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**FERN (*NOTHOLAENA SINUATA*, var. *Crenata*)  
POISONING IN SHEEP, GOATS, AND  
CATTLE—THE SO-CALLED "JIMMIES"  
OF THE TRANS-PECOS**

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Division of Veterinary Science

in cooperation with  
Bureau of Animal Industry  
U. S. Department of Agriculture



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T. O. WALTON, President

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A disease of sheep, goats and cattle which occurs on rocky, limestone areas of the Trans-Pecos and referred to as "jimmies" was reproduced by feeding *Notholaena sinuata* var. *crenata*, a fern growing from central Texas to California and extending into Mexico. Since the greatest loss occurs in sheep and due to the westward movement of this industry, it is becoming one of the leading disease problems for this class of livestock in the Trans-Pecos. The grazing of this plant causes a slight to moderate loss in goats but probably none in cattle. The effects of grazing the plant may appear as early as the middle of November. Mortalities begin the first part of January and continue until about three weeks after other green feed becomes available in the spring. The disease is characterized by trembling and sudden death, both of which are induced by exercise.

In the experimental feeding of this fern to sheep and goats, evidence of toxicity was obtained by walking the animals not earlier than 48 hours after receiving the first dose of the plant. Recovery from the toxic effects of the plant required from 5 to 19 days, a period which agrees with range observations.

Infested pastures should be devoted to goat or cattle grazing. If sheep are maintained in such areas the pastures should be small and no attempt made to work the sheep during the winter months.

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# FERN (*NOTHOLAENA SINUATA*, var. *Crenata*) POISONING IN SHEEP, GOATS AND CATTLE—THE SO-CALLED “JIMMIES” OF THE TRANS-PECOS

By

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(In cooperation with the Bureau of Animal Industry, Pathological  
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For many years ranchers in certain areas of the Trans-Pecos have recognized a disease entity which they refer to as “jimmies.” The disease is characterized by sudden seizures of severe trembling which may be followed by sudden death from respiratory paralysis, both of which are induced by exertion. Affected animals show no indication of a morbid condition while grazing, but fatalities frequently occur as a result of the animals’ being driven as little as 100 yards. The term “jimmies” as applied to the disease herein described bears no relation to the same term which is sometimes used to designate rayless goldenrod poisoning. The two diseases have no resemblance to one another.

The disease occurs in sheep, goats and cattle, but has never been observed by the author in horses. There are reports of its occurrence in horses but after observing this condition on numerous ranches where the horses were being ridden daily with no ill effects and were being grazed in the same pastures as the affected sheep we are forced to conclude that horses are not affected, or that they do not graze this toxic plant. As a rule the disease appears about the middle of December and disappears about three weeks after green feed becomes available in the spring, which is about the latter part of March or the first of April. Drought conditions hasten its appearance in the fall and if continued throughout the winter may prolong its existence well into the spring months. It has never been observed on the igneous rocks of the Davis Mountains, but has been confined to rocky, limestone hills and mountains—a type of soil which appears to be best adapted for the growth of the fern which was found to be the cause of this disease. The fern has been found in sufficient quantities to produce toxic effects at elevations ranging from 2000 to 6000 feet.

The greatest loss occurs in sheep. In a flock of goats the incidence of the disease may be just as high as in a corresponding number of sheep but the loss is never severe. The goat appears to be more conscious of approaching danger and when the symptoms appear can not be forced to continue walking. It is probably this ability of the goat to take care of itself rather than lower susceptibility which accounts for the much lower death rate in goats than in sheep. From reports which have reached

the author it is evident that this condition occurs in cattle but authentic reports of losses from this source have not been received. Since exercise is required to produce the symptoms and since no sane rancher will subject affected sheep to unnecessary driving or handling, there is no accurate method for determining the extent of the morbidity; however, flocks have been observed in which an estimate of 75 per cent would appear conservative. In sheep the loss may vary all the way from 1 to 25 per cent, depending upon range conditions and the management of the flock. Large poorly watered pastures and unnecessary handling contribute materially to the loss, but the chief factors involved in this connection are range conditions and the amount of fern available for grazing.

