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Abstract Approved (Major Professor)

In the process of collecting material for the Ph. D. thesis a new species of Torymus was found parasitizing midge belonging to the family Itonididae. The economic implications concerned within this relationship were of sufficient magnitude that a problem could be worked out for the master's thesis.

The Itonididae host belongs to the genus Dasyneura and works in the seeds of Thuja plicata and Chamaecyparis lawsoniana. It overwinters in the last instar larva inside a double silken white cocoon. Pupation commences during January. The first adults emerge in the third week of March. Eggs are laid on the upper surfaces of the cone scales. When the larva emerges from the egg, it proceeds between the cone scales to the base of the seed where it feeds until shortly after the beginning of August. At this time the silken cocoon is spun and the larva overwinters in its fourth and final instar.

The major parasite of this fly, Torymus festivus also overwinters in the last instar larva. During the 1st week of May, the last instar changes to the pupal stage. The emergence date for the adult was May 14th in the spring of 1948. Mating takes place almost immediately and eggs are laid after the 20th of May. Under laboratory conditions, it takes three days for the egg to hatch. In approximately three weeks, this generation reaches the pupal stage. The adults of this first generation emerge by August 24th. The 2nd generation reaches the hibernation stage, the last larval instar, by October 1st.

Torymus festivus accounts for 60 per cent of its host, fungus 16 per cent and miscellaneous parasites, 3 per cent.

Torymus festivus is described as a new species and is most closely related to T. coloradensis. The antennal segments of the latter are all longer than wide, whereas in the former the segments are all subquadrate. The description, together with type locality, host, location of types, and notes are to be published elsewhere at a later date.

TORYMUS FESTIVUS n. sp. A PARASITE OF DASYNEURA sp., (HYMEN: CHALCIDOIDEA TORYMIDAE)

by

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During the preparation of distributional records, the following kindly gathered together cones of Thuja plicata Don. and Chamaecyparis lawsoniana Parl. and sent them in for inspection: Mr. Louis G. Gentner; Dr. Wayn W. Wells, Southern Oregon College of Education; Mr. Frederick T. Lynd, State College of Washington; Dr. H. J. Lowe, Chico State College, California; Mr. Vincent D. Roth, Mr. E. A. Dickason, and Miss Jean Duspiva, Oregon State College.

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TORYMUS FESTIVUS n. sp.
A PARASITE OF DASYNEURA sp., (HYMEN: CHALCIDOIDEA TORYMIDAE)

PART I. INTRODUCTION

During a collecting trip in the late summer of 1947, numerous minute, circular holes were noticed in cones of Thuja plicata Don. Little attention was paid to these holes at the time, for the cones were still quite green. As the cones began to turn brown, the scales were broken away and inspected closely. At the base of certain scales, small white cocoons were found either on the inner or outer surface of the seed (Photo VIII). Several of these cocoons were opened and their contents inspected with a hand lense. In most, a rich orange, dipterous larva lay preparing for hibernation, but in some cocoons, the larva carried minute parasitic larva on its body. However, no particular significance was attached to the parasites at that time. About a week later, August 23, 1947, close observation was made of the cone surfaces. Great numbers of small, blue-green torymids were found carrying out searching patterns over the cones. Many of these insects had already inserted or were in the process of inserting their ovipositors through the cone scales. When the females were disturbed, the ovipositors were removed quickly and the parasites disappeared in a flea-like manner. Sweepings were immediately made on Thuja plicata. In two sweepings over one hundred specimens of each sex were collected. The following day, August 24, several species of conifers over the campus were swept. C. lawsoniana and varieties of the Port Orford Cedar, however, were found to be the only other trees

harboring these insects. The horticultural varieties of C. lawsoniana had far less parasites than either the native parent C. lawsoniana or Thuja plicata. On one tree of C. lawsoniana, an additional one hundred specimens of the torymid were taken.

After the U. S. National Museum designated the dipterous host as Dasyneura sp. (Itonididae) and Torymus festivus as a new species, investigations were started to discover the economic relationship and importance of this complex.

ECONOMIC IMPORTANCE. Both T. plicata and C. lawsoniana are commercially important trees and any limiting factor in the reseeding of those trees would have economic implications. During the inspection of cones from various infested areas, all stages of destruction of the seeds were found from no seeds being damaged to all seeds being destroyed on the same tree. In the latter cases, cones were found to be somewhat distorted. It could not be ascertained how many cones contained no viable seeds, nor in a problem of this kind could the per cent of nonviable seeds be determined since the laboratory germination of these seeds is extremely difficult. One would not be able to decide whether unsatisfactory germination conditions or feeding insects had prevented germination. Observations made during distributional collections revealed no seedlings of either species of tree. However, the data must be considered incomplete since the range covered by the author was not sufficient for the preparation of such information. Sudworth 1908[18], states that there appears to be intermittent years of reseeding of both T. plicata and especially C. lawsoniana. There is the possibility

that the alternate building up of the host of T. festivus and the natural biological control by this parasite would cause this condition. However, records at hand show no collection of either the parasite or host beyond 1942.

When this work was commenced, the original intent was to work out the life history of the parasite, T. festivus and to describe it as a new species. After completing a certain amount of research, four other species of parasites, Eurytoma stigma Ashm. (Eurytomidae), Tetrastichus holbeini Gir. (Eulophidae), a new species of Cyrtogaster (Pteromalidae), and an undetermined species of Pteromalidae, were found to be involved in this host-parasite relationship. It was also found necessary to work out the life history and development of the host of these parasites. Wherever convenient, records of these other parasites have been kept and will be discussed.

Although this parasite, T. festivus is a new species and its host, Dasyneura sp. probably new, a review of the literature of other parasite-host relationships of this nature should aid in correlating the economic importance and potential of such a relationship.

Eighty-two species of Torymus are known to be parasitic on members of three different families of Diptera (Breland, 1938[3]). These families include for the most part the dipterous members of the gall making groups, Itonididae and Trypetidae. Members of thirteen genera of the gall midges, Itonididae, are attacked by Torymus. Included in this number are three species of Dasyneura gall makers parasitized by two species of Torymus[13]. The species of Dasyneura with which we are concerned here is not a gall maker,

although certain specialists might consider its work resulting in a gall-like formation of the seed (Photo VIII). This consideration will be discussed more fully under the biology of the host. To my knowledge, the host-parasite relationship in this paper is the only one of its kind known at present. Doubtless many other such relationships exist, however, the author is limited to the few species of conifers in the western part of this state producing the type of cone found on T. plicata and C. lawsoniana. The globular type cone produced by members of the genera Cypressus and Juniperus should be excellent sources of similar material.

NATURAL CONTROL OF DASYNEURA sp. There is an average of 50 or more eggs of Dasyneura sp. laid per cone in C. lawsoniana, however less than half of these eggs ever reach the second instar larva. This mortality is a condition difficult to explain. Many of the eggs appeared to have been fed upon by some predatory organism while other patches of eggs simply shriveled after formation of the embryos and failed to produce larvae. The greatest mortality of larvae was in the first instar during their travel from the point of deposition of the egg to the base of the seed. Finally, during the first few instars, observations were made on what appeared to be cannibalism. In several instances, only when the larvae were too crowded, a smaller larva was found at the mercy of a larger one. Prolonged observation failed to reveal the true nature of this association. Of the remaining 20 to 24 larvae per cone which reach maturity, approximately 79 per cent are destroyed

by three sources: T. festivus accounts for about 60 per cent, fungus 16 per cent and miscellaneous parasites, 3 per cent. These results were obtained during the meteorological conditions existing for the fall, winter and spring of 1947-1948. During this season, at least, it is obvious that T. festivus is the greatest single factor in the control of this destructive Itonididae.

DISTRIBUTION. Considering the records received, it is relatively safe to say that generally, Torymus festivus is found wherever its host is found and that this species of Dasyneura is distributed in all the areas where either Thuja plicata or Chamaecyparis lawsoniana grow in nature. Inspection of cones of these two conifers show the presence of T. festivus and its host in the following general areas: Northwestern California in Del Norte county, throughout Oregon from the Cascade Mountains to the coast, East Central Washington, and Northern Idaho. Cones from Western Montana, Western Washington, British Columbia and Alaska were not seen, but undoubtedly this complex exists at least in most of these localities. (For the exact collected localities, see the notes at the end of the description of T. festivus.)

PART II. DESCRIPTIONS OF THE STAGES AND LIFE HISTORY OF DASYNEURA sp.

The species of Dasyneura infesting the seeds of T. plicata and C. lawsoniana overwinters as the last instar larva in a double, silken, white cocoon at the base of and between or on either side of the seeds. This larvae varies between 1.5 mm. and 2.5 mm. in length and from slightly less to a little more than 1 mm. in width (Photo VII). It is light to deep orange in color. The body, exclusive of the head, is composed of eleven segments. On the ventral side of the body immediately posterior to the head is a narrow, forked sclerotization known as a collarbone, approximately equal in length to the segment on which it is found. These larvae commence to pupate in the middle of January. They lie in their cocoons with the head toward the apex of the cone and the dorsal surface toward the outside of the cone. The metamorphosis from the larvae to pupa takes about two weeks. Half of the larvae complete pupation by the end of the first week of February. The pupae average 2.25 mm. in length and 1 mm. in width (Photo VI). The head, thorax and their appendages are black while the abdomen maintains the orange coloring of the larva. When the pupa is mature, hairs and setae can be seen covering the abdomen. The first adults emerge during the third week of March about two weeks after the staminate cones of its host appear on the trees and continue to emerge until the 15th of April. The adults are 2 mm. long with extremely long legs covered with scales and hairs (Photo V). Wings and abdomen are covered similarly. The general body color is light, dusty orange.

