

## Recent Investigations into the Toxicity of known and unknown Poisonous Plants in the Union of South Africa. VIII.

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### CHENOPODIACEAE.

*Atriplex semibaccata* R.Br. O.P.H. No. 7030; 30.9.30).

*Common name*: Creeping salt bush.

*Origin*: Smithfield.

*State and stage of development*: Wilted and in seeding stage.

The plant was suspected of having poisoned sheep.

#### *Picrate paper test for hydrocyanic acid.*

##### A. *Wilted plant.* (10 gm. used in each test).

(a) Leaves: Strongly positive after 12 hours, discolouration of the picrate paper setting in within half an hour after insertion.

(b) Leaves + chloroform: Negative after 24 hours.

(c) Leaves + emulsin: Same result as in (a)—positive.

##### B. *Plant leaves and stems dried in shade and again tested for the presence of hydrocyanic acid.*

(a) Leaves and stems (5 gm.): Negative after 24 hours.

(b) Leaves and stems plus chloroform: Negative after 24 hours.

(c) Leaves and stems plus emulsin: Strongly positive after 24 hours, discolouration of the picrate paper setting in within half an hour after insertion.

The chloroform and process of air-drying apparently inactivated the enzyme responsible for the liberation of hydrocyanic acid from the cyanogenetic-glucoside.

The air-dried plant (stems and leaves) was drenched to a sheep as follows:—

*Sheep 45360 (4-tooth, 45 Kg.):* 600 gm. in two daily doses on each of the 7.10.36, 8.10.36, and 9.10.36 and 300 gm. on the 10.10.36. Total amount of plant drenched = 2,100 gm.

*Result:* Negative.

As the plant submitted for investigation was found to contain a small amount of hydrocyanic acid we should certainly consider it possible that it may under certain soil and climatic conditions develop dangerous quantities of this poison.

Subsequent to the above experiments a small quantity of seed of the plant was obtained from Dr. M. Henrici, Veld Reserve, Fauresmith, and sown in the poisonous plant garden at Onderstepoort. On the 9th December, 1936, when the plants were about 2-4 in. high and flowering, material (whole plant) was collected at 12 noon on a hot and dry day for purposes of testing for the presence of hydrocyanic acid. There was a slight brownish discolouration of the picrate paper eighteen hours after insertion into the tube. The plants showed no signs of wilting. Unfortunately the amount of plant material available was insufficient to allow of tests to which chloroform and emulsin could be added. The plants are, however, showing good growth and these tests will be conducted from time to time.

#### CRASSULACEAE.

*Crassula expansa* Ait. (O.P.H. No. 6449; 21.9.36).

*Common name:* ———

*Origin:* Wolwefontein, C.P.

*State and stage of development:* Fresh and in the flowering stage.

*Rabbit A (2.0 Kg.):* 50 gm. of the fresh plant per stomach tube on 21.9.36; 50 gm. of the fresh plant per stomach tube on 22.9.26.

*Rabbit B (2.0 Kg.):* 80 gm. of the fresh plant on 21.9.36; 80 gm. of the fresh plant on 2.9.36.

*Sheep 45360 (Full-mouth, 42 Kg.):* 800 gm. of the fresh plant per stomach tube on each of two consecutive days.

*Result:* Negative.

#### EUPHORBIACEAE.

*Acalypha indica* L. (O.P.H. No. 2730; 7.7.36).

*Common names:* Indian Acalypha; Mukta-jhuri (Indian). Native name (N. Transvaal)—Machelikoane.

*Origin:* Vetfontein, Northern Transvaal.

*State and stage of development:* Slightly wilted and in the flowering stage.

*Uses:* According to the British Pharmaceutical Codex (Editorial, 1934) the plant is a gastro-intestinal irritant. In small doses it acts reflexly as an expectorant and in large doses as an emetic. It has been used as a substitute for Ipecacuanha. The natives in the Northern Transvaal use the plant in the treatment of eye-diseases.

*Constituents:* It contains an alkaloid, aacalyphine, and resin, tannin and volatile oil. (Editorial, 1934, and Wehmer, 1929.) Mr. G. Roets, B.Sc., of Onderstepoort found that the plant contains hydrocyanic acid. An article on the cyanogenetic glucoside present in the plant is being prepared by him and Dr. C. Rimington for publication in this Journal.

