

United States Department of Agriculture,

BUREAU OF ENTOMOLOGY,

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THE JOINT-WORM.

(Isosoma tritici Fitch.)

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Since the first known serious outbreak of the joint-worm (*Isosoma tritici* Fitch), which occurred in the wheat fields about Charlottesville and Gordonsville, Va., during the years 1848 to 1854, this insect has been reported at irregular intervals and from widely separated localities. While it is known to occur sparingly over most of the wheat-growing sections of both the United States and Canada, and probably does more damage than has generally been attributed to it, its reappearance in the wheat fields of Indiana, Michigan, Ohio, Pennsylvania,

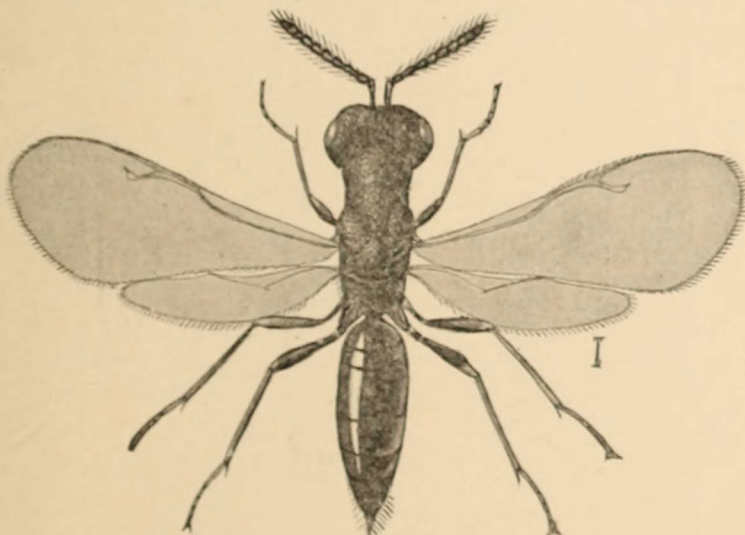


FIG. 1.—*Isosoma tritici*: Adult of the joint-worm. Much enlarged (from Howard).

West Virginia, Virginia, Maryland, and Kansas in 1904, and in still greater numbers in 1905, serves to bring it again to notice. In 1904 some fields of wheat in eastern Ohio were so badly damaged that they were not harvested, and in 1905 a serious outbreak in northeastern Indiana so discouraged some farmers that they questioned the advisability of putting in a crop of wheat at all. In southwestern Virginia the pest was even more injurious in 1905 than it was the previous year. The pest was also very destructive in western Ohio and eastern Indiana during the spring of 1908.

DESCRIPTION OF THE PEST.

The fully developed insect, somewhat resembling a small, winged black ant, is clearly shown, enlarged, in figure 1, its natural size being indicated by a line at the right. The color is black, with joints of legs and feet yellow. The larva or grub is whitish, with brown jaws, the length being about the same as that of the adult, and the form much like that shown in figure 2, which represents the larva of a nearly related species.

LIFE HISTORY.

The insect may be found in wheat stems, in its various stages of development, throughout the year. It lives through the winter as a larva

or grub in cells formed in the stems prior to the ripening of the grain, the adult emerging therefrom in April or May, according to latitude, or some time after the young grain has thrown up stems and several joints have become exposed. The female, using her slender, pointed ovipositor, places her eggs in the stems. The exact position assumed is shown in figure 3,

from a photograph from life by Mr. G. I. Reeves. The eggs hatch and the young grubs, forming cells, feed in the



FIG. 3.—Female *Isosoma* in act of depositing egg in stem. About life size (author's illustration).

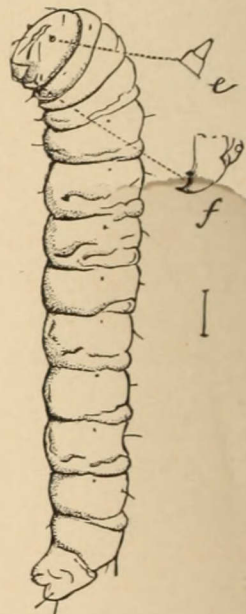


FIG. 2.—*Isosoma grande*: Larva of the wheat-straw worm; *e*, antenna; *f*, jaw. Line at right indicates natural length. (After Riley.)

walls of the stem, reaching their maximum growth by the time the straw becomes fully hardened and ripe. Wintering in the larval state, they pass a short pupal stage and emerge as adults in the spring. While there are both males and females among these insects,

Mr. Phillips of this Bureau has, during two successive years, found that unfertilized females will deposit eggs and that these eggs will hatch out larvæ which develop to adult insects. It is probable, however, that these adults will be found to be largely or all males.