The appendages are a light dusty brown while the sclerites of the thorax are dark brown to black. Mating takes place very shortly after emergence and the females commence laying eggs when the cones are about 4.5 mm. in width or during the first week in April. Egg laying ceases about the 22nd of April and by April 27th, no adults can be found in nature. The eggs are laid in groups of from one to fifteen or more usually on the upper surface of the cone scales. Occasionally an egg may be placed in the opening formed by the stigma of the young ovaries of the cone or in cracks around the leaves at the base of the young cone. There may be from 10 to 50 eggs deposited on each cone. The eggs are 0.20 mm. long, cigar-shaped and a light translucent orange in color (Plate XI). Within one week the embryo is fully formed and is seen by the concentration of dark orange globs of pigment toward the anterior and posterior ends. The eggs hatch at the end of the second week of April and the first instar larva is very slightly longer than the egg. By the 27th of April all the eggs have hatched. The larva very slowly works its way to the junction of the cone scales and down into the cone toward the base of the seed. Feeding commences on the seed or cone tissues as it enters the cone. By the 22nd of April, the larva has traveled half the length of the seed constructing a small trough or burrow, the surface of which turns brown. This first instar larva reaches the base of the seeds during the first week of May. There are two fat bodies formed in each segment and it has reached a length of 0.45 mm. Near the end of May and the 1st of June, the second instar begins to appear. Shortly after, the third fat

body forms in each body segment. The second instar may be recognized by two small black masses which form ventrally just posterior to the head. The second instar is approximately 0.6 mm. long. At the end of the second week of June, the body length is 0.9 mm. The larva has prepared a small pocket in the seed. Part of this pocket is caused by the actual feeding of the larva and the rest is caused by normal growth of the seed somewhat away from the immediate feeding area. These pockets in the seed continue to become larger by these two processes. At the end of June, just before the larva moults to the third instar, fat bodies are formed throughout the entire body. Ninety per cent of the larvae seen by the 2nd of July were in the third instar stage. This instar is recognized by a rather heavy translucent spine protruding from the lateral edge on each side of the body. The fourth and last instar appears during the second week of July. At this time the pockets or pits in the seeds (Photo VIII) are more than large enough to accommodate the fourth instar which will reach 2.5 mm. in length and over 1 mm. in width. The last instar is recognized by the appearance of the collarbone mentioned above. During the first week of August the overwintering larvae commence to spin their cocoons and by the 15th of August all the larvae have prepared themselves for hibernation.

PART III. BIOLOGY OF TORYMUS FESTIVUS

DESCRIPTION OF THE EGG. The egg of T. festivus is 0.58 mm. in length and 0.17 mm. wide (Plate X). It is largest toward the anterior end and tapers gradually to a point posteriorly. The anterior end becomes restricted rapidly and ends in a prominent projection. The surface of the egg is smooth without any evidence of minute nodules or projections as found on many of the eggs in members of the same family or Tetrastichus holbei Gir., another parasite of the same host.

DESCRIPTION OF THE LAST INSTAR LARVA OF TORYMUS FESTIVUS. The last instar larva is cylindrical in cross-section, 1.6 mm. to 2.2 mm. in length and 0.83 mm. to 0.91 mm. in width (Plate VIII). The head capsule measures between 0.31 mm. to 0.40 mm. across. The head viewed from the front (Plate IX) bears three tubricles, one of which is quite prominent just above the fine uni-dentate mandibles and two fine tubricles slightly below an imaginary line drawn halfway between the vertex and the ventral edge of the head and halfway toward the center from the lateral edges. There are three pair of long setae along the lateral edge, one pair near the dorsal margin and one pair about halfway between the latter and the paired tubricles. The remainder of the facial setae are minute paired spines hardly distinguishable under compound magnification. Abdominal segments II-X bear prominent, circular spiracles. The dorsal surface of all segments except the first bear very short spines. The dorsal surface of the first segment has several long,

heavy spines. The spines become progressively heavier and longer toward the ventor of all segments. The setae extending from the ventral surface have a fine barb at the end. Abdominal segments III to VIII are approximately the same size while the segments IX to XIII become progressively smaller. Segments I-II are considerably wider than the others.

DESCRIPTION AND DEVELOPMENT OF THE PUPA Female: The pupae is between 1.5 mm. and 2.2 mm. long and 0.57 mm. to 1.1 mm. wide (Plate V). The head capsule is 0.45 to 1 mm. wide. The ovipositor usually extends beyond the center of the scutellum. When the ocelli become darkened they form somewhat of a crescent with squared corners. The epicranial suture is apparent during the entire stage except when the pupa is completely darkened and the adult is ready to emerge. The body generally is somewhat depressed.

Development: Just before pupation, the larva clears its body, after the hind intestine and anus have developed, of all waste products. At first, the body becomes slightly constricted marking off the throax from the abdomen. Shortly the appendages begin to form ventrally and the abdomen lengthens. The legs appear first and are followed by the antennae and wings. By the time the wings and head take their shape, a large mass of tissue forms on the posterior end of the body, dorsally. The abdomen swells and by writhing movements the skin is split over the head and worked off in about 10 minutes. From the mass of tissue just mentioned, the ovipositor commences to grow up over the abdomen assisted by great

movements on the part of the body. The complete growth of the ovipositor takes slightly more than 30 minutes. Complete pupation takes less than 18 hours under laboratory conditions.

Male: The male pupa is from 1.2 mm. to 1.95 mm. in length and 0.50 mm. to 1.2 mm. wide (Plates VI and VII). The body is somewhat more flattened than in the female. Except in sexual characters, the male pupa is like that of the female.

Development: As in the female except for the growth and development of the ovipositor.

DESCRIPTION OF TORYMUS FESTIVUS n. sp. (Photos I-IV; Plates I-IV.) Female: Length 2.5 mm.; ovipositor 2.2 mm. Body blue-green with purple reflections on propodeum and dorsal surface of abdomen. HEAD: Head transverse, wider than thorax, slightly wider than long as viewed from the front; front green with lateral area beyond clypeal region blue with yellow reflections near eye margins; face below antennae with long, delicate hairs becoming short above; two fine carina extending upward from margin of mouth curving slightly mesad and about as long as the basal distance between them; a prominent medium carina; antennal depressions deep, bright shiny blue; scape somewhat compressed, not reaching median ocellus, yellow beneath and fuscus above; pedicel and ring segment infuscate; funicle and club brown with light brown longitudinal sense organs extending almost entire length of each segment and beyond apical margin of each funicular segment; all segments of funicle sub-quadrate

increasing in width toward the tip; ocelli brownish-red; eyes red.

THORAX: Thoracic dorsum blue-green, minutely punctured, moderately clothed with short whitish hairs anteriorly to very long whitish hairs posteriorly on scutellum; parapsidal furrows distinct; scutellar cross-furrow absent; propodeum weakly reticulate, shining bluish-purple anteriorly to purple posteriorly, green laterally; fore coxae blue-green with apex yellow, middle and hind coxae green; basal and apical portions of femora and tibia honey yellow, median portions brown with metallic green reflections from hind femora; front tibial spur bifid as seen under high power; first three segments of tarsi approaching white, the last two dark brown; wings moderately ciliate; veins testaceous, a small crescent-shaped thickening one-fourth the distance from the base of wing in middle; stigmal vein petioled.

ABDOMEN: Abdomen longer than thorax; dorsal surface of first tergite smooth shining bluish purple, without hairs; dorsal surface of tergites two and three smooth shining brassy black, lateral surfaces blue-green, finely reticulate, sparsely clothed with silky white hairs; fourth segment blue, moderately reticulate with long white hairs laterad; segments five and six bluish-green with yellow reflections; reticulations and hairs same as for segment four; the sterna infuscate; pygostyle possess one heavy and three fine setae of approximately equal length.

Male: Length 1.95 mm. Scape short, light brown basally,

the remainder being dark blue-green; all segments of funicle much wider than long; the longitudinal sense organs extending beyond apical margin of each funicular segment; thorax darker blue-green with purple reflections; abdomen dark brown with bluish-reflections dorso-basally, the remainder dorsally, yellow-green with reddish reflections, median portion of hind femora bright blue-green; in other respects, the male is like the female. Type locality: Campus of Oregon State College, Corvallis, Oregon. Host: Dasyneura sp. infesting seeds of Thuja plicata Don. and Chamaecyparis lawsoniana Parl.

Described from 165 females and 136 males collected by sweeping T. plicata and C. lawsoniana, August 23 and 24 and September 27, 1947; 5 females and 10 males sweeping, Corvallis, Oregon, June 2 and 11, 1948; 2 females and 4 males reared in laboratory during April 1948; 1 female from Cascadia, Oregon, collected in cones April 18, 1948, and emerged in laboratory May 7, 1948; 1 female from Estacada, Oregon, collected in cones March 26, 1948, emerging in laboratory on May 11, 1948; 2 females and 1 male collected in cones at Port Orford, Oregon, on May 30, 1948, and emerged in laboratory on June 3, 1948; 19 females and 8 males collected in Ashland, Oregon, in cones on May 18, 1948, and emerged in laboratory from May 23 until June 15, 1948. Specimens not included in the type series were also found in cones from 10 miles northeast of Pullman, Washington; Oregon City, Oregon; 10 miles west of Philomath, Oregon, and 12 miles east of Cave Junction, Oregon. In the material inspected, specimens were not found in cones from the following localities; Campus of Chico

State College, Chico, California; and Hillsboro, Oregon.

