BULLETIN No. 3483

WESTERN AUSTRALIAN DEPARTMENT OF AGRICULTURE

THE POISON PLANTS OF WESTERN AUSTRALIA

1. CHARACTERISTICS OF THE GROUP

★

Reprinted from "THE JOURNAL OF AGRICULTURE OF WESTERN AUSTRALIA"
VOLUME 8 (Fourth Series) No. 2 - - - - FEBRUARY, 1967

POISON PLANTS OF WESTERN AUSTRALIA

The toxic species of the genera Gastrolobium and Oxylobium

1. CHARACTERISTICS OF THE GROUP

By T. E. H. APLIN, B.Sc., Botanist

THE toxic species of the genera Gastrolobium and Oxylobium are a unique group of poison plants which have caused considerable economic loss to stock-raisers in Western Australia ever since the early days of settlement.

These plants are widely distributed over the agricultural areas of the south-west, and, with the opening up of large tracts of land for stock-raising, the danger is as high as it has even been. Considerable losses of stock are still being sustained by farmers and graziers, due to accidental grazing of these plants.

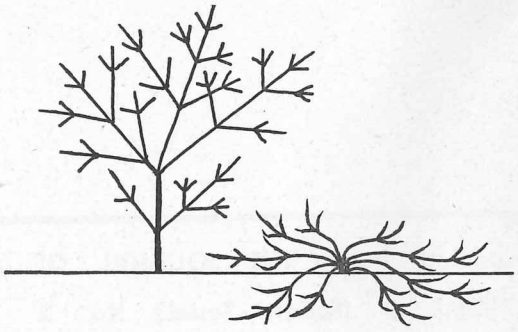
Botanical relationship

The genera Gastrolobium and Oxylobium belong to the pea-flowered, pod-bearing family, the Papilionaceae, and to the tribe Podalyriae, the members of which possess flowers in which the ten stamens are all distinct and separate. In this they are distinct from the other tribes, Genisteae, Trifolieae, Loteae, etc., in which all ten stamens are united or nine are united with one free.

Only the species belonging to the section Racemosae in the genus Gastrolobium and to the section Podolobium in the genus Oxylobium are toxic. Several species which had previously been suspected of being toxic have been shown to be harmless to stock, and have been placed in other sections or genera. Roe's poison and net-leaf poison, previously classified in other plant groups, are now placed in the section Podolobium of the genus Oxylobium.

Description

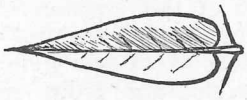
The following characters, although not completely reliable, serve in most instances to describe the toxic pea-flowered plants:



1. All are shrubs, that is, they branch close to ground level, and possess woody stems. Most are less than 5 ft. high, the exceptions being box poison, heart-leaf poison, river poison, narrow-leaf poison, rock poison, Roe's poison, and some forms of prickly poison, which may sometimes reach 10 ft. in height.

2. The leaves are opposite to each other on the stem, or in whorls of three, four or more. Rock poison has leaves irregularly arranged. Narrow-leaf and berry poison have crowded leaves which, while usually in opposites or in threes, may sometimes be irregularly arranged. Box poison has leaves that are arranged in opposites or threes but sometimes scattered.

3. At the base of each leaf, one on either side of the leaf base or the leaf stalk, are two small organs, the stipules. In gilbernine poison and mallet poison, these are flat, lance-shaped, rigid and joined to the leaf stalk at the base, so



This is the first in a series of articles on the toxic species of the genera Gastrolobium and Oxylobium, the most important group of poison plants found in Western Australia.

In these articles great stress is laid on the serious hazards presented by these plants.

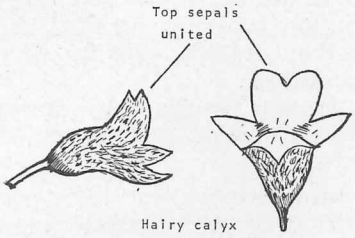
Characteristics by which they may be identified are set out in detail. Their distribution and the type of country where they are likely to be found is also indicated.

Subsequent articles in the series will deal with individual members of the group in turn.