EFFECT ON THE STRAW.

The effect on the straw of the work of the joint-worm is exceedingly variable. Sometimes a distortion occurs like that illustrated in figure 4; at other times the straw is bent or twisted in almost every conceivable shape; again, there will be no enlargement of the straw whatever; or there may be large galls or excrescences, as it were, bursting out of the base of the sheath at one side, some of these abnormal growths having pseudo-rootlets extending downward from their lower extremity. Sometimes the straw will make about normal growth and the hardened sections will be restricted to an inch or thereabouts just above the lower joints; and, again, the growth will not exceed 3 or 4 inches, often not heading at all, or with aborted head and with the straw galled or hardened to the base of the head. In some cases there is no outward indication of attack whatever, the affected part being wholly inclosed in the sheath, and when this last is removed the presence of the cells is indicated only by a slight discoloration, and frequently by a few small, more or less irregular, elevated ridges.

In thrashing the grain the hardened portions of the straw, as shown in figure 5, break up into pieces of from half an inch to an inch or more

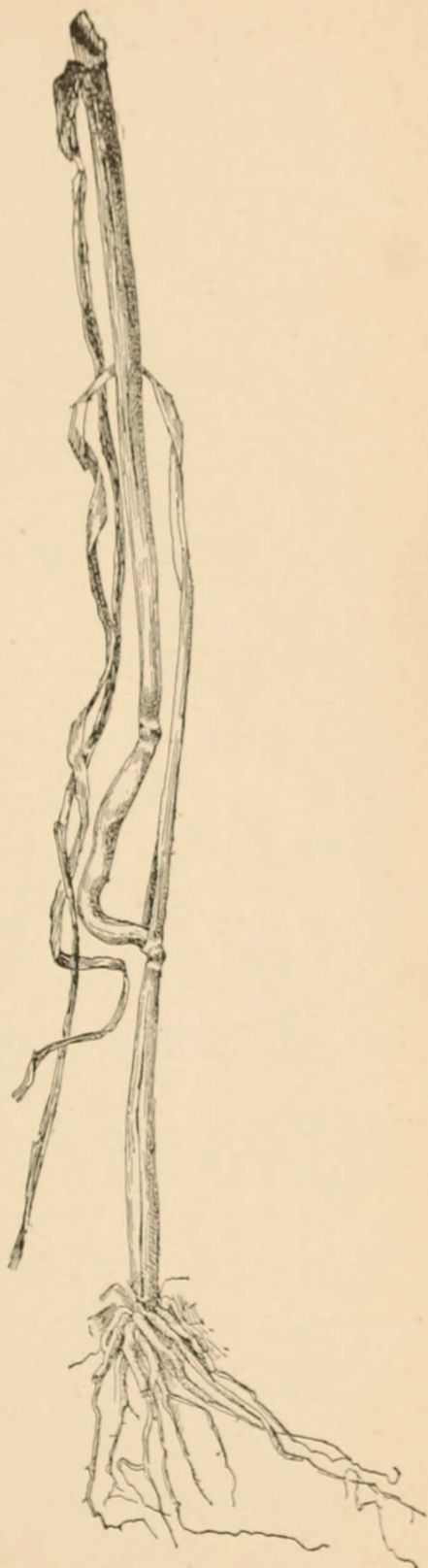


FIG. 4.—One effect of the joint-worm in wheat straw. (Author's illustration.)

in length, many of which do not go over with the straw and chaff, but remain with the grain. The presence of these bits of broken straw in the grain is frequently the first evidence the farmer has seen of the occurrence of the pest in his fields. Millers and elevator men note them also, and in sections where the pest has committed serious depredations several bushels of these hardened bits of straw are found after each day's cleaning of the grain.