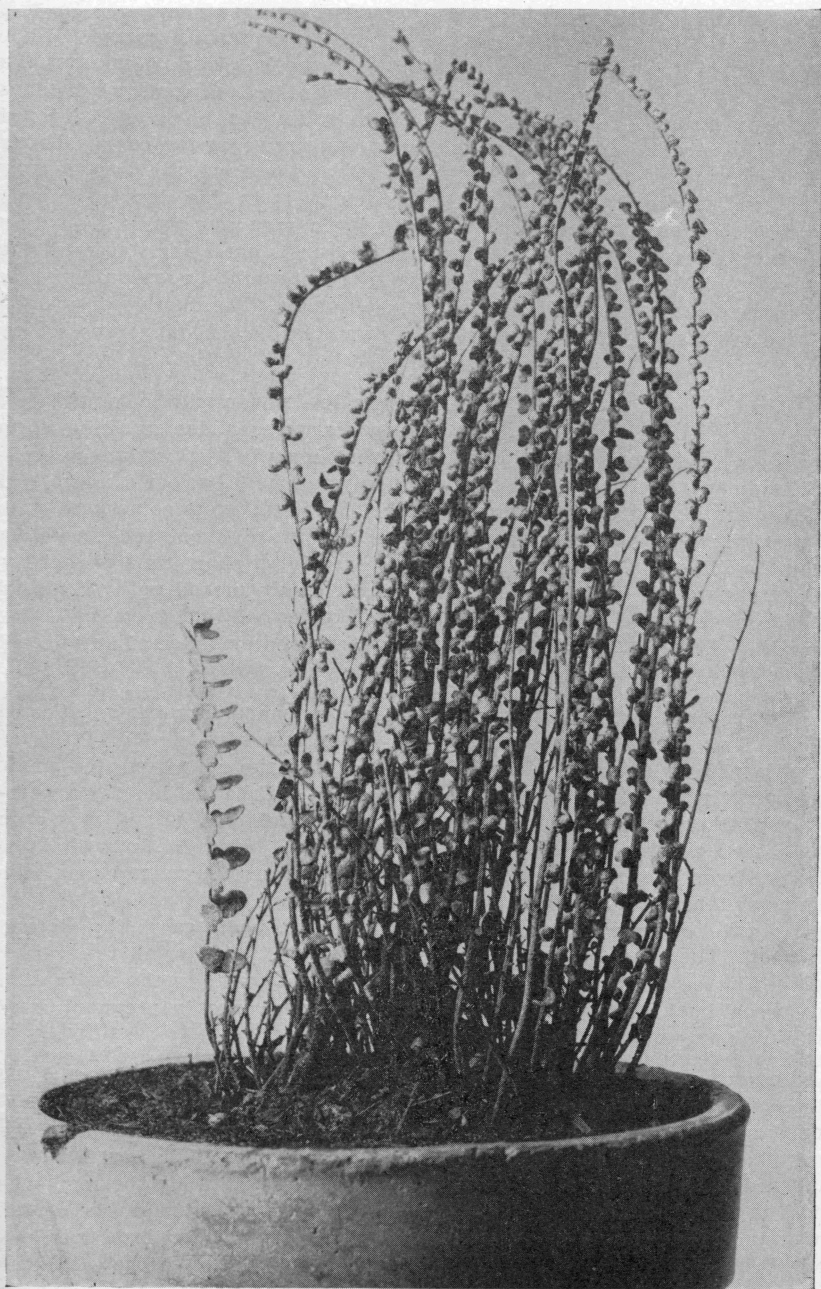
#### **BOTANICAL DESCRIPTION OF *NOTHOLAENA SINUATA* var. *Crenata*\***

(\*By V. L. Cory, Range Botanist, Texas Agricultural Experiment Station.)

