KENTUCKY

AGRICULTURAL EXPERIMENT STATION

OF THE

STATE COLLEGE OF KENTUCKY.

BULLETIN NO. 70.

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1. The Woolly Mullein.
2. The Gape Disease of Poultry.

LEXINGTON, KENTUCKY.

DECEMBER, 1897.

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KENTUCKY

Agricultural Experiment Station,

Address of the Station—LEXINGTON, KY.

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ADDRESS:

KENTUCKY AGRICULTURAL EXPERIMENT STATION,

LEXINGTON, KY.

BULLETIN No. 70.

1. THE WOOLLY MULLEIN (Verbascum phlomoides) IN KENTUCKY.

BY H. GARMAN, ENTOMOLOGIST AND BOTANIST.

In 1896 the Assistant Secretary of the United States Department of Agriculture wrote to the Kentucky Station calling attention to the presence of the woolly mullein in this State and suggesting the advisability of undertaking its extermination. Previous (August, 1895) to that time Dr. J. N. Rose of the Department had looked over the region in which the mullein was established and had prepared a preliminary map of its distribution, as it was known to him, which was kindly placed in our hands. Dr. Rose found the mullein abundant at Dickey's Mills on the north side of Nolin River in Grayson County. On the south side of the river in Edmonson County he found some plants along the road leading toward Mammoth Cave for a distance of perhaps a quarter of a mile from the ford. The mullein was scattered along the roads on the north side of the river in every direction for a distance of a half mile to three-fourths of a mile from the ferry. Two miles from the river on the Grayson Springs Station road Dr. Rose found a few plants in a barnyard and two and a half miles from the river on the same road he found ten plants in a barnyard and one in a pasture opposite.

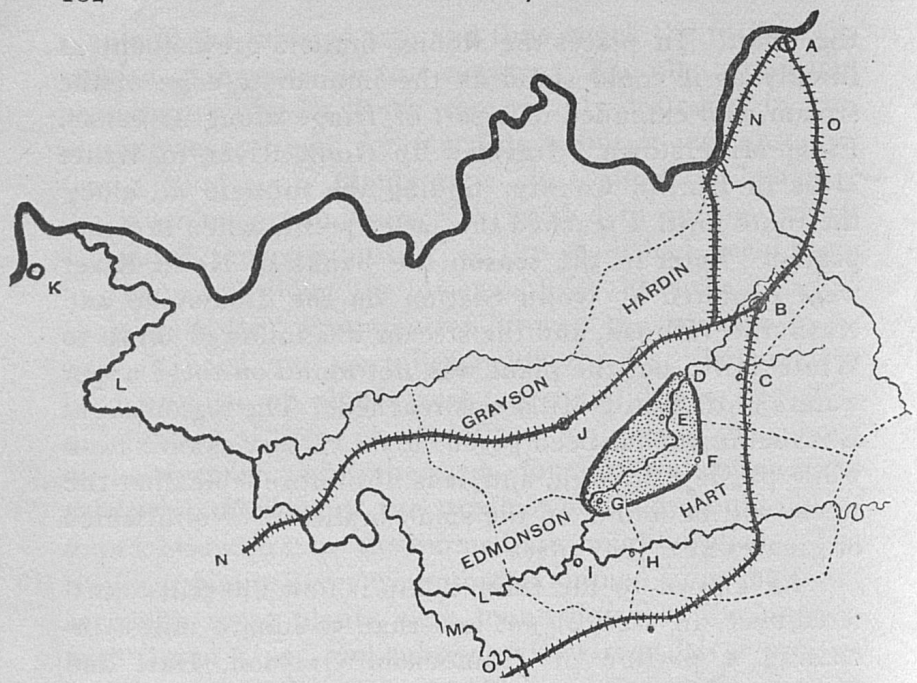
In July, 1896, the writer visited Dickey's Mills for the purpose of looking into the question as to whether or not it was feasible and desirable to attempt to destroy the