Location of the Types: The female type, the male allotype, 50 female and 50 male paratypes are in the California Academy of Sciences. 12 female and 12 male paratypes have been deposited in the following institutions: U. S. National Museum; Southern California Academy of Sciences; Museum of Natural History, New York; Museum of Comparative Zoology, Cambridge, Mass.; State Natural History Survey Division, Urbana, Ill.; British Museum; Cornell University; State College of Washington, and the Oregon State College Collection. The following private persons have received 6 female and 6 male paratypes: Dr. Osmond P. Breland and Dr. W. W. Jones. 43 female and 7 male paratypes are in the author's collection. There is a total of 201 female and 165 male paratypes.

It is to be expected that from such a large series of specimens, one would find considerable variation in size and color. The following were the variations found while the description was being drawn up: The general color of the male and especially the female varies from green with a few slight yellow reflections to rather dark purple. In one particular specimen, also included in the type series, the lateral and ventral body regions and coxa were a brilliant ruby red. In other respects, there can be no doubt that this specimen belongs to T. festivus. The femur and tibia of both sexes varied from honey yellow to brown to bright blue-green. In the female, the length of the body varies from 1.65 mm. to 2.9 mm. and the ovipositor from 1.4 mm. to 2.4 mm. In only one instance was the

ovipositor found to be the same length as the body. The average body length is 2.14 mm.; the average ovipositor length, 1.85 mm. The body of the male varies in length from 1.3 mm. to 2.3 mm., the average being 1.9 mm.

Torymus festivus is most closely related to Torymus coloradensis whose host is Cecidomyia, species gall on Artemisia, species[13]. T. coloradensis, however, differs in the following respects: body generally green, all segments of the funicle are longer than wide, mesepimeron very deeply incised, coppery, and wings strongly ciliated. It is interesting to note that the hosts of both parasites belong to the same family of Diptera.

LIFE HISTORY OF Torymus festivus n. sp. T. festivus overwinters inside the cocoon constructed by its host in the last instar larvae. They were found to lie in either direction in the cocoon. Specimens of the larvae in this stage were continuously brought to the laboratory for rearing and observation about every two weeks during the entire winter. The specimens were kept in 20 mm. watch glasses placed one on top of the other. The larvae would shrivel and die shortly after being placed in this "rearing" situation. The first group of larvae to pupate under laboratory conditions was collected on March 7, 1948. One male pupated on March 13, emerged on March 23 and died seven days later. Under these laboratory conditions it takes approximately eight days for the pupae to become completely darkened. The average pupal period for laboratory conditions was 10 days for the male and 15 days

consistently for the female. The larvae continued to pupate in less and less time when brought into the laboratory rearing situation. In nature, T. festivus commences to pupae near the end of the first week of May. Sweepings were made daily for the next eight days before the first adults were captured in nature, bringing their emergence date to the 14th of May. A package of cones of C. lawsoniana received on the 20th of May from Ashland, Oregon, revealed numerous adults which had already emerged. Mating takes place about one week after the females emerge. These parasites have all emerged by the latter part of June. Egg laying commences after the 20th of May. Of the females dissected, none was found to contain more than three eggs per insect. In carrying out searching patterns over the cones, the female scurries rapidly over the surface of the fruit, hopping from one cone to another. The antennae vibrate continuously making intermittent contact with the cones. When the proper point is selected, several circles are made about this area. Finally the female finds a suitable position, the abdomen is arched and the ovipositor is inserted quickly into the cone. The egg is deposited directly upon the last instar larvae of the host. Under laboratory conditions, it takes three days for the egg to hatch.

The larvae reaches the last instar stage in a little over two weeks feeding externally upon its host. Pupation occurs during the first week of August and all the adults of the first generation have emerged by the 24th of the same month. Egg laying again commences about a week after emergence. In sweepings made two weeks after this time, no males could be found. Shortly after

the middle of September, no females could be found. By October 1st, all the larvae of T. festivus have reached the final stage, last instar, for hibernation inside the silken cocoon made by its host.

OTHER PARASITES (Fig. I) - Tetrastichus holbeini Gir. appears to be the next in importance in the control of Dasyneura sp. to T. festivus. The pupation and emergence of this eulophid follows that of the primary parasite by about two weeks. Egg laying of T. holbeini commences during the first week of July. When laying in the cones of C. lawsoniana, the female decides upon the location and places itself over the junction of the cone scales. The ovipositor is projected downward between the seeds as far as it can be extended without piercing any fruit tissues. The egg may be placed either directly upon the host larvae or in the cracks around or near a larvae. As many as three eggs are attached to a single host. The eggs hatch in from 4 to 5 days, however since this parasite was not observed during the latter part of the season of 1947, no further knowledge was obtained. All instars of its larvae are naked, shiny, and considerably smaller than the stages of T. festivus which were observed. Very early in its development, the region of the stomach of T. holbeini assumes a bright orange pigment and retains this color until pupation.

Eurytoma stigma Ashm. follows T. holbeini in importance. The latter seems to have more success in emerging from pupation. E. stigma precedes T. festivus in its life history and since the cones and the host were extremely late in their development for this

season E. stigma emerged too early to oviposite on this particular host.

Nothing is known about the new species of Crytogaster previously mentioned. Specimens of this parasite were reared from the host, however no observations were made on the habits or life history.

Two other parasites were also reared from this host, but no observations were made on their activities. They are Amblymerus sp. and an undetermined species of Ptermalidae. The former is known to be an external parasite on the pupae of Dasyneura sp., on the pupae and possibly the larvae of T. festivus.

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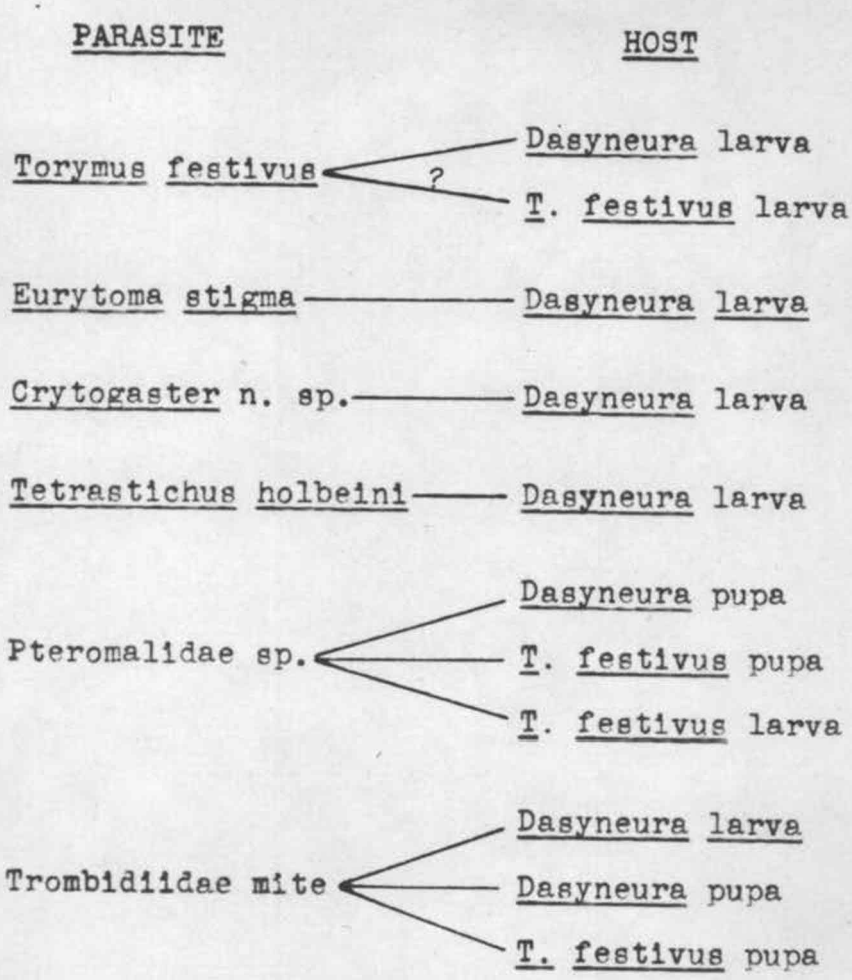

