

not only neglect research, but even their students in the most unblushing manner, in their greed of gold. We hope that when next Mr. Mundella has to ask for a vote for the Science and Art Department, he will present as strong a case for the encouragement of advanced science as he has done for the teaching of elementary science. The facts and figures in favour of the one are as strong as those in favour of the other.

EUROPEAN CADDIS-FLIES

A Monographic Revision and Synopsis of the Trichoptera of the European Fauna. By Robert McLachlan, F.R.S., F.L.S., &c. (London: Van Voorst, 1874-1880.)

MOST persons have seen those curious aquatic insects called caddis-worms, which live at the bottom of the water, protected by tubular cases formed of bits of stick, stones, sand, or shells, and are much used as bait by anglers; being, as Izaak Walton remarked, "a choice bait for the chub or chavender, or indeed for any great fish." It is also generally known that these caddis-worms are the larvæ or grubs of winged insects, known as caddis-flies or water-moths, which abound in the vicinity of rivers or ponds and often fly into houses attracted by the light; but few persons except entomologists are aware that there are nearly a hundred and fifty different species in the British Isles, while between four and five hundred are known from various parts of Europe—that they constitute a distinct order of insects, named "Trichoptera," from their hairy wings—and that they possess peculiarities of structure of the greatest interest as serving to connect, however imperfectly, such distinct and highly specialised orders, as the Hymenoptera and the Lepidoptera.

The perfect insects are characterised by four ample membranous wings, of which the hind pair are usually the largest, while the front pair are somewhat more leathery in texture. The wings are always more or less clothed with hair, sometimes to such an extent as to form a dense coat which completely hides the nervures; and it is this peculiar hairy covering which has given the name to the family. The neurulation of the wings consists of longitudinal branching veins with a few cross veins forming cells, very different from the netted veins of most of the Neuroptera, with which the Trichoptera were formerly united, but bearing a considerable resemblance to those of some of the smaller moths. The body is also hairy, the legs long and spined, while the antennæ are usually longer than the body, slender and thread-like; and when the insect is in repose these are directed forward, and so closely pressed together as to appear like one. The mouth is very small with quite rudimentary mandibles, and Mr. McLachlan thinks that the insects usually take no nutriment whatever in the perfect state, "existing on the superabundant vitality acquired during their long larval stage," but he adds: "some of the larger species frequent flowers at night after the manner of moths, and are even attracted by the mixtures used by lepidopterists to attract their favourite insects, facts which prove that some, at any rate, partake of liquid nutriment." The exact mode in which this is effected is not yet clearly ascertained.

The eggs are gelatinous, and stick together in a mass which is attached to aquatic plants below the surface of the water, into which the female is said sometimes to enter for the purpose of depositing them in a proper situation. The cases formed by the larvæ are built up of various substances fastened together by silken threads spun from the mouth in the same manner as caterpillars spin their cocoons—another curious point of resemblance to the Lepidoptera. These cases vary greatly in the different families and genera, and though at present very imperfectly known it seems probable that every species has a distinctive form of case. The Phryganeidæ, for example make cylindrical cases of morsels of leaves or fibres arranged in a spiral manner, the cases are open at both ends, and it is believed that the larvæ have the power of turning in them. When about to change into a pupa the larva closes up the ends with vegetable matter and attaches the case to an aquatic plant. They live only in ponds, lakes, or marshes. Another family—the Limnophilidæ—have some genera which live in still, others in running waters, and their cases vary greatly, the most curious being those formed entirely of shells, often taken while their inmates are alive. One genus of this family—*Enoicycla*—is altogether anomalous, since the female has rudimentary wings and its larva lives in moss, often in woods far away from water, forming a case of fine sand intermixed with vegetable matter. One species is found in England. In the next family—*Sericostomatidæ*—the larvæ live generally in streams, forming cylindrical cases of sand or small stones, but sometimes the cases are broad and flattened, in others quadrangular, while in one genus—*Helicopsyche*—they are spiral, formed of sand grains, and often so closely resembling the shells of fresh-water molluscs, that some of them have been described as species of *Valvata*, *Paludina*, &c.! In the *Hydropsychidæ* and *Rhyacophilidæ* the larvæ are carnivorous and form irregular cases of small stones fixed to larger stones at the bottom of the water, and sometimes several larvæ appear to live in company under a common covering of vegetable and other *débris* fastened together with silk. These are obliged to quit their retreats when wandering about in search of food, and they accordingly have the body and abdomen of a firmer consistency. The *Rhyacophilidæ* especially frequent torrents. Lastly, the *Hydrophilidæ* live in more or less seed-like, movable cases, formed of silk with minute sand-grains, and having a slit at each end forming two apertures, from either of which the larva can protrude its head. They are found among water-plants, on the surface of stones at the bottom of streams or ponds, and have the power of spinning a silken thread by which both the case and its inhabitant can float securely in the water. The insects produced from these larvæ are the smallest of the order, and often appear in great numbers.

