

NOTES ON THE FUNCTION OF THE FORCEPS OF
EARWIGS.

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"Of what use are the pincers?" is a question the writer has been asked many times. Most text-books say they "are either used as claspers in mating or as an aid in folding the wings." This answer seemed inadequate. Last summer at the Indiana University Biological Station observations were made on the use of these "pincers" or forceps. Two large species of earwigs collected in the region of St. Petersburg, Florida, were used (figs. 1 and 2) and an effort was made to secure typical action photographs. This was rather difficult, though, as subdued light was necessary to get the earwigs to react normally, and their movements were very rapid.

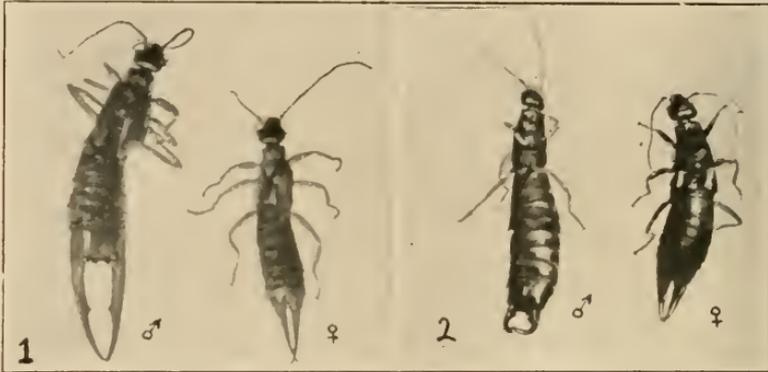
The writer recalls that his introduction to the question of the function of the forceps came while making dissections of some Louisiana earwigs. Some of the large insects pinched so vigorously that the points of the forceps nearly pierced the skin. Although the effect of such an attack on a person was of trivial consequences the force would probably have been great enough to crush an insect as large as the earwig. Another indication of strength was seen in the large muscles that control the forceps. It seemed unusual that such powerful organs had developed merely as claspers in mating or as aids in folding the wings, especially since many of our earwigs do not fly. Figures 1 and 2 show the powerfully developed forceps in both sexes.

Another item that early attracted attention was the number of earwigs, especially males, that failed to survive the effect of shipping. The dry forceps of several males and a few females would be found in each shipment (fig. 4). Usually the sexes were separated as soon as unpacked and placed in large mouth bottles. It was from these segregated males that the truth of the high fatality of the males during shipment was learned to be due to cannibalism.

The method of attack was always with the forceps and the attacking earwig would either flip his body side-ways or run back into his adversary using his forceps all the time in scissor-like strokes. The earwig thus attacked would counter with his forceps and if active and strong enough the battle would resolve itself into a sparring match where the forceps were used both as weapons of offense and defense. Not only are the forceps used as pincers but many times the posterior part of the abdomen is raised, lifting the opponent clamped in the forceps, entirely off his feet. Occasionally the forceps with their victims are rotated through more than ninety degrees which often permits a more favorable hold beyond the heavily armored abdomen. The abdomen in all species examined was the largest in the region of the forceps and tapered toward the thorax (figs. 1 and 2). As soon as the pincers were clamped on an opponent the earwig would start pulling away as shown in figure 5. This gave protection to its head and thorax and often threw the other insect into a position where another

thrust with the forceps would mean defeat for the one being dragged. When an adversary was injured or held in a helpless position so far as the forceps were concerned the winner would twist around and use his mandibles in the softer parts of the victim's body. Figure 6 shows an earwig with a cricket in this condition.

When disturbed the earwigs often raise their forceps in a threatening manner that reminds one of the scorpions. This position seems to



Figs. 1-2. Mounted specimens of the two types of earwigs used in the experiments. Note the powerful forceps. Slightly enlarged.

give protection to the thoracic region and is favorable to a more accurate thrust with the forceps. When this method of attack is used the earwig raises the posterior part of its thorax to an angle of nearly forty-five degrees so that the forceps are brought to a location directly above the head. While running forward in this position the thrust is made in a slightly lateral direction (fig. 3) enabling the earwig to turn the

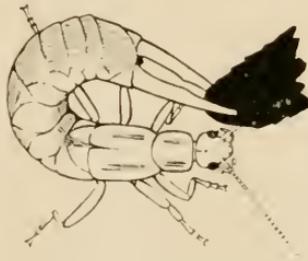


Fig. 3. A male earwig in a scorpion-like position of attack. The forceps were in a position above the head until the "stroke" was made in a lateral direction.

anterior part of its body into a place of safety but still giving battle with the pinching thrusts of its forceps. Some observers have attributed these scorpion-like actions to mimicry but this does not seem to be the case.

