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DER'S TECHNICAL SERIES.

FARM VERMIN

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FARM VERMIN,

HELPFUL AND HURTFUL.

BY

VARIOUS WRITERS.

EDITED BY

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INTRODUCTION.

THE periodical plagues or infestations which from time to time break out in various parts of the United Kingdom, and the damage and loss consequent thereon, show how necessary it is that agriculturists should know how to discriminate between friend and foe. Probably the reason why the farmer is not able to do this is that he is lacking in knowledge on the subject, this being to some extent owing to the want of practical guides. True there is *Curtis's Farm Insects*, and the splendid work on the same subject done by that estimable lady, Miss E. A. Ormerod. Until recently, however, there has been but little material in any permanent form dealing with the Birds or Animals affecting the agriculturist. The first of these has recently been treated of,* and now an endeavour is made to show farmers what animals to regard as friends and what as foes. In the past (if the farmer was interested at all) there has been too great an inclination to rush out with a gun and shoot any or every animal caught trespassing in a crop ; and yet, in the great majority of cases, this is an altogether unwise proceeding. For instance, out of the 360 odd birds recognised as "British," there are two only which are proved beyond doubt to be positively harmful to agriculture. These are the House-Sparrow and Wood-Pigeon. In the cases of the numerous "suspects" (of which the Rook may be taken as an example) the balance of evidence is in favour of the bird ; whilst in the great majority of instances the birds are friends rather than foes.

* "Ornithology in Relation to Agriculture," by various writers, edited by John Watson, F.L.S.

What has been done for Birds in the volume referred to is effected for Animals in this. The writers concerned are not only authorities on the particular subjects with which they deal, but their knowledge of agriculture makes the treatment fuller, and adds to the correctness of their judgment. Miscreants, judged from one standpoint only, get, as a rule, but scant justice, and it is believed that no special pleading will be found in the following pages.

One objection which may be lodged against this little work is that it is not of a sufficiently technical character. But this is part of the design. The book is intended to be readable as well as helpful, which it might not have been (seeing that it is written primarily for agriculturists) had, for instance, that little red mouser been written down *Mustela vulgaris* instead of Common Weasel.

The illustrations which have been appended will, it is hoped, tend to make the volume more useful and interesting. For the Fox, Rabbit, Red Deer, Squirrel, Hedgehog, and Common Bat I have to thank Messrs. Gurney & Jackson ; and for permission to use the illustrations of the Short-tailed Field Vole, Long-tailed Field Mouse, Stoat, Weasel, Kestrel, and Long-eared Owl—the Controller of Her Majesty's Stationery Office, these being taken from the Report of the Departmental Committee on the plague of Field Voles.

It will be noted that whilst the work treats strictly of animals, two of the illustrations are of birds. The reason for this lies in the fact that the best remedy for staying incursions like that of the recent Vole Plague in Scotland is to be found in birds of prey.

J. W.

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FARM VERMIN, HELPFUL AND HURTFUL.

CHAPTER I.

VOLES.

"For what sum would you undertake to keep a mouse for a twelvemonth?" was a question propounded to me by a Scottish sheep-farmer in the summer of 1892, to which I replied that I had never made the necessary calculation. My interlocutor held about 6,500 acres of hill pasture in Eskdale Muir, part of that tract stretching for sixty miles between Hawick on the east and Newton Stewart on the west, which was devastated by a visitation of voles during 1891 and 1892. "Would you do it for twopence?" he asked. No, I certainly would not; a mouse would surely consume more than twopennyworth of food in the course of a year. "Well," he continued, "I reckon that I have 3,000,000 mice on my land" (this did not strike me as an over-estimate, for we had seen the voles on the ground in such numbers as to be like the pattern on a carpet)—"3,000,000, and they have been there for two years. I put down the damage done at twopence a head, and you have admitted that this is not a high estimate."

It took but a simple calculation to make out that 3,000,000 voles at twopence per head per annum would cost in two years £50,000—a sum far exceeding the purchase-value of the land. It was obvious, therefore, that the loss had been over-estimated, and an attempt was made to arrive at a just

idea thereof in another way. The destruction of the pasture had told seriously on the stock; the tenant calculated that the lamb crop during the two years had been short by 1,200, valued at £800, and that 200 ewes, valued at £400, had died of exhaustion in excess of the ordinary death-rate. In addition to that, there was a deterioration of the stock, which he put at 2s. a head on 3,000 sheep for the first year and 4s. a head for the second year, amounting to £900; added to which was the cost of hay and corn used in feeding, to compensate for the loss of natural pasture, £1,200. In all, my informant estimated in this way his losses at £3,300 in two years. Even if this sum were diminished by one-half, in order to bring it well outside the limits of exaggeration, it is evident that the periodical recurrence of the scourge is one well worthy of the attention, not only of the Board of Agriculture, but also of every class depending for their income on the management of pastoral land.

The Departmental Committee appointed in 1892 conducted a searching inquiry into the origin and progress of the latest outbreak in Scotland, and also collected records of former visitations in this and other lands, and their conclusions are embodied in a Parliamentary Blue-book, issued in the spring of 1893. They examined every known or proposed means to avert or overcome the plague, and, although obliged to acknowledge the inadequacy of every expedient which has been tried, when once the voles had possession of the ground, they recommended certain precautionary measures, which landlords, farmers, and shepherds will do well to bear in mind.

FIELD VOLE (*Arvicola agrestis*).

The animal which caused all the trouble in this country is the short-tailed field vole (*Arvicola agrestis*), intermediate in size between the common field mouse and a small rat,

SHORT-TAILED FIELD VOLE.

and distinguished from the former by its blunt, short face and short tail. It is at all times to be found in our pastures, but attracts little notice until a favourable season and abundant food stimulate its prodigious powers of multiplication, when it breaks out in swarms and covers the land. The field vole does not, like some kindred species (the Thessalian vole, for instance, *Arvicola Guntherii*), burrow deeply, but scrapes out shallow runs among the heather and grass roots. The first symptom of abnormal increase in the voles is usually seen in what hill farmers call the "bog" land—*i.e.*, strong marshy land, either grazed or mown for hay. Here they cut the grass between the root and the blade, eating the tender white part just below the ground and leaving the blades in withered wisps. Having destroyed that, they move to the "bent," "lea," or dry hill pasture, and thence to the heather, or to young plantations if there happen to be any in their way. Everywhere their presence is marked by the destruction of all eatable growth, the impoverishment of the stock, and increased death-rate of the sheep dependent on the pasture. When the plague has fairly got possession, no means are known by which it can be stayed. Burning the grass and heather merely drives them upon fresh ground; it is impossible, moreover, to burn all the roughness on a hill farm, as some part must be kept to support the stock. Tens and hundreds of thousands may be killed by men and dogs, but the voles multiply faster than it is possible to destroy them in this way. Birds of prey—buzzards, owls, kestrels, etc.—collect in unusual numbers to feast upon them; and other species, such as rooks, become predatory for the nonce, but without any apparent effect upon the number of voles.

A remarkable incident in the late plague in Scotland was the presence of great quantities of the Short-eared Owl (*Otus Asio*), a migratory, day-hunting species, commonly called the woodcock owl, because it arrives and

departs about the same time as the woodcock. Usually it is extremely rare for this useful bird to remain and breed in these islands, but during 1891 and 1892 it not only arrived in

SHORT-EARED OWL.

great numbers, but nested freely, rearing second broods after the first had flown. Unhappily for their credit with game-keepers, these owls outstayed the voles, and now that the

latter have disappeared it is reported that the owls have begun to attack young game.

Nevertheless, as this is quite an exceptional excess on the part of these useful birds, it ought not to be reckoned against them. Owls will not remain where there are no mice, any more than swallows where there are no flies. When the mice are finished owls will support life for a time on anything they can catch, but they will soon take their departure, and farmers ought to stipulate with their landlords that gamekeepers be forbidden to destroy them. In doing so they will have science on their side. It is only crass ignorance that directs the destruction of all birds of prey as vermin, the less pardonable because such birds afford evidence of their diet in a peculiar way. Hawks and owls swallow feathers, fur, and bones with the flesh, and cast them up again in the form of what are called "pelts," or "pellets." The Vole Committee inspected the farm of Howpasley, near Hawick, which had been visited severely by the scourge. A small wood at the back of the dwelling-house was resorted to by large numbers of owls, and the ground under the trees was literally covered with thousands of pellets composed of the fur and bones of the voles. Not many years since, but before the last outbreak of voles in Scotland, a German naturalist, Dr. Altum, was at the pains of examining the disgorged pellets of the wild birds of prey, and the facts revealed by him should at once and for ever have removed the doubts as to the usefulness of owls. The Tawny Owl (*Syrnium aluco*) is the species that bears the worst character for poaching. In two hundred and ten pellets of this bird Dr. Altum found the remains of one stoat, three hundred and seventy-one mice, forty moles, eighteen small birds, and many beetles and cockroaches. Again, seven hundred and six pelts of the common white or barn-owl produced sixteen bats, three rats, two thousand five hundred and twenty mice, one mole, and twenty-two

small birds. With this record before them farmers will be unworthy of their reputation for sagacity if they do not insist on their feathered servants being unmolested.

As long as the plague endured in Scotland, shepherds looked in vain for help from the weather—frost, snow, rain, drought; the voles seemed impervious to all change; they hived as merrily under the snow-wreaths as they darted about in the midsummer glare.

To what causes, then, can their disappearence be attributed? This can only be answered vaguely—to the cessation of the conditions which brought about their excessive multiplication. From the earliest times, in widely different and distant countries, there are records of similar outbreaks of small rodents. When the Philistines carried off the Ark of the Covenant they were visited by disease, and their fields were overrun with swarms of mice (1 Samuel v. 6), and the people presented expiatory images of the "mice that mar the land." Holinshed records that in 1581 "there sodainlie appeared, in the marshes of Danesey Hundred in Essex, an infinite number of mice, which overwhelming the whole earth in the said marshes, did sheare and gnaw the grass by the rootes, spoyling and tainting the same with their venimous teeth, in such sort that the cattell which grazed thereon were smitten with a murraine and died thereof; which vermine by policie of man could not be destroyed, till at the last there flocked together such a number of owles as all the shire was not able to yield, whereby the marshholders were shortly delivered from the vexation of the said mice."

Other chroniclers—Stowe, Childrey, Lilly, Anstice, Lord Glenbervie, Sir Walter Elliot, etc.—have described similar visitations in various parts of England and Scotland in the years 1615, 1648, 1660, 1745, 1813, 1825, 1836, 1864–67, and 1875-6. Mr. W. H. Hudson gives an interesting description, in his "Naturalist in La Plata," of the Pampas being over-

run by a species of field mouse (*Hesperomys*), and mentions the usual concomitant of extraordinary numbers of short-eared owls which preyed upon them. Lastly, and simultaneously with the latest outbreak in Scotland, the province of Thessaly was invaded by a plague of voles, and, as it had been authoritatively stated that this had been successfully combated by Professor Loeffler, I went out to satisfy myself as to the results of his specific before recommending its adoption in Scotland. The learned Professor having discovered the bacillus of a disease known as mouse typhus, incommunicable to other animals, caused bread, steeped in typhus broth, to be placed in the holes of the Thessalian voles. Undoubtedly large numbers of mice were destroyed in this way, but, inasmuch as each mouse must swallow a portion of the virus before it can suffer from the disease, the impossibility of applying the remedy to a tract so extensive as the infested area in Scotland—measuring, roughly, sixty miles in length by twelve to twenty in breadth—is at once obvious. The expense of the operation puts it out of practical question. No doubt, however, in limited areas, in houses, gardens, or even on arable land, this prescription of Professor Loeffler's will be found invaluable as a destructive agent among rats and mice, and it possesses this advantage over all poisons—that it is perfectly innocuous to other forms of life. But, as displayed in Thessaly, it must be held inefficacious for use on an extended scale, for, so far from having rid that land of voles, when we visited it in January, 1893, six months after the cure had been pronounced complete, the Mahomedan farmers were sending in despair to Mecca for holy water to sprinkle on the fields.

The Committee determined that the only chance of averting a plague of voles, with all its lamentable consequences, is to take concerted action when they first begin to appear in unusual numbers. "The most effective measures," they say, "appear to be periodical and timely burning of grass

and heather, followed by active pursuit of the vermin by men using wooden spades and assisted by dogs.

Light wooden spades are recommended, because the voles dart about so rapidly that it is very difficult to hit them with a stick. "It is hardly necessary to point out that the proprietor of the land should be informed as soon as anyone else, because his keepers and other servants might be usefully employed in assisting to prevent what amounts, if unchecked, to a common calamity upon all classes connected with land.

"When plantations of limited extent are attacked, pitfalls, wider at the bottom than at the top, and about 18 inches deep, should be dug. The voles fall into these and cannot escape, and the ground is soon cleared of them in this way."

The Committee further insisted in the strongest possible way on the necessity of discrimination in the destruction of what is known to gamekeepers as vermin. The birds that prey upon mice do not generally attack game ; buzzards, owls of all sorts, kestrels, and the smaller seagulls should be strictly preserved, and though it is sometimes necessary to kill down sparrow-hawks, this ought on no account to be done by the cruel pole-trap, which captures all species indiscriminately.

Weasels are determined enemies to mice of all sorts, and the injury they do to game has been greatly exaggerated.* They should certainly be left unmolested on hill farms, though it is perhaps hopeless to plead for the more mischievous stoat. But it must be remembered that exclusive reliance cannot be placed on these natural checks. Many witnesses before the Committee attributed the prodigious multiplication of voles to rigorous game preservation,

*The Editor, a considerable portion of whose life has been spent in the fields, has never seen a weasel attack adult rabbits or hares, or any of the game birds. Young rabbits and leverets are occasionally killed, more rarely the downy young of pheasants and partridges. The weasel is an inveterate mouser and ought to be encouraged and preserved. As much cannot be said of the stoat.—EDITOR.

whereby mouse-hunting hawks, owls, and weasels had been almost exterminated. That view cannot be maintained when the state of matters in other countries is taken into account. In Thessaly and the South American prairies nobody thinks of shooting hawks and owls, which exist there in unmolested numbers; yet these lands are just as subject to periodical swarms of voles and mice as our own. Moreover, it has been shown that in former centuries, long before gamekeepers had interfered with the natural enemies of the mice, Great Britain was subject to visitations not less severe than that which has lately caused such grievous damage in Scotland. The only precaution possible is watchfulness, and combined action on the part of landowners, farmers, shepherds, and other persons on the land, so soon as the first symptoms of undue increase in the vermin are detected.

One favourable result of the recent plague—the only one, unless it be that kestrels and owls be henceforth encouraged to stay in our land—remains to be noticed. The grass which has sprung up on the affected land after the departure of the voles is of superior quality, and the pasture has been much improved in quality. But it is an expensive remedy; farmers would rightly prefer to keep the management of their grass lands in their own discretion rather than trust to the empyrics of nature, and no vigilance should be relaxed to avert the recurrence of such a visitation.

CHAPTER II.

THE WEASEL KIND.

