

## NOTES ON CROTALARIA BURKEANA AND OTHER LEGUMINOSE PLANTS CAUSING DISEASE IN STOCK.

BY JOSEPH BURTT-DAVY, F.L.S., F.R.S.S.A., Government  
Agrostologist and Botanist, Transvaal.

*Crotalaria burkeana* Benth., family Leguminosae, is a native of the Transvaal, and has for many years been recognized by stock farmers as the cause of a disease of stock known as stijfziekte; in fact the plant is known in the vernacular as the "stijfziekte bosje". It is also called "klappers" from the character of the somewhat horny pods in which the seeds rattle about. I called attention to the dangerous character of this plant in my annual report for 1903-04 (1).

*Symptoms.*—The following reports have been furnished as to the symptoms produced by feeding on *Crotalaria*. "It is said to paralyse or stiffen the limbs of cattle" (14). "About five days after a beast has eaten this plant it becomes very stiff in its joints and frequently is unable to stand. It is not fatal, however. A further development takes place in that the hoofs begin to grow, until at times they break off, making oxen almost useless for trekking for a long time" (13). "After eating these bushes cattle become almost too stiff to walk, and, in many bad cases, after some time they are not able to stand on their legs. In all cases, except when very mild, their hoofs grow long and make it very awkward for them to move about" (15). "The animals get perfectly stiff in their fore legs, and, if not attended to, will lie down and are unable to rise again" (16). The cause of lameness is not stiffness of the joints, but laminitis, i.e. inflammation of the sensitive laminae (17).

*Stock not always affected.*—Mr. C. McG. Johnston reports that in the Hoopstad District cattle appear to graze among *Crotalaria* without being in any way affected by it, year in and year out (19). Mr. B. Burger, Widdenin, Bultfontein, Orange Free State, reports that the plant does not affect cattle that are used to it.

*No effect on Goats.*—It is stated by farmers that this plant has no effect on goats (20). The same fact has been noted in the case of *Cytisus proliferus* in the Canary Islands (6).

*Local remedies.*—Although they are often empirical, it is well to take note of local remedies, as they sometimes throw an indirect light on problems. "The only thing that I have noticed helps them a little is to outspan as soon as one sees that they are affected. I should be very pleased to get some remedy" (15). The South African farmer is fond of homoeopathic remedies, and this disease is no exception to their rule that "like cures like"; one correspondent wrote that "as a cure the same shrub is taken and boiled in water, a sufficient quantity to fill a quart bottle is given, and they are right in a few days". Another reported that a good remedy

is to make the beast swim several times, after which it gradually gets better. One tablespoonful each of turpentine, paraffin, and raw linseed oil has also been recommended (18).

*Feeding tests.*—Difficulty was experienced in securing enough material for a feeding test; when at length sufficient was obtained, it was sent to *Dr. Theiler*. Six and a half pounds of the dried plant were fed to four bastard sheep under the supervision of Government Veterinary Surgeon Johnston in April, 1906, but no results were obtained. The material was somewhat mouldy, having been delayed in transit from the Free State. Mr. Johnston suggested the possibility that the toxic properties might have escaped during the process of evaporation, which reduced the weight of the parcel from 10 lb. to 6½ lb. In the case of *Crotalaria sagittalis*, however, the dry hay is equally liable to cause the disease. It seems possible that the bastard sheep is, like the goat, more or less immune to some toxins, as was suggested at the time by Stock Inspector Everitt.

Reports continued to come in from farmers to the effect that this plant caused loss of stock. Owing to the fact that other species of *Crotalaria* in other parts of the world are known to cause death, I felt confident that there was some foundation for the suspicion under which our plant was held by the Boers. I therefore determined to have a further test, but difficulty was again experienced in securing enough material. In April, 1910, however, about 12 lb. was collected by Mr. W. F. Williams, Vogelsrand, Ventersburg Road, in the Free State, and sent to *Dr. Theiler*. This was fed to an animal, but without result, which seems to indicate that there is a loss of toxicity in the process of drying, but it may have been that the quantity fed was insufficient, and the feeding not continued for a sufficient period.

