

**KENTUCKY**

**Agricultural Experiment Station**

**OF THE**

**STATE COLLEGE OF KENTUCKY**

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**BULLETIN No. 93.**

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- 1. Diseases of Nursery Stock.*
  - 2. Rabbits and their Injuries to Young Trees.*
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**LEXINGTON, KENTUCKY,**

**June 5, 1901.**

(99)

# KENTUCKY Agricultural Experiment Station.

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KENTUCKY AGRICULTURAL EXPERIMENT STATION,  
LEXINGTON, KY.

# Bulletin No. 93.

## I. Diseases of Nursery Stock, with a List of Inspected Kentucky Nurseries.

BY H. GARMAN, ENTOMOLOGIST AND BOTANIST AND STATE ENTOMOLOGIST.

In Bulletin 80 of this Station, brief mention is made of a disease known as crown gall, and a figure is published showing the gall as it appears on raspberry. At the time this bulletin was issued (March, 1899), the disease had attracted but little attention in the State, and it was known chiefly as an ailment of peach and raspberry. Further experience in the study of the diseases of young trees has shown it to be more common and destructive than was at first apparent, and this spring two small blocks of apple trees were examined, in both of which more than 50 per cent. were affected.

It is chiefly to warn fruit growers and nurserymen against the disease that this supplementary bulletin is issued. The occasion is utilized to present some other matters also bearing upon the subject of nursery stock and its inspection.

### FUMIGATION WITH HYDROCYANIC ACID GAS.

So much has been said of this method of treating trees that there is a common notion abroad to the effect that fumigation with hydrocyanic acid gas makes any trees perfectly safe, no matter how badly they may be infested, even with San Jose scale. The method has its advantages over other treatments, and these have been sufficiently dwelt upon by others.

Its limitations I am convinced from my own experience have not received the attention their importance makes desirable. Some of them will be treated in a later bulletin.

Mr. Coquillett, who had much to do with getting the prac-

tice in convenient shape, gave in 1893, as the final outcome of his experience the following proportions of the ingredients required to produce the gas:

Cyanide of potassium (58 per cent. pure), 1 ounce.

Commercial sulphuric acid, 1 fluid ounce.

Water, 3 fluid ounces.

These quantities of the materials should be used for every 180 cubic feet of space fumigated, and the time required to destroy scale insects varies from 15 to 40 minutes, according to the quantity of the foliage.

In recent work the cyanide of potassium used is about 98 per cent. pure, and since this is the strength of that commonly sold by druggists, the average man will find it more convenient than the weaker grade formerly recommended.

The practice now in vogue is in no essential respect different from that adopted in California shortly after fumigation was introduced. The gas is generated in a stone dish or jar under or in a box, a tent, or a specially constructed house. For all small objects, such as potted plants, buds, etc., a simple box of wood, a tub, or a barrel will serve, and it can either be inverted over the objects to be fumigated or if preferred a door or lid may be constructed so as to make its use somewhat more convenient. In the Vivarium of this Division a box measuring  $2\frac{1}{2} \times 3 \times 3$  feet (its capacity being thus  $22\frac{1}{2}$  cubic feet), provided with a shelf of wire netting, and fitted with a side door, has been used for several years for experiments with both bisulphide of carbon and hydrocyanic acid gas, and for the actual work of disinfecting seed, grain and small plants.

For small orchard trees perhaps the canvas box with light wooden frame, used by Professor W. G. Johnson in Maryland, is as convenient as anything proposed. The frame is covered with 8-ounce duck, coated with boiled linseed oil, and a collapsible top of duck is secured to the upper edge of the frame so as to increase the capacity, being drawn out more or less according to the height of the tree under treatment. A box of this character, constructed by Professor Johnson, measured 8 feet in height, the collapsible top, when extended, increasing

rather than by a nurseryman, and the craft itself will not have saddled on it the odium of such disregard of the ordinary sense of honesty. Very truly yours,

LIST OF INSPECTED NURSERIES.

Certificates were issued to 37 of the following nurserymen in 1900, and will become invalid June 15, 1901. John Horine, of Jessamine county; W. W. White, of Campbell county; and James M. Watts, of Jessamine county, received certificates this Spring; and these three become invalid June 15, 1902.

1. Christian Aebersold, Rockhaven, Meade county, Ky.
2. P. F. Adams & Son, Waco, Madison county, Ky.
3. W. S. Ashby, Cloverport, Breckinridge county, Ky.
4. Baldwin & Summers, Cairo, Henderson county, Ky.
5. J. C. Bingham & Sons, Russell, Greenup county, Ky.
6. R. N. Brown, Congleton, McLean county, Ky.
7. James Childers, Auburn, Logan county, Ky.
8. John R. Childres, South Carrollton, Muhlenburg county, Ky.
9. W. W. Clark & Company, Owingsville, Bath county, Ky.
10. W. M. Combs, Shepherdsville, Bullitt county, Ky.
11. G. P. Dietrich, Maysville, Mason county, Ky.
12. Donaldson & Gibson, Warsaw, Gallatin county, Ky.
13. P. E. Downer, Fairfield, Todd county, Ky.
14. Downer & Briggs, Bowling Green, Warren county, Ky.
15. Downer & Brother, Guthrie, Todd county, Ky.
16. B. G. Ellis, Auburn, Logan county, Ky.
17. J. Erdman, Lexington, Fayette county, Ky.
18. Boone Gardiner (The Kentucky Nurseries), Louisville, Jefferson county, Ky.
19. Mrs. A. S. Hancock, Casky, Christian county, Ky.
20. S. G. Hanson & Son, Winchester, Clark county, Ky.
21. H. F. Hillenmeyer, Lexington, Fayette county, Ky.
22. John Horine, Nicholasville, Jessamine county, Ky.
23. Horace Klingsmith, Cecilian, Hardin county, Ky.
24. J. W. Knadler, Valley Station, Jefferson county, Ky.
25. M. B. Loveall, Onton, Webster county, Ky.

As a rule the farmer who through the innocence of his heart has been defrauded, is teachable, at least learning caution from his own unpleasant experience, but generally the man who swaggers into trouble with the jaunty air of a cake walker and a boast of superior intelligence on his lips is beyond human aid.

After all that has been said and written on the subject it seems there are still in the world people with sufficient effrontery to offer for sale fruit trees known to be infested with San Jose scale. Early this spring I received from a correspondent a circular issued by the "Nashville Trust Company" as "Trustee of the Rosebank, Cumberland, Grandview and Paragon Nurseries," in which the company offers such trees to the public and admit their dangerous condition in the following words:

"It is proper to state that the 'Scale' has been detected in the nurseries, but no evidence of the infection has been seen in the one year old apricots, one year old pecans, one year old peach seedlings, and the dormant buds. In the ornamental trees, it has only been located in the English elm."

"In consequence of the fact of this insect appearing in the nursery, all goods will be sold *without guarantee*."