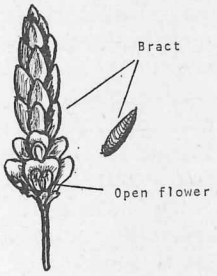
that they persist even after the leaves have fallen. In most other species the stipules are small and bristle-like. In rock poison they are deciduous so are rarely seen. In York Road poison, the stipules are rigid and spreading.

4. The flowers are arranged in loose spikes on an inflorescence-stalk or peduncle, with each flower attached to the peduncle by a flower-stalk or pedicel. The flowers and pedicels are arranged on the peduncle in similar fashion to the leaves of the main stem (in pairs, threes, fours, etc.). The racemes are terminally arranged at the ends of branches or from the axils of uppermost leaves along the stem. They are usually longer than the leaves, and so protrude above the foliage. Heart-leaf poison and narrow-leaf poison are notable exceptions; in these the racemes are contracted, so as to appear short and broad.

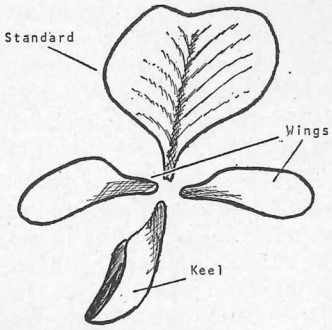
5. The calyx (the outer green series of organs enclosing the petals) which consists of the five fused sepals in the form of an irregular cup, is hairy, except in York road poison. The two sepals which lie behind the large showy petal (the standard) are united nearly to the apex and are longer than the other three sepals, which are united to a lesser degree.



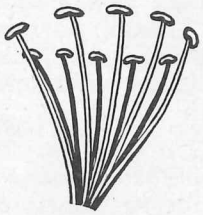
6. Below the calyx, the bracts nearly always fall before the flower has fully expanded. Bracts are small, leaf-like, thin and chaffy organs, which may be seen when the flower is in bud.



7. The corolla (the petals) of the pea-flowered type is usually clear yellow or suffused with red, and in some species, red in colour.



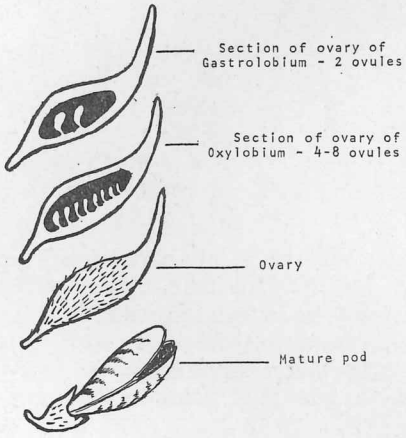
8. The ten stamens are all distinct and separate.



9. The ovary (immature pod, seen in the flower) is silky-hairy, hairy or almost woolly. It is never devoid of hairs, although the pod may become hairless at maturity.

The number of ovules (immature seeds) in the ovary is two in the case of the toxic species of Gastrolobium and from four to eight in the case of the toxic species of Oxylobium. The number of ovules in the ovary is the sole character that separates the two genera.

The number of seeds actually seen in pod may be fewer than there are ovules in the ovary.



Recognition and identification

Some of the characteristics one should look for when seeking to differentiate toxic species of the genera Gastrolobium and Oxylobium from non-toxic species, are:

1. LEAVES: Leaves are entire, that is, they are not compound and do not consists of a number of leaflets, as in vetch, cassia,

lupin, etc. The arrangment of the leaves on the stem is strictly opposite or in whorls of three, four or more, arising from the same level. They are not alternate or irregularly arranged. (Some exceptions exist where certain forms of toxic species may have leaves that are irregularly arranged). Several non-toxic plants also possess leaves that are arranged opposite to each other.

2. STIPULES: Stipules are present; one on either side of the leaf-stalk or base of the leaf. These can fall early, particularly in rock poison, so that when looking for them, young branches should be closely examined. Stipules may also be present on non-toxic plants, including those possessing leaves that are arranged in opposites.

