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A morphological study of the subtribe Ithypori (Coleoptera: curculionidae)

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A MORPHOLOGICAL STUDY OF THE SUBTRIBE ITHYPORI (COLEOPTERA: CURCULIONIDAE)

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INTRODUCTION

This is a morphological study of the subtribe Ithypori, undertaken to discover all that we can about the morphology and if possible justify the present classification. It includes four genera and fifteen identified species.

The economic importance of this subtribe has motivated the research and interest of this paper. The "plum curculio", Conotrachelus nenuphar, was the most dreaded pest of tree fruit during the 19th century. In North America this and other species of Ithypori have greatly affected the following important crops: cotton, sweet potatoes, beans, alfalfa, grass, walnut, corn, spinach, peas, peach and plum.

Of the one hundred and twenty-two genera of the subtribe Ithypori found throughout the world (Hustache, 1936), one hundred and twelve genera occur in the Australian, Oriental, Neotropical, and Ethiopian realms. Only five genera are found in each of the Nearctic and Palaearctic realms.

The North America representatives of these genera occur only in the eastern and southern United States, consequently, the writer has had no field contact with them. Representatives of the species studied came through the kindness of Dr. Tanner from the collections of the Brigham Young University.

The classification of the subtribe and relationships between genera and species are poorly understood. This is partly because very little is known of the taxonomic significance of certain morphological structures.

Therefore, special attention was given in this study to the wings, legs, spermathecae, male and female genitalia, and other structures usually overlooked by former workers. This study has resulted in some new information as to the relationships of the various species and genera examined.

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In the absence of Dr. Tanner at the close of this work, Dr. Stephen L. Wood's willingness to assist and suggest changes for the betterment of this paper have been of invaluable importance. The enthusiasm and interest of these men have been a great help for the forwarding of this study.

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METHODS

All of the subtribe Ithypori used in this study were museum specimens from the collections of the Brigham Young University. The specimens were examined by the use of a binocular microscope at magnifications of 20X-40X as mounted specimens for morphological variations. After this examination of each specimen they were placed in hot water to help relax the various structures. The abdomen was then removed and placed in a 4% solution of potassium hydroxide until the fatty substances and muscles were removed. They were then thoroughly washed with water for a short period of time. The genital structures were extruded by means of a special prepared teasing needle by excising the tergites.

Several structures were mounted on slides in Hoyers Medium for further study and reference. Other structures were placed in a small vial filled with a 70% solution of alcohol for further reference and investigation.

Drawings were made with the aid of a bioscope, and a binocular microscope with an ocular grid. Dorsal, ventral, and lateral drawings of pronotum, antenna, leg, wing, male and female genitalia, spermatheca, elytra and abdomen were made freehand.

SPECIES STUDIED

This study includes four genera and fifteen identified species of the subtribe Ithypori. These species are listed below in the order they appear in Leng (1920).

Subtribe Ithypori

PHYRDENUS Lec., 1876.

muriceus Ger., 1824. Figs. 1, 12, 16, 20, 26, 30-31, 46-47, 62, 76, 78.

CONOTRACHELUS Schon., 1837.

juglandis Lec., 1876. Figs. 4, 14, 17, 23, 27, 40-41, 56-57, 68, 77, 79.

nenuphar Hbst., 1797. Figs. 10, 17, 27, 48-49, 66, 77, 79.

falli Blatch., 1916. Figs. 17, 27, 77, 79.

seniculus Lec., 1876. Figs. 5, 17, 21, 27, 44-45, 64, 77, 79.

integer Csy., 1892. Figs. 6, 17, 22, 27, 58-59, 63, 77, 79.

similis Boh., Schon., 1837. Figs. 7, 17, 27, 65, 77, 79.

floridanus Fall, 1913. Figs. 6, 17, 27, 60-61, 69, 77, 79.

leucophaeatus Fahr., Schon., 1837. Figs. 6, 17, 27, 67, 77, 79.

fissunguis Lec., 1876. Figs. 10, 17, 27, 70, 77, 79.

RHYSSEMATUS Schon., 1837.

palmacollis Say, 1831. Figs. 8, 15, 18, 20, 24, 28, 34-35, 52-53, 74, 80, 82.

lineaticollis Say, 1824. Figs. 9, 15, 18, 24, 28, 38-39, 75, 80, 82.

pruinosus Boh., 1845. Figs. 11, 15, 18, 24, 28, 32-33, 73, 80, 82.

CHALCODERMUS Schon., 1837.

aeneus Boh., Schon., 1837. Figs. 2, 13, 19, 25, 29, 36-37, 50-51, 71, 81, 83.

collaris Horn, 1873. Figs. 3, 13, 19, 25, 29, 42-43, 54-55, 72, 81, 83.

HISTORICAL REVIEW

The subtribe Ithypori, of the tribe Cryptorhynchini, was originally named by Lacordaire (1866) to include the following three genera: Conotrachelus, Rhyssematus, and Chalcodermus. Leconte (1892) separated the species of the tribe Cryptorhynchini into subtribes Ithypori and Cryptorhynchi. This same author added three more genera when he included Zaglyptus, Microhyus, and Micralcinus because of their similarity to Conotrachelus and Rhyssematus. Casey (1892) transferred the genus Zaglyptus to the tribe Barini and added the genus Chaleponotus to the subtribe Ithypori because of its similarity to Chalcodermus and Rhyssematus. Blatchley and Leng (1916) added the genus Phyrdenus to this subtribe because of its prominent humeri and resemblance to Conotrachelus.

Blatchley and Leng (1916) treated the species of Ithypori from Canada and United States East of the Mississippi River, including two species of Phyrdenus, twenty-eight of Conotrachelus, four of Rhyssematus, three of Chalcodermus, one of Microhyus, and one of Chaleponotus. These same authors redescribed all of Leconte's species of Ithypori adding biological and distributional data.

The only comprehensive treatment of any North American group of Ithypori is the revision of the genus Conotrachelus by Schoof (1942), who evaluated the taxonomic and morphological characters of the species of this genus.

For the most part, the characters used in classification have been

the pectoral groove, elytra, humeri, femur toothed beneath and tarsal claw.

MORPHOLOGY OF SPECIFIC STRUCTURES

The members of Ithypori are an assemblage of rather broad, stout, often coarsley sculptured species, which vary greatly in structural detail and appearance. Their color varies from shades of black in Phyrdenus, Chalcodermus, and Rhyssematus to brown in Conotrachelus. They often appear with scales or setae or both, arranged in ornamental designs. They range in size from 2.5-6.5 mm.