In the meantime, however, the Government Veterinary Surgeons at Zeerust and Barberton, working under *Dr. Theiler's* direction, had succeeded in producing the disease stijfziekte by feeding animals with *Crotalaria burkeana*. Specimens of the plant being fed were submitted to me from time to time, for identification. It having been proved that the plant is the cause of the disease, some account of its habit of growth and distribution may be of use to veterinary surgeons and farmers.

*Description of the Genus.*—The genus *Crotalaria* of Linnaeus belongs to the family Leguminosae, sub-family Papilionaceae, and the tribe Genisteae. It differs from other South African genera of this tribe by the usually stipulate leaves, which are either simple or palmately compound, by the sharply rostrate carina, very inflated legume, and racemose or scattered (not umbellate) flowers. It is described as follows:—Calyx sub-bilabiate, the upper lip bifid, the lower trifold. Vexillum large, cordate; carina falcate-acuminate. Stamens monadelphous. Ovary 2 or many ovuled; style elongate, knee-bent, often laterally pubescent. Legume turgid, with very convex valves, sessile or stipulate, few or many seeded.

The *Crotalaria*s are either herbs or shrubs, and are common throughout the tropics and sub-tropics of both hemispheres. Leaves either simple or palmately 3, 5, or 7 foliolate, commonly stipulate; bracts and stipules sometimes wanting. Flowers either racemose or sub-solitary, but not umbellate. Some species of *Lotononis*, especially in the section *Oxydium*, approach *Crotalaria* in the form of the corolla,

but differ by their umbellate inflorescence and unswollen pod. In other *Lotononides*, when the pod is more turgid, the carina is not sharp.

Twenty-four species of *Crotalaria* are described in the *Flora Capensis* (1862), of which seven occur in the Transvaal. Four species not described in the *Flora Capensis* are now found in the Transvaal, of which two belong to the Tropical African flora.

*Description of C. burkeana.*—This species belongs to the section *Racemosae*, having leaves digitately 3 to 5 foliolate, and racemes mostly terminal and densely or laxly many-flowered. It differs from other species of this section by the small, subulate stipules; narrow lanceolate, acute leaflets; long calyx-lobes; and densely hispid branches and petioles; variety *sparsipila* is, however, much less hairy.

*C. burkeana Benth.* (Plate 1).—Herbaceous or suffruticose, erect; branches, petioles, and racemes densely hispid, with long, spreading, rusty hairs; stipules linear-subulate; leaflets 3-5, linear-lanceolate, acute, glabrous above, pilose beneath; racemes terminal, lax, several-flowered; bracteoles lanceolate; calyx deeply cut, its segments lanceolate, nearly as long as the corolla; legume sub-sessile, oblong, very hairy.

Var. *sparsipila* Harv.—Much less hairy. with larger petioles, leaflets, and racemes.

A perennial herbaceous plant, one to two feet high, woody at base, with many herbaceous, slightly branched stems, freely covered with stiff, harsh, rusty-brown hairs. Petioles 1 to 1½ inches long, leaflets as long, often 5 together, 1 to 2 lines wide, acute at each end. Racemes pedunculate, terminal, 10 to 15 flowered. Flowers pea-shaped, yellowish, with purplish-brown veining, about ¾ inch long. Legumes 1½ inches long. Var. *sparsipila* is a more luxuriant and less hairy form, and probably grew in richer, alluvial soil.

*Type locality.*—The type locality for *Crotalaria burkeana* is the Magaliesberg, at the Apies River, doubtless on the north side of the Wonderboompoort, where it was collected by Burke and Zeyher about 1832. The type of variety *sparsipila* was collected in Zululand by Miss Owen.

*Distribution.*—In the Transvaal, *Crotalaria burkeana* is most abundant in the south-western region, including the Districts of Bloemhof, Wolmaransstad, Western Potchefstroom, Marico, and Rustenburg. It has also been collected in the Pretoria, Zoutpansberg, and Barberton Districts, and may be expected in the Lichtenburg, Waterberg, Middelburg, and Lydenburg Districts.

In the Orange Free State it occurs in the Boshof, Hoopstad, Kroonstad, Heilbron, and Winburg Districts.

In the Cape Province it is found in Griqualand West, in the Districts of Barkly West and Herbert.