plants in the infested area and thus check the further extension of the weed in this country. The plants that had been mapped by Dr. Rose were quickly destroyed by employing several men for few a days, but it was observed that a good many plants grew close along the banks of the river on ground that was flooded in spring, which suggested the possibility that the seeds had been sown by the water along the lower part of the stream, below Dickey's Mills. Examination proved the surmise to be well founded, and six miles below the ford (by river) a large number of plants were found and destroyed. The distribution of these plants left no doubt as to the agency of the river in sowing the seeds, for the plants often grew thickly at the edge of the stream when they could not be found elsewhere in the immediate neighborhood. The banks of Nolin River were now examined from the point at which these plants were found down to its junction with Green River, and subsequently Green River was examined at Brownsville and at the mouth of Nolin, but no other plants were discovered.

In July, 1897, I returned to Dickey's Mills where I found the mullein still in considerable numbers, the seedlings of the previous year being now conspicuous, and thence traveled by conveyance across country to Priceville in Hart County, where a few plants had been observed the year previous by one of the men engaged to help me. About midway between the two places, eight miles from Dickey's Mills, a few plants were found along the road, but none were found at Priceville. From Priceville I traveled northwest to Millerstown on Nolin River, at the extreme eastern end of Grayson County. About three miles south of Millerstown in Hart County, the mullein again appeared, becoming more and more abundant as I approached Nolin River, becoming finally on the banks of the stream more common than I had seen it elsewhere. It was apparent here, as at Dickey's Mills, that the river was the most active agent in distributing

the plant. In places the woolly mullein grew about as thickly as it could stand at the immediate edge of the stream, and extended in a sort of fringe along its banks. From Millerstown I traveled up Nolin River to White Mills in Hardin County, finding the mullein all along the route until I reached the latter point, when it disappeared. Later in the season the banks of Nolin River were explored at Nolin Station on the Louisville and Nashville railroad, and the stream was followed down to White Mills, but the plant was not found on these upper waters until White Mills was reached. The region about Elizabethtown has been given only a cursory examination while passing through, and it is not improbable that the weed will be found on the small branch of Nolin which originates near that place.

As known to me the mullein is now unevenly scattered over an area of not less than 50 square miles, including a portion of Edmonson, Grayson, Hart and Hardin counties, as indicated by the dotted area of the accompanying sketch. The infested region begins about 50 miles southwest of Louisville. It was, apparently, introduced originally somewhere on the headwaters of Nolin River, possibly at White Mills, possibly at Elizabethtown. This section is devoted to wheat growing, and numerous grist mills are located along the stream. Hence it is very probable that the mullein was brought here among wheat or other seeds imported from Europe. Including the windings of Nolin River the weed is distributed along a course perhaps 55 or 60 miles in length, not uniformily, but scattered, and abundant only where the conditions are favorable for the deposit of seeds by the water. The distance in a direct course from the lowest point on the river where the mullein has been found to White Mills is about 25 miles. Wherever the weed is abundant on the river it has spread for a distance of from 1 to 3 miles along roads leading into the surrounding country.



A, Louisville; B, Elizabethtown; C, Nolin Station; D, White Mills; E, Millerstown; F, Priceville; G, Dickey's Mills; H, Mammoth Cave; I, Brownsville; J, Leitchfield; K, Henderson; L, L, Green River; M, Barren River; N, N, Kentucky branch Illinois Central R. R.; O. O. Louisville & Nashville R. R. The dotted area bounded by black line showing region known to be occupied by woolly mullein.

Its Dissemination.

It is assumed that the woolly mullein was brought to Kentucky among seeds, or else with imported goods of some kind among packing. And if carried from one country to another by this means it is not improbable that it has been scattered in the same way to some extent since its introduction. Yet from what I have seen of it I am disposed to believe that its seeds are not commonly carried from place to place with other seeds, and that since its introduction it has been disseminated chiefly, if not entirely, by other agencies. Undoubtedly it is being gradually carried down Nolin River, and if not checked will ultimately reach Green River and, later, the Ohio. Green River has, as already stated, been ex-

amined at Brownsville and at the mouth of Nolin. During the past summer it was carefully examined also at South Carrollton in Muhlenburg County, but thus far no evidence of the occurrence of woolly mullein along Green River has been forthcoming.