*Notholaena sinuata* (Lag.) Kaulf., var. *crenata*, Lemmon, is an erect, leafy herb, 10-15 cm. high, from a short, woody, very chaffy rootstock. Its fronds (leaves) are narrow, elongated, once-pinnate, tufted, and petioled. Its pinnae (leaf-divisions or segments) are 5-8. mm. broad, nearly orbicular (as broad as long), one or more crenately toothed or lobed, numerous, short-stalked, grayish-green above, and grayish-brown and scaly beneath. The reproductive body of this plant, as in all ferns, is a spore and not a seed. The spores are borne in spore-cases (sporangia) which are collected in clusters (sori) on the back and near the margin of the pinnae. In many ferns the sori have a proper membranous protective covering which is known as the indusium, but in our plant the indusium is lacking and the sori are naked as also the margin of the pinnae is not inrolled to form a false covering. This counterfeit indusium is present in most of the other species of this genus, hence its Greek name meaning "false cloak." The common name, where one is used, is that of cloak fern. This fern grows in crevices and under rocks in the drier hills and mountains from central Texas on west into southern California and on south into northern Mexico. The species, of which this fern is a variety, occurs over much of this same area. It is about twice as large a plant with pinnae as large, oblong in shape, and sinuate to several-toothed. It requires more favorable moisture conditions for its growth.

#### **SYMPTOMS**

During the early part of the "jimmies" season, which may be considered as from November 15 to December 20, an affected flock has all the appearance of well being, but for various reasons the owner may decide to work a certain pasture. The sheep will be found grazing and when headed for the corral will move off in a perfectly normal manner and may be driven for a mile or more before the first symptoms appear. These consist of an arched back, a peculiar stilted movement of the hind legs and usually increased respiration. Such animals attempt to keep up with the flock



**Figure 1.** *Notholaena sinuata*, var. *crenata*.

but eventually stop and tremble violently from head to foot. By this time both respiration and heart action are very much increased. If the affected individuals are permitted to lie down for 15 to 30 minutes the symptoms subside and they can be driven with the flock for some distance before a second attack will appear. If the affected animals are "dropped out" they frequently continue to follow and arrive at the corral shortly after the main band. Lambs up to one year of age are the first to show the toxic effects of the plant but as the mortality in this class of animals is much less than in older sheep, especially in pregnant ewes, a round-up during the early part of the "jimmies" season is not associated with the dangers and sometimes disastrous results as would be encountered in working the same flock by the middle of January. The number of affected sheep and the severity of intoxication increases as the dangerous season advances.

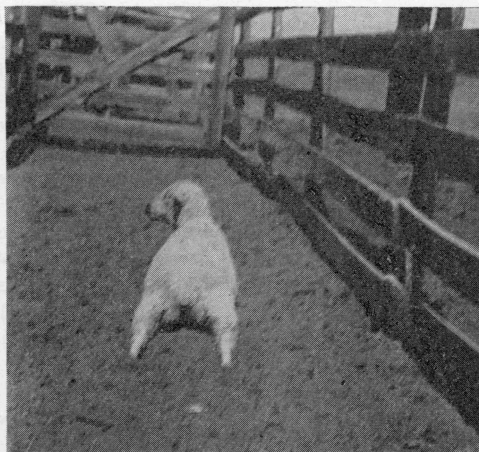
Thus by the first part of January a few dead sheep will be found along the trails and it is evident that the deaths were sudden as there is no evidence of struggle after the animal "went down." At this time observations on an affected flock as they drift to water will disclose a number of stragglers behind every band of sheep. These stragglers sometimes stop, lower the head and take two or three backward steps and trembling usually follows. With each attack they rest for a short time and either attempt to catch up with the original band, or are picked up by a second band on its way to water. In a "jimmies" region, stragglers behind every band of sheep as they drift to water is very good evidence of an affected flock.