In Natal it is recorded for Durban County, and there is a solitary record from Zululand.

*Localities.*—The following localities are recorded and mostly represented by specimens in the various herbaria. I am indebted to Dr. Bolus, Mr. Medley Wood, Mrs. Leendertz Pott, Dr. Schönland, and Professor Pearson for lists of the specimens preserved in the herbaria under their respective controls.

*Barberton District.*

Macsvale, 24th January, 1907. W. P. Macpherson in T.D.A. herb. 3298, letter 3715/B.161/84.

Barberton, July to September. E. E. Galpin 405 in herb. Bolus; Thorncroft in T. M. herb.; Bolus.

Near Barberton, 4th January, 1909. G.V.S. Turnbull in T.D.A. herb.

*Barkly West District.*

Fourteen Streams (reported).

*Bloemhof District.*

Kromellenboog, by roadside, rare; "said to poison stock". 2nd December, 1904. Burt-Davy 1494 in T.D.A. herb.

Elsendale, Christiana (seeds ripe), 19th April, 1907. H. G. Mundy in T.D.A. herb. 4324.

Elsendale, Christiana (in seed), November, 1908. Burt-Davy 5542.

Christiana Town Lands, May, 1910. Burt-Davy 8068. Holwater, 1909; teste F. J. Few.

Bloemhof, 15th February, 1907. "Causing stijfziekte." C. C. Campbell in T.D.A. herb. 3348.

Vecht Vallei, P.O. Abel's Kop, Schweizer Reneke. Teste F. O. Mallett is litt., 13th May, 1910.

*Bloemfontein District.*

Specimen from O.F.S. Department of Agriculture, locality not stated; 24th February, 1906. T.D.A. herb. 1689.

*Boshof District.*

Reported as occurring on several farms bordering on the Vaal River.

*Griqualand West Division.*

Between the Vaal and Kuruman, July. Cruickshank in herb. Bolus 2516.

*Heilbron District.*

Parys. W. R. Dewar (*ex* Botha No. 3). 8th March, 1905.

*Herbert District.*

Douglas. Miss Orpen in herb. Bolus.

*Hoopstad District.*

Mr. C. McG. Johnston, of the Orange Free State Department of Agriculture, reported that on several farms in the Hoopstad District he had seen a fair quantity of *Crotalaria burkeana*.

Specimens were received from Stock Inspector Everitt, Hoopstad, 27th March, 1906 (farm not stated).

Willow Dam, Bultfontein, March, 1904 (in seed). A. W. J. Atkinson in T.D.A. herb. 77.

Middenin, Bultfontein, 1910. B. Burger in litt.

*Kroonstad District.*

Gelykvlakte, via Klerksdorp, 1904. B. J. Marshall.

*Marico District.*

Near Zeerust, G.V.S. Evans.

*Natal.*

Durban, March. Medley Wood 559; 913 in herb. Bolus.

*Potchefstroom District.*

Machavie (ripe pods), 9th February, 1904. Burt-Davy 1485.  
Reported as common near Klerksdorp.

Potchefstroom, October. McLea in herb. Bolus.

*Pretoria District.*

Magaliesberg, at the Aapies River. 1832 (?) Burke and Zeyher (type).

*Rustenburg District.*

Kosterfontein, "on a single ironstone kopje only". Specimens sent by a correspondent in 1904.

*Swaziland.*

Bremersdorp. Bolus 11,784 in herb. Bolus.

*Winburg District.*

Vogelsrand, Ventersburg Road, 12th March, 1910. W. F. Williams in T.D.A. herb. 5841.

*Wolmaransstad District.*

Said to be common in the district. G.V.S. Dale reports a farm on which about twenty cases of *Crotalaria* poisoning existed in June, 1910.

Leeuwdoorns. S. J. Hyde, 9th February, 1909 (plants in seed; seeds sown at Skinner's Court).

*Zoutpansberg District.*

Tzaneen, August, 1905. Pole-Evans in T.D.A. herb. 4013.

Pietersburg. Schlechter in T.M. herb. and herb. Bolus.

Frischgewacht, Ysterberg. Mrs. Leendertz Pott in T.M. herb.

