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Notes on the fruits of *Lechenaultia* (Goodeniaceae), with a new species from northern Australia

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Abstract

Morrison, David A. (John Ray Herbarium, Macleay Building (A12), University of Sydney, Sydney, Australia 2006) 1988. Notes on the fruits of* Lechenaultia *(Goodeniaceae), with a new species from northern Australia. Telopea 3(2): 159–166.* — Characteristics of the fruits and seeds of the 25 species of *Lechenaultia* are described and 22 of them are illustrated. *Lechenaultia ovata*, a rare species from the Northern Territory closely allied to *L. filiformis*, is also described.

Introduction

Since the completion of my recent revision of *Lechenaultia* R. Br. (Goodeniaceae) (see Morrison 1987), a new species from the Northern Territory has been brought to my attention by L.A. Craven of the Australian National Herbarium. This species has a distinctive surface sculpturing on the fruits, and this has prompted me to provide detailed notes on the fruits of the other *Lechenaultia* species. Herbarium specimens of *Lechenaultia* very rarely possess fruits, and consequently knowledge of fruit shape and structure has been very limited. In particular, Carolin (1966) discusses the fruits of only five species when reviewing the Goodeniaceae, although he does note that the shape of the fruits is frequently a good characteristic for distinguishing species. Mueller (1867) and Gardner & George (1963) depict fruits of two of the species.

Fruits

The fruit of *Lechenaultia* is usually described as a capsule containing a double row of small hard seeds, but it is actually somewhat more complex than this, and it is not homologous with a true capsule. It has been described in detail for *L. biloba* by Carolin (1966), and the notes presented here are an extension of this earlier work to cover the rest of the genus. Some of the fruit characteristics that vary between species are listed in Table 1, and the fruits of 22 of the 25 species in the genus are shown in Fig. 1. Gardner & George (1963) depict the fruit of *L. subcymosa*, which is not included in Fig. 1 due to a lack of material; and material was also not available for *L. chlorantha* or *L. pulvinaris*.

During development of the fruit, the outer walls of the loculi grow inwards and partially fuse with smaller outgrowths from the axile placenta. This results in the seeds being entirely surrounded by tissue derived from the loculus wall. The tissue between each seed then separates horizontally, thus forming an 'article' (after Carolin 1966) containing the seed. These articles then separate from each other, and are the final dispersal unit. It is these articles, with their

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Table 1. Some characteristics of the fruits of *Lechenaultia*

Species	Pseudocapsules				Articles		
	Length (mm)	Woody	Opening at maturity	Beak	No. rows	No. pairs per pseudo-capsule	Length (mm)
L. acutiloba	12–16	not	yes	absent	2	5–7	2
L. biloba	23–35	not	yes	absent	2	8–15	2.5
L. brevifolia	22–29	not	yes	absent	2	15–21	1
L. chlorantha	18–23	not	yes	absent	2	8–10	2
L. divaricata	9–32	woody	later	present	1	1–4	3–5
L. expansa	5–10	not	yes	absent	2	2-5	1.5
L. filiformis	25–50	not	yes	present	2	8–14	1–2
L. floribunda	11–18	not	yes	absent	2	7–15	1
L. formosa	10–29	not	yes	absent	2	10–22	1
L. heteromera	20–28	not	yes	absent	2	6–8	2
L. hirsuta	35–42	not	yes	absent	2	7–9	2.5
L. juncea	15–25	not	yes	absent	2	6–8	1
L. laricina	17–29	not	yes	absent	2	10–20	1
L. linarioides	19–33	woody	yes	absent	2	7–11	2.5
L. longiloba	20–26	not	yes	absent	2	13–16	2
L. lutescens	15–25	not	yes	absent	2	10–13	1
L. macrantha	22–33	not	yes	absent	2	15–20	1
L. ovata	22–28	not	yes	present	2	6–9	1
L. papillata	10–16	not	yes	absent	2	9–14	1
L. pulvinaris	5–7	not	yes	absent	2	c.8	1
L. stenosepala	16–22	not	yes	absent	2	8–16	1
L. striata	23–37	not	yes	absent	2	16–20	1.5
L. subcymosa	19–33	not	yes	absent	2	7–11	2
L. superba	13–20	not	yes	absent	2	5–8	2
L. tubiflora	5–7	not	yes	absent	2	c.6	1