By the middle of January if an attempt is made to work an affected flock, it is invariably associated with disastrous results. Mortalities as high as 10 per cent have been observed during the round-up of a single pasture. In this stage of the disease the sheep still have a healthy appearance as they graze around the pasture, but an affected animal may drop dead as a result of being driven not to exceed 100 yards. In such cases there is very little warning of approaching danger; the animal may take three or four stilted steps with the hind legs before it drops to the ground, gives two or three kicks, sometimes a few spasmodic gasps for air and is dead. The heart action continues for a short time after all respiratory efforts have ceased. Artificial respiration has no value in the restoration of the animal. The picture is of common occurrence in pregnant ewes as they approach the lambing season.

Less commonly noted symptoms, and generally observed during the tail end of the "jimmies" season, is a lack of coordination in the movement of the fore and hind legs. The fore legs are advanced in about the normal manner, whereas, the advancement of the hind legs is quite labored, each step becomes a little shorter until eventually the rear support is so far behind and the front support so far in front of the center of gravity that the animal falls on its belly with the hind legs stretched out behind and the fore legs sticking out in front. Another unusual



symptom consists of immobility with a lowered head, and if a person attempts to approach such a case it takes a few backward steps and then rears up on its hind legs several times. However, it does not appear to be able to avoid an approaching person. The handling of such cases will very likely result in fatal termination. It is not uncommon to find young suckling lambs showing marked symptoms but the mothers showing no evidence of the disease.



**Figure 2.** A field case of "jimmies" showing the prostrate attitude brought about by the inability to advance the hind legs.

In goats the symptoms are much the same as in

sheep. The first symptom observed is a rapid switching of the tail in a circular motion. The stilted gait, rapid respiration and trembling soon appear. The goat does not remain standing long after the trembling appears but lies down to rest. In addition to these symptoms the goat utters a bleat which has the tone of fright. When death does occur it is sudden and followed by the symptoms as are observed in sheep.

From the reports obtained upon the occurrence of the disease in cattle the symptoms are about the same as observed in sheep without the fatal termination. Ranchers who are familiar with the disease in cattle state that even though wild, cattle are unable to avoid an approaching person as long as an attack of trembling continues. Recovery takes place more quickly in cattle than it does in sheep and if left alone an affected cow will continue to follow a moving herd and never be very far in the rear.

### **PATHOLOGY**

Within 30 minutes to an hour after death an accumulation of blood-streaked foam is observed around the nostrils, but upon autopsy the only lesions are a few asphyxiation hemorrhages in the lungs and these are lacking as often as they are observed. A thorough microscopic study of the various organs and tissues of affected animals has revealed no microscopic changes.

### **EXPERIMENTAL PROCEDURE**

The leaves of the fern were fed to 10 wethers, one ewe, two wether goats and one calf. The roots of the plant were fed to one wether. The

wethers were from 11 months to 3 years of age, the goats were three years of age and the calf six months. The ewe was suckling a three weeks old lamb during the time she was fed the fern. The usual procedure of grinding and force feeding the plant was at first practiced but it was soon learned that the discharge of the bolus of ground plant into the mouth was all that was required as the animals would then chew and swallow the material with no waste. In order to determine the presence or absence of toxic effects the animals were driven at a walk for one hour around a pasture, unless evidence of the disease appeared in less time. One hour was considered sufficient to detect all but the mildly intoxicated cases. The forced exercise was started 24 hours after the first dose of the plant and continued daily until the animals were shown to be affected. In most of the cases the feeding of the plant was then discontinued and the animals were walked every second or third day in order to determine the time required for recovery.

