The Cause and Prevention of Apple Rot.

Mr. C. H. Peck, the State Botanist, in his recently issued annual report to the Regents of the University of the State of New York, says:

While on the way from Summit to Jefferson, in Schoharie County, an apple tree was observed on which much of the fruit was discolored, and appeared as if beginning to decay. Some of the passengers in the stage remarked that they "never before knew of apples rotting on the tree." Some of the fruit was procured and found to be affected by a fungus known to botanists by the name of *Sphæropsis malorum*, or "apple sphæropsis." It has been described as attacking "apples lying on the ground" in winter. Here was an instance in which the apples were attacked while yet on the tree, and that, too, as early as September. The apples attacked by the fungus are rendered worthless, and experiments recently made indicate that the disease is contagious, and may be communicated from one apple to another. For example, a perfectly sound apple was placed in a drawer with one which was affected by the fungus. In a few days the sound apple began to show signs of decay. Its whole surface had assumed a dull brown color, as if beginning to rot. Two or three days later small pale spots made their appearance, and in the center of each there was a minute rupture of the epidermis.

An examination of the substance of the apple in these pale spots revealed fungus filaments that had permeated the cells of the apple. In two or three days more numerous minute black pustules or papillæ had appeared. They were thickly scattered over nearly the whole surface of the fruit. These constitute the sphæropsis. When microscopically examined each one of these black papillæ is found to contain several oblong pale fungus spores, supported on a short stem or foot stalk, from which they soon separate. It would be well, therefore, whenever this fungus rot makes its appearance, to remove the affected apples at once from the presence of the others, whether they are on the tree or not. It is not enough to throw them on the ground by themselves, for this would not prevent the fungus from maturing and scattering its spores. They should be buried in the ground, or put in some place where it will not be possible for the fungus to perfect itself and mature its spores or seeds. In this way the multiplication of the spores and the spread of the disease may be prevented.

TADPOLES.

The chief interest of the frog lies in the curious changes which it undergoes before it attains its perfect condition. Every one is familiar with the huge masses of transparent jelly-like substance, profusely and regularly dotted with black spots, which lie in the shallows of a river or the ordinary ditches that intersect the fields. Each of these little black spots is the egg of a frog, and is surrounded with a globular gelatinous envelope about a quarter of an inch in diameter.

On comparing these huge masses with the dimensions of the parent frog, the observer is disposed to think that so bulky a substance must be the aggregated work of a host of frogs. Such, however, is not the case, although the mass of spawn is forty or fifty times larger than the creature which laid it. The process is as follows: The eggs are always laid under water, and when first deposited, are covered with a slight but firm membranous envelope, so as to take up very little space. No sooner, however, are they left to develop, than the envelope begins to absorb water with astonishing rapidity, and in a short time the eggs are inclosed in the center of their jellylike globes, and thus kept well apart from each other.

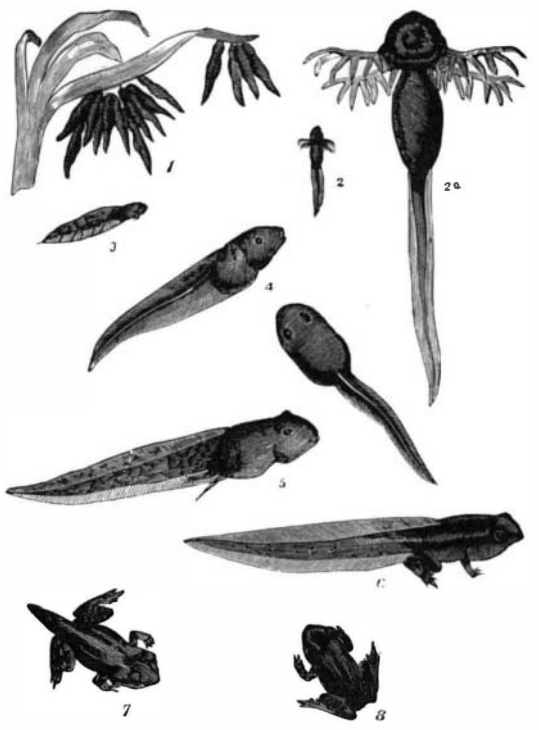
In process of time, certain various changes take place in the egg, and at the proper period the form of the young frog begins to become apparent. In this state it is a black grub-like creature, with a large head and a flattened tail (Fig. 1). By degrees it gains strength, and at last fairly breaks its way through the egg and is launched upon a world of dangers, under the various names of tadpole, pollywog, toe-biter, or horsenail (Fig. 2).