Then follows a list of 38 varieties of apple, together with pear, plum and other trees, admittedly infested with the most destructive pest known to fruit growers, and offered for sale in defiance of the Kentucky law. Our people were warned at the time through the newspapers of the dangerous character of the trees and the unlawful nature of the business in which the Trust Company was engaged. The following letter received subsequently explains itself:

February 7, 1901.

PROF. H. GARMAN:

My Dear Sir:—Personally and in behalf of every Kentucky nurseryman, I want to thank you for your note to the *Herald*, published yesterday. I have twice received the circular to which you allude, and wish to say that it is the most brazen rascality that has come under my notice. The only thing in extenuation is that it is sent out by an assignee,

is a strong demand for blight-proof stocks in the Colony and nurserymen cannot keep pace with their orders for them. Most of the stock worked from was procured from one of the Australian colonies under a government guarantee that it was Northern Spy. Thus far I have heard no complaints arising from the double working of the stock, and the roots are blight-proof. There are, of course, other blight-proof stocks, and not a few orchards have shown striking proof of the value of immunity from the aphis; rows of vigorous uninfested trees growing between others actually dying from the attacks of the pernicious pest."

#### THE SALE OF DISEASED TREES IN KENTUCKY.

The proneness of mankind to be victimized by oily-tongued rascals masquerading as agents of reputable nurseries is a perennial theme for discussion at meetings of fruit growers. It is only to be explained I think as an example of hypnotic influence exerted by one individual over another, and it frequently happens that the subject feels after the *seance* that he has been played upon, and is sincerely sorry that he has been so weak as to part with his hard-earned money. During the past year "agents" operating in Western Kentucky have received numerous orders for seedling fruit trees "warranted" to be superior to the standard grafted and budded sorts. Old trees that have been left over in the nursery are sometimes bought by such men and sold for bigger prices than were received for the selected trees sold out of the same blocks by the men who grew them.

But exceptional men who glory in their sagacity buy trees of inferior quality. A gray haired man observed buying knurly trees on the street this spring volunteered to the writer the information that he had "lived all his life" in Lexington and had never before heard of a nursery inspection law, and then with a fatuousness in keeping with his acumen gave vent to the ancient query, Who might you be? If anything could do it such exhibitions of ill-founded self esteem on the part of the aged would tend to destroy our respect for gray hairs and our faith in the value of opportunity and experience. When will men learn not to throw away their money on stunted, knurly trees? Never!

by a free use of the knife and subsequent spraying of the trunk and other affected parts with Bordeaux mixture. Mr. J. H. McDanell, of Warsaw, Kentucky, chose the more thorough-going plan of cutting out and burning all but one of the diseased trees in his orchard.

Though not very common the disease appears to be widespread, one of the cases known to me being a row of trees in an orchard in western Kentucky.

#### APHIS-PROOF APPLE TREES.

While aware of the opinion held by some of our nurserymen to the effect that northern spy apple trees are about as badly injured by woolly aphis as any variety grown, I wish to call attention again to the so-called double-worked trees being planted in South Africa and Australia. Through the kindness of Mr. Chas. P. Lounsbury, Government Entomologist at the Cape of Good Hope, I have received a report on this subject, issued by the Cape Department of Agriculture, in which the method of propagating these aphis-proof trees is described. It seems that seeds of northern spy apples, or of some other "aphis-proof" variety are planted, to get roots. Upon these roots are grafted scions of the same variety, to give a stem-base. A single selected bud is allowed to develop, and after it has grown one year, the desired variety is grafted on the stem produced by it.

The claims made for the trees are so explicit and positive, and come from such good authority, that we cannot but regard them as having some foundation. I wish to commend the idea to any of our growers who may be disposed to experiment. It is to be remembered that the northern spy apple tree produced by our method has, in its roots, an element of weakness from the standpoint of the believer in aphis-proof varieties.

The report dealing with the subject is entitled, "Manual of Practical Orchard Work at the Cape," by P. MacOwan and Eustace Pillans, Cape Town: W. A. Richards and Sons, Government Printers, 1896.

Mr. Lounsbury writes under date January 30, 1901: "There



cutting would have to be so severe that it would very likely weaken the tree, and while, therefore, this treatment cannot be considered satisfactory, it is the best that can be recommended to those who are not disposed to take affected trees out and burn them. Bordeaux mixture applied to the outside of the galls can do little more than kill the parasite at the surface.

#### A KNOT DISEASE OF APPLE TREES.

In scattered orchards in Kentucky I have observed a knot disease that in its final condition looks not unlike the black knot of plum trees. At the bases of the main branches, sometimes on the trunk itself, smooth, greenish olive warts appear, as shown at A, Fig. 4, then gradually increase in size, the bark covering them becoming roughened, as at B, Fig. 4, and in the end blackening and becoming very rough from a breaking of the bark, as shown at C, Fig. 4. Very old knots are rougher than any of those shown in the illustration, and the whole surface becomes eroded and sooty black.

Where observed, this disease was restricted in great part to one variety, and generally to trees in the same row, but there is evidence indicating that it spreads slowly from such trees to others in the neighborhood, and thus once established may be expected to reach in time all the trees of an orchard. It undoubtedly weakens the trees attacked, but does not keep them from bearing in all cases, and when but few knots are present the trees show no other outward evidence of disease. The disease is not the same as the apple tree canker\* described in Bulletin 163 of the New York Station. This disease occurs also in Kentucky. Nor is it the same as the apple tree anthracnose† described by Professor Cordley in Bulletin 60 of the Oregon Station. The Kentucky disease produces mounds‡ two inches or more in diameter, and from  $\frac{3}{4}$  to 1 inch in depth.

The disease has some appearance of being due to a microscopic fungus parasite, and if it is, good can probably be done

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\*Due to the fungus *Sphaeropsis malorum*.

†Due to the attacks of a *Gloeosporium*, which Cordley names *G. malicorticis*.

‡The illustration was made from material kindly sent me by Mr. J. H. McDanell, of Warsaw, Ky.

The disease is not restricted to the nursery. When transplanted to the orchard the galls continue to grow, eventually producing large warty masses at the base of the trunk. Such trees can never be very profitable, since in their enfeebled condition they will not bear well.

The trees examined in Jessamine County were, in most cases, galled where the graft had been made (See Fig. 1), indicating that the parasite\* invaded the tree by way of the cut surfaces. In most cases the growths were at or a few inches below the surface of the ground, the depth depending upon how the trees had been planted, but occasional trees showed an abnormal swelling just above the ground, with a warty surface, as shown at A, Fig. 2. These swellings have an appearance of having been caused by the same parasite as the others, but seemingly because of exposure to the air fail to develop the rough, broken surface characteristic of those developed in the soil. The latter have a somewhat spongy character at first and when old become brown, while the dead outer surface breaks away, as shown at B, Fig. 2. Quite often the attack had resulted in the complete destruction of the tap root below the gall (A, Fig. 3), in which case numerous fibrous roots had generally developed above the lost tip, often pushing out from the midst of the gall. Small knots were sometimes observed in the fibrous roots, but these were of but slight importance compared with the large growths on the central root and stem.

