

Plant Poisoning in Stock and the Development of Tolerance.

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TRANSVAAL SLANGKOP (*Urginea Burkei* BAKER).

In previous experiments (Steyn 1932, 1933 and 1934) it was found that animals develop a tolerance to *Chrysocoma tenuifolia* Berg and *Centaurea picris* D C., whilst *Asclepias physocarpa* Schltr. and *Dichapetalum cymosum* (Hook.) Engl. had cumulative effects. The two latter plants appeared to induce sensitisation in some animals.

It is well known that stock reared in *slangkop* areas never, or rarely, partake of the plant unless they are forced to do so owing to scarcity of edible vegetation. On the other hand, stock newly introduced into such areas very frequently fall victims to poisoning with the plant.

Some stock-owners maintain that stock reared on *slangkop* veld eat the plant with impunity. If this statement were true it would mean that animals, which repeatedly partake of non-toxic amounts of the plant, develop a tolerance to it.

In order to investigate this possibility, it was intended to conduct an experiment on the following lines:—

A. Seven Rabbits.

Each to receive:—

0·25 gm. (i.e. $\frac{1}{16}$ M.L.D.) dry bulb three times weekly for two weeks.

0·5 gm. (i.e. $\frac{1}{8}$ M.L.D.) dry bulb three times weekly for two weeks.

1·0 gm. (i.e. $\frac{1}{4}$ M.L.D.) dry bulb three times weekly for two weeks.

B. Seven Rabbits.

Each to receive:—

0·5 gm. (i.e. $\frac{1}{8}$ M.L.D.) dry bulb three times weekly for two weeks.

1·0 gm. (i.e. $\frac{1}{4}$ M.L.D.) dry bulb three times weekly for two weeks.

1.5 gm. (i.e. $\frac{3}{20}$ M.L.D.) dry bulb three times weekly for two weeks.

The tolerance test was to be conducted ten days after the animals had received the last dose of *slangkop*.

In the course of the experiment it was, however, found that the above programme had to be modified.

The following table embodies the result of the experiment conducted in order to ascertain whether these animals are capable of developing a tolerance to *slangkop*:—

TABLE.—TOLERANCE EXPERIMENT—SLANGKOP.

Rabbit No.	Weight in Kg.	Amount of dry slangkop bulb given per Kg. body-weight.	Result.
I	1.75	0.25 gm. on 6/11/33, 8/11/33, 10/11/33, 13/11/33, 20/11/33, 25/11/33, 27/11/33, 29/11/33, 2/12/33, 4/12/33, 6/12/33, 8/12/33, 11/12/33, 13/12/33, 18/12/33, and 20/12/33	<i>First tolerance test on 27/12/33 (N.B.—Only 9/16 M.L.D. given):—Severe symptoms of poisoning three hours after drenching. Recovered after two days.</i> <i>Second tolerance test on 22/1/34 (N.B.—Only 9/16 M.L.D. given):—Same result as on 27/12/33.</i>
II	1.7	Ditto.	<i>First tolerance test on 27/12/33 (N.B.—Only 9/16 M.L.D. given):—Same result as in Rabbit No. I.</i> <i>Second tolerance test on 22/1/34 (N.B.—Only 9/16 M.L.D. given):—Same result as in rabbit No. I.</i>
III	2.45	Ditto.	Treated in same way as rabbits I and II with same result.
IV	2.18	Ditto.	<i>First tolerance test on 27/12/33 (N.B.—Only 9/16 M.L.D. given):—Died fifteen hours after drenching.</i>
V	2.8	Ditto.	Died on 15/11/33, before tolerance test was conducted.
VI	1.8	Ditto.	<i>First tolerance test on 27/12/33 (N.B.—Only 9/16 M.L.D. given):—Died 9 hours after drenching.</i>
VII	1.9	Ditto.	Treated in same way as rabbits I and II with same result.
VIII	1.8	0.8 gm. on dates given above	<i>First tolerance test on 27/12/33 (N.B.—Only 9/16 M.L.D. given):—Died 4 days after drenching.</i>
IX	1.85	Ditto.	Treated in same way as rabbits I and II with same result.
X	2.4	Ditto.	Treated in same way as rabbits I and II with same result.