Figure 1. Cedar Midge-Parastie Relationship

Photo I. Adult female of T. festivus

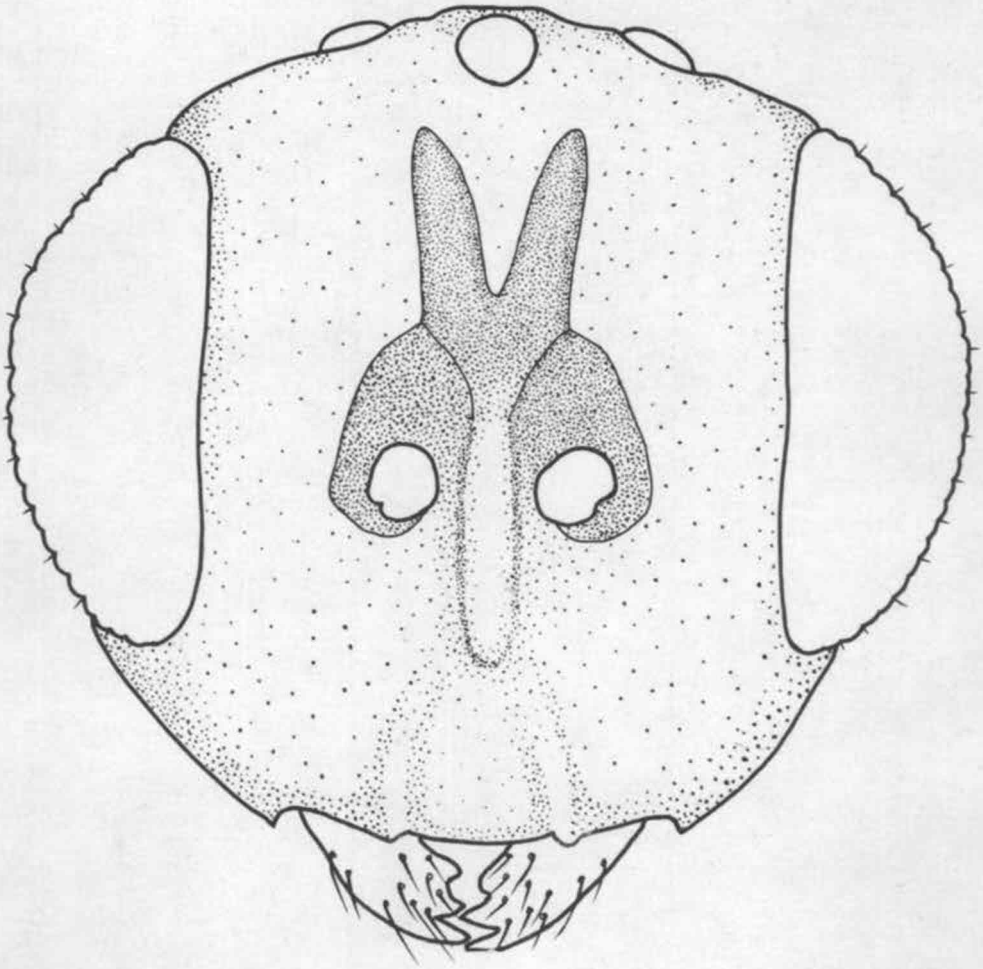

Plate I. Anterior aspect of head of adult Torymus festivus

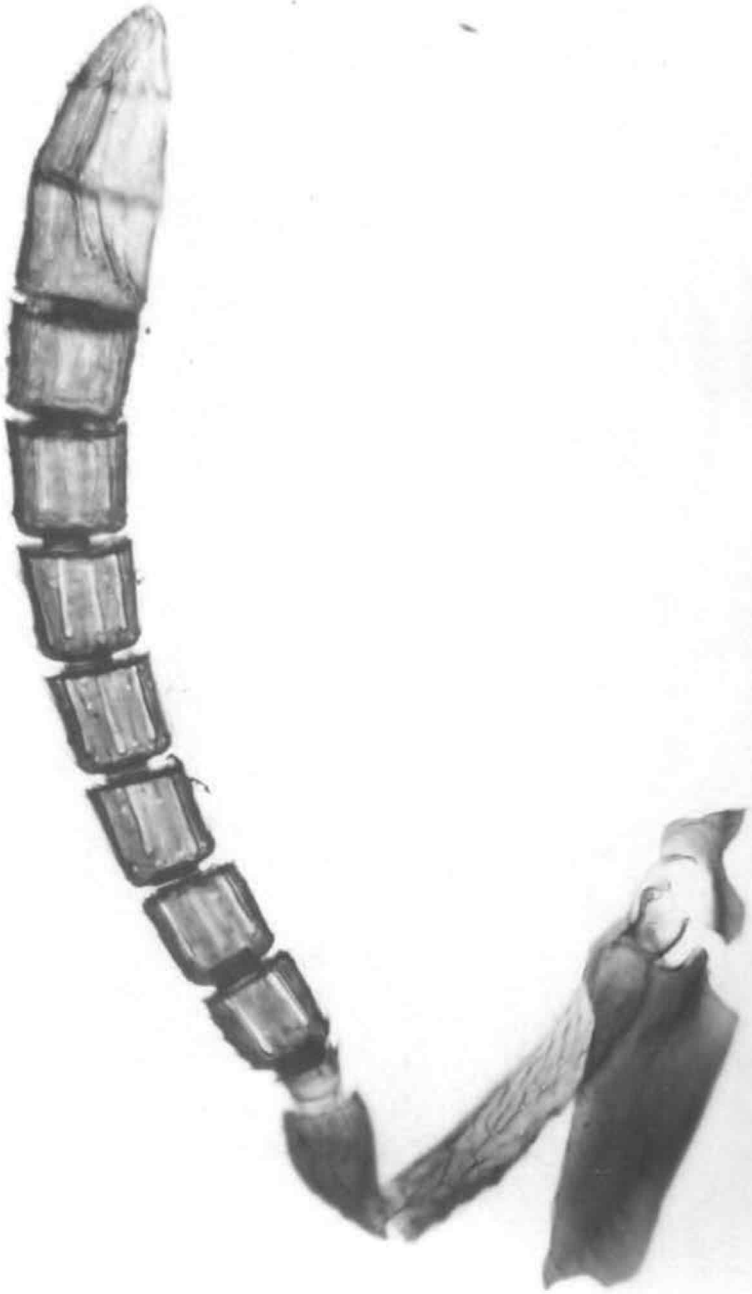

Photo III. Antenna of T. festivus

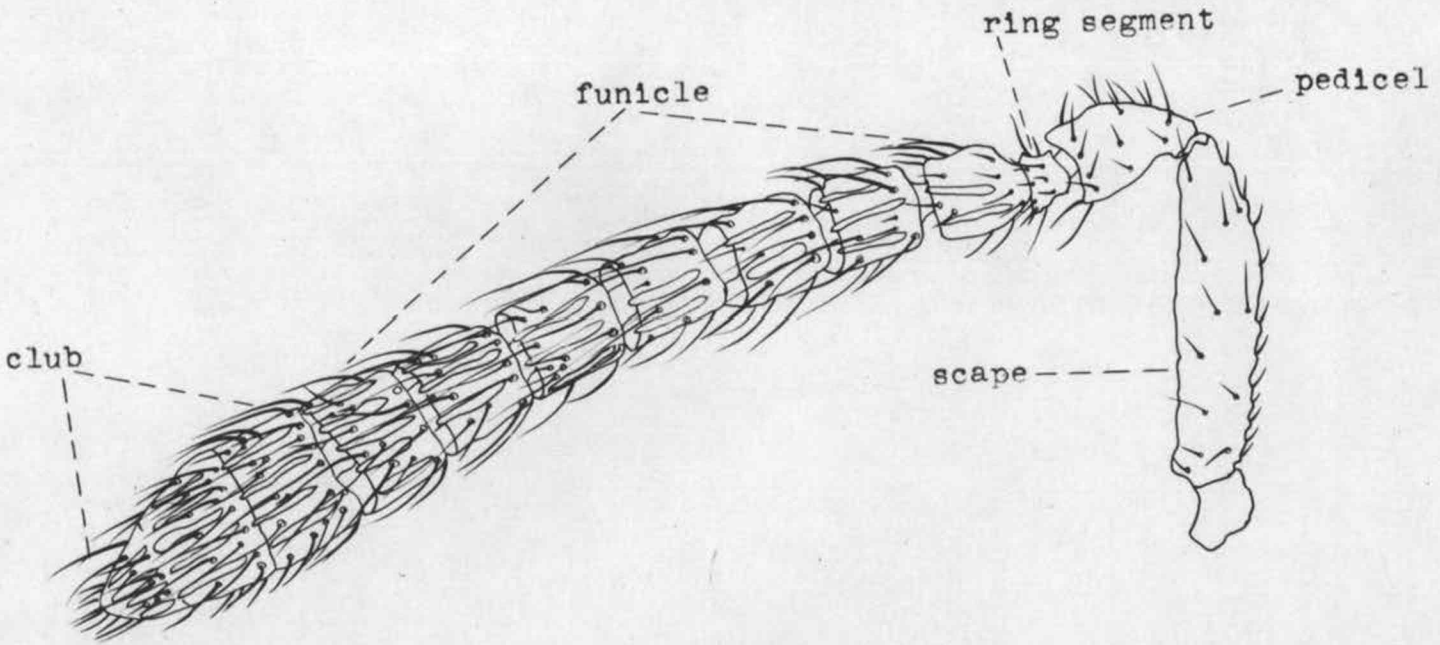

Plate IV. Antenna of Torymus festivus

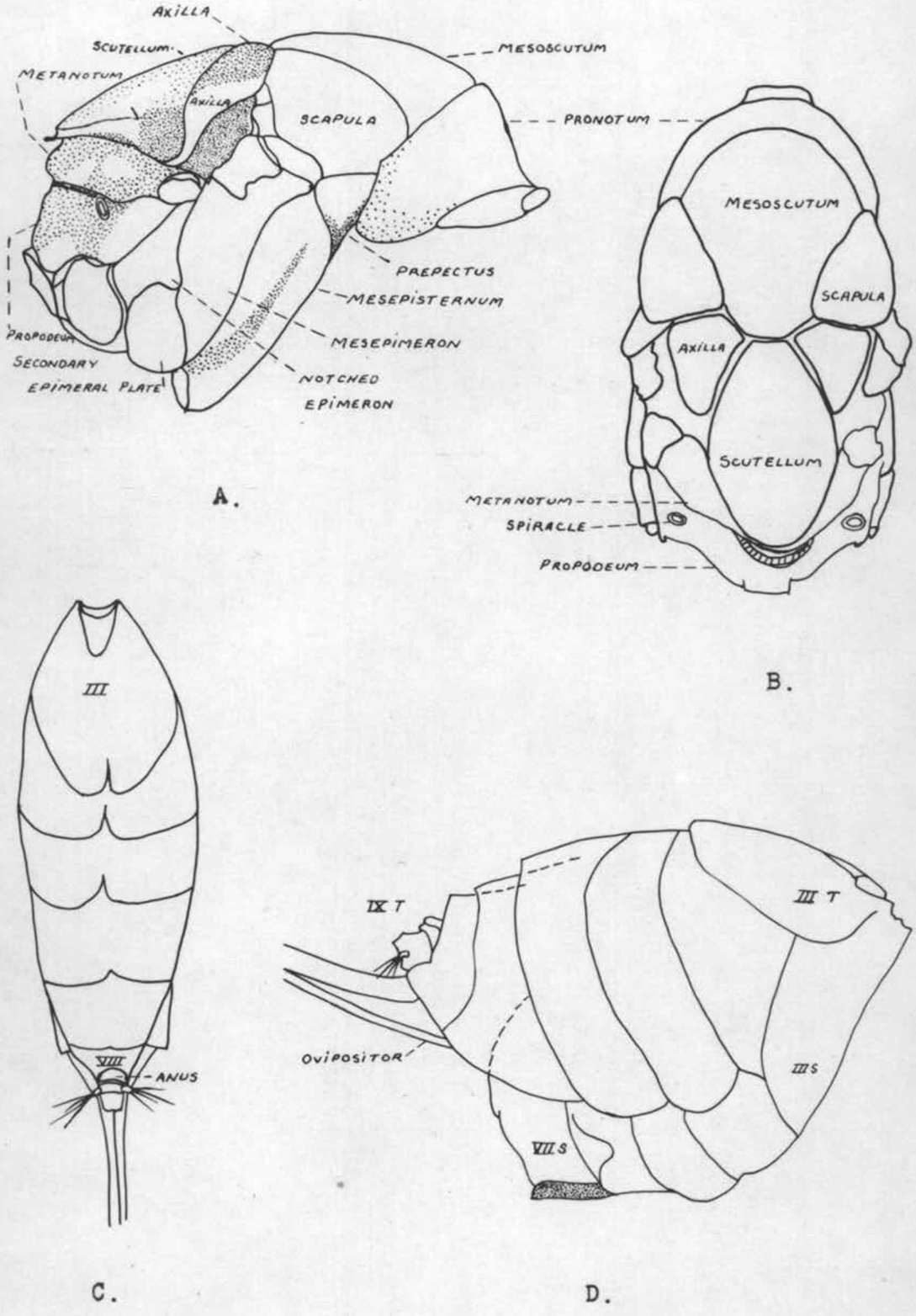

Plate III. Lateral A, Dorsal B, views of thorax and Dorsal C, Lateral D, views of abdomen of Torymus festivus.