Head

The dorsal aspect of the head capsule in representatives of the subtribe Ithypori is oval with the exception of the subtribe Phyrdenus (Fig. 1) which is anteriorly truncate. The beak is stout, usually equal in length to the combined length of head and thorax; it is curved slightly downward with the dorsal antennal inseration varying from one half to three-fourths down the beak. Most species of Conotrachelus have the antennal inseration found at the extreme end of the beak with the exception of C. floridanus in which it is located half way down the beak. In C. similis the female has a cylindrical beak equal in length to the elytra, while the male has a much shorter and broader structure equal to the combined length of the head and thorax. This is the only case of sexual difference in this character.

The antennae are of the geniculate type, usually being longer than the length of the beak except in Conotrachelus similis. The funicle is composed of seven segments and the solid club has three annulated joints.

In all species of Ithypori studied the antennae are similar except Phyrdenus (Fig. 12) which has the scape greatly enlarged termially and a stouter club. The length of the scape in Conotrachelus (Fig. 14) is equal to the combined length of the flagellum and pedical whereas in all others of this subtribe it is about three-fourths as long.

Thorax

The dorsal aspect of the pro-thorax varied considerably between the species of this subtribe, from a simple semi-circular structure in Rhyssematus lineaticollis (Fig. 9) to a very elaborate angulate structure in Chalcodermus aeneus (Fig. 2). In most of the species studied it was similar to R. lineaticollis.

This writer's investigation of the lateral and ventral view of the pterothorax did not reveal any important taxonomical characters in this subtribe.

Leg. The general contour of the femur of each genus is similar to (Figs. 20-25) with the exception of the apical ventral margin of the genus Conotrachelus (Figs. 21-23) in which the males have two teeth and the females have one. This difference is useful in sex determination as pointed out by Schoof (1942).

The tibiae of Ithypori are usually long, narrow and smooth. Chalcodermus (Fig. 25) was the only genus that had a serrated ventral margin of the tibia. Rhyssematus (Fig. 24) enlarges apically forming a stout structure. The contour of Phyrdenus (Fig. 20) is similar to Conotrachelus (Fig. 17), but lacks metatibial spines. The metatibial spines are two in number. Schoof (1942) states, "The metauncus spine is usually stout, with a curved hook developed from the outer apical angle of the

tibia while the metamucro spine developes from the inner angle of the tibia." The tibiae of Conotrachelus studied are constant except for the variation in the metatibial spines (Figs. 21-23). The metauncus spines are absent in Conotrachelus integer, fissunguis, and floridanus (Fig. 22). Species of Rhyssematus studied appear only with a metamucro spine whereas Chalcodermus has both spines present.

The tarsal claws of Ithypori appear distinct for each genus studied. All species of Rhyssematus, Conotrachelus, and Phyrdenus have cleft structures while Chalcodermus are simple. The teeth of Rhyssematus are equal in length while Phyrdenus and Conotrachelus are unequal. Phyrdenus teeth branch basically while Conotrachelus branch distally.

Elytra

The elytra within each genus are constant in contour. Phyrdenus (Fig. 76) basal borders are truncate, sides arcuate narrowing to apex. Conotrachelus (Fig. 77) basal borders emarginate, side emarginate on basal forth gradually narrowing to apex. Rhyssematus (Fig. 80) basal borders sigmoid, sides arcuate narrowing to apex. Chalcodermus (Fig. 81) basal borders arcuate, sides subparallel on basal half gradually narrowing to apex. Similarities were noticed in that Phyrdenus and Rhyssematus elytra were wide as they were long where as in Conotrachelus and Chalcodermus the length exceeded the width.

Hind Wing

The general outline of the hind wings of the species of Ithypori are similar except the anterior margin in Phyrdenus which has a noticable emargination. With the assistance of Crowson's illustrations (1955, p. 159)

the veins were homologized and it was found that radial vein 2, media 1 and 4, and anal 4 are present in all species of this subtribe. Anal vein 5 was present in all genera except Phyrdenus. Detached radial vein 3, anals 2 and 3 only appear in species of Conotrachelus and Rhyssematus. The fusing of anals 4 and 5 is characteristic of some, but not all, species of Conotrachelus, and absent in all other members of this subtribe.

Abdomen

The ventral aspect of the abdomen of Ithypori are divided into five segments, with the sutures between the abdominal sterna revealing variations. Rhyssematus differs from all other genera in that the median portion of the suture located between the first and second abdominal sterna extends anteriorly forming an obtuse angle (Fig. 82). The above mentioned suture in Phyrdenus, Conotrachelus, and Chalcodermus is straight. The second, third and fourth sutures in Phyrdenus curve anteriorly (Fig. 78) in contrast to the parallel and straight sutures of the other genera studied.

Female Genitalia

The most reliable character of the external female genitalia is the spiculum ventrale which is basically Y-shaped. In Chalcodermus aeneus (Fig. 36) each branch of the Y is expanded into a triangular plate. Rhyssematus lineaticollis (Fig. 42) is similar to Chalcodermus aeneus except the inter-line extends posteriorly forming a narrow arm. Rhyssematus pruinosus and R. palmacollis are similar in that both arms of the Y have long narrow branches extending posteriorly with a round nob at the apex. Conotrachelus juglandis (Fig. 40) is similar to R. pruinosus and R. palmacollis with the exception that each branch of the Y is enlarged at its

base. Chalcodermus collaris (Fig. 42) has a partial extension of the Y tapering posteriorly.

Spermatheca. The spermathecae (Figs. 56-75) in the Ithypori are of the compact type with the nodulus and ramus area enlarged and tapering to the cornu, except in Rhyssematus (Figs. 73-75). The three species studied in this genus have one of the spermathecal ducts located on the side of the nodulus with the other located on the enlarged nodulus and ramus area as they usually appear in other species of the subtribe. Rhyssematus pruinosus (Fig. 73) has an enlarged projecting ramus area that does not appear in R. palmacollis (Fig. 74) or R. lineaticollis (Fig. 75). The over all contour of R. pruinosus is similar to Conotrachelus and Chalcodermus. The spermatheca of R. lineaticollis has a small nodulus and ramus area which gradually enlarges half way down the structure and then tapers towards the apex of the cornu.

All structures studied were comparable in size, as might be expected from the uniformity in size of the species studied. The inter-angle located between the ramus and cornu of Ithypori is acute and similar to those found by Kidd (1957) in Sitona. The sclerotization of these structures varied only in the genus Phyrdenus (Fig. 62) where the anterior area is highly pigmented apparently due to sclerotization. This character was of unusual interest and possibly may have some taxonomic importance.

