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THE TOXICITY OF YELLOW-WOOD (*Terminalia oblongata*) TO CATTLE.

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SUMMARY.

1. *Feeding tests were carried out with yellow-wood, which was suspected of poisoning cattle in central Queensland, producing a subacute to chronic disease characterized by emaciation, photophobia and frequent urination.*

2. *All animals fed on yellow-wood leaves exhibited symptoms differing only slightly from those observed in natural cases, and yellow-wood is therefore regarded as the cause of the trouble.*

3. *The main lesion is a parenchymatous nephritis.*

INTRODUCTION.

A peculiar disease of cattle has been observed for very many years in certain parts of the Fitzroy River basin in central Queensland. It has been stated that in dry years losses of as much as 10 per cent. of the stock, including a high proportion of young cattle, have occurred on some affected properties, while even in relatively good seasons the disease is present during the drier months of the year.

During 1940 and 1941, field surveys of the affected area were carried out by the district Departmental Veterinary Officer. These surveys (Irving, 1940, 1941) indicated that the disease was apparently confined to a particular type of country and suggested that a poisonous plant—probably yellow-wood (*Terminalia oblongata*)—was involved. Following a botanical survey of properties on which the disease was known to occur, Francis (1941) reported that in his opinion, of nine species widely distributed, commonly eaten and known to be toxic to livestock, yellow-wood was to be most suspected. He pointed out that the geographical distribution of this plant was fairly close in its limits to the area in which the disease occurred and that it was abundant on affected properties. Further, it was well known to be eaten by stock in fairly large quantities during dry periods—in fact, it has been regarded by many landholders as a useful fodder, particularly in times of

drought. Finally, the plant had been shown by McIntosh (1934) to be poisonous to sheep, though the syndrome shown by cattle does not resemble that exhibited by sheep, which show a peculiar train of nervous symptoms.

In view of the suspicion attached to yellow-wood as the cause of the disease condition peculiar to the Fitzroy River basin, it was decided to conduct feeding tests with cattle. These were carried out at Clermont, in central Queensland, during the winter months of 1944 and are reported upon later in this paper.

DESCRIPTION OF THE YELLOW-WOOD PLANT.

Terminalia oblongata is a large shrub or small tree of rather dense growth. The leaves are 1–2 inches long, of a light-green colour, and commonly borne in clusters along the stems. The flowers are insignificant and are carried in short spikes. The fruit or seed capsule is dry and its sides are extended into broad wings, the whole capsule, including the wings, being about 1 inch broad. The plant coppices very freely at the base of the trunk.

The plant is apparently confined to Queensland, where it has a fairly wide distribution in the central and northern coastal and sub-coastal areas. Collection localities include Rockhampton, the Suttor and McKenzie River basins, the Burdekin River, Springsure, and the Belyando River.

OCCURRENCE AND SYMPTOMS OF THE NATURAL DISEASE.

Mortalities occur at all seasons but are most common during dry periods; hence sick animals are most frequently encountered between June and December.

The condition is not restricted to any one sex or age group of cattle, but it does not occur in calves which have not commenced to graze.

The symptoms presented in the field are rather unusual. The first manifestation is a disinclination on the part of the animal to move out and graze during the hours of bright daylight. If driven out from the shade, the animal turns away from the sun; blinking is continuous and the eyelids are not more than half opened. Lachrymation is apparently increased and there is a thin yellowish discharge across the face which mats the hair. In more advanced cases the head is held in an elevated position, which gives the impression that the animal is more alert than usual. Possibly the sight is impaired in some of these cases, for the animal lifts its forefeet a little higher than usual. In a small percentage of cases a distinct keratitis develops.

Inflammation of the muzzle is noted; the skin cracks and incrustations appear. There may be a slight discharge from the nostrils. The respiration rate is frequently increased (up to 50 per minute).

Feeding and rumination are usually depressed but the animal does not appear to lose its appetite completely. Oedematous swellings may appear

under the jaw and in the region of the brisket and forelegs. This oedema may be one of the early symptoms, and sometimes it is transient in nature.

