FURTHER OBSERVATIONS ON STACHYS ARVENSIS.

"STAGGER WEED" AS A CAUSE OF STAGGERS OR SHIVERS IN SHEEP.


(Read before the Royal Society of New South Wales, Oct. 7, 1925.)

Staggers is a term applied somewhat loosely to any condition wherein there is a staggy gait. In this State, however, there is a peculiar form of Staggers, also termed Shivers, which comes on when animals are driven. It has been shown by Dodd and Henry that such may be due to feeding on Marshmallow (Malva parviflora), or on Lamium amplexicaule. As will be seen in this paper, a third plant has more latterly been incriminated, and the purpose of this article is to record the factors which have a bearing on the development of Staggers or Shivers due to this third plant (Stachys arvensis).

Natural Order—Labiatae: (Mint, &c., Family).

Popular Description.—An annual herb ½ to 1½ feet high, with opposite leaves, oval, or occasionally almost heart-shaped at the base, and with wrinkled margins. The flowers are grouped in circles round the upper part of the square stem, one circle immediately above each pair of leaves. It is a native of Europe and Western Asia.


The fact that this plant might cause Staggers or Shivers was first indicated in certain experiments conducted by one of us (W.L.H.), at Moss Vale in 1921. As these experiments involved only three sheep, only one of which showed definite shivers (held by us to be the best index of the condition), an endeavour was made at Narara in 1922 to confirm the previous results. These experiments were conducted by Hindmarsh, assisted by Mr. E. G. Griffiths, B.Sc., Assistant Chemist, but in this second series of experiments only negative results were obtained.

The following summary of the Moss Vale (1921) experiments may be detailed here:—In this experiment three adult sheep (one merino and two crossbreds) were employed and offered the weed ad libitum, no other food being allowed. The sheep were placed in a small yard and allowed water; supplies of the weed were freshly cut each day. The sheep did not eat the weed at all readily.

Sheep I.—Crossbred ewe, broken mouthed. Tested by driving on 14th day, it showed symptoms of both Staggers and Shivers. Tested again on the 21st day, it refused to travel more than 100 yards, and showed trembling. It died the same day.

Sheep II.—Merino ewe, aged. Tested by driving on the 21st, 27th and 28th days, travelled 3 to 4½ miles without showing definite symptoms of Shivers or Staggers, though there appeared to be some urinary irritation—a condition often seen but not invariably present in sheep which show definite Staggers.
Sheep III—Merino ewe, aged. Tested by driving on the 14th day, it travelled normally. On the 21st day (a 4 mile drive), it showed slight stiffness of action for the last mile of the journey. On the 27th day it travelled well for one mile, and then showed the signs of urinary irritation exhibited by the other sheep. At times whilst standing and straining to pass urine, the whole body trembled. It travelled a further 1½ miles, but gradually walked more slowly and went down. Similar symptoms were shown the following day. It was then killed.

In the Narara (1922) experiments, the following results were obtained:—

Pen I—Three adult sheep fed on freshly gathered plant, average 2.45 lbs. per day per sheep for 40 days. Tested—No symptoms of Staggers.

Pen II—Two adult sheep drenched daily with expressed juice and watery extract from freshly gathered plant. Average juice and extract from 6.77 lbs. plant per sheep per diem. Result—No ill effects.

Pen III—One adult sheep fed on residue after pressing, average 2.55 lbs. per diem. Residue mixed with lucerne chaff. Result—No ill effects.

Pen IV—Two adult sheep controls remained normal.

The following year (1923), it was decided (in view of the inconclusive results previously obtained), to conduct more extensive tests, such to be both at Narara and at the Glenfield Veterinary Research Station, which had meantime been established. These showed very definitely that
the weed was capable of inducing Staggers or Shivers, and the fact had been recorded by Seddon.

During certain of these experiments, more particularly those at the Veterinary Research Station, it became obvious that the effects of *Stachys* might be quite variable, even apart from individual idiosyncrasy in sheep (which will be discussed later), and the purpose of the present paper is to review the whole of the feeding experiments that have been conducted, and to offer an explanation for this variation in the effect of the plant.

