Preliminary note on the Poisonous Properties of Cotyledon Orbiculata.

By D. Kehoe, M.R.C.V.S.

The object of the following note is to call attention to the poisonous properties of the plant Cotyledon orbiculata (Nat. Ord. Crassulaceae) for fowls and also the goat. Particular interest attaches to the toxic properties of this plant when it is remembered that another species of the same genus (C. Ventricosa) is held responsible for the production of a disease affecting goats and more rarely sheep known as Nenta (Syn. C'Nenta, T'Nanta, Rita, Krimpziekte, and Cerebro-Spinal-Meningitis).

This disease has been known to exist for many years in several districts of Cape Colony, and is first mentioned under the name of Rita in the Report of the Cattle Diseases Commission of 1877, where it is referred to as a "disease called Rita which is very destructive to goats. It affects them in a way that seems to indicate paralysis of the nervous system." In another portion of the same report Professor MacOwan is quoted as making the following statement:—"It is much the same with the 'Nenta' *Lessertia annularis Buch.*, a small leguminous plant which in carroid and 'gebroken' veld is sometimes very abundant, and acts as a poison upon sheep and goats, resembling the results reported of Gastrolobium R. Br. and some of its congeners in West Australia. It seems to produce cerebro-spinal paralysis, by which the animal is unable to co-ordinate the movements of its several limbs. The head wags helplessly backwards and forwards, and in severe cases death speedily ensues."

In the same report, and in a letter written by Dr. Browne, the following statement occurs: "My attention has also been called to the T'Nanta, in regard to which a gentleman writes: 'In travelling through Boschjesveld lately, where these plants abound, I was informed that about the months of November and December, when the seed-vessels are on the plants, a great number of goats and kids die of the disease commonly called T'Nanta, which they get by eating the seed-pods of the plant. The animal is affected generally about eight days, and then it dies. The symptoms manifested are a stiffness of the neck which is either drawn downwards or sideways, and violent heaving, etc.'"

"The plant sent to me is the *Lessertia annularis*, most readily identified by the form of the legume or pod which is arched into a semi-circle or is more or less completely annular."

The first reference made to the disease by Hutcheon is, so far as I can find, in the report of the Colonial Veterinary Surgeon for 1882, where he speaks of his investigations into the cause of the disease in the Jansenville district of Cape Colony. He mentions that the farmers in the neighbourhood considered that the disease was due to some plant which the goats ate, but that different men pointed out different plants as being the causal agent of the disease. Several of

these suspected plants were fed to goats, but with negative results.

In this report for 1884 Nenta is again referred to by Hutcheon, and a letter from Professor MacOwan which was written in reply to a query concerning the plant *Diplopappus Filifolius* is quoted. In this letter Professor MacOwan makes the following statement:—"The peculiar cerebral disorder referred to by the Veterinary Surgeon is due to quite another plant, viz., the *Lessertia annularis Burch*, a prostrate leguminous plant branching widely from a central root and creeping on the surface soil under the taller bosjes . . . . . This is the T'Nenta or C'Nenta, and I have satisfied myself by examination of the contents of the stomach of animals dying from the peculiar disease referred to that it is the direct cause of the mischief . . . . . The symptoms of *Lessertia* or T'Nenta poisoning are analagous to those observed in almost all cases of poisoning by other Leguminosae."

Hutcheon, however, stated that he could not confirm this statement since on the farm Bonnindale, where he principally studied the disease, he was unable to find the plant, and that though in the previous C'Nenta season 1,000 out of 2,500 goats were affected on this farm, yet on the same farm Mr. Barrington was only able to find three specimens of *L. annularis*.

In 1890 Mr. Meyer, of Darlington, reported that he had discovered the plant which when eaten was capable of producing the disease, and so Veterinary Surgeon Soga proceeded to Mr. Meyer's farm, where he procured eight goats selected from a flock running on a portion of the farm free from the disease, and by feeding them on two ounces each, of the suspected plant, per day, he was able to produce in all of the goats symptoms similar to those of Nenta, and six of them died, two recovering. Professor MacOwan identified the plant, causing the symptoms referred to above, as *Cotyledon Ventricosa*. He expressed surprise to find a crassulaceous plant suspected of possessing such active properties as would be involved in the production of the cerebro-spinal paralysis and other symptoms of Nenta.