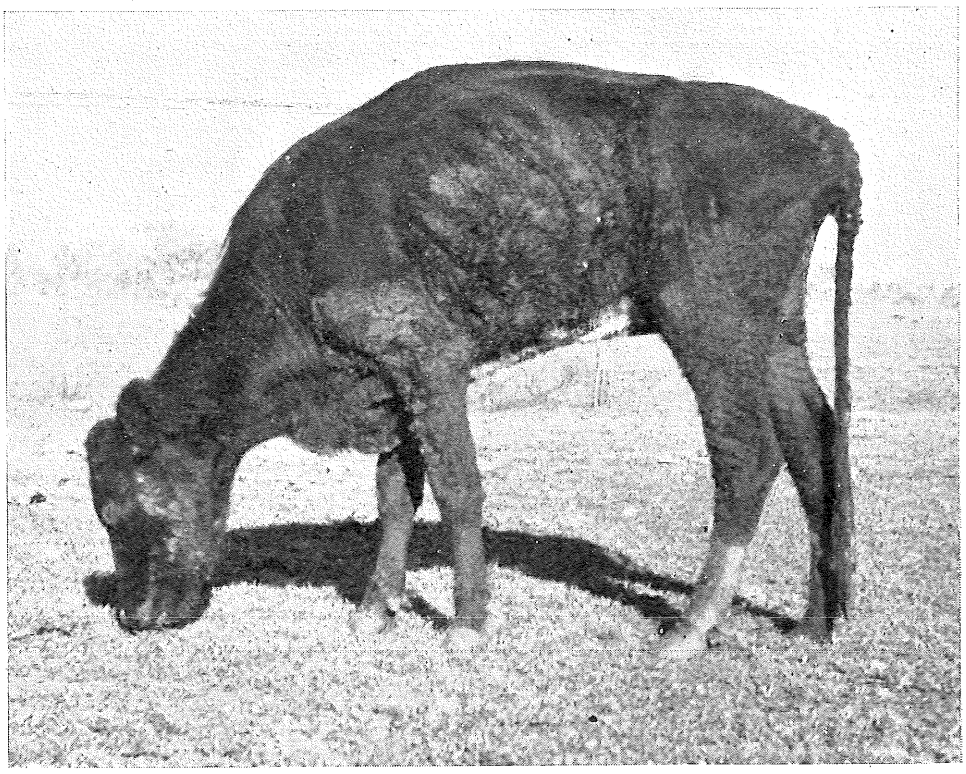

Plate 1.

An advanced natural case of yellow-wood poisoning, showing emaciation, photophobia, and evidence of scouring. (The side of the animal is mud-encrusted, due to bogging.)

Urination is much more frequent than usual and occasionally there is an almost continuous dribbling. In affected females, this dribbling causes the animal to hold the tail in an arched position, while the skin below the vulva and along the thighs may be urine-stained and "scalded" in appearance. In males dribbling is, as a rule, not such a marked feature.

Occasionally an affected animal appears to suffer from a form of laminitis. It walks on the heels and the toes turn up, with a growth of horn up to six inches long extending from the toe.

Many graziers recognise a "wet" and a "dry" form of the disease. The "dry" type is characterized by an aggravation of the eye symptoms as the disease progresses, rapid wasting and a relatively early death. In the "wet" type, oedema, which may vary from very slight to very marked, with accumulation of fluid about the lower jaw, the brisket and the legs, develops. Not infrequently both sets of symptoms are seen in the one animal, though

in an outbreak one or other type is usually predominant. A typical case showing the extreme emaciation of a naturally affected animal is shown in Plate 1. A less advanced case of the disease is illustrated in Plate 2.

