Tulp Poisoning.

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Synonyms.—All the different species of Homeria and Moraea known under the common name of " tulp " (tulip).

Introduction.

The name tulp includes a large number of Homeria and Moraea species. It is a stock poison well known to farmers and transport-riders. There are fifty or more tulp species. of which only three have been definitely proved toxic, viz.: (1) *Homeria pallida*, Baker, (2) *Moraea polystachya*, Ker, and (3) *Moraea spathacea*, Ker.

In 1900 Borthwick and Dixon were instructed to carry out feeding experiments with *Moraea polystachya* and another tulp variety, probably *Moraea tenuis*, and they were the first to prove that these two plants were definitely toxic to cattle, although the farmers have always regarded all the tulp species as being poisonous to stock.

Historical.

As generally is the case with poisonous plants in South Africa, investigation as regards poisoning by the different species has been sadly neglected in the past. A number of Moraea species from different parts of the country have been fed to animals, but up to the present time these varieties have not been identified. A large number of feeding experiments are still to be carried out in order to fill the gaps in our knowledge of the tulps. Even before 1900 Hutcheon referred to the poisonous nature of the tulps, and in 1900 he described the symptoms of tulp poisoning as follows:—"An acute gastro-enteritis accompanied by great nervous prostration, the affected animals dying generally in a state of collapse. In those animals which survive the toxic effect of the plant, inflammation of the bile ducts of the liver generally supervenes." He further described the post-mortem appearances as being " an acute gastro-enteritis, hæmorrhagic spots on the mucous membrane of the gall bladder, subendocardial hæmorrhages in the right ventricle, and hyperaemia of the brain, which contained a large quantity of serous fluid at its base."

Another reference is that of Walsh (1909) describing the two tulp species *Homeria collina*, Vent (groot tulp), and *Moraea spathacea* (klein tulp), their symptoms of poisoning and the treatment.

Marloth (1913) treated the tulps from a chemical point of view, and stated that nothing is known about the active principle nor of their antidotes.

Stent and Curson (1922) in their pamphlet described *Homeria pallida*, Baker, and the Moraeas generally, and also discussed the toxic principle, the eradication, symptoms of poisoning, post-mortem appearances, and the treatment.

Rindl (1924) investigated the toxic principle of *Homeria pallida*, and found a poisonous alkaloid, but was unable to obtain it in a form suitable for chemical analysis. He suggests the name Homeridine for this apparently new alkaloid.

At Onderstepoort feeding experiments with tulp poisoning were carried out by Theiler, Du Toit, and Curson, and at the Allerton Laboratory, Pietermaritzburg, by Mitchell. The Director is continuing the feeding experiments at Onderstepoort in order to ascertain whether all the tulp varieties are poisonous or only some of them.

Description.

The following is an extract from the pamphlet by Stent and Curson (1922):—

Homeria pallida (Transvaal yellow tulp) Root stock:—A whitish corm (bulb) from ½ to 1 inch in diameter, covered with a network of dark brown fibres; single leaf produced from the base of the stem, long, rigid, and strongly ribbed, about ½ inch broad or narrower and from 1½ to 3 feet long, and often with a number of bulbils in the axils. Stem: Usually about 1 foot high, but sometimes taller, bearing clusters of flowers on the upper half, each cluster surrounded by and exserted from tightly-rolled green spathes (sheaths), which are finely ribbed and up to 2 inches long.

Flowers—yellow—the sixth perianth segments (petals) about the same size and shape, equally spreading and finely spotted at the base. The filaments (threadlike stalks) of the stamens united into a slender column, the three anthers pressed against the back of the three style branches, which are yellow, and resemble small, narrow, and deeply-cleft petals. The club-shaped fruit has three cells, and contains numerous angled brown seeds. The Cape *Homeria collina* and its varieties and *Homeria elegans* resemble *H. pallida* very closely, but the flower of the Cape species is usually of a reddish tinge or sometimes quite red, with conspicuous darker blotches at the base of the petals.

