoles linear to narrowly triangular, 0.3-0.4mm long. Calyx lobes ± as long as or longer than the tube, 3-5mm long; upper and lateral lobes sometimes slightly falcate; tube 2-3mm long. Standard elliptic or ovate, 8-10(–13) × 7-9(–12)mm, without an apical cusp; claw 2-3mm long. Wings oblong-elliptic, ± as long as or longer than the keel, 7-11mm long; apex obtuse; claw 3-5mm long. Keel almost rostrate with a slight lobe below the apex, 6-8mm long. Stamens monadelphous. Pistil with the style incurved towards the apex; ovules 2. Pods ± oblong, 16-20 × 7-10mm; stipe 7-10mm long; upper margin slightly convex. Seeds unknown.

**Diagnostic characters**

*R. capensis* subsp. *carinata* differs from the other subspecies in the almost rostrate keel petal, which has a slight lobe below the apex (see Figure 9, 25) (truncate to emarginate with a large lobe below the apex in the other subspecies). This subspecies often appears identical to subsp. *dichotoma*, but is distinguished by keel shape.

**Distribution and habitat**

This subspecies is limited to the Cedarberg (Figure 37), and has a distribution similar to that of *R. spicata* (Figure 34). It grows on dry fynbos, sand flats or steep, rocky mountain slopes and is associated with shale, sand from Table Mountain Sandstone and sandy loam and occasionally grows in deep sand.

**Flowering time**

*R. capensis* subsp. *carinata* flowers from August to February.
Specimens examined
—3219 (Wupperthal): Citadelkop, Clanwilliam (—AA), Compton 24283 (NBG, 1 & 2); Cedarberg wilderness area, Groot Koupoo (—AA), Haynes 1325 (NBG, PRE); 90km from Berg-en-dal to Cedarberg (—AA?), Stirton 9182 (PRE); Heuningvlei extension (—AA), Taylor 11257 (NBG, PRE); Cedarberg, near Wupperthal (—AC), Bolus s.n. sub BOL 32561 (BOL); Thode a.1986 (PRE, 1 & 2); Cedarberg Forest Reserve, Hoogverooten (—AC), Kruger KR956 (NBG, PRE); Cedarberg, Rocky Pass between Sneeuwberg hut and Maltese Cross (—AC), Taylor 10516 (PRE); beyond Die Riff, central Cedarberg (—AC), Taylor 11917 (NBG, PRE); Cedarberg, plateau after Uitkyk Pass, road to Algeria (—AC), C.M. van Wyk 2549 (MO, PRE); Cedarberg, between Wupperthal and Eelbank (—AC), Van Wyk 3680 (BOL, K); Algeria Forest Station, Sneeuwberg (—AC), Viviers 124 (PRE); Cedarberg, Elandskloof Pass (—CA), Campbell & Van Wyk 126 (JRAU); Clanwilliam division, Sneeuwberg, Cedarberg (—CA), Esterhuyzen 18035 (BOL); Cedarberg State Forest, Sneeuwberg Peak (—CA), Forsyth 157 (NBG, PRE); Cedarberg, Kromrivier (—CA), Shaw s.n. sub BOL 32561 (BOL); Bokeveld, Sneuukop (—CD), Bean & Viviers 1975 (BOL) between ‘Op-die-Berg’ and Citrusdal (—CD), Van Wyk 2304 (NBG, PRE).

18c. Rafnia capensis (L.) Schinz subsp. calycina G.J. Campbell & B.E. van Wyk subsp. nov., a subspecies ceteris lobis calycis longis, valde reflexis (in subsp. calycina corollam aequantibus; in subspecies ceteris dimidio longitudine corollae, recte) differt.

TYPUS.—Western Cape Province: Piquetberg, 2.1km along New Caledonia Road, 18/10/1995, Campbell & Van Wyk 121 (NBGI, holotypus; BOL, JRAU, K, MOI, NBGI, PRE, isotyp).