In treating of a carnivorous and predacious family of animals like the present in its relation to agriculture, it will be necessary to consider the animal food of its various members, and whether that food consists of creatures of some value to the agriculturist, or, on the contrary, of animals in themselves injurious to his interests. A side issue, the effect of the Weasel kind upon ground game, also arises, and might confuse the matter, inasmuch as, when the farming tenant is not the shooting tenant, ground game would be animals "injurious to his interest," but often exactly the contrary when he himself has the shooting rights.

Time was when almost all parts of England could boast of the possession of five species of this family in fair abundance. But at the present day one of them, the Marten, or Marten Cat, is almost extinct; two others, the Otter and the Polecat, or Fitchet Weasel, are becoming yearly more rare; and the Stoat, or Ermine Weasel, and the common Weasel are now the only two species which may be said to still exist in any numbers generally over the kingdom.

THE OTTER (*Lutra vulgaris*).

As the Otter differs in many respects in structure and habits from the rest of the family, it will be well to consider

it first. To such an extent, indeed, does it differ, that the question whether it is flesh or fish has even arisen! So Izaak Walton—

"*Piscator.* I pray, honest huntsman, let me ask you a pleasant question; do you hunt a beast or a fish?

"*Huntsman.* Sir, it is not in my power to resolve you; yet I leave it to be resolved by the College of Carthusians, who have made vows never to eat flesh. But I have heard the question hath been debated among many great clerks, and they seem to differ about it; yet most agree that her tail is fish; and if her body be fish too, then I may say that a fish will walk upon land (for an otter does so), sometimes five or six or ten miles in a night."

Pennant, indeed, saw an otter being cooked for dinner in the kitchen of a Carthusian Convent. But if we (being free from the pressure of perpetual *maigre* days) are unwilling to deceive ourselves as to the zoological affinities of *Lutra vulgaris*, we must acknowledge that the latter eats fish, and a great deal of it too. Lithe and supple as an eel, with long, flat body; short, broad, strong tail; and broad, web-toed feet; the otter is almost as much at home in the water as fish are. To have, therefore, otters inhabiting a reach of river, and to keep up a large stock of fish therein, is an incompatible condition of affairs.* On the other hand, unless a stream is very strictly preserved, and closely fished, an occasional otter will do little harm, and even some good—for this reason: the otter having to satisfy his hunger likes a

* I have lived all my life on the banks of a famous trout-stream in the North, and have invariably found trout most abundant near the haunts of the otter. The otter destroys fewer fish than is generally supposed; its food consists mainly of fresh-water crayfish. This may appear a bold statement, but it is a fact. It is confirmed by water-bailiffs and fish-poachers. Of forty-five dead otters killed in hunting, in two only were there the remains of fish food, and this consisted of eels—deadly enemies to trout streams or salmon rivers. These forty-five otters were, for the most part, killed before six in the morning, and, consequently, when their stomachs were most likely to contain traces of what had been taken in their night's fishing.—EDITOR.

big fish, and the latter, though wary of the wiles of the fly-fisher or angler, is probably more easily captured by the methods employed by the otter than are smaller and more active fish. Now, no worse vermin can exist in a stream, most of all a trout stream, than a big fish, and most of all a big trout; and these monsters, little likely to fall victims to the lures of the casual angler, are very well bestowed in the jaws of an otter. This is all we can urge in his favour to the fisherman, except, if the latter be an all-round sportsman, that legitimate otter-hunting is a very charming sport. But if the otter's virtues end upon the river-bank, his vices terminate there likewise. For we may regard the charges of visiting farmyards and destroying poultry, and even young lambs, as (if proved) too exceptional to be of serious import.

Many instances are on record of the otter being tamed and taught to fish for the benefit of its master.*

Otters may occasionally be trapped by placing a fairly strong steel gin in their tracks through a bed of rushes or osiers. The trap must be well covered up and attached to a small chain. Some trappers have recommended that when the trap is set close to the edge of deep water, the chain to which it is attached should not be fastened to a fixed object, but to a piece of lead of such a weight that the otter, when frightened by the snap of the trap, instinctively diving under water, can drag it over the edge, but is unable to come to the surface again with it. In this case the otter is drowned, and there is less risk of it wrenching or biting its foot free from the trap. A long line ought, of course, to be tied to the trap, in order to trace the whereabouts of the drowned otter. The plan has the recommendation of insuring a speedy and easy death to the captive.

* One of my friends had a young otter which he led about in a leash. At Bassenthwaite a man and his son trained a pair of otters to fish in the lake. They would return when called upon, or follow their master home when the fishing was over.—EDITOR.

THE MARTEN (*Martes sylvestris*).

Two species of marten, known respectively as the Beech and the Pine Marten, were formerly supposed to inhabit this country; but further investigation has shown that the second species, while it occurs in continental Europe, is not a British animal, and that the white and yellow breasted martens found with us are merely varieties of one and the same species. Martens, whether white or yellow breasted, are now so rare in Great Britain that they can no longer be looked upon in the light of vermin, but rather as interesting survivors of a fast-departing race. In its habits the marten is far more arboreal than the typical weasels—indeed, its true home is among the branches of the larger timber trees, and, accordingly, we hear of it in the days of its abundance frequenting the larger ranges of woodland and the forests in preference to more open country. In the branches the martens caught birds (doubtless robbing many a nest of young), probably squirrels also, but they were always said to be very destructive to game, both ground and winged, and to visit farmyards, where they killed poultry of all kinds. Yet even this destructive animal did some good when it descended to the ground, and, seeking humbler prey, destroyed mice, rats, voles, and moles. Those who have had an opportunity of observing this animal in life are unanimous in their admiration of its beauty and the sprightliness and activity of its movements. The fur of the marten bears some resemblance, but is inferior, to that of the sable, and a considerable quantity of skins are imported into England from the North of Europe. The scent secreted by the glands in this animal is much less unpleasant than in some other members of the family, and it has on this account been called the Sweet Marten, in contradistinction to the polecat, which bears the name of foul-mart, or foumart.

THE POLECAT (*Mustela putoria*).

The Polecat, or Fitchet, although much more numerous in this country than the marten, is, with the exception of the wilder parts of the kingdom (including some wooded parts of midland England where excessive game-preserving is not carried on), decidedly a rare animal. In the days when it was common it must often have inflicted severe loss upon the poultry-keeper, the ravages it committed among fowls and ducks, and even among geese and turkeys (young and old alike in the former cases), being in no wise restrained by the limits of its appetite. For the polecat, finding itself in the midst of plenty, killed far more victims than it could eat, contenting itself for the time being with eating only the brains and part of the blood of the slain; and it is even said to have gratified its love of killing by destroying every head of poultry in the roost to which it had obtained an entry.* A more unwelcome denizen in a game preserve it is difficult to imagine, pheasants and partridges, hares and rabbits, alike

* Miss E. A. Ormerod contributes the following:—"With regard to the weasel kind, in their forms of stoat, weasel, and polecat, I send you a reminiscence of a massacre of poultry as an example of the destructive habits which it appears to suit the polecat's view to carry out, quite irrespective of its personal need of provisions. The locality was the Sedbury Park Estate, the Gloucestershire property of my late father, Geo. Ormerod, D.C.L. It lay along the Wye (opposite Chepstow) and the Severn, with a frontage of about a mile along each river. In the woods and wooded cliffs there was shelter for wild life, both bird and beast, which to those who, like myself, cared to watch what was going forward, brought many an observation of rare appearances. But with regard to the polecats and weasels—the great quantity of rabbits, which almost swarmed in the cliffs afforded a provision that made them a pest to be constantly needing consideration; and the polecat—though only so occasionally seen that when one was destroyed the body was almost always brought to the house as a trophy for inspection of the beautiful fur, yet from time to time appeared. On one occasion the following disaster swept off almost all my sister's ducks. These and the common fowls were kept in fairly large poultry-houses, about twenty feet by ten, walled at back and one end, the rest believed to be made vermin-proof with woodwork and wires; and on the floor of this, with due accommodation, or in boxes at ground level, the ducks passed the night, with the fowls on perches above. One morning, however, when the dairymaid and yardman went to open the poultry-house door, instead of the state of affairs they expected, the floor was strewn with the corpses of at least fourteen ducks. So amazed were the two at the sight that it never occurred to them that the cause of evil was within. Whilst the very inefficient natural history committee stood at the open door, holding up their hands and ejaculating, the polecat, seeing no difficulty in escaping simply ran out through the door."—EDITOR.

falling victims to its rapacity. Bewick relates the case of a polecat being observed to frequent the banks of a river to some purpose, for eleven eels were found in its retreat. And another writer mentions a nest containing five young, close to which were stored no less than forty large frogs and two toads, these being alive, but disabled from moving away, each one being bitten through the brain. But as long as the polecat keeps away from the temptations of the farmyard, it will naturally, in those districts which are not highly stocked with game, do good by destroying vermin to a degree proportionate to the mischief to which its bloodthirsty disposition incites it in more luxurious quarters. I have myself seen a polecat hunting along the brookside where the too-numerous rats (I mean rats, not water-voles) were the largest—if not the only—game it would find ; and the rats in the hedgerows after harvest would afford the polecat the best chance of obtaining a dinner in those districts (numerous enough) where hares are scarce, pheasants and rabbits still more so, and partridges far from abundant. The polecat is proverbial for its strong scent, but its fur is worn freely under the name of "fitch." Similarly, the fur of the despised stoat in its winter dress is worn as "ermine"; and one of our most expensive furs is procured from an animal (the skunk) whose odour is one of the most disgusting, as it is certainly the most pungent animal smell, the whole world produces. Those who know from experience the strength of this perfume, and the distance at which it is perceptible, must be excused a little exaggeration of imagination if they breathe a sigh of thankfulness that the whole broad Atlantic stretches between England and the home of this odoriferous little beast.

STOAT OR ERMINE (*Mustela erminea*).

Hitherto I have had to speak of the members of the weasel family, treated of in this chapter as very destructive

vermin, doing some good certainly, but not nearly sufficient to counteract the harm. We now come to an animal which may fairly be said to do quite as much good as harm. But it is hardly necessary to say that in those cases of excessive game-preserving, when on a given extent of ground a far larger head of game is maintained than nature ever intended it to maintain, man, having already violently upset the balance of nature, is obliged to go a little farther, and not only remove every stoat from the temptations arising from a residence among semi-tame pheasants and swarming ground-game, but also trap the rats with which the stoats would have contented themselves to a large extent under ordinary conditions of life. It is not to be denied that the stoat is a terrible enemy to rabbits, and will and does kill not only those, but hares also; that probably now and again it succeeds in surprising an old pheasant or partridge (to say nothing of young ones) or that it is an occasional and most unwelcome visitor to henroost and dovecot. At the same time its favourite prey is the rat, and in pursuit of this it hunts the hedgebanks in summer and comes into the stackyards in winter. The stoat may often be seen hunting along the stream-banks in pursuit of the water-vole and of the common brown rat, large numbers of which latter animal take to the stream-banks during summer, and are confused by unobservant people with the comparatively harmless water-vole. Many mice are also killed by the stoat, which is figured on page 19. In the Blue-book embodying the Report of the Royal Commission upon the Field Vole plague, the stoat is described as "among the deadliest and most persevering enemies of small rodents." Like some of its congeners, the stoat hunts by nose, following the scent of rats or rabbits with the greatest pertinacity. It often takes to the water, swimming with ease and rapidity, and is equally well capable of climbing trees.

THE WEASEL (*Mustela vulgaris*).

It only remains now to speak of the little red weasel, and I shall claim for it that while very beneficial as a mouser and a destroyer of other small rodents, it is nearly (but not quite) harmless to the poultry-keeper and game-preserver. To begin with, the weasel is so small that it would have some difficulty (savage and active as it is) in mastering full-grown game or poultry, and (apart from very exceptional cases) its misdeeds are probably confined to the occasional slaughter of a young rabbit, leveret, or chick. Casual offences of this kind might well be overlooked in view of services rendered, and, except in the case of incorrigible offenders (such as a weasel which has found its way into a dovecot, or to breeding-coops, or is raising a family close to rabbit-burrows), protection might be afforded to weasels if only on account of the large numbers of mice they destroy. Bell gives the total length of the male weasel at 10¾ inches, which I think is above the average, for I remember being greatly struck with the size of one which proved to measure only a quarter of an inch more. A male weasel, therefore, can thread the mole's runs easily, and the female, which is a wonderfully small animal, measuring only 8 or 9 inches total length, can even follow the field mice underground, and is probably by far the most deadly enemy the small rodents have. In those wheat-ricks, too, which are infested with mice and tunnelled in all directions by their runs, weasels often do a great deal of good—indeed, when a weasel takes up its quarters in a rick, it generally soon effects a clearance of the murine vermin. Rats are said to desert a sinking ship, and neither they nor mice are likely to find a wheat-rick a very convenient habitation when once a stoat or a weasel has adopted it as part of its beat.

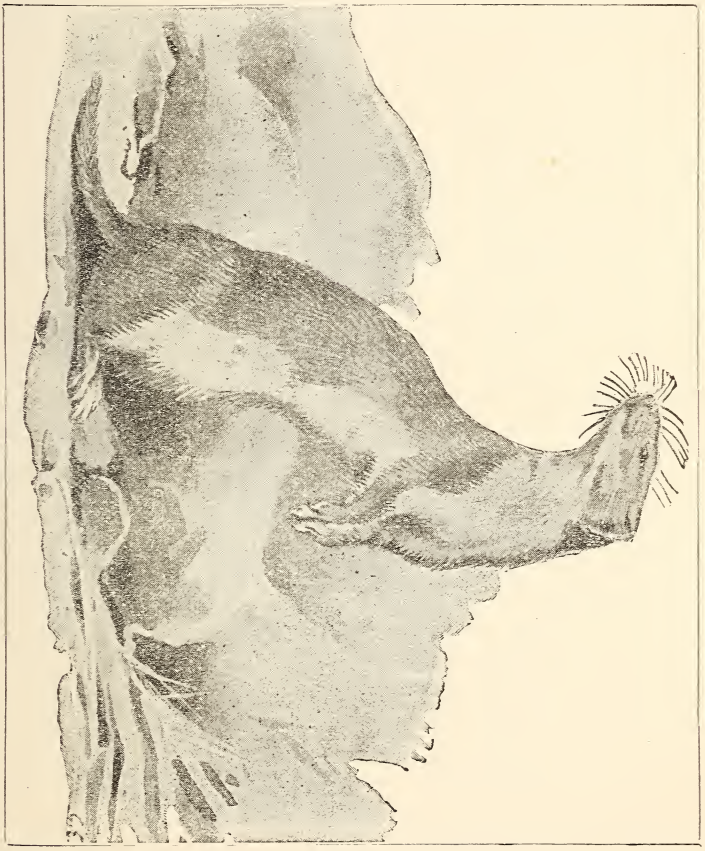
Many people do not know clearly what the difference is

THE STOAT.

between the stoat and the weasel. The stoat is considerably the larger of the two, is brown above, and has a rather long, somewhat bushy tail, the tip of which always remains black; the weasel is of a paler reddish brown above, with a tail uniform in colour with the back, and of uniform thickness.