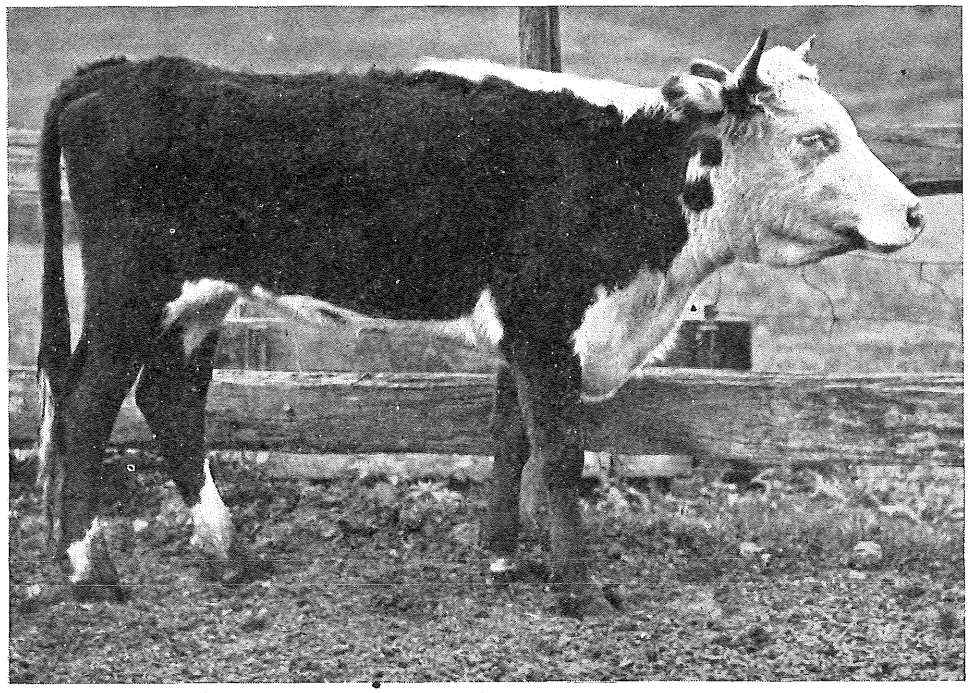

Plate 2.

A natural case of yellow-wood poisoning, not very advanced, showing wasting, photophobia, and oedema in the region of the throat.

All degrees of the condition are seen in the field. Sometimes when the condition is relatively mild it appears to clear up temporarily, particularly if good rains occur; at other times it runs a fairly rapid course with death usually resulting in 4–8 weeks. Some young cattle partially recover after being affected, but never return to normal and are stunted for the remainder of their lives.

FEEDING TESTS WITH YELLOW-WOOD.

Feeding tests with eleven calves were conducted. The records relating to six of these animals are set out hereunder as typical of the symptoms following ingestion of yellow-wood.

Animal No. 1.

Small Illawarra Shorthorn steer. Approximately 125 lb. live weight. Age 7 months.

Feeding with yellow-wood commenced on April 14. The amount

consumed per day averaged about 7 lb. and consisted of the leaves, which were stripped from the branches. No other food was given. Condition was maintained for the first few days; by the end of a fortnight the appetite was depressed considerably, and the amount of leaves consumed dropped to approximately 4 lb. per day. Attempts were then made to coax the animal to eat a little oaten and lucerne chaff and this was continued for a fortnight. During this period the appetite was depraved: small stones and gravel were licked up from the ground and the bark was chewed from the rails of the fence.

Two weeks after feeding commenced, rapid blinking of the eyelids was noticed, followed a few days later by a bilateral discharge of yellowish material from the inner canthus of the eye. By the end of the first month photophobia was evident, the animal standing in one position with the eyes half closed. Loss of condition was now obvious. Urination became much more frequent and the animal strained a little, often standing for a considerable time with the back arched. Respirations were increased and became shallow and abdominal.