Erect or procumbent shrublet up to 0.5m high. Leaves lanceolate or broadly elliptic or obovate or ovate or round; leaves on flowering branches invariably opposite, 14–22 6–15mm; basal leaves 21–29 17–25mm. Inflorescences single-flowered. Flowers 10–13mm long. Pedicel 3–7mm long. Bract 1–2mm long. Bracteoles linear to narrowly triangular, ± 0.7mm long. Calyx long; lobes triangular to narrowly triangular, much longer than the tube, 7–9mm long; lateral and lower lobes greatly reflexed at anthesis, tube 3–4mm long. Standard oblong, 9–11 7–10mm; claw 3–4mm long. Wings oblong, shorter than the keel, 6–7mm long; claw 4–5mm long. Keel asymmetrically truncate to emarginate with a broad lobe below the apex, 7–8mm long; claw ± 4mm long. Stamens monadelphous. Pistil with the style incurved towards the apex. Pods oblong, 12–17 4–7mm; stipe (10–)13–16mm long; upper margin slightly convex. Seeds oblong-reniform.

Diagnostic characters

R. capensis subsp. calycina differs from the other subspecies in the long, strongly reflexed calyx lobes (lobes as long as the corolla in subsp. calycina and up to half as long as the corolla and less reflexed in the other subspecies).

Distribution and habitat

This subspecies occurs on the Piquetberg and Olifantsrivier mountains (Figure 37). It occurs in montane fynbos or disturbed places on gentle or steep, stony slopes and is associated with soils derived from Table Mountain Sandstone and deep sand.

Flowering time

R. capensis subsp. calycina flowers from August to February.

Specimens examined
—3218 (Clanwilliam): Boekenberg (—BC), Leighton s.n. sub BOL 32557 (BOL); Olifantsrivier mountains, adjacent Swartboskraal, south of Bo-Swartberg (—BD), Bean & Viviers 1500 (BOL); between Kransevlei and Eelbankstein (—BD), Bolus s.n. sub BOL 23041 (BOL); Eelskloof (—BD), Rabanowitz s.n. sub SAM 68749 (PRE), Stokoe s.n. sub SAM 68749 (SAM); Piquetberg division, plateau between Avontuurberg and Zebrakop (—DB), Pillans 7508 (BOL, NBG); Piquetberg (—DC?), Bolus 8429 (BOL, PRE, 1 & 2), Compton 22963, 1 & 2, 22968 (NBG), Maguire 1178 (NBG, 1 & 2), Martin 782, 1 & 2, 857 (NBG); Piquetberg, 2.1km along New Caledonia road (—DC), Campbell & Van Wyk 38, 1 & 2 (JRAU), 121 (BOL, JRAU, K, MOI, NBG, PRE); Piquetberg district, Levant Hill (—DC), Esterhuyzen 35798 (BOL, PRE); Piquetberg, dam east of Levant Peak (—DC), Goldblatt 6515 (PRE); Piquetberg district, turn-off to New Caledonia (—DC), Van Wyk 3225 (JRAU).

18d. Rafnia capensis (L.) Schinz subsp. dichotoma (Eckl. & Zeyh.) G.J. Campbell & B.E. van Wyk stat. nov. Type: Western Cape Province, in montibus prope ‘Gnadenthal’ (Caledon), Ecklon & Zeyher 1190 (SAM), lecto., here designated.

Rafnia dichotoma Eckl. & Zeyh., Enumeratio Plantarum
Africæ Australis Extratropicæ 2: 161 (Jan., 1836); Walp.: 465 (1839); Benth.: 469 (1843); Presl: 474 (1845); Harv.: 37 (1862); Schinz: 199 (1894).

*Pelarctis dichotoma* E. Mey.: 14 (Feb., 1836); Walp.: 580 (1843). Type: Western Cape Province, Drakenstein in montosis (III, A, e), Drège s.n., not seen.

*Pelarctis gibba* E. Mey.: 14 (1836); Walp.: 580 (1843). Type: Western Cape Province, Cedarbergen, (III, A, d) Drège s.n. (Pl).

*Rafnia gibba* (E. Mey.) Druce: 643 (1917).

