of 1903, 1463 plaice were marked in this way, and of these 287, or 19 per cent., have been returned to the association. The general facts regarding migrations brought out by these experiments are these:—the smaller fishes do not appear to migrate to any considerable extent, and the larger the fish is the more extensive are its migrations. In some cases the distance travelled has been very considerable; thus one plaice is shown to have travelled a distance of 175 miles in about six weeks, and another travelled a distance of 210 sea-miles in eight months. The general trend of the migrations has been in a southerly direction during the winter and in a northerly one during the summer. As a rule, the smaller fishes travel from the shallow water "nurseries" to the deeper waters during the earlier period of their life.

A most attractive part of these migration experiments is the question of the transplantation, on a commercial scale, of fishes from overcrowded grounds to those grounds where the conditions for favourable growth are present, but where there is not already an abundant population of the kind of fish in question. An interesting account of such an experiment is given by Mr. Garstang. Although the conditions of nutrition on the well known Dogger Bank are apparently very favourable for plaice, yet, on account of its comparatively isolated situation, this area contains a population of plaice which is probably far below that which it is able to support. Accordingly, more than 1000 small plaice were transplanted from certain in-shore grounds to the Dogger Bank, and in the course of a year more than 40 per cent. of these fishes were re-captured from the Bank itself and the slopes around it. It is shown that the growth-rate of these fishes was far in excess of that of those living on the ordinary in-shore fishing grounds, and the question of the practicability of the wholesale transplantation of small plaice from the shallow-water fishing grounds to such grounds as the Dogger Bank is carefully discussed. It is very questionable, however, whether transplantation operations on such a scale could be arranged at all so as to be successful.

The remainder of the report deals with the records of the fishing experiments and with various other matters. Dr. Wallace presents a report on the growth-rate of the plaice based on the examination of the annual growth-rings in the otoliths. Mr. Todd contributes a lengthy account of his examination of the contents of the stomachs of a very great number of fishes caught in the course of the trawling operations, and draws some interesting conclusions on the food of the various species dealt with. Lastly, Mr. Gough reports on the occurrence and distribution of the plankton of the English Channel during 1903.

The records of the trawling experiments contain a large mass of observations which are capable of much further analysis than has been attempted in the present report. 84,000 measurements of individual fishes have been made in the North Sea and in in-shore waters, and when these are considered along with the records of the hauls made by the Scottish Fishery Board's exploring steamer abundant material should be forthcoming for a discussion of the distribution of fishes in the North Sea according to their age and size. Altogether the North Sea Fisheries Investigation Committee is to be congratulated on the publication of these reports.

J. JOHNSTONE.

INSECT PESTS OF THE COTTON PLANT.[1]

THESE two reports may be taken as object-lessons of the way in which such economic investigations should be carried out by the agricultural departments of progressive countries.

The wide area over which cotton cultivation is spreading makes the investigation of its enemies in those regions where it has long been cultivated of great value. Such researches guide us in investigating new enemies, and they prepare us to guard against the introduction of pests with foreign seed.

The authors of the report on the bollworm have produced a work of great value to all cotton planters. The pest is recorded from North and South America, the West Indies, Europe, many parts of India, China, and Japan, the East Indies, Australia and New Zealand, and even in the Gilbert and Navigator Islands. Of particular interest is the record from the Sudan and British East Africa, but it is not recorded as attacking cotton there. Besides infesting cotton, it is equally destructive to corn, and the authors tabulate seventy other food plants, distributed over twenty-one natural orders.

There are excellent plates showing ova, larvæ damaging the buds, tassels and ears of sweet-corn as well as cotton.

The injuries are explained, and it is clearly pointed out how the cotton becomes infested by the third and fourth generations of larvæ, the previous ones feeding upon the corn.