**Causes of variation in the effects of Stachys arvensis in Sheep.**

(a) *Age of Animal.*

In the experiments recorded by Seddon, it was shown that when ewes and lambs were fed simultaneously, the lambs might show symptoms earlier than the adult sheep, or even to show symptoms whilst the adult sheep remained unaffected.

Thus in Experiment 1 (Glenfield), commenced 11th October, 1923, of three merino ewes with three well grown, recently weaned lambs, all the lambs showed symptoms on the fifth day of the experiment, whereas only one of the adult sheep showed them on that date, the other two not developing them till the seventh and twelfth days respectively.

In Experiment 2, with sheep from the same source as those used in the previous experiment, conducted at Glenfield, but not commenced until 10 days after Experiment 1, the two lambs showed slight symptoms, commencing on the 8th and 13th days respectively, but definite Shivers occurred in neither until the 25th day, on which date one exhibited Shivers, the other lamb being found dead in the pen on the same day; the adult sheep remained normal throughout, although the experiment was continued for 32 days.
(b) Condition of plant.

The following summary of all feeding experiments to date shows the date of commencement, and shows that the negative results were in general obtained in the late spring, whereas earlier (winter) experiments were positive.

<table>
<thead>
<tr>
<th>Date of commencement of experiment</th>
<th>Year</th>
<th>Locality from which plant drawn</th>
<th>Result of expt.</th>
<th>Minimal interval before symptoms appeared</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 26, 1921</td>
<td>1921</td>
<td>Moss Vale</td>
<td>Positive</td>
<td>14 days</td>
</tr>
<tr>
<td>July 23, 1924</td>
<td>1924</td>
<td>Lisarow</td>
<td>Positive</td>
<td>6 days</td>
</tr>
<tr>
<td>August 23, 1924</td>
<td>1924</td>
<td>Lisarow</td>
<td>Positive</td>
<td>13 days</td>
</tr>
<tr>
<td>September 26, 1922</td>
<td>1922</td>
<td>Narara</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>September 26, 1923</td>
<td>1923</td>
<td>Narara</td>
<td>Positive</td>
<td>12 days</td>
</tr>
<tr>
<td>October 11, 1923</td>
<td>1923</td>
<td>Narara</td>
<td>Positive</td>
<td>5 days</td>
</tr>
<tr>
<td>October 21, 1923</td>
<td>1923</td>
<td>Narara</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>October 30, 1923</td>
<td>1923</td>
<td>Narara</td>
<td>Negative</td>
<td></td>
</tr>
</tbody>
</table>

As the seasons vary considerably from year to year, the condition of the plant on a given date may differ considerably in different years. A comparison of the experiments conducted in 1923 and 1924 shows that whereas the first experiments were invariably positive, in experiments conducted later in the same year the effect was more delayed or even entirely lacking. As successive feeding tests were first performed in 1923, it was only then that this fact was recognised. Thus in Experiment 3 (Narara, commenced 26th Sept.), and Experiment 4 (Narara, commenced 30th October), it was found in the first mentioned that Staggers was induced in three adult sheep in 12, 12 and 19 days respectively, whereas in the later experiment an adult sheep did not exhibit symptoms when tested repeatedly up to the 20th, 27th, and 33rd days after feeding commenced.

A similar result was shown by the adult sheep in Experiments 1 and 2 (quoted above), for whereas in the former symptoms were induced in three sheep in 5, 7, and 12 days respectively, in the latter no symptoms were induced, though the feeding was continued for 32 days.

It should be noted that the interval between these ex-
periments was quite small, being 34 days in the first mentioned comparison and only 11 days in the second. As the sheep used in this latter case were exactly comparable, it became obvious that some considerable change must have occurred, and that relatively suddenly, for the feeding to be attended with such diverse results.

It was noted that the plant used in the earlier of each of these pairs of the experiment appeared green and succulent, whereas in the later pair of experiments it was much drier and of a yellowish colour.