Erect, much-branched shrub up to 1 m high or a prostrate, decumbent shrublet up to 0.2 m high, 0.5 m wide. Leaves broadly elliptic to transverse-elliptic or obovate to transverse-obovoid or round; leaves on flowering branches invariably opposite, 14–23 ° 11–19 mm; basal leaves 16–25 ° 10–18–(23) mm; cippe leaves broadly ovate or round or oblate, 29–40 ° 25–42 mm. *Inflorances* single or rarely 2–3-flowered. *Flowers* 8–11 mm long. *Pedicel* 2–5 mm long. *Bract* 0.5–0.8 mm long. *Bracteoles* linear to narrowly triangular, 0.3–0.4 mm long. *Calyx* lobes usually triangular or sometimes short and broadly triangular, 2–4 mm long. *Standard* broadly elliptic or broadly ovate, 6–10 mm long; claw 2–3 mm long. *Wings* obovate or oblong-elliptic to suborbicular, 6–8 ° 3–4 mm; claw 3–5 mm long. *Keel* symmetrically truncate without a broad lobe below the apex or asymmetrical truncate to emarginate with a broad lobe below apex, 6–8 mm long. *Stamens* monadelphous. *Pistil* with the style incurved towards the apex; ovules 2. *Pods* broadly oblong, 14–23 ° 6–10 mm; stipe 4–10 mm long; upper margin slightly convex. *Seeds* cordate-reniform or suborbicular, ± 4 mm wide.

**Diagnostic characters**

*R. capensis* subsp. *dichotoma* (Figure 41d) differs from the typical subspecies in the invariably opposite leaves on the flowering branches (leaves subopposite to opposite in subsp. *capensis*), the very large cippe leaves which differ from the basal and upper leaves (cippe leaves not as distinctly different from the other leaves in subsp. *capensis*), the longer bracteoles and calyx lobes, the wing claw which is broadly attached to the wing blade (not broadly attached in subsp. *capensis*), the incurved style (not incurved in subsp. *capensis*) and the cordate-reniform or suborbicular seeds (the seeds are olong to reniform in subsp. *capensis*).

**Distribution and habitat**

This subspecies is fairly widespread, and seems to have a distribution (Figure 38) that overlaps with both subsp. *capensis* (Figure 36) and subsp. *ovata* (Figure 39). *R. capensis* subsp. *dichotoma* reaches from the Cedarberg in the north, southwards to Caledon and eastwards to Ladismith. It grows in grassy fynbos, on foothills or high mountain slopes or sand flats and on gentle or steep dry, rocky stony Table Mountain Sandstone slopes.

**Flowering time**

*R. capensis* subsp. *dichotoma* flowers from June to January.

**Regional variation**

*R. capensis* subsp. *dichotoma* has been divided into five regional forms. The northern form occurs in the Olifantsrivier valley and near Ceres and has long, narrow calyx lobes. The forms occurring in Caledon, Jonaskop, Genadendal, Montagu and Riversdale are more or less typical forms, with slight variations according to locality. An atypical form occurs on Prospect Peak near Worcester. It is a prostrate, diffuse shrublet with very small, cordate leaves (similar to those of *R. acumina*) but flowers typical of subsp. *dichotoma*.

Selected specimens examined

—3219 (Wupperthal): Cedarberg, Heuningvlei (–AA), *Pocock* 584 (NBG, PRE); 2 miles (3.2 km) east of Citrusdal (–CA), Hanekom 1251 (NBG, PRE); Porterville, Piquetberg division (–CC), Edwards 254 (PRE).

—3319 (Worcester): Ceres division, Olifantsrivier mountains, ridge south of Groen (–AA), Estersuyhen 13467 (BOL); Matroosberg (–BC), Bolus 3967 (NBG); Franschoek Pass, Paarl (–AA), Van Wyk 2999 (JRAU, 1 & 2); Kroonland Peak, outside High Noon property, Villiersdorp (–CD), Hugo 2454 (NBG); Dassieshoek Peak, Langeberge, near Robertson (–DB), Estersuyhen 29061, 29129 (BOL); Rivieronderend mountains, Villiersdorp, Jonaskop (–DC), Campbell & Van Wyk 160 (BOL, 1 & 2, JRAU, 1 & 2, K, 1 & 2, NBG, PRE, 1 & 2).

—3320 (Montagu): Keurkloof (–BC), Compton 5817 (BOL); Langeberg near Goedelfoof hut, Swellendam State Forest (–CD), McDonald 1449 (NBG, PRE); Tradouw's Pass (–DC), Adamson s.n. sub SAM 38999 (SAM), Levyns & Levyns 635, 636 (BOL, NBG); Barrydale mountains (–DD), Barnard s.n. sub SAM 28982 (SAM).