Male Genitalia

In dorsal aspect the sides of the median lobe or aedeagus vary from parallel in Chalcodermus aeneus (Fig. 50), to an apically broadening structure in Conotrachelus seniculus (Fig. 44), a tapering one in Rhyssematus palmacollis (Fig. 52), and a constricted one in Conotrachelus

integer (Fig. 58). The apical margin varies from emarginate appearance in Conotrachelus seniculus (Fig. 44), with a mucronate appearance in Conotrachelus integer (Fig. 58), and an arcuate appearance in Conotrachelus juglandis (Fig. 56).

Orifical plates were absent in Phyrdenus muriceus and Rhyssematus palmacollis (Fig. 52) but were present in all other species of Ithypori. One pair of plates was present in Conotrachelus seniculus (Fig. 44), juglandis (Fig. 56), and Chalcodermus aeneus (Fig. 50) and collaris (Fig. 54). Conotrachelus integer (Fig. 58) has two pairs of plates present while Conotrachelus floridanus (Fig. 60) has three pairs of plates.

The median struts attach to the antero-lateral margin of the aedeagus and extend anteriorly. The length of the struts appears to be of importance with some being shorter than the median lobe as those in Conotrachelus and Phyrdenus compared with those of Chalcodermus and Rhyssematus which are longer than median lobe.

The tegmen usually forms a complete ring around the median lobe in all species of this subtribe showing similarity to those structures studied by Bruhn (1947). The ventral apodeme of the tegmen which extends anteriorly is absent in all species of Conotrachelus, but present in Phyrdenus, Rhyssematus, and Chalcodermus.

DESCRIPTION OF STRUCTURES STUDIED

The most salient characters have been used in these descriptions. Many characters are common to all species of Ithypori and are presented only in the description of the subtribe. Common characters of each genus are not continually repeated in the species description.

Subtribe Ithypori

Description: Head cylindrical, dorsal apical aspect arcuate except in Phyrdenus. Eye: lachrymiform except in Phyrdenus. Beak: usually equal to the length of head and thorax, slightly bent inwardly. Antenna: geniculate, scape gradually enlarges apically, funicle seven jointed, club oval having three annulated joints. Pro-thorax: broader than long, constricted in front, usually very coursely sculptured. Sternum: the pectoral groove confined to the prosternum; mesosternum declivous or flat. Leg: femur toothed except in Phyrdenus; tibia slender except in Rhyssematus, ventral margin smooth except in Chalcodermus, metatibial spines present except in Phyrdenus; claws toothed. Elytra: distinctly wider than thorax, with prominent surface sculpture. Hind Wing: membranous with anals 4 and 5 present except in Phyrdenus; radial 2 present; medial 1 present. Female Genitalia: spiculum ventrale Y-shaped. Male Genitalia: of the annulate type with the basal piece forming a complete ring around the median lobe. Spermatheca: compact, having an elongate cornu which narrows toward bluntly pointed apex.

Phyrdenus muriceus Germ.

Description: Head: dorsal apical aspect truncate; eye circular convex; beak short, stout, with the antennal insertion half way down the beak. Pro-thorax (Fig. 1) sides and basal border arcuate. Tarsal claw (Fig. 26) unequally cleft, distal and connate at base. Elytra (Fig. 76) width equals length; basal border truncate; lateral side arcuate converging to apex. Hind Wing (Fig. 16) anal 5 absent, apical portion of 2 and 3 absent; radial cell open. Abdomen (Fig. 78) width longer than length; suture located between first and second segments straight, remaining three sutures arcuate extending anteriorly. Female Genitalia (Fig. 30) spiculum ventrale "Y" in shape. Male Genitalia (Fig. 46) median lobe half as wide as long, narrows toward apex, apical process mucronate without setae; median orifice anterio-medial; orifical plates not present; inter-aedeagal structure not visible; median struts 3/4 length of median lobe converging gradually posteriorly. Spermatheca (Fig. 62) stout, highly pigmented due to scleritization in the nodules and ramus areas; nodules and ramus distinctly separated, sides emarginate; cornu short, narrowing to bluntly hooked apex.

Distribution: According to Leng (1920) this species is found in Indiana.

Biology: Unknown.

Conotrachelus juglandis Lec.

Description: Head (Fig. 4) dorsal apical aspect arcuate; beak longer than length of head and thorax, stout, with antennal insertion near apex; male and female structures similar. Antenna (Fig. 14) length of scape equal to combined length of flagellum and pedical. Pro-thorax

(Fig. 4) wider than long, broadly constricted in front, sides rounded, base bi-concave. Leg (Fig. 23) femur alike in both sex, apical ventral teeth present; metatibial spines present; tarsal claw (Fig. 27) toothed or cleft. Elytra (Fig. 77) longer than wide, basal margin tri-emarginate, medial half of sides parallel, gradually narrowing to apex. Hind Wing (Fig. 17) anals 4 and 5 not fused, apical portion of 2 and 3 absent; apical portion of radial 3 present; radial cell closed. Abdomen (Fig. 79) longer than wide; intersegmental sutures parallel and straight. Female Genitalia Figs. 40-41) spiculum ventrale Y-shaped, both branches with an enlarged extention running posteriorly and tapering with a round nob at the apex. Male Genitalia (Figs. 40-41) median lobe stout, sides sub-parallel, apical process arcuate without setae; orifical plates large; inter-aedeagal structure visible; median struts 3/4 length of medial lobe, gradually converge apically. Spermatheca (Fig. 68) nodules and ramus not distinctly separated; cornu short and stout which narrows toward bluntly pointed apex.

Distribution: Leng (1920) reports that this species ranges from Quebec and New England to Illinois, south to Georgia.

Biology: According to Schoof (1946) the butternut curculio, juglandis Lec. attacks the following species of Juglans: J. mandshurica (Japanese walnut), J. cordiformis(heartnut), J. cinerea (Butternut), J. nigra (black walnut),and J. regia (English walnut).

The injury produced by juglandis is by the larvae burrowing into the nut and the adults feeding in the nut. Further damage is done by the larvae and adult puncturing the leaf and stems causing young shoots to sometimes wilt and die. According to Brooks (1922), "Many cases have been observed in which 50% or more of the nuts dropped from the trees prematurely

on account of injury by the curculio larvae, the percentage of loss being greatest in years of light crops."