TABLE.—TOLERANCE EXPERIMENT—SLANGKOP. (*Continued.*)

Rabbit No.	Weight in Kg.	Amount of dry slangkop bulb given per Kg. body-weight.	Result.
XI	2.4	Ditto.	<i>First tolerance test on 27/12/33 (N.B.—Only 9/16 M.L.D. given):—Died three days after drenching.</i>
XII	1.8	Ditto.	Died at 4 p.m. on 14/12/33, before tolerance test was conducted.
XIII	2.1	Ditto.	Died on 19/11/33 from purulent pleuritis and pneumonia.
XIV	2.0	Ditto.	<i>First tolerance test on 27/12/33 (N.B.—Only 9/16 M.L.D. given):—Developed severe symptoms of poisoning but recovered after 3 days.</i> <i>Second tolerance test on 22/1/34 (N.B.—Only 9/16 M.L.D. given):—Died about fifteen hours after drenching.</i>

The *slangkop* bulbs, which were collected in the vicinity of Hamanskraal, Pretoria District, were in the post-flowering stage. No leaves were present. The bulbs were sliced, dried in the sun, and ground to a fine powder, which was vigorously shaken in a closed vessel in order to achieve an equally distributed toxicity. In a duplicated experiment in which twelve rabbits were employed the M.L.D. of this powder per Kg. rabbit was found to be 4.0 gm. All the rabbits in the tolerance experiment exhibited slight symptoms of poisoning (loss of appetite, slight paresis, apathy, accelerated heart-beat and respiration) after they had received the first four doses. Consequently drenching was discontinued for seven days.

In the above table the following points are noteworthy:—

A. Rabbit V died with symptoms of *slangkop* poisoning after it had received a total of 1.0 gm. *slangkop* (=approximately 1/11 M.L.D.) in four doses in the course of seven days. The post-mortem appearances resembled those seen in *slangkop* poisoning in rabbits. This animal apparently possessed a highly developed idiosyncrasy for the plant or had become sensitised.

B. When the tolerance test was conducted the amount of powdered bulb that had to be administered was too large for one dose. Accordingly the total dose for each rabbit, which amounted to $1\frac{1}{2}$ M.L.D., was divided in two equal parts which were to be administered at an interval of four hours. As three hours after administration of the first dose ($=\frac{9}{16}$ M.L.D.) all animals developed symptoms of poisoning the remaining half of the M.L.D. was not given. Rabbits IV, VI, VIII and XI succumbed to the effects of $\frac{9}{16}$ M.L.D., whilst the remaining animals (I, II, III, VII, IX, X and XIV) recovered after having exhibited severe symptoms of poisoning. Twenty-six days after this tolerance test the seven animals, which had recovered, again received $\frac{9}{16}$ M.L.D. *slangkop* with the result that No. XIV died, whilst the remaining six recovered a few days after having shown severe symptoms of poisoning.

From the above results it is apparent that the active principle of *slangkop* has a tendency to accumulate in the body. It is also possible that in addition to having a cumulative effect repeated doses of non-toxic amounts of *slangkop* cause progressive damage in the heart (and possibly in the central nervous system) thus rendering the animal more susceptible to the poison.

SYMPTOMS OF SLANGKOP POISONING IN RABBITS.

The first discernible symptoms in cases of acute poisoning are restlessness, accelerated respiration and a slowed but forceful heart-beat. These are soon followed by diuresis, apathy, paresis and paralysis. At this stage the animals lie on their sides unable to move, the heart-beat being extremely accelerated and weak, and the respiration laboured. In many cases diarrhoea is present. Death may occur with convulsions.

In less acute cases, for example in the case of rabbits V, VIII, XI and XII, the animals die suddenly, apparently from heart failure, without having exhibited any striking symptoms, or they may remain in a paralytic state for days before recovery sets in or death occurs.

POST-MORTEM APPEARANCES.

Per-acute and acute cases.—Pronounced dilatation of both heart ventricles; pronounced hyperaemia of, and haemorrhages in, gastro-intestinal mucosa; hyperaemia of all parenchymatous organs; oedema of lungs (rare).

Sub-acute cases.—Marked hydroperitoneum and hydrothorax (rare); hyperaemia and oedema of the lungs; pronounced dilatation of both heart ventricles; catarrhal gastro-enteritis. A number of cases showed no signs of any gastro-intestinal irritation.

SUMMARY.

From the results of experiments conducted upon fourteen rabbits it appears that repeated ingestion of small amounts of *slangkop* does not induce the development of tolerance but that the plant has cumulative effects. What has been said about *gifblaar* (Steyn, 1934) in this respect, is also applicable to *slangkop*.

As the active principle of *slangkop* belongs to the *digitalis series* the above findings are not at all surprising.

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