hard woody outer layer derived from the loculus wall, that have usually been interpreted as the seeds; however, the hard outer layer is probably homologous with the true fruit (Carolin 1966). The outer floral parts surrounding the inferior ovary develop into what has been interpreted as a capsule, which contains the articles in a double row. However, strictly speaking, the outer floral parts separate from the true fruit and the fruit breaks up like a lomentum. I will refer to the outer 'capsule' as a 'pseudocapsule' for want of a better term.

All of the species have seeds and fruits that follow the pattern of development described by Carolin (1966) for *L. biloba*, except for *L. divaricata*. In this species, the swelling of the seed ruptures the septum and there is no division along the placenta when the fruit breaks up into articles. Thus each article is derived from both loculi, one of the seeds of each pair being subsumed by the other (see Carolin 1966).

The pseudocapsules are very uniform between species, and are essentially enlarged almost-unchanged floral tubes, often with persistent sepals and style. The pseudocapsules of *L. divaricata* and *L. linarioides* form a woody outer layer, giving them a distinctive grey appearance when dry, and *L. divaricata* often retains the fruits for several years before the pseudocapsules open.

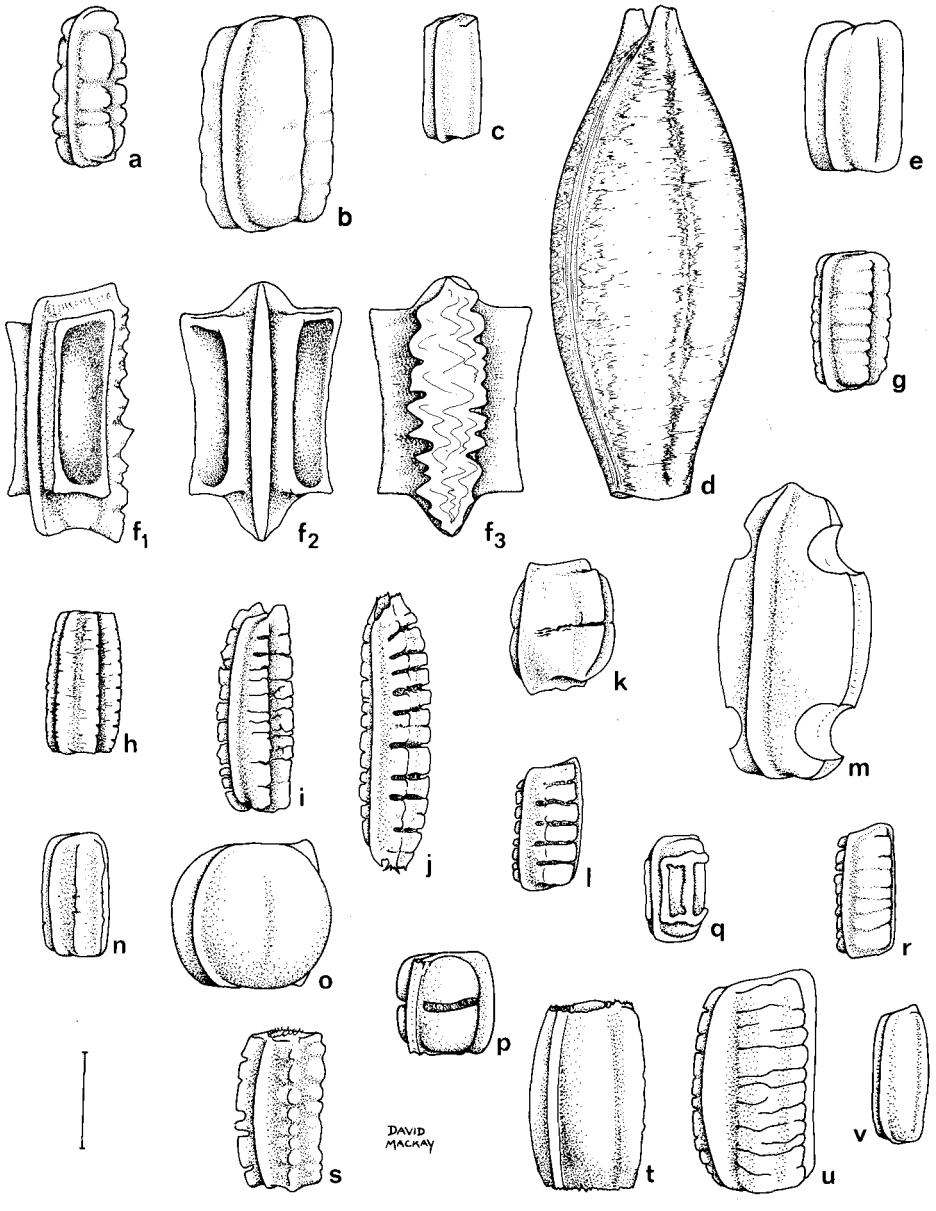

Fig. 1. Articles of some *Lechenaultia* species: **a**, *L. acutiloba (Morrison 230*, SYD). **b**, *L. biloba* (*Morrison 172*, SYD). **c**, *L. brevifolia* (*Newbey 3322*, SYD). **d**, *L. divaricata* (*Carolin* –.vi.1956, SYD). **e**, *L. expansa* (*Goadby 216*, NSW 76517). **f, 1–3**, *L. filiformis* (oblique, front, side views) (*Byrnes 1858*, SYD). **g**, *L. floribunda* (*Morrison 220*, SYD). **h**, *L. formosa* (*Benn* 