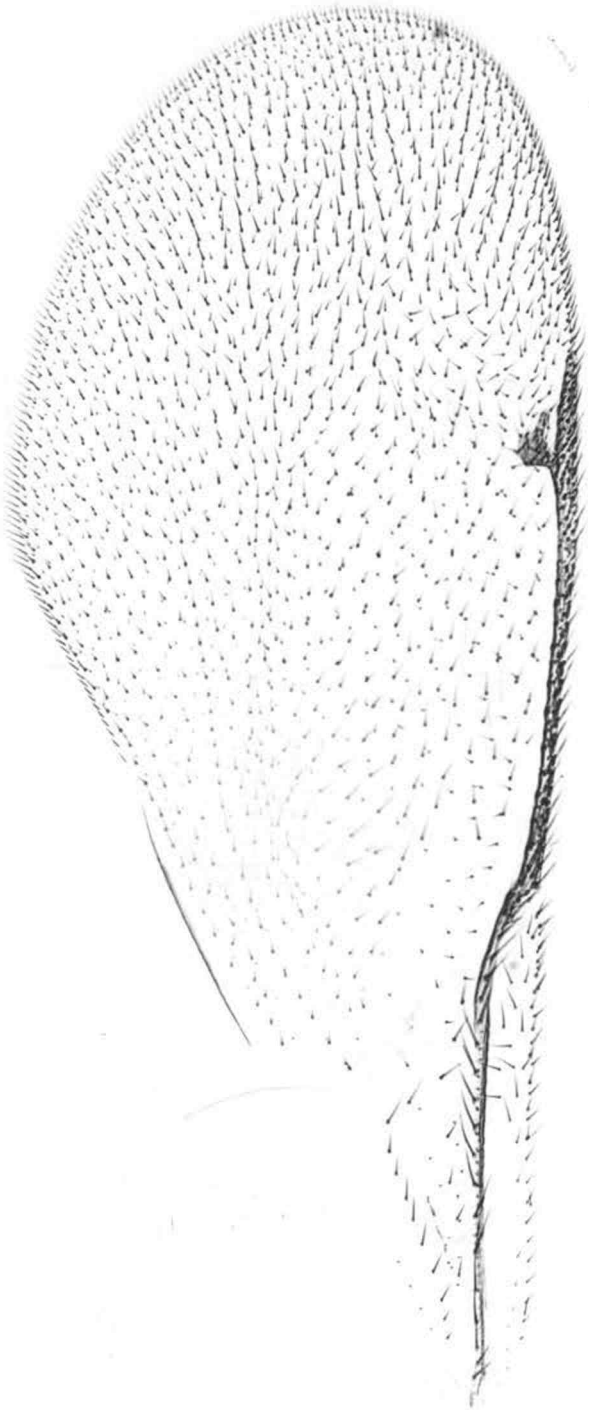

Photo Iv. Wing of T. festivus

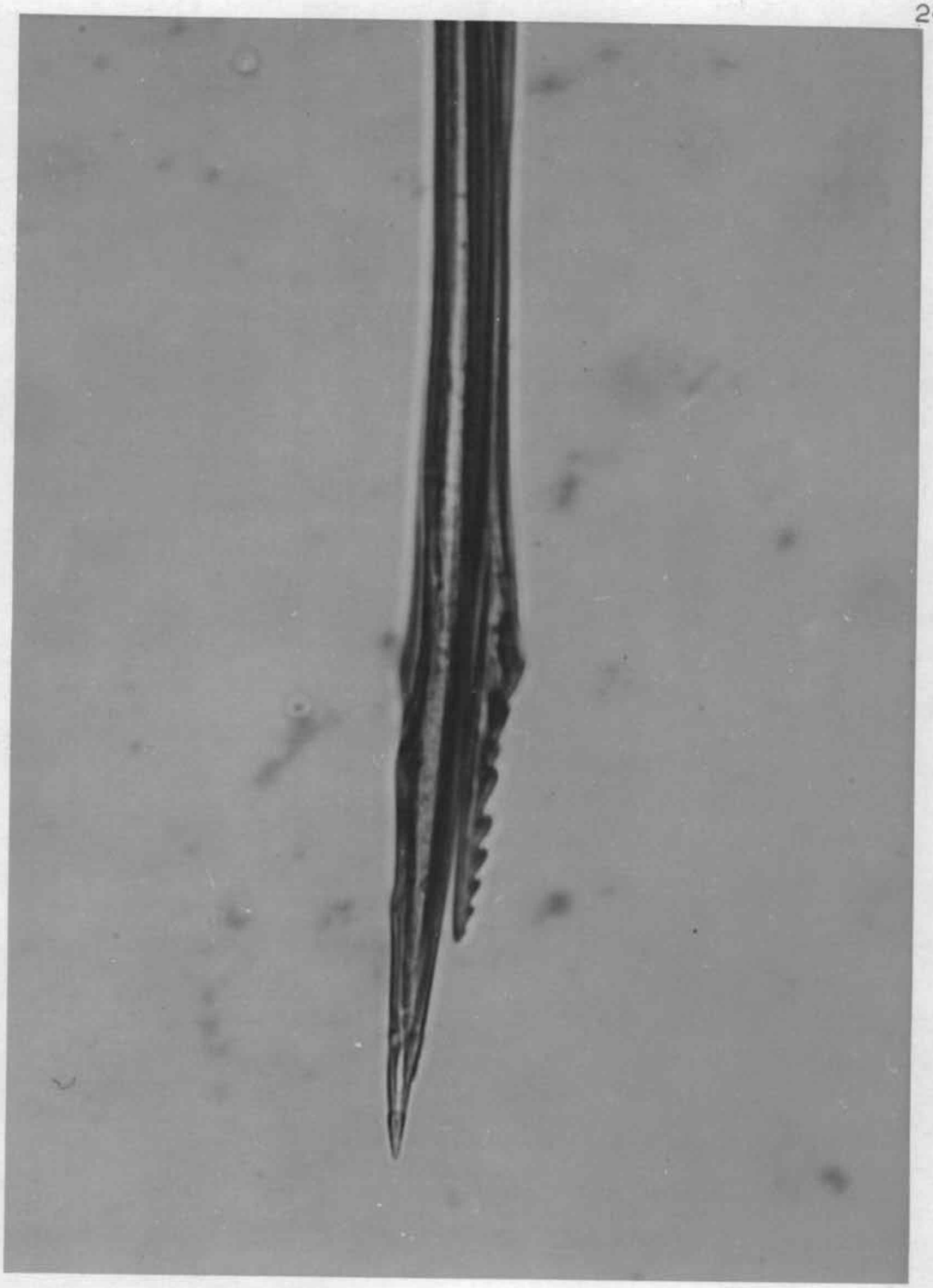

Photo II. Ovipositor saw of T. festivus

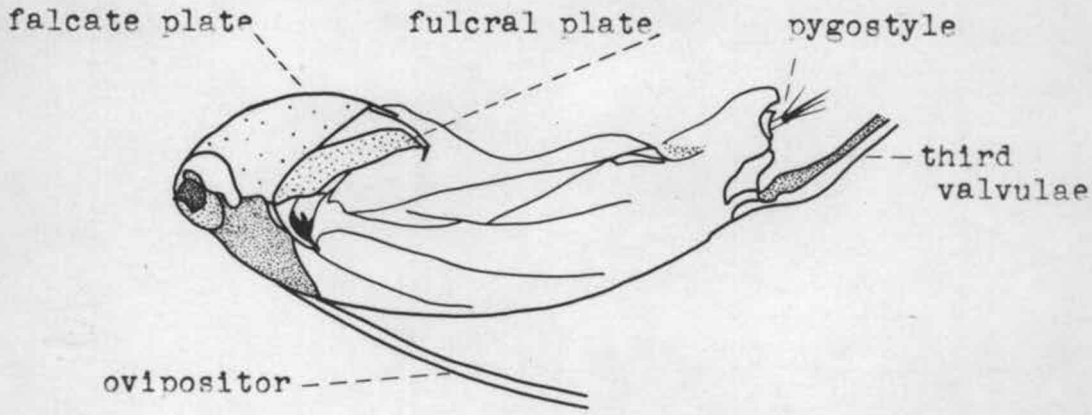

Plate II. Ovipositor of Torymus festivus

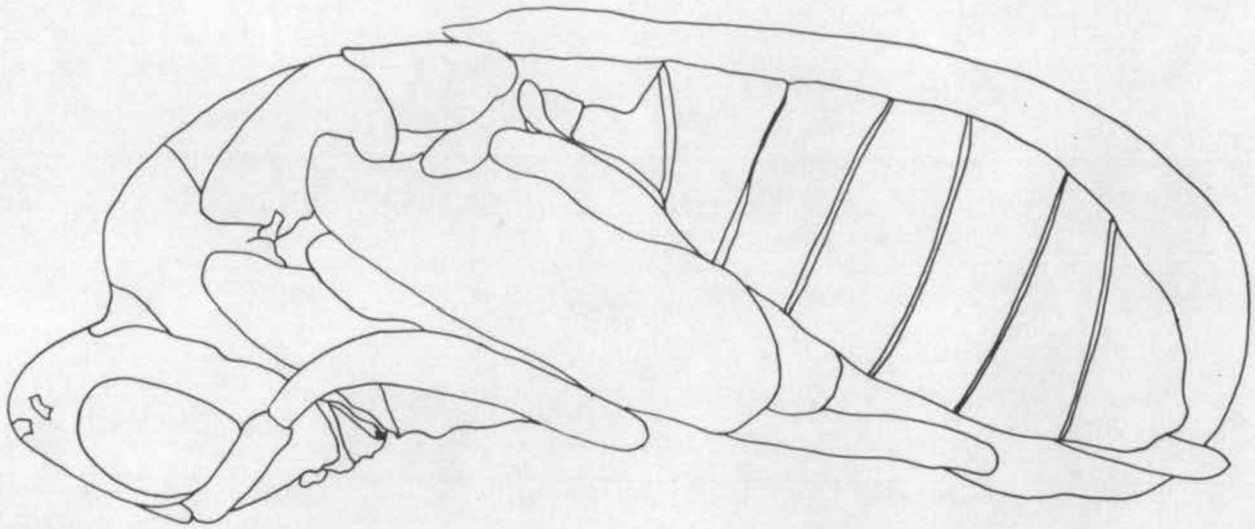

Plate V. Lateral view of female pupae of Torymus festivus

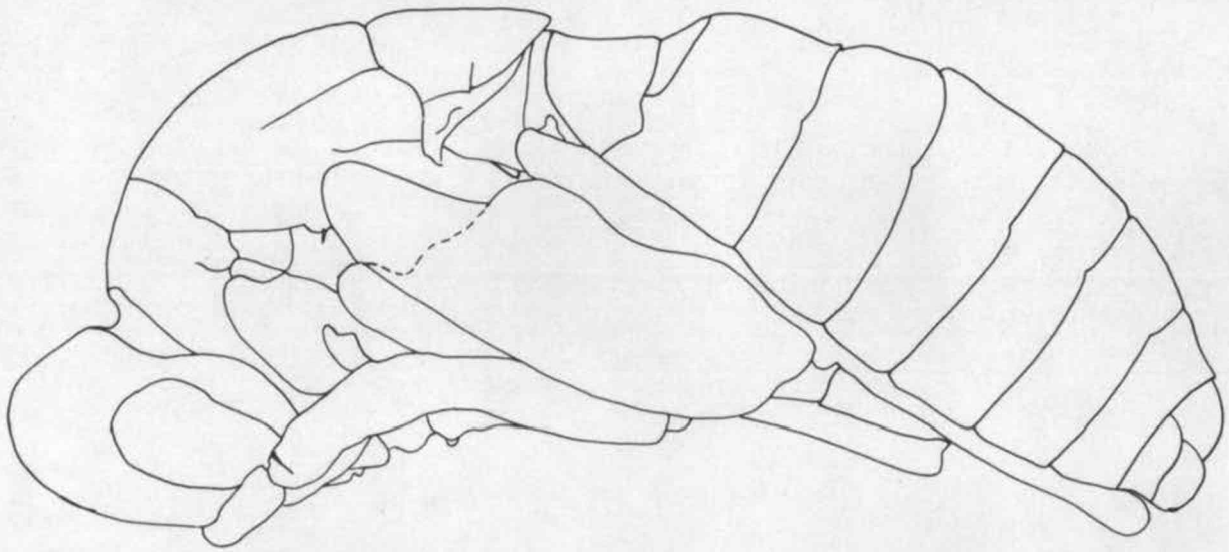