—3321 (Ladismith): Garcia's Pass, Riversdale division (–CC), Estersuyhen 28791 (BOL).

—3419 (Caledon): Swartberg (–AB), Zeyher s.n. sub SAM 15221 (SAM); Genadendal (–BA), Bolus 372 (BOL, PRE, 1 & 2, SAM); Dasberg near Stormsvlei, Rivieronderend mountains (–BB), Stokoe s.n. sub SAM 62240 (PRE, SAM). Precise locality unknown: In montibus prope 'Gnadenthal' (Caledon), Ecklon & Zeyher 1790 (SAM).


*Sparrtium ovatum* Berg., Descriptions plantarum ex Capitae bonae Spei: 197 (1767).

*Rafnia ovata* (Berg.) Schinz: 199 (1894).

*Crotalaria cuneiformis* Lam.: 195 (1785). Type: *D. Sonnerat* (P?).

*Rafnia cuneifolia* Thunb.: 145 (1800a); 123 (1800b); Wild.: 950 (1802); Thunb.: 563 (1823); DC.: 118 (1825); E. Mey.: 147 (1832); Eckl. & Zeyh.: 161 (1836); E. Mey.: 12
(1836); Walp.: 463 (1839); 579 (1843); Benth.: 468 (1843);
Presl: 474 (1845); Harv.: 37 (1862). Type: 'e Cap. b. spei',
Thunberg s.n. sub THUNB-UPS 16431 (UPS, microfich, lecto., here designated, specimen on right hand side of
sheet).

*Rafnia cuneifolia* var. *ovobata* Harv.: 37 (1862), nom.
superfl. Type as for *R. cuneifolia*.

*Rafnia cuneifolia* var. *lanceolata* Harv.: 37 (1862). Type as
for *Pelecythis corymbosa* E. Mey.

*Pelecythis rhomboidea* E. Mey., 14 (1836); Walp.: 579
(1843). Type: Western Cape Province, Piquetberg in apricis,
altit. 2800 ped. (III, A, d) Drège s.n. sub Herb. Bent. (K!);
sub Herb. Hook. (K!).

*Rafnia rhomboidea* (E. Mey.) Walp.: 464 (1839); Benth.:
499 (1843).

*Rafnia cuneifolia* var. *rhomboidea* (E. Mey.) Harv.: 37
(1862).

Much-branched woody shrub up to 1m high or a procumbent
shrublet, up to 0.4m high. Leaves lanceolate or broadly ellip-
tic or obovate to broadly obovate or transverse-obovate or
ovate or round; leaves on flowering branches subopposite to
opposite, 15–39 × (4–)8–17mm; basal leaves 21–48 ×
(7–)13–26mm. Inflorescences single- or more often 2–9-
flowered. Flowers 9–12mm long. Pedicel 3–7mm long.
Bracteoles narrowly triangular or minute. Calyx lobes trian-
gular to narrowly triangular, ± as long as or longer than the
tube, 1–6mm long; tube 1–2mm long. Standard oblong,
6–10mm long, with an apical cusp. Wings oblong-ovate, ±
as long as or longer than the keel, 6–10mm long: apex
obtuse. Keel asymmetrically truncate to emarginate with a
broad lobe below the apex. Pistil with style slightly incurred
towards the apex; ovules 2–3. Pods broadly oblong to ±

obliquely lanceolate, 12–29 × 5–9mm; sipe 2–4mm lon
Seeds oblong to oblong-cordiform or reniform to broad
reniform or cordate-reniform.

**Diagnostic characters**

*R. capensis* subsp. *ovata* differs from the typical subspecie
in the broader, more variable leaves, the 2–9-flowered
racemes (rarely single-flowered in subsp. *ovata* and invar-
ably single-flowered in subsp. *capensis*), the generally lar-
ger bracts and bracteoles, the oblong standard petal (th
standard is elliptic or ovate in subsp. *capensis*), the wing
which are as long as or longer than the keel (shorter than the
keel in subsp. *capensis*), the invariably asymmetrical trur
cate keel petals (the keel may be obtuse, symmetrically trur
cate or asymmetrically truncate in subsp. *capensis*) and the
shorter pod stipe.