The Moraeas range in colour from purple, mauve, and blue to shades of yellow and red. The shape of their flowers resemble the garden iris or flag lily. The petals are usually much narrowed in the lower half and reflexed from about the middle, the inner three being often narrow and less high coloured than the three outer, and the petal-like branches of the style are larger than those of Homeria.

Distribution of Tulps.—Homeria pallida occurs in the Transvaal, Orange Free State, and Bechuanaland. A species resembling it very closely and producing the same symptoms has been found in Natal. *Homeria collina* and its varieties and *Homeria elegans* are found in the Cape Province. The Moraeas occur in practically every district of the Union. The tulps generally occur in vleis and along river banks, water-furrows, and streams.

Season.—They appear in early spring, the long grasslike leaf appearing first, which is soon followed by the stem bearing the fragile yellow flowers. Among these plants one often finds a number with very fine threadlike leaves and very small bulbs. These are the seedlings, which some farmers regard to be more poisonous than the older plants.

Toxicity.—There is no doubt that there is a difference in the toxicity of the different tulp varieties, and it is well known that *Homeria pallida* (the Transvaal yellow tulp) is one of the most toxic

tulps. Like all the other poisonous plants, the toxicity of the same variety of tulp is liable to vary according to the locality, stage of growth, and climatic conditions under which it grows.

All animals are susceptible to tulp poisoning when fed with the plant, but under natural conditions cattle, sheep, goats, and donkeys are most liable to tulp poisoning, whereas horses very seldom or never eat tulp under natural conditions.

Moraea collina bulbs have also caused death in human beings. It has also been proved that all the parts of tulp are poisonous as well as that there is no difference in the toxicity of *Homeria pallida* whether dry or green, thus care should be taken that no tulps be mixed with hay.

In the veld, tulp poisoning occurs most often in dry seasons, as the green leaves of the tulps appear before any other veld vegetation.

As regards the toxicity of the tulps, it has already been mentioned that *Homeria pallida* is one of our most toxic tulps, as is clear from the following illustration. Four to eight ounces of *Homeria pallida* is sufficient to kill an ox within twenty-four to forty-eight hours after ingestion, whereas of *Moraea polystachya* at least 1½ lb. is required to cause this fatal effect in cattle; 1 lb. of the latter tulp variety only causes a pronounced diarrhoea, the animal again recovering after a few days. Furthermore, experiments have been carried out with a variety of tulp (Moraea) collected in the vicinity of Port Elizabeth, and even quantities as big as 10 lb. fed within four days caused no symptoms, whereas 7½ lb. fed in one day caused stiffness in the hind-legs and micturition. These symptoms disappeared after nine days.

Toxic Principle.—Very little is known about the toxic principle in the different varieties of tulp. In 1900 Macowan stated that the poison of Moraea resembles that of Scilla (Scilliline).

Rindl, who investigated the toxin in *Homeria pallida,* found it to be an alkaloid which is soluble in water, alcohol, ethyl acetate, and chloroform, and suggested the name Homeridine for this new alkaloid.

The following may be quoted from his article (1924):—

"Although the attempts to obtain the alkaloid or a derivative in a form suitable for chemical analysis were abortive, it should be remembered that the amount available was extremely small, and it is quite possible that positive results may be achieved when working with larger quantities.

" In spite of the fact that it was not possible to characterise the alkaloid chemically, and although at the present stage it is impossible to assign a definite formula to it, the physiological results are so marked that it would appear to be an alkaloid new to science."

Methods of Feeding.—None of the animals in experiment, except a few bovines, would eat tulp voluntarily, so they had to be starved for a period of twenty-four hours, and then received the tulp chopped up and mixed with lucerne, boermeal, green barley, etc. Even these mixtures were not taken by some horses and sheep, in which cases the animals were drenched with a diffusion of the plant.

