Evidence is accumulating that in the end will overthrow belief in the efficiency of what has been called protective coloration in speculative writings of the past 150 years. Like many other attractive theories that of protective coloration has been unduly elaborated, and facts opposed to it have been ignored. Those who have studied the food of birds, mammals, reptiles, and other groups constantly have the impression forced upon them that the so-called protective adaptations do not protect. Doctor Pearl's results go to confirm the belief that we have been unable to avoid and have often asserted that the influence of natural enemies taken as a whole, is indiscriminate. In other words their food is obtained from the various species they prey upon practically in proportion to the abundance of those species in the state of nature.— W. L. M.

**Economic Ornithology in recent Entomological Publications.**— In 'The hothouse milliped as a new genus' [1] O. F. Cook says "Prussic acid and other corrosive secretions may aid in the precipitation of colloidal substances in the humus, in addition to the protection that they give by rendering the millipeds distasteful to birds and other animals that might otherwise feed upon them." This statement implies that millipeds have no natural enemies, an Utopian condition probably no organism enjoys. Millipeds are the chief food of certain beetle larvæ, and are greatly relished by toads. They are eaten by armadillos and skunks at least among mammals and the brand of protection their secretions give them against birds is not exactly what men would choose to insure comfort and peace of mind. Records in the Biological Survey show that millipeds are eaten by no fewer than 83 species of United States birds, 36 of which are known to take considerable numbers of them.

Walter E. Collinge begins a new series of economic publications in his 'First Report on Economic Biology' [2] and as usual includes references to the food of various birds. Crane fly larvæ, well known pests of root and cereal crops, are recorded as doing serious injury to bulbs. The bird enemies of these insects include the starling, lapwing, pheasant, various gulls, and the rook. It is of particular interest that one of the shorebirds should be assigned great economic value, as the whole group has recently received that distinction in this country. Collinge says: "All the species of crane flies have increased enormously with the decrease of the lapwing and the same holds true with regard to wireworms and other soil pests."

Mr. Collinge presents a summary of his investigation of the rook, which has previously been reviewed,[3] and a note on the injurious budding of fruit trees by bullfinches. The stomachs of 176 birds collected in April and May, contained nothing but fruit buds, and there is evidence to indicate that damage to young fruit continues through June and July. Aggressive

[1] Proc. U. S. Nat. Mus., 40, 1911, p. 625.
[2] Birmingham, England. 1911, 78 pp.
[3] Auk, XXVII, No. 3, July, 1910, pp. 359, 360.

measures against bullfinches are recommended. An increase in the number of voles in the Midland counties is attributed to the ruthless destruction of owls and the kestrel. "It cannot be too widely known that the short-eared owl, the barn owl, and the kestrel feed very largely upon voles and mice and should be protected."

In a recent bulletin [1] of the Ontario Agricultural College Mr. L. Caesar makes certain statements showing that his experience with bird enemies of the codling moth is in harmony with that of most entomologists who have written on the subject. He says "when searching under bands and loose bark for larvæ in the spring, we have been surprised at the very large percentage that have perished during the winter. Sometimes as high as 90 per cent or more seem to have been destroyed by various causes. The chief of these, so far as we could see were birds, the grub of a small black beetle (*Tenebrioides* sp.) and diseases. Many birds at one time or another during the year feed upon either the adults or larvæ of the codling moth, but during the winter the most useful birds in this respect are the woodpeckers, especially the downy woodpecker and the chickadee. If these two birds are encouraged during winter by hanging bones or pieces of meat on the tree they will often stay in the orchard all year and search every trunk and large branch carefully for larvæ."

D. B. Mackie reports on the locust pest in the Philippines [2] mentioning several birds among the natural enemies. These are cuckoos, crows, small hawks and gallinaceous birds, including domestic fowls. An important paper [3] on the African migratory locusts by Dr. W. La Baume, discusses the natural enemies of several species. Under general remarks on natural enemies, the author says "there can be no doubt that they play an important part in the destruction of the locusts and are a valuable aid to man in the battle against the pests. Deserving especial mention are the 'locust birds,' accounts of whose gratifying work one constantly meets in the locust literature. It is to be commended that legal orders for their protection have been issued in many parts of South Africa, and demanded for them in other districts."