*Remedial Treatment.*—Galled trees may well be burned at once, not only because they are unfit for a place in the orchard, but because if allowed to grow they endanger other trees in their neighborhood. Soil in which the diseased trees have grown should be avoided for some time.

It is rather difficult to get to the gall, without taking up the tree, in such a way as to remove the diseased parts with a knife, and even under the most favorable circumstances the

\*Professor J. W. Toumey, of the Arizona Station, has applied the name *Dendrophagus globosus* to the microscopic organism he finds in galled trees in his region. It remains to be determined whether or not the crown gall of the Eastern States is in all cases identical with that described by him.

veniently and cheaply than formerly, and it is demonstrable that these mechanical mixtures are very effective against San Jose scale, without attending injury to dormant trees. I have recently examined apple trees which were sprayed for San Jose scale last winter with 50 per cent. of coal oil mixed with water. The trees were not injured, and very few if any living scale remained, though the bark was encrusted with those that had been killed. Another application of the mixture may be required for these trees, but it is questionable if the gas treatment would have cleared the trees more completely of living scale insects than had been done by this mixture.\*

#### CROWN GALL.

An examination of a block of four year old apple trees (about 1100 in number) on the place of Mr. James M. Watts, of Hanly, Jessamine County, Kentucky, this spring revealed a surprising number of affected trees, rather more than 50 per cent. in fact. These trees had not before been inspected, owing to the fact that Mr. Watts had not reported his nursery, and it was only after encountering him while engaged in selling trees that had not been inspected that his place was located. The galled trees were destroyed after my examination was made, but it is impossible to say to what extent the disease may have been disseminated from this little planting of trees before the diseased trees were removed. A similar state of affairs was found among several rows of young apple trees on the place of Mr. John Horine, of Nicholasville. These galled trees were very promptly taken up and destroyed by Mr. Horine, whose disposition with reference to the matter was most commendable. It has been demonstrated that crown gall is a contagious disease, to be conveyed to seedling trees by crushing the galls and putting them in soil in which seeds are planted. Trees grown with others that are galled are therefore not above suspicion even when they show no outward evidence of the disease.

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\*Our Bulletin 80, pages 204 and 205, contains figures of two pumps which produce mechanical mixtures of coal oil. Such pumps can now be bought of most manufacturers for a little more than the price of ordinary pumps.

the height 7 feet more. It was placed over trees by means of a 35-foot mast mounted on a farm cart and provided with a gaff and the necessary pulleys and ropes for hoisting and lowering. The cost of such a box is, we are told, \$12.00, which is about two-thirds the cost of a tent like those used in California and suitable for trees of the same size as those covered by the box tent. Apparatus for handling costs \$12.00 additional.

Nurserymen will find a fumigating house or shed a convenience, since this will allow the fumigation at one time of large quantities of trees after these have been taken up. The chief consideration in constructing such a house is to make it as nearly air-tight as possible. An opening in the roof, which can be tightly closed, is desirable, as a means of allowing the gas to escape after the trees have been treated.

Johnson, who appears to have had useful recent experience in fumigating large numbers of trees, recommends the following quantities of the ingredients for making the gas *for each 100 cubic feet* of space enclosed:

Cyanide of potassium (about 98 per cent. pure) 25 grams.  
Sulphuric acid, commercial,  $1\frac{1}{4}$  ounces.  
Water,  $1\frac{7}{8}$  ounce.

For fumigating orchard trees, he gives a slightly different formula, namely, *for each cubic foot* enclosed:

Cyanide of potassium, 0.20 gram.  
Sulphuric acid, 0.30 cubic centimeters.  
Water, 0.45 cubic centimeters.

#### COAL OIL FOR SCALE-INFESTED TREES.

It is hardly practicable to fumigate exceptionally large trees, and cases frequently arise where it is not worth while to construct tents for small trees. The man with a half dozen scale-infested trees in his yard, for example, would have no further use for a tent after applying gas to them a couple of times. For him, spraying with soap solution or preparations of coal oil is the better and cheaper practice. By the use of one of the pumps constructed for producing mechanical mixtures of coal oil, it is now possible to use the oil much more con-

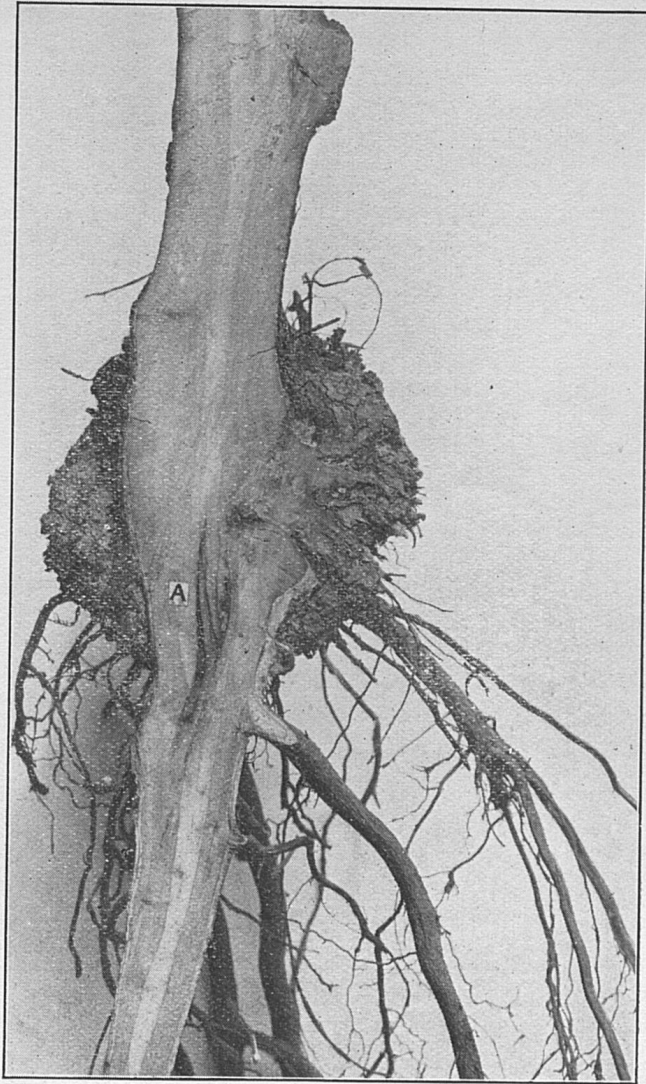


Fig. 1. A section of an apple tree affected with crown gall, showing the graft at A. Natural size. Photographed by H. Garman.