Symptoms (Theiler, Du Toit, and Curson).—As has been stated previously, cattle, donkeys, goats, and sheep are mostly susceptible to tulp poisoning under natural conditions, whereas horses never, or very seldom, eat the plant voluntarily. The nature of the symptoms depends on (*a*) the variety of tulp and (*b*) the quantity ingested; and

as is the case with all poisons, the symptoms start sooner after ingestion and are more marked when the animals drink water after having eaten the plant.

A sheep ingesting ½ lb. of *Homeria pallida* starts showing symptoms as soon as half an hour after ingestion, and dies within an hour's time. Smaller quantities of this tulp variety may only cause a diarrhoea, the animal again recovering after a few days, or the animal may die after two or three days, having gone down tremendously in condition.

Cattle (Theiler, Du Toit, and Curson).—Non-lethal quantities of tulp cause inappetence, stiffness in the hindlegs, passing of a lot of urine in short intervals, abdominal pain, and diarrhoea, the animal recovering after a few days of illness. It has often happened that transport-riders have lost a number of oxen within a few hours after they have outspanned and allowed the animals to graze in vleis where tulp was prevalent. When lethal quantities of tulp have been ingested the symptoms start with abdominal pain, which manifests itself by the groaning of the animal, the grinding of the teeth, looking round at the hindquarters, and by passing small quantities of urine at short intervals. A little later on these symptoms are followed by a diarrhoea varying in degree from slightly fluid to bloody. The pulse, which at first is strong, hard, and accelerated, later on becomes very weak and even imperceptible. The respiration is superficial and hurried. Very often the animals at first show a rise in temperature, which on account of the profuse diarrhoea drops below normal.

The above symptoms are accompanied by general weakness and depression, the animal standing with an arched back and the abdomen "tucked up," the coat staring, and the ears and limbs cold. The weakness steadily increases until the patient is unable to rise. Lachrymation and tympany are symptoms often seen in tulp poisoning. Very often nervous symptoms, such as muscular twitchings, marked dullness, and stertorous breathing can be seen. The animal dies in a state of collapse, still passing liquid or blood-stained faeces every few minutes.

The most constant symptoms of tulp poisoning are colic, diarrhoea, tympany, and dullness. Very often the animals show marked thirst, and if they live for a few days there is a marked loss in condition.

Horses, Mules, and Donkeys (Theiler, Du Toit, and Curson).—The symptoms resemble those in cattle very closely. The symptoms of colic are very severe, pulse and respiration are accelerated, and a yellowish green fluid diarrhoea supervenes. The animals may show icterus due to the swelling and consequent obstruction of the duodenal opening of the bile duct, thus causing stagnation of the bile. This condition may also be found in cattle provided they survive long enough. The affected animals show an increasing dullness, standing with a drooping head. The weakness increases and the animals, like cattle, die in a state of collapse.

Sheep and Goats (Theiler, Du Toit, and Curson).—The symptoms of poisoning are identical with those of cattle.

Dogs, Guinea-pigs, and Rabbits.—No experiments have been carried out with these animals. *Chronic cases* of tulp poisoning have not yet been established. Theiler fed cattle and horses with hay containing tulp for a period of two months with no results.

Post-mortem Appearances.

Cattle (Theiler, Du Toit, and Curson).—The most constant post-mortem appearance is an acute gastro-enteritis, which may vary in degree from a slight catarrhal to a marked hæmorrhagic. Furthermore, there can be present subepicardial and subendocardial hæmorrhages, congestion of the brain, hyperaemia and oedema of lungs and kidneys, hæmorrhages in spleen and thymus.

Horses, Donkeys, and Mules (Theiler, Du Toit, and Curson).—Hydropericardium, gastro-enteritis, hæmorrhages in spleen, and congestion of the brain.

Sheep and Goats (Theiler, Du Toit, and Curson).—Subepicardial and subendocardial hæmorrhages, hydrothorax, hyperaemia, and oedema lungs, gastro-enteritis varying in degree from slight catarrhal to hæmorrhagic, and congestion of the brain.