The males are more pugnacious than the females but cannibalism is very common among females placed in containers with only a small amount of food. Figure 7 shows a female eating a cricket that it has

just killed with its forceps. So viciously did this female attack the cricket that one of its large legs was torn off with the first blow.

Various insects and small crustacea were used in experimenting with the earwigs, but the cricket was chosen as the most favorable.

With the exception of the most pugnacious the males are very timid and are the first to scamper away when disturbed. The young males are especially timid and apparently stay in hiding most of the time. This probably accounts for the few very young males collected. Most of the older males were battle scarred and it was seldom that a specimen did

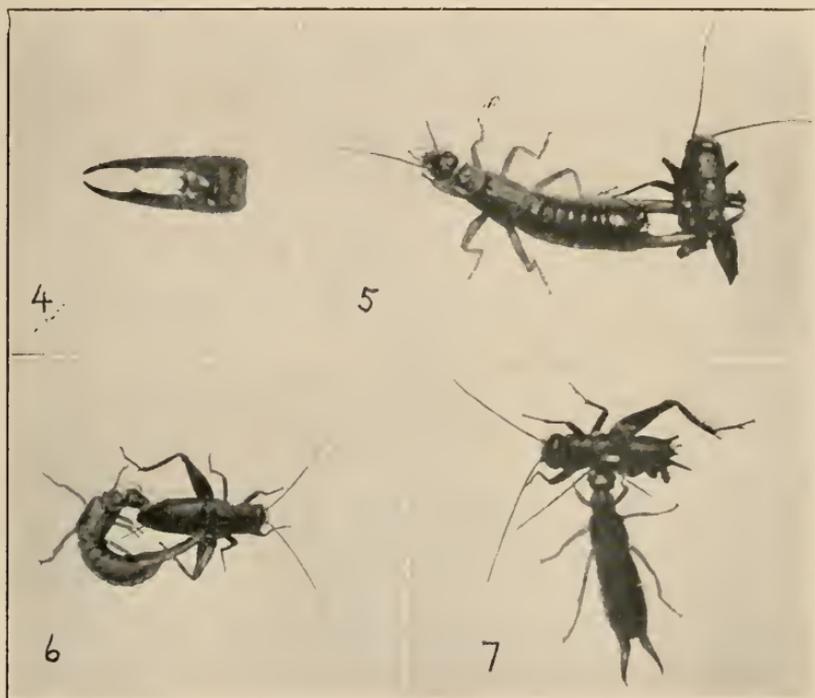


Fig. 4. The forceps of a male. All that was left of a victim of cannibalism.

Fig. 5. A male dragging a cricket which it has killed with its forceps.

Fig. 6. Eating the prey, a cricket, that is being held by the forceps.

Fig. 7. A female eating a cricket that it has just killed. The forceps are held in a characteristic position.

not lack part of an antenna or parts of one or more legs. Mr. N. P. Fry who collected the Florida earwigs said he was able to collect more than three times as many females as males. The ratio of males in shipment, including those killed during shipment, was about the same in all species used. The fighting among the males probably reduces their numbers but the difficulty in collecting them due to their being more timid than females is a more reasonable answer to the question of sex ratio in collection.

Another indication that the forceps are important in defense as well as attack is the position in which they are held when not in use. Figure 7 shows a female with the forceps in a characteristic pose. Both

sexes are very often seen hiding with only the forceps and posterior part of the abdomen protruding from the cover. When an earwig passes such a hiding place very often these forceps push out and close and open in a threatening manner that cannot be mistaken for sex attraction. Very often the passing earwig offers fight and several such combats have been observed that had fatal endings.

A few cases of the earwigs in sexual embrace were observed but in no instance could the forceps be seen to act as claspers. The position of the forceps during mating, though probably not of any especial advantage to the earwig, might easily have been mistaken for similar structures as found in other animals. Whether the forceps were formerly claspers which have developed into organs of combat in our modern earwigs is a question the writer is not prepared to discuss. Regardless of the former importance of the forceps or their present function in primitive forms the writer's conclusion is that they are primarily weapons, developed and used as such in all forms observed.

Summary of Observations.—1. The forceps of American earwigs are well developed and controlled by powerful muscles. Their strength is nearly sufficient to pierce the skin of a person. (2) The male earwigs are very pugnacious. (3) Earwigs are cannibalistic, especially the males. The forceps are then the chief weapons of attack. (4) The females are more apt to become cannibalistic when food is scarce. (5) Males have been observed to attack and devour females. (6) Earwigs assume a position in attack similar to the scorpions, due to convenience and effectiveness rather than mimicry. (7) They protect their head and thorax but keep the forceps in readiness for defense if disturbed. (8) Earwigs are nearly omnivorous but may attack as prey insects or small crustacea, using their forceps. (9) The forceps are often used in holding the prey while it is being eaten. (10) In no case were the forceps used in folding the wings. (11) The forceps are of little if any importance as claspers in mating.