**Distribution and habitat**

*R. capensis* subsp. *ovata* is widespread in the western
Cape, from Nieuwoudtvlei in the north, through the
Cedarberg to the Hermanus region in the south (Figure 39).
The distributions of subsp. *ovata* and subsp. *capensis*:
(Figure 36) coincide south of the Cedarberg. *R. capensis*
subsp. *ovata* grows in montane fynbos, disturbed areas of
dry sand flats and occupies gentle or steep, rocky stony
slopes in shallow Table Mountain Sandstone, granitic, clay
or shaly soils.

**Flowering time**

*R. capensis* subsp. *ovata* flowers from August to April.

**Regional variation**

*R. capensis* subsp. *ovata* is similarly variable to subsp.
*capensis* and subsp. *dichotoma* and various regional forms
are distinguished. In the northern part of the distribution
range, subsp. *ovata* is a much-branched woody shrub,
reaching a height of 1m, with relatively small obovate
leaves. The typical form, occurring in areas such as
Worcester, Franschhoek, Paarl and Stellenbosch, is a smaller,
herbaceous shrublet with large basal leaves and occa-
sional single-flowered inflorescences. The Hermanus form
is similar to the broad-leaved Peninsula form of subsp. *capen-
sis* in leaf shape and the single-flowered inflorescences.

Selected specimens examined
—3119 (Calvinia): Arendskraal farm, near Nieuwoudtvlei
(–AC), Barker 9776 (NBG).
—3218 (Clanwilliam): Gryskop, Piquetberg (–DA), Sriton
10051 (PRE); Piquetberg, Versveld Pass (–DC), Campbell & Van Wyk 37 (JRAU, NBG, PRE).
—3219 (Wupperthal): Near top of Pakhuis Pass, below Faith,
Hope and Charity Peaks (–AA), Campbell & Van Wyk 42
(JRAU); near Algeria Forest Station, Cedarberg (–AC),
Compton 6210 (NBG); Ceres, between Olifantsrivier and Kromrivier, (–CA), Andreae 201 (NBG); Porterville, about half
way up Dasklip Pass to Zuurvlakte, Groot Winterhoek State

Forest (−CC), Campbell & Van Wyk 32, 1 & 2, 110 (JRAU).
—3318 (Cape Town): Piquetberg division, Porterville (−BB), Loubser 803 (BOL); Paarlberg (−DB), Bolus 2752 (BOL);
Jonkershoek State Forest, Langrivier catchment, Stellenbosch (−DD), Haynes 1118 (NBG, PRE, 1 & 2).
—3319 (Worcester): Tulbagh Kloof (−AA), Guthrie 2115 (NBG); Elandskloof, north of Wellington (−AC), Bond 623
(NBG); Ceres, Mitchell’s Pass (−AD), Bolus s.n. sub BOL 43014 (BOL); Du Toitskloof valley, entrance to Tiekloof
(−CA), Boucher 5339 (NBG); Worcester (−CB), Fine G166
(PRE); Paarl, top of Franschhoek Pass (−CC), Phillips 1102
(SAM, 1 & 2); Caledon district, above High Noon, Kaaimansgat, Villiersdorp mountains (−CD), Esterhuysen
33367 (BOL).
—3418 (Simonstown): Hottentotsholland mountains, near Palmietrivier (−BB), Bolus 4133 (BOL); Palmietrivier,
Caledon (−BD), Compton 14094 (NBG).
—3419 (Caledon): Houwhoek (−AA), Schlechter 119, 9399
(PRE); Hemel-en-Aarde (−AC), Barker 7620 (NBG); Greyton
Nature Reserve, Riviersonderend mountains (−BA), Goldblatt 8669 (PRE).
Precise locality unknown: ‘e Cap. b. spei’, Grubb s.n. (SBT)
[photograph only].

18f. Rafnia capensis (L.) Schinz subsp. ellsiae G.J. Campbell & B-E. van Wyk subsp. nov., a subspeciebus
ceteris habitu minori prostrato differt. Etiam a subsp. capensis
foliis in ramis floriferis semper alternis (in subsp. capensis
suboppositis vel oppositis), foliis semper obovatis (in subsp.
capensis forma variis), et racemis 4–8-floribus (in subsp.
capensis unifloribus) differt.