The life history of juglandis as recorded by Schoof (1942) follows: "The butternut curculio passes the winter in the adult, stage, probably in ground litter. In West Virginia the curculios appear at the time the walnut trees bloom and commence feeding upon the stems and leaf veins. After mating, the females begin oviposition, the first eggs being laid in the new growth, the later ones in the nuts. In J. cinerea the majority of the eggs are deposited in the nuts. At first the eggs are places in crescentshaped marks near the blossom end of the nuts, but later when the husks are tougher they are inserted in simple, gouged-out cavities in the side of the nut. The resultant larvae feed in the shoots and in the nuts, becoming full grown in 4 to 5 weeks, at which time they leave the host and enter the ground 1 to 3 inches for pupation. From one to six larvae develop in a nut, depending on its size. The curculio spends almost a month in the soil as a prepupa and pupa. On issuing from the ground in late summer and early autumn, the adults fly to the trees and feed on the leaf petioles and terminal shoots in a manner similar to that of the parent generation. With the oncoming of freezing weather the curculios go into hibernation."

Conotrachelus falli Blatch.

Description.--Beak: equal to length of head and thorax. Hind Wing (Fig. 17) anals 4 and 5 fused. Female Genitalia:unseen. Male Genitalia: unseen. Spermatheca:unseen.

Distribution: According to Leng (1920) this species is found in Indiana. Schoof (1942) states that they are also found in Virginia and Louisiana.

Biology: Unknown.

Conotrachelus seniculus Lec.

Description.--Beak: equal to the length of head and thorax. Leg (Fig. 21) the femur of the male have two apical ventral teeth while the female have one. Hind Wing (Fig. 17) anals 4 and 5 fused; apical portion of radial vein 3 absent. Female Genitalia: unseen. Male Genitalia (Figs. 44-45) median lobe short and stout, sides broaden apically, apical process emarginate without setae; orifical plates large; medial struts 1/8 as long as median lobe. Spermatheca (Fig. 64) cornu narrow and elongate.

Distribution: According to Blatchely and Leng (1916) they range from Quebec and New England to Michigan southward to Mississippi and Florida. Leng (1920) located the species in Arizona. Schoof (1942) in quoting Mr. C. A. Frost, states that Blatchley and Leng (1916) confused seniculus with elegans. If this be the case seniculus should not be recorded as from New England. Mr. C. A. Frost, who has collected extensively records seniculus found from: Arizona, Alabama, California, Arkansas, Delaware, Florida, District of Columbia, Illinois, Iowa, Indiana, Kansas, Louisiana, Kentucky, Mississippi, Maryland, Nebraska, Missouri, North Carolina, Ohio, New Jersey, Virginia, Texas, Tennessee, South Carolina, Oklahoma, Pennsylvania.

Biology: Chittenden (1898) reports that Conotrachelus seniculus feeds on the roots of Amaranthus. In 1924 he gave the common name of "Amaranth Curculio", to this species. Chittenden found by further investigation that the larva of seniculus can be found on the roots of cultivated amaranth during the first part of the month of September. The adults make their appearance during the later part of September. Further study by

Chittenden revealed seniculus feeding on cotton bolls, spinach, alfalfa, grass and bean stalks.

Conotrachelus similis Boh.

Description.--Beak: cylindrical with small circumference, female structure equal in length to elytra with the male being 1/4 shorter. Pro-thorax (Fig. 7) apex emarginate. Leg. (Fig. 21) femur alike in both sex; one apical ventral tooth present. Hind Wing (Fig. 17) apical portion of anals 2 and 3 present. Female Genitalia: unseen. Male Genitalia: unseen. Spermatheca (Fig. 65) cornu elongate narrowing to bluntly hooked apex.

Distribution: According to Leng (1920) this species is found in Georgia and Florida. One specimen examined was listed as being from Vermont.

Biology: Schwarz (1889) found the adults of this species appearing in great numbers on Bumelia lanuginosa (Gum Elastic Tree), when the tree is blooming. Found on Oak (Beutenmuller, 1893).

Conotrachelus integer Csy.

Description.--Beak: of male equal to length of head and thorax while the female is one 1/4 longer; antennal insertion of male located 3/4 down beak compared to 2/3 for female. Pro-thorax (Fig. 6) apex slightly emarginate; basal margin not bi-concave. Leg (Fig. 22) femur alike in both sex, one tooth present; metauncus spine absent. Hind Wing (Fig. 17) anals 4 and 5 fused, apical portion of 2 and 3 absent. Female Genitalia: unseen. Male Genitalia (Figs. 58-59) median lobe sides concave, apical process muricate with setae present; two sets of orifical plates present; medial struts 1/4 length of median lobe. Spermatheca (Fig. 63) nodules

and ramus not distinctly separated; nodulus emarginate.

Distribution: According to Leng (1920) this species has only been found in Arizona.

Biology: Unknown.

Conotrachelus nenuphar Herbst

Description: Pro-thorax (Fig. 10) apex truncate. Hind Wing (Fig. 17) anals 4 and 5 fused, apical portion of 2 and 3 present. Female Genitalia: unseen. Male Genitalia (Figs. 48-49) median lobe sides parallel; orifical plates small; median struts 3/4 length of median lobe. Spermatheca (Fig. 66) cornu narrow and elongate.

Distribution: According to Leng (1920) this species is found in Florida and Texas. Chapman (1938) extends the range from Nova Scotia to Manitoba and Colorado. Schoof (1942) examined one specimen labelled Bitter Root Valley, Montana.

Biology: According to Kalm (1749) the first references recorded of this pest in literature are found in the correspondence between Peter Collinson and the pioneer American botanist John Bartram. The literature of nenuphar is so extensive because of its economic importance that the reader is referred to Snapp (1930), Quaintance and Jenne (1912), and Chapman (1938) for further information concerning the biology.

Schoof (1942) mentions the following fruits which have served as hosts: apples, cherry, peach, pear, apricot, plum, nectarine and quince. Chapman (1938) reported specimens of nenuphar to be found in fruits of huckleberry, strawberry, grape, gooseberry, and persimmon.

Conotrachelus floridanus Fall

Description: Pro-thorax (Fig. 6) similar to integer. Leg (Fig. 22) apical ventral tooth present in male and female. Hind Wing (Fig. 17) radial 3 not present. Female Genitalia: unseen. Male Genitalia (Figs. 60-61) median lobe sides converging apically; apical process feebly emarginate with setae present; three pairs of orifical plates with central plates fused; medial struts 1/3 length of median lobe. Spermatheca (Fig. 69) cornu narrow and elongate.

