

The Ovipositor of the Cicada

by Itasca Hilsman

1921

Submitted to the Department of Entomology of
the University of Kansas in partial fulfillment of
the requirements for the Degree of Master of Arts

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Approved by:

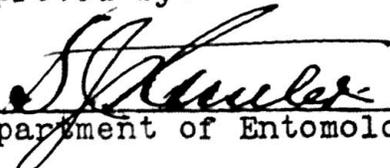

Department of Entomology.

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Introduction.

In all taxonomic keys published, are male genitalia only. All show no use made of the ovipositor, as affording any specific characteristics. The difficulty of a person using such keys to identify female cicadas is manifest to all. This attempt has been made to see if the ovipositor afforded characteristics of use, comparable to the use of the uncus and ventral piece of the male genitalia. The material at hand was used to determine whether the shape of the ovipositor, the number and shape of its teeth, or any other distinct characteristics were constant, or specific enough to be of aid in classifying specimens.

No attempt was made to make a careful morphological study of the structure and development of the ovipositor, but simply an attempt to find characteristics for use in taxonomic work.

The specimens examined included members of twenty-one species, occurring in Kansas, which were listed by P.B. Lawson, in his paper on the Cicadadae in Kansas, appearing in the Kansas University Science Bulletin, Volume XII, No., 2, 1920. Two additional species occurring in Kansas, were also examined, namely, *Tibicen Sayi* and *Melampsæta kansa*. No specimen of *Okanagana balli* (Davis), recently added to the Kansas list, was available for study.

To Professor S.J. Hunter, head of the Department of Entomology, who made it possible that this work could be undertaken, the writer wishes to express appreciation. I wish to thank Mr. P.B. Lawson, upon whose suggestion the problem was undertaken, and under whose direction the work was conducted, for his interest in my investigations and for his assistance rendered.

Genera and Species Found in Kansas.

Tibicen Latreille

Tibicen bifidus (Davis)
 Tibicen linnei (Smith and Grossbeck)
 Tibicen pruinosa (Say)
 Tibicen sayi (Smith and Grossbeck)
 Tibicen lyricen (De Geer)
 Tibicen aurifera (Say)
 Tibicen eugraphica (Davis)
 Tibicen vitripennis (Say)
 Tibicen auletes (Germar)
 Tibicen marginalis (Walker)
 Tibicen dealbata (Davis)
 Tibicen resh (Haldeman)
 Tibicen resonans (Walker)
 Tibicen superba (Fitch)
 Tibicen dorsata (Say)

Cicada Linnaeus

Cicada hieroglyphica (Say)

Proarna Stal

Proarna venosa (Uhler)

Tibicina Kolenati

Tibicina septendecim (Linnaeus)
 Tibicina septendecim var. cassinii (Fisher)

Okanagana Distant

Okanagana synodica (Say)
 Okanagana bella (Davis)
 Okanagana balli (Davis)

Tibicinoides Distant

Tibicinoides hesperius (Uhler)

Melampsalta Kolenati

Melampsalta calliope (Walker)
 Melampsalta kansa (Davis)

Abdomen of Female Cicada.

In the dorsal aspect of the abdomen of the female, eleven tergites are visible, and part of the eleventh sternite. First tergite broad and short, with caudal margin excavated medianly for about one-third of the width. First and second broader than other tergites. Second tergite a little longer than first tergite. Tergite three and four of about the same width and length, slightly longer than two in length, posterior margin of five slightly curved caudally, each decreasing in width causing the abdomen to taper posteriorly. Eight tergite long and narrow. Number nine exceedingly long and narrowed, about twice the length of the third tergite, though less than half as wide, with pointed horn-like spike projecting from the middle of the caudal margin. Tenth and eleventh tergites forming oval tube, the former ring-like when viewed dorsally, the latter about oval in outline. Situated between the basis of the eleventh tergite and eleventh sternite, seems to be present a small rounded sclerite on each side. Between the eleventh tergite and the tips of the cerci, which form the apex of the abdomen, is visible a small portion of the eleventh sternite.

Morphology of the Ovipositor.

The ovipositor consists of three pairs of valves, namely ventral, dorsal, and lateral. The ventral valves are two tongue-like pieces which are attached laterally to the lateral valves. Their tips are free and their mesal margins meet in the region not far cephalad of the first teeth. They arise from the eighth sternite.

The lateral valves are the sclerites bearing the teeth. They are closely united with the ventral valves and are apparently fused with them until near the apex. They slide along a groove which is present in the dorsal valves, and thus making oviposition in twigs possible. Like the ventral valves they are fastened to the eighth sternite.

The dorsal valves are fused together, sometimes being separated for a short space apically. These valves form the central portion of the ovipositor along which the lateral and ventral valves slide. This pair is fastened to the ninth sternite.

The cerci are the sclerites which act as guards of the ovipositor and completely covers it when at rest. They consist of two segments, the smaller anterior segment, united with the ninth sternite, and the second and larger segments being strongly concave for their entire length and thus enclosing the valves of the ovipositor.

In the ventral aspect of the abdomen, eight pleurites are visible, the first short and strongly curved, the second is longer, somewhat narrowed and slightly curved. Three, four, and five are large, rectangular, of about the same size with the lateral margins telescoping. Six pleurite very broad, being overlapped by six. Eighth pleurite very small and triangular in outline.

Seven sternites are visible. The first is very short, cephalic margin small lobe on either side of the middle line. Second sternite of average length broadest, extending nearly the entire width of the third segment, caudal margins sinuate. Third to sixth sternite of about same length decreasing slightly successively in width.

Seventh sternite longer, posterior margin broadly excavated, fully one-third the length of the sclerite. Ninth tergite extends ventrally to the ovipositor, forming the large pygofer. Between the margins, the pygofer are visible the ovipositor and its guards, or cerci, which are two segmented, the first small and connected with the

ninth sternite. The second segment is large, forming the apex of the abdomen.

Five pairs of spiracles are visible. First pair are apparently situated on the cephalo-mesal corner of the third pleurite. The second, third, fourth, and fifth, are found in the cephalo-lateral corners of the fourth, fifth, sixth, and seventh sternites.

The sixth pair of spiracles is visible only when the pygofers and eighth pleurites are pushed apart.

Genus *Tibicen* Latreille

Ovipositor generally large, smaller in a few cases, due to size of insect, number of teeth in ovipositor, range from nine to fifteen. Fifteen species were examined, one showing nine teeth, one showing ten, two eleven, three twelve, three thirteen, one fourteen, and three fifteen. Teeth generally with rounded margin, the large teeth widely separated, standing out more individually. Largest teeth about center of ovipositor, ranging from the fourth to the seventh tooth, according to the species. Number of ridge-like teeth range from none to four, usually distinct, but sometimes rudimentary. One showing no distinct ridge-like teeth, three showing two, and two showing four ridge-like teeth.

Tibicen bifidus (Davis)

Six specimens of this species were examined, five taken in Morton County, one in Comanche County, Kansas.

Ovipositor rather long, medium size, two and three-fourths times as long as wide; ventral, lateral, and dorsal valves dark and strongly chitinized. Minimum number of teeth observed fifteen, maximum number fifteen, usual number fifteen; four ridge-like teeth. First, second, and third teeth ridge-like, overlapping ventral valves. Fourth tooth ridge-like and short. Ridge-like teeth with curved appearance, projecting out as shelf. Numbers five and six are small and pointed apically, six a little larger than five, slanting toward base of ovipositor. Seventh tooth large slanting similarly. Number eight rounded, and larger than any other tooth. Number nine smaller than eight, and curved in on side toward eighth tooth, rather widely separated from eighth and ten. Teeth from ten to thirteen of similar shape, slightly decreasing in size toward tip, crowded, separated by curved grooves. Teeth fourteen and fifteen appearing as one tooth divided. Ventral valves medium size, mesal margins straight, meeting at point opposite base of sixth tooth.

Tibicen linnei (Smith and Grossbeck)

Six specimens of this species were examined, all taken at Raleigh, North Carolina.

Ovipositor small, delicate, length two and a half times width; ventral valves very light, not heavily chitinized, easily crushed, lateral and dorsal valves also light, and not heavily chitinized.