*Rabbit A (2.0 Kg.):* 10 gm. of the slightly wilted plant per stomach tube at 11 a.m. on the 7.7.36. There was laboured respiration within two hours after drenching.

8.7.36: Apathetic, not feeding, laboured respiration, and accelerated but forceful heart-action.

9.7.36: Died at 7 a.m.

*Post-mortem appearances:* Blood of a dirty chocolate-brown colour and not coagulated; pronounced oedema of the lungs; pronounced fatty degeneration of the liver; gastric mucosa covered with a thick layer of mucus. Stomach contents positive for hydrocyanic acid.

*Rabbit B (2.5 Kg.):* 20 gm. of the slightly wilted plant per stomach tube at 11 a.m. on 7.7.36.

There were pronounced dyspnoea and restlessness within one hour after drenching. The heart-action was very much accelerated and became progressively weaker. Paresis and paralysis also set in commencing in the front-quarters and progressed until the animal was prostrate and unable to rise. Dyspnoea was very pronounced. The animal struggled continuously and died with convulsions, probably due to asphyxia, one and a half hours after drenching.

*Post-mortem appearances:* Blood of an intense chocolate-brown colour and not coagulated; all internal organs of a light dirty-brown colour; pronounced hyperaemia and oedema of the lungs; very pronounced hyperaemia of the gastric mucosa; the mucosa of the stomach and small intestine covered with a large amount of mucus.

*Rabbit C (2.1 Kg.):* 5.0 gm. of the dry plant (dried in shade) per stomach tube daily from 12.8.36 to 27.8.36.

Excepting loss of appetite, no symptoms of poisoning were seen in the animal until one hour after the 5-gram dose administered on the 27.8.36. There were pronounced restlessness, dyspnoea, and general convulsions with the head drawn backwards. Death occurred in a state of paralysis one and a half hours after the last dose on 27.8.36.

*Post-mortem appearances:* Pronounced oedema and slight hyperaemia of the lungs; heart in systole; slight sub-acute catarrhal gastro-enteritis; urine of a reddish colour; blood dark brown in colour and not coagulated. Stomach contents positive for hydrocyanic acid.

*Rabbit D (2.45 Kg.):* 7.5 gm. of the dry plant per stomach tube at 9 a.m. on 12.8.36.

The animal developed symptoms of poisoning similar to those described in rabbits A and B and died fifteen hours after drenching. The post-mortem appearances were also similar. The urine was of an intense reddish-brown colour and fluorescent.

*Rabbit E (2.75 Kg.):* 12.5 gm. of the dry plant per stomach tube at 9 a.m. on 12.8.36.

The animal died one and three-quarters of an hour after drenching. The symptoms and post-mortem appearances were similar to those described above. There was a number of haemorrhagic patches on the gastric mucosa.

*Rabbit F (2.1 Kg.):* 12.5 gm. of the dry plant per stomach tube on 12.8.36.

Death occurred one and a half hours after drenching with symptoms similar to those described above.

*Post-mortem appearances:* As described above and in addition extensive haemorrhage into the duodenal mucosa, which showed pronounced swelling; pronounced hyperaemia of the gastric mucosa.

The dark chocolate-brown heart blood was collected and examined spectroscopically by Dr. J. I. Quin, Professor of Physiology, Onderstepoort. There was no haemolysis and no methaemoglobin bands were detectable. It should, however, be pointed out that owing to the intense dark-brown discolouration of the blood it had to be diluted excessively in order to examine it spectroscopically. It is, therefore, possible that the dark-brown discolouration of the blood was due to the formation of methaemoglobin in spite of the fact that the spectroscopic analysis was negative.

As hydrocyanic acid is not known to cause such an intense dark chocolate-brown discolouration of the blood it was thought that the plant may contain a second, or even a third, active principle causing the discolouration of the blood and the gastro-intestinal irritation. There seems little doubt that the most pronounced dyspnoea seen in the experimental animals is due not only to the toxic effects of hydrocyanic acid but also to the discolouration of the blood, which most probably reduces its oxygen-carrying capacity.