Distribution: Leng (1920) reports this species only from Florida.

Biology: Unknown.

Conotrachelus leucophaeatus Fah.

Description: Pro-thorax (Fig. 5) similar to seniculus. Hind Wing (Fig. 17) anals 4 and 5 fused, apical portion of 2 and 3 suggestive; spur of radial 3 absent. Female Genitalia: unseen. Male Genitalia: unseen. Spermatheca (Fig. 67) lateral sides of nodulus and ramus emarginate; cornu narrow and elongate.

Distribution: According to Schoof (1942) this species has been found in Colorado, Arizona, Texas, Oklahoma and Kansas.

Biology: According to Schoof (1942) leucophaeatus frequents milkweed and cotton. It breeds in the stems of Euphorbia marginatea with the larvae being present during the summer months (Pierce, 1907).

Conotrachelus fissungus Lec.

Description: Pro-thorax (Fig. 10) similar to nenuphar. Leg (Fig. 22) femur of female have one apical ventral tooth, male structure unseen. Hind Wing (Fig. 17) anal 5 absent; radial 3 absent. Female Genitalia:

unseen. Male Genitalia: unseen. Spermatheca (Fig. 70) lateral aspect of nodulus slightly emarginate; cornu narrow and elongate.

Distribution: "Ranges from New Jersey and District of Columbia to Louisiana," Blatchley and Leng (1916). According to Schoof (1942) the range should be extended west to Missouri, Illinois, and Texas.

Biology: Blatchley and Leng (1916) reports fissungus breeding in the seed pods of Hisbiscus moscheutos.

The life history of fissungus as recorded by Schoof (1942) in quoting Weiss and Dickerson (1919) follows: "The curculio passes the winter in the adult stage, appearing the following year in July. These adults feed at the base of the flower petals, the females beginning oviposition as soon as the seed capsules are formed. The eggs are deposited in the seed capsules, being inserted through irregular circular punctures in the wall. Some capsules are punctured as many as eighteen times, others only two or three times. The newly hatched larva bores into the developing seed and feeds upon it until only the outer shell remains. When too large to enter the seeds, the larva consumes them from the outside. On attaining full growth, the larva leaves the capsule by cutting a circular hole through the wall or by merely crawling out if the capsule has split open. After dropping to the ground, it burrows one-half to one inch below the surface of the soil for pupation."

Chalcodermus aeneus Boh., Schon.

Description: Head (Fig. 2) dorsal anterior aspect arcuate; eyes lachrymiform, coarsely granulated; beak length equal to head and thorax, stout, with the antennal insertion half way down the beak, male and female structure similar. Antenna (Fig. 13) scape gradually enlarged apically,

length less than combined length of flagellum and pedical. Pro-thorax (Fig. 2) wider at base than long, anteriorly constricted, sides and base angulate. Leg (Fig. 25) femur alike in both sex, apical ventral teeth present; apical ventral margin of tibia serrated, metatibial spines present; tarsal claw (Fig. 29) approximate and connate at base. Elytra (Fig. 81) longer than wide, basal borders arcuate, sides subparallel on basal half gradually narrowing to apex. Hind Wing (Fig. 19) anals 4 and 5 separated, apical portion of 2 and 3 absent; radial vein 3 absent; radial cell closed. Abdomen (Fig. 83) width longer than length; sutures parallel and straight. Female Genitalia (Figs. 36-37) spiculum ventrale "Y" in form with each branch producing a triangular structure. Male Genitalia (Figs. 50-51) median lobe is short, broad, apical process arcuate with setae present; orifical plates large; inter-aedeagal structure visible; median struts twice as long as median lobe. Spermatheca (Fig. 71) nodules and ramus distinctly separated; cornu elongate, narrowing to apex.

Distribution: Blatchley and Leng (1916) lists it from Oklahoma to Maryland and south to Texas.

Biology: According to Blatchley and Leng (1916) this species is known as the "Cow-pea Curculio", with the larvae breeding in Cow-peas and other legumes. It is sometimes mistaken for the Cotton Boll Weevil when found upon the stems of cotton. When the larva is fully grown it cuts a hole in the pods and drops to the ground and pupates in the earth from one to four inches beneath the surface. They hide under soil and trash until they emerge during the months of May or June.

Bissell (1938) relates that the Tachined Fly, Myiophasia globosa Tns. was bred in large numbers from aeneus in cowpeas and once from string beans.

Chalcodermus collaris Horn

Description.--Beak: antennal insertion 2/3 down the beak. Pro-thorax (Fig. 3) anteriorly constricted, sides arcuate on basal half, basal borders bi-sinuate. Female Genitalia (Figs 42-43) spiculum ventrale "Y" in form with a partial extention of the arms tapering posteriorly. Male Genitalia (Figs. 54-55) median lobe width half length, narrows towards apex, apical process laterally arcuate medial mucromate with setae present; orificial plates small; inter-aedeagal structures not visible; median struts 1/4 longer than median lobe. Spermatheca (Fig. 72) nodules and ramus distinctly separated; cornu elongate narrowing to apex.

Distribution: Blatchley and Leng (1916) lists it from Texas in the south to Massachusetts and New Jersey to Illinois in the north.

Biology: According to Olsterlund (1937) collaris was reared from the seed pods of Cassia chamaechrista L., or Partridge Pea, at Urbana, Illinois. This low, yellow-flowered legume can be commonly found around Urbana along roadsides and railroad embankments. Mitchell and Pierce (1911) reported it to be found on cotton. One specimen of the Tachined Fly, Myrophasia globosa Tns., was found emerging from a larva of collaris (Bissell, 1938).

Rhyssematus pruinosus Sch.

Description: Head (Fig. 11) dorsal anterior aspect arcuate; eyes lachrymiform, coarsely granulated; beak length equal to head and thorax, stout, with the antennal insertion half way down the beak, male and female structure similar. Antenna (Fig. 15) scape gradually enlarged apically, length less than combined length of flagellum and pedical. Pro-thorax (Fig. 11) wider at base than long, anteriorly constricted, sides arcuate.

Leg (Fig. 24) femur alike in both sex, apical ventral tooth present; apical ventral margin of tibia smooth, metamucro spine present, metauncus absent; tarsal claw (Fig. 28) cleft. Elytra (Fig. 80) wider than long, sides arcuate narrowing to apex. Hind Wing (Fig. 18) anals 4 and 5 separated, apical portion of 2 and 3 present; apical portion of radial 3 present; radial cell closed. Abdomen (Fig. 82) width longer than length; suture between first and second segments extends anterio-medially forming a point. Female Genitalia (Figs. 32-33) spiculum ventrale "Y" in form with an extention running posteriorly tapering with a round nob at the apex. Male Genitalia: unseen. Spermatheca (Fig. 73) nodules and ramus distinctly separated; ramus is a crenulated projector; one spermatheca duct located laterally;cornu stout, tapering to apex.