Minimum number of teeth observed twelve, maximum number twelve, usual number twelve; ridge-like teeth three. First and second teeth ridge-like, of same size and both overlapping ventral valves. Number three ridge-like and short. Slight elevation between three and four, not counted as a separate tooth. Number four of medium size, rounded at margin. Number five large, standing out, being widely separated from numbers four and six. Teeth five and six apically ridged. Teeth seven, eight, nine, and ten of same shape, decreasing successively in size, depression between them curved. Teeth eleven and twelve very small, appearing as one tooth divided. Ventrals valves small, mesal margins slightly curved, meeting at little cephalad of third ridge-like tooth.

Tibicen pruinosa (Say)

Six specimens of this species were examined, all taken in Douglas County, Kansas.

Ovipositor of medium size, robust, stoutest in region where ridge-like teeth begin, less than twice as wide as long; ventral valves light brown and not heavily chitinized, while the lateral and dorsal valves are very dark and heavily chitinized. Minimum number of teeth observed twelve, maximum number thirteen, usual number thirteen; ridge-like teeth three. First and second teeth ridge-like, overlapping ventral valves, the second shorter. Number three ridge-like and short. Number four small and projecting out beyond number five which is also small. Number six large and strong, widely separated from number seven. Number seven also large and widely separated from eight which is a little smaller than seven. Teeth ten, eleven, twelve, and thirteen of same general shape, decreasing successively in size. Teeth crowded at tip. Thirteenth tooth rounded, forming tip. Ventral valves broad, mesal margins straight, meeting at point opposite base of first ridge-like tooth.

Tibicen sayi (Smith and Grossbeck)

Three specimens of this species were examined all taken at Manson, North Carolina.

Ovipositor of medium size, long and very slender, broadest in region of fifth tooth, about two and a third times as long as wide; ventral valves light brown and not heavily chitinized, while lateral and dorsal valves are dark and heavily chitinized. Minimum number of teeth observed twelve, maximum number

twelve, usual number twelve; ridge-like teeth three. First and second teeth ridge-like, first greatly overlapping ventral valves, second only slightly. Third tooth ridge-like and very short. Number four large and pointed, widely separated from three and five. Number five large and very broad. Six and seven of same shape as five, decreasing successively in size. Teeth eight, nine, ten, eleven, and twelve of same shape, decreasing in size, and very compact; the last two very small. Ventral valves small, mesal margins straight, meeting at point between second and third ridge-like teeth. Ridge lateral of ventral valves characteristically irregular.

Tibicen lyricen (De Geer)

Six specimens of this species were examined, two taken in Riley County, two in Elk County, and one in Douglas County, Kansas, and one in Ramapo Mountains, New Jersey.

Ovipositor large and long, two and one-third times as long as wide; ventral valves light brown, not heavily chitinized, while lateral and dorsal valves are very dark and heavily chitinized. Minimum number of teeth ten, appearing only on one side of one specimen, maximum number twelve, usual number eleven; ridge-like teeth three. First and second teeth ridge-like, overlapping ventral valves. Number three ridge-like, lying on elevation. Number four small, joined closely to number five which is larger. Number five widely separated from number six. Number six very large, rounded, curving slightly cephalad, widely separated from seven, which is also very large. Eight of same shape as seven but much smaller. Teeth nine, ten, and eleven same shape, decreasing in size, very compact. Number twelve rounded to form point. Ventral valves medium size, mesal margins only slightly curved, groove along which ventral valves slide, very deep with elevated margin showing plainly along edge of teeth four and five. Specimen taken from Ramapo Mountains, New Jersey, shows lateral and dorsal valves light brown and only slightly chitinized. Specimen, which is smaller than usual, shows the typical brownish color of this species is replaced by green.

Tibicen aurifera (Say)

Five specimens of this species were examined, three taken in Wilson County, and one each in Franklin and Elk Counties, Kansas.

Ovipositor of medium size, rather slender,

twice as long as wide; ventral, dorsal and lateral valves medium brown and of medium chitinization. Minimum number of teeth observed thirteen, maximum number fourteen, usual number thirteen; ridge-like teeth three. First and second teeth ridge-like, overlapping ventral valves, the second only slightly. Number three ridge-like and shorter. Number four small and truncate, widely separated from five, which is medium size and with rounded tip. Number six largest, widely separated from five and seven, number seven large, slanting towards number eight. Teeth eight, nine, and ten of same shape, compact and decreasing successively in size, Eleven, twelve, and thirteen very small, closely joined together. Ventral valves large, mesal margins curved, meeting at point opposite base of third ridge-like tooth.

Tibicen eugraphica (Davis)

Six specimens of this species were examined, all taken in Barber County, Kansas.

Ovipositor small, one and a half times as long as wide; ventral, lateral, and dorsal valves dark and rather heavily chitinized. One specimen showed ventral and lateral valves very light and of slight chitinization while dorsal valves were dark and rather heavily chitinized. Minimum number of teeth observed twelve, maximum number twelve, usual number twelve; no ridge-like teeth or only a rudimentary ridge. First tooth small, second small and truncate. Third and fourth teeth large and rounded, four being the largest found on the ovipositor, rounded and extending lateral. Teeth five, six, and seven of equal medium size, firmly joined at base. Teeth eight, nine, and ten of same shape, decreasing successively in size. Eleven, with small depression forming twelfth tooth which is very small. Ventral valves of medium size, mesal margins slightly curved, meeting at point far cephalad of first tooth.

Tibicen vitripennis (Say)

Two specimens of this species were examined, both taken in Barber County, Kansas.

Ovipositor short and stout, length one and a half times width; ventral valves, as well as lateral and dorsal valves, are dark and heavily chitinized. Minimum number of teeth observed nine, maximum number nine, usual number nine; ridge-like teeth two. First and second teeth ridge-like, overlapping ventral valves. Third tooth long. Number four largest, widely separated from numbers three and five. Number five

smaller, more rounded, and widely separated from six. Number six of same shape as five, joined closely at base to seven. Teeth seven, eight, and nine of same general shape, decreasing successively in size, very compact. Ventral valves large and broad, mesal margins straight, meeting at point just opposite base of first ridge-like tooth.

Tibicen auletes (Germar)

Two specimens of this species were examined, both taken at Albany, Georgia.

Ovipositor very large, twice as long as wide, very wide from region of ridge-like teeth to tenth tooth; ventral valves light brown, not heavily chitinized. Lateral valves very light, chitinization very slight, teeth appearing almost transparent. Dorsal valves dark brown, and more heavily chitinized. Minimum number of teeth observed fifteen, maximum number fifteen, usual number fifteen; ridge-like teeth three. First, second, and third teeth ridge-like, overlapping ventral valves, very slightly. Number four of medium size, well rounded and very widely separated from numbers three and five. Numbers five and six large, widely separated, apices broadly truncate. Seven and eight decreasing in size, pointed, separated widely from adjacent teeth. Small elevation separates eight and nine. Teeth nine to fifteen of same shape, decreasing only slightly in size, very compact, only separated at margins. Ventral valves large, mesal margins straight, meeting at between bases of first and second ridge-like teeth.

Tibicen marginalis (Walker)

Two specimens of this species were examined, both taken in Cherokee County, Kansas.

Ovipositor large and strong, length one and three-fourth times width, teeth large in general; ventral valves dark and heavily chitinized, lateral and dorsal valves very dark and heavily chitinized. Minimum number of teeth observed eleven, maximum number eleven, usual number eleven, ridge-like teeth two. First and second teeth ridge-like, overlapping ventral valves. Number three of medium size and pointed. Number four large, slanting toward point which is widely separated from number three. Number five large and broadly rounded, widely separated from four and six. Number six large, not so rounded as five, widely separated from seven. Teeth seven, eight, nine, ten, and eleven of same general shape, decreasing successively in size, fitting compactly together. Ventral valves not very large, mesal margins curved, narrow at tips, meeting at point opposite base of first ridge-like tooth.

Tibicen dealbata (Davis)

Twelve specimens of this species were examined, two taken in each of the following Kansas Counties, Smith, Barber, Kingman, Cheyenne, and one taken in each of the following Kansas counties, Sedgwick, Sherman, Snyder, and Meade.

Ovipositor large and robust, broad in region of ridge-like teeth, one and three-fourth times as long as wide; ventral valves light brown, and not heavily chitinized, while the lateral and dorsal valves are dark and heavily chitinized. Minimum number of teeth observed eleven, maximum number thirteen, usual number twelve; ridge-like teeth two. Ridge-like teeth of same size, both overlapping ventral valves. Between second and third tooth slight elevation, not counted as separate tooth. Tooth number three of medium size, cephalic margin shorter than caudal margin shorter than caudal margin. Number four large, and pointed, widely separated from numbers three and five. Number five large, and rounded at tip, widely separated from six. Number six of medium size and rounded. Number seven smaller and broadly rounded, widely separated from six and eight. Teeth eight, nine, ten, and eleven of same shape, decreasing successively in size, separated by curved grooves. Number eleven small and rounded.