Near Pietersburg, *cir.* 4000 ft., February, 1904. Bolus in N.G. herb.

Vaalboschfontein, 4400 ft., January. Schlechter 4234 in N.G. herb. (District not stated; probably in Zoutpansberg.)

*Zululand.*

Miss Owen, teste *Flora Capensis*.

*Soils.*—*Crotalaria burkeana* is most common in sandy soils, and is often to be found in silt along the roadside. Government Veterinary Surgeon Dale, of Potchefstroom, reports that in some parts of the western portion of his district it is especially common on old lands. It is found that even if it exists in the unbroken veld in such small quantity as to be harmless, as soon as land is cultivated, and maize or kaffir corn planted, the *Crotalaria* makes its appearance along with them.

*Season.*—Growth begins about October, or with the spring rains, according to locality. At Leeuwdoorns it does not appear till December (Hyde). The plant is said to be most poisonous when the pods have developed, which is usually about the end of January or in February (13). In the Barberton District cattle do not appear to be affected until about January (17). It is cut to the ground by

severe frost, and, being brittle, soon breaks up and disappears. By the end of May, it is often difficult to find any, even in localities where it is usually abundant. In some years it has disappeared by the end of March. The Assistant Resident Magistrate, Klerksdorp, writing under date 20th January, 1904, reported that the plant was said to be at its worst about that time.

*Other Plants causing Neuritic Troubles.*—The late *Professor MacOwan*, Cape Government Botanist, came to the conclusion that there had been a serious confusion in the farmer's recognition of the disease, and that a large number of cases of reputed stijfziekte have been nothing more than tympanitis, that is "opblaas" or "hoven". The real stijfziekte or t'nenta, he points out, is certainly an acute form of neuritis, and is attended by distinct lesions of the terminal portions of the nerve structures of the extremities. Here, again, there appears to have been some confusion between true neuritic stijfziekte and "lamziekte", which latter *Professor MacOwan* considered to arise from the absence of sufficient calcic phosphate in the food to properly solidify the bones (6). It is interesting to note that the general distribution of the disease called gal-lamziekte synchronises with the region of the greatest abundance of *Crotalaria burkeana*. But it should not be overlooked that *Crotalaria* extends farther east than the disease is known to occur, and that *Crotalaria* does not appear to grow in some parts of the Cape Province where the disease occurs. Other species of *Crotalaria* are likely to occur there, however. Mr. B. Burger notes that his stock are not troubled with lamziekte as regularly as with stijfziekte; some years the former is severe, and in others not so bad. Moreover, lamziekte generally results in death, while animals usually recover from stijfziekte.

*MacOwan* points out that various forms of this neuritis occur in different countries, but that their correlation does not admit of doubt. The symptoms show small differences such as are to be expected when the species and genera of the plants eaten are not exactly the same.

#### *Crotalaria sagittalis* L. ("Rattle-box.")

In the East and Central United States this plant is known to be poisonous to stock, producing a disease called "crotalism", or "Missouri bottom disease", because of the prevalence of the plant along the Missouri River bottoms of Western Iowa. The plant is poisonous not only green, but also in dried hay.

*Poisonous principle.*—An unnamed alkaloid has been isolated from the seeds by *Dr. Power*, but *Chestnut* states that the poisonous principle is unknown, and that it occurs both in the leaves and the seeds. Horses and sometimes cattle are killed by eating grass or meadow hay in which the plant is mixed. They are not poisoned so often by eating the plant in the field. *Dr. Stalker*, of Iowa, in 1884, while investigating the cause of "bottom disease", then prevalent among horses in Iowa, was led to believe that it was mostly if not always due to this plant. Extracts were prepared which, when fed to young horses, produced analogous symptoms and death. The pronounced symptoms from a moderate dose were great stupor and loud, heavy breathing. A larger dose caused death in one and one-half hours. Small doses repeated daily induced the characteristic stupor on the fifth day, and death on the thirteenth (3).

*Symptoms.*—As generally described from accidental cases, the symptoms are much more prolonged, death resulting only after several weeks or months. There is a general decline of vigour, and a gradual loss of flesh, as observed in the case of loco, with which this plant is closely related. The rattle-box does not, however, appear so often to produce the craziness characteristic of loco.