An experiment was therefore planned in order to determine whether the plant freed from hydrocyanic acid was still toxic to rabbits.

The dry plant was ground, mixed with emulsin and moistened. It was then incubated at  $\pm 40^{\circ}$  C. for a few days until only the slightest trace of hydrocyanic was left and again drenched to two rabbits as follows.

*Rabbit G* (2.5 Kg.): 15 gm. of the dried incubated plant on each of four consecutive days.

At no time were any symptoms of poisoning discernible.

*Rabbit H* (1.9 Kg.): 10 gm. of the dried incubated plant on each of four consecutive days.

The animal developed no symptoms of poisoning.

From these results it appears that the active ingredient, or ingredients, responsible for the production of the dark chocolate-brown discolouration of the blood and the gastro-intestinal irritation has also been inactivated by the method applied to expel the hydrocyanic acid from the plant.

#### GRAMINEAE.

##### *Cynodon Transvaalensis* Burt-Davy.

*Common name*: Transvaal kweekgras; quick grass.

*Origin*: Warmbad, Transvaal.

*State and stage of development*: Fresh and flowering.

In spite of the fact that the plants showed no signs of wilting they were found to contain a fair amount of hydrocyanic acid.

*Melica decumbens* Thunb. (O.P.H. No. 14679; 5.3.37).

*Common names*: Dronkgras, Kaapse dronkgras.

*Origin*: Tierhoek, Klipfontein Siding, Cape Province.

*State and stage of development*: Dry and in the seeding stage.

The owner of the farm, Tierhoek, alleges that the above grass is the cause of "dronksiekte" ("intoxication") in his stock. The symptoms described by the owner resemble those seen in cases of poisoning with *Cynanchum africanum*, *Cynanchum obtusifolium* and *Equisetum ramosissimum*, but the owner is convinced that none of these plants are to be found on his farm.

Each of sheep 41929 (6-tooth, 45 Kg.) and 46981 (6-tooth, 47 Kg.) received 4.4 Kg. of the dry grass per stomach tube over a period of twelve days without suffering any ill-effects whatsoever. The animals were chased about at intervals as exertion is known to precipitate the symptoms.

They refused to take the grass voluntarily.

Seed has been collected and will be sown in spring. It is intended to graze animals on the green grass.

##### *Sorghum vulgare* Pers.

*Common names*: Kafferkooring, kaffir corn, broom corn, shallu, durra, sorghum.

*Origin*: Vryburg, Cape Province.

*State and stage of development*: Dry immature and mature seed heads.

*Hydrocyanic acid test (picrate paper).*

(a) *Stalks.*

- (1) Stalks (10 gm.): Negative after 24 hours.
- (2) Stalks (10 gm.) plus emulsin: Positive after 24 hours.

(b) *Seed (mature and immature).*

- (1) Seed (10 gm.): Negative after 24 hours.
- (2) Seed (10 gm.) plus emulsin: Negative after 24 hours.

LEGUMINOSAE.

*Canavalia ensiformis* D.C. (O.P.H. No. 7007; 9.10.35).

*Common names:* Swaardboontjies; sword bean.

*Origin:* Mr. B. van der Vyver, Government Veterinary Officer, Pretoria, submitted a small quantity of the mature beans and wished to know whether the plant could be utilised *ad lib.* as a stock feed.

*Ox 7063* (1 year old; 177 Kg.) and *Ox 7133* (1 year old; 162 Kg.) These animals were fed with the entire plant in the fresh state. Feeding was commenced when the plant was in the early flowering stage and continued until the pods were almost mature.

The animals ingested 275 Kg. and 310 Kg. of the fresh plant respectively in a period of forty days. At no time was there any evidence that the plant exerted detrimental effects on the health of the animals. On the contrary, in spite of the fact that they took no additional feed they grew well and gained in weight.

At the commencement of the experiment ox 7063 did not take the plant too well, whilst ox 7133 relished it right from the first day.

It should be mentioned that some years ago the author fed the mature beans to a young bovine. The animal ingested 22 Kg. in a period of three weeks without suffering any ill-effects.