One specimen of this species observed was evidently a freak, with eight teeth on both sides, appearing as if growth stopped after eight tooth appeared. Ventral valves medium size, pointed, mesal margins very slightly curved, meeting at point cephalad of base of first ridge-like tooth.

Tibicen resh (Haldeman)

Six specimens of this species were examined, all taken in Elk County, Kansas.

Ovipositor of medium size, broadest in region of fifth tooth, one and three-fourth times as long as wide; ventral valves very light brown, slightly chitinized, while the lateral and dorsal valves are decidedly dark and very heavily chitinized. Minimum number of teeth observed nine, maximum number twelve, usual number ten; ridge-like teeth three. First and second teeth ridge-like, overlapping ventral valves, second tooth shorter and not overlapping as far as first. Number three ridge-like and shorter than two. Number four small, only slightly elevated. Fifth tooth largest, widely separated from number four, with well-rounded margin, close up to number six. Teeth numbers six, seven, eight, nine, and ten of same general shape, decreasing successively in size, very close to each

other from base to outer margin. Tenth tooth large in comparison with other species. One specimen examined showed nine teeth on one side and ten on the other. Ventral valves small, mesal margins curved, meeting at point cephalad of base of first ridge-like tooth.

Tibicen resonans (Walker)

One specimen of this species was examined, taken at Southern Pines, North Carolina.

Ovipositor large, robust, stoutest in region of fifth tooth, twice as long as wide; ventral valves light brown, of medium chitinization, while lateral and dorsal valves are dark and heavily chitinized. Number of teeth observed thirteen; ridge-like teeth three. First, second, and third teeth ridge-like, decreasing successively in size. Number four small, widely separated from three. Number five large and broadly truncate, widely separated from four and six. Teeth numbers six, seven, and eight of same general shape, widely separated from each other apically. Numbers nine and ten of same shape, round at tip. Numbers eleven, twelve, and thirteen very small. Ventral valves medium size, mesal margins straight, meeting at point opposite base of first tooth. Ventral valves fitting into deep grooves, with elevated border, showing prominently from first ridge-like tooth to center of fifth tooth.

Tibicen superba (Fitch)

One specimen of this species was examined, taken at Foss, Oklahoma.

Ovipositor of medium size, very long, almost three times as long as wide. Ventral lateral and dorsal valves very light yellow and with very slight chitinization, appearing lighter than in any other ovipositor. Number of teeth observed fifteen; four ridge-like teeth. First, second, and third teeth ridge-like overlapping the ventral valves. Fourth tooth ridge-like and short. A small elevation between fourth and fifth tooth. Fifth tooth rounded, distant from number six. Number six is large, followed by number seven is the same shape but smaller. Teeth from eight to fifteen of same general shape, decreasing successively in size, separated from each other by small curved grooves. Ventral valves of medium size, mesal margins curved, meeting at point opposite base of fifth tooth.

Tibicen dorsata (Say)

Six specimens of this species were examined, three taken in Barber County, and three in Wilson County, Kansas.

Ovipositor large, long and wide, about two and a half times as long as wide; ventral lateral, and dorsal valves medium color and rather heavily chitinized. Two specimens showed slighter color and lighter chitinization. Minimum number of teeth observed thirteen, maximum number fifteen, usual number thirteen, number of ridge-like teeth three. First and second teeth ridge-like, overlapping ventral valves, about equal length. Third tooth ridge-like, small. Fourth tooth smaller than five. Numbers six and seven larger than other teeth. Six fitting into seven at base in curve like groove. Teeth seven, eight, nine, and ten of same relative shape, decreasing successively in size. Numbers eleven, twelve, and thirteen rounded apically, of same relative size. Number fourteen much smaller, rounded forming tip. One specimen examined showed thirteen teeth on one side and fourteen on the other. Ventral valves large, full, widely separated, mesal margins curved, meeting at point cephalad of base of first ridge-like tooth.

Genus Cicada Linnaeus.

One species of this genus was examined.

Ovipositor very small, narrow, and very delicate. Number of teeth ten. First teeth large and pointed, narrowing down to small rectangular teeth at tip; no ridge-like teeth. In the species examined, the whole ovipositor characterized by its delicate structure and slight chitinization.

Cicada hieroglyphica (Say)

One specimen of this species, taken at Lakehurst, New Jersey, was examined.

Ovipositor very small, narrow and delicate, twice as long as wide; ventral, lateral, and dorsal valves very light brown, and very slightly chitinized, very easily crushed. Number of teeth ten; no ridge-like teeth. Separate teeth difficult to distinguish. First, second, and third teeth of same shape, increasing successively in size, pointed tips widely separated. Number four smaller, rounded. Five very small, closely joined to six. Teeth from six to ten of same general shape, joined very compactly decreasing successively in size. Number ten very small. Ventral valves broad, mesal margins curved, meeting far cephalad of base of first tooth.

Genus *Proarna* Stal.

One species of this genus was examined.

Ovipositor small and stout. Number of teeth ten. No ridge-like teeth. Teeth in main large and distinct, except apically, where they are closely crowded.

Proarna venosa (Uhler)

Four specimens of this species were examined, all taken from Santa Rita Mountains. Arizona.

Ovispositor very small, short, one and a half times as long as wide; ventral valves very light brown, only slightly chitinized, while lateral and dorsal valves are darker and of medium chitinization. Minimum number of teeth observed ten, maximum number ten, usual number ten; no ridge-like teeth. First tooth broad, second tooth small and narrow, widely separated from number one and three. Number three large and rounded. Number four is large and pointed, while five is smaller, slanting toward tip. Teeth six and seven of same shape, seven smaller, being closely joined to each other. Teeth eight, nine, and ten very small and rounded, forming tip. Ventral valves of medium size, mesal margins straight, meeting at point cephalad of base of first tooth.

Genus *Tibicina* Kolenati

One species and a variety of this genus were examined.

Ovipositor of medium size, robust. Number of teeth ranging from fifteen to sixteen. Teeth very compact, of same general rectangular shape, with exception of small apical teeth. No ridge-like teeth. Ventral valves laterally cleft, forming small process continuous with first and second teeth in the variety, and with first three teeth in case of the typical species.

Tibicina septendecim (Linnaeus)

Twelve specimens of this species were examined, all taken in Douglas County, Kansas.

Ovipositor of medium size, robust, one and three-fourth times as long as wide; ventral, lateral, and dorsal valves very dark and heavily chitinized. Minimum number of teeth thirteen, maximum number sixteen, usual number sixteen; no ridge-like teeth. First, second, and third teeth appearing as continuation of ventral valves. Teeth four and five of same shape, five larger. Six tooth largest, from this tooth on, teeth of same general rectangular shape, decreasing successively in length. Fifteenth tooth finely divided, making possible existence of sixteenth tooth. Teeth very close together and very stout. Ventral valves large, mesal margins, slightly curved, meeting at point opposite base of first tooth. Ventral valves laterally cleft, forming small process, continuous with first three teeth.

Tibicina septendecim var. *cassinii* (Fisher)

Twelve specimens of this variety were examined, all taken in Douglas County, Kansas.

Same description applies as above with exceptions, ovipositor smaller and minimum number of teeth fifteen, maximum number fifteen, and usual number fifteen. Small process formed by lateral cleft of ventral valve continuous with first and part of second tooth.

Genus *Okanagana* Distant.

Two species of this genus were examined.

Ovipositor of medium size, and not strongly narrowed toward tip. Number of teeth fourteen. Three ridge-like teeth on slight elevations. Teeth for the most part rectangular, the more apical ones tending to be rounded.

Okanagana synodica (Say)

Three specimens of this species were examined, two taken in Hamilton County, Kansas, and one in Salida, Colorado.