3. FLOWERS: Flowers are yellow, yellow suffused with red, or occasionally red. They are never blue or violet.

4. INFLORESCENCES: The inflorescences are many-flowered racemes which are terminal on the branches or arise from the upper leaf axils. They are never in clusters along the branches, in the axils of the stem leaves.

Certain non-toxic species closely resemble poison plants and appear to possess all the characters required to identify poison plants. Close inspection of these will reveal leaves that are irregularly (not strictly) whorled, stipules that are absent, inflorescences that are not racemes, or flowers that are of a different colour.

Distribution

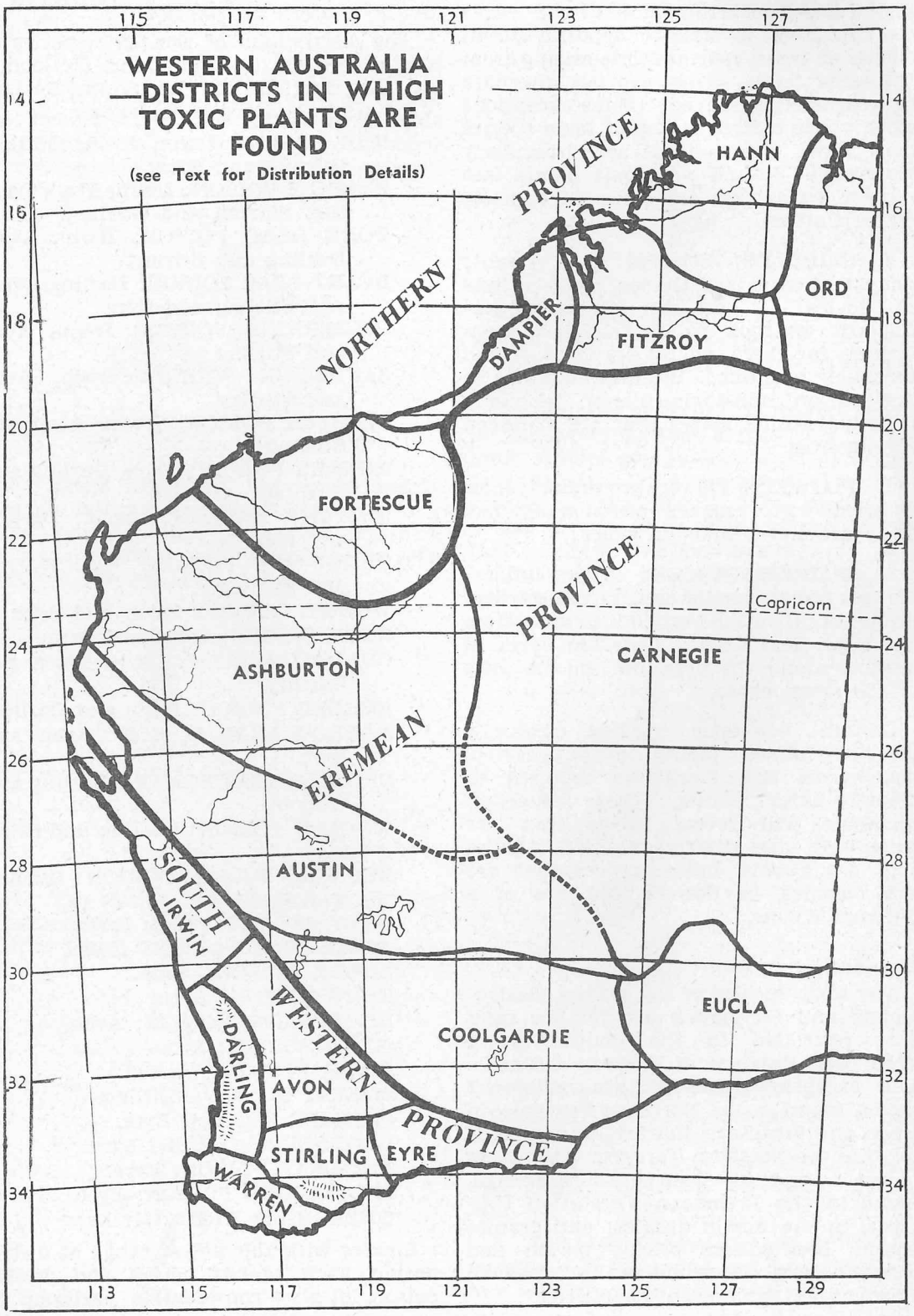
The toxic species of the genera Gastrolobium and Oxylobium are for the most part restricted to the South-Western Vegetation Province of Western Australia. The exceptions to this are wallflower poison found in the Northern Province, in Hann and Fortescue districts, and extending into the Northern Territory and across to Queensland; kite-leaf poison or Breelya, found in the Eremaean Vegetation Province, in the Austin district; and granite poison, box poison, prickly poison and Wodjil poison, also found in the Eremaean Province, in the Coolgardie district.