In continuing this series of experiments, Veterinary Surgeon Tomlinson, then stationed in the Jansenville district, fed goats on the *L. annularis* and another plant of the same order, but with negative results, and this was on a farm, where the disease was prevalent. In regard to another farm on which he carried out some experiments Veterinary Surgeon Tomlinson reported: "I have carefully examined the parts where the disease (Nenta) is most severe, but I have not been able to find any of the leguminous plants I experimented with at Uitkomst, but with regard to the cotyledonous plant it is very abundant."

In Sutherland district Veterinary Surgeon Tomlinson was able to produce the symptoms of Nenta in goats obtained from a farm, where no Nenta had ever been known by feeding six of them on the plant *C. ventricosa*. Two of these goats died and four recovered.

Later Veterinary Surgeon Borthwick, working in the town of Somerset East and far from any locality where the disease was known to exist, was able to produce the symptoms of Nenta in goats by feeding them on *C. ventricosa* obtained from Mr. Meyer, of Darlington, and similar results were obtained by Veterinary Surgeon Dixon when experimenting on a farm in the Beaufort West District, and feeding goats on *C. ventricosa* obtained from Victoria West district.

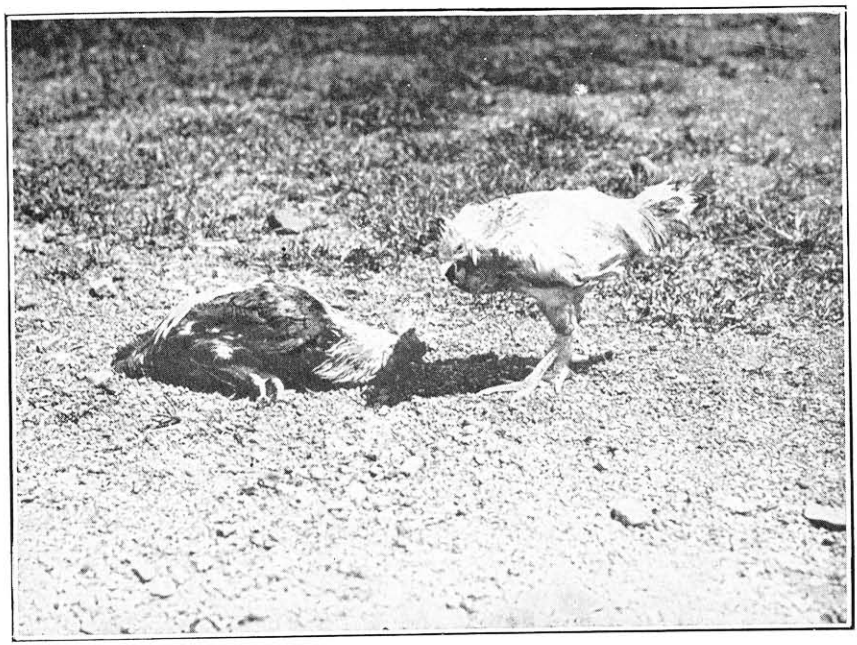
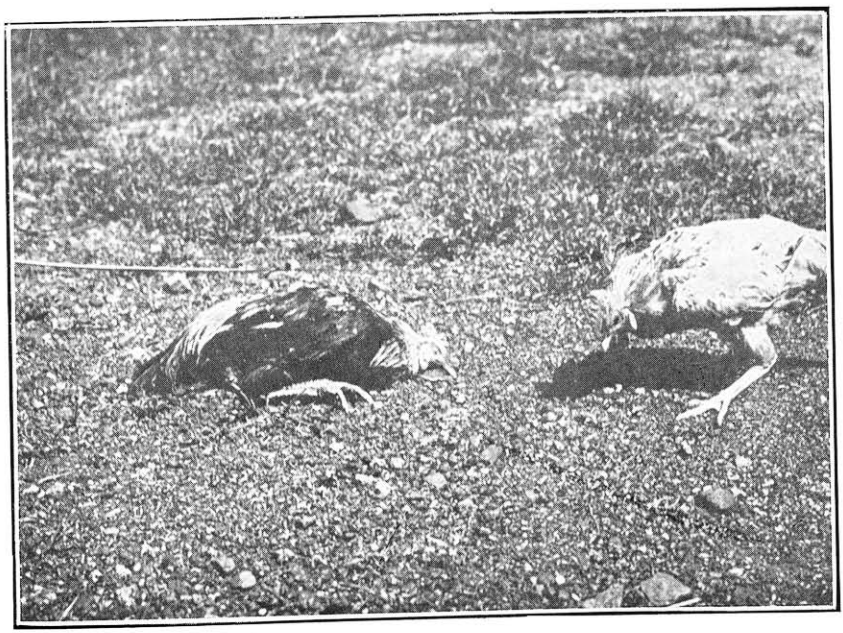


Plate No. 41.]