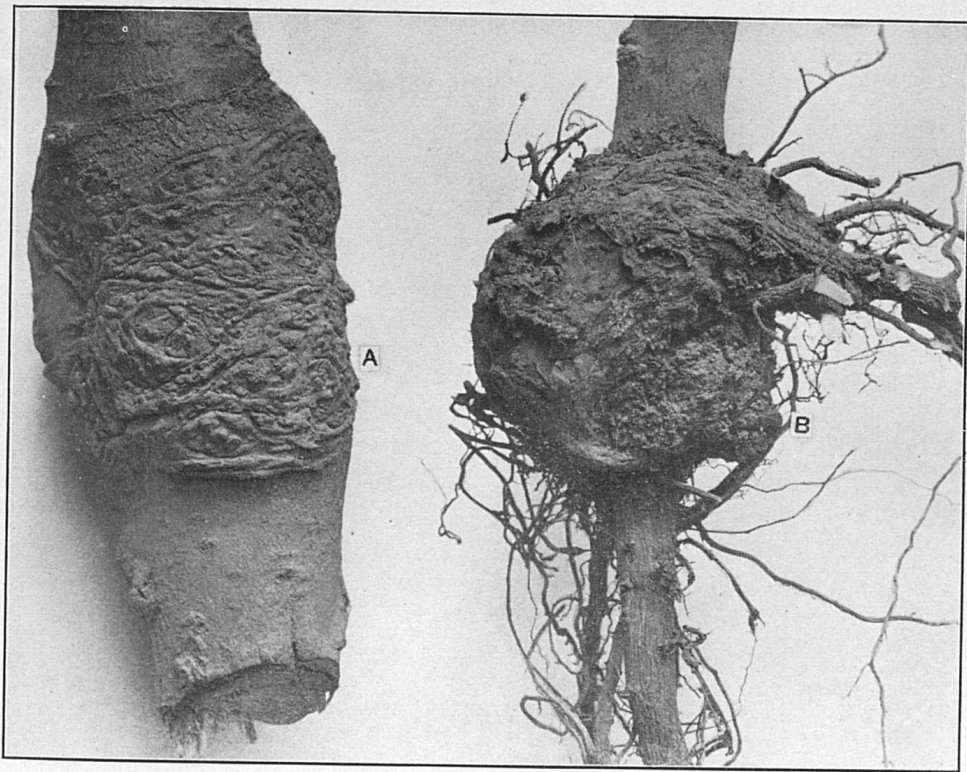


Fig. 2. *A*, a gall formed just above the surface of the ground; *B*, an old crown gall, with the surface breaking away. Natural size. Photographed by H. Garman.

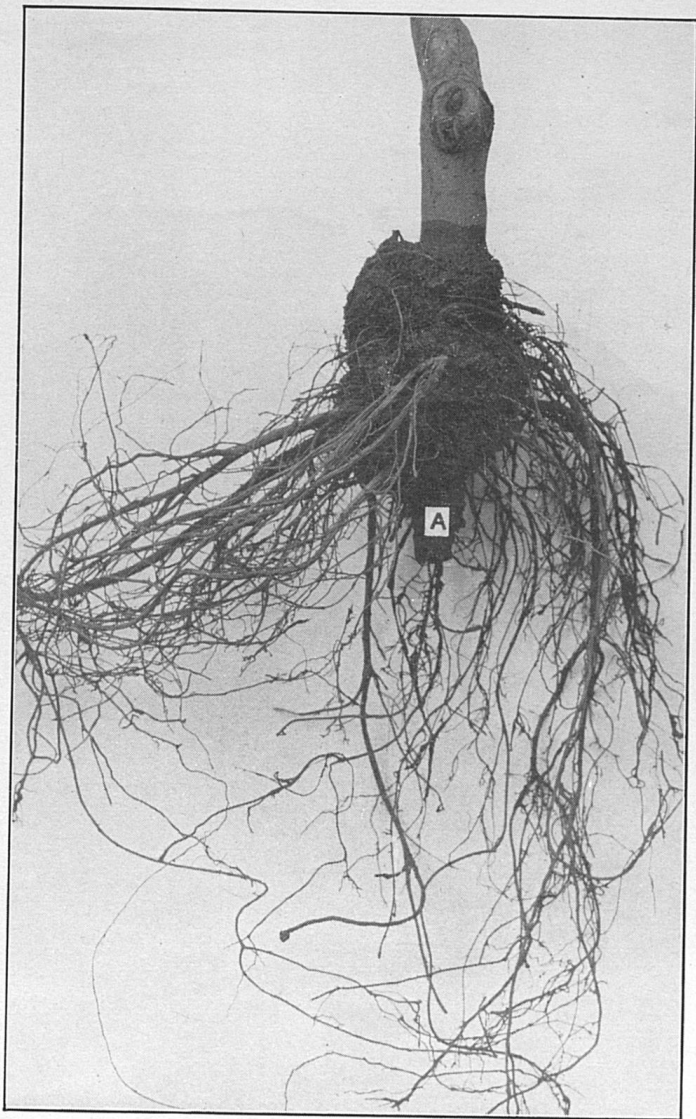


Fig. 3. A gall which has killed the tap root (A) and caused it to rot away. Natural size. Photographed by H. Garman.