As the rat forms a favourite food of the stoat, so even to a greater degree do various kinds of mice that of the weasel; the latter also destroys many moles, rats, and water-voles, and, although not on all occasions guiltless of the blood of young game and poultry, is even less harmful in these respects than its congener the stoat, the burden of whose sins it often has to bear. The late Professor Bell relates that, having concealed himself on one occasion close to a weasel's nest containing young, he saw the parent bring, in a little more than an hour, five mice for her young. He caused the female to drop the fifth, which he picked up, and found that it was a specimen of the field vole (*Arvicola agrestis*), commonly known as the short-tailed field mouse or grass mouse; Professor Bell had no doubt, from the general resemblance which the other four bore to this one, that they were all of this species. Now the significance of this fact will at once be apparent when we reflect that this same *Arvicola agrestis* is the little animal the depredations and overwhelming abundance of which in Scotland were the occasion, in 1892, of the appointment of a Departmental Committee to inquire into and report upon the circumstances attending the existing plague of voles in some of the southern counties of Scotland, and upon preventive and remedial measures. The minutes of evidence and appendices, embodied in a Blue-book, extending to 98 pages, exclusive of the Report of the Committee, presented to both Houses of Parliament, together with a pamphlet on the subject issued by the Board of Agriculture, are now before me. The information contained therein is of the greatest

moment to all who are interested in the question of the comparative good and harm effected by the animals and birds commonly known as vermin. With respect to the



THE WEASEL.

causes of the outbreak, the Committee report that "the increase in the number of voles to the dimensions of a plague was attributed by all witnesses to one of two reasons, or to a combination of both." The first is the character of

the seasons. "The second cause assigned by witnesses is the destruction of hawks, buzzards, owls, stoats, and weasels by persons interested in the preservation of game." Major Craigie "had previously stated to your Board that a preponderance of opinion amongst farmers is reported, tracing the cause of the present outbreak to the scarcity of owls, kestrels, hawks, weasels, and other vermin. Of the prevalence of this opinion your Committee were made fully aware, nearly every witness who was examined giving it as his belief that the outbreak was due to the destruction of the 'natural enemies' of the voles." The Committee further reported that they had "no hesitation in recommending that weasels, which are persistent mouse-hunters and do little damage to game, should not be molested, at least on moorlands and hill pastures, where they can do little harm and much good."

In case of an undue abundance of the smaller members of the weasel family, trapping may have to be resorted to. Some kind of fall or tunnel trap for use "on speculation" in likely places; and the steel gin, either baited or set where the animal is likely to pass, in the case of the desired destruction of individuals known to frequent any given place, are the "remedies." The bottom of a small dry ditch is a favourite "road" with stoats and weasels in passing from place to place, and among buildings they always like to travel along just at the foot of the walls or under anything that will give them temporary shelter from observation. I have more than once seen stoats running along the top of a low dry stone wall, and a flat stone or old slab set up in a slanting position against the wall may tempt one coming that way to pass between them. Success in trapping depends largely on finding out these likely spots.

CHAPTER III.

FOX AND BADGER.

THE FOX (*Canis vulpes*).

NOTORIOUS in all ages for his cunning and trickery, the Fox is now the only wild representative of the *Canidæ* left in Great Britain. Notwithstanding his many faults, he was always tolerated and treated with favour by the northern races, who, believing all nature to be alive, attributed to beasts and birds the gift of human speech and the actions of men and women, with super-added powers of transformation and change of shape. The most popular tales and folk-lore in all countries and ages are connected with the craft and sagacity of the fox and his power of outwitting beast, bird, and even man himself; and many an Aryan mother of that younger world has hushed her child to rest with much the same rhymes and stories of sly Reinke as have done good service in the modern nursery. The fox also held a subordinate place in the Norse mythology, being sacred to the mighty Thor, whose red, flaming beard was of the same typical colour.

There are several remarkable varieties of *Canis vulpes* in Great Britain, the largest and strongest being the Highland fox, in size and strength more like a wolf, when compared with his brother of the Lowlands—his fur stronger and of a greyer tint, and more white at the tip of his brush; the skull also is larger and stronger and its breadth greater, and armed with more formidable canines.

In sandy soils foxes will, unaided, excavate considerable burrows, or "earths;" in strong soil they will often take possession of disused rabbit-burrows, which they enlarge, or badger earths, and it is a well-ascertained fact that these two will live together in the same vicinity and on the most amicable terms. The young are almost always brought forth in these earths, although occasionally a vixen has been known to select a straw-stack or a hollow tree. Once when riding down the open furrows in a deep-ploughed fallow we found four little blind cubs in the space between two

THE FOX.

up-turned furrows; these lay quite exposed in a shallow nest of dried grass. On going to the place the next day we found them gone, the keen-eyed vixen in some manner having become aware of their discovery.

There can be no disguising the fact that, however great a favourite Reynard is in the hunting shires of England, he is looked upon as an unmitigated pest and nuisance in the mountain districts of northern Britain, where no hound or

horseman ever comes. Man in those regions has no use for him, and will not tolerate his too-frequent depredations, which are resented in proportion to his utter uselessness. In Scotland generally he is "King of the vermin," and nothing escapes him—weakly sheep, lambs, ptarmigan, grouse, hares, rabbits, game, wild fowl generally, and young roe ; such smaller deer, too, as rats, mice, and moles. He robs the nests of the wild bee for the honey of which he is inordinately fond—a bait which has often lured him to destruction.

In England, where food is not so readily procurable as in North Britain, foxes feed largely on leverets and rabbits. They are deadly foes to brooding pheasants and partridges, both slaying the sitting bird and devouring her eggs. Only this year (1894) we have learnt of the fearful havoc and mischief done in one night by a fox which had succeeded in evading the sleepy watcher, among the young coop-reared pheasants of a neighbouring preserve, scores of young birds having been destroyed out of what appeared to have been "pure cussedness," as most had been left strewn about the ground. When pressed by hunger the fox will not disdain frogs, snails, and worms, and even the acrid toad, and we have sometimes found the droppings full of the wing-cases of beetles. An old farmer who began life as a keeper, and had lived much of his time near a fox-covert, recently told us that foxes are very fond, in the spring, of the droppings of young lambs, as long as they are sucking the ewes, and will resort constantly to the fields where these can be got.

On this side the Border the fox is pre-eminently distinguished as the worst enemy of the poultry yard, and, presuming on long immunity, so bold does he become during the season his family are dependent on him, that he will carry off the unwary duck or hen in broad daylight and in the most public manner, regardless of shouts and

yells and barking collies ;* he has been known to clear a whole parish of out-sitting ducks and hens. Near the coast he is particularly partial to decayed or rotten fish, constantly visiting the locality, night by night, as long as this savoury viand is procurable ; nor will he disdain to take a light and salutary repast from the dangling scare-crow gibbeted above newly-sown or ripening corn. Perhaps one of the worst charges we have heard brought against him is that of cannibalism—a fact we have had the opportunity of verifying. In a grass field in the parish in which we lived there was a big stack of thorns, purposely contrived as a retreat and refuge for foxes. Here two vixens laid up, and in summer evenings we have watched the pretty gambols of the cubs. One day the tenant brought word that the foxes had been quarrelling, that the vixen had killed a cub, and that subsequently the rest had dined off it, of all which sad scene he had been an eye-witness. On examining the place we found it was a too-true tale, and the only relic left was the fresh skin of the unlucky cub, neatly turned inside out, like a glove, and picked clean of every particle of flesh, a certain indication that a fox—and a fox only—was the author of the deed.

Hedgehogs, too, form part of his diet ; the skin, as in the former case, being invariably turned inside out. When flocks are folded on turnips in winter, foxes will sometimes take advantage of the helpless condition of an overcast sheep, and inflict terrible mutilation and death. Such outrages, however, we consider quite exceptional, and induced by scarcity of natural food, or it is not improbably the work of some old rascal who, like the flesh-eating parrot of New Zealand, has developed a taste for fresh mutton or kidney fat.

* I once saw a striking instance of this. A sheep shearing was proceeding in the fold of a mountain farm, when a vixen fox suddenly sprang over the wall and immediately made off with a gamecock, It was broad daylight, there were men and dogs about, and the fold was in a general bustle.—EDITOR.

We cannot but admit that these charges amount to a serious indictment, and we will now hear what can be urged on the other hand in the defence. First, then, we plead that there is no animal, tame or wild, which is such a persistent and clever rat-catcher. Mice, also, both the common, the long-tailed, and the destructive short-tailed field vole, he will catch and eat in large numbers. If you doubt his liking for these, leave exposed the dead rats and mice when a rick is threshed, and you will find that where there are foxes all will probably have disappeared in a night or two, and that the work is done by these will be shown by the neatly reversed skins of the larger rodent. It is a somewhat suggestive fact that in the recent plague of rats which for two years levied so heavy a toll on the agricultural produce in Lincolnshire, the injury was confined to the fens and those districts in which foxes are not preserved, or where there is no hunting. A brace of foxes will keep the rats in their vicinity well within bounds. His depredations amongst game and poultry might be effectually prevented if keepers would supply the vixen during the time the cubs are with her with a few rabbits and rooks left conveniently near her earth. So likewise with poultry. When we want to keep strawberries and fruit from blackbirds and thrushes we cover them up with nets. And if landlords and tenants would supply suitable shelter and accommodation for poultry, the loss from foxes and other vermin, including the two-legged sort, would be proportionately small. In these days of depressed agriculture poultry-rearing has become an important item in the balance-sheet. We can scarcely expect a fox, however knowing, to discriminate between wild and tame birds, and we are sorry to say that the conditions of keeping poultry in our agricultural districts are usually such as offer him every inducement to help himself. In the vast majority of cases there is no sort of poultry-house on the farm, the hens nesting anywhere, all over the place, and at

night roosting on firs and evergreens, the cart hovels, implement sheds, and other buildings, where, in due course, wood and iron alike become coated and corroded with droppings.

When a hen-house exists, it is usually some ramshackle lean-to against the side of a larger building, a monument of the ingenuity of the tenant, and pervious to wind and rain on every side, or, when more substantially constructed, having no proper ventilation. The inside swarms with creeping and jumping vermin; woodwork and floor alike are coated thickly with hot and acrid guano, feathers, and rotten straw; the smell is overpowering;—and yet in poisonous dens like these we expect our poultry to thrive and fowl-rearing to be remunerative. Let owners and occupiers provide suitable and roomy yards and shelters where the poultry can be locked in at night, and we shall hear little more of the depredations of the foxes.

Indirectly the preservation of foxes is of immense benefit to the agricultural classes. If no foxes there could be no hunting, and if no hunting then no necessity for horses bred for that purpose. Let those who are eager to destroy our great national sport visit any of the great agricultural shows and inspect the classes for blood sires, brood mares, and hunters, and they will then better realise the enormous amount of money which changes hands, all which goes, in one way or other, to benefit agriculture. Again, let them calculate the amount of hard cash sown broadcast in a hunting county in wages, purchase of hay, straw, corn, rents and general expenditure, to say nothing of saddlers, tailors, and veterinary surgeons, hunt balls and hunt suppers, and such-like entertainments. There is no doubt that if it had not been for this lavish expenditure, the sole foundation and beginning of which is our little friend Reynard, the distress in many agricultural districts would in late years, have been greatly accentuated. There is also a social

and moral side of the question which must not altogether be passed over in silence. "Hunting," as the immortal Jorrocks says, "is the sport of kings, the image of war without its guilt and only twenty-five per cent. of its danger." The Duke of Wellington always preferred fox-hunters for his aides-de-camp, because he knew they would be well mounted, could ride straight to a point, and possessed coolness, judgment, and rapid decision. Any man who can ride to hounds has the making of a good cavalry officer, and most assuredly the day will come when England will once more be proud of her hard-riding sons, her cavaliers of the hunting-field, men who are as ready to charge the enemies' ranks as to ride at a stiff bullfinch.

To sum up, then, for and against. In districts where there is no fox-hunting, like northern Britain, it is right and proper that the fox should be kept in check by other means and not allowed to increase unduly. In much of England, however, his preservation, as we have shown, is undoubtedly a substantial gain and advantage to the country. The propensity to evil courses in our vulpine friend may be much checked or altogether prevented by care and precaution.

May fox-hunting flourish amongst us! It is a healthy and life-giving exercise and the grandest sport in the world, and can be enjoyed, in degree, by all states and conditions of men, whether these be the "hupper crust" of the hunt, as Mr. Jorrocks calls them, or the chimney-sweep on his jackass.

We should perhaps lay ourselves open to the charge of unfairness if we failed to notice the occasional damage done by fox-hunters in galloping across root crops and breaking fences. We are sorry to say the agricultural fences of England in many districts are now in a very different state to the trim, neatly-cut hedges we can recollect twenty-five years ago; now full of gaps and repaired in the most casual way with dead thorns, or a few yards of spiked wire, taken

down again before hunting commences. Having lived in a hunting district much of our life, and within easy walk of a town, we have no hesitation in saying that the damage done by hounds occasionally crossing a parish is as nothing compared with the injury inflicted to live stock, crops, and fences by poachers, bird-nesters, plover-egg seekers, wool and watercress gatherers, mushroom seekers, herb and wild-flower root collectors, gleaners, blackberry gatherers and nutters, and all that class of nondescript town slink-abouts who will do anything rather than an honest day's work.

THE BADGER (*Meles taxus*).

The badger is the only representative of the Plantigrades (that is, animals walking on the soles of their feet) which is now found in Great Britain. He is not a very distant relative of the bears (*Ursidæ*), and exhibits also close zoological affinities to the weasel tribe (*Mustelidæ*). He is a gentleman of very ancient descent, and was co-existent in these regions with the mammoth, elk, and beaver, and other animals long since extinct, yet still survives all the changes and vicissitudes of time and place in spite of his most unjust and cruel persecutions by man. That he has succeeded in holding his own is due to his retiring habits, seldom being seen outside his burrow in the daytime. In fact, we are disposed to think that he is not so rare as is generally supposed, and we have sometimes found his unmistakable tracks in places where we little expected to see them—a long foot with five toes parallel to each other, and the sharp nail-prints an inch or two in advance. Compared with the fox, the badger is a dull, lazy beast, and invariably very fat. His habits are wholly nocturnal, issuing out of his burrow after dusk and returning before dawn. Keepers who are out very early have seen them returning to their retreats, following each other in direct line. The earth of a badger is often a big affair, a regular fortress, four to five feet deep, and with many twists and

ramifications. At the end it rises about a foot to secure drainage, and is terminated by a chamber lined with dead grasses and ferns. We have known quite a barrow-load taken from one of these chambers. The whole of the internal arrangements are kept beautifully clean and free from pollution. It is in this chief room, or one similar, that the young are born; these are blind at first and not unlike little bears, greyish white, and the facial markings not very distinct. The young accompany the females during the summer.