Distribution: According to Leng (1920) this species can be found in Arizona and California.

Biology: Pierce (1916) states that pruinosus breeds in the pods of Mimosa fragans in south Texas.

Rhyssematus palmacollis Say

Description: Pro-thorax (Fig. 8) sides anteriorly emarginate. Female Genitalia (Figs. 52-53) median lobe two and a half times longer than wide, tapers toward apex, apical process bluntly arcuate without setae; orificial plates absent; inter-aedeagal structures visible; medial struts 1/4 longer than median lobe. Spermatheca (Fig. 74) nodules and ramus not separated; narrow; one spermatheca duct located laterally; cornu elongate, tapering to blunt apex.

Distribution: "Ranging from District of Columbia and southern Ohio to Florida and Texas, Blatchley and Leng (1916).

Biology: According to Pierce (1916) palmacollis breeds in the seed pods of Ipomoea sinuata. Mitchell and Pierce (1911) report them entering the ground around July 21 and coming forth as adults August 13.

Rhyssematus lineaticollis Say

Description: Pro-thorax (Fig. 9) contour semi-circular. Female Genitalia (Figs. 38-39) the inter-margin line of the spiculum ventrale extends posteriorly forming a narrow arm. Male Genitalia: unseen. Spermatheca (Fig. 75) nodules and ramus not separated, laterally emarginate; one spermatheca duct located laterally; cornu elongate, tapering to a hooked apex.

Distribution: "Ranges from Massachusetts to Michigan and Kansas, south to Florida and Texas", Blatchley and Leng (1916).

Biology: According to Chittenden (1890) this species breeds in the seed pods of Asclepias tuberosa and incarnata. Chittenden observed the adult insect feeding upon the stalks of milkweed throughout the months of May, June, and July.

DISCUSSION

The species of Ithypori vary in size from 2.5-6.5 mm. They are usually rather broad, robust, often strongly sculpture species.

The head of the species of Ithypori is spherical in form having usually a stout beak equal in length to the combined length of the head and thorax. The antennae are of the geniculate form being usually similar throughout the tribe. The dorsal aspect of the head is arcuate except in Phyrdenus which is truncate. The eye is lachrymiform except Phyrdenus in which it is circular and convex.

The pronotum is so variable within Ithypori that the characters appear to be of no more than specific value. However, similarities of general contour do exist between the following pair of species: Conotrachelus integer and floridanus, juglandis and falli, seniculus and leucophaeatus, nenuphar and fissunguis.

The femur of Conotrachelus similis, integer, floridanus, and fissunguis have one apical ventral tooth while juglandis, falli, nenuphar and leucophaeatus have two teeth present. The male of C. seniculus has two teeth while the female has one, this difference being useful in sex determination as observed by Schoof (1942). Species of Rhyssematus and Chalcodermus have one femoral tooth. Femoral teeth are absent in Phyrdenus (Fig. 20).

The smooth apical ventral margins of the tibiae in Phyrdenus, Conotrachelus, and Rhyssematus are in contrast with the serrated margin

of Chalcodermus (Fig. 25). Rhyssematus (Fig. 24) has a much stouter structure than other members of this subtribe. Metatibial spines are absent in Phyrdenus (Fig. 20), but present in all other genera. Two metatibial spines are present in Conotrachelus similis, juglandis, and all species of Chalcodermus examined. The metamucral spine is absent in Conotrachelus seniculus, falli, integer, nenuphar, floridanus, leucophaeatus, fissunguis, and species of Rhyssematus.

The tarsal claws were used by Leconte (1876), Casey (1892), and Blatchley and Leng (1916) as a character for separating genera. The tarsal claws of Phyrdenus (Fig. 26), Conotrachelus (Fig. 27), and Rhyssematus (Fig. 28) are cleft while in Chalcodermus (Fig. 29) they are simple. In Rhyssematus the teeth are equal in length while Phyrdenus and Conotrachelus are unequal. In Phyrdenus they branch basally while in Conotrachelus they branch distally.

The general contour of the hind wings of the Ithypori are similar except in Phyrdenus which has an emargination on the anterior margin. The radial cell is closed in all species of this group except Phyrdenus. The radial veins 1 and 2, media 1 and 4, and anal 4 are present in all genera of this subtribe. Radial vein 3 is present in Conotrachelus, similis, juglandis, integer, nenuphar, and all species of Rhyssematus, but absent in Conotrachelus seniculus, falli, floridanus, leucophaeatus, fissunguis, and species of Chalcodermus. Anals 2 and 3 are present in Conotrachelus similis, juglandis, nenuphar, leucophaeatus, and all species of Rhyssematus, but are absent in Conotrachelus seniculus, falli, integer, floridanus, fissunguis, and species of Chalcodermus. Anal vein 5 is present in all genera of Ithypori except Phyrdenus (Fig. 18). Anals 4 and 5 are fused in

Conotrachelus seniculus, falli, integer, nenuphar, and leucophaeatus. They remain separate in Conotrachelus similis, juglandis, floridanus, and all species of Rhyssematus and Chalcodermus.

The ventral aspect of the abdomen of Ithypori is divided into five segments with the shape of the sutures showing characters of possible generic value. The suture located between the first and second abdominal sterna extends anteriorly forming an obtuse angle in species of Rhyssematus (Fig. 82). These same sutures in Conotrachelus (Fig. 79), Phyrdenus (Fig. 78), and Chalcodermus (Fig. 83) are straight. The second, third and fourth sutures in Phyrdenus curve anteriorly in contrast to the parallel and straight sutures of the other genera studied.

The spiculum ventrale of the female of all Ithypori is Y-shaped. There is variation in the size and shape of the arms of the Y. Each arm of the Y in Chalcodermus aeneus (Fig. 36) forms a large triangular structure, which is gradually reduced in size in the following order of species studied to a simple Y: Conotrachelus juglandis (Fig. 40), Rhyssematus lineaticollis (Fig. 38), Rhyssematus pruinosus (Fig. 32) and palmacollis (Fig. 34), Chalcodermus aeneus (Fig. 42), and Phyrdenus (Fig. 30). A specific pattern was noted in the spiculum ventrale, but further investigation is needed to determine the true taxonomic value of this structure.