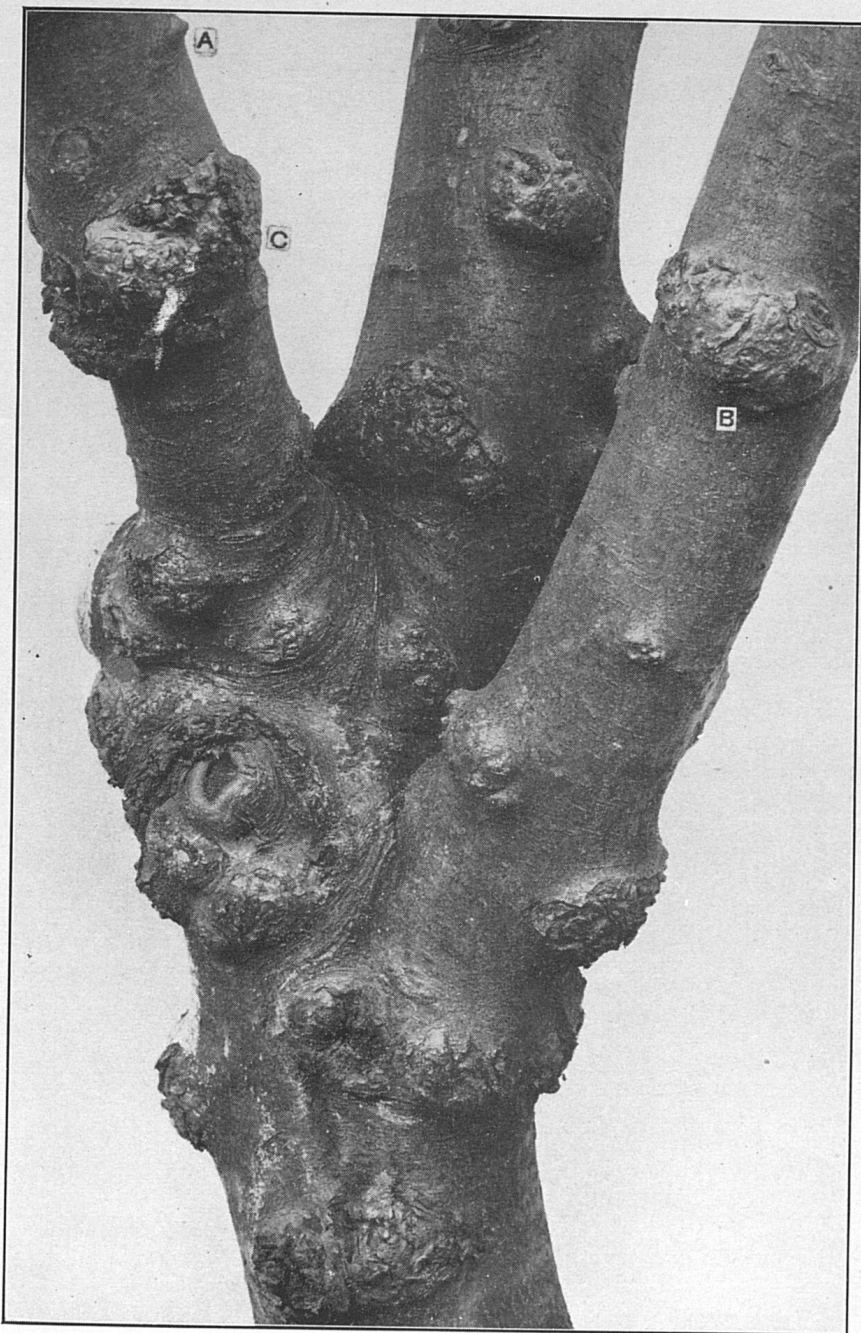


Fig. 4. An apple tree affected with the knot disease described on page 106. *A*, the first appearance of the knot; *B*, an older knot; *C*, showing a knot as it appears when the bark over it becomes ruptured and blackened. Reduced to about one-third the diameters of the original. Photographed by H. Garman.



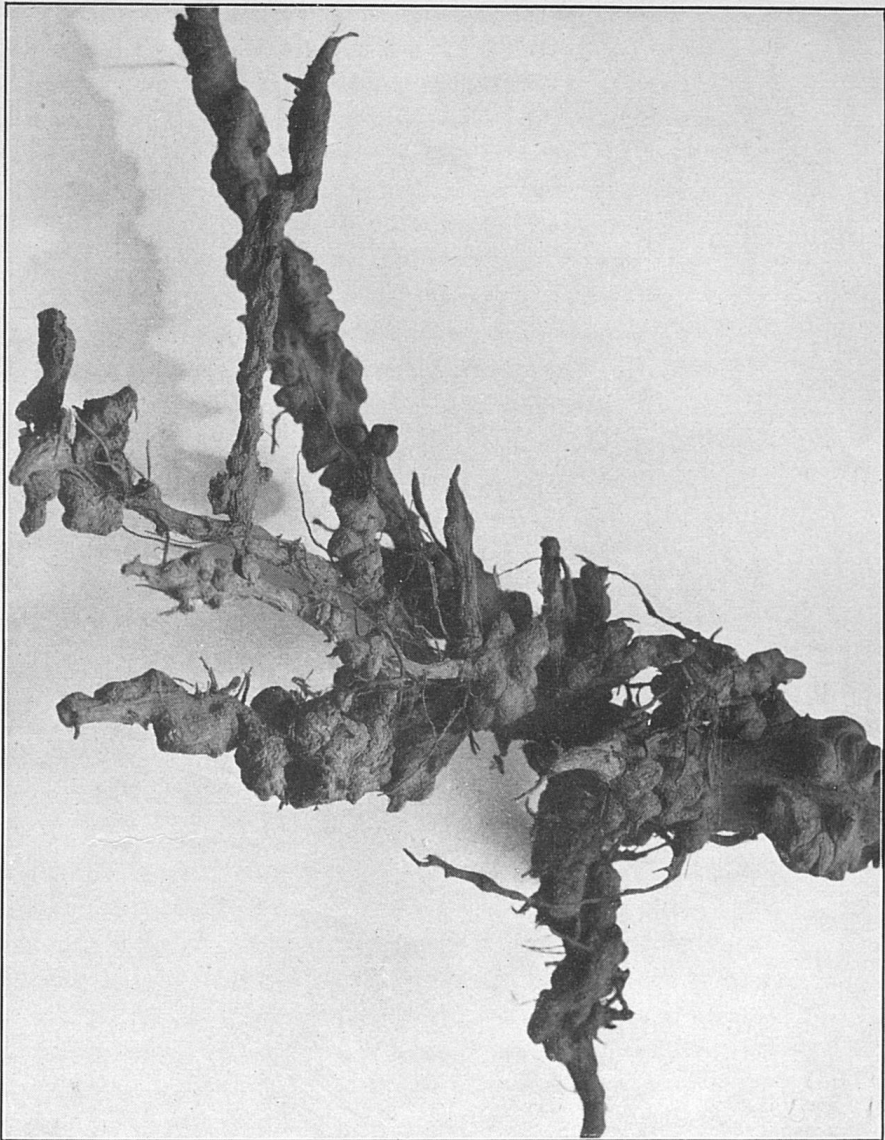


Fig. 5. The roots of a young apple tree badly galled by woolly aphids. Reduced to about  $\frac{3}{4}$  of the diameters of the original. Photographed by H. Garman.

26. A. A. McGinness, Bowling Green, Warren county, Ky.
27. J. A. McKee & Company, Kingsville, Lincoln county, Ky.
28. Nanz & Neuner, 582 4th Ave., Louisville, Jefferson county, Ky. (nursery at St. Matthews).
29. Allen Popham, Solway, Hardin county, Ky.
30. O. Piper, Clinton, Hickman county, Ky.
31. Jas. W. Radcliffe, North Pleasureville, Henry county, Ky.
32. J. Q. A. Rahm, Leitchfield, Grayson county, Ky.
33. The Ream Company, Kidd's Store, Casey county, Ky.
34. W. A. Sandefur, Robards, Henderson county, Ky.
35. Edwin Stovall, Vine Grove, Hardin county, Ky.
36. E. K. Taliaferro, Newport, Campbell county, Ky.
37. Mark Tudor, Cottonburg, Madison county, Ky.
38. James M. Watts, Hanly, Jessamine county, Ky.
39. W. W. White, Sr., Alexandria, Campbell county, Ky.
40. Elvis J. Whitmer, Bremen, Muhlenburg county, Ky.