Plate VI. Lateral view of male pupa of Torymus festivus

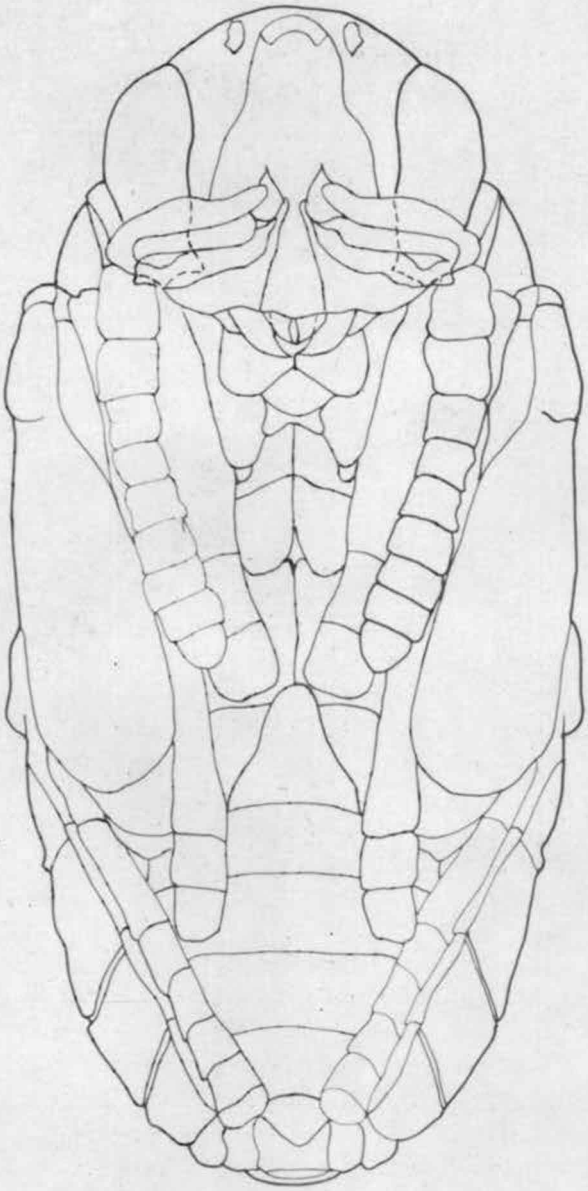

Plate VIII Ventral view of male pupa of Torymus festivus

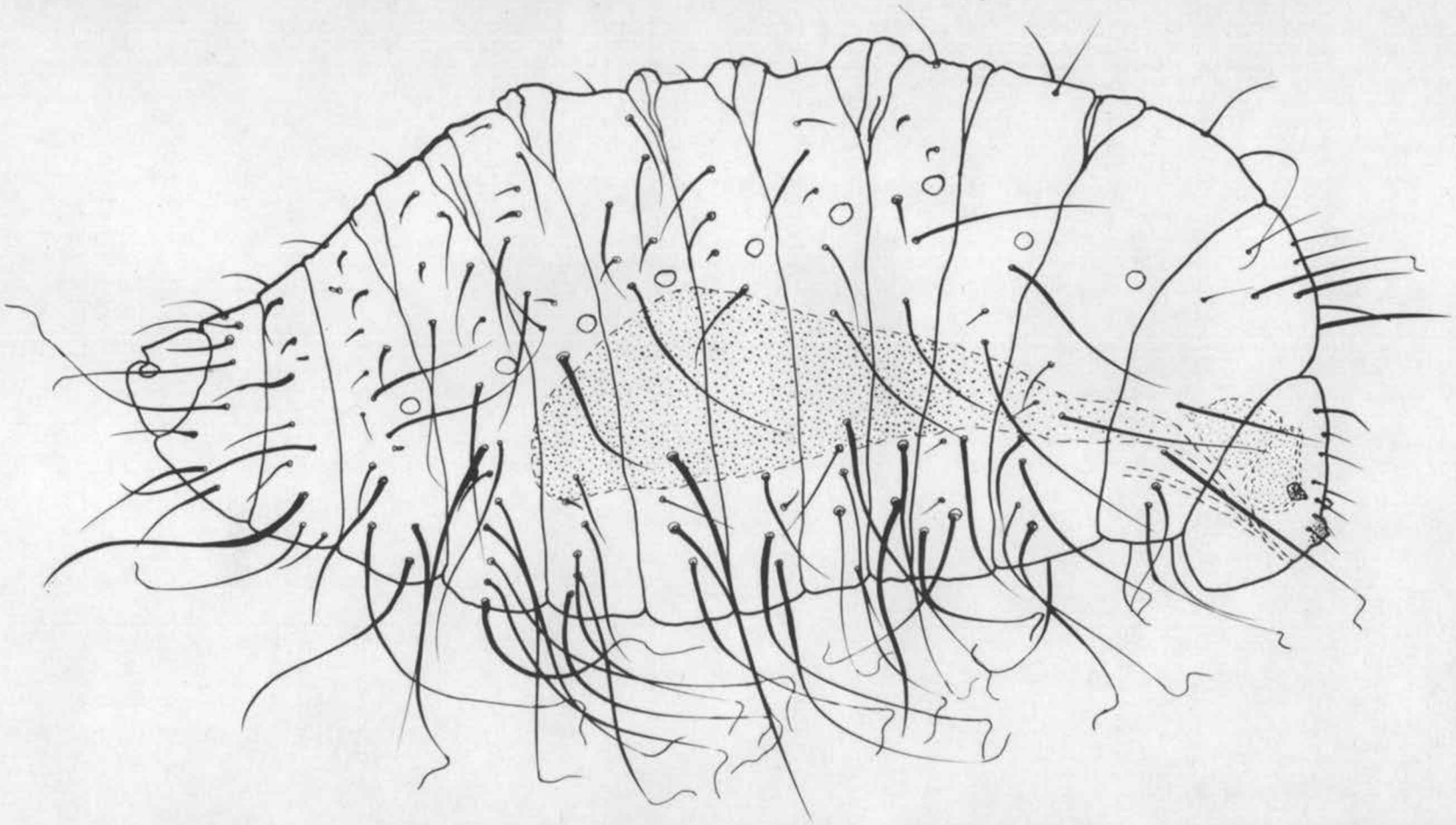

Plate VIII. Lateral view of mature larva of Torymus festivus

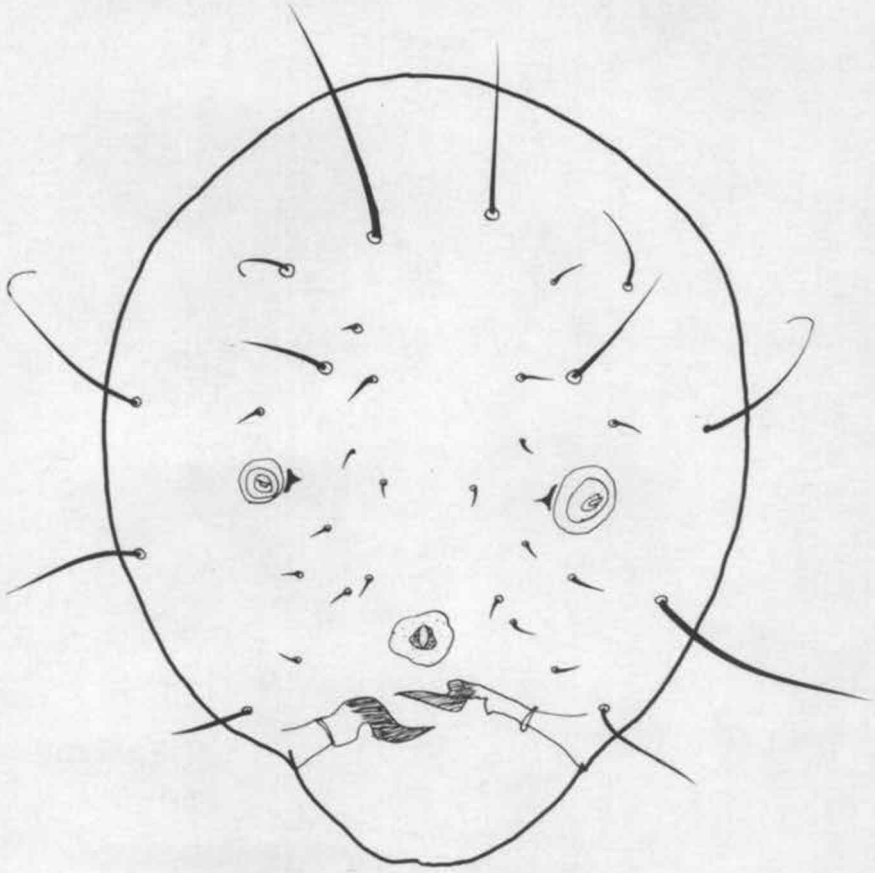

Plate IX. Anterior aspect of head of mature larva of Torymus festivus.