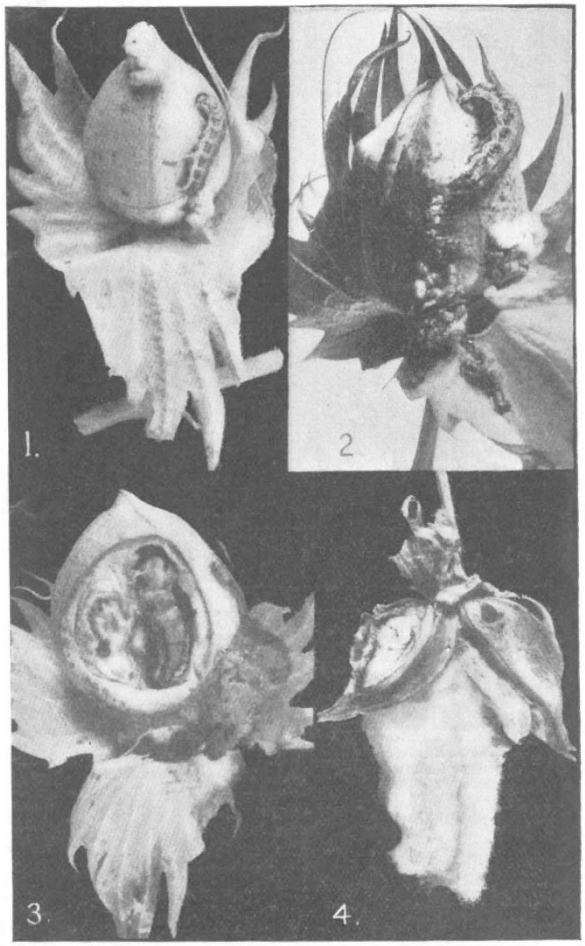


FIG. 1.—Work of Bollworm in Cotton Bolls. 1, Bollworm eating into a half-grown cotton boll; 2, bollworm boring into a full-sized cotton boll; 3, full-grown bollworm and its work in large cotton boll; 4, cotton boll only partially destroyed by bollworm, two "locks" open, the others destroyed (original).

The summary given of the life-history shows that the moth may lay from 500 to 3000 eggs, especially upon the "silks" of corn and the "squares" of cotton. During warm weather they hatch in two or three days. In spring the young larvæ eat the buds, later the silks and tassels of the corn; in August and September they attack the cotton. They bore directly into the "squares" and "bolls," and destroy the latter. Maturity is reached in two weeks; they then enter the soil to pupate. Detailed descriptions are given of all the stages, the effects of climate, and variations in colour. Nothing definite is shown to account for the great variation seen in the larvæ.

[1] "The Cotton Bollworm." By A. L. Quaintance and C. T. Brues. U.S. Department of Agriculture, Bureau of Entomology, *Bull.* 50. Pp. 155+plates xxv+figs. 27. (1905.)
"The Mexican Cotton Boll Weevil." By W. D. Hunter and W. E. Hinds. *Idem*, *Bull.* 51. Pp. 181+plates xxiii+figs. 8. (1905.)

Amongst predaceous enemies is mentioned a Chrysopa which feeds upon eggs and young larvæ. Wasps appear to do most good. Numerous parasites are also described; one, *Trichogramma pretiosa*, a small hymenopteron, attacks the eggs, others the larvæ; but from what we gather from the report man cannot expect much help from these "natural checks." Remedial and preventive cultural measures are thus fully explained.

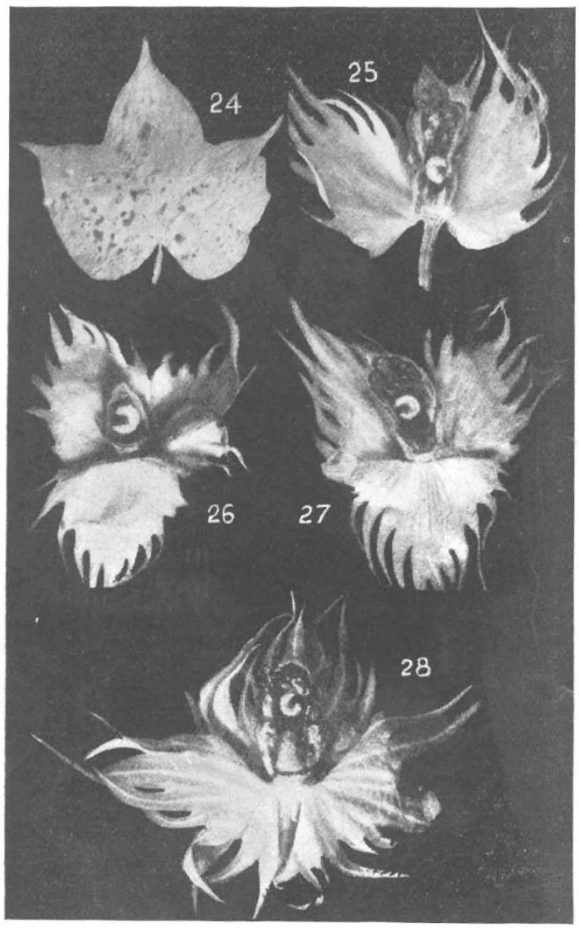


FIG. 2.—Various Results of Larval Work. 24, Leaf fed on extensively by weevils in confinement; 25, full-grown larva in square ready to bloom; 26, full-grown larva in square of usual size; 27, larva full-grown, ovary in square entirely destroyed: 28, larva full grown, ovary untouched—all reduced (original).