| TYPUS.—Western Cape Province: Worcester, Waaiboek
| Peak, 15/1/1961, Esterhuysen 28730 (BOL, holotypus;
| BOL, NBG, PRE, isotypi). Prostrate, decumbent shrublet, much-branched from
| base, up to 0.3m high. Leaves narrowly obovate to obovate to
| ± angular-obovate; leaves on flowering branches invariably
| alternate, 12–17 (−20) × 4–8 mm; basal leaves 9–15 × 3–6 mm.
| Inflorescences 4–8-flowered. Flowers 9–12 mm
| long. Pedicel 4–7 mm long. Bracteoles subulate, 0.5–0.7 mm
| long. Calyx lobes triangular to narrowly
| triangular, longer than the tube, 4–6 mm long; tube 2–3 mm
| long. Standard elliptic or ovate, 8–9 × 8–9 mm, with an apical
| cusp; claw ± 3 mm long. Wings oblong, shorter than keel,
| 7–8 × 3–4 mm; apex obtuse; claw ± 3 mm long. Keel asymmecrically
| trunctate to emarginate with a broad lobe below the
| apex, 7–8 mm long; upper margin basally convex; claw
| 2–3 mm long. Stamens monadelphous. Pistil with the style
| not incurved towards the apex; ovules 4. Pods oblong,
| 17–18 × ± 7 mm; stipe 5–6 mm long; upper margin slightly
| convex. Seeds unknown.

**Diagnostic characters**

*R. capensis* subsp. *ellsiae* differs from the other subspecies in the smaller, prostrate habit, and it differs from the typical
subspecies in the invariably alternate leaf arrangement on
the flowering branches (subopposite to opposite in subsp.
capensis), the basal leaves which are smaller than the upper
leaves (the basal leaves are larger than the upper leaves in
subsp. capensis), the uniformly obovate leaves (leaves variable
in subsp. capensis), the 4–8-flowered racemes (single
flowered in subsp. capensis) and the longer calyx lobes
which are longer than the tube (about as long as the tube in
subsp. capensis).

**Distribution and habitat**

*R. capensis* subsp. *ellsiae* is known only from two localities,
i.e. Waaiboek Peak and Milner Peak in the Worcester area
(Figure 40). This subspecies occurs in montane fynbos,
especially in recently burnt veld, and is associated with
shale bands and rocky slopes.

**Flowering time**

*R. capensis* subsp. *ellsiae* flowers from November to January.

Specimens examined
—3319 (Worcester): Waaiboek Peak (−AD), Esterhuysen
8308 (BOL, NBG, PRE), 9927 (PRE), 28730 (BOL, 1 & 2,
NBG, PRE); Milner Peak (−AD), Esterhuysen 14858 (BOL,
PRE); Fonteintjesberg (−CB), Forsyth 312 (PRE).

18g. Rafnia capensis (L.) Schinz subsp. pedicellata G.J. Campbell & B-E. van Wyk subsp. nov., a subspeciebus
ceteris racemis 20–45-floribus (in ceteris usque 9-floribus),
et pedicellis longis (in subsp. pedicellata longioribus quam
foliosus; in ceteris infra dimidio minoribus quam floribus),
differt.

| TYPUS.—Western Cape Province: Fernkloof Nature
| Erect or procumbent shrublet, not much-branched, up to

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**Figure 39:** The known geographical distribution of *R. capensis*
subsp. *ovata*
0.5m high. Leaves broadly elliptic or obovate to broadly obovate or obovate-lanceolate or ovate or round; leaves on flowering branches invariably alternate, 31–42 x 12–18mm; basal leaves (29–)33–60 x 7–30–(34)mm. Inflorescences multi-flowered, 20–45 flowers, aggregated into umbel-like racemes. Flowers 11–14mm long. Pedicel long, 13–18mm long. Bract 1.5–3mm long. Bracteoles subulate to narrowly triangular. Calyx lobes triangular to narrowly triangular, ± as long as or longer than the tube, 3–6mm long; tube 2–3mm long. Standard oblong, 9–11 x 8–11mm, without an apical cusp; claw ± 3mm long. Wings oblong, ± as long as or longer than the keel, 9–11 x 4–5mm; apex obtuse; claw 3–5mm long. Keel symmetrically truncate without a broad lobe below the apex, 8–9mm long; claw 3–4mm long. Stamens monadelphous. Pistil with the style ± as long as or shorter than the ovary, sometimes slightly incurved towards the apex; ovules 2–3. Pods obliquely lanceolate, (26–)31–40 x 9–12mm; stipe 6–11mm long; upper margin straight. Seeds unknown.