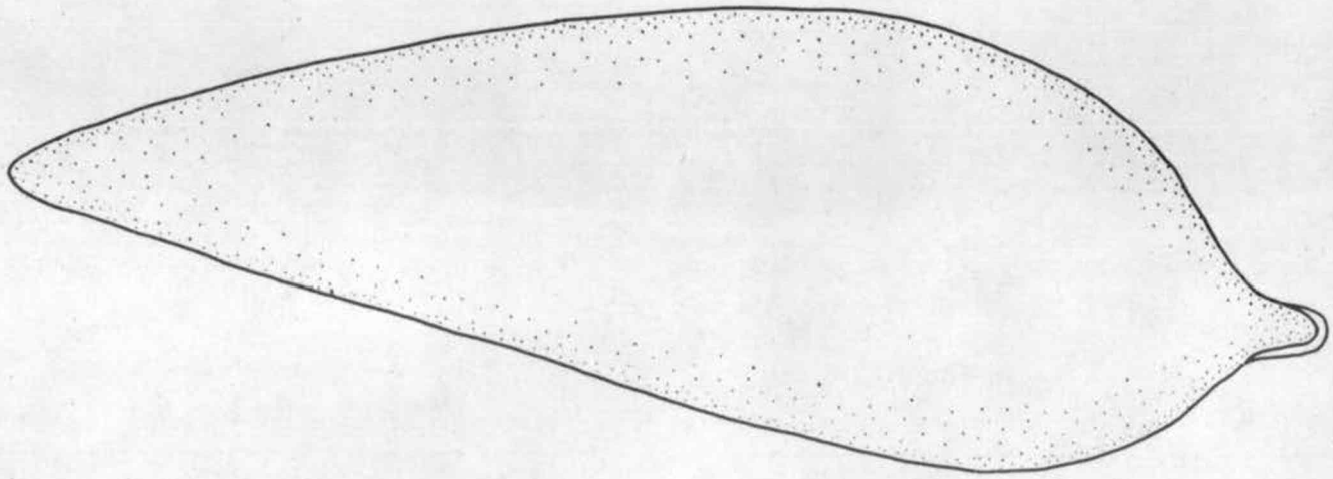

Plate X. Egg of *Torymus festivus*

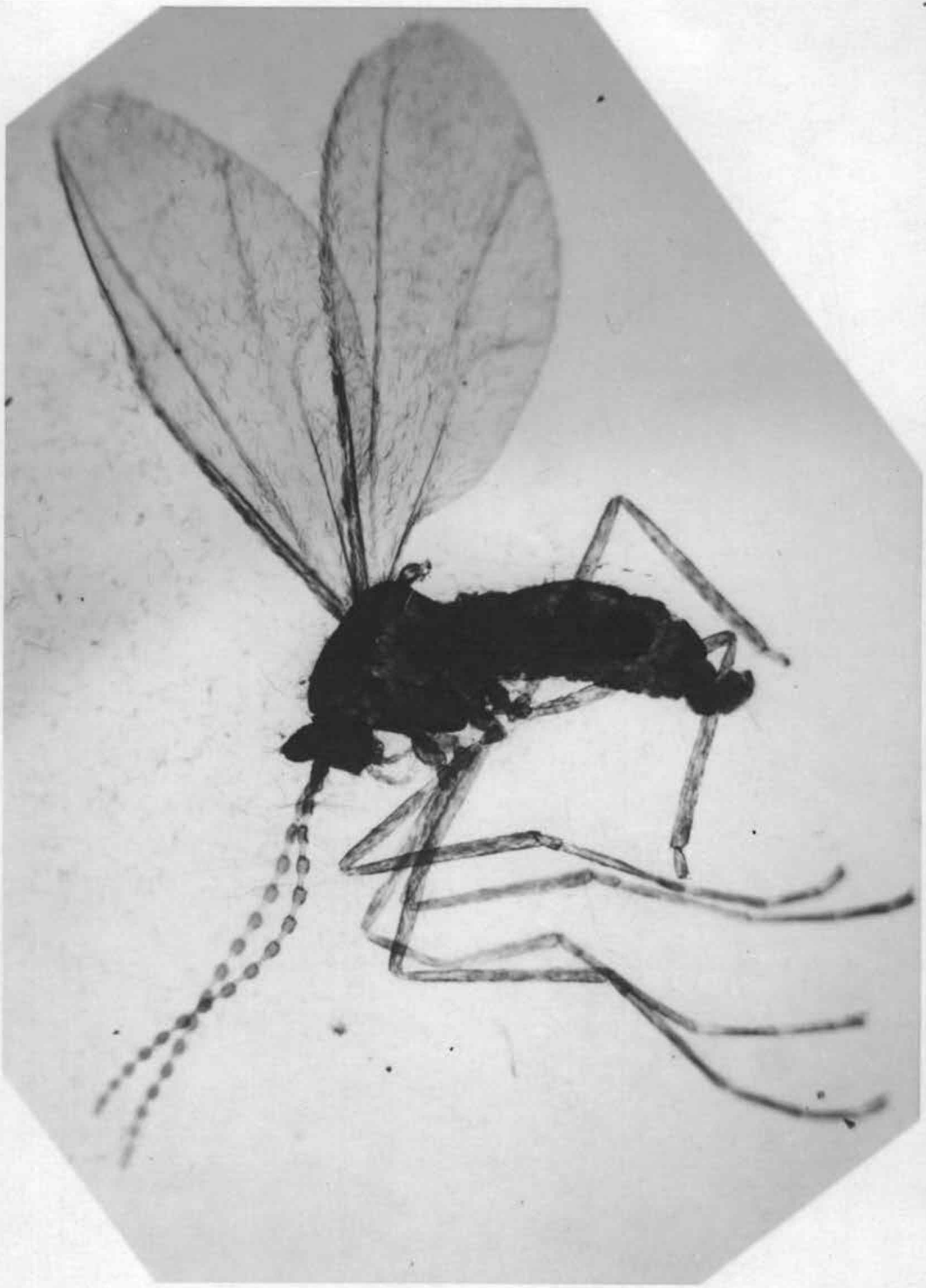

Photo V. Adult male of Dasyneura sp.

Photo VI. Pupae of Dasyneura sp.

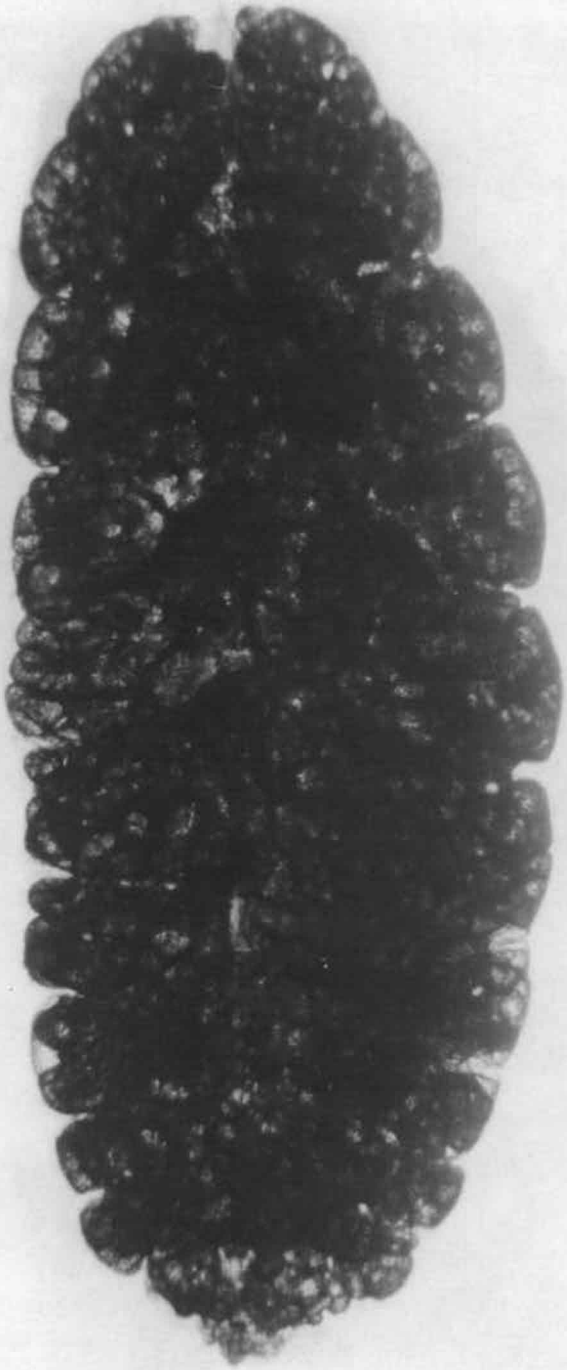

Photo VII. Larva of Dasyneura sp.

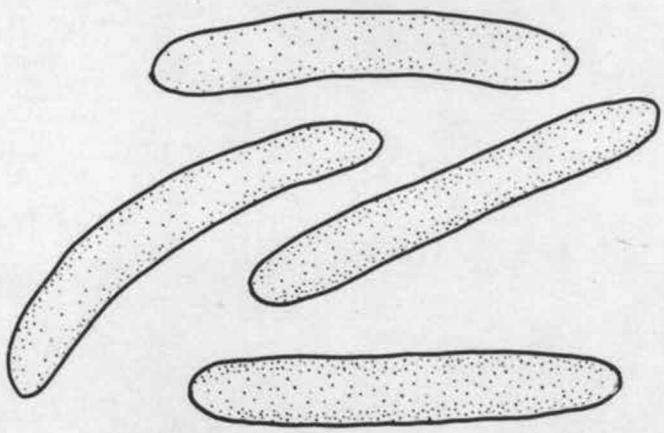

Plate XI. Eggs of Dasyneura sp.