The following have filed applications for inspection, and their stock will be examined the coming summer:

- Boswell Fox, Winchester, Clark county, Ky.  
Isaac W. Wilson, Mortonsville, Woodford county, Ky.

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## **2. Rabbits and Their Injuries to Young Trees.**

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BY H. GARMAN.

The rabbit is very common in Kentucky, furnishing a good deal of sport to hunters and, in winter, not a small part of the food of our people. It is the especial prey of negroes, who take great delight in pursuing it with dogs, and devour it with gusto when fried or made into potpie. But with all its endearing qualities it develops at times such a penchant for barking young trees that it becomes a veritable pest to nurserymen and fruit growers, who sometimes find difficulty in saving their trees from total destruction. In the more closely settled portions of Kentucky hunters and dogs keep the num-

bers so reduced that complaints of injury of this sort are rare, but in sections where there is still a great deal of forest with undergrowth, hunting is not sufficient to keep them in subjection, and whenever snows are deep and other food becomes scarce, the trees suffer. I have examined nurseries in which 25 per cent. of whole blocks of apple trees was so badly gnawed as to be worthless. When trees are from one-half to one inch in diameter of trunk the bark alone is commonly eaten, but they may be completely girdled for a distance of 8 or 10 inches up the trunk. Very young trees (one-year olds) are sometimes cut off by the sharp incisors as cleanly as if severed with a knife.

Hunters cannot be given the freedom of a nursery because of the damage done to trees by charges of shot. Dogs alone are not a complete protection. Other means are a necessity at times.

#### RABBIT-PROOF FENCES.

When the nursery is small, as is true of most of those in Kentucky, it is possible to enclose it with a close slat fence that will "turn" rabbits. Since fences of this character serve all the purposes of ordinary fences besides, and since some kind of fence is required to keep out stock, they ought to be given preference unless there is some disadvantage in their cost or durability, with which I am at present unacquainted. In timbered countries, where rabbits are most troublesome they can be cheaply built. Two types of fence suitable for the purpose are to be seen in the State. The most common is made of rough slats four to six feet long and about three inches in width. The slats are securely fastened together from 1 to 2 inches apart with No. 11 wire, stout posts being set at intervals of 10 to 16 feet to insure stability and keep the panels upright. Since the slats can be adjusted to any unevenness of the ground, it is possible to exclude anything that a fence can reasonably be expected to turn.

The second type is made of shorter slats, three or four feet long, and these may be supplemented above by one or more wires stretched from post to post. Mr. J. Q. A. Rahm, of

Leitchfield, has built such a fence about his nursery. He uses slats three feet long, none less than one-half inch thick, and sets his posts in spring; waiting until hot weather in August and September before putting up the slats, in order to have the wire fully expanded at the start. The wires are simply crossed between the slats and are kept taut while building by a harrow loaded with about 1,000 pounds of stone and placed from 100 to 400 yards ahead of the workmen. Near the harrow the wires are secured to a single-tree made of a piece of stout timber, a log chain being passed around this and secured to the weighted harrow. The slats used by Mr. Rahm cost from \$4.00 to \$7.00 per thousand.

#### TRAPS.

Rabbits are very easily caught, notwithstanding their well known cunning. One of the simplest and best traps used for the purpose is made of rough fence boards six inches wide and about two feet long. These pieces are nailed together so as to make an oblong box, one end of which is closed with a short piece of board, while the other is provided with a door consisting of another piece of board which slides down from above in grooves cut in the projecting sides, or between slats nailed onto the end, as shown in Fig. 8.

The bottom piece may also be allowed to project so as to make the door more secure when closed. A small hole is bored through the top at about the middle of the box, and midway between this and the door a stick is secured in an upright position. Across the top of this latter a second stick is secured, by a nail, in a notch made in the upright one so that it will see-saw up and down. A third stick of small size is notched near one end and secured at the opposite end by means of a piece of twine, to the end of the larger movable piece. This movable piece is now connected by twine at its forward end to the top of the door, when the trap is ready to set.

The door is elevated, the little stick passed through the hole in the top and secured by the notch to the front edge of the hole. When the rabbit enters it pushes the projecting end of

the stick before it, setting it free, allowing the suspended door to descend and thus cutting off its own escape. Mr. P. E. Downer, of Fairview, Todd County, keeps numbers of these traps set among his young trees at all times during the winter, catching scores of rabbits and completely preventing injury from them. The traps may be baited with a piece of apple or cabbage placed in the end farthest from the door, but rabbits sometimes go into them when no bait is used, either out of curiosity, or in search of shelter. They are very likely to take refuge in the traps when closely pursued by dogs.

The traps can be taken indoors in summer, and with this care will last for a long time. They should be made of old weather-beaten boards, as these are less likely than new lumber to arouse suspicion. I have seen traps of this pattern made by a ten-year-old boy that worked well, to the great delight of their owner.

A second trap sometimes used in the State is made of the same material as that described, but the door is hinged at the top and swings inward, so that when open it is against the top of the trap. It is secured in this position by a wire which passes through a couple of eyelets and is finally connected with a treadle consisting of a loose piece of board resting on the floor, by its front edge, while farther in it is raised by means of the wire connected with the open door. When any weight presses upon the treadle, the wire is drawn from beneath the edge of the door and lets it drop. Being somewhat longer than the opening it strikes the bottom of the trap in an oblique position, and any attempt of a rabbit to escape only wedges it the more securely. The hinges required may be made of bits of old leather. The wire commonly employed is that designed for fences.

The common form of snare used in this State consists of a ring of small pegs driven into the ground so as to project about three inches, the pegs set one inch apart and the ring made about five inches in diameter. Then in place of one of the pegs a small figure-four is made with the horizontal piece bearing an apple projecting to the middle of the ring of pegs. A sapling is bent down, a piece of chalk-line attached and the noose at

its end is passed about the ring of pegs and connected with the figure-four, so that when anything disturbs the apple the noose is released and the sapling flies up. Mr. B. G. Ellis, of Auburn, Logan County, tells me that he uses these snares with good effect as a protection to his apple trees.

#### POISONED BAIT.

It is possible to poison rabbits by the use of strychnine or arsenic, but the traps and fences are to be preferred for reasons so evident that they need not be pointed out.

#### RUBBING TREES WITH BLOOD AND OTHER MATERIALS.

Even in the nursery it is possible to go over blocks of trees during the winter and rub the trunks for a foot and a half above the ground with blood from a slaughtered hog or steer, and those who have tried it claim that it is a complete protection against rabbit depredations. Sometimes a piece of liver is used, the rubbing being done in either case with the hands, these sometimes protected by an old mitten or glove. The practice does not commend itself to me as the best means of attaining the desired end, so far as the nursery alone is to be considered. In the young orchard the rubbing can be done with less waste of labor.