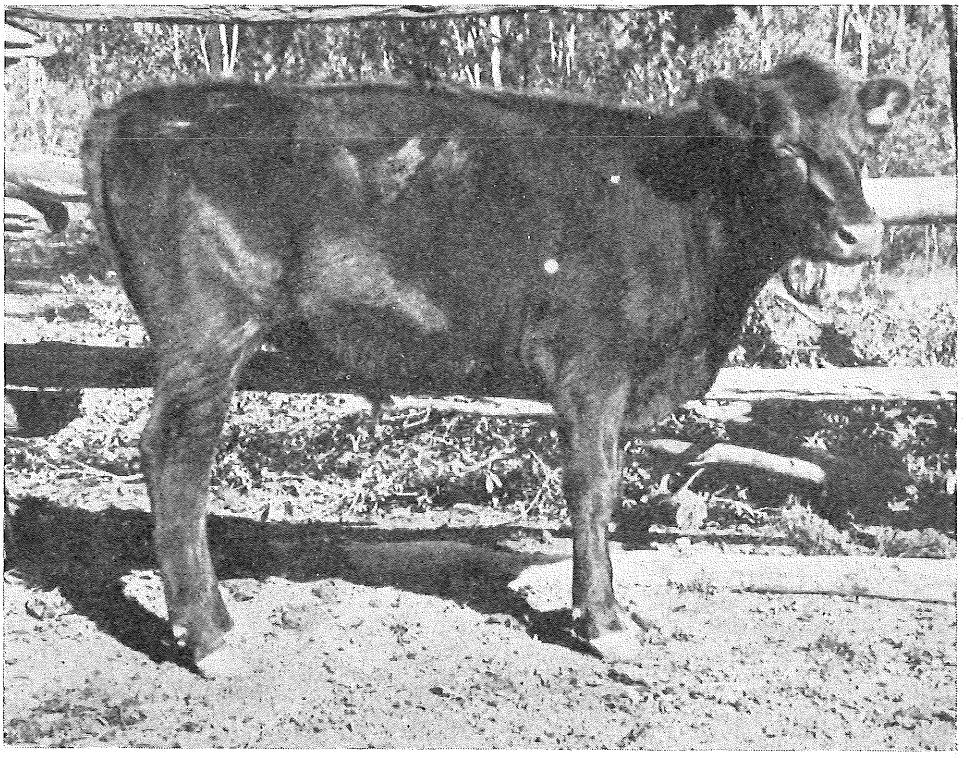

Plate 3.

Experimental animal No. 2, photographed 30 days after commencement of feeding. Note photophobia and eye discharge and the typical stance—head elevated, ears at the alert and back arched.

As the disease advanced, the symptoms noted were gradually aggravated. Frequently, when the beast moved it staggered and fell and only with difficulty regained the normal posture. The skin over the nose dried and cracked. The animal was eventually destroyed 44 days after the experiment commenced, by which time it had consumed 214 lb. of yellow-wood leaves. It was very weak and emaciated when slaughtered.

Animal No. 2.

Illawarra Shorthorn steer. Approximately 180 lb. live weight. Age 10 months.

Feeding commenced on April 14. This animal was a voracious eater, and for approximately six weeks consumed an average of just under 13 lb. of yellow-wood leaves per day. It was then allowed to browse from branches of the tree placed in the yard and no effort was made to measure its daily intake. Blinking and photophobia were in evidence a fortnight after feeding commenced, but these symptoms were not very marked, and the animal generally maintained its appetite. Lucerne was fed occasionally when the appetite appeared to be a little depressed. A month after feeding on yellow-wood commenced it was noticed that the head was being carried in an elevated position and that the animal appeared to be a little more timid than usual when approached. The nose was continually licked—the tongue passing from one nostril to the other—and the skin on the muzzle commenced to crack. The animal is shown at this stage in Plate 3. Urination was much more frequent than usual. A discharge from the eyes dried on the sides of the face, matting the hair. During the seventh week of feeding the general condition became worse and the symptoms aggravated. Respirations had increased and were mainly abdominal. At the time of death, 66 days after feeding commenced, the animal was very emaciated.

Animal No. 3.

Large Illawarra Shorthorn steer. Approximately 280 lb. live weight. Age about 12 months.

For more than two months before entering the trial, this animal was confined and fed on a good ration of oaten and lucerne chaff, maize and bran. It was in excellent condition when the trial commenced.

Feeding on yellow-wood commenced on June 23, the branches of the tree being placed in the yards and the animal allowed to browse at will. No attempt was made to calculate the amount ingested, but the animal ate readily. Rapid blinking was noted 10 days after the trial commenced and a few days later photophobia was evident. Constant licking of and cracking of the skin over the nose were observed and there was considerable discharge from the eyes. Loss of condition was very marked and it was estimated that 15 days after the trial had commenced the animal had lost over 100 lb. in weight. Urination was more frequent and muscular inco-ordination was

observed, the gait being of a lumbering and unsteady nature. If forced to move rapidly the animal lost its balance and fell. It was eventually destroyed 31 days after feeding commenced.