The following figures are quoted from Wehmer (1929):—

- (a) *Seed:* 8.13 per cent. water; 22.7-26.8 per cent. protein; 2.6-3 per cent. fat; 1.1-6.6 per cent. cellulose; and 2.25-3.83 per cent. ash.
- (b) *Pods:* 35.7 per cent. protein; 10.2 per cent. cellulose; 2.45 per cent. fat; and 3.33 per cent. ash.

*Medicago sativa* L.

*Common names:* Lusern; lucerne; alfalfa.

*Origin:* Plant material for the tests was collected from a small patch of lucerne growing on red sandy soil in a private garden (House No. 36) at Onderstepoort. For a period of eight days prior to the date on which the under-mentioned tests were made the weather was very hot and dry with the result that the lucerne, which was in the early flowering stage, showed signs of wilting.

*Hydrocyanic acid test (picrate paper).*

Specimens of the wilted lucerne picked at 10 a.m. on 8.11.36 and tested immediately showed the presence of fair amounts of hydrocyanic acid. Tests conducted with specimens of fresh lucerne collected from the same plot a few days after heavy rains had fallen were, however, negative.

It, therefore, appears that lucerne, like so many other plants (Gramineae, etc.) is likely to develop hydrocyanic acid during the process of wilting. Further experiments are in progress at Onderstepoort in order to go more fully into this phenomenon. The various Agricultural Colleges in the Union of South Africa have kindly agreed to co-operate in this matter and it is hoped that with their assistance and collaboration we will be able to collect valuable information. It may prove that death caused by lucerne is not always due to hoven as such, but that, in some cases at least, hydrocyanic acid may be a contributory factor. It is well known that hoven is a typical symptom of poisoning with this acid.

*Tephrosia macropoda* E. May. (O.P.H. No. 6139; 11.9.36).

*Common Names:* Zulu—iHlozana, iLozana, u Qwengu. Used as a fish poison by Natives.

*Origin:* Kelso Junction, Natal.

*State and stage of development:* Wilted and in the flowering stage.

The plant is suspected of having caused death in sheep.

*Hydrocyanic acid test (picrate paper).*

5.0 gm. of the wilted leaves plus emulsin caused dark reddish-brown discolouration of the picrate paper within six hours.

It is, therefore, possible that the plant may under certain conditions cause hydrocyanic acid poisoning.

*Tephrosia Vogelii* Hook.

*Common names:* Fish-bean.

*Origin:* Onderstepoort Poisonous Plant Garden.

*State and stage of development:* Fresh and in the pre-flowering stage.

*Hydrocyanic acid tests (picrate paper).*

- (1) Fresh plant: Negative after 24 hours.
- (2) Fresh plant+chloroform: Negative after 24 hours.
- (3) Fresh plant+emulsin: Negative after 24 hours.

Tests will be made with the plant in the wilted state.

## LILIACEAE.

*Ornithogalum Pretoriense* Bkr. (O.P.H. No. 10198A; 7.12.36).

*Common names:* ———.

*Origin:* Meyerton, Transvaal.

*State and stage of development:* Fresh bulbs and leaves in the post-flowering stage.

*Rabbit A* (1.9 Kg.): 60 gm. of the fresh bulbs and leaves per stomach tube on each of two consecutive days.

*Rabbit B* (2.15 Kg.): 120 gm. of the fresh bulbs and leaves per stomach tube on each of two consecutive days.

*Result:* Negative.

This plant has in the past been repeatedly drenched to sheep and rabbits with negative results.

*Urginea* sp. (O.P.H. No. 5603; 23.9.36).

*Common names:* ———.

*Origin:* Sekukuniland, Transvaal. Per Mr. A. O. D. Mogg, Botanist, Division of Plant Industry.

*State and stage of development:* Fresh bulbs with no leaves, flowers or seed.

The fresh bulbs were finely minced and then forced through a press with fair-sized holes (meshes). The expressed juice was dosed to rabbits.

*Rabbit A* (2.2 Kg.): 40 gm. of the above juice on each of two consecutive days.

*Rabbit B* (2.4 Kg.): 100 gm. of the above juice on 23.9.37. Within two hours after drenching the animal developed transient symptoms of general weakness.

24.9.37—appears normal. It received another 100 gm. of the above juice.