Ovipositor small, stoutest in region of fourth tooth, twice as long as wide; ventral valves with dark brown tips of medium chitinization, lateral and dorsal valves dark and heavily chitinized. Minimum number of teeth observed fourteen, maximum number fourteen, usual number fourteen; ridge-like teeth three. First, second, and third teeth ridge-like. Number four small and pointed, slanting towards number five, which is medium size and curved toward number four. Teeth from five to thirteen of same. General shape, decreasing successively in size, and joined very close together. Number fourteen very small and rounded, forming tip. Ventral valves large, mesal margins straight, meeting at point opposite base of second ridge-like tooth.

Okanagana bella (Davis)

Two specimens of this species were examined both taken at Creede, Colorado.

Ovipositor of medium size, about the same thickness up to the ninth tooth, one and three-fourth times as long as wide, ventral valves light brown, only slightly chitinized, while dorsal and lateral valves are very dark and heavily chitinized. Minimum number of teeth observed fourteen, maximum fourteen, usual number fourteen; three ridge-like teeth, ridges on slight elevations. Number four medium size, projecting out a little farther than number three. Number five widely separated from number four, very large. Number six large. Number seven as long and broad, and very close to number six. Number eight decreasing in size, same general shape as seven. Teeth nine, ten, eleven, twelve, and thirteen, separated apically, of same general shape, narrow, decreasing successively in size. Number fourteen, rounded, forming tip. Ventral valves broad, mesal margins slightly curved, meeting at point a little below base of first ridge-like tooth.

Genus *Tibicinoides* Distant

One species of this genus was examined.

Ovipositor small, lateral margins basally parallel, then suddenly converging to the apex. Number of teeth thirteen; three ridge-like teeth appearing on slight elevations. Teeth very compact, rectangular in shape, decreasing successively in size. Ventral valves more angulate apically than in other genera.

Tibicinoides hesperius (Uhler)

Two specimens of this species were examined, one taken in Trego County, Kansas, and one at Fort Collins, Colorado.

Ovipositor small, widest in region of fifth tooth, one and a half times as long as wide; ventral valves dark but not very heavily chitinized, while lateral and dorsal valves are dark and of medium chitinization. Minimum number of teeth observed thirteen, maximum number thirteen, usual number thirteen; ridge-like teeth three. First, second, and third teeth ridge-like, slightly overlapping ventral valves, the ridges on slight elevations. Number four close to number five and pointed. Teeth from five to thirteen are very close together of same general rectangular shape, and decreasing successively in size. Number thirteen rounded and pointed, forming tip. Ventral valves of medium size, mesal margins only slightly curved, meeting cephalad of point opposite base of first ridge-like tooth.

Genus *Melampsalta* Kolenati

Two species of this genus were examined.

Ovipositor very small, number of teeth range from nine to fourteen; no ridge-like teeth. First teeth not very small as in same other genera, majority of teeth rectangular in shape, decreasing successively in size.

Melampsalta calliope (Walker)

Five specimens of this species were examined, two taken in Linn County, one each in Miami, Douglas, and Ottawa Counties, Kansas.

Ovipositor very small and stout, only one and a half times as long as wide; ventral valves brown and of medium chitinization, while lateral and dorsal valves are dark and more heavily chitinized. Minimum number of teeth observed ten, maximum number thirteen, usual number twelve; no ridge-like teeth. A small process coming before first tooth not counted as separate tooth. Teeth very compact, of same general shape, decreasing successively in size, with exceptions of nine and ten, which are more rounded, appearing as one tooth divided. Ventral valves of medium size, mesal margins slightly curved, meeting for cephalad of first tooth.

Melampsalta kansa (Davis)

One specimen of this species was examined, taken in Rush County, Kansas.

Ovipositor small, robust, stoutest in region of fifth tooth, one and a half times as long as wide; ventral valves light brown and not heavily chitinized, while lateral and dorsal valves are dark brown and heavily chitinized. Number of teeth fourteen; no ridge-like teeth. First, second, and third small with first broader, fitting very close together. Number four very close to number three, and joined closely to number five. Number five very long but not very broad. Teeth numbers six, seven, and eight of same general shape, decreasing, broad and not narrowed apically. Nine thru thirteen of same general shape, pointed apically, decreasing successively in size. Teeth six, seven, and eight very compact. Numbers thirteen and fourteen appear as one tooth divided. Ventral valves broad, mesal margins straight, meeting far cephalad of base of first tooth.

Conclusions:

After close observation, the writer finds that there are generic differences in the ovipositor of the Cicada. These differences may exist in the relative size and shape of the ovipositor and in the size and shape of the teeth. Some of the generic differences are constant, as in the case of the more rounded curved teeth of the genus *Tibicen*, in contrast with the rectangular and more regular teeth of the genus *Okanagana*. There are also special distinguishing characteristics to be found, as in the case of the genus *Tibicina*, where the lateral cleft of the ventral valve may be used as an easy means of distinguishing the members of this genus.

The ovipositors of the species within the genus show different structural characteristics such as the number, size, and shape of the teeth, and the size of the ovipositor. It is possible to find within the genus, species with a distinctly characteristic ovipositor, which will easily set it apart from other species, such as the large truncate teeth of *Tibicen resonans*. Another good example of specific characters is found in the teeth of *Tibicen linnei*, which has teeth five and six apically ridged.

To the beginning student these generic and specific differences are of very little use in taxonomic work, so that with few exceptions it seems inadvisable to use them in keys to the genera and species, but to the specialist, they often afford constant and ready characteristics which may at times be of decided value to him in the determination of closely related species.

Plate I.

L - - - - Lateral valve.
D - - - - Dorsal valve.
C - - - - cercus.
9s - - - - ninth sternite.
8s - - - - eighth sternite.

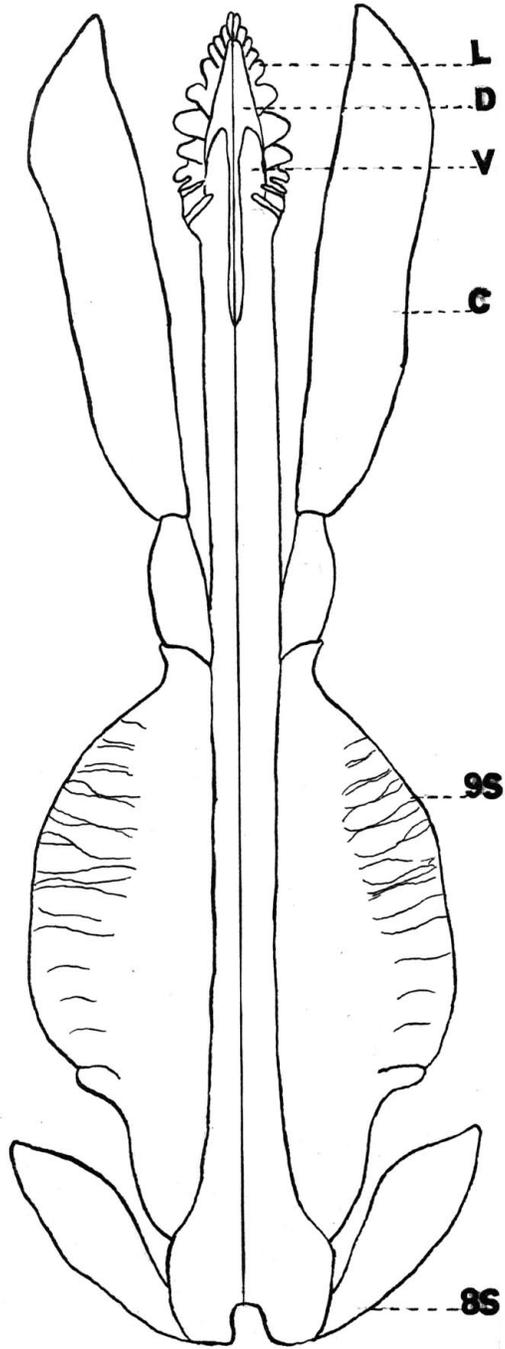


Plate II

L - - - - Lateral valve.
V - - - - Ventral valve.
8s - - - - eighth sternite.

Plate II.