As it is intended for the present to lead an aquatic life, its breathing apparatus is formed on the same principle as the gills of a fish, but is visible externally, and when fully developed consists of a double tuft of finger-like appendages on each side of the head. The tadpole, with the fully developed branchiæ, is shown at Fig. 2 *a*, in the accompanying illustration. No sooner, however, have these organs attained their size than they begin again to diminish, the shape of the body and head being at the same time much altered. In a short time they entirely disappear, being drawn into the cavity of the chest and guarded externally by a kind of gill cover, as seen in Fig. 4.

Other changes are taking place meanwhile. Just behind the head two little projections appear through the skin, which soon develop into legs, which, however, are not at all employed for progression, as the tadpole wriggles its way through the water with that quick undulation of the flat tail which is so familiar to us all. The creature then bears the appearance represented in Fig. 5.

Presently another pair of legs make their appearance in front, as in Fig. 6; the tail is gradually absorbed into the body—not falling off, according to the popular belief—the branchiæ vanish, and the lungs are developed. Fig. 7 represents a young frog just before the tail is fully absorbed, and Fig. 8 shows the perfect frog.

The internal changes are as marvelous as the external. When first hatched, the young tadpole is to all intents and purposes a fish, has fish-like bones, fish-like gills, and a heart composed of only two chambers, one auricle and one ventricle. But in proportion to its age, these organs receive corresponding modifications, a third chamber for the heart being formed by the expansion of one of the large arteries,



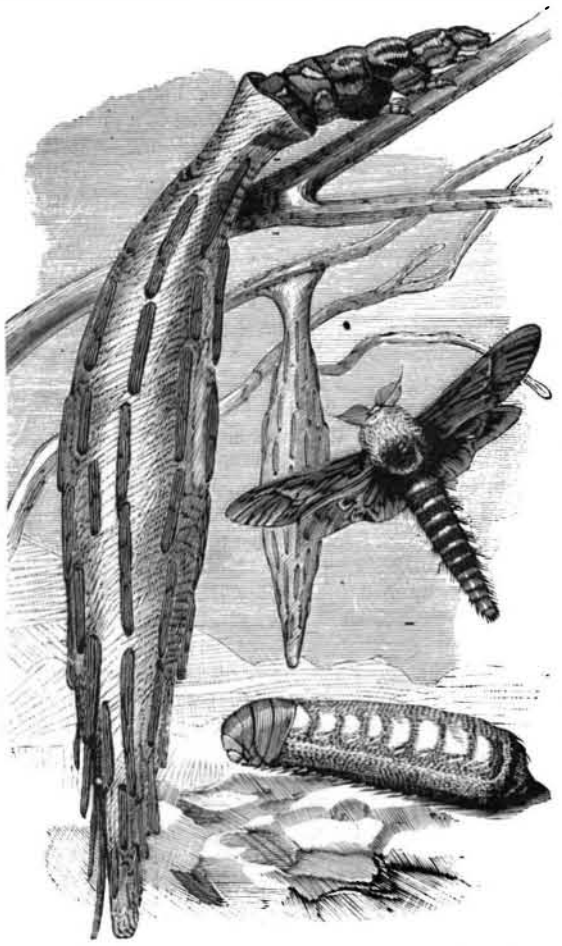
TADPOLES IN DIFFERENT STAGES OF DEVELOPMENT.

the vessels of the branchiæ becoming gradually suppressed, and their place supplied by beautifully cellular lungs, formed by a development of certain membranous sacs that appear to be analogous to the air bladders of the fishes.

HOUSE-BUILDER MOTH.

Perhaps the most curious example of the moth family is the species which is represented in the illustration, which we take from "Wood's Natural History."

The house-builder moth is common in many parts of the West Indies, and is in some places so plentiful as to do considerable damage to the fruit trees. As soon as the larva is hatched from the egg, it sets to work in building its habitation; and even before it begins to feed, this industrious



HOUSE-BUILDER MOTH.—*Oiketicus Sandersii.*

insect begins to work. The house is made of bits of wood and leaves, bound together with silken threads secreted in the interior. When the creature is small, and the house of no great weight, it is carried nearly upright; but when it attains size and consequent weight, it lies flat and is dragged along in that attitude. The entrance of this curious habitation is so made that the sides can be drawn together, and whenever the creature feels alarmed, it pulls its cords and so secures itself from foes.