It will be convenient here to give a short account of the plant as we have seen it grow. It is peculiar in that though an annual, it has not a direct seasonal growth, but springs up whenever conditions are favourable, at any time of the year, but is confined apparently to cultivated ground. It, therefore, appears in quantity in orchard land, lucerne or other cultivation paddocks, and in gardens during the winter and early spring, and usually thrives from then on until destroyed by cultivation in the late spring or by the dryness of mid-summer. With the early autumn rains it may spring up again, but the winter frosts are unfavourable for it.

The plant commences to flower and seed when only a few inches in height. Under favourable conditions, the plant may remain green and show luxuriant growth (including branches), and attain a height of up to 12 inches. Should dry conditions prevail, however, it rapidly assumes a yellowish colour, and such occurs irrespective of the size or age of the plant. At the same time it naturally becomes somewhat harsh.

Thus at any time from late winter to late spring, one may find the majority of the plants either green and succulent or yellowish and harsh, depending on whether conditions are favourable for its growth or not. As
moisture in the soil is often influenced by cultivation processes, these latter may have a bearing on the condition of the plant.

An examination of rainfall records shows that just prior to the period at which the plant was noted to lose its potency, there was, in each year, a marked dry spell which, with the rising temperature consequent on the advent of summer, might prove unsuitable for the further growth of the plant.

The variation in the effect of "green" and of "yellowish" plant here discussed might have been associated with death or wilting of the plant, and to determine whether this was so or not, samples of the plant were dried to hay and tested by feeding to sheep.

These experiments were planned as follows:—A quantity of the fresh plant was fed and at the same time a similar amount was weighed out and then sun-dried and fed to animals of the same class as those used for the fresh plant. The samples of dried weed were kept separate and fed in proper rotation.

The results are shown in the following table:—

<table>
<thead>
<tr>
<th>Ex. pt.</th>
<th>Year</th>
<th>State of plant</th>
<th>Sheep used</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1923</td>
<td>Fresh</td>
<td>1 adult sheep 2 lambs</td>
<td>Adult sheep—negative Lamb 1—symptoms 8th day Lamb 3—symptoms 13th day</td>
</tr>
<tr>
<td>5</td>
<td>1923</td>
<td>Dried (7 days)</td>
<td>1 adult sheep 2 lambs</td>
<td>Adult sheep—negative Lamb 1—symptoms 39th day Lamb 2—negative Lamb 1—symptoms 16th day Lamb 2—symptoms 18th day (died) Lamb 3—symptoms 24th day</td>
</tr>
<tr>
<td>6</td>
<td>1924</td>
<td>Fresh</td>
<td>3 lambs</td>
<td>Lamb 1—symptoms 10th day Lamb 2—symptoms 12th day Lamb 3—symptoms 12th day</td>
</tr>
<tr>
<td>7</td>
<td>1924</td>
<td>Dried (14 days)</td>
<td>3 lambs</td>
<td></td>
</tr>
</tbody>
</table>
Thus, in 1923 and 1924 lambs on both fresh and dried Stachys arvensis showed Staggers. Comparison of the effect of fresh and of dried Stachys, however, gave inconsistent results, for whereas in 1923 it appeared that the fresh weed was the more potent, in 1924 the reverse was the case.

Consideration of the manner in which these supplies of the weed had been dried showed that in 1923 the weed had been placed on jute bags of a rather open texture, which were lifted out into the sun daily, to hasten the drying process. In 1924 the bags used were placed in a shed and not disturbed until the weed was required for feeding. Further, it was observed that on lifting the dried (or drying) weed, the seed was easily lost, and thus in the 1924 experiments it was retained, whereas in the 1923 experiments it was probably largely lost.