The Mexican cotton boll weevil is luckily confined to the United States, Mexico, Cuba, and Guatemala. The authors have been unable to verify the reports that it has been found in Africa or Brazil. If a cotton weevil occurs in the former country it is probably another species, as we see is the case in the Philippine Islands.

The Mexican weevil has the unique record of developing in less than twenty years from an obscure species into a great pest. The authors ably describe its life-history and destructive habits in Texas and elsewhere. In the summary of the life-history it is stated that the egg is deposited by the female in a cavity formed by eating into a square or boll. The egg hatches in a few days, and the footless grub begins to feed, making a larger chamber for itself as it grows. The pupa also occurs in the boll. It is important to note that no other food than cotton has been found.

Some interesting experiments are recorded which tend to show that the weevils are not able to locate their food by smell.

Another series of experiments showed that the weevils prefer Egyptian cotton (Mit Afifi) to the American upland cotton.

Their capacity for reproduction seems appalling, judging from the table given showing the annual progeny of one pair of hibernating weevils, which amounts to 12,755,100!

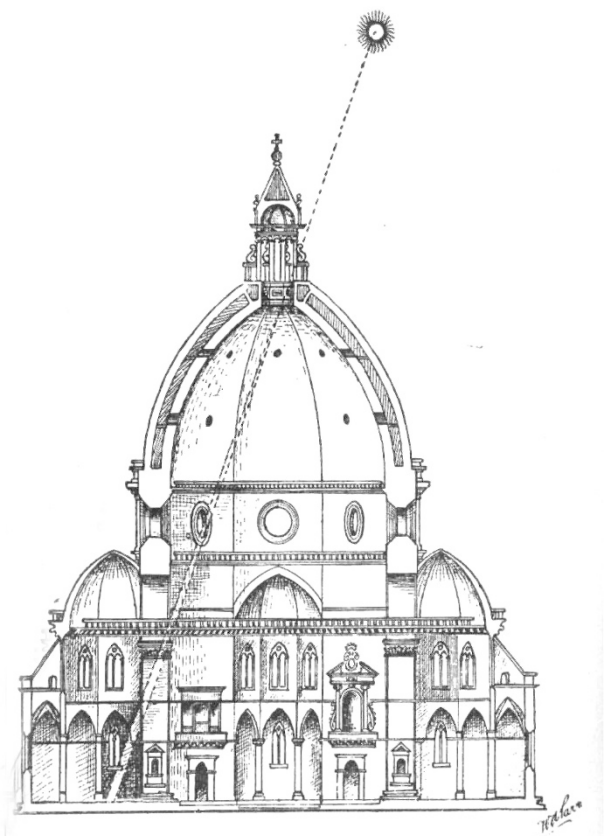
The beetles hibernate in many places, as in infected bolls and stalks, and it is shown that the early destruction of the stalks in the fall is the most effective way to reduce the pest.

Dissemination takes place in cotton in bales and that sent for "ginning." Shipments of seeds are said to be almost certain to carry weevils if coming from infested areas. The report also shows another important point, namely, that the pilosity of the plant affects the progress of the weevil. Parasites do not seem to be of much use. Doubt is cast by the authors upon the benefit of *Pediculoides ventricosus*. Mention is also made of the possible use of the Mexican ants (*Ectotomma tuberculata*), &c. Of great importance to those who import seed is the result showing that bisulphide of carbon is the best substance to clean the seed.

FRED. V. THEOBALD.

THE GREAT GNOMON OF FLORENCE CATHEDRAL.

ALTHOUGH numerous Christian churches are either oriented or adorned with reference to some astronomical phenomenon, there are few of such direct interest to the astronomer as the magnificent cathedral of Florence, which contains a gigantic contrivance for determining the advent of the summer solstice. We refer to the famous gnomon, placed in the dome of that cathedral by Paolo Toscanelli about the middle of the fifteenth century, and described and illustrated by Mr. W. A. Parr in the December number of *Knowledge and Scientific News*.



Lalande in 1765 referred to this instrument as "la méridienne que l'on voit dans la Cathédrale de Florence est le plus grand monument d'Astronomie qu'il y ait au