

elements down below which will not be at all consistent with that quiet and repose necessary to a healthy and productive tree. For instance, in applying lime to your trees it should be in small quantities, otherwise in the sulphate form, and if barnyard manure, the same direction, as it may be with burnt gypsum; or, what is just as good, there is to be found along the base of the mountain a great many tarns, lakelets, mineral springs, bog holes—all containing sulphur in some degree, as may be discovered by stirring up with a stick, when they will be found to smell very bad. Now the mud from these places is good, not only to fix the ammonia of the barn dung; it is a capital thing when in some excess, to banish vermin—always a matter of much concern in an orchard.

The soil of an orchard should be on the whole, then, somewhat compact on the surface, so as to afford as little shelter as possible to any kind of vermin, from mice down in size to the microscopic orders of animalia, also for protection and nourishment to the roots; and indeed as a defence against extremes of heat, cold, and drouth. But by all means provide for the escape of water.

I find that my article has already grown sufficient in length; if I proceed much further your readers will be looking for a whole treatise on orchard trees, which I have no intention of offering here and now—and this for a very good reason indeed. I hope the readers will not suppose that I have been able to furnish all the material for this crude and ill-expressed article from my own unaided store of wisdom and knowledge; on the other hand, it pretty much all came out of books, as any of your readers can find, if they look in them.

CLOVERDALE.

MIDDLE RIVER, 19th July, 1883.

Dear Sir,—In answer to yours on the probable result of the crops in this district, I may say that, judging from present appearance the result will be a good average crop, every kind of grain makes a good appearance, the hay crop will exceed the yield of last year, and potatoes never looked better, particularly those sown on dry soils.

Respectfully yours,
JOHN McLENNAN.

A prominent New York farmer, whose crops are proverbial for their abundance, uses no other fertilizer than land plaster and clover. His plan is to sow clover, plaster it so as to secure a rank growth and turn under for his other crops, wheat included. He has kept up this plan for over fifty years, and claims that his farm is growing more valuable each year.—*New York Herald.*

LIFE HISTORY OF THE LIVER-FLUKE PARASITE.

[Professor A. P. Thomas, writes on this subject in the columns of *Nature*.]

The winter of 1879-80 was marked by a widely-spread outbreak of the liver rot amongst our sheep. The losses during that winter were estimated at 3,000,000 sheep, or about one-tenth of the total number in the United Kingdom, and during the following winter the losses were equally severe. It had long been known that the disease was due to the presence in large numbers of a parasite called the liver-fluke (*Fasciola hepatica*) in the liver of the affected animals, and that the parasite invaded sheep or sometimes other animals allowed to feed on wet pastures, and especially on flooded ground. But notwithstanding that the question had been repeatedly investigated by numerous zoologists, including Professor Leuckart, so well known for his researches on parasites, the manner in which the disease was incurred remained a complete mystery. It was known indeed that the animals most nearly allied to the liver-fluke, the digenetic Trematodes, presented an alternation of generations, and that they possessed larval forms infesting various species of molluscs. These nurse-forms, as they are called, produce internally larvæ, usually tailed, known as cercariæ, which leave the nurse and encyst themselves in some other mollusc or in aquatic insect larvæ, &c., and remain there quiescent, only reaching maturity if swallowed together with the animal harbouring them by some suitable vertebrate host. Such is a typical instance of the development of a trematode with alternation of generations, but there is a great deal of variety in the life-histories of the different species. It was supposed that the liver fluke had a somewhat similar life-history, but all attempts to discover what mollusc served as intermediate host had been fruitless.

The Royal Agricultural Society of England was induced by the heavy losses of sheep in 1879-80, to offer a grant for the investigation of the natural history of this most destructive parasite. I undertook the research, and the result of my work during the summer and autumn of 1880 were published in the *Journal of the Society* for April, 1881. Certain slugs had been suggested as probable bearers of the larval form of the liver fluke, and I was able to show that these conjectures had little evidence to support them, and suggested that *Limnæus truncatulus* was really the intermediate host, or at least one of the intermediate hosts of the liver-fluke. For on the Earl of Abingdon's estate at Wytham, I examined thoroughly a clearly circumscribed area of infection situate on the side of a

hill far above the reach of floods, and found that almost the only species of water-snail occurring on the ground was *Limnæus truncatulus*, found in a boggy spot. This contained an interesting form of cercaria, produced in a cylindrical redia, or nurse form provided with digestive tract.

The free cercaria had a body of oval form, about 0.3 mm. in length, but was of very changeable shape. The two suckers characteristic of the adult forms of the family of the Distomidae were of nearly equal size, the oral sucker about terminal, and the ventral sucker near the middle of the ventral surface. The anterior part of the body was covered, at least in the most mature examples, with exceedingly minute spines. But the most striking character of the cercaria was due to lobed lateral masses extending the whole length of the body on each side of the middle line. These lobed masses were an opaque white from the multitude of granules composing them. The cercaria had a tail, which, when fully extended, was more than twice the length of the body. It was exceedingly active, but soon came to rest, showing a strong tendency to encyst itself on surrounding objects. It contracted so as to assume a rounded form, and exuded a mucous substance, containing numerous opaque granules derived from the lateral masses described, which were thus shown to be a special larval organ, producing the substance of which the cyst was composed. The tail continued to wag violently, and was at length pinched off as it were by the hardening wall of the cyst. The cysts were snowy white by reflected light, but on upturning them the included larva was found to be quite transparent. I had a few months previously seen a sheep which I had the best possible reason for knowing to be infected with flukes, wandering over the boggy spot from which the snail containing the cercaria came, and the presence of so highly developed an organ for the production of the substance of the cyst in a cercaria which encysted on any plants at hand seemed to indicate that there was the cercaria of the liver-fluke, and it has since been proved that such was the case. Moreover, I had collected evidence from independent sources, which rendered it probable that the parasite was taken up by the sheep while grazing from the damp roots of grass, most likely in the encysted condition.

Of this cercaria I wrote at the time as follows:—"The structure and habits of this cercaria render it possible that it may prove to be the larva of *Fasciola hepatica*, but want of material has prevented my testing the question by giving the cyst to rabbits. I intend, however, to pursue the case further."