Similar discordant results were obtained in connection with experiments designed to furnish a clue to the nature or location in the plant of the Staggers-producing principle as is shown in the following table:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2 (1923)</td>
<td>Fresh Stachys</td>
<td>2 lambs</td>
<td>Lamb 1—symptoms 8th day</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lamb 2—symptoms 13th day</td>
</tr>
<tr>
<td>8 (1923)</td>
<td>Watery extract from Stachys</td>
<td>2 lambs</td>
<td>Lamb 1—symptoms 7th day</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lamb 2—symptoms 15th day</td>
</tr>
<tr>
<td>9 (1923)</td>
<td>Residue</td>
<td>2 lambs</td>
<td>Lamb 1—negative (30 days)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lamb 2—negative (30 days)</td>
</tr>
<tr>
<td>6 (1924)</td>
<td>Fresh</td>
<td>3 lambs</td>
<td>Lamb 1—symptoms 16th day</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lamb 2—symptoms 18th day (died)</td>
</tr>
<tr>
<td>10 (1924)</td>
<td>Watery extract from Stachys</td>
<td>3 lambs</td>
<td>Lamb 1—negative (46 days)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lamb 2—negative (46 days)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lamb 3—negative (46 days)</td>
</tr>
<tr>
<td>11 (1924)</td>
<td>Residue</td>
<td>2 lambs</td>
<td>Lamb 1—symptoms 12th day</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lamb 2—symptoms 12th day</td>
</tr>
</tbody>
</table>
In each year the "extracts" were prepared from similar material, and at the same time that the fresh plant was fed to the lambs. Further, the same quantity of weed was used for feeding in the fresh state, and for preparation of the "extract," the "residue" being the pressed plant residue remaining after the fluid "extract" had been removed by expression. As the lambs were of the same class, the experiments in each year become strictly comparable. (The "extract" was administered by the mouth, and for sustenance the lambs were provided with wheaten chaff; control sheep, receiving the same ration but neither drenched with extract nor fed with the weed, were included in the experiment.)

The 1923 results indicated that the Staggers-producing principle was present in the "extract," and not in the "residue"; the 1924 experiments as conclusively indicated the contrary.

These extracts were prepared by passing the weed through a mincing machine, adding tap water to thoroughly moisten the mass, allowing to stand overnight, and then expressing the fluid (so-called "extract"), by means of an ordinary meat press. An important difference in technique was made in each year, inasmuch as in 1923 the material was reduced to a much finer state than in 1924, the attrition in the former year being sufficient to break the seeds, whereas in the following year it was not. This result was due to different apparatus having been used.

These several variations in the effect of *Stachys arvensis* collected at different dates, of dried (and possibly deseeded) weed, and of extraction of thoroughly bruised and of simply chopped weed, all pointed to a possible common cause, namely the seed content of the plant.

That the plant commences to flower when only a few inches in height, and that the seeds are rapidly formed,
had not escaped notice, and one recognised the futility of attempting to collect the plant in quantity in the pre-flowering stage.

As a quantity of the dried *Stachys* was available, it was threshed, and two sheep were drenched (Experiment 12), with a watery extract of the seed as follows:—Fifty grams of the seed were thoroughly pounded in a mortar, and 400 c.c. of water added. It was allowed to stand overnight, and then filtered through muslin and drenched to lambs Nos. 34 and 35. This was repeated daily. The result was that both animals showed symptoms on the third day of drenching (S. 35 "shivered," S. 34 lagged).

An attempt was then made by threshing to remove the seed from dried supplies of the plant, as used in Expt. 7, the plant having now been drying for two months. (This experiment is not exactly comparable with Expt. 7, in which the first sample was weighed out on 30th July, for in the later experiments (Nos. 13 and 14), the first sample used was that put aside to dry on 10th August.)

After the 27th day of the experiment it became necessary to use dried weed from a bulk sample of "hay." The results of these experiments were as follows:—

Experiment 13.—Lambs fed on carefully *threshed weed*. Remained normal after 40 days' feeding.

Experiment 14.—Lambs drenched with emulsified seeds from threshed hay. (Hay from same quantity of weed as that used in the fresh state for Expt. 7.) One lamb shivered on 24th day, others remained normal.

The effect of drenching an emulsion of the seeds was then repeated, the material not being filtered. In the experiment (No. 15), 100 grams of seeds were administered
daily to each sheep in 400 c.c. of water (after crushing and allowing to soak in the water overnight). Result: Lamb 93 shivered on 3rd day and Lamb 94 on the 10th day.