Naturalists are yet much divided in opinion as to the period of gestation in the badger, some making it a year, or even fifteen months, and others eleven or twelve weeks. The young are born early in spring; we have seen a female killed on January 20th, which was then suckling. There is no prettier sight than a litter of young badgers with their mother, but to be able to watch their habits it is necessary to take your stand on a midsummer night or in bright moonlight in some wood frequented by them, keeping concealed near an open space or where the chief rides cross. If fortunate, we shall see them emerge from the underwood, waddling to and fro in eager search for worms, grubs, and snails, and in the uncertain light looking not unlike a litter of little grey pigs on the stray, and snuffling and grunting much in the same manner. In his food the badger may be said to be omnivorous—earthnuts, roots, bulbs of wild hyacinths, beech-mast, all sorts of fruit, garden produce (we know of one shot with grass in his mouth), frogs, worms, and insects. They are exceedingly fond of the garden snail, also eggs of all sorts, wounded game, and hedgehogs. He will scratch out a nest of young rabbits, and no doubt eat very young hares if he comes across them in his rambles. Regarding the two latter, to judge by the agitation which preceded the passing of the Ground Game Act, he and the fox also are conferring a benefit on the farmer by keeping

down the devourers of his crops. One curious result of the Act is that, whereas in many districts the hare has become virtually extinct, the rabbit has greatly increased. The former being a wandering animal is naturally snapped up by the man on whose land it happens to be, lest it should get into his neighbour's pie-dish instead of his own. The rabbit, on the other hand, being more stay-at-home and keeping to one place, has, since it became the property of the occupier, been carefully fostered and looked after and considered a most valuable perquisite—a curious instance of how circumstances alter cases.*

One of the favourite repasts of the badger is the nest of the wasp, of which he destroys great numbers. This he will grub out from any depth, not for the honey, for the wasps do not lay it up, but for the larvæ—a most delicious morsel for him.

Having lived for some time in a great fruit-growing district we can testify to the enormous damage done by wasps to fruit, even to the extent of quite one-half the produce, and we have thought a few badgers would have been of great help in keeping these pests under.

From the middle of November to the middle of March badgers hibernate and keep to their holes, filling up the entrance to exclude the cold. They are, however, frequently tempted from their retreat by mild weather. The poor retiring "brock" is the most innocuous and peaceable of animals in his daily life, and deserves protection from man, committing no depredations on his poultry and flocks. It is difficult to understand that there are men so brutal as to deliberately promote the tortures of a quiet, harmless, and most inoffensive animal, in the cowardly amusement known as badger-baiting. Man, as a rule, deals most cruelly with the wild creatures amongst which he has lived so long—the birds

* I have observed the same fact—it is very general.—EDITOR.

and beasts—the mystery of whose lives he is not able to fathom. What does he yet know about these ancient neighbours of his—their means of communication amongst themselves, their powers of appreciation, their attachment to home and young, their capabilities of enjoying life, their loves and fears, and of that mysterious power which, for want of a better word, we call instinct? To quote from a Saturday Reviewer: "All sylvan and rural England is being 'dispeopled' of her 'dreams,' of her shy population in fur, fin, and feather." Surely, then, when so little remains of the ancient fauna of England, it is right to spare what is left, and strive rather to preserve, increase, and restore these our most curious and interesting neighbours, thus making a late and tardy reparation for much wrong done in the past in the hard old times which are gone past recall.

CHAPTER IV.

RATS AND MICE.

MANY of the smaller quadrupeds which affect the economy of the farm belong to the great group of rodents, or gnawing animals, among which the *Muridæ*, or rat tribe, hold a prominent place.

The *Murinæ*, or specially rat-like members of the *Muridæ*, are very typically represented in this country by the voles and various species of rats and mice.

For the voles, the Liliputians of the beaver tribe, the honour of a separate chapter has been reserved. It will suffice for our purpose to say that, though often confounded with the true rats and mice, they can generally be distinguished by their blunt noses, short ears, and hairy tails.

THE BROWN RAT (*Mus decumanus*).

Facile princeps among farmyard pests is the brown, or Norway rat.

Just as, more than 1,500 years ago, hordes of Huns swarmed into Europe from the plains of Tartary, striking terror into the heart of Teuton and Roman, so, early in last century, did huge armies of the brown rat migrate from their home in Central Asia, driving before them and well-nigh exterminating their predecessor the black rat, *Mus rattus*, which no longer flourishes except in countries like South America, to which its more powerful congener has not yet penetrated.

It is very prolific, bearing eight or ten young several

times a year, and its depredations upon poultry, pigeons, grain, roots, and the bark of trees witness to its omnivorous appetite.

Rats have been known to steal eggs, and to carry them off without breaking them; they are cannibals, and eat each other on occasion; and they will not hesitate to attack animals, such as rabbits, which are much larger than themselves.

In waging war against these pests our weapons are of two kinds—poison and traps. The former is perhaps the more humane, but within doors it is apt to lead to unpleasant consequences quite apart from its possible consumption by dogs and cats. If a poisoned rat should die beneath the flooring, recourse should be had to an expedient which is probably familiar to the reader. Not blood-hounds, but bluebottles, are placed upon the trail, for, if imprisoned in the room, they will settle in the neighbourhood of the offensive body, and indicate its precise whereabouts.

In a highly useful article in the Journal of the Royal Agricultural Society on "Vermin of the Farm," Mr. Harting quotes from Waterton a recipe which is, perhaps, as efficacious as any. Two pounds of coarse brown sugar and one dessert-spoonful of arsenic are thoroughly mixed with as much oatmeal as would fill an ordinary washhand basin. The dose is a tablespoonful, which should be placed from time to time in the runs frequented by the rats.

Mr. Harting adds the useful suggestion that shallow vessels of water should be placed near the poison in order that the rats may attempt to quench their thirst induced by the arsenic, and thus die on the spot instead of in their holes. Chickens killed and partially eaten by rats should be poisoned in anticipation of their return.

If traps be preferred to poison, they should not be too large, and, if properly placed, will often be more efficacious unbaited than baited. The disposition both of poison and traps is of

the highest importance. The favourite runs should first be ascertained, and food should be distributed in them for some nights before the capture is attempted.

A well-known and simple live trap which has on occasion proved immensely successful consists of a barrel containing about six inches of water, in the middle of which a brick is placed on end. The top is covered with stout paper, which is baited for several nights in succession. A cross is then cut in the middle of the paper, and the rats, repairing to their usual feast, fall one by one into the barrel, where their scrambling for a foothold on the brick is sure to attract numbers of their fellows.

It is exceedingly unfortunate that it is considered necessary, in the interest of game, to wage a war of extermination against almost all the natural enemies of the rat. Stoats, weasels, owls, and kestrels are indiscriminately slaughtered, the domestic cat alone being tolerated. There can be no doubt whatever that, from the farmer's point of view, owls, kestrels, and weasels should be regarded in the light of friends. As regards the stoat—easily recognisable by its black-tipped tail and its white winter coat—the *pros* and *cons* are perhaps more evenly balanced.

Of the true mice, three species are sufficiently well known in this country, the House mouse (*Mus musculus*), the Long-tailed field mouse (*Mus sylvaticus*), and the Harvest mouse (*Mus minutus*), the smallest of European species. The first named is too well known to need description, but it is by its depredations in the rick-yards that it chiefly affects the farmer. Mr. Harting well remarks : "The weasel is to the mouse what the ferret is to the rat—an inveterate foe, and its presence in a stackyard ought to be welcomed, instead of being looked upon with a suspicion which too often results in its untimely death." The long-tailed field-mouse, which breeds in cornfields, hedgerows, and gardens, works sad havoc among grain, seeds, fruit, and nuts, storing

them up in astonishing quantities in its underground retreat. The beautiful little harvest mouse, though its habits are perhaps equally reprehensible, is too small and too rare to be a serious pest to the farmer.

Against the character of the Shrew there is really nothing to be advanced, and its least enthusiastic admirers will, at all events, admit that it is perfectly harmless. Often called the shrew-mouse, it is almost universally confounded with the rodents to which it bears a general resemblance, and is ruthlessly killed. It may be easily recognised by its long tapering snout and its squared tail.

There are several English species, and all are strictly insectivorous. It has many natural enemies, and, in addition to this, it seems subject to some mysterious disease which kills off great numbers in the autumn.

Nature is constantly enforcing the lesson, that when man interferes too greatly with the nice balance of forces she sets up, he may expect to pay the penalty, sometimes in ways little anticipated by him. In certain seasons and localities, special forms of life may unduly increase and be with wisdom combated, but there is always a tendency to proceed too far in this direction, and to extirpate when more moderate measures would avail.

MICE AS ENEMIES TO WOODLANDS AND NURSERIES.

DORMICE (*Myoxidæ*).

Of the three kinds* of Dormice, the Common Dormouse and the Garden Dormouse are more confined to the warmer tracts of central and southern England than the Hazel Dormouse, which is more frequent throughout the colder, northern tracts of Europe. On the whole they closely re-

* These varieties of the dormouse are local; there is, of course, only one dormous known to British Naturalists—*Muscardinus avellanarius*.—EDITOR.

THE LONG-TAILED FIELD MOUSE.

semble the squirrels with regard to the nature of the damage they do in woods and orchards, but they are injurious in a much less degree. They love to feed on acorns, chestnuts, beech and hazel nuts, and fruit, peel the tender rind from young trees, and rob the nests of certain insectivorous birds of their young broods. They also bite off the young sprays of conifers, like squirrels ; but they nibble off the needles only, and do not feed on the flowering-buds. Alder, birch, beech, and hazel, of ten to twenty-five years of age, are most liable to be damaged through gnawing of the bark, but the injuries thus inflicted occur mostly in narrow, horizontal lines, and are not so large as those due to squirrels. On the whole, their attention is rather confined to woods formed of the broad-leaved species of trees than to those in which coniferous trees are most numerous. As they feed during the night-time it is much more difficult to find them actually engaged in the work of gnawing than is the case with squirrels or certain other kinds of mice. Before retiring into the hollows of trees for their winter period of rest they lay up food-supplies in the shape of various fruits and berries.

As, under favourable circumstances, dormice increase with great rapidity, active measures must be be taken to keep them in check. Wherever the marten is to be found they are not likely to multiply unduly ; but otherwise traps will have to be laid for them, as their small size and nocturnal habits alike preclude the advisability of shooting them.

MICE (*Muridæ*).

Mice differ from voles in having a pointed head, large ears, and a tail as long as the body. Two species, the Harvest Mouse (*Mus minutus*) and the Long-tailed Field or Garden Mouse (*Mus sylvaticus*) do damage in woods and nurseries. They turn up and devour acorns, beech-mast, and hazel-nuts that have been sown out in the

autumn, and nibble the cones of conifers in order to get at the seed inside. During winter they also gnaw the buds of young seedlings and transplants in the nursery beds, and of young plantations up to about ten or twelve years of age; beech, ash, maple, sycamore, and willow being the species of trees which seem to attract them most, although in hard winters they will attack any young growth they can obtain access to. In orchards young stems up to two inches in diameter at the base may be gnawed through, and when the injuries have been inflicted at from one to three feet above the soil, the damage is due to mice and not to voles. Seedling growth in nurseries and sowings is sometimes damaged to a greater or less extent by the burrowing of these mice, although in this respect the damage done is much less than by voles. Mice are chiefly to be found on warm sunny exposures with a tangled soil-covering of grass and weeds. They are not as prolific as voles; the wood-mouse produces from four to six young ones twice or thrice in the course of a year, while the field-mouse produces from four to eight three times a year.

The measures adoptable for keeping mice in check are included in those which are noticed in Chapter VII. with reference to voles; but as the former always remain in the woods, whereas the latter only migrate into them from the fields in winter, the exterminative remedies are not generally so effective. On the whole, the best way of keeping wood-mice in check consists in the protection of their natural enemies, such as the weasel, the fox, and the owl.

CHAPTER V.

HARES AND RABBITS.

The term Ground-game applies to hares and rabbits, and these animals, although they belong to the same family (*Leporidæ*) and are similar in many respects, yet in a few details they differ as to their mode of life and habits. Before entering into a description of the damage committed and the loss incurred by hares and rabbits, the methods employed in preventing their attacks, and the aids and helps introduced by legislation from time to time to enable the tenant and occupier of the land to cope with these creatures, it will be useful to give a short insight into their natural history.

The most marked feature in the life-history of hares and rabbits is their marvellous fecundity ; the latter surpass the former in this respect, and it has been computed that a pair of rabbits in four years, under favourable conditions, will produce the enormous number of 1,274,840 descendants. Although this is possible, it must be owned that such extraordinary fertility is not very probable.

THE HARE (*Lepus Europæus*).

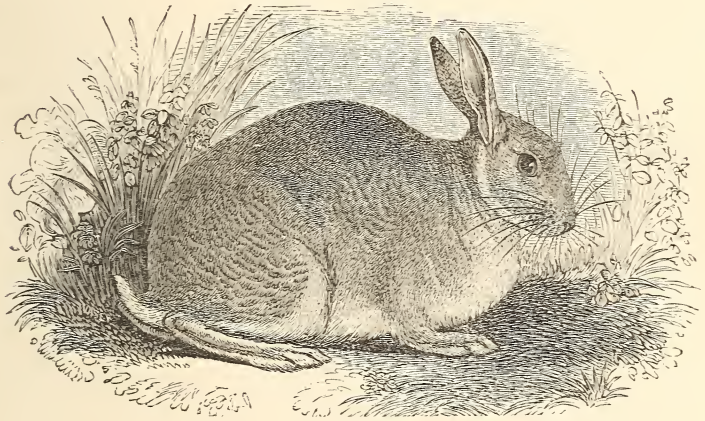
The Hare (*Lepus Europæus*), although possessed of no actual means of offence or defence, has been furnished by nature with wonderful perception and acuteness of hearing, and also great speed and endurance. Its long ears endue it with enhanced hearing, and its eyes are so placed laterally as to receive the rays of light on every side ; therefore, it has the

power of discerning objects distinctly in the rear, although it runs forward. When one considers its numerous and powerful enemies, it must be granted that its extraordinary vision and auditory faculties are merciful provisions of nature. Besides these gifts, the hinder limbs of the animal are of such peculiar structure and length that it is enabled to run up-hill with immense celerity. Most animals which would naturally pursue the hare possess swiftness in the opposite direction, and puss, with an instinctive knowledge of this advantage, often flees up-hill, and in this way eludes or discomfits its would-be captors. The hare sleeps by day in its "form," a spot to which it constantly returns, and is with difficulty compelled to abandon. The sagacious creature selects her retreat where the surrounding objects match her own hue in colour. The hare breeds three or four times a year, and has a litter of young from two to four in number. The leverets, or young hares, immediately they are born possess to the full the gifts of sight, hearing and speed so essential to their preservation—indeed, were this not so, the race would quickly cease to exist. The animal is short-lived, never attaining more than seven or eight years. The genus is widely spread over the world, and in cold climates some species change the ordinary colour to white.

THE RABBIT (*Lepus cuniculus*)

Inhabits most of the temperate portions of Europe. This animal was not originally a native of England but was introduced into this country from Spain or Portugal. It can readily be distinguished from the hare owing to its smaller size and the shortness of its ears and legs, nor does it possess the wonderful speed of the latter quadruped; it is owing to this that it seeks its safety, if molested, by burrowing and tunnelling in the ground. It is, again, peculiarly social in its habits, and large numbers of its kind congregate together.