The question as to the length of time seeds of the woolly mullein will bear immersion in water is an important one in this connection, and the Station is indebted to Dr. F. V. Coville, Chief of the Division of Botany at the U. S. Department of Agriculture, who kindly tested seeds furnished him. Under date June 5, 1897, he wrote me:

"The seeds of *Verbascum phlomoides* you sent us some time ago for germination test showed an average of 73 per cent., after floating seven days in a bowl of water, while on the fourteenth day they showed a germination of 69 per cent., according to experiments made by Mr. Hicks. Practically, therefore, these seeds would not lose their vitality through any soaking with water that they are likely to get while being carried down a stream."

Supposing the distance from Dickey's Mills on Nolin River to the mouth of Green River to be 200 miles, including the windings of the stream, and that the water at flood time flows at the rate of three miles per hour, in only 2¾ days mullein seeds might be carried to the mouth of Green River; and it is perhaps too much to hope in view of these considerations that the mullein is not already established in places along Green River.

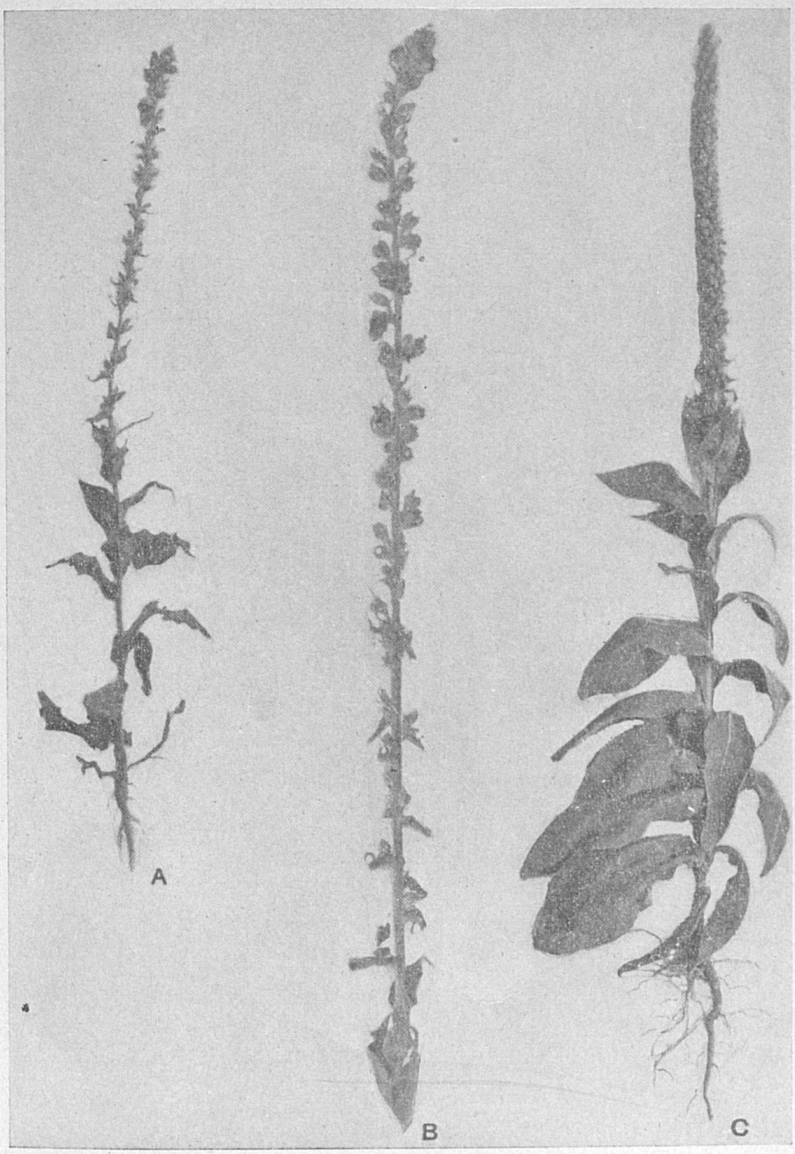
Away from Nolin River the mullein is distributed very largely along roads, a fact which suggests the agents by which it is carried. The plants with ripened seeds remain standing for a long period, sometimes in sheltered places all winter, and I have sometimes taken seeds from old plants that had flowered twelve months previous. Sheep and hogs roaming among such plants no doubt sometimes shake the seeds from the open capsules, and

