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POISON *Plants* OF WESTERN AUSTRALIA

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TOXIC PLANTS OF THE GENUS ISOTROPIS

Including the so-called "Lamb Poison"

THE genus *Isotropis* is restricted to Australia. Of the total of nine species six are recorded in Western Australia, two of them being known as "Lamb poisons" while the remainder have no common names. Three are known to be toxic to stock, but concerning the remaining three we have no definite information.

Isotropis takes its name from *Isos*, equal, and *tropis*, the keel of a vessel. The keel of a peaflower is formed of the two innermost petals which enclose the stamens and ovary. While these two (usually united) petals are usually shorter than the wings and the outermost "standard" petal, in *Isotropis* they are about as long as the wings.

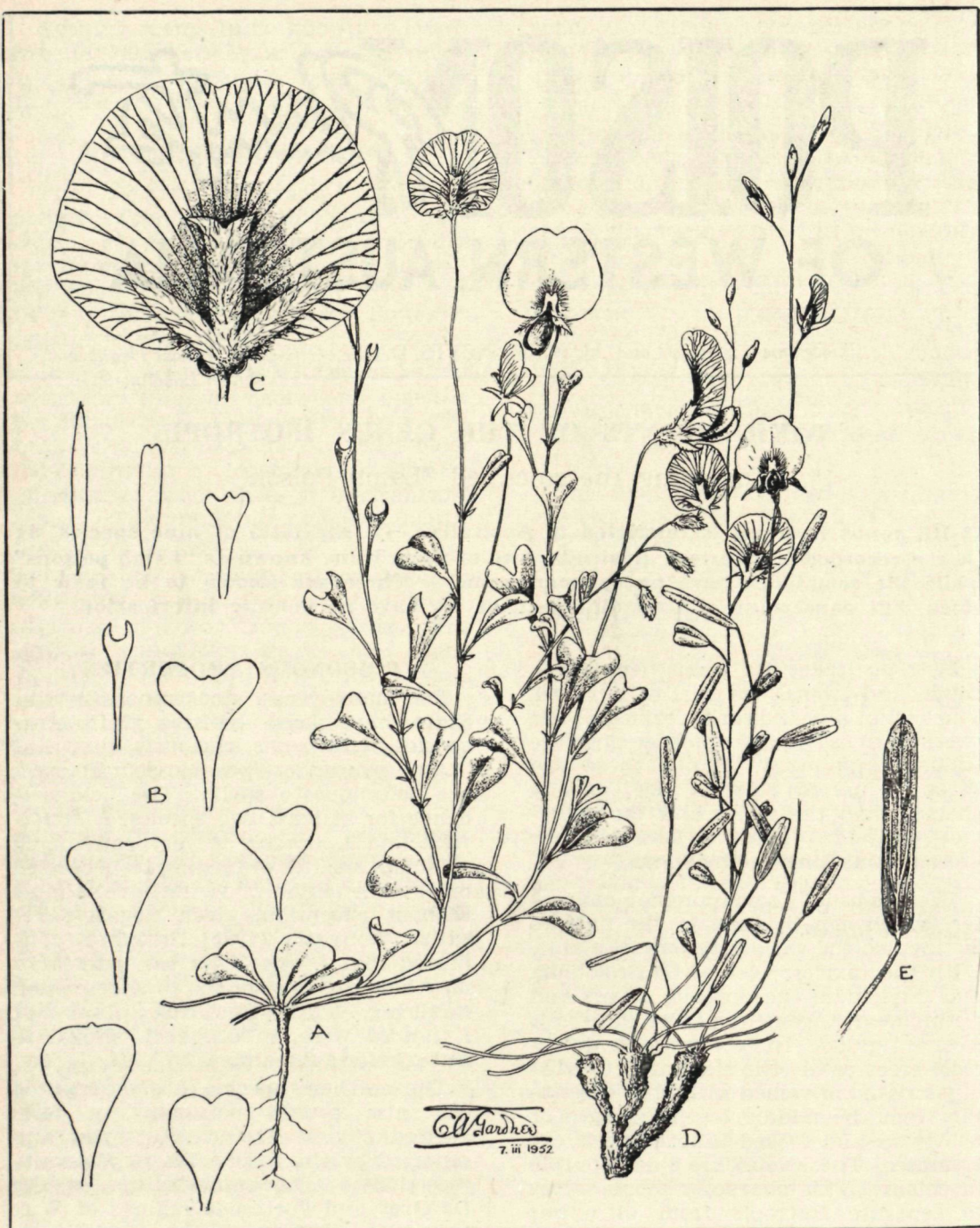
There is usually some common character, which can be used in the field to distinguish the various genera of plants. With the toxic species of *Gastrolobium* and *Oxylobium* the opposite leaves and terminal arrangement of the flowers is a useful guide. In *Isotropis* the outermost erect petal (the standard) is radially striated or veined with lines extending from the middle to the margin or nearly so, and forked towards their extremities. These veins are a deep purple in colour. This character alone serves to separate *Isotropis* from all other native legumes in which the calyx is deeply cleft and in which the 10 stamens are free. Additionally the pod contains from seven to 40 seeds