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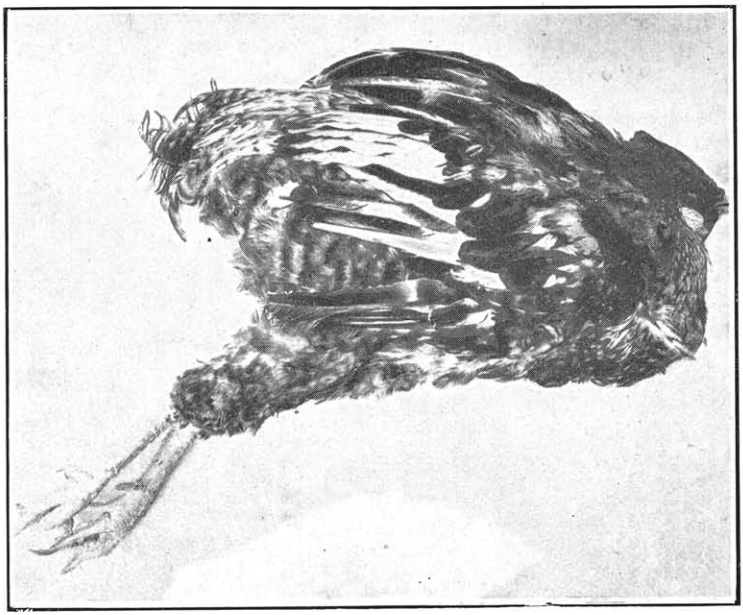

Plate No. 43.]

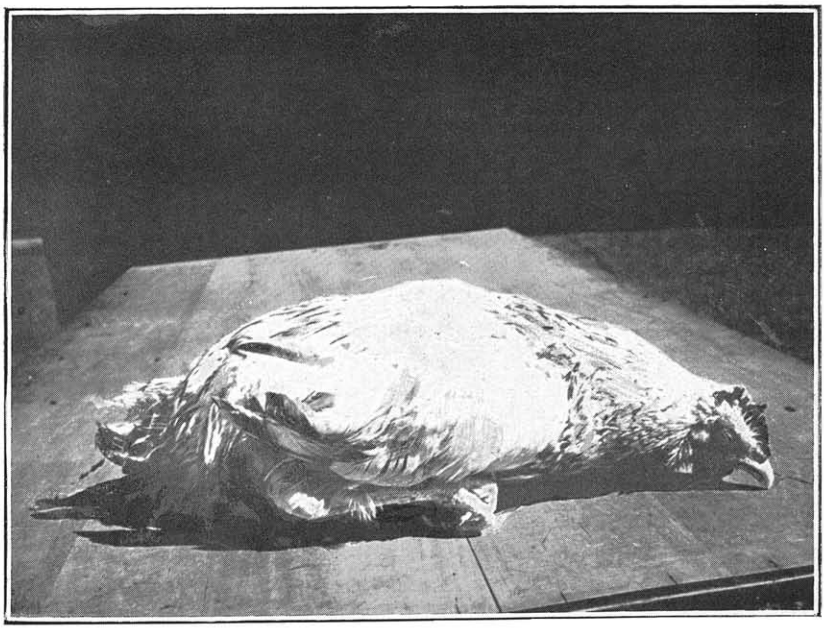

Plate No. 44.]