After mentioning the mammalian enemies of the brown locust (*Pachytilus sulcicollis*) Dr. La Baume says: "Of far greater importance as locust enemies are the birds, of which certain kinds in South Africa are significantly called 'locust birds,' because in locust time they persistently follow the migrating swarms and live almost exclusively upon the insects." The principal kinds are: a field swallow (*i. e.*, a swallow-plover or pratincole, *Glareola melanoptera*) known as the "little locust bird"; the jackal-buzzard (*Buteo jackal*), the two storks (*Ciconia alba* and *Ciconia nigra*) generally known as "big locust birds"; the marabou (*Leptoptilus crumenifer*), the blue crane (*Anthropoides paradisea*) the white-bellied stork

[1] No. 187, Jan., 1911, pp. 24, 25.

[2] Philippine Agr. Rev., III, No. 4, April, 1910, pp. 227–240.

[3] Beihefte z. Tropenpflanzer, XI, No. 2, April, 1910, pp. 65–128.

(*Abdimia adimii*) and a kind of ibis; other enemies are starlings, guinea-fowls, certain bustards, the black and white hornbill (*Buceros leucomelas*), several falcons (*Tinnunculus rupicolis, T. naumanni, T. rupicoloides, Milvus aegypticus*), rooks, plovers, lapwings, shining thrushes, weaver-birds, etc. Most of the birds eat nymphs of the locust as well as the winged form, some dig up the eggs and devour them.

The enemies of the red-winged locust (*Acridium septemfasciatum* are principally the same species that attack the brown locust. The white and black storks and guinea fowls are given special mention. As is the case with the enemies of other migratory locusts, birds rank highest among the vertebrate foes of *Schistocerca peregrina*. Especially in Usambara, wherever locusts were observed, they have been found by flocks of birds. In the mountains, hooded crows, buzzards, marabous and black storks, and on the plains marabous, waders, guinea fowls, and the ground hornbill (*Bucorax caffer*) made themselves useful.

Dr. A. Fredholm gives high credit to the bird enemies of the mole-cricket (*Scapteriscus didactylus*) which is responsible for an annual loss of $15,000 on field and garden crops in Trinidad.[1] He says: " First place among the natural enemies belongs to insectivorous birds. Three of our commonest birds, the savannah blackbird (*Quiscalus crassirostris*), the tickbird (*Crotophaga ani* L.) and the Qu'est ce qu'il dit (*Lanius pitanga*) feed freely on these insects whenever found, and were it not for their persistent hunting, the pests would have committed more extensive depredations in Trinidad than has been the case so far. The birds will not only quickly snap up any insects appearing above the ground, but they will also carefully scrutinise the vaulted top of every burrow they descry for any movement indicating the passage of the insect beneath. As soon as a criket is thus detected they will demolish the roof and drag it out."

Dr. Fredholm is of the opinion also that " The most effective as well as economic method of coping with the pest would undoubtedly be to protect its natural enemies: blackbirds, tickbirds, Qu'est ce qu'il dits, toads and lizards. These are true friends of the planters and it should be seen to that due protection is accorded them."

In a bulletin[2] of the North Carolina Experiment Station on insect enemies of cabbage, Mr. Franklin Sherman, Jr., mentions bird enemies of various pests. In relation to cutworms it is stated that the insect-eating birds " which spend much time on the ground are the most useful, especially the bobwhite, crow, blackbirds, meadowlark, sparrows, catbird, mockingbird, etc. These in the course of a season and especially when rearing their young, pick up many a juicy cutworm." It is not exaggeration to say that cutworms are eaten on sight by practically all birds that glean their food from the ground or from low vegetation. The author remarks that " we know but little about natural enemies of flea beetles . . . .

[1] Proc. Agr. Soc. Trinidad, XI, part 2, Feb., 1911, pp. 153–163.
[2] Vol. 32, No. 7, July, 1911.

possibly small birds like sparrows would pick a few of them off the cabbage plants, but our information is not very definite or satisfactory." Flea beetles as well as all other Chrysomelidæ, although classed as specially protected insects by supporters of the theories of mimicry and other phases of protective coloration, certainly are eaten by many birds. To cite instances of only a few genera of flea beetles alone, beetles of the genus *Phyllotreta* are at present known to be eaten by 5 species of birds, *Haltica* by ten, *Epitrix* by 12, *Systena* by 21 and *Crepidodera* by 26 species. Mr. Sherman notes a locality where English sparrows usually keep in check the harlequin bug (*Murgantia histrionica*). The same bird also does good work by eating cabbage worms (*Pontia rapæ*).