### RESULTS OF EXPERIMENTAL FEEDING

The results of feeding the leaves and roots to sheep, goats and one calf are summarized in Table 1. There are a few items of interest in connection with the feeding of the fern, one being the regularity with which symptoms could be produced by walking the animals on the second day after they received the first dose of the plant. It is rather remarkable that doses ranging from 0.5 to 1.4 per cent of the body weight of six sheep and two goats, symptoms of toxicity could be produced, by walking, approximately 48 hours but not 24 hours after receiving the first dose of the plant. One sheep (No. 159) which received the equivalent of 0.5 per cent of its body weight showed no evidence of toxicity until the fourth day after receiving its first dose of the fern, and another sheep (No. 166) was not affected until the third day but this animal was fed but one dose and that equivalent to 0.33 per cent of the body weight. Evidence of cumulative effect was obtained by feeding 0.25 per cent doses to sheep No. 142 for 21 days before evidence of toxicity was detected. This is evidently approaching the minimum toxic doses as sheep No. 149 was fed 0.2 per cent doses for 48 days with no apparent ill effects. The fact that sheep No. 149 was fed the dry plant might be interpreted as an indication of loss of toxicity as a result of drying the fern. However, this is not the case, for sheep No. 142 and No. 149 were fed the same material at the same time. Furthermore, the same batch of the plant was found to be toxic one month after the feeding of sheep No. 149 was discontinued. It has also recently been found that the fern retains its toxicity after drying for 8 months. The goat is about as susceptible as sheep, judging from the symptoms observed and the size of doses required to produce the symptoms. The results of feeding the fern to the one calf would indicate less susceptibility on the part of cattle. Doses equivalent to 0.54 per cent of the body weight of the calf had no ill effects for 8 days and when the dose was increased to 1.08 per cent of the body weight seven more doses were required before evidence of toxicity was produced.

**Table 1. The results of feeding *Notholaena sinuata* var. *crenata* to sheep, goats and one calf, green leaves unless otherwise stated**

Animal Number	Weight	Pounds of fern fed	Per cent body wt.	Number of days fed	Days required to produce toxicity	Recovery in days
S149	50	0.1*	0.2	48	No ill effects	-----
S142	80	0.2*	0.25	21	21	11
S166	75	0.25	0.33	1	3	N.D.
S100	100	0.5	0.5	3	2	-----
		0.25	0.25	3	--	11
S130	90	0.5	0.55	3	2	5
S153	60	0.4	0.66	3	2	N.D.
S159	75	0.5*	0.66	3	4	19
S158	60.	0.5*	0.8	2	2	-----
		0.25*	0.4	2	Dropped dead on fourth day	
S129	60	0.6	1.0	3	2	11
S151	35	0.5	1.42	3	2	N.D.
G114	70	0.5	0.7	2	2	-----
		0.25	0.35	4	--	11
G124	65	0.5	0.77	4	2	6
C124	245	1.33*	0.54	8	No ill effects	
		2.66*	1.08	7	15	7
S155	60	0.5†	0.8	2	No definite ill effects	
		0.25	0.4	4	7—dropped dead	

\*Dry plant expressed as original weight of green.

†Roots of plant.

N.D.—not determined.

S=sheep; G=goat; C=calf.

NOTE: Sheep No. 100, No. 158 and Goat No. 114 were fed for a demonstration of the disease. The quick response in these animals suggested the advisability of a 50 per cent reduction of the amount fed daily without interrupting the experiment in order to prolong intoxication without fatal terminations until the day of the demonstration arrived. Sheep No. 155 was fed at the same time and for the same purpose. Although this animal showed no definite ill effects the first three days there was a suspicion that it was affected, hence the reduction of the amount fed daily.

The results obtained from feeding the roots of the plant to sheep No. 155 were interesting. Three days after it received the first dose the walking of this animal produced suggestive evidence of toxicity but nothing definite was obtained until it dropped dead after being walked 20 minutes on the 7th day. For about two minutes before it dropped dead this sheep was showing the arched back and stilted gait of the hing legs, but familiar as we were with the indications of the danger point for such cases, we were not prepared for the fatal termination of this animal. An immediate autopsy on this case proved that respiration and heart action ceased at the same time, a deviation from the consistent findings of numerous autopsies conducted immediately after the death of range cases of the disease.

The time required for apparent recovery varied from 5 to 19 days after the feeding of the plant had been discontinued or an average of 10.5 days for five sheep and two goats, the shortest period 5 days and the longest 19 days. These results coincide with the time required for

recovery from the disease under range conditions. Over a period of years there has been opportunity to observe the effects of moving several affected bands of sheep from infested to non-infested areas. Reliable reports from ranchers state badly affected flocks could be worked as early as one week after removal to non-infested pastures without danger of loss, although some affected animals were invariably found. Two weeks after removal to non-infested pastures sheep have been worked with no evidence of the disease. The calf had recovered by the seventh day.