POISONOUS PROPERTIES

For many years, stockowners in this State have been positive that some species of *Isotropis*, variously known as "Lamb poison" or "pea-blossom Poison", are poisonous to stock. The field evidence for at least two species, *I. cuneifolia* and *I. juncea*, is very convincing although a series of feeding tests carried out over a period of years have, almost without exception, given negative results. Bennetts (1935), however, confirmed that *I. cuneifolia* var. *parviflora* may be highly poisonous to sheep when flowering, while flowering plants of *I. juncea* were, in one test, shown to be toxic for guinea pigs.

The northern species, *I. atropurpurea* was also proved poisonous in tests carried out in Eastern Australia and reported by the Poison Plants Committee (1934). Stock mortalities in the De Grey and Fortescue regions of W.A. have been attributed to this species.

The symptoms and post-mortem appearances described for poisoning by *I. cuneifolia* and *I. atropurpurea* are very



similar to those encountered in mortalities in Western Australia which have been attributed to *Isotropis* spp. generally.

We have considerable evidence that the poisonous properties of species vary greatly with locality, with stage of growth, and with the form or variety of the species. *I. cuneifolia*, for example, undoubtedly has been responsible for numerous mortalities of cattle and sheep in the Gingin and Hill River districts, and in the South coastal areas from Albany to Esperance, whereas in some other localities where it occurs commonly stock have not been reported affected by it. This species in particular, on field evidence, seems to be dangerous only during the flowering and fruiting stages of growth.

The negative results of many feeding tests carried out in this State are attributed probably to the variation in toxicity referred to and to the fact that samples tested commonly have not been in a fresh condition; there is some evidence that toxicity may diminish rapidly after picking. On the other hand, however, the positive results with both *I. cuneifolia* and *I. atropurpurea* were obtained with plants not freshly picked—the latter material was “old dried plant”.

Although these two species are the only ones definitely proved poisonous, on available evidence all should be regarded with suspicion.

The poisonous principle of *I. atropurpurea* is thought to be an alkaloid.

Animals Poisoned—Cattle and Sheep.—It has been stated frequently, in this State, that lambs particularly are susceptible. There is little definite evidence that this is so, and it is highly probable that much of the lamb mortality attributed to *Isotropis* during the earlier years of settlement, was actually due to a bacterial disease, enterotoxaemia, which commonly occurs at the same time as the plants are flowering.

Amount Required to Cause Death.—Under experimental conditions the following amounts were proved poisonous:—

Cattle—4 ozs. of *I. atropurpurea*, “old dried plant” killed a calf 3 months old.

Sheep—2½ lb. of *I. cuneifolia* var. *parviflora*, green flowering plant fed one day after picking killed two sheep. Under natural grazing conditions much smaller quantities appear to be fatal.

Symptoms.—Field evidence indicates that a relatively large amount of plant may cause sudden death, without definite symptoms being noted, within several hours of sheep or cattle having access to the plant.