#### WRAPPING THE TRUNKS WITH CORN STALKS, PAPER, ETC.

Young orchard trees can be protected, however, by simply wrapping the trunk with closely-placed corn stalks, coarse straw, or stout paper. Such wrappings are frequently employed, and I am assured by those who have tried them that trees so defended are never disturbed by rabbits, though it must be confessed there is no evident reason why they should pay heed to so flimsy a covering when their stout teeth could easily remove it.

#### HABITS OF THE COMMON RABBIT.

In Europe the name rabbit is applied to but one species (*L. cuniculus*), which differs from the others in that it is of gregarious habit, and makes extensive underground burrows in which its young are reared and to which it retreats when alarmed. The European hare (*L. timidus*) does not burrow

extensively and is solitary in its disposition. In this respect it is like our own rabbits, and it has sometimes been suggested that we have no true rabbits in this country—that all our species are hares. The indiscriminate use of these common names cannot well be controlled, however, and the fact is presented only for what it is worth.

Throughout much of Kentucky the small gray rabbit known to naturalists as *Lepus sylvaticus* is the only one present, and in the State as a whole it probably constitutes more than four fifths of the individuals; but in the swamps of western Kentucky we may look for another rabbit of about the same size, known as the swamp rabbit (*L. palustris*), and also a large species to which the name water rabbit (*L. aquaticus*) is applied. These are southern species that extend northward along the Mississippi River, ranging even into southern Illinois. The water rabbit occurs in the State at the present time. About the swamp rabbit there is some doubt. The northern hare (*L. americanus*) seems not to have been observed by any one in the mountains of Eastern Kentucky, although from its distribution outside the State it would not be surprising to find it there. Correspondence with numerous residents of the mountain counties, and some personal experience in the mountains have at any rate thus far failed to disclose any safe grounds for considering it a member of our fauna.

1. Common rabbit (*Lepus sylvaticus*). Small, about 16 inches long. Front edge of ear white. Tail white beneath. Nails of feet not exposed. Width of skull half of its length.

2. Swamp rabbit (*L. palustris*). Small. Ears not white edged. Tail not as noticeably white beneath as in No. 1. Nails of feet exposed. Width of skull half of its length. Teeth and lower jaw heavier than in the common rabbit.

3. Water rabbit (*L. aquaticus*): Large, sometimes reaching a length of 19 to 20 inches. Colors like those of the common rabbit. Head large relatively, the width of the skull less than half its length. Nails of feet not exposed.

Our common rabbit makes a very attractive pet when captured, even after he is fully grown. But a wilder thing was

probably never handled than an individual just taken from the trap: He comes as near jumping out of his skin as anything alive. His fright is pitiable to behold, and, mute that he is at other times, the wail he then sets up is enough to touch the heart of the most hardened and brutal.

Much of his life is spent in thickets about cultivated fields, at the edges of woods, wherever suitable forage is to be found. His trust in his fleetness and cunning is such that he penetrates even into the edges of cities. At Lexington, with its 25,000 inhabitants, situated in the center of a populous and closely cultivated region, the prints of his feet in snow during the winter are common within the city limits, and individuals are not infrequently caught there in traps. But in the thinly settled districts he is in his glory, even though he is there shot and brought to the towns for sale by the wagon-load.

During the day time our rabbits remain on their "forms," which consist of slight depressions in the ground among grasses and weeds. Their colors harmonize so completely with their surroundings that they are very effectively concealed, and it is only when one stumbles on them, or when dogs nose them out, that they are started. They do not burrow, and are not much given to going underground, although they will dash into any hole or crevice that offers refuge when closely pursued. During very severe snow storms they resort to brush heaps, and are sometimes surrounded here and killed in large numbers.

In the spring, often in March, when the weather is still cold, the female makes a little pocket, a few inches in depth, in the soil in some retired place, and lines it with the soft fur torn from her body. The young, which number four or five, remain in this snug retreat for several weeks, but soon run about probably remaining in the neighborhood of the mother for some time later.

Their colors are quite different from those of the adult, and considerable individual variation is to be seen in young from the same nest. A litter of four was received by me April 4, 1899, from Mr. O. Piper, of Clinton, Ky. They were about three inches in length, and were probably not a week old.



The head was larger relatively and the ears much shorter than in the adult. All of them showed some trace of a white frontal stripe or bar, which in two of them became one-half inch long and  $\frac{1}{3}$  inch wide. Tip of snout, chin, and belly white. Chest, flanks and legs tawny. Side of head below eye black, with a straight line of black through the eye. Upper eyelid tawny. Top of head mouse-gray. Ears held close to back of head with hollow out; black within, tawny without. Back black, but bases of hairs gray on sides, with rather long tawny hairs projecting beyond the rest. Tail and hind legs poorly developed. The white bar on the forehead is possibly a sex mark, being, I am inclined to think, most conspicuous in the males.

For the European rabbit, which is often kept in a state of domestication, the period of gestation is about thirty days. It is altogether probable that our species retains its young for about the same length of time. Two broods at least are produced during a season, and some close observers assert that three broods are brought forth. The young of the second brood are to be found in the nest in June. I have seen, and occasionally captured, very small rabbits in August and September that may have represented the third brood, but most of the individuals seen during these months are nearly or quite grown.

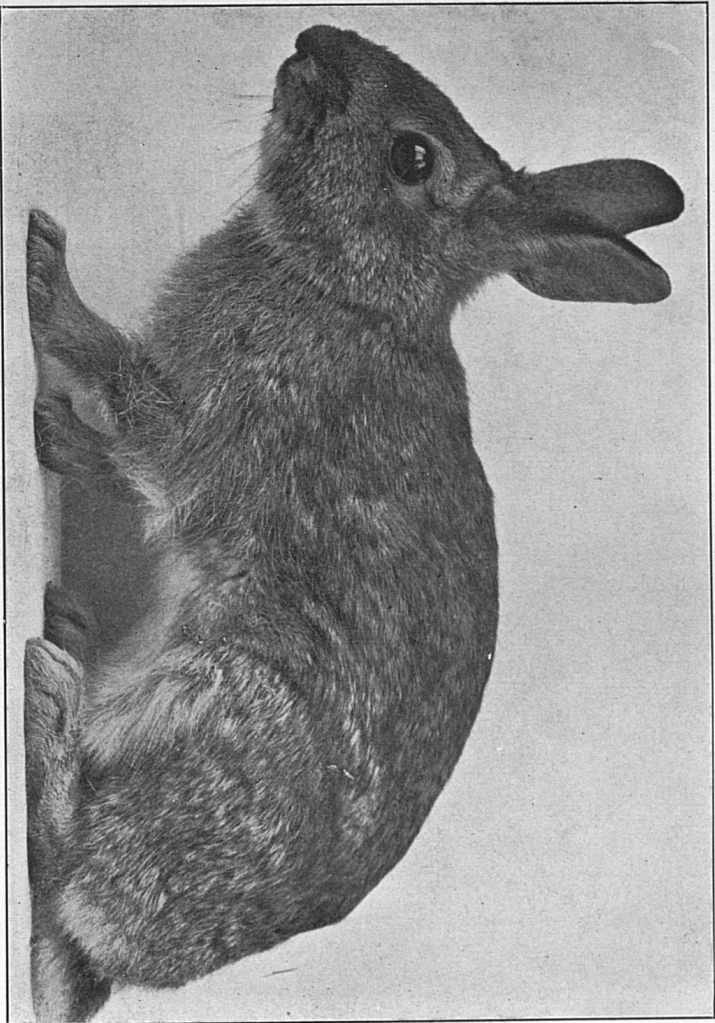


Fig. 6. The common wild rabbit, immediately after taking from a trap. Photographed by H. Garman.