The larch sawfly (*Nematus erichsoni*) of which there have been serious periodical outbreaks in the United States since 1881, has defoliated thousands of acres of larch or tamarack in southern Canada, Michigan and Minnesota, during the present season. Dr. C. Gordon Hewitt, Dominion Entomologist, gave a lecture on the pest before a meeting of the Canadian Forestry Association in January, 1911,[1] in the course of which he emphasized the normal impracticability of directly combatting the insect. This condition makes the work of natural enemies of paramount importance. In commenting on the results of a study of the sawfly problem in England, Dr. Hewitt gives first rank among natural enemies to a parasitic Ichneumonid. "The chief of the other potent natural causes were the small voles or field mice and the birds, especially the tits." A paper[2] published in England by Dr. Hewitt gives further details regarding bird enemies: "When the larvæ were in the earlier stages it was found that the three species of Tits — the Great Tit, Cole Tit, and Blue Tit — fed upon them to a considerable extent. They were also assisted by Chaffinches, which were found feeding on the full grown larvæ. In addition to these birds, which perform no little service, great destruction of the larvæ was effected by the Rooks, Jackdaws, and Starlings which were to be seen in large flocks in and about the more seriously attacked plantations. They not only fed upon the larvæ on the trees but also followed them on the ground when about to spin their cocoons beneath the turf. When the larvæ had reached this stage one frequently found that the rooks had riddled the turf round the bases of the trees with holes in search of the larvæ."

The natural means of control can be assisted and augmented, "and such is the case with regard to the birds which have been mentioned as feeding on the larvæ; chief of these are rooks, jackdaws, and tits. In the districts where the trees are badly attacked these birds should not be destroyed on any account. The starlings and tits should be encouraged and protected by feeding them during the winter and thus prevent the customary great mortality which results from hard weather, and also

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[1] The Spruce Budworm and Larch Sawfly. Kingston, Ont., 1911. 8 pp.
[2] Reprint from Journ. Bd. Agr., [London], XV, No. 9, Dec., 1908, 12 pp.

by the provision of nest-boxes in the plantations. Larch plantations are singularly devoid of suitable nesting places for birds and they should therefore be supplied. In England these insectivorous birds are not sufficiently encouraged in places where nesting sites are absent by the provision of nesting boxes, the value of which form of forest protection has been recognized for a number of years in Continental forests. The best type of nest-box is that designed by Baron von Berlepsch."

In the Canadian paper Dr. Hewitt gives the results of actual trial of this system of bird encouragement. "Nest boxes were distributed, an additional number being provided each year. Last year there were nearly 300 boxes and over 50% of these were occupied which indicates a considerable increase in the number of birds in view of the scarcity previous to their encouragement. Such a system of bird protection . . . . is carried on in Europe not only by individuals but also by those states in which the forests are important natural resources." Dr. Hewitt is strongly of the opinion that "If the natural means of control, such as birds, are encouraged and it is upon these and the parasites that the extermination of the pest chiefly depends, the attack will last for a much shorter length of time, and there will ultimately be less pecuniary loss than if a policy of *laisser faire* be adopted."

It is of interest in this connection that Mr. Vernon Bailey of the Biological Survey observed cuckoos and red-eyed vireos feeding on larvæ of this sawfly at Elk River, Minn., in July of the present year. Birds of several other species were abundant in the infested region. Stomach examinations show that the ruffed grouse, bobolink and least flycatcher feed upon this or closely related larvæ, and the range of these birds makes it probable that they will prove to be fond of the larch sawfly larvæ.— W. L. M.

**An Australian Bird Book.**[1] — The interest in ornithology in Australia, which resulted in the formation of the Australasian Ornithologists' Union in 1900, now finds its logical development, through the added stimulus of coöperative effort, in the publication of works on Australian birds designed to meet the wants of bird students of every class. Thus Mr. Gregory M. Mathews is producing an elaborate folio with colored plates, of which four parts have thus far appeared; Messrs. Lucas and Le Souëf have recently published a more convenient work, while the present volume "is intended as a pocket-book for field use, so that the many teachers, nature students, nature-lovers, schoolboys, schoolgirls and boy scouts who like to '*see* what they *look at*' may be able to name the birds they meet."

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[1] An Australian Bird Book. A Pocket Book for Field Use. By J. A. Leach, M. Sc. With Introduction by Frank Tate, M. A., I. S. O. Published by Arrangement with the Education Department of Victoria. Melbourne, Whitcombe and Tomb Limited. 1911. 12mo., pp. 200. Numerous colored and half-tone figures. Price 3/6.