The prolificacy of the rabbit is stupendous, and it will breed seven or eight times a year, its progeny being reared at the bottom of a separate hole, termed "stab" in some districts; they are born blind and are perfectly helpless. Considerable value is attached to the rabbit as an article of food, and its flesh is greatly appreciated. Again, the skin is of worth, being largely employed in the manufacture of felt hats, muffs, furs, and boas. The refuse skin, and ears and feet are used as articles of manure in fruit-growing and hop-producing districts. In localities where hares and rabbits abound,



THE RABBIT.

considerable damage is done, and great loss frequently sustained by farmers and cultivators of the land generally. No crop seems to escape their ravages; hardly any plant is free from their attacks, for they will devour with avidity almost every description of agricultural produce. Amongst corn crops they make persistent havoc, not only when the young and tender blade is shooting from the ground, but also when the ripe corn is standing in the fields. From, seed-time to harvest, wheat, oats, and barley alike suffer from their onslaughts. Hares, especially, take pleasure in nipping

off the young shoots of cereals, thereby causing the crop to come to maturity and ripen later than it otherwise would. Again, both hares and rabbits bite off the corn at the knots or joints of the stem, for the sake, it is said, of the sweet or sugary matter found there. In fields of standing corn, paths or ways are frequently seen, and here hares are numerous ; the crop has been diminished greatly on account of these tracks, which are sometimes as wide as two feet across, and give the corn the appearance of old stubble. Amongst straw crops especially ground game destroy far more food than they really require ; they roam afar through the fields, and cut and clear away large open spaces, to allow them more room for play, and in the large amount of sustenance before them they bite down and wantonly destroy more than they can possibly consume. The injury to crops from ground game is certainly most marked in dry seasons, as dry weather not only favours the productive powers of hares and rabbits, but also weakens and stunts the plants, and therefore they succumb the more easily to the depredations of these animals. In a dry summer, such as that experienced in 1893, rabbits were more plentiful and more destructive than they had been for years. Turnips and swedes, mangolds and carrots, are eaten off with great relish by ground game when the plant is young, and even when mature the outer skin is broken by their teeth, and the bulb is soon destroyed by frost, or is quickly rotted by the weather. In such cases hares and rabbits do not confine their whole attention to individual plants, but nibble small pieces from numerous bulbs. A witness before the Select Committee to inquire into the Game Laws, in 1873, stated that he had had half of a crop of turnips, bought for his sheep, ruined by hares and rabbits. Occasionally, in some districts, where ground game is present in great numbers, crops such as winter tares, or winter carrots, have to be abandoned entirely, owing to the impossibility of, and

complete failure in, trying to raise a crop. Artificial grasses, trifolium, and clovers cannot stand against the ravages of hares and rabbits, since the persistent bite of these animals destroys the plants; and, although rye-grass will struggle on for a few months, other grasses will die at once —the reason being that rabbits pinch off the grasses with their teeth and do not tear them off like sheep and bullocks. Indigenous grasses are, in some degree, proof against ground game, but neither cattle nor sheep will feed on pastures where rabbits are numerous and where the grass is fouled or tainted by them. Pastures which are thus stained are useless, as the grass is soured and poisoned, and cattle and sheep will almost starve before they will touch the herbage. In the same manner it is asserted that hares will not remain on land which is fouled by rabbits.

Lucerne and sainfoin are also much injured, as well as cabbages—indeed, nearly all the vegetables raised in market or private gardens are eaten by ground game, and it is difficult to discover a crop which they will not molest. Fruit plantations and young trees planted out in woods, unless protected, will quickly be destroyed. Hares and rabbits, especially in the winter months and in frosty weather when food is scarce, will peel off the bark of young trees and leave them to perish, or check their growth to such a degree that they never attain their proper shape, size, or fruitfulness. Hares also nip off, for mere mischief, the shoots in woods and plantations, and those of rare shrubs and trees in shrubberies and gardens. Fruit-growers who have not taken the trouble to protect their young pear, apple, damson, and plum trees know to their cost the great loss and damage sustained from the attacks of ground game.

In hop-yards or hop-gardens the farmer frequently discovers the young tender bines eaten off by these pests, and even when the bine has ascended and is high up the

pole the rabbits sever it at the bottom with their teeth, and leave it to wither and die. This action on their part seems strange, as they can derive but little nutriment from it. As an example of the wanton mischief they perform, the following is a noteworthy incident. They will, if a hop-pole fall to the ground owing to high wind or other causes, strip the hops from the bines, but leave them untouched and uneaten beside the pole.

The methods of prevention against injury to different crops by hares and rabbits are numerous and effectual if carried out in a right manner. Mr. Rooke, in his evidence before the Committee in 1873, says that wire netting is quite sufficient, if put down in a workman-like manner, to protect crops and farms from ground game. Wire netting (galvanised wire, $1\frac{5}{8}$-inch mesh, is the most suitable kind) is the best acknowledged method of checking the ravages of ground game, and if placed round crops liable to be attacked is found to be thoroughly efficacious. Mr. Rooke recommended wire netting 3 feet wide, 6 inches of which is placed in the ground in order to prevent the rabbits from burrowing. This netting is secured to posts and a top-wire is stretched from post to post. A ditch is dug on the protected side and the wire is placed on the edge of the ditch. The first cost for putting up protection of this kind is £71 for every mile, and the annual expense of repairing and keeping in order is £4 17s. 2d. per mile. Mr. Arch, a witness before the same Committee, said that it would be only justice for the game-preserver to put up fences of the above nature. It is said that this wire netting is equally adaptable on all soils, both heavy and light, but in some instances it has been found necessary to place a layer of chalk under the fence.

In fruit plantations and amongst woods wire netting, or twigs of quick or thorn, are sometimes placed round the trees. Sacking or matting is also tied round. Trees may

be smeared with any mixture which is obnoxious to ground game and at the same time not injurious to the trees,—a compound of tempered clay, cowdung, and soot, formed into a paste with water, and brushed on the trees has been found especially successful.

Hares and rabbits are easily snared, and it is allowed by law to place traps or gins in the holes and burrows of rabbits —but *only* in their holes and not in the open field.

Many cultivators, although they have no ground game on their property, and perhaps not even an abundance of hares and rabbits in the immediate vicinity, may suffer considerably from the inroads of ground game; for rabbits, and hares especially, will go a long way for food, and will travel great distances for any special crop which they delight in, such as a field of carrots or parsnips.

Rabbits and hares are, of course, kept down to a large extent by the gun, and by sportsmen; by dogs, and by poachers, and by their natural foes, the fox, the stoat, and the weasel. Birds of prey, such as crows, members of the hawk family, and owls, are extremely partial to young rabbits and leverets. When the extraordinarily productive powers of hares and rabbits are taken into consideration, the former producing two or three young two or three times a year, and the latter from four to ten young six or seven times a year, it must be acknowledged that ground game should be kept constantly in check, and it will be gathered from previous remarks how great an extent of loss and damage may be committed where hares and rabbits are over-abundant.*

* On this point Miss E. A. Ormerod contributes the following note:—"I think the rabbit's prolificacy is often overestimated. I daresay that the facts are very well known practically, and what can be made to take place in domesticity very likely differs a good deal from what *does* actually take place in wild life. I transcribe a quotation from Dr. J. Ritzema Bos's fine book, entitled '*The Injurious and Useful among Animals*:—'Rabbits increase in a larger ratio than fowls These animals copulate from winter to the end of autumn, and in that period the female gives birth five or six times to her young, to the number of four to eight.' I find in the second edition of *Bewick's Brit. Quads.* the statement that 'the fecundity of the rabbit is

A lesson as to the truth of this is to be derived from the position the rabbit has taken in Australasia, where it has developed and increased with such strides that the animal, which was primarily introduced in Australia, Tasmania, and New Zealand for the purpose of use and profit, is now regarded in these colonies in the light of a curse rather than a blessing. In such numbers has it multiplied that a large reward has been offered to anyone suggesting a remedy for its subjection, if not for its complete annihilation. English legislators showed their appreciation of the fact that ground game must be put down with a strong hand by passing the Ground Game Act in 1880, an Act for the better protection of occupiers of land against injury to their crops from ground game. This measure was, no doubt, an outcome of the Select Committee on the Game Laws in 1873. This Committee, after the evidence brought before them, came to the following conclusion concerning ground game:

"That the principal, if not the sole, cause of mischief to crops is attributable to rabbits and hares, and that the time has arrived when legislative protection, given to these animals by the Game Laws, should be withdrawn; and that, since there is no difficulty in rearing and feeding such animals on enclosed ground or in confinement, the wants of the nation could be supplied in this way." To sum up, it was recommended that rabbits and hares should be taken out of the fostering protection of the Game Laws, and that no licence should be required, in respect of taking, buying, or selling them.

The Ground Game Act of 1880 allows every occupier to have a right, inseparable from his occupation, to kill

truly astonishing. It breeds seven times in the year, and generally produces eight young at a time; from which it is calculated that one pair may increase in the course of four years to the amazing number of one million two hundred and seventy-four thousand eight hundred and forty,' etc., etc. I fancy that Bewick has been the father of a good many marvellous statements of the prolificacy of rabbits, and that this is one of them."—EDITOR.

ground game, and also allows the occupier, and persons duly authorised by him, to kill, take, and sell ground game without a game licence. By this Act, also, no person may shoot ground game between the expiration of the first hour after sunset and the commencement of the last hour before sunrise ; spring traps, except in rabbit holes, and poison of any kind, are prohibited.

This Act, which seems a fair and just measure, and which enables a tenant to take somewhat into his own hands the quantity of ground game carried on his farm, gave rise in 1892 to another measure, the Hares Preservation Act, which enacts that during the months of March, April, May, June, and July it is unlawful to sell, or expose for sale, hares or leverets. This measure does not apply to foreign hares. It was deemed expedient to allow a close time for these animals, as it was considered in some districts that the hare would be speedily exterminated.* As has been stated before, the hare is surrounded by many enemies ; its young are born in the open field, and are consequently exposed to various dangers. Not only are hares shot by sportsmen, and snared and killed by poachers, but they are, unlike their near relative the rabbit, coursed by greyhounds and hunted by harriers. A hare is one of the easiest animals to snare, and it affords a better mark, and one of more value, than the rabbit. The damage committed by hares is undoubtedly great ; but it has been ascertained that, unless protected, they would gradually die out ; therefore, a close time for hares is, on the whole, a salutary measure, and the Hares Preservation Act, 1892, is acceptable to sportsmen and

* Concerning the "Hares Preservation Act, 1892," much misconception exists. The "close time" (March to July, inclusive) is a theoretical rather than a practical one. Hares and leverets may be killed during these months by those entitled to kill them, *but they must not be exposed for sale*. It is, however, both cruel and wasteful to kill any food animal during the breeding season, and when practical it is to be hoped that the hare may be spared. Of late years it has been a fast-diminishing species—a fact to be regretted.—EDITOR.

landlords, tenants and farmers. It is hoped that landlords and game-preservers will not in future preserve unlimited and unnecessary quantities of game, more especially ground game ; that they will perceive—and many of them, it must be admitted, have already done this—that in these years of agricultural depression the landlord, the tenant, and the labourer should join together in one common interest—namely, to endeavour to work the land at a profit to each class. Game-preservers, by preserving game unduly and without restriction, in many cases beyond reason, hamper and hinder the farmer in his vocation, add to the many troubles to which he is subject, and raise up a spirit of animosity and contention, and a desire, which has been expressed in some instances, to totally abolish the Game Laws. If game-preservers were to act fairly to the tenants, and remember that their sport and pleasure frequently interfere with the livelihood of others, numerous and great heartburnings would be spared.*

* On another point Miss Ormerod writes as follows: — "Another remarkable and very unpleasant circumstance coincident with the great number of rabbits present on the land, as well as *Limnæus*, or water-snails, in the little grassy pools, was a serious prevalence of liver-fluke in the sheep. The bailiff declared he 'never killed a sheep with a sound liver.' How far he was correct in this sweeping statement I cannot tell, but so far as 'fluke' being only too plentiful there was no doubt."—EDITOR.

CHAPTER VI.

ENEMIES TO WOODLANDS AND NURSERIES.

Among the Mammalia that are specially injurious to woodlands and nurseries several distinct classes may be noted—viz.: Large Game, including red-deer, fallow-deer, and roe-deer; Ground Game, including hares and rabbits; and Vermin, including the smaller Rodentia, squirrels, dormice, rats, and voles, as well as the mole, badger, and weasel, some of which, however, are at the same time of great assistance in keeping the other more injurious kinds from increasing too rapidly.

The damage done by game of different kinds is by no means confined to the woodlands, which serve as their covers and breeding-places. Owing to their quietness, and to the fact that under the existing laws they may not be invaded by the farmer, woodland tracts only too frequently serve principally as game preserves, from which deer, hares, rabbits, pheasants, partridges, pigeons, etc., sally forth at their feeding-times, committing considerable havoc on the crops of various kinds coming within their reach. The ravages of this nature that are directly permitted, and even encouraged, by the landlords, are now distinctly of a nature and an extent which call for some notice from the Royal Commission at present sitting (1894), with a view to the framing of proposals for the practical alleviation of the existing agricultural depression and distress. For so long as our British woodlands rank only, or principally, as game preserves, it stands to reason that tenant-farmers, and the

nation generally, cannot possibly reap the advantages which otherwise would be theirs, if they were allowed to avail themselves of the full productive capacity of the soil, in place of having to suffer a diminution of each year's harvest through the game preserve, for the amusement of their landlord and his guests.

But even where woods are grown on purely sylvicultural and financial principles, the amount of damage that may be done can sometimes become very serious.

LARGE GAME.

Red-deer (*Cervus elaphus*).

Red deer bite off the top buds and young succulent shoots in plantations, often causing the immediate death of young plants, and prejudicing the development of those of greater age and sturdier growth. This is more particularly the case during the late autumn and the winter months, when there is a want of good grazing; but it is also occasionally noticeable during the summer months. The trees which suffer most in this manner are ash, aspen, willow, beech, hornbeam, oak, maple, sycamore, hazel, larch, and silver fir; whilst birch, elm, Scots pine, and spruce are much less exposed to damage. But it is almost invariably the case that any particular species of exotic tree which may happen to be a rarity in the neighbourhood, and which is introduced among the other trees in individual specimens only, seems to offer specially toothsome attractions to deer.

The extent to which the nibbled plants are prejudiced in growth differs according to the species of the tree. Oak, beech, and hornbeam exhibit a stronger recuperative power than ash, maple, or sycamore; whilst among conifers the silver fir overcomes the damage most easily. Owing to their far smaller supplies of nutrient reserves, the conifers are, on the whole, much more exposed to serious damage than the broad-leaved species of trees.

But much greater damage than that which is caused merely by browsing or nibbling can be done by the red-deer when they begin to gnaw and strip the bark from poles of the smooth-barked species of trees. Young spruce and oak are most exposed to this particular danger, whilst Scots pine, black pine, larch, alder, and birch suffer

RED-DEER.

damage least frequently. The woods most liable to be attacked are young healthy spruce plantations from twenty to forty years of age, and oak coppices of fifteen to twenty years. When Scots pine plantations have attained an age of twenty years, they practically outgrow the danger, owing to the thickening of the bark; while spruce crops are liable to attacks up to about sixty years of age. Damage of

this sort is most liable to occur in plantations that have been recently thinned; for not only can the deer move about with greater freedom, but the bark becomes thicker at the same time and more succulent and juicy in consequence of the larger individual growing-space and the better supplies of light, air, and warmth available for the foliage.