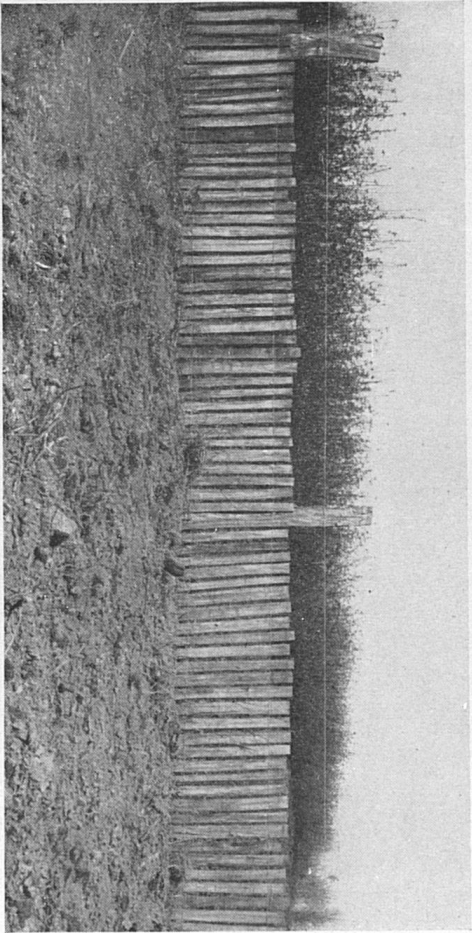


Fig. 7. A rabbit-proof fence about young nursery trees. Photographed by H. Garman.

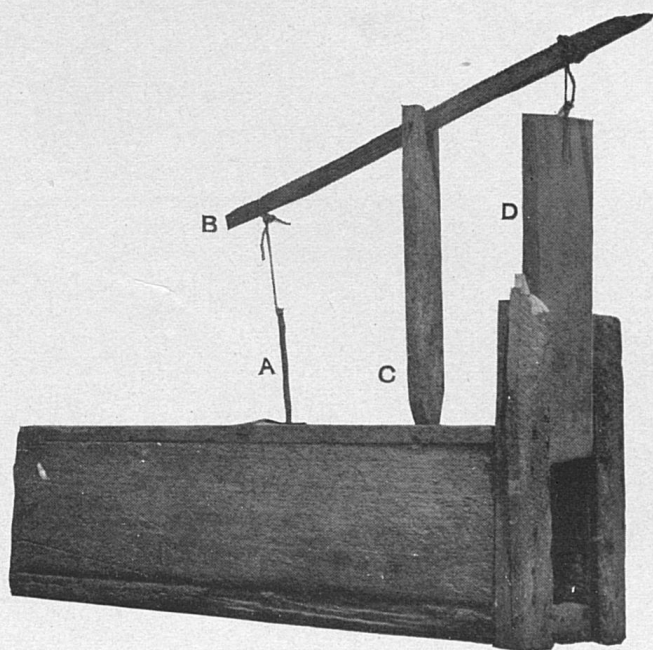
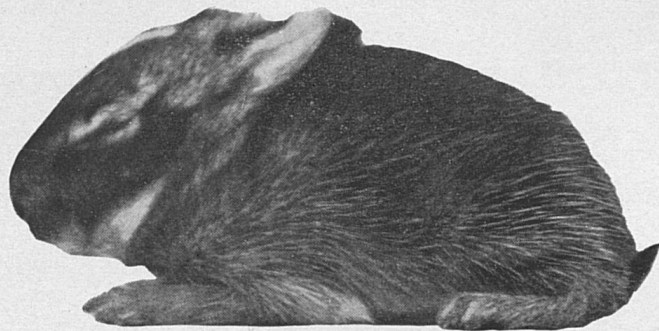


Fig. 8. A rabbit trap, such as is commonly used in Kentucky. Photographed by H. Garman.



D



A

B

C

Fig. 9. Young rabbits taken from the nest Natural size.  
Photographed by H. Garman.

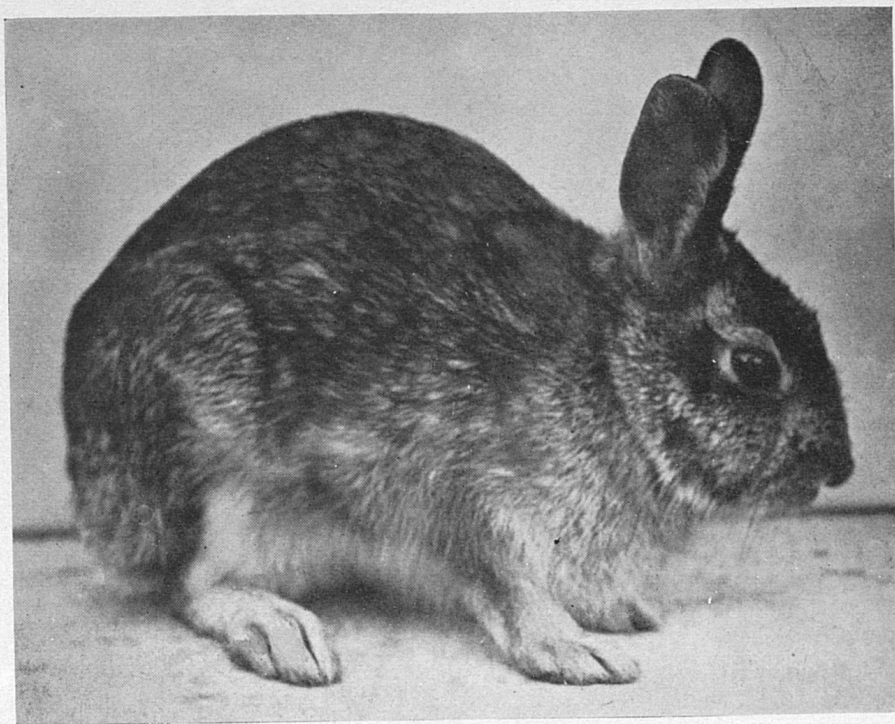


Fig. 10. The common wild rabbit after it has been kept in confinement for some time.