South-Western distribution

The distribution of the toxic species of the genera Gastrolobium and Oxylobium in the districts of the South-Western Vegetation Province is as follows:

BOX POISON: Irwin, Avon, Darling, Stirling and Eyre.
PRICKLY POISON: Irwin, Avon, Darling, Warren and Stirling.
YORK ROAD POISON: Irwin, Avon, Darling and Stirling.
HEART-LEAF POISON: Darling, Warren, Stirling and Eyre.
GILBERNINE POISON: Irwin, Avon and Stirling.
SANDPLAIN POISON: Irwin, Avon and Stirling.
CLUSTER POISON: Irwin, Avon and Stirling.
RUNNER POISON: Avon, Darling and Stirling.
BULLOCH POISON: Avon, Darling and Stirling.
THICK-LEAF POISON: Avon Warren and Stirling.
WODJIL POISON: Irwin and Avon.
ROCK POISON: Irwin and Avon.
CHAMPION BAY POISON: Irwin and Darling.
HORNED POISON: Irwin and Darling.
NARROW-LEAF POISON: Avon and Eyre.
CRINKLE-LEAF POISON: Darling and Warren.
WOOLLY POISON: Darling and Stirling.
STIRLING RANGE POISON: Stirling and Eyre.
HUTT RIVER POISON: Irwin.
SCALE-LEAF POISON: Irwin.
BERRY POISON: Avon.
ROE'S POISON: Avon.
HOOK-POINT POISON: Avon.
SPIKE POISON: Avon.
RIVER POISON: Warren.
MALLET POISON: Stirling.
SLENDER POISON: Eyre.
BROTHER-BROTHER: Eyre.
NET-LEAF POISON: Eyre.
MT. RAGGED POISON: Eyre.
OXYLOBIUM RIGIDUM: Eyre.

Species with the widest range of distribution, such as box poison and prickly poison, display considerable variation in


WESTERN AUSTRALIA
—DISTRICTS IN WHICH
TOXIC PLANTS ARE
FOUND
(see Text for Distribution Details)
115
117
119
121
123
125
127
14
16
18
20
22
24
26
28
30
32
34
113
129
PROVINCE
HANN
ORD
NORTHERN
DAMPIER
FITZROY
FORTESCUE
PROVINCE
Capricorn
CARNEGIE
ASHBURTON
EREMEAN
AUSTIN
SOUTH
IRWIN
WESTERN
DARLING
AVON
COOLGARDIE
EUCLA
PROVINCE
STIRLING
EYRE
WARREN

form. Species with very localised distribution, such as scale-leaf poison and spike poison, show little or no variation in form.

Ecology

Most of the South-Western Vegetation Province occupies the "old plateau" or peneplain, which due to subsequent dissection, has given rise to the present-day landscape of high ironstone-capped "hills," often bounded by "breakaways," sloping down in gentle terraces to the more recent river valley systems.

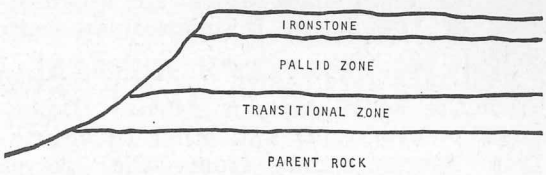
The tops of the "hills" consist of ironstone material which may be overlain with sand. Down the valley slopes the soils consist of sand or gravel or both, overlying a heavier subsoil. The lower terraces of the valley floor consist of the better class red or brown soils of the agricultural region.