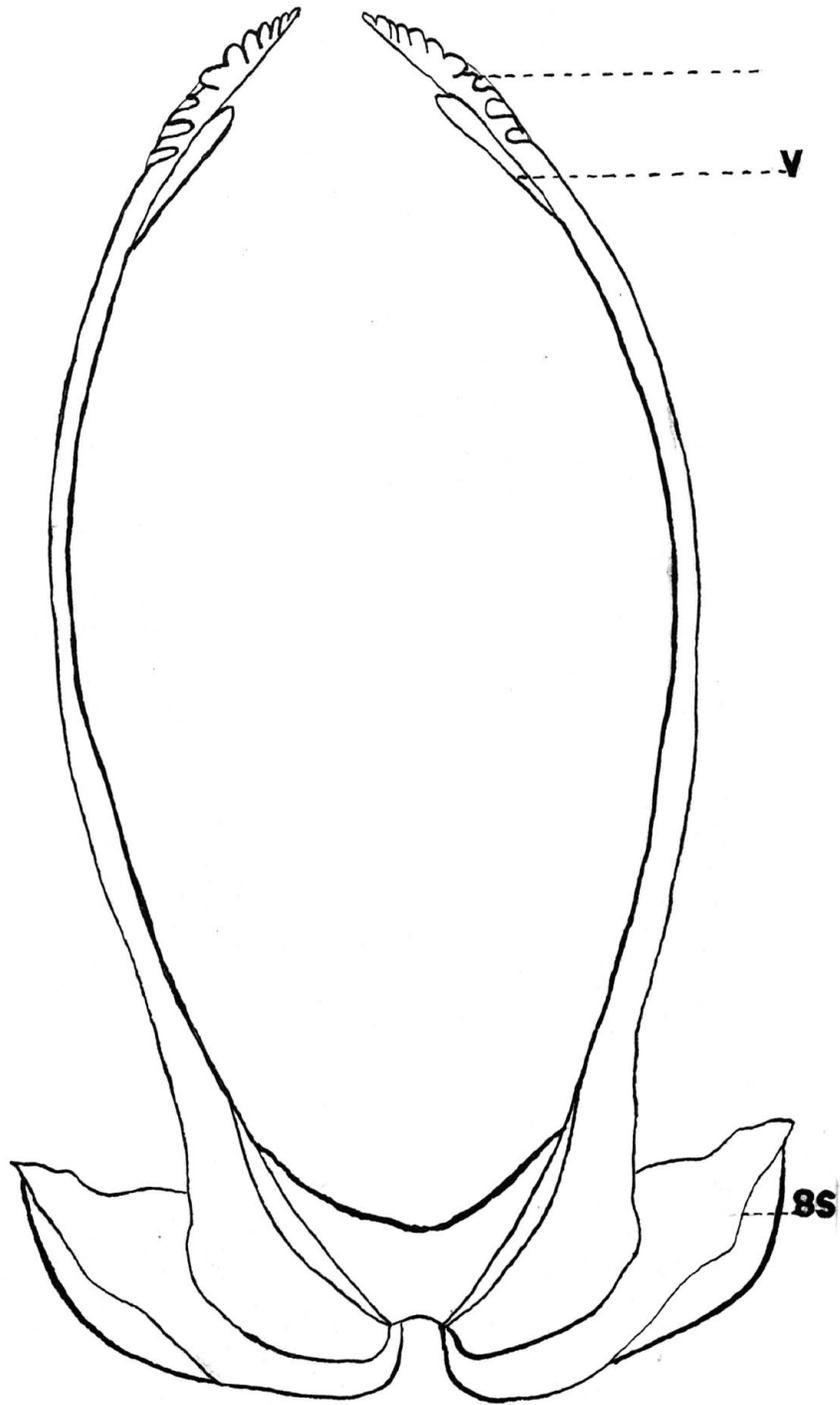
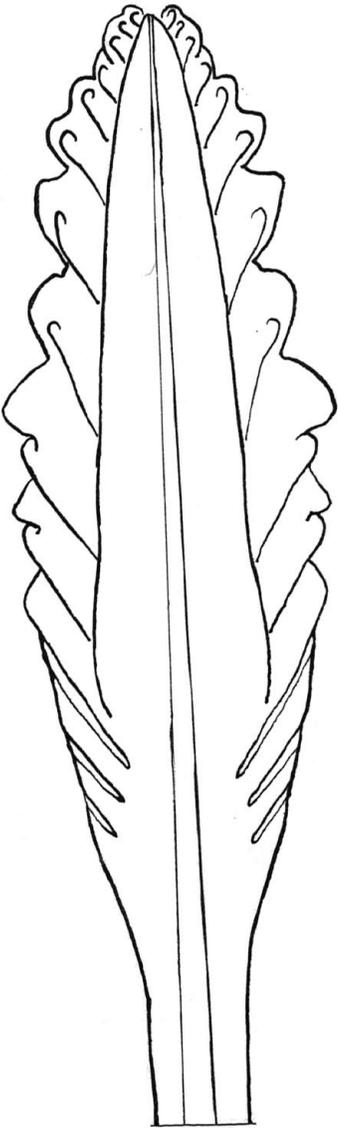
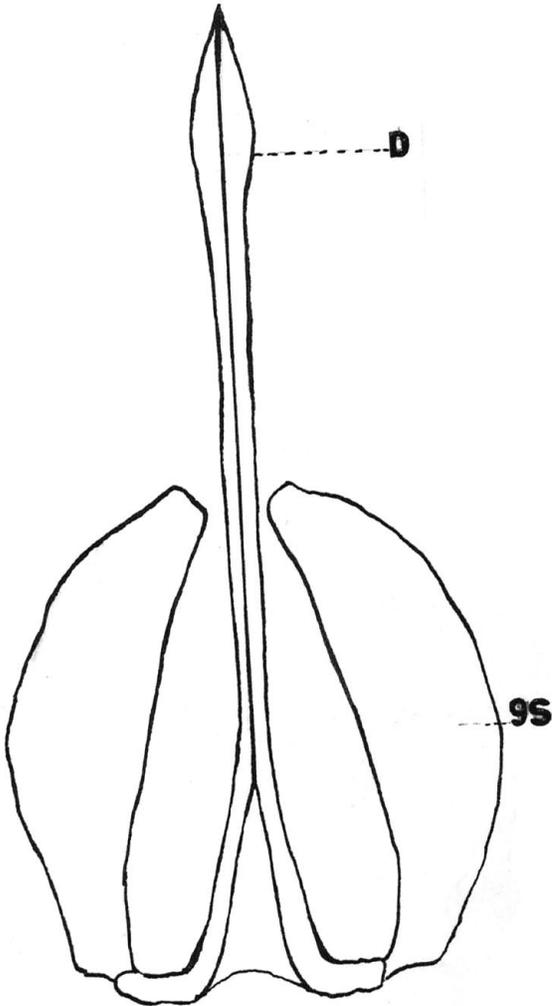


Plate III.

1. Portion of ovipositor.
D - - - - Dorsal valve.
9s - - - - ninth sternite.
2. Dorsal view of ovipositor.



2



1

Plate IV.