Cotyledon orbiculata poisoning

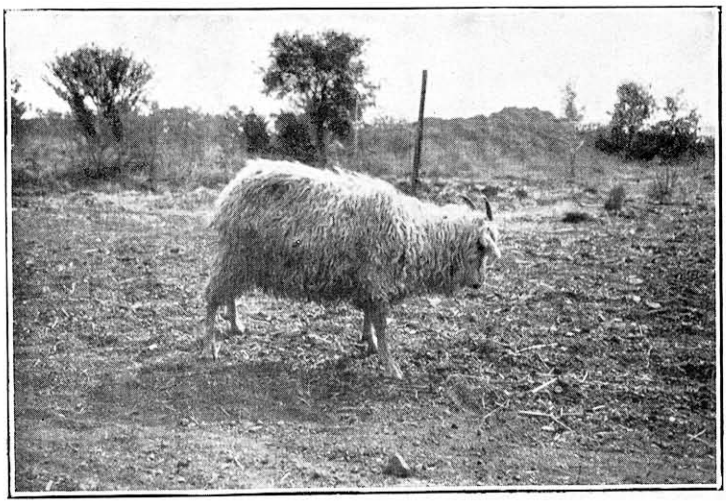

Plate No. 45.]

Hutcheon, as a result of these experiments, came to the following conclusions.—

"The results of these experiments leave little doubt that the plant *Cotyledon ventricosa* is at least one of the plants which induces the disease known as "Nenta" or "Krimpziekte" in goats and sheep, and that it requires but a comparatively small quantity of the plant to produce the symptoms characteristic of that disease . . . . But the best proof that this plant is the principal, if not the sole, cause of Nenta, is the fact that on places where the disease was previously contracted by goats in a severe form, after this plant was completely cleared out no more cases occurred."

According to Walsh, *C. eckloniana* is also capable of producing poisoning effects in goats and sheep, cases having been reported from Pella, in Namaqualand, and also from Ladysmith.

The species of plant with which the experiments of the writer were made was the *Cotyledon orbiculata*. Attention was first directed to the poisonous properties of this plant when fed to fowl in connection with a case (mentioned in the Transvaal Agricultural Journal of July, 1909) where it was fed to fowl in Pretoria by the owner who thought it was a form of Aloe. On the day following that on which they were given the plant, six birds were dead and the others were very ill. The plant in this case was identified by Mr. Burtt-Davy as *Cotyledon orbiculata*. The popular name of the plant is Varkens-Ooren, owing to the resemblance between the leaf and the pig's ear.

It is also mentioned that Dr. Theiler produced symptoms of poisoning in two hens by feeding them with the same material. Both of these birds are reported to have died with symptoms of paralysis preceding death.

In order to further test the poisonous, or otherwise, properties of *Cotyledon orbiculata*, the following experiments were made:—

Experiment No. 1.

Fowls Nos. 1 and 2 were given some of the finely chopped-up leaves of *C. orbiculata* (collected at Onderstepoort, Pretoria) on the 30th and 31st of December, 1911. The plant given on the 30th was eaten, but not that given on the 31st. The symptoms shown by these birds were as follows:—

On the 31st December, 1911, both birds showed symptoms of poisoning, inasmuch as that No. 1 was dull and drowsy-looking, standing with the head hanging down, the beak resting on the ground, the eyes partly closed, and the wings drooping slightly. When disturbed it walked a few steps with difficulty and with inco-ordinate movements, and then gradually sank down into a sitting posture.

The symptoms shown by No. 2 were similar, but more marked, and in walking this bird used the lower edges of the wings to support it as it tended to fall to one side or to the other. Neither of the birds would feed on this date.

On 1st January, 1912, the symptoms shown by No. 2 were more marked than on the previous day, the bird lying down with the head and neck outstretched, and if made to stand could only walk for a couple of steps, soon sinking to the ground, and in doing so lowered

itself gradually to the ground by resting on the edge of the wing of one side or the other before it finally lay down, falling slightly to one side in dong so.

No. 1 showed less marked symptoms than No. 2, and could walk farther than the latter bird, though the movements of the legs were inco-ordinated, and the bird, after walking a few steps,would sink to the ground, lying with its head and neck outstretched, but not falling to one side as did No. 2.

In the case of both birds, in lying down, the head gradually drooped until the beak rested on the ground, and then the birds slowly sank down into the lying position. In walking the legs were sometimes crossed in front of each other, and sometimes the birds momentarily swayed backwards, but quickly recovered their balance by pitching forwards. The photographs show the positions assumed by the birds both in standing and lying down. The white bird in Plates Nos. 41 and 42 is that referred to here as No. 1.

On the 2nd January, 1912, the symptoms shown by both birds were more marked than on the previous day, No. 1 being inclined, when lying, to lie on its side, but still is not so markedly affected as No. 2, and when induced to walk can do so in a more certain manner than the latter bird.