The main vegetation forms of this region consist of the karri and jarrah forests; the tuart, wandoo, york gum and salmon gum woodlands; the mallee, wodjil and tamar scrub; and the sandplain vegetation.

On rocky outcrops where the parent rock (granite, quartzite or sandstone) is exposed, it is not unusual to find toxic species like heart-leaf poison, rock poison, box poison, granite poison, Roe's poison, kite-leaf poison, brother-brother, net-leaf poison, Oxylobium rigidum, York road poison, gilbernine poison, hook-point poison, horned poison, Stirling Range poison, Mount Ragged poison, narrow-leaf poison and prickly poison.

On gravelly or white or mottled clay soils of the pallid zone, just below the ironstone ridges or hills, may be seen species such as wodjil poison, Champion Bay poison, Hutt river poison, prickly poison, York road poison, bullock poison, sandplain poison, narrow-leaf poison, berry poison, spike poison, cluster poison, box poison, thick-leaf poison, runner poison and woolly poison.

On the ironstone soils particularly near the edge of "breakaways," or on the tops of granite tors bearing remnants of iron-stone "capping," may be seen sandplain poison York road poison, prickly poison, rock poison and crinkle-leaf poison.



Along watercourses, on alluvial soils, particularly in the lower South-West, may be found heart-leaf poison, slender poison, and river poison.

Toxicity

Stock losses attributable to the toxic species of the genera Gastrolobium and Oxylobium, were experienced in the very earliest days of settlement in Western Australia. In 1837 mortalities in sheep and goats were recorded at Guildford, on land where "similar losses (were suffered) some years back," and in which "the animals were attacked with staggering fits and were found dead shortly afterwards."

Suspicion was first thrown on a member of the genus Gastrolobium when it was observed that on the occasions that animals ate a certain leguminous plant, they were affected, whereas when they avoided it no losses were sustained. Feeding trials conducted as early as 1839 showed that the observed leguminous plant, almost certainly York road poison, was toxic to stock.

Today, as a result of intensive investigations undertaken over the years into the toxicity of these plants, the number of poison plants of this group stands at 34.

The characterisation or identification of the toxic principle of a poison plant is a necessary prerequisite to other studies on poison plants. The first unsuccessful attempt to isolate the toxic principle in toxic members of the genera Gastrolobium and Oxylobium was made in 1896. It was not until 1964 that the toxic substance mono-fluoroacetic acid was eventually isolated, independently and almost simultaneously, from the Northern Australian wallflower poison and from box poison and rock poison of south-western Australia.

On the basis of the botanical relationship of poison plants, and the characteristic poisoning syndrome displayed by affected stock, there can be little doubt

that the main toxic radical for all members of the group is mono-fluoroacetic acid.

This substance, which has been isolated from the South African gifblaar (*Dichapetalum cymosum)* and other *Dichapetalum* species and from the gigyea (*Acacia georginae*) of Queensland and the Northern Territory, is better known as its sodium salt "1080", the poison widely used in rabbit control.

The toxic radical which may be present in poison plants at all times of the year, and so provide a constant hazard to stock, rises dramatically at the flowering and pod stage, and when the plant is making rapid growth. The sudden and plentiful supply of soil moisture after summer thunderstorms brings about a rapid increase in toxicity.

Much lower quantities of plant material are required during these "flush" periods, to provide lethal doses to stock.

Chemical analyses conducted by the Government Chemical Laboratories have shown that plants like net-leaf poison, thickleaf poison, cluster poison, river poison, box poison and rock poison, may contain over 1,000 parts per million of the toxic radical in terms of sodium fluoro-acetate on an air dry basis. At this level of toxicity 0.88 ounces of plant material is sufficient to kill a 110 lb sheep.

One sample of box poison recently analysed contained 2,500 parts per million of sodium fluoro-acetate.

Brother-brother and kite-leaf poison may each contain over 500 parts per million of sodium fluoro-acetate, while plants with over 100 parts per million of the toxic radical include wodjil poison, York road poison, Roe's poison, prickly poison, berry poison, Stirling Range poison, spike poison, gilbernine poison, heart-leaf poison, hookpoint poison, sandplain poison, Champion Bay poison and woolly poison.