Another structure was found in the external female genitalia of the genus Phyrdenus that was not present in other genera of this subtribe. Located in conjunction with the valvifer extending to the stylus is a structure termed here interlobes (Fig. 30). These interlobes are encompassed apically by very stout spines. This structure is unique in

the subtribe and definitely merits further consideration as a taxonomic character.

The general contours of the spermathecae reveal a possible generic relationship between Conotrachelus, Chalcodermus, and Phyrdenus. Because of the great variation in the contour of the spermathecae of Rhyssematus the characters appear to be of no more than specific worth. However, it was noted that the spermathecal gland duct entered on the nodulus side of the spermatheca in all species of this genus. My investigation of the spermathecae of Ithypori agree with the findings of Sanders (1951) and Moore (1953) that the spermatheca is a reliable taxonomic character for the identification of species, but probably not for higher groups.

The median lobe as viewed from the dorsal aspect is so variable in all the species studied that the characters appeared to be of no more than specific value. However, some similarity was seen in the lateral contour of Conotrachelus nenuphar (Fig. 49), juglandis (Fig. 57), and integer (Fig. 59). Orifical plates were absent in Rhyssematus palmacollis (Fig. 52) and Phyrdenus muriceus (Fig. 46). Conotrachelus seniculus (Fig. 44), juglandis (Fig. 56), nenuphar (Fig. 48), and Chalcodermus aeneus (Fig. 50) and collaris (Fig. 54) each have one pair of plates. Conotrachelus integer (Fig. 58) has two sets of plates while Conotrachelus floridanus (Fig. 60) has three sets of plates with the center set fused. It was noted that the median struts of the median lobe of Phyrdenus and Conotrachelus were shorter than median lobe while in Rhyssematus and Chalcodermus they are longer. The struts of Conotrachelus integer, floridanus, and seniculus are very stubby.

The ring-like tegmen is common to all members of this subtribe.

The ventral anterior apodeme of the tegmen is present in all species of *Phyrdenus*, *Chalcodermus*, *Rhyssematus*, but absent in *Conotrachelus*.

CONCLUSIONS

This study has revealed some characters of taxonomic value in the hind wing, male and female external genitalia, and spermatheca which were previously unknown.

Conotrachelus and Chalcodermus show greater relationship toward one another than do the other genera of Ithypori in the following characters: elytral length longer than width, sutures of abdomen straight, contour of spermatheca similar, two metatibial spines present in Chalcodermus and some Conotrachelus, radial vein 3 and anals 2 and 3 present in Chalcodermus and in some species of Conotrachelus. Differences between these genera are as follows: tarsal claws simple in Chalcodermus but cleft in Conotrachelus, median struts of the aedeagus in Chalcodermus longer than those of Conotrachelus.

Rhyssematus shows a closer relationship toward Conotrachelus than to other genera of this subtribe in having the following similarities: radial vein 3, anals 2 and 3 present in Rhyssematus and in some species of Conotrachelus; spiculum ventrale of Conotrachelus similar to some species of Rhyssematus, metamucral spine of the tibia absent in Rhyssematus and some species of Conotrachelus. Differences are as follows: tibiae of Rhyssematus are stouter than those of Conotrachelus, tarsal claws of Rhyssematus approximate while those of Conotrachelus are distal, orificial plates are absent in Rhyssematus but present in all species of Conotrachelus, elytra of Rhyssematus are broader than those of Conotrachelus, first

abdominal suture is straight in Conotrachelus but recurved in Rhyssematus.

Chalcodermus is more nearly like Phyrdenus than any other genus. The only structural similarities between Phyrdenus and Chalcodermus are the following wing veins: radial 3 and anals 2 and 3 absent. Differences are as follows: dorsal aspect of head in Phyrdenus truncate while in Chalcodermus it is arcuate, antenna of Phyrdenus stouter than Chalcodermus, anal vein 4 absent in Phyrdenus and present in Chalcodermus, femoral tooth absent in Phyrdenus and present in Chalcodermus, metatibial spines are absent in Phyrdenus but present in Chalcodermus, tarsal claws of Phyrdenus are cleft while those of Chalcodermus are simple, abdominal sutures 2-4 are recurved in Phyrdenus and straight in Chalcodermus, the interlobe structures located on the female genitalia of Phyrdenus are absent in Chalcodermus, orifical plates absent in Phyrdenus but present in Chalcodermus.

From the standpoint of wing and leg structures Conotrachelus appears to be located between Rhyssematus and Chalcodermus. A closely knit relationship is apparent between Chalcodermus, Conotrachelus and Rhyssematus, but Phyrdenus appears to be completely unrelated to this group and the writer would suggest further investigation of the group to determine whether or not it should be removed from the subtribe Ithypori.

SUMMARY

This is a morphological study of the subtribe Ithypori, undertaken to identify and analyse some morphological characters of some of the North American species of this subtribe. Four genera and fifteen North American species of Ithypori were analyzed in terms of the following structures: head, pronotum, antenna, wing, leg, elytra, abdomen, male and female genitalia, and spermatheca.

The head, eye, and antenna of this subtribe are similar except in Phyrdenus.

The pronotum is so variable within the subtribe that it is of no more than specific worth.

The wing structures of Ithypori were unknown in the taxonomic descriptions of Ithypori. This writers findings reveal that the radial cell, radial veins 2 and 3, media vein 1 and 4, anals 2 and 4 offer good taxonomic characters for this group.

The elytra appear to be constant in contour for each of the genera of Ithypori.

Workers on the Ithypori have often used the leg characters in taxonomic descriptions. The various genera can be separated by the use of the number of femoral teeth present, number of metatibial spines present, shape of the tibia and tarsal claws.

One of the most salient characters found in the female Ithypori is the spiculum ventrale which appears to be only of specific worth.

The "inter-lobes" of the female genitalia of Phyrdenus is unique for this subtribe.

The relative size, shape, and contour of the median lobe, tegmen, orifical plate of the male genitalia, appear to offer good specific characters. The ventral tegmen strut is absent in all species of Conotrachelus.

The spermatheca is a reliable taxonomic character for the identification of species in this subtribe, but not for higher groups.

Many of the early descriptions of Ithypori are in good standing today, although, in one case a species has been added to this subtribe with only superfical evidence. The genus Phyrdenus appears to have many structural differences from other genera of this subtribe. It appears from all evidence and data accumulated that Phyrdenus should be removed from the subtribe Ithypori.