10.x.1963, SYD). **i**, *L. heteromera* (*Morrison 227*, SYD). **j**, *L. hirsuta* (*Morrison 223*, SYD). **k**, *L. juncea* (*Morrison 189*, SYD). **l**, *L. laricina* (*Morrison 217*, SYD). **m**, *L. linarioides* (*Morrison 178*, SYD). **n**, *L. longiloba* (*Drummond 179*, NSW 76454). **o**, *L. lutescens* (*George 8781*, SYD). **p**, *L. macrantha* (*Morrison 222*, SYD). **q**, *L. ovata* (*Craven 2438*, CANB 269215). **r**, *L. papillata* (*Wrigley* 6.xi.1968, NSW 125989). **s**, *L. stenosepala* (*Morrison 186*, SYD). **t**, *L. striata* (*George* s.d., SYD). **u**, *L. superba* (*Morrison 229*, SYD). **v**, *L. tubiflora* (*Morrison 203*, SYD). Scale bar = 1 mm.

Although the flowers are 5-merous, the pseudocapsules have eight valves. There are only four sepaline ribs, as two of the sepals are connate (Carolin 1959), and there are only four semi-free corolla parts (Carolin 1959). This produces four small and four large valves respectively. Most species, however, open their pseudocapsules through only four valves, as the adjacent sepaline and petaline valves remain fused. The exception is *L. striata*, which opens through four to eight valves.

The articles have a hard outer covering formed from the inner layers of the loculus wall, the cells of which have greatly thickened walls (Carolin 1966). The shape of this outer layer is very useful in distinguishing species (Fig. 1), although the seeds themselves are all almost identical (see Carolin 1966). Most species have cylindrical articles, but a number have broad ovoidal ones. The surface sculpturing of the articles can also be very useful in distinguishing species, although this usually correlates with the shape. All of the articles have a distinctive ridge around the circumference where the adpacent pairs of articles were originally coherent.