The toxic radical has not so far been detected chemically (less than 30 parts per million) in runner poison, horned poison, bullock poison, Mt. Ragged poison, crinkle-leaf poison, slender poison and *Oxylobium rigidum.*

Variable results have been obtained with several species. For example, box poison collected from different localities has contained 2,500, 1,220, 550, 120 and 100 parts per million of sodium fluoro-acetate. Cluster poison has contained 1,300, 800 and 600 parts per million of the toxic radical while thick-leaf poison has contained 1,350, 150 and 100 parts per million of the toxic radical.

Even within an area of one square chain, variable results have been obtained, with levels of sodium fluoro-acetate ranging from 1,000 to 2,500 parts per million in Box poison and from 100 to 1,000 parts per million in Rock poison.

HOW TO PREPARE PLANT SPECIMENS FOR IDENTIFICATION

1. Collect and consecutively number duplicate sets of specimens. One set should be submitted for identification and the other set retained as a reference collection to check with identifications.

2. Select representative plant material; avoid atypical, damaged or malformed material.

3. Select specimens that are as complete as possible—with stem, leaves and flowers (and fruit if possible).

4. Prepare notes on the plant, its associated plant cover, soil type, topography, location number, etc.

5. Press and dry plant specimens between sheets of newspaper under pressure. Change papers to increase rate of drying and to prevent development of mould growth on specimens.

6. Keep your duplicate set (in newspaper folders) in a dry place. Naphthalene flakes sprinkled over the specimens should keep them free of insect attack.

7. Prepare specimens for mailing by placing individual specimens between sheets of newspaper placed in a cardboard container or between stiff sheets of cardboard. Wrap container or cardboard covers firmly in brown paper and string, and address and mail the parcel with an accompanying letter to the Department of Agriculture.

These variations are due to several factors, not the least of which is varietal differences within the species. For example, in prickly poison the variety *grandiflorum* is more toxic than other varieties.

Variation in toxicity may depend upon the metabolic activity of the plant. Plants showing active growth are generally more toxic than less actively-growing plants. The available fluorine in the soil and the acidity or alkalinity of the soil also affects toxicity, since uptake of fluorine by plants and its conversion to nono-fluoro-acetic acid depends on the amount of fluorine available, while fluorine uptake is enhanced by greater acidity in the soil.

Cattle, sheep, goats, pigs, horses, as well as cats and dogs, are highly susceptible to the toxic radical, whereas certain marsupials and birds are less susceptible. These creatures eat the seeds of poison plants with apparent immunity. Dogs and cats fed on the carcasses of these animals have died in convulsions, through the ingestion of the toxic radical present in their entrails.

Box poison, heart-leaf poison, rock poison, and others which are soft leaved and apparently very palatable to stock present a very serious threat at all times. Prickly poison and bullock poison, which have harsh, prickly and relatively unpalatable leaves, become hazardous to stock only with the appearance of fresh young, and more palatable leaves, or when there is a shortage of other feed. Dried leaves still remain toxic to stock so grubbed bushes should be burnt rather than left for stock to consume.

There is no effective practical antidote for stock poisoned by members of the genera Gastrolobium and Oxylobium.

CONCLUSIONS AND RECOMMENDATIONS

The toxic members of the genera Gastrolobium and Oxylobium are highly dangerous poison plants, by virtue of

- their extreme toxic nature, for which no antidote is available,
- their apparent palatability to stock,
- their wide distribution in the main stock-raising areas of Western Australia.

Farmers are urged to

- learn to recognise the plants,
- avoid exposing stock to the hazards of the plants,
- eradicate all plants, before infested areas are subsequently utilised for stock-raising activities.

Farmers not certain of the identity of a suspected poison plant should not hesitate to submit a specimen of the plant for identification to:—

The Officer in Charge,
Botany Branch,
Department of Agriculture,
Jarrah Road,
South Perth.

33786/2/67—3M

ALEX. B. DAVIES, Government Printer, Western Australia