*Antidote.*—No antidote has been suggested, but *Dr. Stalker* states that provided the animals are given a proper and nutritious diet, they will be greatly benefited by daily doses of 2 ounces of epsom salts, with 2 drachms of sulphate of iron and 1 drachm of nux vomica.

*Eradication.*—*Chestnut* recommends burning the veld at the time of the seeding of the *Crotalaria*, which, he claims, will materially reduce the percentage in the veld hay cut the following season (3).

*Crotalaria alata* Hamilt.

A native of India, is suspected of poisoning stock in Queensland (9).

*Crotalaria mitchellii* Benth. (“Yellow Darling Pea.”)

A native of South Australia, New South Wales, and Queensland; is supposed to produce the same effect on cattle as *Swainsona* (10).

*Swainsona galegifolia*, R.Br. (“Darling Pea”, “Indigo.”)

In Australia this plant is well-known to be poisonous to stock. Most of the cases of poisoning by it are said to occur in the dry season, when stock are especially attracted by green and succulent foliage, and are more likely to gorge themselves upon a single species which remains green, if found in fair abundance.

*Physiological action.*—*Professor Martin* has investigated the action of *Swainsona galegifolia* on sheep, and finds that its effects are similar to those produced by slow poisoning with alcohol and certain toxic proteids, resulting in peripheral neuritis and degeneration of the nerve endings, accompanied by a loss of muscular control. The action is a slow one, four to six weeks being required to produce serious symptoms. If at once put on a proper diet, recovery takes place, but not if paralytic symptoms have supervened. Young lambs probably respond more rapidly to the poison; when the symptoms are fully established there is no remedy (5). Experiments on frogs indicated that *Swainsona* possessed very powerful sudorific properties, reducing them in a few hours to mere skeletons (11).

*Bailey* describes the effect on sheep eating the plant as follows:—They separate from the flock, wander about listlessly, and are known to the shepherds as “pea eaters” or “indigo eaters”. When once a sheep takes to eating it, it seldom or never fattens, and may be said to be lost to its owners (11). In 1873 a Mr. Charles Thorn tested this plant on a lamb which had become an “indigo eater”; it was placed in a small paddock, where it refused to eat grass; Mr. Thorn collected a quantity of indigo plant, which it ate greedily, following him all over the paddock and eating it out of his hand (11). Horses which had been feeding on *Swainsona* were exceptionally difficult to catch; their eyes were staring out of their heads, and they were prancing against trees and stumps. The second day two out of nine died, and five of the rest had to be left behind. When

driven they would suddenly stop, turn round and round, and keep throwing up their heads as if they had been hit under the jaw; they would then fall, lie down for a while, rise, and repeat the performance (11).

#### LOCO WEEDS.

In California, Colorado, and other Western States of America, a neuritic disease, ending in hallucinations and death, is produced by eating several species of the leguminose genera *Astragalus* and *Oxytropis*. In Texas, *Sophora secundiflora*, also a legume, is the cause of "locoism".

*Lessertia annularis* Benth. ("T'nenta.")

*Professor MacOwan* pointed out that this leguminose plant, when in full bearing of its crop of pods and ripening seeds, was a cause of true neuritic stijfziekte in the Cape Province. A lesser amount of suspicion, he adds, rests upon several common species of *Indigofera* and *Tephrosia* (6).

*Melolobium candicans*, Eckl. & Zeyher.

This plant was also reported by *Prof. MacOwan* as suspected at the Cape of causing t'nenta poisoning in small stock (6).

*Cytisus proliferus* Linn.† ("Tagasaste.")

If eaten when in pod, this plant is said to intoxicate horses (6).

*Lathyrus sativus*. ("Muttar.")

The dried peas of this plant have been known to poison a whole stud of omnibus horses, the symptoms being analogous with the forms of neuritis already mentioned (6 and 8). A disease called "lathyrism" appeared among Russian peasants in 1891 after feeding on bread made of the muttar pea when wheaten flour was unobtainable (6). *Church* states that the paralysis induced in horses, bullocks, as well as in man, by the free use of these seeds is beyond dispute (12).

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