Several of the species have specifically characteristic articles (see Fig. 1), notably *L. divaricata, L. juncea, L. linarioides, L. lutescens, L. macrantha* and *L. ovata*; and *L. filiformis* has very distinctive articles with large truncate appendages on either side. The articles of the other species tend to fall into two broad groups. One group has a wrinkled or corrugated surface to the articles, and includes *L. heteromera, L. acutiloba, L. floribunda, L. heteromera, L. hirsuta, L. laricina, L. papillata, L. stenosepala, L. subcymosa* and *L. superba.* The other group includes *L. biloba, L. brevifolia, L. chlorantha, L. expansa, L. formosa, L. longiloba, L. pulvinaris, L. striata* and *L. tubiflora*, all of which have relatively smooth articles.

These groups have very little similarity to the cladogram groups of Morrison (1987), which were based on floral and vegetative characteristics. This suggests that the surface structure of the articles is complex and not easily resolved into characters suitable for coding for cladistic analysis.

However, following the ideas presented by Mickevich & Mitter (1981) and Mickevich (1982) these complex polymorphic characters can be usefully analysed. For example, the articles can be roughly described by a two-state polymorphic attribute (surface wrinkled or not), with the unique articles being treated as autapomorphies (unique derived character states). If the two character states are then plotted onto the cladogram, an analysis can be made of which polymorphic state (wrinkled or smooth) is more likely to be the derived (apomorphous) condition and which the primitive (plesiomorphous) condition using the parsimony criterion.

If the wrinkled state is considered to be the primitive condition, then 7 character state changes are required on the cladogram (Fig. 2), whereas if the smooth state is considered to be primitive then at least 8 changes are necessary. Therefore, the most parsimonious hypothesis is that the wrinkled articles are the plesiomorphous character state, while the smooth articles are the apomorphous state.

Furthermore, by including the articles on the cladogram, two of the five polychotomies can be resolved into pairs of dichotomies. The trichotomy between *L. stenosepala, L. biloba* and the *L. pulvinaris/L. expansa* group is resolved if smooth articles is a shared derived character state (synapomorphy) for *L. biloba, L. pulvinaris* and *L. expansa*; and the trichotomy between *L. brevifolia, L. striata* and the *L. juncea/L. ovata/L. filiformis* group is resolved if