Microscopical Pathological Anatomical Diagnosis.—No specimens examined up to the present time.

Differential Diagnosis.

1. *Anthrax.*—In peracute cases of tulp poisoning where the animals are found dead in the veld anthrax must be excluded, which can be done by the examination of blood-smears. Furthermore, tulp will be prevalent in the veld.

2. *Gifblaar Poisoning.*—Diarrhoea, which is very marked in tulp poisoning, is a very rare symptom in gifblaar poisoning. Furthermore, the locality and time of the year will exclude or confirm gifblaar poisoning, as it is poisonous in spring and autumn only, whereas tulp is toxic throughout the year.

3. *Slangkop Poisoning.*—In cases of slangkop poisoning there is a profuse diarrhoea as in tulp poisoning, but when affected animals are available for examination a valuable symptom of differentiating between the symptoms caused by these two plants is that the pulse rate in slangkop poisoning is reduced to about half the normal rate, whereas in tulp poisoning the pulse rate is increased.

4. *Arsenical Poisoning.*—In cases of arsenical poisoning a profuse diarrhoea also supervenes as is the case in tulp poisoning, but the anamnesis, the examination of the veld, and the chemical analysis of the liver and stomach contents will allow of a correct diagnosis being made.

Treatment.

The treatment is purely symptomatic. The animal must be prevented from consuming any more of the plant, and further absorption of the poisonous material must be prevented by using the stomach tube and by administering a rapid-acting purgative, e.g. arecoline subcutaneously. Furthermore, demulcents such as linseed oil should be given, and the animals should be kept away from water. In order to stimulate the elimination of the poison, large quantities of physiological solutions of common salt intravenously and diuretics should be given. Digitalis preparations can be used as heart stimulants. Nervous depression can be treated with brandy or ether given in water.

Farmers usually administer large doses of decoctions of mimosa bark or other bushes, all of which have astringent effects on the bowels, thus inhibiting the absorption of the toxic material.

Prevention.

As is the case with all diseases, prevention is better than cure. There are three possibilities to prevent tulp poisoning, viz.: (*a*) proper herding of the animals so as to keep them away from the tulp-infested parts of the farm; (*b*) fencing in of the tulp areas, and (*c*) eradicating the tulp.

As regards the herding and fencing in of the infected areas, this can only be done with success when the tulp occurs in patches and when these patches are limited in number, otherwise the fencing in of these patches would decrease the carrying capacity of the farm to a considerable extent.

Eradication by means of digging up the tulp is impossible where the plant grows over rocky hillsides. In this case the eradication by means of arsenical preparations as advised by the Department of Agriculture may be tried.

In conclusion I take the opportunity to express my thanks to Dr. H. H. Curson for reading through this article and making a few valuable suggestions.

TULP LITERATURE.

(1) *Hutcheon, D.* "The Poisoning of Stock by Tulp (*Moraea polystachya*)." *The Agricultural Journal of the Cape of Good Hope*, Vol. XVII, 1900, p. 84.

(2) *Rindl, M.* "Preliminary Note on a Poisonous Alkaloid from the Overground Portions of the Transvaal Yellow Tulp (*Homeria pallida*)." Transactions of the Royal Society of South Africa, Vol. XI, p. 251, 1924.

(3) *Stent, S. M.*, and *Curson, H. H.* "Poisonous Plants of South Africa." Bulletin No. 6 of Department of Agriculture, 1922.

(4) *Curson, H. H.* "Some little known South African Poisonous Plants and their effects upon Stock." Tropical Veterinary Bulletin, Vol. XIV, p. 79, 1926.

(5) *Walsh, L. H.* "South African Poisonous Plants" (p. 40). T. Maskew Miller. Capetown, 1909.

(6) *Marloth, R.* "The Chemistry of South African Plants and Plant Products," p. 5 and 16. Capetown, 30th May, 1913.