Simple gnawing of the bark mostly takes place during the winter months when there is a dearth of food; but, in its more injurious form of stripping, it is also often continued into the spring and summer months, when the sap is in flow, partly out of sheer wantonness, and partly because of the succulence of the sappy bark, and the ease with which it can be stripped. Having bitten through the rind with the lower incisors, and taken it firmly between the upper and lower teeth, the deer steps gradually back and the strip of bark is torn off from the stem, sometimes to a height of over six feet. The wounds thus occasioned often take long to heal, and, until they become cicatrised, offer an open door for the entrance of fungoid disease into the stem; at the same time, by inducing sickly growth for some time after the wounds are made, such injuries predispose young trees to attacks from injurious insects.

The stags strip the bark more frequently than the hinds, and seem to do most damage at the time they are beginning to set their antlers in the spring. It is supposed that the tannic acid contained within the bark serves as a digestive tonic when deer are fed with hay in deer-parks, and that this and other ingredients present in the sappy cambium stimulate the secretion of matters requisite for the formation of the stag's antlers and for other physiological purposes. It is worthy of special remark that stripping of the bark seldom occurs except when the deer are confined within a ring fence; when they are free to roam about over extensive areas gnawing is unusual and stripping rare. The damage is usually perpetrated in the morning, when the deer are

returning to the woods from feeding, and is most frequent during rainy weather, when the bark has become softened by moisture. The damage heals most quickly in oak and ash among broad-leaved trees, and in silver-fir, larch, and Weymouth pine among conifers; maple, sycamore, and spruce seem to possess the lowest recuperative powers as regards this class of wounds. Even when they heal over completely, which is seldom the case, the lower portion of the bole is usually rendered almost totally unfit for the higher technical uses as timber.

Whilst rubbing the velvet from their antlers during July and August, and again from sheer wantonness during the rutting season towards the beginning of autumn, stags often do a good deal of damage by using young saplings and poles as "fraying-stocks." The fraying usually occurs at night, and the species of trees most liable to be injured are those having soft bark, like lime, aspen, maple, horse-chestnut, willow, larch, silver fir, and Weymouth pine. These species are more especially exposed to danger when they occur scattered individually amongst woods formed of other kinds of trees.

Besides doing a great deal of damage through grazing on the young seedlings and transplants in nurseries into which they have effected an entrance, deer also commit serious injury by treading down the young growth with their sharp cutting, horny hoofs.

To endeavour to estimate, either as to the amount of raw produce or of its exchange value, the damage done during the night-time by deer to meadows and farm-crops would be entirely beyond the scope of this chapter. That, however, in conjunction with what is done by other kinds of game, it helps to swell the total damage annually inflicted to an amount that really is of national importance can admit of no doubt.

In orchards, too, considerable havoc is done during the night-time by deer when the apples and pears are beginning to

ripen. The hinds eat voraciously of all the fruit hanging within their reach, whilst the stags stand on their hind legs for the purpose of bringing down the fruit and breaking off the smaller fruit-laden branches that are situated beyond the reach of their mouths.

Fallow-deer (*Cervus dama*).

Fallow-deer commit very nearly the same kinds of damage in woods and nurseries as is occasioned by the red-deer. But as they are more restless and more dainty than the latter in their grazing, they perhaps do somewhat more damage by nibbling young growth and trampling it under foot. On the other hand, they are much less given to gnawing and stripping the bark; this only takes place when they are confined within deer-parks, but not when they have the freedom of the forest, and can roam over large areas. The fallow-stag is somewhat later than the red-deer in fraying the velvet from its broad antlers; but, like the latter, it loves to select the less common species of trees as fraying-stocks.

Roe-deer (*Capreolus capræa*).

Roe-deer are fond of varying their ordinary food with beech-nuts and acorns, or with the cotyledons of young oak and beeches, and love to nibble and browse on the buds and young shoots of many kinds of trees, particularly when these latter are succulent and juicy in the spring. They exhibit in this latter respect a preference for maple, sycamore, acacia, oak, beech, ash, aspen, willow, larch, and silver fir, whilst pines and spruce appear less dainty to them, and alder and birch the least toothsome of all. But these general preferences also give place, as in the case of the red and fallow deer, to the superior attractions offered by any particular kinds of trees that, being of less frequent local occurrence, are simply scattered individually throughout the woods. Plantations with a sunny southern or south-western exposure are apt to suffer more from nibbling during the winter months than those having a northern or north

eastern aspect, as the roe-deer seek the warmer localities during the colder portion of the year. They do not, however, like the larger kinds of deer, gnaw or strip the bark of poles or saplings.

The bucks select small, smooth saplings as fraying-stocks when clearing their horns of the velvet during April, and again when full of wanton mischief during the rutting season in July and August; the species for which they have preference appear to be larch, silver fir, Weymouth pine, aspen, lime, acacia, white alder, and mountain ash; and when these are planted as ornamental trees along the edges of drives or green lanes running through the woods, they are exposed to special danger.

For protection against roe-deer during the winter-time, the fencing round nurseries and gardens requires to be at least four and a half feet high. When once they have managed to effect an entrance, either through any gap in the fencing, or by leaping over it, they are very apt to acquire the habit of returning to feed on the plants put out in the nursery-beds. The erection of scarecrows is of little use in this case, as the roe-deer soon get accustomed to them.

The leading shoots of conifers can easily be protected against roe-deer by a very simple and inexpensive method, which consists in tying bits of newspaper, about four inches square, round the buds at the top of the leading shoot; if this be done in autumn, the roll of paper will usually remain attached like a collar at the base of the new shoot till the following autumn. Or if the top shoots be coated with a mixture of four parts fresh cowdung, one part coal-tar or slacked lime, and just enough urine to make the whole assume the consistency of thick oil-paint, which may be laid on with a wooden spud, then neither roe-deer nor red-deer will injure them. Whichever of these methods is adopted, it, of course, has to be repeated each autumn until the plants outgrow the danger of being bitten, and of thus losing their leading shoots.

GROUND GAME.

Hares (*Lepus Europæus*).

Hares damage plants of woodland growth by biting the buds as far up as they can reach, and by nibbling and gnawing the bark of young trees and poles. Where they have a considerable choice of species of trees, as on large woodland estates, they exhibit preference for beech, hornbeam, aspen, ash, elm, maple, and sycamore; whilst the conifers generally, and Scots pine and spruce in particular, attract them in a less degree than the broad-leaved species of trees. But in comparatively unwooded tracts, like many of the Scottish moors, it is often absolutely impossible to rear plantations even of pines, spruce, or larch, unless they are well fenced in and protected to a height of $2\frac{1}{4}$ to $2\frac{1}{2}$ ft. with wire netting. During hard winters hares flock from all the neighbouring hill-districts and moors to the plantations, and form well-trodden runs round the fencing in their endeavours to effect an entrance. In parks, and on the residential portions of estates, wherever they have any marked opportunities of selection, hares single out papilionaceous species of trees, more particularly the acacia (*Robinia pseudo-acacia* and *Gleditschia triacanthus*), for gnawing and peeling off the bark. In the Highlands of Scotland it is more particularly the Blue Hare (*Lepus variabilis*) that commits the greatest damage. In orchards hares sometimes commit very extensive damage to young fruit trees of the better sort, after they have been grafted. Experience shows that apple-trees suffer most from such attacks, cherry-trees to a less extent, and pear-trees least of all.

The best remedy against damage of this sort undoubtedly lies in shooting the hares off. But failing the legal power to do this, the protection of young plantations, nurseries, or orchards may be ensured by means of a complete fence of wire netting offering no opportunities of entrance. Where this is not applicable, the stems should be covered from

November to April with a casing of straw or of thorny brushwood, or should be coated over to a height of a couple of feet with a mixture of cowdung, lime, and asafœtida.

Rabbits (*Lepus cuniculus*).

Rabbits occur in greatest numbers where the soil is of a sandy nature. In addition to damaging plants, as hares do by nibbling them and by gnawing off the bark so as to interfere with their normal development and often with their very existence, rabbits also do an excessive amount of damage by undermining the soil.

The kind of tree most likely to be injured by the nibbling of the shoots is the Scots pine, the chief species of trees planted out on sandy soils, although black pines, larch, and spruce all suffer to a considerable extent when they come within the reach of rabbits.

Wherever in extensive woodlands they have full opportunity of making any choice in the matter, they exhibit a preference for gnawing the bark of hornbeam, ash, acacia, aspen, willow, hazel, dog-wood, and fruit trees. But on vast sandy, moorland stretches, where woods occur only here and there over small areas, they are exceedingly apt to overrun young plantations, and to commit great havoc by nibbling and gnawing the young shoots of all the different kinds of plants, by tunnelling and undermining the light soil, and by damaging the roots.

It is a peculiarity worth noticing that, in woodland districts where rabbits are at all plentiful, hares are less numerous than usual; for the restlessness of the former would appear to be highly inimical to the comfort of the latter.

Even despite the steady use of the gun, and the aid of ferrets and traps, rabbits are apt to breed in excessive numbers, wherever they take possession of sandy soil and form their warrens. Among their other natural enemies may be mentioned the weasel, the stoat, and the fox, whose numerical increase in any considerable degree, however, would hardly

be compatible with the other objects favouring the preservation of game. For young plantations, nurseries, and orchards, and for the protection of individual specimens of valuable species in parks, the same remedies are recommended as against hares—viz., good fencing with wire netting all round the base in the former cases, and encasing in straw or brushwood in the latter. In putting wire netting round fences, it is necessary to insert it below the level of the ground, as otherwise the rabbits can burrow under it. The best plan is to bend it slightly outwards at the same time, to stop the rabbits from beginning to make deep burrows, which would be sure to carry them past the wire.

CHAPTER VII.

ENEMIES TO WOODLANDS AND NURSERIES—*continued.*

VERMIN.

The Squirrel (*Sciurus vulgaris*).

The Common Squirrel, when occurring in large numbers, commits considerably greater damage in woodlands and nurseries than may be popularly laid to the charge of this pretty, graceful little animal. The good it does by devouring cockchafer grubs and the chrysalides of saw-flies and other insects is far outweighed by the injuries it inflicts. It not only devours large quantities of acorns, beech-nuts, chestnuts, and the seeds of conifers, which it obtains by pulling the cones to pieces, but it also picks out the hearts of buds during winter, scrapes up the cotyledons of seedlings germinating in spring, bites off succulent young sprays, and gnaws the bark from young saplings and poles.

Where squirrels have an abundant choice of food in woodlands, their chief articles of nourishment are beech-nuts, acorns, hazel-nuts, and spruce seed, although the fruits of the maple, sycamore, and hornbeam, and the seeds of the coniferous trees, are by no means left untouched. In orchards they attack any kind of fruit, but exhibit a preference for walnuts and apples.

The attacks made on buds are most marked during the winters following upon cool seasons in which the trees have not been sufficiently stimulated, with regard to the formation of reserve supplies of nutrients, to enable them to set and mature their average quantities of seed. The buds selected for food are chiefly the flowering-buds, owing to the larger amount of protein which they contain. The

species of trees suffering most in this manner are conifers, especially spruce, silver fir, and Scots pine. In young thickets that have not yet begun to set flowering-buds, the squirrels bite the young shoots through about four inches below the terminal cluster of buds, which they can then devour in comfort, whilst on older growths, whose shoots will easily bear their weight, they make their meal without having first to be at the trouble of biting off the shoots.

THE SQUIRREL.

In young pole or tree forests they are forced, in order to get at the male flower-buds situated at the extremity of the thin twigs, to gnaw off the shoots above the last whorl before they can enjoy the dainty morsel in comfort. It is worthy of note that they seem to prefer the male flower-buds to the female; the cast sprays are often to be found in large numbers below the crowns of lofty spruce trees. Coniferous woods in which squirrels are abundant yield but small quantities of seed, for, even when there is a sufficiency of female flowers, pollination is very uncertain if the male flower-buds be decimated.

The gnawing and ringing of the bark of young saplings and poles is fortunately not a general practice of the squirrel, for the damage would otherwise be of no little consequence in young plantations. Among conifers, larch and pine are most exposed to danger ; whilst beech, hornbeam, aspen, and willow suffer most among the broad-leaved species. Young woods of from fifteen to thirty years of age are on the whole most liable to this form of danger ; as it chiefly takes place during the months of May, June, and July, and is more apt to be frequent in dry, hot years like the last (1893), there seems every reason to believe that the wounds are inflicted more for the purpose of obtaining supplies of tasty sap than for the satisfaction of actual requirements as regards food. The gnawing is usually performed in the crown, where the bark is still soft. Sometimes, only irregular-shaped patches are gnawed off here and there, in which case the crowns may recover ; but not infrequently the bark is peeled off all round the shoot, or, less frequently, in a very regular screw-like spiral between the whorls of the conifers, and in either of these latter cases the death of the crown ensues.

Besides these direct cases of inflicting damage, other indirect injuries are also caused by squirrels to woodlands, nurseries, and gardens—for they cannot be altogether acquitted of being carnivorous. They are often guilty of attacking the young of very useful species of birds, like starlings, which would otherwise help to maintain the due balance of nature by waging war against injurious insects.

The greatest enemy of the squirrel is the tree-marten ; but where the latter occurs in large numbers it is apt to multiply rapidly, and to become a serious pest, unless its prolific tendency is counteracted by the use of the gun.*

* On the Increase and Destruction of Squirrels.—"At Cawdor, Altyre, and elsewhere they have multiplied to a great extent, and have become very injurious to the Scotch fir and larch, though chiefly to the former. They are fond of the cones, or rather the seeds, of the spruce fir, but have not been known to touch its bark as they do—most destructively—that of the Scots fir and larch. It is certainly remarkable that these

Voles.

Voles differ from mice in having a broad, blunt head, small ears hidden in fur, short legs, and short tail.

All the species chiefly spend the day under the ground, which they undermine in all directions. As their runs lie close below the surface of the soil, they displace the tender roots of seedlings in nursery-beds and in young crops that are being raised by sowing. Their food being mainly vegetables, they do no inconsiderable damage in picking seeds out of the soil, in nibbling the stems of small plants in nurseries and orchards during winter, and in gnawing through roots when making their runs. At the same time they do a certain amount of indirect damage by destroying young broods of insectivorous birds.

The gnawing of the bark from the stems of young saplings in winter is usually confined to within about a foot of the ground, broad-leaved species of trees being attacked in preference to conifers ; the wounds inflicted occur generally in irregularly shaped patches, although they not infrequently extend like a ring round the stem. Owing to the difference in the size of the teeth-marks, wounds inflicted by voles can easily be distinguished from those made by hares, rabbits, and squirrels.