On the 3rd January, 1912, both birds are improved in appearance and eat a little grain.

On 4th January, 1912, No. 1 appears to be much better and more inclined to walk than on the previous day, though its movements are still improperly co-ordinated.

No. 2 is not so much inclined to walk as No. 1, and its movements are not so co-ordinated as those of the latter bird. Both birds do not, however,walk very far, and soon stand and gradually sink to the ground in the lying position.

On 5th January, 1912, both birds had slightly improved in condition.

On 6th January, 1912, No. 1 had almost completely recovered, but No. 2, though it had improved, still walked in a very inco-ordinate manner, and was not inclined to walk very far, soon lying down.

On 7th January, 1912, No. 1 had recovered, and No. 2 was much better than on the previous day and was still inclined to lie.

On 8th January, 1912, No. 2 was still slightly ill and inclined to remain lying down, and walked in a jerky inco-ordinate manner, crossing the legs and sometimes falling down into a sitting position.

On 9th January, these symptoms were only slightly marked, and on the *10th* the birds had practically recovered.

Experiment No. 2.

A sample of *Cotyledon orbiculata* was received on the 9th January, 1912, from Mr. Burtt-Davy. This sample was collected at Skinner's Court, Pretoria, and was fed to Birds Nos. 1, 3, and 4 in the quantities of 30 grammes each on the 9th January, 1912, and each bird received about 8 grammes per day from this date up to the 17th January, 1912, but the results were negative in this instance.

Experiment No. 3.

The results were also negative in this case where Birds Nos. 5 and 6 were fed daily from the 13th to the 18th January, 1912, on the leaves of *Cotyledon orbiculata* sent to Pretoria by Dr. Theiler from a farm situated near Mimosa in Albany district of the Cape Colony. The species of this plant was determined by Mr. Burtt-Davy.

Experiment No. 4.

A sample of *Cotyledon orbiculata* was submitted by Mr. Burtt-Davy on 5th March, 1912, which sample was also collected at Skinner's Court, Pretoria.

On 6th March, 1912, this material was fed to two fowls, viz., Nos. 1 and 7. Two medium-sized leaves (20 grammes) were given to each bird.

Bird No. 1 did not eat.

No. 7 ate the portion of the plant fed to it, and on the morning of the following day, 7th March, 1912, appeared to be quite normal in condition, and when taken out of its cage walked and behaved in a perfectly normal manner. In the afternoon of the same day, however, it was noticed by the attendant that the bird was ill. The bird was then standing in the cage with the head drooping down, the feathers of the neck slightly ruffled, and the beak resting on the bottom of the cage. On slight excitement, such as that produced by approaching the cage, the bird would lift its head, but after a little time, if one stood and watched it without exciting it, the head gradually drooped down again until the beak again rested on the bottom of the cage. On taking the bird out of the cage at this time (3.30 p.m.), it walked a short distance, then stood and turned its head round until the beak touched the neck, the head itself at the same time being somewhat rotated on the neck so that the under aspect of the beak was directed upwards. The eyes were kept closed. The bird now gradually sank to the ground slowly flexing the leg joints, and when the body had come in contact with the ground, it fell over on its right side. As soon as it fell on its side the upper wing was flapped vigorously and the bird struggled, rapidly working its feet until it regained the sitting position, the head and neck, however, being outstretched and resting on the ground.

At 8 p.m. the same day the bird was lying in the cage, the eyes being open. On taking it out of the cage it was seen that it would walk until it came in contact with some object and then it came to a standstill, the head drooped until the beak rested on the ground and the leg joints were slightly flexed. In this position (similar to that noted in the case of the Bird No. 1, Experiment No. 1, and illustrated in Plate No. 41) the bird would stand for a time before gradually sinking down into a sitting position. If the bird was now lifted up into a standing position and not made to walk, it would again sink down in the manner just described.