The following symptoms, however, are commonly noted:—Dullness, tucked up appearance, roach back, loss of appetite, diarrhoea, which becomes persistent; within a day or two blood and mucus are voided. Affected animals become

KEY TO THE SPECIES

- A. Northern and Ereman species (as far south as the Murchison District): flower purple or violet, with darker veins. Pedicels twice as long as the calyx or less.
 - B. Leaves broad, densely rusty-velvety; broad at the base, wings and keel petals almost as long as the standard. Shrub 1. *I. atropurpurea*
 - B. Leaves narrow or at least narrowed towards the base; petals about equal. Undershrubs.
 - C. Leaves linear 2. *I. Forrestii*
 - C. Leaves cuneate-ovate 3. *I. canescens*
- A. South Western species: flowers yellow or orange-yellow, veined with prominent purple radiating forked veins which extend to the margin; wings and keel much shorter than the standard.
 - B. Flowers racemose, the pedicels rarely much longer than the calyx.
 - C. Stems erect, rush-like, leafless except near the base; calyx silky-pubescent. 4. *I. Drummondii*
 - C. Stems ascending; leaves narrow, entire, jointed at the junction with the pedicel; calyx glabrous. 5. *I. juncea*
 - B. Flowers on long solitary pedicels in the upper axils; leaves broadened upwards, usually notched at the apex; calyx usually silky-pubescent 6. *I. cuneifolia*

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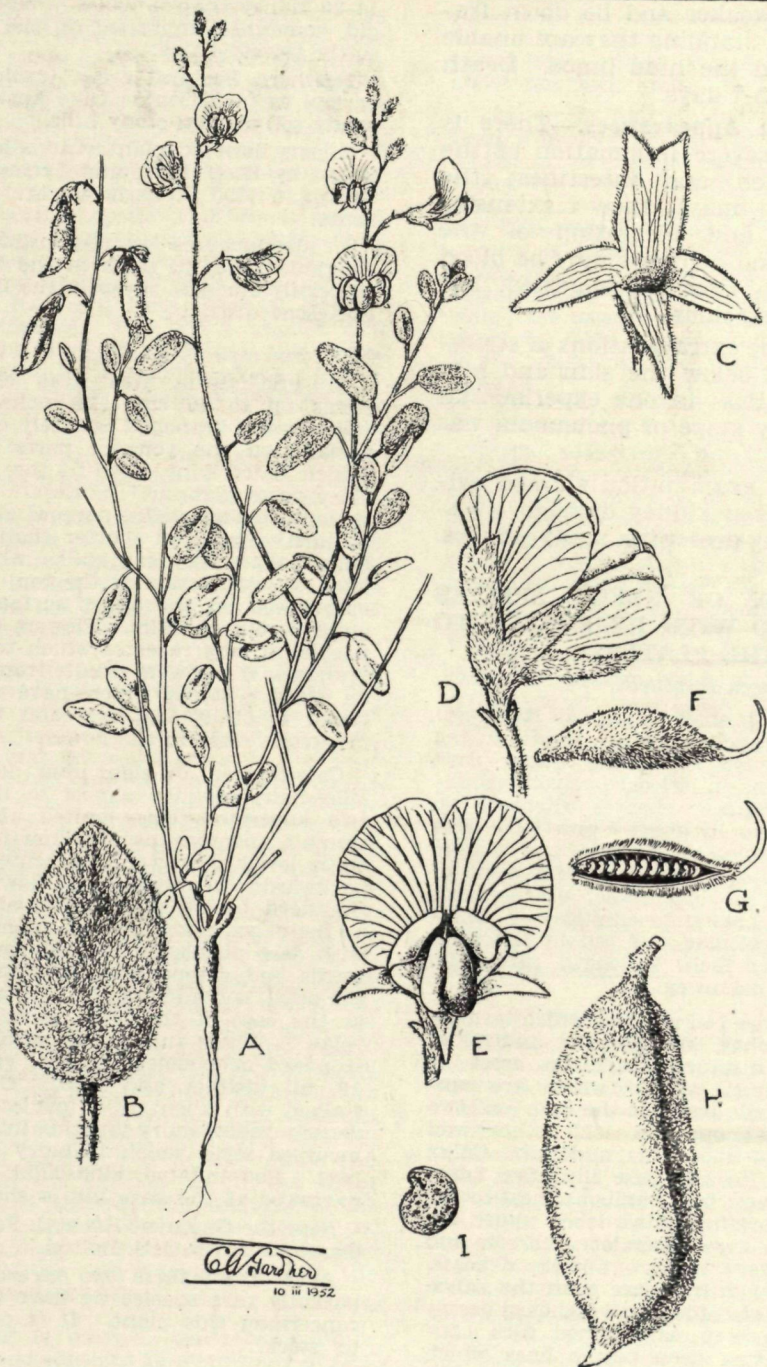


PLATE 2.