Animal No. 4.

Small Illawarra Shorthorn heifer. Approximately 125 lb. live weight. Age 6 months.

Feeding commenced on June 4 with weighed amounts of yellow-wood leaves, the animal consuming an average of just under 9 lb. per day for the first month.

Blinking was noted during the third week after feeding commenced, and slight scouring occurred at that time. Photophobia was observed about a week after the blinking was first apparent. There was a discharge from the eyes, cracking of the skin over the nose occurred, and the ears were affected with a dry necrosis. Gradual emaciation and frequent urination were noted during the fourth and fifth weeks. The respiration rate had increased considerably. For several days before death the animal refused to consume yellow-wood leaves. An attempt was made to feed it with oaten and lucerne chaff during this period: it ate sparingly and in spite of slight improvement in respect of some of the symptoms remained weak and emaciated. It was destroyed 41 days after the experiment commenced; during the period it had eaten 254 lb. of yellow-wood leaves.

Animal No. 5.

Small Illawarra Shorthorn heifer. Approximately 150 lb. live weight. Age 7 months.

From July 20 the animal was allowed to browse on the leaves from the branches of the tree, which were placed in the yard. It ate readily. Blinking was noted during the third week and photophobia observed a few days later. The respiration rate was increased and there was a slight discharge from the eyes. The animal was destroyed, 19 days after feeding commenced, in a relatively early stage of the disease.

Animal No. 6.

Small Illawarra Shorthorn heifer. Approximately 150 lb. live weight. Age 7 months.

From July 20 this animal, like No. 5, which ran in the same yard, was allowed to browse on the leaves from limbs of the tree freshly cut and placed in the yard. It consumed the plant fairly readily during the first few weeks. During the fourth week the following symptoms were observed:— rate of respiration had increased, blinking was frequent and there was a bilateral discharge from the eyes. Photophobia was noted a few days after blinking had commenced, the animal showing a marked disinclination to face

the sun. Urination became more frequent and was associated with a good deal of straining, the urine being voided in small quantities of about 100–150 ml. at a time. The characteristic attitude of the animal was to stand with its head away from the sun, with the back arched, the legs straddled and the tail half lifted and held to one side. General emaciation was noticeable during the third and fourth weeks after the experiment commenced and by the fifth week muscular inco-ordination was observed. The animal was destroyed 34 days after feeding had commenced.

SUMMARY OF SYMPTOMS IN TEST ANIMALS.

The experimental cattle in all cases ate yellow-wood with relish and there was no difficulty in inducing them to consume considerable quantities per day. For the first two or three weeks condition was in most cases maintained on a yellow-wood diet alone. Usually at the end of this period, symptoms developed, the first one noted being generally blinking of the eyelids. This sometimes increased with the passing of time until movement of the eyelids, especially when the animal was turned to the sun, was at the rate of 40–45 to the minute (normal animals were observed to blink on an average eight times per minute). Soon after increase in blinking was noted, a yellowish discharge appeared which ran over the face, drying in scaly masses. The animals often carried their heads in an elevated manner and appeared to be more alert than usual. Coincident with the appearance of the ocular discharge, photophobia was evident and the animals sought the shade. If forced to move out of the shade, they invariably turned their heads away from the sun.

With the development of photophobia the consumption of the plant decreased and the animals lost condition. Sometimes at this stage a depraved appetite was observed: the animal chewed the bark on the rails of the yard or licked dirt and gravel. An attempt was made to coax some of the animals to eat small quantities of lucerne and oaten chaff. In some of these the appetite gradually returned. One beast, which had consumed considerable quantities of yellow-wood, refused good quality chaff.

The skin of the nose dried and cracked and tended to peel. At first there was a reddening of the shiny surface, followed by exfoliation. Evidently the nose was painful for it was licked continuously, the animal's tongue moving first into one nostril, then into the other.

Increased frequency of urination was observed in several animals though it is not known whether the total amount of urine was increased. One animal was observed to urinate three times within 15 minutes, and when slaughtered after the last act of urination showed approximately 500 ml. of urine in the bladder. Animal No. 6 strained considerably when urinating and assumed a characteristic attitude with the back arched. The tail did not return to the normal position for some time after urination had ceased.