8th March, 1912. On the morning of this date the bird was lying in the cage on its right side, the legs being outstretched backwards and the eyelids closed. On approaching the cage one noted that the bird became somewhat excited, weakly flapping the upper wing, and

at the same time drawing the legs, which trembled slightly, up towards the abdomen. The bird also drew the head and neck backwards, and would appear as if about to expire, but then the legs would be gradually extended backwards, the muscles of the neck relaxed until the head and neck resumed their former position, and the bird would remain lying on its side with the legs extended backwards until again excited. The condition of the bird remained the same all day, except that the comatose condition seemed to become more pronounced, the bird lying with the eyes closed and appearing to be almost dead, but still, however, if the comb was pinched, or gently pricked with a sharp point, the head was rapidly shaken and drawn away, the eyes were opened and sometimes even a spasmodic muscular contraction occured which caused the legs to be slowly drawn up to the abdominal wall and after a while to be slowly extended again.

At 9 p.m. on the same day the bird was lying on its side with the legs outstretched backwards, the eyes closed, and appeared inert save for the respiratory movements (8 to 10 per minute) and a trembling of the limbs and body which was just perceptible on closely observing the bird, and more easily determined by resting the fingers on the limbs or body. The limbs were stiff and were passively flexed with some little difficulty and when released they returned to their former position. The corneal reflex was easily obtained on opening the eyelids and the touch of a fine point on the extreme periphery of the cornea or on the edge of the eyelid causes the membrane nictitans to be rapidly moved across the eye. Pricking or pinching of the comb caused the head to be shaken and the beak to be opened and closed a few times. The comb also appeared congested and dark in colour. The temperature was 104° F.

On *9th March, 1912,* the symptoms were similar to those of the previous day but more marked as regards the comatose condition of the bird. Plate No. 43 represents a photograph of this bird which was taken on this date.

10th March, 1912. The bird still lay in the same position and the quivering of the muscles was still present. Corneal reflex was still present and also the reflex movements obtainable by pricking the comb. In the evening the respirations were 8-10 per minute and the bird was making a " snoring " noise in breathing.

11th March, 1912. The bird was lying in the same position but appeared to be more conscious to its surroundings. The reflexes obtained by pricking the comb appeared to be rather exaggerated since the stimulus produced marked flapping of the upper wing, rapid movements of the feet, opening of the eyes, and then the legs were drawn slowly up to the abdomen, and the head was drawn backwards whilst the beak was rapidly opened and shut several times. The bird would then resume its original position and this performance would be repeated again on three or four occasions.

12th March, 1912. The bird was still lying on its side. Respirations 8 to 10 per minute, eyes closed, comb congested and dark in colour in its upper half. The reflexes were still obtainable, although delayed and there were no exaggerated movements like those of the previous day. The bird appeared to be very exhausted and the trembling of the muscles of the legs and body was not evident.

On *13th March, 1912.* The bird was found dead in the cage Post mortem examination revealed no macroscopic lesions in the organs and the structures of the central nervous system appeared normal to the naked eye. The proventriculus and ventriculus were empty and the contents of the intestine were semi-liquid and greyish in colour.

Bird No. 8 was given, on the 8th March, 1912, 12 grammes of the same material as the last bird received.

On the morning of the following day (and about 10 hours after the bird received the plant) when taken out of the cage it walked with marked inco-ordinated movements of the legs and stood still after walking a few steps, sinking down into the same sitting posture as the last bird and with the head and neck resting on the ground. During the day the bird lay in the cage with the head resting on the bottom and the eyes closed. It was not easily disturbed. Later in the evening, the bird when taken out of the cage, was unable to stand and lay on its side. The eyes were open, but feinting as if to strike the eye, caused no movement of the eyelids or of the head. At times the bird lifted the head and pecked at the air three or four times as if attempting to catch imaginary insects and sometimes the head and neck were turned so as to peck at the feathers of the back and at the same time the head was also rotated so that the under aspect of the beak was directed upwards. The corneal reflex was still present.

10th March, 1912. The bird was lying on its side, the eyes closed and the comb appeared congested and dark in colour. The muscles of the limbs were relaxed though at times the legs were slowly drawn up towards the abdomen and then slowly relaxed again. The respirations were *100* per minute.

On *11th March, 1912,* in the morning at 7.15 the bird was lying in the same position as yesterday but the respirations were only 16 per minute on this occasion.

At 11.30 a.m. the bird was found dead. The post mortem examination revealed to the naked eye no characteristic lesions in the organs. The gizzard was full of the finely triturated portion of the plant and the contents of the intestines were dark grey in colour and of liquid consistency.