Isotropis atropurpurea F. Muell. A—Habit (half natural size). B—Leaf (somewhat enlarged). C—Calyx, showing the two united uppermost lobes. D—Lateral view of flower. E—Anterior view of flower. F—Ovary. G—Ovary in section showing ovules. H—Pod (enlarged). I—Seed (much enlarged). Icon. origin.

progressively weaker and lie down frequently; when standing they are unable to fully extend the hind limbs. Death occurs within 2-7 days.

Post-Mortem Appearances.—There is more or less severe inflammation of the fourth stomach and intestines; the large bowel may show extensive haemorrhage and ulceration of the inner lining and contents may be blood stained. The liver is congested, but kidneys pale in colour.

There may be extravasations of straw-coloured fluid below the skin and into the body cavities—in one experimental sheep an early stage of pneumonia was present.

Microscopic examination showed evidence of marked kidney damage—hyaline casts being present in many tubules.

DESCRIPTION OF SEVEN SPECIES (TO BE USED WITH REFERENCE TO THE PLATES)

1. *I. atropurpurea* F. Muell.

A shrub, usually about 60 cm. tall (two feet) with erectly branched twiggy stems arising from a tap-rooted stock, the whole plant covered with dense interlocked velvety yellowish or rusty hairs. Leaves alternate on slender stalks usually about 5 mm. long, with two minute stipules at the base, and a more or less distinct articulation at the point of attachment of the leaf blade, which varies in shape from oblong to elliptical or sometimes almost orbicular, and usually less than 12 mm. (half an inch) in length, rarely the leaf longer or narrower.

Flowers arranged in racemes which terminate the branches, usually the individual flowers some distance apart, on erect or spreading pedicels (stalks) which are subtended by a single bract at the base and two small bracteoles opposite each other and usually situated above the middle. Calyx divided almost to the base into five lobes, the two uppermost being united almost to the summit and forming a two-lobed upper lip, the remaining three lower lobes narrow and acute, all velvety hairy. Corolla delicate, purple, only slightly longer than the calyx, glabrous (hairless), the broad standard deeply notched at the top, and veined with conspicuous radiating deep purple lines which fork upwards and extend almost to the margin; wings and keel somewhat shorter than the standard, striated. Stamens ten, all free from each other. Ovary densely velvety, on a very short stalk, containing

14-20 kidney-shaped ovules. Pod oblong, turgid, somewhat impressed on the lower side, softly velvety-hairy.

Northern Pastoral areas (excluding Kimberley) as far south as Lake Austin, in stony sandy soil and on stony hills.

A pale flowered plant (var. *alba*) was collected by H. S. King and Lefroy near Lake Austin in 1890. The leaves are narrow and acute.

I. atropurpurea is responsible for considerable losses in stock in the North West, especially amongst sheep in the De Grey and Fortescue districts.

2. *I. Forrestii* F. Muell.

An undershrub with weak erect flexible stems up to 45 cm. (18 inches) tall, the stem erectly branched, sparsely covered, (especially on the younger parts) with short golden hairs lying close to the surface, the older parts glabrous (hairless). Leaves few on long slender stalks, narrow, about 12 mm. ($\frac{1}{2}$ inch) long, and shorter than or scarcely longer than the leaf stalks which have a joint or articulation at the top, the leaf flat or grooved on the upper surface almost or quite devoid of hairs. Flowers deep bluish-purple, in long racemes which terminate the branches, the flowers remote from each other, on slender stalks which have a small but broad bract at the base and two opposite bracteoles close to the flower.