EFFECTS ON THE KERNEL.

The wheat heads from infested stems are foreshortened, and the kernels thereby necessarily reduced in both size and number, and in case of severe attack they become shrunken.

NATURAL ENEMIES.

Natural enemies of the joint-worm are quite numerous, and most of them have the advantage of being double-brooded, whereas the joint-worm has but one generation annually.

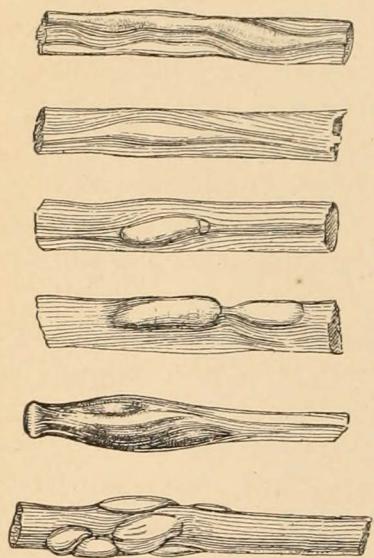


FIG. 5.—Bits of hardened straw remaining with the grain after thrashing. (Author's illustration.)

Among the most efficient of these are two rather common species of insects. One of these, almost as big as the *Isosoma* itself, with dull metallic thorax and yellow abdomen and with long ovipositor, is *Ditropinotus aureoviridis* Crawford, and the other, smaller, darker colored, and slender, also somewhat resembling an *Isosoma*, is *Eupelmus allynii* French. The writer reared also another species in Ohio, *Websterellus tritici* Ashm., which has similar habits.

A somewhat similar insect with metallic body and yellow abdomen, *Stictonotus isosomatis* Riley, is very efficient in destroying the larvæ in the straw. *Homoporus* (*Semiotellus*) *chalcidiphagus* Walsh and Riley, and beyond a doubt other chalcidoids, are also instrumental in holding the pest in check. These are all small four-winged flies, and a number of additional, undescribed forms have been discovered.

The larva of a small, slender, black and yellow carabid beetle (*Leptotrachelus dorsalis* Fab.) crawls up, descends into the stubble, and devours the *Isosoma* larvæ, but unfortunately its sense of taste seems to be too obtuse to allow it to confine itself strictly to *Isosoma*, and as a consequence it devours parasites as well as host. A mite, *Pediculoides* (*Heteropus*) *ventricosus* Newp., is also an enemy, gaining access to the larvæ precisely as does the beetle larva previously mentioned.

PREVENTIVE MEASURES.

There are no known remedies for the joint-worm, but there are several preventive measures that are not impracticable and are reasonably efficient.

In the midst of the outbreak in Virginia, previously mentioned, a "Joint-worm Convention" was held at Warrenton, in that State, to devise means for controlling this pest. This body recommended a better system of farming, the use of guano and other fertilizers to promote a rapid growth and an early ripening of the grain, and the burning of the stubble, all of which are as advisable to-day as they were at that time. The most serious ravages are observed on thin or impoverished soils, especially along the margins of the fields infested. Anything, then, that tends to add vigor to the young growing grain will constitute a preventive measure. Burning the stubble, where this is practicable, is, of course, most efficacious, but over the larger portion of the territory ravaged by this pest it is customary to seed with grass after wheat, and under this condition burning over the stubble field is impossible. Such fields should be raked over with an ordinary hay rake, and the loosened stubble removed and burned before the adults have emerged in the spring. If, however, the grain is cut low at harvest, and the straw passed through the stables as bedding for stock during the winter, thus becoming saturated by liquids and more or less thoroughly composted, the treatment would seem sufficient to destroy the *Isosoma* larvæ so that few, if any, would develop adults the following spring. In case of bedding for horses, it seems quite probable that if any larvæ at all survived the thrashing machine, the heat from the decomposing manure would develop them prematurely. However, there has been no experimentation exactly along these lines, and according to a press bulletin^a by Prof. R. H. Pettit, of the Michigan Agricultural College, serious injuries have followed the year after application and plowing under of barnyard manure in the fall before the wheat was sown. In this case the manure would necessarily be fresh and the bedding of straw of the same season's growth, otherwise the adults would have already emerged. This would be a proposition quite different from that of allowing the stable manure to accumulate during the winter and applying it in the spring elsewhere than to the wheat fields, or even of applying it to wheat fields before plowing, months after the larvæ surviving the effects of the stable had developed and escaped. The one might destroy all or nearly all larvæ in the straw, and the survivors would emerge about the stables or in the barnyard; while the other method, simply to take the straw with the living larvæ present from an old field, move it