Fowl No. 1 received the same quantity of the same material as the last bird on 9th March, 1912. On the following day it showed slight symptoms of poisoning as it was inclined to sit in the cage and though it walked in a co-ordinate fashion when removed from the cage, yet it did not walk far and soon stood and slowly assumed the sitting position in the same manner as the other birds affected.

On *11th March, 1912* it lay in the cage all dav in the position shown in Plate No. 44. If induced to walk it could do so for a few steps in a co-ordinate manner and then lay down again, resuming the former attitude, the eyes being closed. The comb was congested but the reflexes from the cornea and those produced by pricking the comb were still present.

12th March, 1912. The symptoms shown were the same as on the previous day save that the movements of the bird when walking were more markedly inco-ordinated.

On the following day the symptoms were the same as on previous day but were still more marked and on the 14th March, 1912, the bird was unable to stand even when lifted.

On the morning of the 15th March, 1912, the bird was lying in the position shown in the photograph taken on the 9th and the reflexes from the cornea and pricking of the comb were still present. The bird was dead at 3.30 in the afternoon of the same day (15th).

The autopsy revealed no macroscopic lesions in the organs and the conditions of the gizzard and the intestines were the same as in the last-mentioned bird.

This bird, No. 1, was one of the birds which recovered after having shown symptoms of poisoning in the experiment of 30.12.11.

Fowl No. 9. Was fed with the same quantity of the same material as the last bird on the 9th March, 1912, and appeared to be normal on the following day.

On *11th March, 1912* the bird was dull, inclined to sit all day and if taken out of the cage and induced to walk, would only take about a dozen steps before it again lay down.

12th March, 1912. The bird was very dull, lay in the cage with the head resting on the bottom and the eyes closed. The comb was congested. If made to walk it could only walk for three or four steps at a time in a co-ordinate manner and then lay down in its former position.

On *13th March, 1912, and the day following* the same symptoms were noted but after this the bird gradually improved, the symptoms became less marked and recovery had occurred about the 19th March, 1912.

Experiment No. 5.

Two fowl Nos. 10 and 11 received on the 22nd July, 1912, respectively, 8 and 13 grammes of Cotyledon orbiculata collected at Onderstepoort, Pretoria.

Goats Nos. 3233 and 3243 received 30 and 25 grammes each respectively, of the same material but the results in both the case of the fowl and the goats were negative.

Experiment No. 6.

A specimen of Cotyledon orbiculata was received from Mr. Burtt-Davy and was fed to four fowl on the 19th September, 1912.

These fowl received the following quantities:

No.	11	received	23	grammes.
,,	12	,,	17	,,
,,	13	,,	8	,,
,,	14	,,	9	,,

No symptoms were shown by the birds 12, 13 and 14 but on the 20.9.12 symptoms of poisoning, similar to those observed in the previous cases, were observed in the case of Bird No. 11. These symptoms lasted until about the 24th September, 1912, by which time the bird had practically recovered.

The same material was administered to two Angora goats Nos. 4597 and 4598 each of which received respectively 240 and 80 grammes on the 21.9.12.

The result in the case of Goat No. 4598 was negative. Goat 4597 showed the following symptoms:—

The condition of the animal remained normal up to the afternoon of the 23.9.12. On the evening of this day the animal refused to feed and was lying down and was not inclined to stand or walk. If lifted on to its feet it stood with the head hanging and the back arched and the hind legs more widely apart than usual. The expression on the face was dull. The respirations were 20 and the pulse was 60 per minute.

24th September, 1912. The animal was lying down in the morning not feeding and at times made a moaning noise. Respirations 24, pulse 60 per minute. When made to stand the position assumed was the same as on the previous day. Up to the afternoon the animal seemed to improve slightly and when made to stand the head was sometimes held up. It could not walk in a co-ordinate manner, however, and after walking a few yards was inclined to support itself against any neighbouring object. A photograph (Plate No. 45), showing the position assumed on standing, was taken on this day.

In the evening the appearance of the animal was again the same as on the previous evening. The respirations were 20 and the pulse 42 per minute.

25th September, 1912. The animal lay down on its side all day and was unable to rise of its own accord. The respirations in the morning were 22 per minute, the pulse being 36. When standing the back was arched, the head hung down and the animal had a very dull appearance and refused to walk more than a few steps, being unable to move its legs in a co-ordinate manner. In the evening the respirations were 20, the pulse 36 per minute.