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animals should have disappeared for so long from a district where there must always have been sufficient wood to shelter them, and where, of late years, they have been spreading so vigorously and extensively. In order to diminish their numbers, and thus in some measure save the plantations from their attacks, premiums have been offered. Mr. Stables, Lord Cawdor's agent, in kindly furnishing me with the following memorandum of the squirrels killed on the Cawdor property, tells me that it is only by shooting that their number can be reduced. A terrier dog is very useful, as it runs the scent to the trees they have gone up and barks very keenly, giving notice to the man in search of them. Note of the number of squirrels killed on the Cawdor plantations :—

In 1862	..	469	In 1867	..	1,164
1863	..	617	1868	..	1,095
1864	..	468	1869	..	503
1865	..	609	1870	..	867
1866	..	779			

Mr. Stables remarks that the number killed each year depended a good deal on the qualifications of the men employed, and on the price paid for each tail."—From *Autumns on the Spey*.—Editor.

In years during which the common field vole (*A. agrestis*), the great enemy of the agriculturist, has multiplied excessively, the woodlands have to suffer when the swarms withdraw from the arable and pasture lands into the forests. Here they commence feeding on all the young plants they come across, biting through young two to five year-old stems close to the ground, and killing older saplings and young poles by gnawing off the bark all round at a height of about eight to ten inches above the ground. Conifers are less exposed to the danger of attack than the broad-leaved species, among which beech, ash, hazel, and willow appear to be singled out first of all.

But from a sylvicultural point of view, the greatest amount of damage is done by the water-vole and the bank-vole. The water-vole (*A. amphibia*) is rather a misnomer for a species of vole which is very often to be found living in the woods far away from water. It does a considerable amount of injury to nurseries and in young crops by biting through roots up to two and even three inches in diameter when forming its runs ; these wounds are most serious when they are made on the tap-roots of oak or ash. This vole seems to prefer poplar, willow, and apple trees to other species, whilst beech and conifers escape injury to a great extent.

The red field vole (*A. glareolus*) is unfortunately endowed with an excellent capacity for climbing. It is to be found frequenting the edges of the forest, and in open woods bordering on arable land, rather than in the depths of large blocks of woodland, where it singles out for its attacks larch, pine, and aspen among the over-wood, and dog-wood and black elder principally among the undergrowth. When once they commence their work of devastation they continue it very assiduously, as they do not wander far from the places where once they take up their abode. Towards the end of October they commence gnawing off the bark in small patches or in strips, and as they continue operations all through the

winter till the end of the following March, the damage they contrive to do is very considerable indeed.

Voles multiply far more rapidly than the true mice. The field-vole is the most prolific of all, as about 75 per cent. of the total number are females. These produce from eight to ten young ones every six or eight weeks, and as the young begin to breed at an equal rate when they have attained an age of eight weeks, the total progeny of one female vole may, from March till late in the autumn, amount to about 10,000 ; fortunately for our woodlands, the bank-vole and the water-vole are not so prolific. Mild winters and dry spring and summer weather favour their increase, whilst damp weather, heavy rainfall, and frost without snow tend to diminish their prolific power and to weaken them constitutionally.

As they love a certain amount of protection, mice and voles are usually to be found where there is a thick soil-covering of grass or fallen leaves. Hence young crops and plantations showing a strong growth of grass are their favourite abodes, partly on account of the actual shelter they afford, and partly owing to the food-supplies stored up in the roots of the perennial and biennial grasses and weeds. When the fall of seeds from trees forming older woods has been devoured, the voles withdraw to younger woodlands unless there be a good covering of dead foliage on the soil. Where mice and voles are at all numerous, it is better to defer the operation of sowing in spring rather than carry it out in autumn; this is more particularly the case as regards acorns and beech-nuts. The best protection against any undue increase in the number of mice and voles is to be found in taking measures to maintain the due balance of nature by means of preserving all mice-devouring birds and animals, among which are principally to be reckoned kestrels, owls, buzzards, crows, moles, hedgehogs, stoats, weasels, martens, badgers, wild cats, and

foxes. As, however, these birds and animals of prey also attack game, the interests of the farmer, the nurseryman, and

KESTREL OR WINDOVER.

the forester here clash with the full indulgence of the land lord's sporting tastes. If these, their natural enemies, are

allowed to have a fair chance of life, plagues of voles, such as that of 1891-92 in the south of Scotland, are little likely to occur.

Although the badger often commits a good deal of havoc in the sowings of acorns and beech-nuts as well as in orchards when the fruit is ripening, and though, like the hedgehog it is also guilty of sucking the eggs of song-birds, and even of pheasants, yet the damage they both do is far more than outweighed by their useful services. And the same may be urged even more strenuously on behalf of the mole to which, notwithstanding the annoyance it occasions in gardens, nurseries, and meadows by the mounds it throws up, we should be very grateful for the useful services it renders in keeping down the numerical increase of voles, earthworms, snails, and grubs on which it feeds. In fact, it is usually only to be found where such vermin abound. Besides being a voracious feeder individually, it produces three to five young ones twice a year, in May and August. The formation of its nest is on a beautiful plan : it consists of two main terraces with numerous exits, so as to provide it with easy means of escape when it is pursued by enemies like the brown rat.

CHAPTER VIII.

MOLE AND HEDGEHOG.

THE MOLE (*Talpa Europæa*).

THE question "Is the Mole injurious to the farmer," so often asked, is best answered in the negative, with a qualification to the effect that in those districts where the natural enemies of the mole have been killed down it will be necessary for the occupier of the land to do their work, and, by trapping, to keep the numbers of the mole within bounds.

When a colony of moles becomes firmly established in a certain locality, it soon begins to increase, and, as a matter of course, the stronger it becomes the more rapid in proportion is the increase. The natural enemies of the mole are now few in number, and consequently sooner or later the occupier of land on which such a colony is established has to commence a campaign, and spend a certain amount of money on traps and head money, until the moles' numbers are considerably reduced. Unfortunately, trapping moles always gives us, sooner or later, a practical illustration of the proverb about a multiplicity of cooks. In a little book published in 1836 there is a "tailpiece," after the manner of Bewick, bearing upon this. An iron "gin" rat-trap had been set upon the floor of a store-room, and a cat had been put in likewise; the woodcut shows the cat caught by the foot in the trap, while the rats are running about the room in safety. When passing a place where a good deal of mole-trapping has been done, I am often reminded of this woodcut by seeing a weasel hanging up among the dead moles;

on a barn wall on which were nailed the results of several years' mole-trapping, I once saw a good many weasels, occurring at irregular intervals in the rows of moles. The fact is that the weasel is the greatest enemy the mole has, and if we had more of them we should not have to do nearly so much trapping. The short legs and general shape of the weasel enable it to run easily along the moles' tunnels, and it is when in pursuit of the inhabitants that it sometimes shares the fate of the cat in the picture and gets caught in the snare arranged for the reception of its intended victim. Some other animals, as, for instance, stoats, and some birds of prey, also feed on moles.

The mole affects the agriculturist in two ways; first, by the food it eats, and, secondly, by the works it carries on to obtain that food. As regards the mole in gardens, we may dismiss this part of the subject at once by saying that, whatever good is done there by the mole is more than counterbalanced by the trouble, annoyance, and damage to plants caused by the tunnels and cuttings which an energetic mole will drive through onion-bed, grass-plot, and flower-border alike. Any mole attempting to stake out a claim in a garden should be trapped at once, or at least as soon as possible—which is often quite another thing. Yet there have been town gardens which their owners would gladly have seen riddled and furrowed in all directions by moles, so that they (the moles) could have just let themselves go among their favourite food for a time, and rid the soil from a superabundance of earthworms sufficient to make the garden, once a place of pleasure or profit, loathsome and almost useless.

It is unnecessary to enlarge here upon the beneficial action of the earthworm (*Lumbricus terristris*) upon the earth's surface. Practically it forms the whole of that valuable vegetable mould (at least that which is spread over the surface of hills and slopes) upon which, in

temperate climes, we have to depend for the growth of our crops ;—in fact, the worm may, in a sense, be truly said to renew the face of the earth.

Worms also do a vast amount of good by their borings through the soil, in loosening it and keeping it open ; without them the soil would cake together and become hard, dead, and unproductive. It is only necessary to remind farmers and gardeners of the increased productiveness in soil caused simply and solely by tillage to make this point clear.

Like many other excellent things, however, it is quite possible to have too much of the earthworm. But we are not (at least in this country) in much danger of this ; for such a state of things has been carefully guarded against in the scheme of nature. It is wonderful what a number of creatures eat earthworms ; birds, beasts, reptiles, and even (as we have been lately told) a species of snail feed on them ; and it is hardly necessary to add that most kinds of fish relish the worm when they can get it. But the earthworm is very prolific, and although in gardens and in thickly wooded and enclosed country the surface-feeding creatures might be sufficient to keep down their numbers, yet in open arable and pasture land, where woodland birds are less numerous, and there is less harbour for some of the earthworm's four-footed enemies, they would probably prove wholly inadequate for the purpose. Here it is that the mole comes in. He wants no shelter, for he works underground, and pushing his runs through the earth attacks the worm (literally) in its own ground, where it is safe from surface-feeding creatures.

Every farmer will have a kindly feeling for an enemy of the wire-worm, and in this category the mole is certainly to be placed.

In 1830, Mr. Le Keux, writing with regard to the wireworm in Devonshire, remarks : "I think it probable that

the mole may prove the best protection against the ravages of this insect ; I observed that seven years ago moles were very numerous all over the farm, and at that time the wire-worm was never found to be injurious to any of the crops ; but a war of extermination has ever since been most sedulously carried on against the mole, and with such success that it has become a rare thing to meet with one upon the farm. The wire-worm, on the contrary, is now so abundant as to cause very serious and perceptible injury by laying bare large patches of the different crops."

Another insect which is highly injurious to the roots of grass and other crops is the mole cricket. The words which Bouché uses with regard to the mole as the chief destroyer of this pest summarise very fairly the arguments as to its general utility. He writes : "This little quadruped, called by Linnæus, *Talpa Europæa*, is continually digging in pursuit of insect larvæ, particularly grubs, mole-crickets, and earthworms, and destroys them. I have observed that a field which contained an endless number of mole-crickets or root-worms was freed entirely by the moles in two years. They certainly destroy many young plants by burrowing, but their usefulness is found to overbalance the mischief they occasion, which is only when the plants are young. They likewise retire from those places where they find no prey to be caught, when they have freed the field from vermin. It is, therefore, not wise entirely to destroy the moles."

To consider, secondly, the earthworks of the mole What has been said of the good done by the earthworm in boring into and loosening the soil is true also of the mole. By driving its tunnels in all directions it lets the air into the soil, and when, from the effect of rain and frost, the sides of the runs cave in, the soil all round is moved. The worm brings up the undersoil to the surface in the form of castings, which, if they were not kept

spread by the action of rain and frosts, would in time cover the herbage ; these castings are really a kind of top-dressing. The mole does much the same thing in another way. In the course of making its runs it throws up the loose soil on to the surface in the form of mole-hills, which, when spread over the ground, cannot fail to act in some degree as a top-dressing. I have often noticed in spring just as the grass was beginning to move, that it has sprouted perceptibly earlier and stronger in places where some mole-hills had recently been spread, and also round the bases of some still standing where a small portion of the fine loose soil had slipped down and spread out at the foot. It is true that mole-hills have to be spread whether we like it or not, because they would if undisturbed, when of any size, become hard and in time covered with vegetation, and in that state be almost as much a nuisance as ant-hills, but the spreading is not usually a heavy matter.

It is not as if the hills were thrown up to the same extent at all seasons of the year. On the contrary, the chief period of activity on the part of the mole is during part of the winter and the spring. It is then that by far the greater proportion of the mole-hills are thrown up, and if the mounds are spread just before the fields are shut up for hay it will be found that few more will appear. It may be added that it is just at this season that a little fine soil spread over the surface will benefit grass land. Chain and brush harrowing, too, at that season make it more easy to smooth down the traces of the mole's beneficial activity.

In summer the mole works, I believe, to a very large extent upon the surface, and the large mounds which it erects over its breeding-places are usually situated in some out-of-the-way place, such as a hedge-bank or the foot of a tree. At that season the mole finds sufficient

cover in the thick bottom grass and procures most (probably nearly all) of its food above ground. Anyone who will go out before sunrise on a summer's morning, or take a candle and walk over the lawn on a dewy night, will see at once what a feast of large, fat worms, the mole finds spread out for him without the trouble of moving an inch of earth. It is just because the worms, in mild weather at the end of winter and in the early spring, come up near the surface of the ground, that the moles make such a disturbance with their surface runs and hillocks at that season. The main runs leading from the mole's abode in a hedge-bank, and those going down to some convenient drinking-place, are generally at some little depth below the surface. Experienced trappers always look out for these runs.

The foregoing remarks upon the mole's farming operations are more especially applicable to grass land. Of its effect on arable land it is more difficult to speak. For one thing, I think it may safely be said that the mole prefers to work in grass fields—it may be because the worm, being there undisturbed by man's tillage, and on that account less exposed to the attacks of its surface-feeding enemies than in those (for instance) which are turned-up once a year in sight of the hungry rook or seagull, abounds more under the turf ; and, therefore, that such situations afford the mole a field of operations in which he can more readily assuage his exacting appetite. Be this as it may, the mole can well be allowed a free hand until well on into the spring on land in preparation for barley ; and perhaps it is only among winter wheat, spring corn other than barley, and possibly in clover leas that it is likely to do any damage. In fields carrying these crops it is certainly sufficiently annoying to see the surface runs and hillocks in all directions—plants being uprooted by the surface runs or covered up by the hillocks. But by the time wheat has been hoed, the mole's great

activity underground will have abated or ceased, and few hillocks remain there to face the reaping machine in harvest. After all, the test question is—Have we ever seen any portion of a white-corn crop showing signs of serious damage by moles by the time the plant is in ear?

The staple food of the mole consists of earthworms, but it will also eat various insects and the large grubs of beetles so injurious to the roots of grass; mice, birds, and reptiles are also said to be occasionally devoured by it. "Devoured" is a better word than "eaten" when speaking of this extraordinary animal. The voracity of the mole is, indeed, almost past belief. Except during the time when it retires to its fortress to sleep, it is unable to live for many successive hours without food. I remember once when I was at school trying to keep a mole alive (in a biscuit-box filled with earth, I believe), and our astonishment at the rate with which it consumed worms before us within a few hours of its capture. A night passed without food, however, proved fatal to it, although I did not at the time realise that it had actually died of starvation in less than twelve hours.

Geoffrey St. Hilaire says that the mole (I quote from Bell) "does not exhibit the appetite of hunger as we find it in other animals; it amounts in it to a degree of frenzy. The animal, when under its influence, is violently agitated; it throws itself on its prey as if maddened with rage; its gluttony disorders all its faculties, and nothing seems to stand in the way of its intense voracity."

In hard weather, during winter, when frost has driven the earthworms deep down into the ground, the mole is said to descend in pursuit of them and to carry on its operations at a considerable depth. But it seems more probable that at such seasons it spends a greater time sleeping in its winter fortress (an elaborate system of chamber and galleries formed in a large hillock in some secure place) than is generally supposed. In light arable land the mole's feeding-runs are

often merely trenches along the surface; and in late winter or early spring, when a fall of snow has covered the ground to the depth of some inches, it sometimes works just underneath the snow, leaving only tracks on the ground which are exposed when a thaw ensues.