these falling upon their backs and clinging there would often be carried some distance before being again detached. In mud on the feet of stock and on the wheels of wagons it is probable the seeds are also sometimes conveyed from one point to another. But the seeds are not provided with special means for clinging to the coats of animals, and have no special equipment for their dissemination otherwise, hence except by water their spread is rather slow, and were it not for the part taken by the river it would be a long time in all probability before the species became widely scattered in this country.

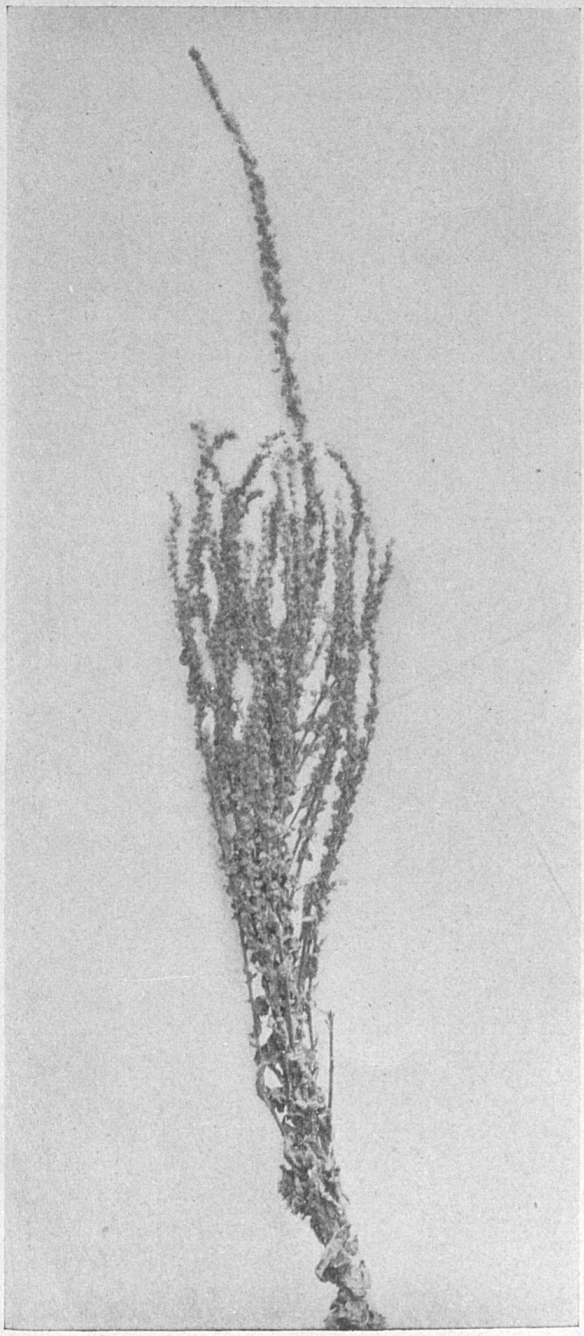
Its History in Kentucky.