An attempt was then made to remove the seed from *Stachys* and to feed the dried plant in as large quantities as would be consumed (about 1 lb. per day), a larger quantity than had been employed in Experiment 13. It was found impossible to remove all the seed, except by the tedious process employed in Experiment 13, a process not practicable with the larger quantities used in this experiment. The result of the experiment (No. 16), was that lamb 97 shivered on the 12th day and lamb 98 on the 15th day.

(c) Quantity Fed.

Obviously, this must play an important part. In nearly all our work, animals have been given as much as they would eat. With the fresh plant, the only case in which similar animals were fed at different rates was in 1923, when ewe 24 (Experiment 77), was fed with the weed *ad libitum* (consuming up to 6 lbs. daily), and developed symptoms of Staggers on the 12th day, and shivered on the 24th day, whereas sheep 38 (Experiment 2), fed 2 lbs. per day, remained normal. As one of these sheep was a cross-bred and the other a merino, it is perhaps unfair to compare them, though parenthetically it may be stated that both classes are susceptible, but whether equally so or not is unknown.

A more striking example is seen in the experiments wherein large quantities of seed were employed. In these two experiments shivering was manifested on the third day, whereas in no other experiment has an animal shown symptoms so rapidly. The quantity of seed given would be considerably more than that contained in the largest quantity of plant (fresh or dried) that a sheep could eat in the same time.
Further, when small quantities (average 8 grams per day) of seed were given (Experiment 14), shivering was manifest in only one of three animals, and then not until after 24 days' feeding, whereas of two similar sheep fed at the same time at the rate of 100 grams per day, one shivered on the third and the other on the 10th day.

(d) Duration of feeding.

No precise information is available on this point, but from the facts that on removal from the weed sheep recover rapidly (within 4 to 6 days) from the "Staggers" state, that in certain experiments sheep did not manifest symptoms until after as long as 40 days continuous feeding, it is probable that the action is a cumulative one, except in excessive doses large enough in themselves to induce the condition, e.g., large quantities of seed.

(e) Distance Travelled.

In very badly affected sheep, symptoms may be manifest almost immediately on submitting them to exercise. In the great majority of our cases, however, they have not developed until the animals have travelled at least one or two hundred yards, and not infrequently sheep have not exhibited the condition until they have been driven for between one and two miles.

(f) Idiosyncrasy of Individual Sheep.

It has always been our aim to include in each experiment as many sheep as possible, in order to avoid possible negative results due to individual insusceptibility as it appeared from the work of Dodd and Henry, on Malva and Lamium, that such might occur. Owing to the multiplicity of our experiments, it has rarely been possible to include more than three sheep in each experiment.

It is always possible that one sheep may eat less of the plant than another, and particularly is this likely to be so
in the earlier part of an experiment. Once the animals have been got in the way of subsisting on the plant, such a factor is not likely to play a large part and differences in the effect on the sheep may be ascribed to idiosyncrasy.

There are a number of examples of this given in the following table:

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Material</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 (1924)</td>
<td>Fresh Stachys</td>
<td>Sheep 8, shivered 13th day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot; 13, shivered 21st day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot; 16, lagged from 13th to 21st day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot; 14, remained normal — ceased</td>
</tr>
<tr>
<td></td>
<td></td>
<td>feeding after 21st day.</td>
</tr>
<tr>
<td>11 (1924)</td>
<td>Fresh Stachys</td>
<td>Sheep 67, shivered 8th day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot; 71, shivered 10th day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot; 72, shivered 19th day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot; 68, shivered 21st day</td>
</tr>
<tr>
<td>14</td>
<td>Seed</td>
<td>Sheep 66, shivered 24th day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot; 69, remained normal 35 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot; 70, remained normal 35 days</td>
</tr>
</tbody>
</table>

In other cases the results are much more uniform as evidenced by the following:

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Material</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 (1924)</td>
<td>Dried Stachys</td>
<td>Sheep 77, shivered 10th day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot; 78, shivered 12th day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot; 79, shivered 12th day</td>
</tr>
<tr>
<td>19 (1924)</td>
<td>Pressed residue</td>
<td>Sheep 67, shivered 12th day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot; 68, shivered 12th day</td>
</tr>
</tbody>
</table>

In each of the experiments quoted in these two tables the sheep used were carefully selected, so as to be uniform as regards breed and age. As they were driven together at least every two days, it becomes evident that there is a variation in susceptibility, some animals exhibiting symptoms much earlier than others. This is in accord with field experience of the disease.