It may readily be imagined, therefore, what a large amount of food the mole must consume; and it is impossible to estimate the effect upon the numbers of the earthworm which a total extermination of this animal would produce.

The mole produces from three to six young, which are usually born about April or May; but young moles may be found at any time during the summer, and it is possible that two litters are reared in the course of the season.

When it is necessary to reduce the numbers of the mole in any particular locality, the best way is to procure a dozen or so of the ordinary iron mole-traps, and set a labourer, who has some knowledge of the habits of these animals, to work as molecatcher, paying him so much a head for the moles he catches.

There is, perhaps, no animal about which more divergence of opinion exists than the mole. There can be no doubt of the beautiful adaption of its structure to its mode of life, nor of the ingenuity of its mining operations, and it is worth while to consider it for a moment in this aspect before viewing its actions from an economic standpoint.

Its long, cylindrical body is covered with an upright pile of fur, which, so to speak, cannot be stroked the wrong way, No external ears project from the head to impede it in its passage through the earth.

Our English species (*Talpa Europæa*) is not blind. The eyes are very minute and buried in the fur, and keenness of vision is assuredly not its strong point. There is a South European species (*T. cæca*) with eyes still less serviceable, for they remain covered by a fold of skin, so that the popular idea of the blindness of the mole tribe is not without some

foundation in fact. The senses of hearing and smell are acute in the mole, but its subterranean habits afford little scope for that of sight, which is but feebly developed.

The legs are short and powerful. The fore-limbs are perfect digging instruments, being highly muscular, furnished with strong claws, and so set that the palms are directed outwards. The snout is long and tapering and the mouth is set with sharp teeth, which are well adapted to seize and masticate the worms and insects upon which the animal feeds. The mole conducts its mining operations on a definite plan. The essential parts of the structure are a central chamber and two circular galleries, the larger being on a level with the nest, and the smaller being some inches above it. From the upper gallery three passages lead to the nest, while the two galleries communicate by several more or less vertical passages. From the basis of these galleries the mole tunnels the earth in various directions in search of food.

During the cold weather the central nest is always found to be plentifully stored with food—generally earthworms —which the mole has disabled but not killed, and these are doubtless for the use of the parent and not of the young, which are suckled until able to forage for themselves.

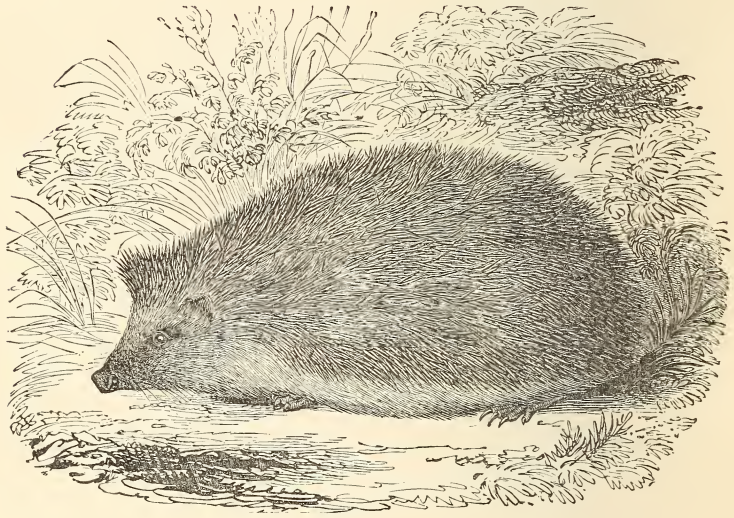
The misdeeds of the mole are so obvious, and the benefits it confers so modestly concealed, that its general popularity is little to be wondered at. In the garden it must be admitted to be an intolerable nuisance, but on the land it is probable that its utter extermination would lead to very grave consequences.

The mole is not only a voracious destroyer of earthworms, but also of many of the larvæ which annually do so much injury to the roots of the crops.

THE HEDGEHOG (*Erinaceus Europæus*).

The hedgehog leads such a retiring life that we seldom hear anything about his manners and customs, and few

people ever "seek his merits to disclose, or draw his frailties" from their prickly abode. Yet like most of our beasts and birds, he has his faults as well as his virtues. Rolled up comfortably at the bottom of some dry leaf-filled ditch, or perhaps snugly laid up in moss and leaves in a deserted rabbit burrow, the hedgehog passes away the winter months in sleep, and even when he comes to life again in the spring he is a purely nocturnal or



THE HEDGEHOG.

crepuscular animal; so that, unless he is routed out by a dog, or mown out of grass or corn by the mower or reaper, we seldom see anything of him except in the long summer evenings. Our midsummer nights in the Northern hemisphere are so light that night animals have no choice there but to show themselves or starve. The hedgehog can afford to starve least of all, for he has to lay up a store of fat for the ensuing winter's hibernation. So in the dewy

evenings we see him gravely walking over the turf, feeding as he goes, or hear him rustle in the green corn, where, no doubt, he finds a good supply of succulent insects and grubs.

He is not, however, always sedate in his movements but can bestir himself on some occasions and run with considerable activity. I once, rather rashly, passed a night in the same room with a hedgehog, gaining some insight into his ways at the cost of most of a night's rest. Confined at first in a basket, he made such a noise there after the candle was put out that I liberated him, and then the game began in real earnest. That hedgehog spent the whole of the night in running up and down and round and round the room at quite a quick pace, varying this amusement with endeavours to force himself between the walls and any piece of furniture standing close to them. At length, in pushing himself behind a big sponge-bath which was tilted against the wall, he brought this sonorous object down upon him with a crash. A few minutes' quiet ensued, and then he wriggled out again to resume his trot. During the whole time he kept up a loud snuffing noise, and I subsequently ascertained that a hedgehog, while thus engaged, carries his nose in the air like the proverbial pig in a hurricane.

The usual food of the hedgehog consists of large insects, worms, slugs, and snails, but roots and other vegetable substances are also eaten, as also occasionally are mice frogs, snakes, and eggs. It is simply in regard to its food that the hedgehog affects the agriculturist and horticulturist. In the garden it is most beneficial, and upon the farm also, it undoubtedly does a great deal of good by devouring noxious insects and various small vermin. Such, then, are its virtues, with the addition that it is said to be very good to eat, unreasonable prejudice to the contrary notwithstanding. Of its faults, which are few, the gravest is that of egg-stealing, and it has been certainly proved that the

hedgehog will destroy not only the eggs of ground-breeding wild birds, but also those of domestic poultry.* By many gamekeepers it is accordingly considered as "vermin"; but the occasions when the farmer will suffer from raids upon his henroosts will probably be few and far between. Isolated instances of a hedgehog attacking other things, a leveret and a young rook fallen from the nest, for instance, are on record; but a more serious impeachment (ancient as to its origin and widely believed in) of sucking a cow during the night has, although laughed at by some modern writers, been revived of late years from an undoubted case of a hedgehog gnawing the udder of a sheep which was "thrown" in a ditch.

The hedgehog is never likely to become sufficiently numerous to constitute a "pest," and systematic trapping need never be resorted to. In the case of a particular individual paying repeated and objectionable visits, two or three ordinary gins set about the place will generally be the means of securing the intruder. The traps should, of course, be attached by cord to a peg driven into the ground or to some fixed object.

* Upon one occasion, finding that the eggs were disappearing from the nest of a wild pheasant sitting in the woods, I set a gin to catch the depredator—baiting it with an egg. Next morning I found a hedgehog in the trap. Upon another occasion a hedgehog, which had been introduced into a vegetable garden as a friendly helper, killed nine chickens in a night. In the morning it was found comfortably curled up among its victims. Yet another instance of its *penchant* for flesh. When a schoolboy I, upon one occasion, placed a hedgehog and a stock-dove in the same box overnight. In the morning only the hedgehog was there, and "traces"—a parallel incident to that of "The Lady and the Tiger.'—EDITOR.

CHAPTER IX.

BATS.

In the preceding chapters the more important of the farmer's friends and foes have been treated of, and it only remains for the writer to take up the threads of the subject, so to speak, and in the present contribution to notice those creatures—small, it may be, but none the less harmful or beneficial—which have not yet come under examination.

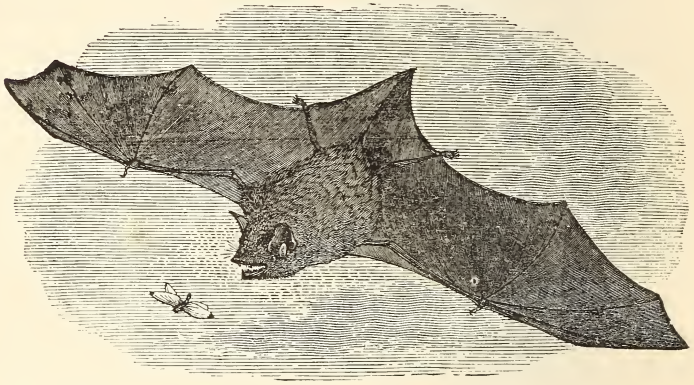
Chief among these is the family of bats, and it is pleasant to be able to say that the influence they exert is an altogether beneficial one.

The importance of this family will at once be seen when it is stated that there are fifteen or sixteen different species found in Britain, and that they are all more or less feeders on insects—insects, moreover, which are by no means friends to the farmer. We are apt to call a bat a bat, but the fallacy of this would be seen at once if only we were to watch more closely the "flitter-mice" which are constantly flying about our homesteads. Of the sixteen indigenous species alluded to, all belong to the insectivorous division of the order, and are either crepuscular or nocturnal in their habits. Everywhere about us one may see the admirable precision in the ordering of nature; and in the present case we notice that the regular emerging of the Cheiroptera from their winter quarters is contemporaneous with that of the insect hosts in spring.

It is unnecessary here to go elaborately into the life-history of the British bats, and it will be sufficient to

indicate generally that their food is such as to give them a place among the farmer's friends.

The Great Bat (*Vesperugo noctula*) is a tree-loving species, and, avoiding buildings, it generally affects hollow oaks. Its preference for this special tree need not be wondered at when we remember what a host of insect enemies the oak harbours. As a species it is gregarious, and wherever a colony is found, there immense numbers of May-chafers (*Melolontha vulgaris*) are devoured. Here is a testimony from Bell of the Great Bat's usefulness:—"The Noctule, in general conformation, is essentially adapted for the mastication and capture of coleopterous insects. The broad muzzle



THE COMMON BAT.

and strong jaws are found quite equal to the reduction of the stubborn elytra of beetles as large as the cockchafer (of which, according to Kuhl, he will consume as many as thirteen, one after the other), and the wings are in no way deficient in power when in pursuit of insects. During the fine midsummer evenings, when cockchafers are abundant, and you hear them humming on every side, the noctule is in his glory. Then he flies high and straight, and you hear his shrill but clear voice as he passes overhead, interrupting himself only to dart at some prey, and then passing on. But an

observer will not watch his movements long on such occasions without noticing a manœuvre which at first looks like the falling of a tumbler pigeon, but on closer observation proves to be simply a closing of the wings and a consequent drop of about a foot. Sometimes this is repeated every few yards as long as in sight. It is occasioned by some large and intractable insect having been captured, and the anterior joint of the wing, with its well-armed thumb, is required to assist in retaining it until masticated."

To prevent confusion it may be here stated that, although Britain seems to have a proportionally large number of species of bats, yet some of these, like the Hairy-armed (*V. Leisleri*), Serotine (*V. serotinus*), and Parti-coloured Bat (*V. discolor*), are exceedingly rare.

Every agriculturist will frequently have noticed the Common bat (*V. pipistrellus*) hawking for flies; and various dipterous insects, which are its main food, are specially injurious to farm crops. It is particularly noticeable in the common bat that it spends the twilight hours mainly round farm steadings and buildings which house cattle, and is thus always near its food-supply. Individuals in confinement take large numbers of house-flies on the wing, and are not averse to small pieces of meat. It is from keeping bats in confinement that much of their life-history has been learnt—among other facts the interesting one that they produce but a single young one at a birth. For a time the young one sticks closely to its mother's breast, and, when not suckling, is kept carefully tucked up in one of the wing folds.

Whilst several of the rarer bats are extremely local in their distribution, it often happens that these exist in considerable numbers in particular districts. An illustration of this may be given in connection with the Mouse-coloured bat (*Vespertilio murinus*), referred to above. This species is particularly fond of the nocturnal Lepidoptera, the wing-

cases and harder portions of which are found in its excrement. When Buffon visited the famous grotto of Arcy he found the ground covered to the extent of several feet with what he at first thought to be soil. Upon examination this proved to consist mainly of the remains of wings and the harder portions of various insects—a mass which had doubtless taken years to accumulate. Another instance is recorded where one hundred and eighty-five bats (mainly *V. noctula*) were taken from under the eaves of Queen's College, Cambridge, and sixty-three individuals upon another occasion. And yet again a singular scene in this connection is reported in connection with the discovery of a colony of bats of the Reddish-grey species (*Vespertilio natterer*) in the village church at Arrow—proving the social and gregarious habits of the species :—"Between the ceiling of the church and the tiled roof was a dark retreat, accessible by a low arch from a floor in the tower. Here the bats were seen adhering, by all their extremities, to the under surface of the row of tiles which forms the crest or ridge of the roof (partly supported, however, by the upper tier of roof-tiles on which the ridge-tiles rested), and others clinging to them, until a mass was made up three or four inches thick, six or seven wide, and about four feet in length. It would be wrong to call this their place of repose, as they presented a most singular scene of activity, the constant endeavour of those outside being to penetrate the mass, probably for warmth, and to do this they were continually poking their noses between those nearest them, and then forcing in their bodies, to be in their turn again pushed to the outside. In this way a regular bickering was kept up in the whole mass. However, they seemed to be very gentle, and to have no idea of biting or otherwise annoying each other."

One of our fairly abundant species, Daubenton's bat (*Vespertilio Daubentonii*), has for its haunts aquatic situations,

and takes enormous numbers of gnats and insects found in low-lying situations ; whilst the Long-eared bat (*Plecotus auritus*), which is not very common, makes a speciality of the Micro-lepidoptera, hovering like a kestrel when in pursuit of them. The Great Horseshoe Bat (*Rhinolophus ferrum-equinum*) devours enormous quantities of chafers.

From these general observations it will be seen that, the food of British bats consists almost wholly of insects, and that many of these are among the well-known pests to agriculture.

As in the case of bats, the influence of the Frog (*Rana temporaria*), and the Toad (*Bufo vulgaris*) is altogether on the side of the farmer. No insect is too small nor too large for these creatures to appreciate. The quantities of tiny hoppers which they destroy is enormous, and no species of worm, caterpillar, moth, fly, or grub comes amiss to them. It would hardly be practicable to erect toad-houses on a farm, but this is often actually done by nurserymen and gardeners —and with the very best results. In a greenhouse a toad is a most effective scavenger, and its power of destroying black beetles is far superior to that of the hedgehog. What applies to the toad applies to the frog, and if we knew of the immense benefits which the armies of frogs and toads bestow on our fields and pastures they would be held in widely different esteem to what they are. There is scarcely any low form of life found in our fields which the frog does not appreciate as food, and his appetite is insatiable.

THE END.

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