SIMILARITY OF NATURAL AND INDUCED SYMPTOMS.

The disease produced by feeding on yellow-wood leaves differs little from the condition seen in the field and there is no doubt they are one and the same. Under natural conditions, the cattle probably do not consume as much per day as did the experimental animals, due to the fact that the latter were allowed no grazing. It can be assumed, therefore, that in the field the condition tends to become more chronic. This would be sufficient to account for the slight difference in symptoms observed between the two groups.

The most important differences were the presence of oedema about the neck and brisket of the natural cases and the presence of urinary salts about the hindquarters of females and the prepuce of males, features not observed in the experimental animals. It is felt, however, that these variations were due merely to the more chronic nature of the natural disease. The experimental calves showed albuminuria and the consequent loss of protein might conceivably have led to oedema.

LESIONS.

Whether dying from the natural disease, or destroyed after ingestion, under controlled conditions, of considerable quantities of the plant, all animals show some emaciation. The degree, however, differs considerably; in the natural cases it is usually very marked. The alimentary tract may show evidence of catarrh and occasional areas of congestion, though these are not confined to any particular section. Extensive oedema of the rugae and abomasal wall is often seen. This lesion is not necessarily associated with subcutaneous oedematous swellings in the region of the head or brisket. On section the swollen abomasal wall presents a typical whitish gelatinous appearance. Occasionally an oedema of a similar nature, though varying in degree, is observed involving other portions of the alimentary tract and the wall of the urinary bladder.

The organs of the chest cavity show little or no departure from the normal.

The liver, spleen and pancreas show little change as a rule, though in some cases the spleen may appear to be slightly enlarged and softened.

The kidneys exhibit the most marked changes. Though not altered in shape or size, these organs show a peculiar discolouration ranging from greenish-blue to a slate grey. On section, particularly in the more acute type of case, there may be some oedema in the region of the hilus, and there is considerable congestion. The more chronic type suggests the formation of some fibrous tissue, particularly in the cortex. In such cases there may be difficulty in stripping the capsule.

Microscopically the kidneys exhibit a distinct departure from the normal. In the cortex the vessels frequently show congestion, and the glomeruli also are affected. In the capsular space a considerable deposit, probably of protein

material, is evident, suggesting a leakage from the vessels of the glomerulus. The cell walls of the proximal convoluted tubules show evidence of damage, indicated by swelling and the appearance of some detritus in the cavity of the tubule, and the same changes may be seen in the loops of Henle and the collecting tubules. In some advanced cases there is evidence of more extensive damage, indicated by the appearance of fibrous tissue cells between the tubules, though generally this is not a very marked feature. A fine granular brownish material has been observed throughout the deposits in the capsular space, the cells of the tubules, and within the tubular space.

Generally speaking, the condition suggests a subacute to mild chronic parenchymatous nephritis due to an irritant agent.

Marked hypertrophy of the urinary bladder with retention of large volumes of urine is a common feature of chronic cases of the natural disease. In some animals the bladder wall is oedematous, while in others it tends to be indurated and thickened (especially in the neck region), and in these the lining mucosa is inclined to be catarrhal.

No lesions beyond a mild to moderate conjunctivitis have been noted in the eyes in experimental animals, but the behaviour of some of the animals—e.g., the "alert" attitude and the habit of stepping high when moving—suggests that the eyesight is impaired.

BIOCHEMICAL TESTS.

Routine tests to determine the presence of protein were applied to urine samples collected, on post-mortem, from all experimental animals. All samples gave a strong positive reaction; quantitative analysis revealed that the amount rose as high as 0·41 per cent.

Samples collected from the animals before entering the test gave negative results to both the heat and the ring tests.

ACKNOWLEDGEMENT.

Reports submitted by various Departmental officers—particularly Mr. Marshall R. Irving (formerly Departmental Veterinary Officer at Rockhampton) and Mr. W. D. Francis (Botanist, Botanical Section)—in the preliminary stages of the investigation of the disease were of considerable value in the planning and the conduct of the experimental work and have been drawn upon in the preparation of this paper.

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