1. Ovipositor of *Tibicen bifidus*.
2. Ovipositor of *Tibicen linnei*.
3. Ovipositor of *Tibicen pruinosa*.

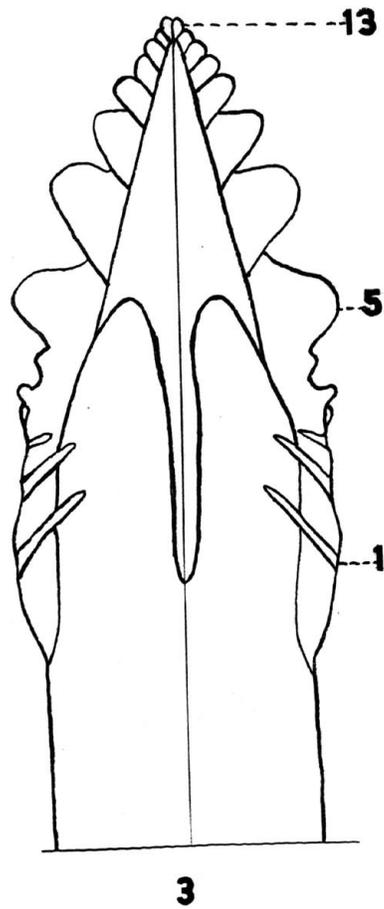
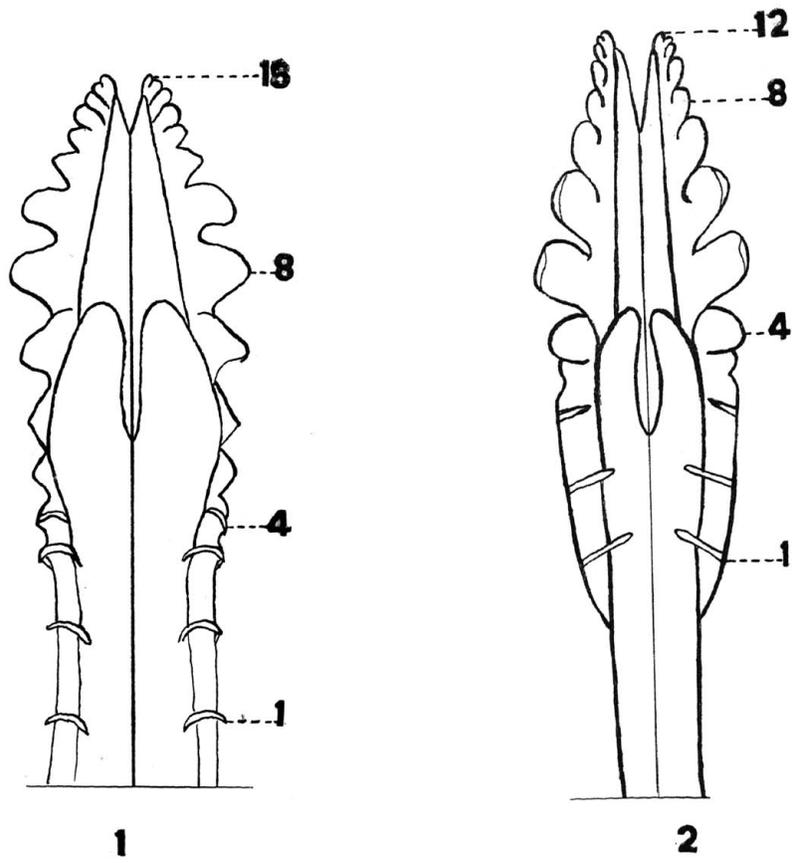
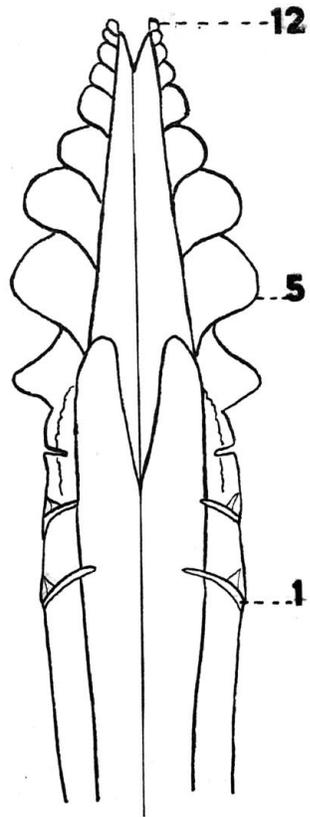
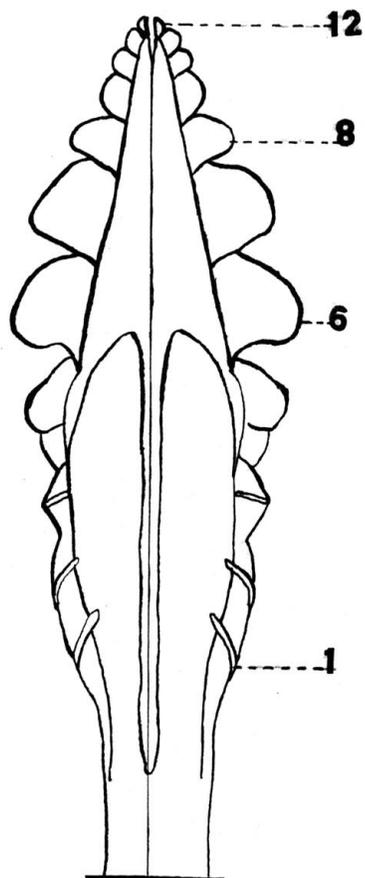


Plate V.

1. Ovipositor of *Tibicen sayi*.
2. Ovipositor of *Tibicen lyricen*



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1

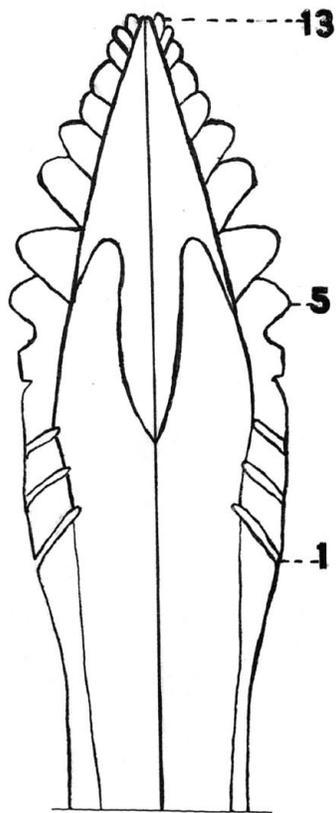


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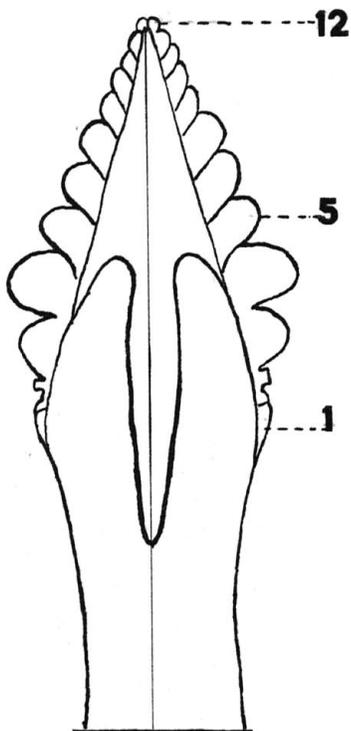
Plate VI.

1. Ovipositor of *Tibicen aurifera*.
2. Ovipositor of *Tibicen eugraphica*
3. Ovipositor of *vitripennis*.

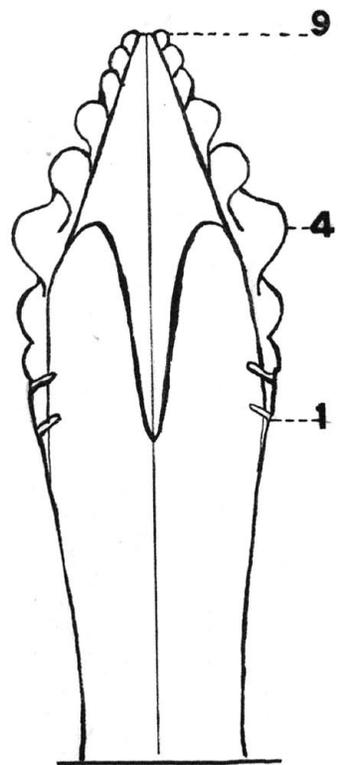
Plate VI.



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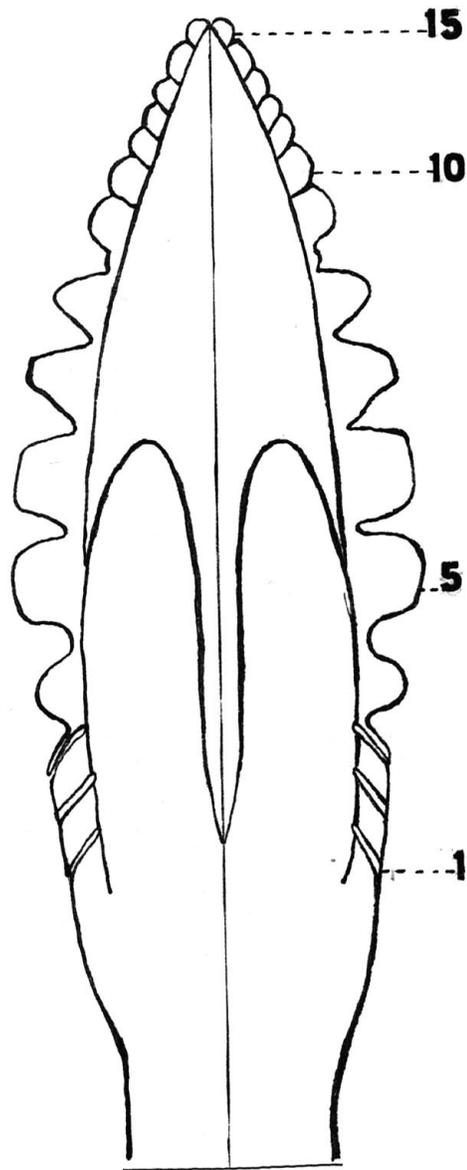
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Plate VII.