Calyx seven to eight mm. long, sparsely silky-hairy, divided almost to the base, the two uppermost lobes united almost to the summit, and forming a narrow upper lip, the three lower narrower and acute, all curving backwards in the open flowering stage. Standard broad, purple-blue, about as long as the calyx, notched at the summit, striated with deep purple lines which are forked upwards and extend almost to the margin of the petal, and additionally with a white patch at the base of the petal above its stalk or "claw". Wings and keel about as long as the standard, deep violet with dark veins. Stamens 10, all distinct and free. Ovary shortly stalked with about 13-15 ovules, shortly and densely yellow hairy tapering into the slender incurved style which is hairy in the lower part. Pod inflated, ellipsoidal, velvety silky narrowed at the base into a short stalk.

Near the Gascoyne River, J. Forrest (1882); Gascoyne River, J. S. Dalton.

Apart from these two records of an apparently rare species we have no knowledge concerning this plant. It is probably toxic to stock.

3. *I. canescens* F. Muell.

We know very little concerning this plant collected by Young at Victoria Spring in 1875. It is known only from the original

collection and has not been seen since. It is a trailing plant with stems two to five inches long, from a simple slender root, and the whole plant is silky-hairy. The leaves are more or less wedge-shaped and rounded at the top, and about half an inch long, not evidently veined on very short stalks, with small acute stipules. The flowers are borne in few-flowered racemes (the same arrangement as in *I. atropurpureum*), the bracts are small and lance-shaped. The flowers are on stalks smaller than or scarcely longer than the calyx which is one quarter of an inch in length and hairy-silky with minute hairs. The petals have not been observed, neither have the stamens. The pod is swollen and about an inch in length, ellipsoidal and oblong in outline, and the numerous seeds are somewhat heart or kidney shaped, on long slender stalks

4. *I. Drummondii* Meissn.

This species can usually be easily recognised by reason of its erect rigid, usually leafless, rush-like stems which attain a length of over 12 inches, and in which the leaves when present are mostly on the lower parts of the stems only.

The root is a thick vertical corky taproot forming a stock at the top from which the erect stems arise. The leaves are, when present, narrowly wedge-shaped but acute at the top and gradually taper at the base into a stalk which is continuous with, and not jointed to the leaf blade, the blade is prominently net-veined, hairless, and up to an inch in length; the stipules at the base of the leaf stalk are slender and almost hair-like. The flowers are arranged along the upper part of the stem in a raceme of usually many flowers on slender stalks shorter than, or scarcely longer than the calyx, the calyx, its stalks, and the upper part of the stem being grey-downy. The calyx is like that of the other species, nearly half an inch long, but less deeply cleft into lobes, and is grey-hairy-downy. The flower stalk has a very small bract at the base and two opposite bracteoles immediately below the calyx. The standard is conspicuously striated with deep reddish purple veins, radiating from the centre and extending to the margin as in the other species, forked towards the margin of the petal. The wing and keel petals are shorter than the standard and elegantly veined. The 10 free stamens are enclosed within the purple united keel petals.

The ovary is narrow, white-hairy on a short stalk and contains 30-40 or more ovules. Ripe pods have not been seen, but in the immature state they are long and narrow on a slender stalk, or the pedicels are reflexed.

If correctly matched, specimens in pod from Balladonia and from the Jerdacattup River,—in the latter case said to be responsible for heavy losses among sheep—have turgid pods about one inch long.

This plant has a small range extending from Pingelly and Konongorring to Ballidu and as far east as Boorabbin and Balladonia. Along the South Coast it extends on the sandy coastal country from the Phillips River and Hopetoun districts to the eastwards. The species is closely related to the Common Lamb Poison (*I. cuneifolia*) but may be distinguished by its narrow entire acute leaves which are usually on the lower parts of the plant, or quite absent, and by the shorter flower stalks of the many flowered erect racemes.

5. *I. juncea* Turcz.

Stems numerous, slender, prostrate or variable, ascending from a thick woody stock, wiry flexible hairless as well as the whole plant. Leaves usually few, variable in shape and size, on a rather long slender leaf-stalk which is jointed immediately below the base of the leaf-blade, the leaf-blade wedge-shaped to narrowly oblong or linear, obtuse, rarely notched at the apex.