*Result:* Negative.

Some of the bulbs were minced and dried and drenched to rabbits as follows:—

*Rabbit C* (2.2 Kg.): 10 gm. of the dry bulbs (=approximately 17 gm. fresh bulb) on each of two consecutive days.

*Rabbit D* (2.05 Kg.): 20 gm. of the dry bulbs on each of two consecutive days.

*Result:* Negative.

*Sheep* 44141 (*Full-mouth*; 46 Kg.): 400 gm. of the fresh bulbs at 9 a.m. and 400 gm. at 3 p.m. on 7.10.36.

8.10.36—8 a.m., pronounced diarrhoea; laboured respiration; not feeding; heart-action normal; temperature 104° F. Another 800 gm. of fresh bulbs in two doses.



9.10.36—8 a.m., pronounced diarrhoea; laboured respiration; accelerated and strong pulse; slight apathy; losing in condition; temperature 104° F. Another 800 gm. of the fresh bulbs in two doses.

10.10.36—Condition as on 9.10.37; temperature 103° F.

11.10.36—Condition as on 9.10.37; temperature 102° F.

12.10.36—Animal feeding; diarrhoea less severe; heart-action normal. The animal appeared in normal health again on the 16.10.36.

#### PAPAVERACEAE.

##### *Argemone mexicana* L.

*Common names:* Steekbossie; bloudissel; Bathurst burweed; Mexican poppy; prickly poppy; Texas poppy; yellow poppy; devils fig. Erroneously called "Scotch Thistle".

*Origin:* Cultivated lands, Onderstepoort, Transvaal.

*State and stage of development:* Fresh and in the pre-flowering stage.

*Sheep 43795 (Full-mouth; 45 Kg.):* 300 gm. of the fresh plant on each of three consecutive days.

*Sheep 44141 (Full-mouth; 46 Kg.):* 800 gm. of the fresh plant on each of three consecutive days. Total amount of plant drenched = 2,400 gm.

*Result:* Negative.

Seddon and Carne (1927) report that the plant is not toxic to sheep. They fed 4 lb. of the green leaves to a sheep in twelve days and 1 lb. of the green fruiting heads to another sheep in eight days with negative results. Furthermore a sheep, which was drenched with crude aqueous extracts of the green leaves and fruiting heads (2 lb. equivalent) suffered no ill-effects.

#### POLYGONACEAE.

##### *Rumex ecklonianus* Meisn. (O.P.H. No. 8730; 8.12.36).

*Common names:* Tongblaar, dock.

*Origin:* Rooispruit, Cape Province.

*State and Stage of development:* Dry and in the flowering stage.

*Rabbit A (1.8 Kg.):* 10 gm. of the dry plant on each of eight consecutive days.

*Rabbit B (2.3 Kg.):* 20 gm. of the dry plant on each of eight consecutive days. The total amount of dry plant drenched was 160 gm.

*Result:* Negative.

#### SUMMARY.

Chemical tests and drenching and feeding experiments were conducted with fourteen different plants.

It is significant that hydrocyanic acid was detected in specimens of wilted *Medicago sativa* L. (lucerne), *Tephrosia macropoda* E. Mey (fish poison); and *Atriplex semibaccata* R.Br. (creeping salt bush), whilst none was detected in fresh specimens of these plants. The possibility of hydrocyanic acid poisoning through the eating of these plants in the wilted state must, therefore, be considered.

No hydrocyanic acid was detectable in fresh specimens of *Tephrosia Vogelii* Hook.

*Acalypha indica* L. is a deadly poison, the active principles being hydrocyanic acid (cyanogenetic glucoside) and a substance causing intense dark chocolate-brown discolouration of the blood, and gastrointestinal irritation.

Large amounts of bulbs of an *Urginea* sp. (O.P.H. No. 5603; 23.9.36) caused transient symptoms of poisoning in a sheep.

The results of feeding and drenching experiments conducted with the following plants were negative:—

- Crassula expansa* Ait.
- Melica decumbens* Thunb.
- Canavalia ensiformis* DC.
- Ornithogalum Pretoriense* Bkr.
- Argemone Mexicana* L.
- Rumex ecklonianus* Meisn.

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