(g) Non-permanency of the Condition.

In our experimental work it has generally been found that once an animal has attained the condition in such a severe form that it shivers during the first thousand yards
travelled, it will show symptoms at each subsequent driving, provided that it is still fed with the weed. The initial symptoms under such circumstances are persistent lagging, often passing on to complete refusal of the animal to travel ("knocking up"). Experience has shown that if such animals are forced to travel, fatal consequences are liable to occur, and for that reason such animals are generally exempted from further driving.

It has happened, however, that sheep have shown shivers one day and then on some, even may be on all, subsequent drivings have travelled in a normal manner, and that notwithstanding that they were still receiving the weed. In the experiments wherein an animal has shivered one day, travelled normally at the next driving, and then shivered again at the following driving such is, we think, not to be ascribed to a complete or temporary recovery, but to an insufficiency of the test driving employed. Direct evidence of this being the correct explanation has been furnished by the result of driving an extra lap or two such animals as might have been expected to show symptoms—the extra distance usually serving to elicit symptoms. These cases, it should be noted, have only occurred in animals in which symptoms have been previously manifest after driving a considerable distance, and they were, therefore, we may conclude, not severely affected with the condition.

The cases wherein there has been recovery whilst still on the weed have been where at the commencement the fresh plant has been fed, but where there has been evidence that as the experiment progressed the plant became less harmful. An example of this is to be found in a record by Seddon (loc. cit. Experiment 1, Sheep 1; compare Sheep IV for fact of diminished potency of the weed).
Discussion.

From the foregoing it would appear that, as we early suspected, variation in the effect of the plant was related chiefly to two factors—

(a) Age of animal.
(b) Amount of seed contained in the plant fed.

The former is a clinical experience and its proof was furnished in the report earlier published.

The experiments in support of the latter are not so crucial as one would like, chiefly owing to the great difficulty of removing all the seed from samples of the dried plant and the impossibility of securing quantities of the plant in the short stage before seeding.

The recognition, however, of the fact that the Staggers-producing substance is present in quantity in the seed is an advance in our studies to determine the nature of the active principle and generally facilitates further work on the condition.

Summary of knowledge regarding Stachys arvensis as a cause of Staggers or Shivers in sheep.

It will be convenient now to give a general summary of the above, this being based upon field observations and the results of experimental feeding upon the plant.

1. Stachys arvensis, "Stagger Weed," is a cause of Staggers or Shivers in sheep. (Other plants capable of causing the condition are *Malva parviflora* (Marshmallow) and *Lamium amplexicaule* (one of the Nettle family).

2. For this effect to be produced the animals must have been eating the plant for at least four or five days.

3. The condition of Staggers or Shivers is observed only when the animals are driven or otherwise exercised. Thus they appear normal in the paddock or pen and show symptoms only when travelled. The amount of exercise
necessary to produce symptoms is variable: it may be only 50 yards or so, more usually it is from 200 to 500 yards, but it may be delayed until the animal has travelled over a mile.

4. Symptoms appear comparatively suddenly. The most prominent are a staggering gait and attacks of shivering. Frequently, but not invariably, animals lag behind the flock for a while before these attacks of Staggers or Shivers become manifest. Animals may show "Shivers" without any previous staggering. Again, they may at times stagger without showing "shivers."

Another symptom often but not constantly observed is frequent urination.

5. Following an attack the animal usually goes down and if allowed to rest a little while may get up and travel normally. More often any enforced driving leads to complete "knocking up" or further attacks of shivers.