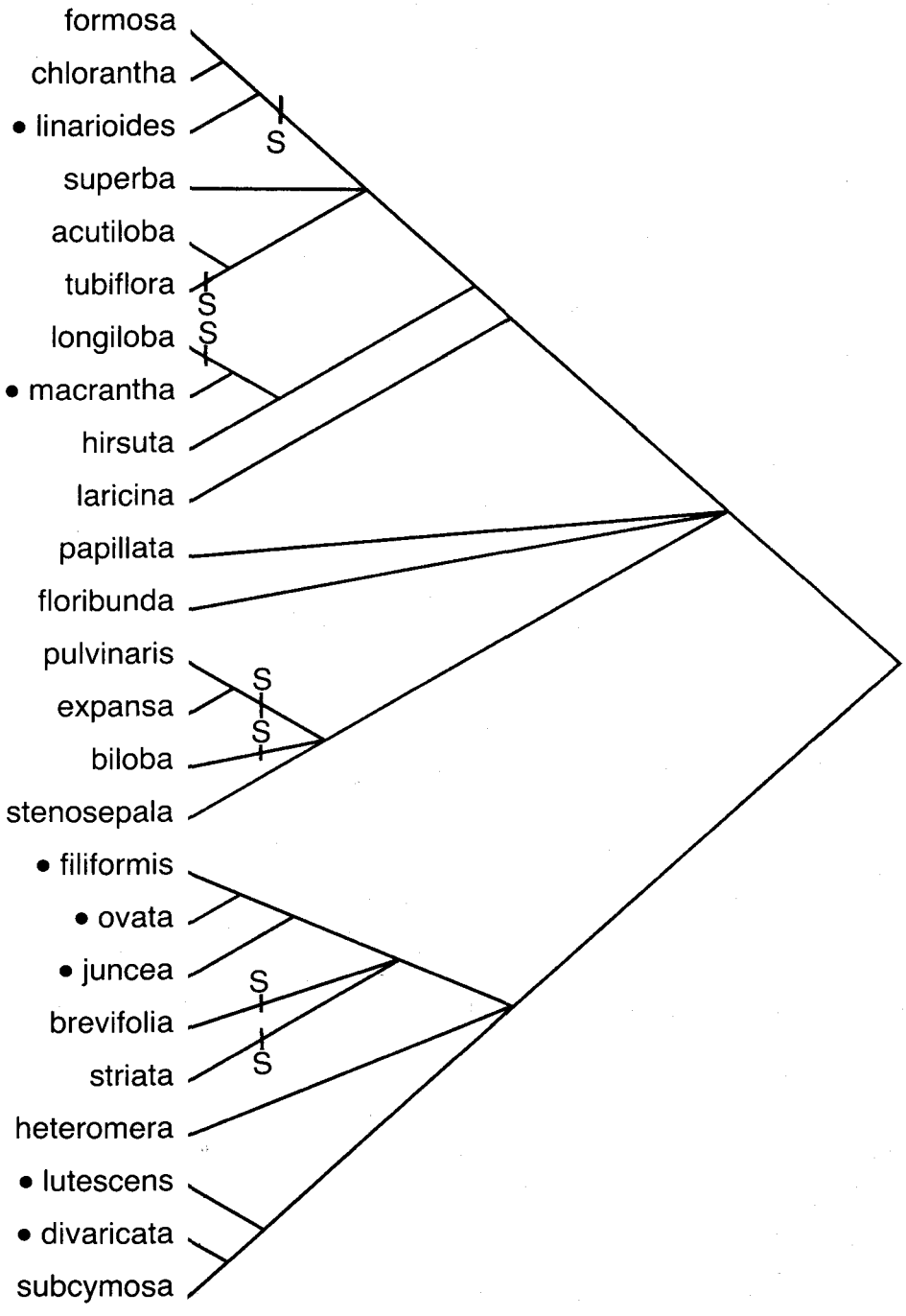

Fig. 2. Cladogram of the *Lechenaultia* species as presented by Morrison (1987). The distribution of the 2-state polymorphic article attribute has been plotted onto the cladogram, with the smooth state (s) treated as the apomorphous condition. The species with unique articles (treated as autapomorphies) are marked with a ● ; all of the remaining species have wrinkled articles (the plesiomorphous condition).

smooth articles is a synapomorphy for *L. brevifolia* and *L. striata*. This would reduce the number of character state changes required for the articles by 2 steps, as only 1 postulated origin of the derived character state is required instead of 2 at each of the resolved trichotomies.

Therefore, the cladistic analysis of the articles, although perhaps less elegant than that of the floral and vegetative attributes, improves the information content of the cladogram by allowing some of the uninformative ambiguities to be resolved.

Lechenaultia ovata *D.A. Morrison*, **sp. nov.**

Species affinis *L. filiformis* R. Br. sed foliis ovatis perparvis, floribus perparvis notabilis.

HOLOTYPUS: NORTHERN TERRITORY: 30 km SE of Jabiru, c. 12°50'S 133°05'E, *Craven 2438*, 27.2.1973 (CANB 269215) [the upper left hand specimen is designated as the holotype]. ISOTYPI (*n.v.*): A, BRI, L, NT.