Flowers arranged in slender terminal, few flowered racemes (see plate) the flower-stalks almost thread-like, shorter or rather longer than the calyx, each subtended by a short broad minute bract and with a pair of bracteoles immediately below the calyx. Calyx hairless, about a quarter of an inch long, deeply divided, the lobes narrow, the two uppermost united to the top, all reflexing after flowering. Flowers orange-yellow, the standard half an inch long, and more in breadth, striated with prominent radiating forked purple veins, the wing and keel petals shorter. Ovary almost without a stalk, with about 30 ovules.

6. *I. cuneifolia* (Sm.) Domin.

Herbaceous perennial or subshrub with a strong root and prostrate, ascending, or rarely erect stems, hairy with rather long scattered hairs. Leaves variable, the lower usually broadly or narrowly wedged-shaped or occasionally heart-shaped tapering into the leaf stalk and not articulated or jointed at the base of the leaf, the upper leaves usually narrower, but typically two-horned or two-lobed. Very occasionally a few of the upper very narrow and without teeth or lobes. Stipules broad and short rarely lanceolate.

Flowers solitary in the axils of the leaves, sometimes appearing racemose, but then the pedicels with two stipules and much reduced or bract-like leaf at the base (in all other species the flower stalk is subtended by a solitary bract). Pedicels elongated, often three to five inches long, with two bracts at

the base of the calyx often spurred at the base. Calyx divided almost to the base, glabrous or hairy, often over $\frac{1}{2}$ inch long, the upper lobes forming a truncate upper lip. Standard large, elegantly nerved, yellow or orange, with deep purple forked veins. Wings and keel shorter. Ovary on a short stalk, hairy, containing numerous (about 30) ovules. Pod $\frac{3}{4}$ to one inch long, much contracted towards the base, pubescent.

This is the common species of the South-West extending from the vicinity of the Irwin River to the south coast. It is common on the

western coastal plain and in the Vasse district, and its flowers are called "granny bonnets" by children.

Reports on this species by stockowners in various parts of the South-West have indicated that in some localities the plant is regarded as being harmless, while in others the plant is known to be toxic. An examination of specimens in the State Herbarium has enabled the material of this species to be separated into three forms or varieties, of which one is known to be toxic. The following key will serve to separate these forms.

KEY TO FORMS OF *I. CUNEIFOLIA*

- A. Leaves all dilated upwards, lobed, emarginate, retuse or truncate; stipules rather broad; calyx hairy, usually densely so.
 - B. Stipules foliaceous, usually with one lateral tooth; usually half or more than half as long as the leaf; plant coarsely hairy forma α
 - B. Stipules small, usually ovate to lanceolate forma β
- A. Upper leaves narrow-linear, entire; stipules linear to narrow-linear; calyx glabrous or with a few long erect, mostly marginal hairs forma γ
 - 1. Forma α This plant occurs in the Moora district. It was sent in without any collector's name. It is apparently of dwarf habit and erect growth and can be distinguished by its leaf-like rigid and often toothed stipules.
 - 2. Forma β This is the typical form of the South-West with variable foliage, usually broadly wedge-shaped leaves (at least the lowest) and a hairy calyx. In this form the flowers sometimes appear to be in racemes, but then each pedicel is subtended by three bract-like structures (a reduced leaf and two stipules) and the calyx is hairy.
 - 3. Forma γ This is the toxic form which has been collected from the Moore River (R. H. DeBurgh), Gingin (Carne and Gardner), Moora (S. Bennett) and from between Dandarragan and Jurien Bay (W. E. Blackall). It can be distinguished by its upper leaves which are long and narrow (linear), its elongated linear stipules and its glabrous calyx, or the calyx very sparsely hairy with a few long hairs. This form is toxic to cattle and sheep.

References.—Bennetts, H. W. (1935)—J. Dept. Agric. West. Aust. 12, 431. Poison Plants Committee (1934)—Coun. Sci. Ind. Res. (Aust.) Pamph. 49.

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