### TOXIC PRINCIPLE ELIMINATED IN MILK

A ewe which was sucking a three-weeks old lamb was fed 0.3 lb. of the dry fern (equivalent to 0.5 lb. of the green plant, 0.49 per cent of the body weight) for 6 consecutive days. The ewe and lamb were walked daily from the third to fifth day after receiving the first dose with no ill effects in either animal. On the sixth day after the ewe received the first dose the lamb developed a severe and typical case of trembling after being walked for 10 minutes. The ewe was not affected although she got in the lead of other sheep which were being walked at the same time and led them around the pasture for about an hour before she could be corraled. Walking these animals the next day was a duplication of the results of the sixth day. The ewe went off feed about this time and later died. The lamb recovered. The death of the ewe was probably the result of over-heating while stampeding around the pasture on the sixth and seventh day as both were very warm days and the ewe was certainly over-heated on both occasions.

### CONTROL

Since it is not uncommon to find sheep, goats and sometimes cattle being grazed in the same pasture with a serious loss occurring in the sheep but none in either the goats or cattle, the control of this condition is, therefore, principally concerned with sheep. In this connection the occurrence and distribution of the fern should first be considered as it is rare to find all the pastures on any given ranch infested, and quite often there will be as many non-infested as infested pastures. The infested areas should be grazed between April 1 and November 1 to 15, the non-infested pastures should be held for winter grazing and the sheep placed in them not later than November 15. Probably a more profitable and simplified method would be a combination of sheep and goat raising, with the goats maintained in infested pastures and the sheep on the fern free areas. In some areas cattle could be substituted for goats, but as a rule infested areas are very rough and thus better adapted to goat than to cattle grazing.

If infested pastures must be devoted to sheep raising they should be small and well watered in order to cut down travel to and from water as much as possible. The sheep should be placed in the pastures in the

fall and never handled again until the following spring when the danger of the condition developing is passed. No attempt should be made to maintain breeding ewes, which are due to lamb anywhere between February 1 and April 30, on infested areas. Lambs and wethers are the only classes of sheep which may be grazed with reasonable safety on infested areas and even in these classes an important loss is liable to occur.

Grubbing of the plant might be found profitable in small areas but as a rule the value of the land would not justify this method of control, as the grubbing would cost more than the \$3.00 to \$7.00 an acre, for which most of the infested land can be purchased. No specific treatment can be recommended at this time.

### DISCUSSION

With the increasing westward movement of the sheep industry, this is rapidly becoming one of the leading disease problems in the Trans-Pecos area of Texas for this class of livestock. Ranch conditions and lack of familiarity with this disease has contributed materially to the losses from this source. Many large cattle pastures have been converted to sheep pastures without proper subdivision and without proper watering facilities. Due to the tendency of sheep to graze against the wind until they encounter a fence in large pastures they eventually arrive at points several miles from water. As they are thirsty by this time they start a steady walk back to water rather than graze much of the distance. Such conditions invariably predispose to a serious loss the latter part of the "jimmies" season. The over-grazed area so frequently observed around central watering places also contributes to the loss. In returning to water sheep strike a steady walk when this area is reached, thus creating a hazard of considerable importance whenever the radius of this area amounts to as much as one-half mile or more.

The grazing of this fern can not be attributed to over-stocking as losses have been observed under excellent but dry winter ranges. Wet mild winters, which provide other green feed tend to reduce the loss; dry cold winters have an opposite effect. The fern appears to possess considerable palatability and is grazed as soon as the more palatable forage is killed by frosts. Frosts and freezing weather have no effects on the fern, thus it generally remains the only succulent forage during the winter months. The almost sudden disappearance of the disease in the spring is due to two factors; first, more palatable green feed becomes available, and second, the first few hot days of spring have a withering effect on the fern which probably decreases its palatability.