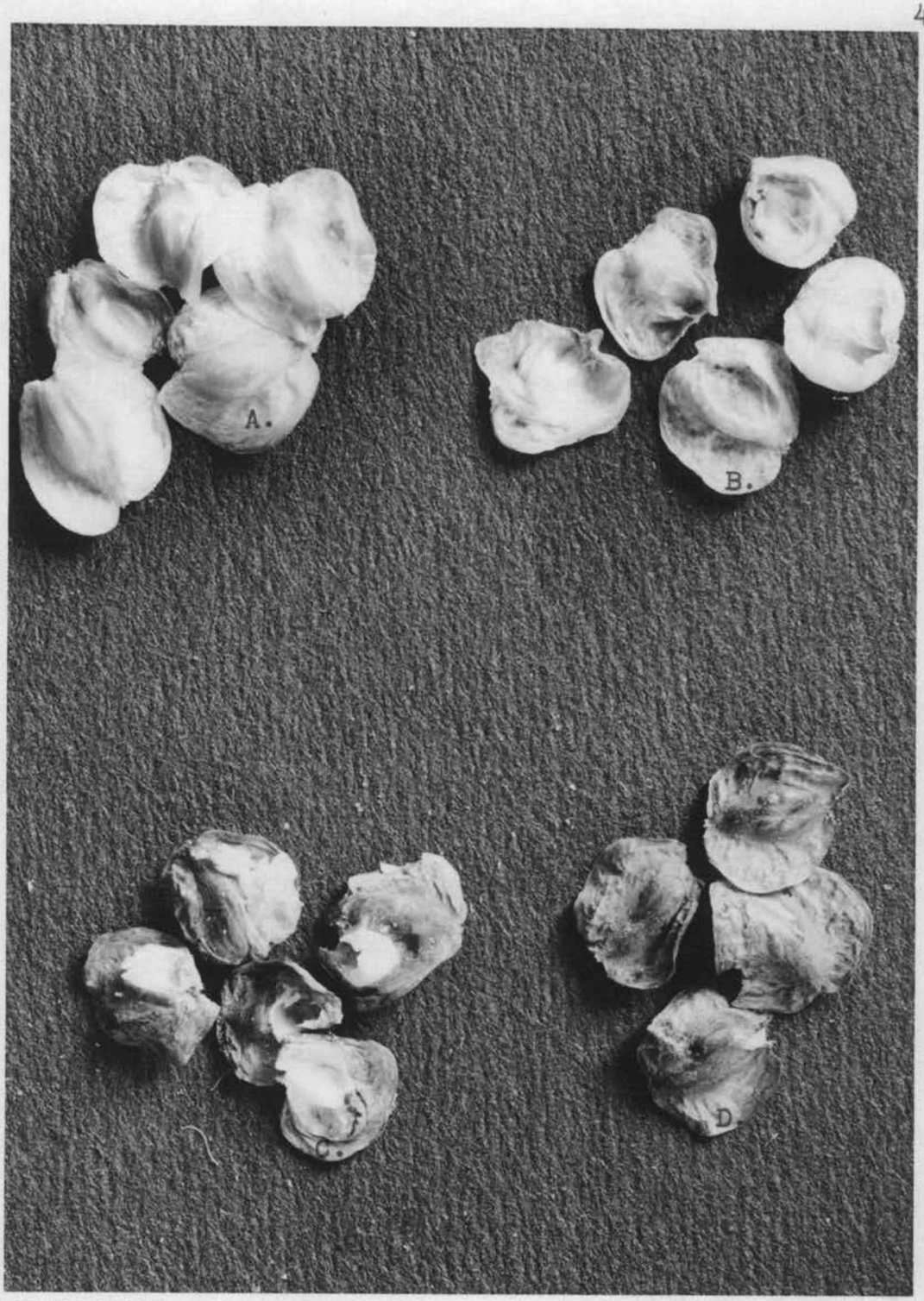

Photo VIII. A, recently matured, undamaged seeds; B, recently matured seeds showing pits from which one or more mature larvae have been removed; C, seeds one season old showing white cocoons after emergence; D, seeds one season old, the upper three undamaged, the lower one showing emergence hole of T. festivus.