6. Once having shown symptoms (lagging, knocking up, staggers or shivers) any enforced exercise is liable to cause sudden death of the animal, and the greatest care therefore has to be taken in droving a flock affected with the condition.

At times in our experimental work an animal has been found dead in the pen: it would appear therefore that severe exercise is not always necessary to bring about death.

7. The plant grows only in cultivated land (orchards, fallows, lucerne fields, etc.). It is a rapid grower when conditions are favourable, provides abundant herbage, and as otherwise it is not bad sheep feed, flocks might at times be depastured upon it. Under such circumstances therefore one might find that the whole or greater part of a flock becomes affected with the condition.

8. It occurs commonly in the following Pasture Protection Districts:—Maitland, Cumberland and Berrima.
So far as is known it does not occur in profusion in the main sheep districts. It would probably occur there, especially in the Tablelands, if more cultivation of crops for sheep feeding were carried out. It is never likely to be of importance in the central and western part of the State owing to the dry conditions.

9. The effects are most marked in young animals, particularly lambs. Ewes, even though not showing symptoms themselves, may transmit the condition through the milk, and thus even young lambs, not old enough to eat the plant in quantity themselves, may show symptoms.

10. The plant varies in its effects, and such is due chiefly to the amount of seed it contains.

11. The plant flowers and seed is formed when only a few inches high, and as the seed ripens it falls out. Thus, young, green, succulent, actively growing plants have been found to be most harmful.

Later the plant becomes drier, somewhat harsh, and yellowish in colour. The seed has then nearly all fallen out, and feeding at that stage may produce no ill effects. Soil conditions, particularly degree of moisture present, have a marked influence on the growth of the plant, and hence on its effect.

12. Generally speaking, it may be said to be most harmful in the late winter and early spring, and to decrease in stagger-producing action as spring advances until, drying off in the early summer, it becomes harmless. The amount of plant required to produce symptoms is therefore variable. In all experimental work wherein sheep were fed they received the plant alone—no other feed. Under such conditions lambs showed symptoms after eating at the rate of 1 lb. per day for five days. This was the young plant.

13. As mentioned before, the poisonous substance is present in greatest quantities in, if not entirely confined
to, the seeds. Drenching animals (fed on wheaten chaff) with an emulsion of large quantities of seed has led to symptoms in three days. *Stachys* hay from which all the seed had been threshed produced no ill effects.

14. If taken off the plant and placed on other feed (chaff, grass, etc.), affected animals recover in a few days. This is a very important fact, for in the case of an affected flock which it is desired to travel a distance, a change for say a week to a pasture free of stagger weed will allow them to recover and travel normally.

15. The majority of animals, as long as they are kept on the weed, provided it be at a noxious stage, retain the staggers condition, i.e., show symptoms on driving. A proportion however may recover. There appears therefore some individual tolerance, but this does not apply to the majority.

16. Animals that have shown symptoms and then recovered when placed on grass, have, when placed again on the weed, contracted staggers a second time, thus showing that they do not become immune.

17. In our experiments it has been found that over 90% of sheep are susceptible to the weed.

It is with pleasure we express our appreciation to Mr. H. G. White, Superintendent, Viticultural Nursery, Narara, and to Stock Inspector Hamilton, of Moss Vale, for the help afforded us in those experiments which were conducted in the field.

References cited.


Seddon. Veterinary Research Report No. 1, Dept. of Agriculture, N.S.W., 1925.

View This Item Online: https://www.biodiversitylibrary.org/item/175278
DOI: https://doi.org/10.5962/p.359898
Permalink: https://www.biodiversitylibrary.org/partpdf/359898

Holding Institution
Smithsonian Libraries

Sponsored by
Biodiversity Heritage Library

Copyright & Reuse
Copyright Status: In Copyright. Digitized with the permission of the rights holder
Rights Holder: Royal Society of New South Wales
License: http://creativecommons.org/licenses/by-nc-sa/3.0/
Rights: https://www.biodiversitylibrary.org/permissions/

This document was created from content at the Biodiversity Heritage Library, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at https://www.biodiversitylibrary.org.

This file was generated 27 June 2023 at 09:04 UTC