26th September, 1912. The animal was lying down, the head turned round so that the nose touched the flank. It was very weak and when made to stand it stood, with the head nodding, a very dull expression on the face, and could not retain this position for more than a few minutes at a time. The legs and ears were cold but the cutaneous sensibility on pricking the skin of the legs still remained. The respirations were 18 and the pulse 36 per minute.

For the next few days the animal lay down refusing to stand or eat, the respirations being very shallow, and the pulse weak, but neither varied much in frequency from one day to another, the respirations being between 16 to 20 per minute and the pulse 32 to 36 during each day. The animal died during the night of the 1st to 2nd of October, 1912.

The temperature record of the animal during this time was as follows:—

21.9.12	...	M.	... —	E.101.6°
22.9.12	...	M.	... 101	E.101.4
23.9.12	...	M.	... 103	E.101
24.9.12	...	M.	... 100	E.103.2
25.9.12	...	M.	... 101.8	E.102

26.9.12	...	M.	...	100	E.101.4
27.9.12	...	M.	...	100	E.101
28.9.12	...	M.	...	101	E.102.2
29.9.12	...	M.	...	101	E.103
30.9.12	...	M.	...	101.2	E.102
1.10.12	...	M.	...	100.8	E.104

The post-mortem examination of this animal revealed the following:—

Rigor mortis was present.

There were 5 ccs. clear liquid in the pericardium. There was a small extravasation under the pleura of the right lung and both lungs were slightly hyperaemic. The vessels of the mucosa of the trachea were slightly injected. The myocardium was somewhat paler and softer than usual, but the heart was otherwise normal.

The liver was reddish brown in colour and softer than normal and the gall-bladder was distended with green liquid bile. The kidneys showed a hyperaemia of the medulla and boundary zone and were softer and paler in colour than usual.

The spleen was normal in appearance.

The abomasum showed a well-marked hyperaemia of the folds of the mucous membrane and there were also patches of hyperaemia involving the mucosa between the folds.

The mucous membrane of the omasum was normal and the contents moist.

There were small areas of hyperaemia in the mucous membrane of the ileum and jejunum. The contents of the colon and caecum were semi-solid coated with mucus and there were small areas of hyperaemia of the mucosa of these portions of the bowel. The brain and spinal cord and their coverings appeared normal.

Thus we see that poisoning can be induced in fowl, in certain instances, by feeding them on the leaves of the *Cotyledon orbiculata*, and also that symptoms of poisoning were produced in the case of Goat 4597 by feeding it with 240 grammes of the same plant.

The chief symptoms produced as a result of the toxic effects of the plant appear to be due to an affection of the central nervous system.

We also see that in the case of different samples of the plant, it is not in every instance that toxic symptoms follow their administration of fowl, although the quantities fed to fowl with negative results, (See Expt. No. 2) may be larger than those producing toxic symptoms (Expt. No. 4).

We may also note that a fowl (No. 1) which has shown toxic symptoms in response to being fed with the plant may show similar symptoms on a second administration of the plant at a later date.

So as to remove any doubt as to the classification of the plants used in the experiments Nos. 2 and 4 with fowl, where one sample of the plant sent by Mr. Burtt-Davy from Skinner's Court, Pretoria, caused the production of toxic symptoms whilst the other failed to do so, this latter gentleman forwarded specimens of these two samples to Dr. Schönland, of Grahamstown for his identification.

The following is Mr. Burtt-Davy's letter concerning these specimens:

"With reference to the Cotyledon specimens furnished by me, one of which proved fatal to fowls and the other innocuous, I submitted material of both plants to Dr. Schönland who is our recognised authority on the Crassulaceae; he writes as follows:—

'The Cotyledons received from you must both be referred to *C. orbiculata*. I thought at one time that we could separate it into a number of species, but this is quite impossible. Your Transvaal specimens cannot be separated from specimens which I had from German South West Africa, S.W. Cape Colony, etc.'"

I have now pointed out to him certain differences which I think might warrant a varietal name, and will advise you of his answer.

(Sgd.), J. BURTT-DAVY,

Government Agrostologist and Botanist.

Up to the present time the difficulty has been to obtain a sufficiently large quantity of the plant for experimental purposes. Just now however it would seem that more of the plant can be obtained than formerly and further experiments are being made to test the effects of the plant when fed to goats, sheep, and larger stock, and efforts will be made to isolate the active toxic principle contained in the leaves.