In this domicile the transformations take place, and from its aperture the male insect emerges when it has assumed its perfect form, and takes to flight. But the female behaves in a very different manner. According to the ancient maxim, she stays at home and takes care of her house, from which she never emerges, nor indeed can she emerge, as she has no external vestige of wings, and looks more like a grub than a moth; the head, thorax, and abdomen being hardly distinguishable from each other. Love and courtship with this insect are carried on quite in an Oriental fashion, pushed to extremes; for whereas the Oriental in many cases never sees the face of his veiled bride until after the nuptial ceremony is completed, the house-builder never sees his mate either before or after marriage, and so is obliged either to love blindly or not at all. Perhaps, considering the peculiar ungainliness of his spouse, he is rather fortunate than otherwise in the fate which forbids him to contemplate the charms that lie hidden behind the dense curtain that shrouds the nuptial couch, and which, but for the mystery that surrounds them, might inspire any feeling rather than that of affection.

The grub-like female is seen lying on the ground, just below the flying figure of the male insect. It will be noticed that, except for the feathered body, the creature looks more like a larva than a perfect insect. Owing to the resemblance which these remarkable insects bear to the fasces which were borne by the lictors before Roman consuls, one species has been termed the lictor moth. The Singhalese appropriately call them by a name that signifies billets of firewood, and believe that the insects were once human beings who stole firewood while on earth, and are forced to undergo an appropriate punishment in the insect state. About five species of house-builder moths are known.

Injurious Insects Killed by Fungi.

It is a well known fact that various insects are subject to the attacks of parasitic fungi which prove fatal to them. The common house fly is destroyed by one, the silkworm by another, and the pupæ of various moths by others. Two other noticeable instances of this kind were observed last season by Mr. C. H. Peck, the State Botanist, and are described as follows in his "Report to the Regents of the University of the State of New York," just issued:

It was found that the "seventeen-year locust" (*Cicada septemdecim*), which made its appearance in the Hudson River valley early in the summer, was affected by a fungus. The first specimen of this kind that I saw was taken in New Jersey, and sent to me by the Rev. R. B. Post. Examination revealed the fact that the cicadas, or "seventeen-year locusts," in this vicinity, were also affected by it. The fungus develops itself in the abdomen of the insect, and consists almost wholly of a mass of pale-yellowish or clay-colored spores, which, to the naked eye, has the appearance of a lump of whitish clay. The insects attacked by it become sluggish and averse to flight, so that they can easily be taken by hand. After a time some of the posterior rings of the abdomen fall away, revealing the fungus within. Strange as it may seem, the insect may, and sometimes does live for a time even in this condition. Though it is not killed at once, it is manifestly incapacitated for propagation, and the fungus may therefore be said to prevent to some extent the injury that would otherwise be done to the trees by these insects depositing their eggs therein. For the same reason the insects of the next generation must be less numerous than they otherwise would be, so that the fungus may be regarded as a beneficial one. In Columbia county, the disease prevailed to a considerable extent. Along the line of the railroad between Catskill and Livingston stations many dead cicadas were found, not a few of which were filled by the fungous mass. As the insect makes its appearance only at intervals of seventeen years, and consequently will not be seen here again till 1894, it will scarcely be possible to make any further observations on it and its parasite for some time to come; yet it would be interesting to know how the fungus is propagated, or where its germs remain during the long interval between the appearance of two generations of the insect. Do the fungus germs enter the ground in the body of the larva, and slowly develop with its growth, becoming mature when it is mature, or do they remain quiescent on or near the surface of the ground, waiting to enter the body of the pupa as it emerges seventeen years hence? Or, again, is it possible that the fungus is annually developed in some closely related species as the "harvest fly" (*Cicada canicularis*), and that it passes over from its usual habitat to the seventeen year cicada whenever it has the opportunity? These questions are merely suggestive. They cannot yet be answered. A very good account of this fungus was given by Dr. Leidy, of Philadelphia, in Vol. V. of the Smithsonian Contributions, but as he bestowed no name on it, Mr. Peck has created a new genus for its reception and called it *Massospora cicadina*. The other instance of the destruction of insects by fungi is given by Mr. Peck as follows:

While in the Adirondack region, numerous clumps of alders were noticed that had their leaves nearly all skeletonized by the larva of some unknown insect. The larva were black in color and scarcely half an inch long. They were seen in countless numbers feeding upon the leaves, and threatening by their numbers, even if but half of them should come to maturity, in another year to completely defoliate the alders of that region. Upon looking under the affected bushes for the pupa of the insect, in order, if possible, to have the means of ascertaining the species, what was my astonishment to find the ground thickly flecked with little white floccose masses of mould, and that each one of these tufts of mould was the downy fungus-shroud of a