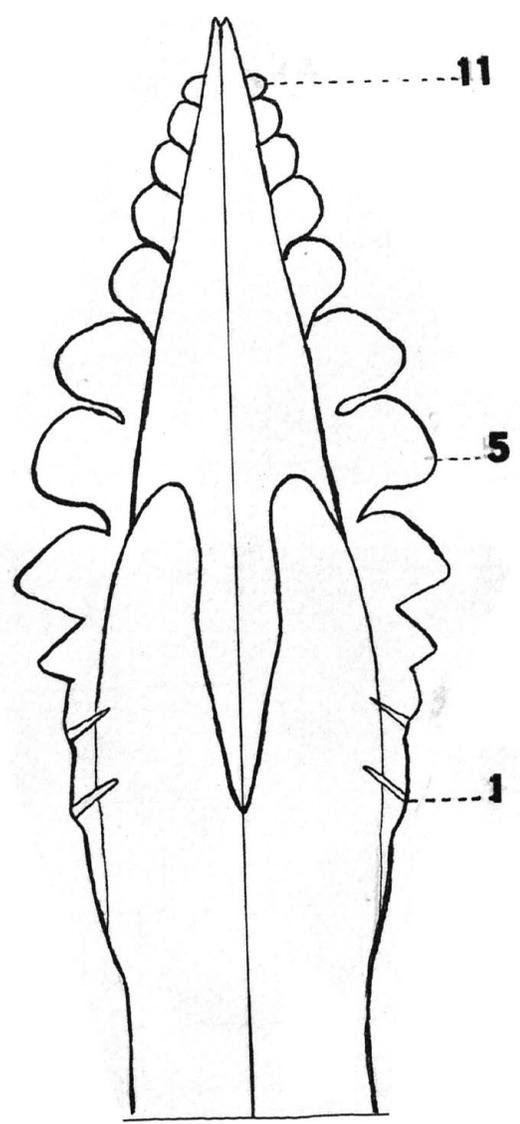
1. Ovipositor of *Tibicen auletes*.



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Plate VIII.

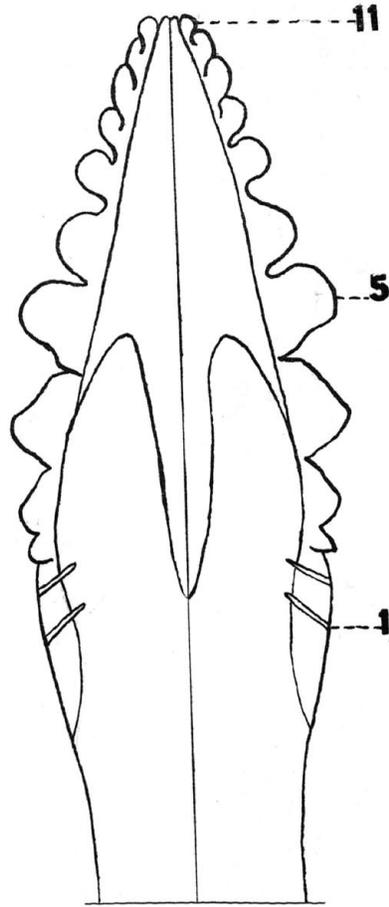
1. Ovipositor of *Tibicen marginalis*.



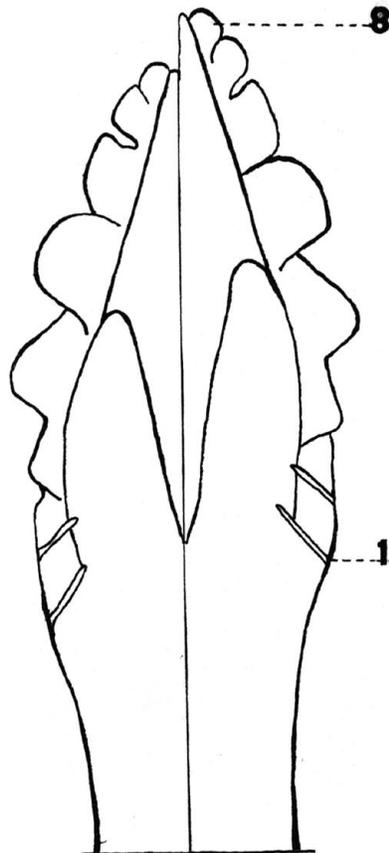
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Plate IX.

1. Ovipositor of *Tibicen dealbata*.
2. Ovipositor of *Tibicen dealbata*
(freak).



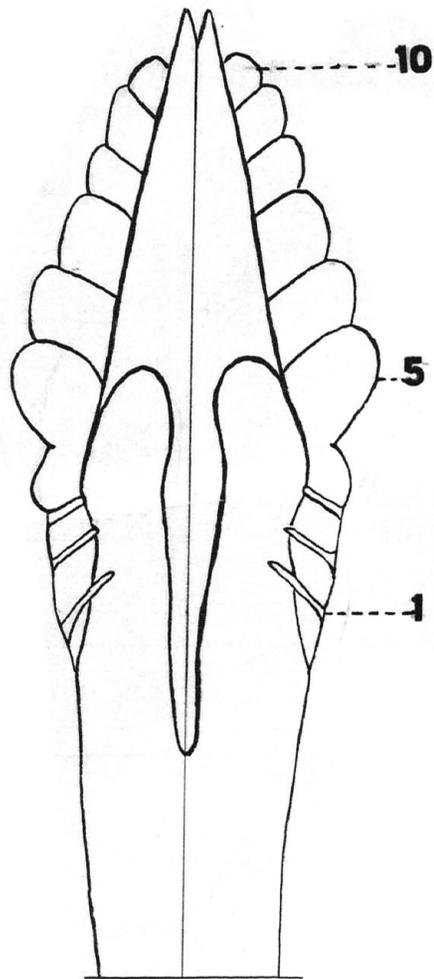
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Plate X.

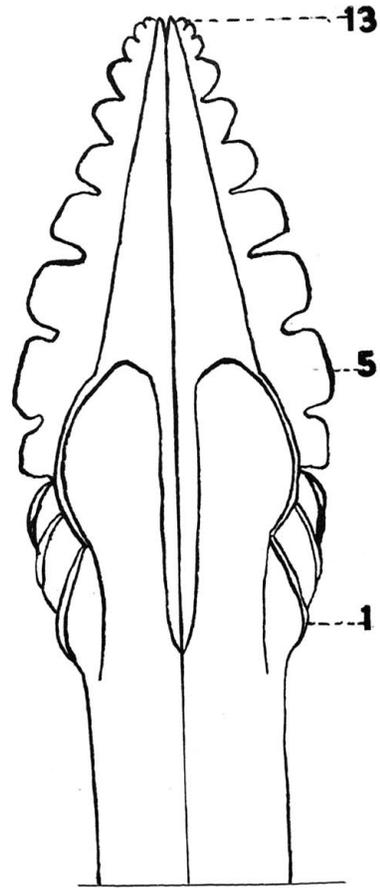
1. Ovipositor of Tibicen resh.



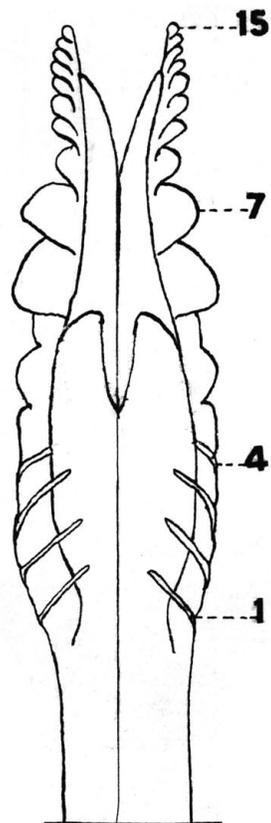
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Plate XI.