^a Mich. Agr. Col. Exp. Sta., Press Bull. No. 15. The Wheat Joint-Worm.

through the stable, cart it out on a new field, and plow it under, is one that the farmer should evidently be careful to avoid.

Exactly in this connection, an assistant, Mr. Charles N. Ainslie, while waiting between trains in the city of St. Louis, Mo., found at the corner of Sixteenth and Locust streets a pile of bricks to be used in the erection of a building. These bricks were stamped "Massillon, Ohio," and were packed in straw which the chief contractor stated came with the bricks from Ohio. This straw contained larvæ of this species which later on transformed to adults, but the latter did not emerge from the straw.

In the past it has always been thought necessary, as a precautionary measure, to burn the infested bits of hardened straw that break up

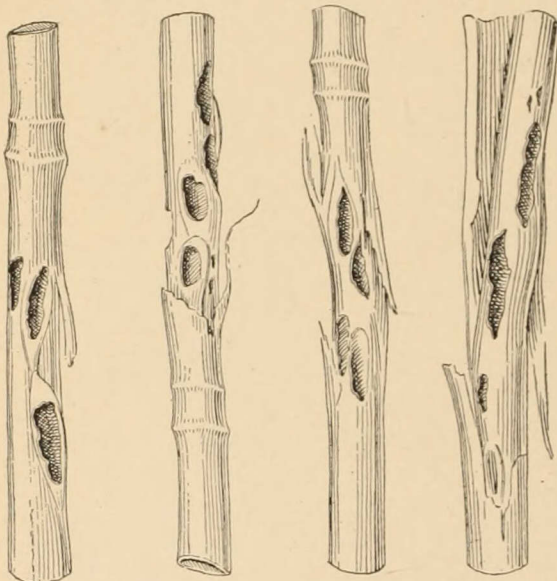


FIG. 6.—Wheat straws injured by the joint-worm (*Isosoma tritici*), from which the joint-worms have been removed by some beneficial animal, perhaps the short-tail shrew (*Blarina brevicauda*). (Author's illustration.)

in thrashing the wheat, many being carried out with the grain instead of going over in the straw. Several experiments in rearing adults from large numbers of these broken bits of straw (fig. 5), collected about elevators and thrashing machines, has shown that almost all of the larvæ of both *Isosoma* and parasites are killed, probably by the concussion of the cylinder of the thrasher. In some cases we have been able to verify these experiments by collections of stubble from fields in the vicinity of these elevators. So far as we have gone into the investigation everything indicates that the

danger from these broken bits of hardened straw, or even from the straw itself, is of too little importance to be worth consideration. Prof. R. H. Pettit, of the Michigan Agricultural College, and Mr. W. J. Phillips, of this Bureau, in 1906, found in northern Indiana great numbers of straws affected by the joint-worm, where the enveloping sheath had been torn away, the galls formed by the larvæ deftly eaten away, and the joint-worms missing. In no case was the entire gall gnawed away, but just enough of the walls immediately over the larva to make possible the removal of the latter (fig. 6). While we have not been able to get definite information as to the identity of this decidedly beneficial animal, suspicion seems to point to the short-tail shrew (*Blarina*

brevicauda) as the species to which credit should be given, and probably much of the work is done while the grain is in shock.

Rotation of crops is advantageous, because it necessitates the migration of adults from one field to another, and if this takes place in stormy weather or during high winds, many of the migrants will be killed or blown astray. It is easily seen that where infested straw is applied to a new field prior to sowing to wheat, this migration of adults would not be made necessary.

The sowing of early ripening varieties is also beneficial.

Approved:

JAMES WILSON,

Secretary of Agriculture.

WASHINGTON, D. C., *July 16, 1908.*

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