Its history in Kentucky corroborates this view of the matter. In the letter above mentioned, from the Assistant Secretary of Agriculture, it was stated that the first plant received at the Department was sent in about eight years previous, which would make the date of its discovery about 1888. At that time it had been carried down Nolin River nearly to the lowest point on the stream at which it now occurs, for the plant then sent to Washington was obtained at Dickey's Mills. I am informed, however, by Mr. R. W. Horn, who resides at Dickey's Mills, that the plants were very scarce there at that time and that he had difficulty in getting specimens to send to Mr. C. F. Very of New Albany, Indiana, to whom belongs the credit of first noticing the plant.

How long the plant has been in the State can only be a matter of conjecture. Assuming that the mullein has been carried by Nolin River only six miles below Dickey's Mills since 1888, and that it was carried from the headwaters of the steam at the same rate, it must have taken at least fifty years to reach Dickey's Mills; for the distance from this place to White Mills in a direct course is 25 miles, and the length of the bed of the river between the two places is fully twice as great. That a plant of this sort should be present for so long a time without



A, woolly mullein, young plant; B, top of same plant, less reduced; C, common mullein.



Woolly Mullein; top of large plant.

being detected need not surprise us greatly when we remember that the region in which the mullein is established is not thickly peopled and that many of those living there have never observed that two kinds of mullein are present.

The Woolly Mullein in Europe.

I am indebted to Mr. Dewey of the Division of Botany, U. S. Department of Agriculture, for references to the works of a number of European botanists who have written on the woolly mullein. It seems that the plant is widely distributed through Continental Europe. It is recorded by one or another from Spain, France, Denmark, Sweden, Germany, Austria, Italy, Greece, Russia and most of the other smaller countries. Nothing very definite can be gathered from these writers, however, with reference to its character as a weed, but they agree very well as to the situations in which it is generally found, noting it as growing at the edges of fields and on neglected land, in dry and often sandy or rocky places.

The Woolly Mullein as a Weed in Kentucky.

The woolly mullein is not restricted to dry and barren soil in Kentucky, but grows wherever it gets a foothold, excepting in thick woods. It flourishes on the richest land along Nolin River. As often happens with introduced plants and insects it seems to have developed a more aggressive disposition here than in its native land, *but it does not thrive in cultivated fields when these are properly cared for*, and hence is not to be feared like crab grass, for example, which persists in spite of hoe and plow. It is chiefly as a useless frequenter of roadsides, pastures and meadows, where it crowds out useful plants, that it is objectionable, being in this respect much like its cousins the common mullein and moth mullein, and I agree with Mr. Dewey when he writes in a letter addressed to me some time ago: "If allowed to spread unmolested the woolly mullein would probably become no

worse as a weed than the black mullein or the moth mullein, but there appear to be abundant indications that it might be fully as bad, and a good work will certainly be accomplished if a weed as bad as one of these is prevented from becoming established in this country."

We have already addressed a circular to the farmers living along Nolin River requesting their aid in checking the further spread of the mullein. Our investigations made since then show the mullein to have been here longer, and to be more widely spread, than was then supposed. Still, the plant is readily killed with the hoe, or by simply pulling it up, and our main purpose in writing this account of the weed is to point it out again to the farmers living along Nolin and Green rivers and to request them to destroy it whenever they may observe it on or about their farms.

The Station has, while looking into the distribution and character of the woolly mullein, destroyed many thousands of plants, but with other pressing work on our hands it will not be possible for us to give the subject the continuous attention needed unless special appropriations can be made for the purpose, sufficient to hire competent assistance.

Description of the Woolly Mullein and Comparison With the Common Mullein.

The woolly mullein resembles the common species more closely than any other mullein occurring in the Eastern United States. The leaves are of the same general character, being large, elongate, and woolly, but the woolly coat is, in large plants, less abundant than in the common mullein and the color of the leaf more green, i. e., less silvery. The leaves of the recently introduced plant are also more pointed at the tip. The stem of the new mullein is round, not ridged like that of the common mullein, and there is a strong disposition in the new plant to branch, so that large examples become quite

bushy at the top owing to the development of numerous slender flower-bearing branches, of several feet in length (See figures). The flowers of the woolly mullein are like those of the common species in general character, but are scattered instead of being crowded together. They are of a bright orange color, and average larger than those of the common mullein, being sometimes as much as 1.40 inch across.