Perennial herb, to 10 cm high and 15 cm diam., glabrous. *Stems* many, ascending to erect, probably growing annually from a common woody rootstock, not or only sparsely branched with the branches erect, terete or angled by decurrent leaf bases, up to 0.5 mm thick, not woody, glaucous. *Leaves* not crowded, somewhat fleshy, ovate to narrow-ovate, 7.5–10 mm long, 1.6–2.0 (–2.2) mm wide, more or less flat, acute to acuminate, more or less smooth to rugulose, glabrous. *Flowers* solitary and terminal; bracts narrow-ovate, 3.5–7 mm long, 1–1.5 mm wide, acute to acuminate, more or less smooth, glabrous. *Calyx* lobes scarcely overlapping at the base, linear, the four inferior lobes 3–4 mm long, the superior lobe 1 mm longer than the others, 0.2–0.3 mm wide, acuminate, rugulose, glabrous. *Corolla* white; tube split to the base but the petals cohering, 2.5–3 mm long, outside glabrous, inside with dense short erect simple hairs on the edges of the petals on the upper half; lobes not equal, inferior lobes erect at the base and more or less spreading towards the tips, narrow-lanceolate, 6–7 mm long, 0.7–0.8 mm wide; superior lobes more or less erect, strongly coherent along the lower half by interlocking very dense long erect simple hairs, enclosing the indusium, narrow lanceolate-falcate and distinctly widened around the indusium, 4.5–5 mm long, 0.7–0.8 mm wide; all lobes acute and not extending beyond the wings, outside and inside glabrous; wings on the inferior lobes rounded, 2–2.5 mm long, 0.7–0.8 mm wide, margins crinkled, transverse veins obscure; wings on the superior lobes rounded, 1 mm long, 0.1 mm wide, transverse veins obscure. *Stamens* enclosed in the tube; filaments very thin, 1.7–1.9 mm long; anthers linear, 0.7–0.8 mm long, obtuse, yellow. *Ovary* erect, 17–24 mm long, more or less smooth, glabrous; style erect, thin, not dilated towards the base, 5–5.5 mm long, glabrous or with scattered very short erect capitate hairs on the middle third, with dense short weak simple hairs at the back of the indusium. *Pseudocapsule* 4-valved, 22–28 mm long, not woody, opening spontaneously at maturity, slightly constricted between the articles, many distal articles not developed, glabrous. *Articles* in two rows when mature, about 6–9 per row, prismatic, 1 mm long, dark purplish, ridged around the middle with a B-shaped boss on each side. Fig. 3.

DISTRIBUTION: Known only from the type collection.

HABITAT: The type was collected from short sedgeland in a sandy depression on a sandstone plateau.