Diagnostic characters

R. capensis subsp. pedicellata (Figure 41e) differs from other subspecies in the 20–45-flowered racemes (usually single-flowered or up to 9-flowered in other subspecies) and the long pedicels, which are longer than the flowers in subsp. pedicellata and less than half as long as the flowers in the other subspecies. It also differs from the typical subspecies in the invariably alternate leaves on the flowering branches (leaves subopposite to opposite in subsp. capensis), the larger leaves and flowers, the longer calyx lobes, the oblong standard petal (elliptic or ovate in subsp. capensis), the wings, which are about as long or longer than the keel (shorter than the keel in subsp. capensis), the invariably symmetrically truncate keel (keel obtuse or symmetrically or asymmetrically truncate in subsp. capensis) and the larger, obliquely lanceolate pods (pods oblong in subsp. capensis).

Distribution and habitat

This subspecies is restricted to the Palmietrivier and Bredasdorp regions (Figure 40), where it occurs in montane or coastal fynbos, at river mouths, near the beach and in disturbed areas, on gentle or steep, dry rocky, stony slopes. It is frequently associated with soil derived from Table Mountain Sandstone.

Flowering time

R. capensis subsp. pedicellata flowers from September to February.

Specimens examined

—3419 (Simonstown): Groot Hangklip (–BD), Boucher 520 (NBG, PRE); Caledon division, Palmietrivier mouth (–BD), Compton 6087 (NBG), Gray s.n. sub BOL 26050 (BOL), Stokoe s.n. sub SAM 61407 (PRE, SAM); Davidskraal, between Palmietrivier and Hangklip, Caledon (–BD), Compton 6095 (NBG); Rooiels, Caledon (–BD), Esterhuysen 14119 (BOL), Levyns 10369 (BOL);

—3420 (Bredasdorp): Bredasdorp (–CA), Van Breda 1464 (PRE).

Figure 40: The known geographical distributions of R. capensis subsp. elsiae (squares), R. capensis subsp. pedicellata (dots) and R. globosa (triangles).

Palmietrivier (–BD), Gillett 4248 (PRE), Martin 783 (NBG); 5 km from Rooiels to Kleinmond (–BD), Grobelaar 2766 (PRE), Betty’s Bay, Caledon (–BD), Jordan 1242 (NBG), Levyns 10207 (BOL), Van Rensburg 2154 (NBG, PRE), Vogts 7 (PRE), Walters 287, 1135 (NBG); between Rooiels and Pringle Bay, Caledon (–BD), Parker 4812 (BOL, NBG, PRE); Caledon division, mountains near Rooiels and Hangklip (–BD), Stokoe s.n. sub SAM 52461 (SAM); Caledon division, Palmietrivier valley, Plateberg (–BD), Stokoe s.n. sub SAM 65715 (SAM); between Betty’s Bay and Palmietrivier (–BD), Van Wyk 3135 (BOL); Kleinmond, Kogelberg State Forest, about 1km northeast of Oudebosch house (–BD), Vlok, Van Wyk & Schutte 45 (K, PRE).

19. Rafnia globosa G.J. Campbell & B.E. van Wyk sp. nov., a R. capensis/inflorescentii in ramis (capitulis) globosis,
foliosis, agglomerations secondarias formantibus (in *R. capensis* haud aggregatis), lobis calycis valde reflexis (in *R. capensis* minus reflexis), et petalo fere rostrato infra apicem cum lobo parvo (in *R. capensis* plerumque truncato vel emarginato), differt.

TYPUS.—Western Cape Province: Central Cedarberg, Algeria Forest Reserve, 0.8km from Algeria campsite along Nieuwoudt's Pass, before sign 'Groothoek', 19/10/1995, *Campbell & Van Wyk* 125 (NBGI, holotypus; BOL, JRAUI, K, MOI, NBGI, PRE!, UPSI, isotypi).