The flowers of the new mullein expand early in the morning, at which time they are visited by bumble bees, by other smaller bees, and by a small black thrips. The plants are often found growing side by side with the common species, and I have seen some hybrids which combined the characters of the two so that it was impossible to say which species they resembled most.

The new mullein begins to flower early in July when not more than two to three feet high, and at this stage is often unbranched. It continues to produce flowers, and to put out lateral branches at the base of the median flower spike, for six weeks or more, and if growing on good soil often reaches a height of as much as eight feet. An example observed by me measured ten feet and seven inches in height, being the largest mullein of any species I have ever seen.

The species has not yet found its way into American botanies.

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2. THE GAPE DISEASE OF YOUNG POULTRY.

BY H. GARMAN, ENTOMOLOGIST AND BOTANIST.

Young chickens are very much troubled in Kentucky with gapes. The disease occurs throughout the State, but is not uniform in its occurrence, being destructive on one farm, while farms adjoining are free from it. On the Experiment Farm at Lexington the disease rarely makes its appearance, while on a place just across a pike the majority of the chicks hatched are some seasons destroyed by it. At my own place again, a mile away, the trouble is very annoying. It appears that once it becomes estab-

lished on land it maintains itself there and thus renders it ill suited to the raising of chickens.

The immediate cause of the trouble is of course the presence of the well known gape worm (*Syngamus trachealis*) in the trachea or windpipe. These worms obstruct the passage of air to and from the lungs and thus occasion the characteristic gasping movements of the suffering chicks. The symptons and general nature of the trouble are so well known that further reference to them may be dispensed with.

Common Remedies.

The commonly recommended practice of introducing into the trachea a partly stripped feather, or a bluegrass top, and by a twisting motion dislodging and removing the worms does not seem to me after considerable experience with the diseased fowls to be practicable for very young chicks. The trachea is so small and so easily injured that it is impossible to dislodge and remove all of the worms by such means. With the greatest care I have never been able to give affected chicks more than temporary relief in this way.

It has been my experience, however, that chicks generally recover without treatment when they are attacked after they are half grown, and hence fowls that might from their size be treated successfully with a feather do not require treatment of any sort. It is the very young chicks that suffer most, and the only remedial treatment in their case that seems to me to be successful is rubbing the neck from time to time with lard or vaseline thoroughly mixed with a little turpentine (3 parts of the lard or vaseline to 1 part of turpentine). This treatment should begin before the disease makes its appearance. It will not help a chick in the last stages of the disease. Pure turpentine will very quickly kill a chick when rubbed on the neck over the trachea, a fact which I

have several times demonstrated on badly affected individuals.

Since my observations on the disease were made I have read a valuable article on gapes and gape worms, written by the French naturalist Megnin. He asserts that the use of pounded garlic with the usual food has been made to completely eradicate the disease among pheasants in Europe. He recommends the use of one garlic bulb to ten pheasants each day, and the same proportion would in all probability be sufficient in the case of the common chicken. He supplements this treatment with special care in the matter of drinking water, using only pure water and changing it several times a day.

The Source of Gapes.

My curiosity as to how chickens contracted the disease was aroused by the observation noted above as to its irregular occurrence. The current belief among naturalists is that the worms are in soil and are picked up with food. No doubt this is true while the disease is present on a place, but I have known instances in which flocks were very badly affected on land where chickens had not been raised for years. How did these minute worms persist in soil that is each year dried and parched by the sun's heat? It is known that they can not endure either heat or drought. It is hardly probable that they migrate like earthworms down into the soil in summer and reappear again at the surface during fall and spring, when the surface soil is damp. It is a natural supposition that they may enter the bodies of insects, mollusks, or earthworms, like some other parasitic worms, and be received by poultry with such food. Yet Megnin asserts that they do not pass any stage of their existence in the bodies of any animals other than birds.