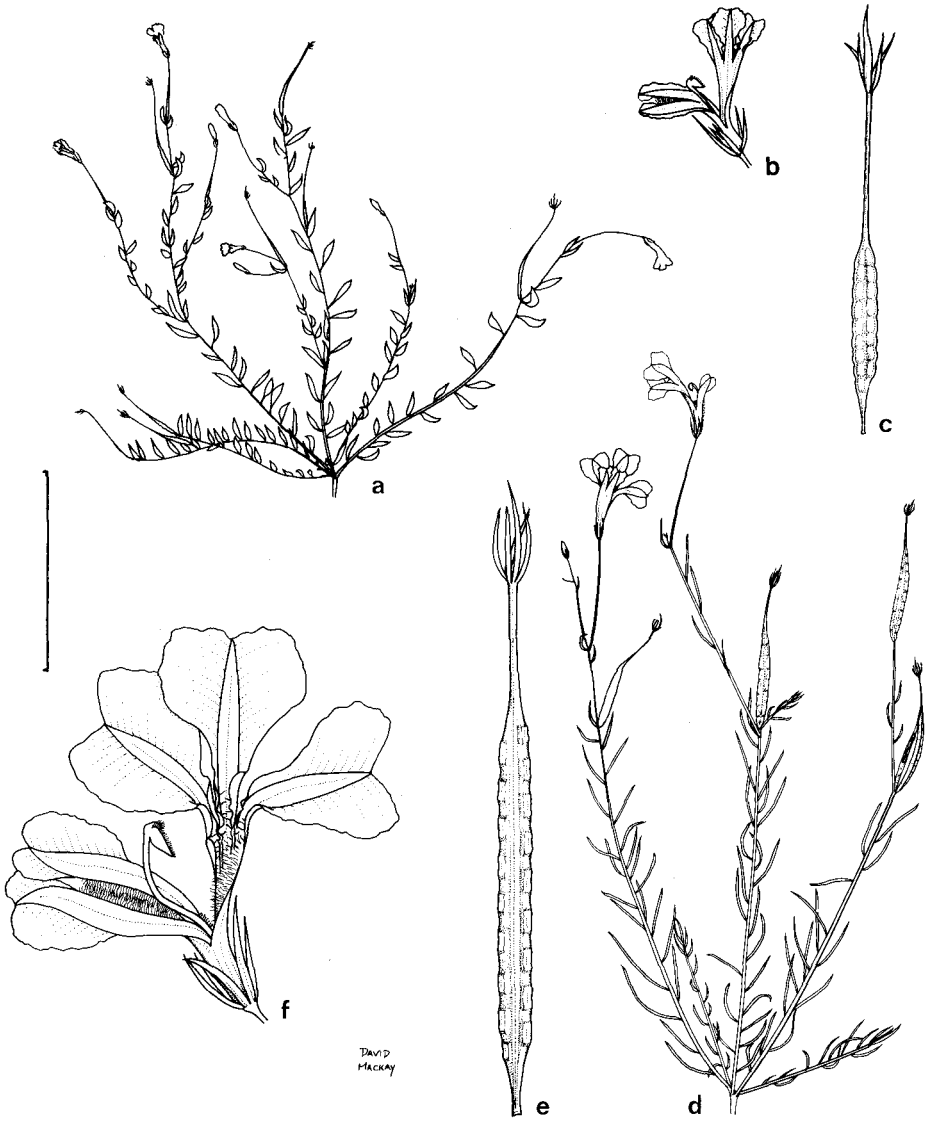

Fig. 3. *Lechenaultia ovata:* **a**, habit. **b**, flower. **c**, pseudocapsule (*Craven 2438*, CANB 269215). *Lechenaultia filiformis:* **d**, habit. **e**, flower. **f**, pseudocapsule (*Byrnes 1858*, SYD). Scale bar: **a**,**d** = 4 cm; **b**,**c**,**e**,**f** = 1 cm.

CONSERVATION STATUS: 1E. The population is fairly large (L. Craven, personal communication), but the collection locality would seem to be just outside Kakadu National Park.

The epithet refers to the ovate leaves, which are unique within the genus.

L. ovata is very closely related to *L. filiformis*, the only species of *Lechenaultia* with which it is sympatric. These two species possess three

characters that are not found elsewhere within the genus: a prolongation of the superior sepal, interlocking hairs along the cohering margins of the superior petals, and a long 'beaked' appearance of the capsule due to many of the distal articles not developing (*L. divaricata* also has a 'beak', but it is much shorter). These characteristics give these two species both flowers and fruits that are very distinctive within the genus.

Nevertheless, the two species can be easily distinguished from each other (Fig. 3). The flowers and fruits of *L. filiformis* are very variable in size (Morrison 1987); however, *L. ovata* has much smaller flowers and fruits than have been recorded for *L. filiformis* (c. 81 specimens examined). Also, the flowers of *L. ovata* are solitary rather than in monochasial or dichasial cymes as in *L. filiformis*; and the articles have distinctive surface sculpturing. More noticeably, the leaves of *L. ovata* are much shorter and wider than those of *L. filiformis*, and the plants are also notably smaller.

L. filiformis grows in the same general area as *L. ovata* (L. Craven, personal communication), with both species remaining distinct. This suggests that there is some form of isolating mechanism keeping the populations genetically distinct.

Acknowledgements

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