When the larvæ of Trichoptera are about to change into pupæ they close up the apertures of their cases either with a network of threads or with other materials, and some of them besides spin an inner cocoon. The pupæ, though quite motionless, bear a considerable resemblance to the perfect insect, the antennæ, legs, and wings being fully formed, but shorter, and all inclosed in separate sheaths and arranged on the breast. The head is however armed with a pair of strong horny hooks or jaws

quite different from those of the larva or the rudimentary jaws of the perfect insect. These are to enable the pupa to cut its way through the cocoon and outer case, when it is ready to assume the perfect state. It then becomes active, swimming by means of its two middle legs, the tarsi of which are densely fringed with long ciliæ, forming admirable oars. By means of these the pupa reaches the stem of some aquatic plant, up which it creeps out of the water, and then sheds its pupa-skin, and lives a short aerial life which seems wholly devoted to the duty of continuing the species.

From the foregoing brief sketch of the main features of this order of insects, it will be seen that they form what is probably a very ancient group, which has preserved some of the characteristics of several distinct orders. Though, owing to the structure of the rudimentary mouth, the Trichoptera have to be classed among the mandibulate or gnawing insects, and are supposed to be allied to both the Neuroptera and the lower Hymenoptera, yet in the neuration of the wings, their hairy clothing, the silk-spinning and case-bearing larvæ, and the form and habits of the perfect insect, they more nearly resemble some of the smaller moths, with which Mr. McLachlan believes they have a real affinity. So, in the curious activity of an otherwise quiescent pupa, which possesses special organs for gnawing and for swimming, these insects seem intermediate between the groups with an imperfect and those with a perfect metamorphosis, though far more closely allied to the latter; and owing to these various peculiarities the Trichoptera may be said to constitute a "critical" group, whose study cannot fail to throw light on the affinities and genealogy of insects generally. Owing however to their obscure colours and slightly varied forms they have attracted comparatively little attention, though a few ardent workers have for many years devoted themselves to this branch of entomology; but the appearance of the present elaborate work, which is a model of conscientious labour and research, will form an important era in the study of the group.

This large and handsome octavo volume is devoted to a complete description of all the species of Trichoptera which have been discovered in Europe and Northern Asia, or in what is now termed the Palæarctic Region. These descriptions have all been drawn up from specimens of the insects themselves—often of the greatest rarity—and the fact that the 'chief museums and private cabinets of Europe and America have placed their collections in Mr. McLachlan's hands for the purposes of this work, is the best proof of the high reputation he has attained as a master in this branch of entomology. The book is illustrated by fifty-nine plates containing about 2,000 distinct figures (all drawn by the author himself), illustrating generic and specific characters mostly derived from the neuration of the wings and the structure of the anal appendages. These latter organs are wonderfully varied from species to species while constant in each; and by carefully delineating them by means of the *camera lucida*, species have been shown to be distinct which appear in all other respects to be identical; and the fact of such distinctness in a considerable number of cases is one of the most curious and interesting results of Mr. McLachlan's researches.

The work has occupied nearly six years in its publica-

tion, and it has had the effect of stimulating inquiry to such an extent that a large number of new species have been discovered during its progress, rendering the book half as large again as was anticipated; yet the author believes that a comparatively small portion only of the European species are yet known, while in less familiar regions there is a wide field for the discovery of new and remarkable forms. There remain also a number of larvæ which have not been identified with the perfect insect, and an interesting and useful line of observation is thus open to entomologists both at home and abroad. Under these circumstances every naturalist will appreciate the value of a work which has collected together and thoroughly worked up all the material available to the latest date. Such a book cannot, from its nature, be a popular one. Its production has been a labour of love, and is to that extent its own reward; but the expense of producing such a volume is very great, and in order to encourage and even to render possible the production of such works it becomes the duty of all who wish to advance the study of nature to do what in them lies to relieve such enthusiastic workers from the pecuniary burthen which their self-denying labour brings upon them. If every scientific institution and every Naturalist's Field Club in the kingdom were to purchase a copy of this admirable volume for the use and instruction of their members, they would do much to render the production of such works more common, besides really furthering the progress of research, perhaps even more than by the publication in full of their own Proceedings.

This is undoubtedly the most important British work on Entomology since the completion of Mr. Stainton's "Natural History of the Tineina" thirteen years ago, and it is well worthy of the high reputation of its author; while the clearness of the type, the excellent systematic arrangement, the full indices, and the beautifully engraved figures, are equally commendable. Any detailed criticism on such a book could only be given by a worker in the same group; but as one who has often to refer to natural history volumes for information, the present writer would suggest that the absence of any *family* names as headings to the pages is a great inconvenience, as there is no means of ascertaining what group a genus belongs to or of finding the commencement or end of a family without constantly turning to the index. So far as the typography and general arrangement of the volume are concerned this is the only defect that has been noticed, and that it is so small a one may be taken as an indication of the care and attention which has been bestowed upon the publication, no less than on the composition of this notable volume.

A. R. W.

OUR BOOK SHELF

Ornithological Journal of the Winter of 1878-79; with Collected Notes regarding its Effects upon Animal Life, including Remarks on the Migration of Birds in the Autumn of 1878 and the Spring of 1879. By John A. Harvie-Brown, F.Z.S., M.B.O.U. (*Proc. Nat. Hist. Soc., Glasgow, 1879.*)

MR. HARVIE-BROWN, well known as one of the most active and practical of our home-ornithologists, has endeavoured to chronicle the abnormal effects of an