When the disease is under way among a brood of chicks it is beyond doubt conveyed by way of drinking

water and food from affected fowls to others. Chicks suffering from gapes may sometimes be observed to dislodge worms and discharge them from their mouths during spells of sneezing. According to Megnin's observations young hatched from the eggs in the bodies of these discharged worms may live for some time in the drinking water, where they swim about like vinegar eels, ready to be taken into the stomachs of fowls.

These facts in the history of the worms show why dissolving copperas in the drinking water, isolating affected fowls, and changing the quarters of the others sometimes have the effect of checking the spread of the disease.

But when the young gape worms are already abundant in the soil such treatment will not avail unless the chicks can be kept from the ground.

Chicks Reared on a Plank Floor Not Attacked by the Gape Worm.

I find by experiment that it is possible to prevent the trouble completely on my place at Lexington by keeping chicks on a board floor from the time they are hatched until they are large enough to endure the attacks of the worms.

Chicks hatched by two hens June 5–7, 1897, were taken from the nests before they had an opportunity to get to the ground, and confined in two compartments of the same coop. One compartment was provided with a board floor; in the other the chicks were allowed the freedom of the ground. There were twenty chicks in all divided equally between the two hens and confined in the two compartments, which were separated by wire netting. Immediately after the experiment was started three of the lot on the floor managed to get into the other compartment and were allowed to remain. There were thus on the plank floor seven chicks, while confined on the ground beside them were thirteen. One of the latter lot died from

some unknown trouble soon after they hatched, leaving only twelve for experiment.

The two lots were treated alike in every respect except in the matter of the floor and in the character of food. Those on the plank floor received the accustomed food given young chicks, namely, corn meal mixed with water and scraps of bread, potato and meat from the table. After they had grow somewhat, a little oats was given them occasionally. The chicks on the ground received the same kind of food, except that they had in addition a daily ration of earthworms. The following is a record of observations on the lot to which earthworms were fed:

June 23. One of the chicks observed to be badly affected with the gapes. It died during the following night. Several others slightly affected.

June 24. A second chick of the same lot nearly dead from gapes. It was removed and chloroformed, when its trachea was found to contain gape worms.

June 29. A third chick of this lot was found dead, and on examination its trachea was found partly filled with the worms. A fourth, nearly dead from the disease, was chloroformed and it also had worms in the trachea. Several of the remainder were at this date observed to be affected, and probably not a single one was entirely free from the trouble.

June 30. Three more chicks were so badly affected that it was decided to remove and destroy them. All had gape worms in the trachea.

July 1. Three of the five remaining chicks were affected and were removed and chloroformed. The tracheæ of all contained gape worms.

July 3. One of the two remaining chicks was affected. It was removed and destroyed like the others.

July 5. The last one of the lot was removed and chloroformed and also had gape worms in the trachea.

During this time not a single chick of the seven kept

on the plank floor became affected with the disease. The hen kept with them, however, appeared to suffer from the close confinement and cramped quarters, and subsequently died. Her trachea did not contain gape worms.