Erect suffrutex, not much-branched, up to 0.6m high. Leaves round, obovate, elliptic, broadly obovate, often pinnennerved; leaves on flowering branches invariably opposite, 20–33 × 9–15(–18)mm; basal leaves 25–44 × 14–26mm. Inflorescences single-flowered, secondarily aggregated towards branch ends into globose flowering branches (heads). Flowers 10–14mm long. Pedicel 2–5mm long. Bract narrowly triangular to linear, 1–2mm long. Bracteoles 0.3–0.4mm long. Calyx lobes triangular to narrowly triangular, as long as or shorter than the tube, 3–5mm long; upper lobes ± as broad as the lateral lobes; lobes often curl backwards over the tube in old flowers; upper sinus rarely deeper than the others; tube 3–4mm long. Standard broadly ovate, slightly folded in along the lower edges, 9–11(–14) × 10–13mm; without an apical cusp; claw 2–3mm long. Wings oblong, 7–10 × 4–5mm; apex obtuse; claw not broadly attached to the blade, 4–5mm long. Keel almost rostrate, slightly lobed below the apex, 7–8 × 3–4mm; claw ± 4mm long. Stamens monadelphous. Pistil with the style slightly incurved towards the apex, shorter than or ± as long as the ovary; ovules 2; stigma small, fibrolose. Pods ± oblong, 14–16 × 5–8mm; stipe 4–5(–8)mm long; upper margin convex; lower margin straight, proximally convex, sharply upcurved into the stipe. Seeds corolate-reniform or broadly oblong to suborbicular or sometimes oblique-cordiform, 3–5 × 3–5mm; sinus deep; testa rough.

**Diagnostic characters**

*R. globosa* (Figure 41f) is distinguished from the other species of *Rafnia* by the inflorescences which are secondarily aggregated towards the branch ends into globose, leafy flowering branches (heads). It also differs from *R. capensis* in the extremely strongly reflexed calyx lobes (less reflexed or not reflexed in *R. capensis*), and the almost rostrate keel petal, which has a slight lobe below the apex (usually truncate to emarginate in *R. capensis*).

**Distribution and habitat**

*R. globosa* is known only from two localities, i.e. Algeria in the Cedarberg and Clanwilliam (Figure 40) and is associated with montane fynbos and soils derived from Table Mountain Sandstone.

**Flowering time**

*R. globosa* flowers from September to December.

Specimens examined

— *3218* (Clanwilliam): Between Witselskloof and Lambertshoekberg (~BD), Pillans 9081 (BOL).

— *3219* (Wupperthal): Nieuwoudt's Pass (~AC), Andrag 143 (NBG), Compton 4779 (NBGI); Central Cedarberg, Algeria Forest Reserve, 0.8km from Algeria campsite along Nieuwoudt's Pass, before sign 'Groothoek' (~AC), *Campbell & Van Wyk* 125 (BOL, JRAUI, K, MOI, NBGI, PRE!, UPSI, isotypi).

Erect suffrutex, not much-branched, up to 0.6m high. Leaves round, obovate, elliptic, broadly obovate, often pinnennerved; leaves on flowering branches invariably opposite, 20–33 × 9–15(–18)mm; basal leaves 25–44 × 14–26mm. Inflorescences single-flowered, secondarily aggregated towards branch ends into globose flowering branches (heads). Flowers 10–14mm long. Pedicel 2–5mm long. Bract narrowly triangular to linear, 1–2mm long. Bracteoles 0.3–0.4mm long. Calyx lobes triangular to narrowly triangular, as long as or shorter than the tube, 3–5mm long; upper lobes ± as broad as the lateral lobes; lobes often curl backwards over the tube in old flowers; upper sinus rarely deeper than the others; tube 3–4mm long. Standard broadly ovate, slightly folded in along the lower edges, 9–11(–14) × 10–13mm; without an apical cusp; claw 2–3mm long. Wings oblong, 7–10 × 4–5mm; apex obtuse; claw not broadly attached to the blade, 4–5mm long. Keel almost rostrate, slightly lobed below the apex, 7–8 × 3–4mm; claw ± 4mm long. Stamens monadelphous. Pistil with the style slightly incurved towards the apex, shorter than or ± as long as the ovary; ovules 2; stigma small, fibrolose. Pods ± oblong, 14–16 × 5–8mm; stipe 4–5(–8)mm long; upper margin convex; lower margin straight, proximally convex, sharply upcurved into the stipe. Seeds corolate-reniform or broadly oblong to suborbicular or sometimes oblique-cordiform, 3–5 × 3–5mm; sinus deep; testa rough.

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