We have been unable to find sufficient amounts of this plant growing among the igneous rocks of the Davis Mountains to conduct a feeding test for toxicity. It is probably the scarcity of this variety of fern which accounts for the fact that we have not observed this disease in the Davis

Mountains. On the other hand, *Notholaena sinuata* is rather abundant in this region, much more so than it is in the Glass Mountains, the region from which the *crenata* variety was obtained for the present investigation.

A toxicity test on *N. sinuata* was conducted by feeding three sheep from two to three times the toxic dose for *N. sinuata* var. *crenata* without producing toxic effects. This would indicate that *N. sinuata* growing in the Davis Mountains is not toxic. Its status when growing in a limestone area has not been determined, as thus far we have not found sufficient quantities in limestone areas to conduct a toxicity test. Should future investigations on *N. sinuata* confirm the non-toxic nature of this plant, it would appear that we have sufficient justification for designating *crenata* as a distinct species rather than a variety.

The walking of the experimental sheep for one hour as a test for determining the presence or absence of toxic effects of the fern was not as arbitrary a standard as might appear. It is a fact that we have observed sheep to manifest symptoms of intoxication after being walked for more than one hour under range conditions, but a fatal termination in such cases is rare, therefore the degree of intoxication in such cases must be considered mild. It would follow that in affected areas, any pasture that requires a steady walk of one hour or more in order to return to water is too large for sheep and should be subdivided or more watering places provided. The same reasoning prevails in case a rancher finds it necessary to work a pasture during the winter months. The pasture should not be large enough to require a drive of as much as an hour in order to reach the corrals. If at the end of that time no fatalities have occurred no serious disease problem exists.

During the years this condition has been under investigation we have picked up many field cases and hauled them to the experimental feed pens for further observations. Quietly picking these animals up and placing them in a car for transportation, or the unloading upon arrival at the pens has resulted in the death of many sheep which in all probability would not have died if they had not been molested. In contrast to these observations, we as well as ranchers have observed that badly affected animals, if suddenly startled, will break into a run and continue at this pace for as much as a mile without a fatal termination. In other words, sudden violent exercise does not appear to have as serious effects as a slow steady walk. In working with our experimental animals similar observations were made. We have found that the best way to bring out the symptoms of the disease was to herd the sheep around a large pasture at a slow but steady walk. In attempting to bring out the symptoms in a corral where the animals would have to be forced into a walk one minute and would break into a run the next, we have never produced as clean-cut results as we have in a pasture with a slow but steady walk maintained. This is a peculiar observation and one for which no explanation is offered.

After a study of a number of years we are able to predict a chain of events when an uninformed rancher encounters "jimmies" for the first

time. The appearance of a few dead sheep along the trails attracts his attention and he immediately decides he is dealing with hemorrhagic septicemia. He proceeds to round up the flock and vaccinates. The round-up is invariably associated with a serious loss. For about two weeks after this treatment he finds no additional dead sheep, he is convinced that he has the answer to the problem. By the beginning of the third week the mortalities begin again, but this time tape worms are blamed for the trouble. Another round-up is made with the same disastrous results. The sheep are treated for tape worms and an apparent improvement for about two weeks follows. By this time, fortunately for the rancher, spring is at hand, the disease disappears and the sheep are subjected to no further handling. Unfortunately the same rancher must learn the next year that his evidence of beneficial results from the tape worm treatment was erroneous and that all he had succeeded in doing the previous year was to kill off the most severe cases of "jimmies" and thus lost many sheep that would have survived if they had not been molested.

### SUMMARY

The so-called "jimmies" which occurs on rocky, limestone areas of the Trans-Pecos is described. The disease occurs in sheep, goats and cattle and was found to be due to the grazing of a fern.

The symptoms of this type of fern poisoning were induced by walking experimental sheep and goats 48 hours after they received the first dose of the plant.

The toxic principle appears to have a direct action on the respiratory center. It is eliminated in the milk and was found to resist drying for as much as eight months.

Recovery from the toxic effects of the fern is complete when feeding on the plant stops and requires from 5 to 19 days.