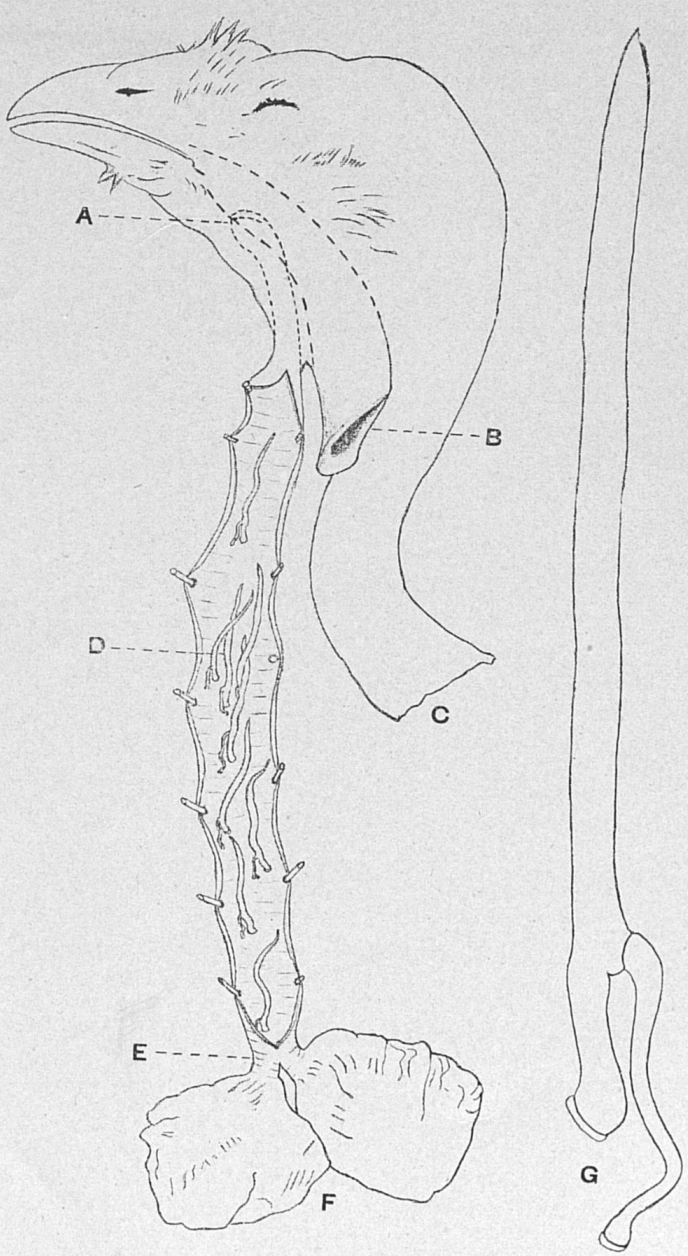
Conclusion.

It is evident that the chicks in the compartment without a floor obtained the gape worms either from the ground or else from the earthworms which were fed to them. At the time my experiment was made I had not seen Megnin's interesting account of the gape worm infesting the European pheasant, and while I must admit that the experiment here recorded does not prove that gape worms live within the bodies of earthworms and are by means of the latter conveyed to the lungs and tracheæ of chickens, yet I am far from convinced by anything observed by Megnin that they may not be thus conveyed.

Convincing evidence can be obtained by confining two lots of the chicks on plank floors, one to be fed earthworms, the other not. A test of this sort was started last spring, after the other was completed, but a drought set in at that time and drove the earthworms so deep into the soil that enough could not be secured. The matter will be taken up again next spring

The result of value to the farmer obtained from this preliminary experiment is, that keeping chicks, for several weeks after they hatch, on a plank floor will prevent the gapes. It is my present opinion that the same result would be obtained by simply elevating an earthen floor above the surrounding level so that it would not retain moisture. It must be remembered, though, that after the disease is established in a brood it will be conveyed from one to another through the medium of food and drink, and in such case a plank floor would not alone save it. In case the disease should be introduced by chicks which had contracted it elsewhere the proper treatment would be to isolate affected individuals as soon as discovered and medicate the drinking water of the rest.

Young chick suffering from gapes. Photographed from life by H. Garman.



Dissection of a chick affected with gapes, the trachea pinned open. A, the glottis or opening through which air enters the trachea from the mouth; B, the cut end of the œsophagus; C, the cut neck; D, the open trachea with gape worms attached to its wall; E, the bronchial or lung tubes, one for each lung; F, the lungs; G, a pair of gape worms, the small male being permanently attached to the female. Both figures enlarged. H. GARMAN, del.