1. Ovipositor of *Tibicen resonans*.
2. Ovipositor of *Tibicen superba*.



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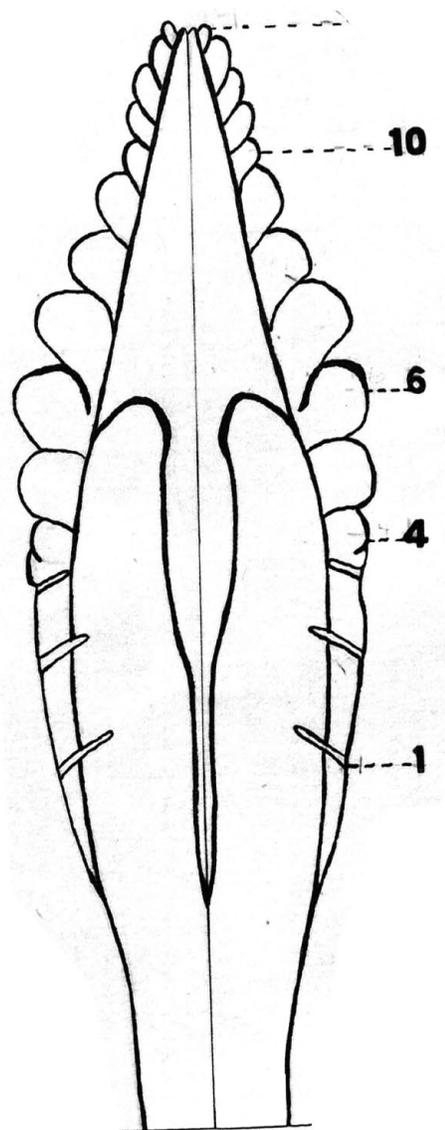


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Plate XII.

1. Ovipositor of *Tibicen dorsata*.

Plate XII.

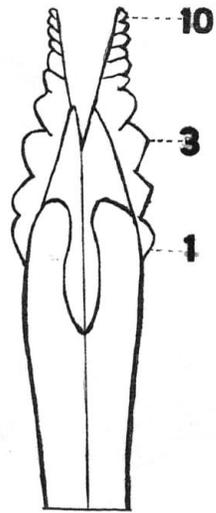


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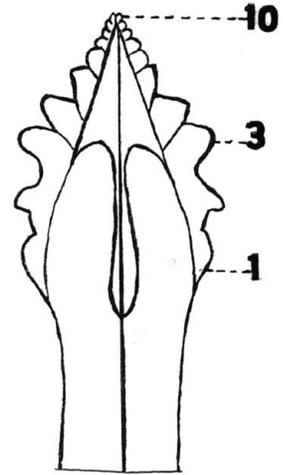
Plate XIII.

1. Ovipositor of *Cicada hieroglyphica*.
2. Ovipositor of *Proarna venosa*.
3. Ovipositor of *Tibicen septendecim*.
4. Ovipositor of *Tibicen septendecim*
var. *casinii*.

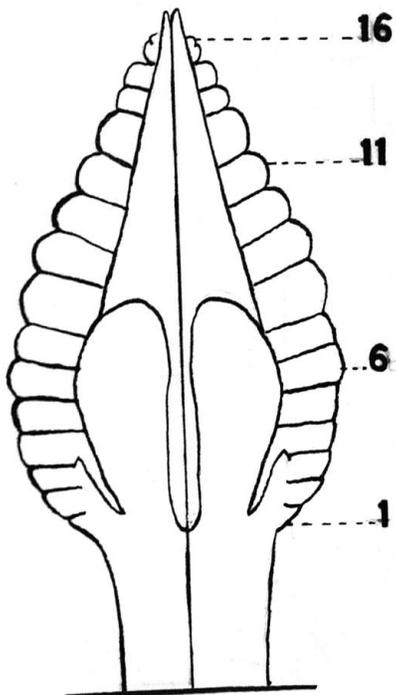
Plate XIII.



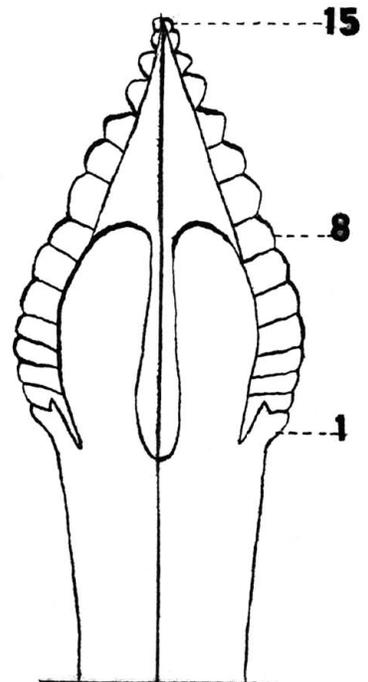
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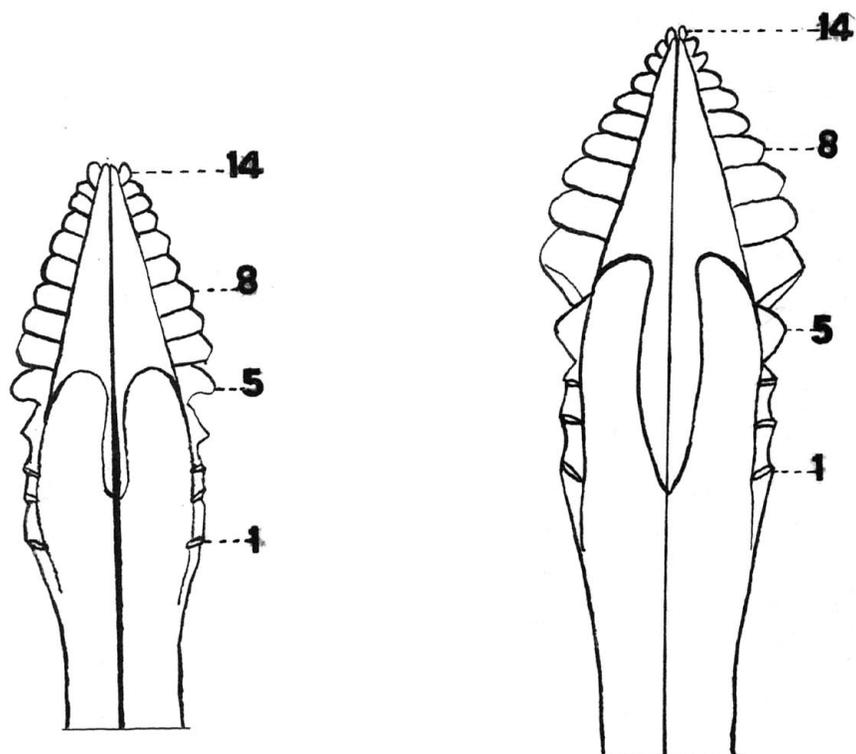


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Plate XIV.

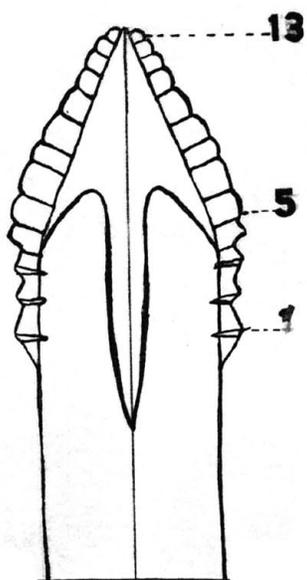
1. Ovipositor of *Okanagana synodica*.
2. Ovipositor of *Okanagana belli*.
3. Ovipositor of *Tibicinoides hesperius*.

Plate XIV.



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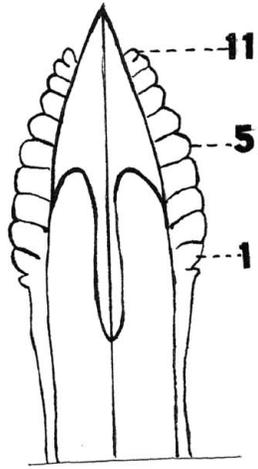


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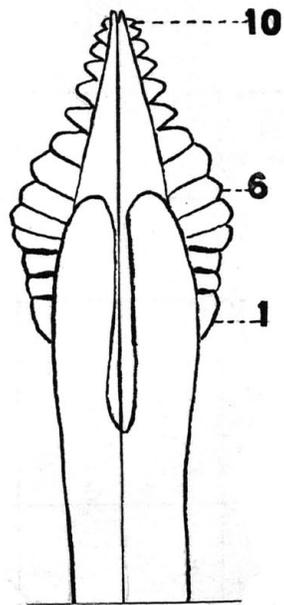
Plate XV.

1. Ovipositor of *Melampsalta calliope*.
2. Ovipositor of *Melampsalta kansa*.

Plate XV.



1



2

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