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ABSTRACT

Four genera and fifteen species of Ithypori were included in a morphological study, undertaken to identify some morphological characteristics of the species of this subtribe. External structures studied included head, pronotum, antennae, wings, legs, elytra, abdomen, male and female genitalia. The only internal structures analyzed were the spermathecae.

The antennae appear to be quite uniform within the subtribe with slight variations in the length of the scape. The rostrum appears to be similar with the exception of one species.

The pronotum is variable within the subtribe and appears to have only specific worth. The legs have good generic and specific characters with the variations being in the number of femoral teeth present, metatibial spines present or absent, and the shapes of the tarsal claws.

The wing structures were found to exhibit great similarities in most species studied. The presence or absence of various radial and anal veins give good generic and specific taxonomic characters.

Perhaps the most important specific morphological character found was the spiculum ventrale. However, a unique structure was found in the female genitalia in conjunction with the valvifer extending to the stylus of Phyrdenus.

The male genitalia have good specific characters. Similarities were seen in the length of the medial struts, and contour of the median

lobes.

Species of three general of Ithypori appear to have generic tendencies in the spermathecae.

Eighty-two illustrations were made of the pronotum, antennae, legs, elytra, hind wings, abdomen, male and female genitalia, and spermathecae.

EXPLANATION OF PLATES

The terminologies used in this paper have followed Sanders (1951) and Moore (1953) for spermathecae, Crowson (1955) for wings, and Tanner (1927), Schoof (1942), and Bruhn (1947) for terminalia.

The dorsal aspect of the right hind wing of each species was analyzed.

R - radial vein

Rc - radial cell

RM - radial medial cross vein

M - medial

M_4 + Cu - medio-cubital vein

Cu - cubital vein

A - anal vein

The female and male genitalia magnifications are not constant but range from thirty to forty-five times. Abbreviations used on plates II and III include the following:

sty - stylus

c - coxite

au - anus

sv - spiculum ventrale

ml - median lobe

ms - struts of median lobe

op - orificial plates

is - inter-aedeagal structures

tg - tegmen

ts - tegminal strut

The spermathecae are labelled according to the following terms:

rm - ramus: portion of spermatheca receiving seminal fluid.

nd - nodulus: portion of ramus to which spermathecal gland attaches.

cu - cornu: distal portion.

spd - spermathecal ducts.

PLATE I

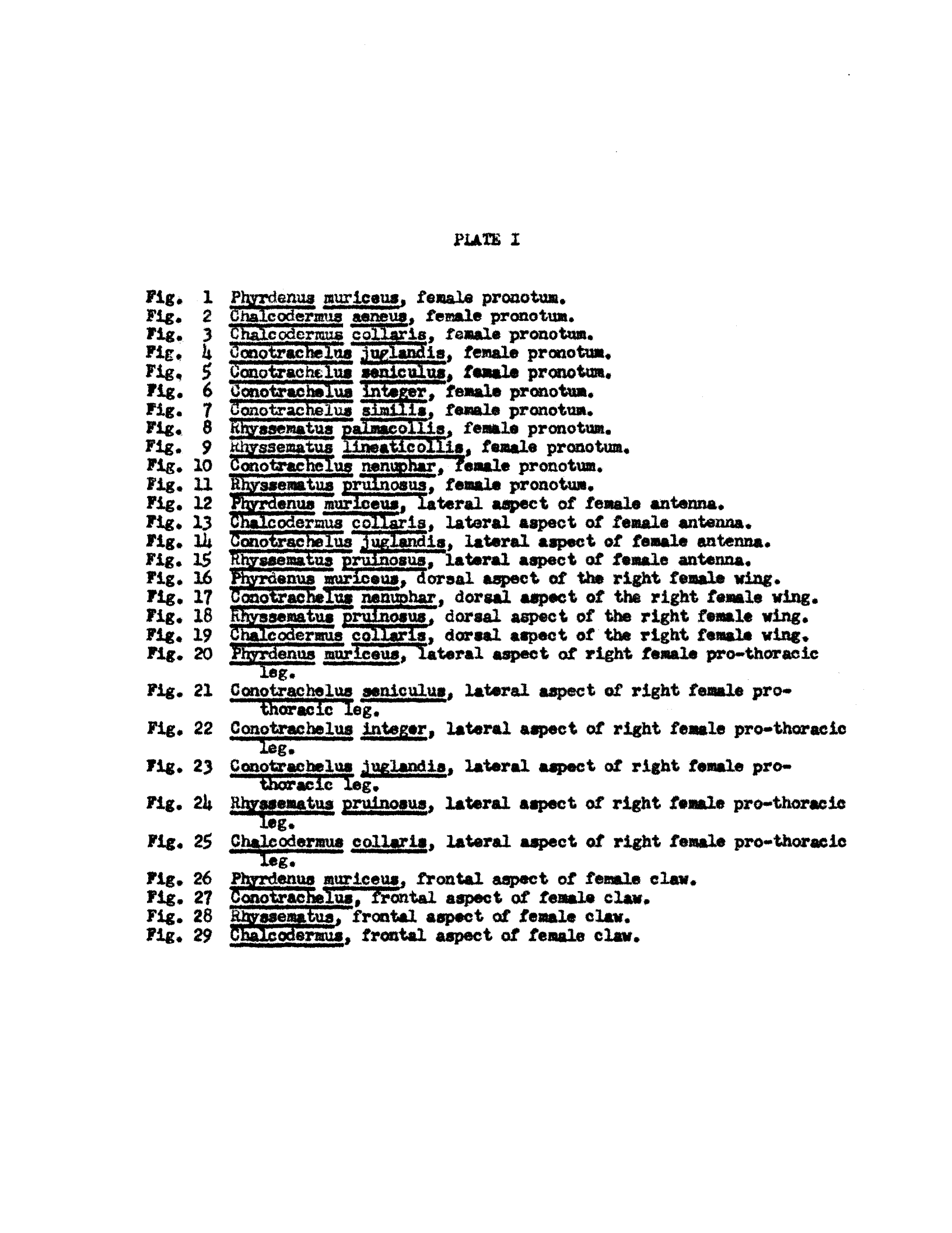

Fig. 1 Phyrdenus muriceus, female pronotum.
Fig. 2 Chalcodermus aeneus, female pronotum.
Fig. 3 Chalcodermus collaris, female pronotum.
Fig. 4 Conotrachelus juglandis, female pronotum.
Fig. 5 Conotrachelus seniculus, female pronotum.
Fig. 6 Conotrachelus integer, female pronotum.
Fig. 7 Conotrachelus similis, female pronotum.
Fig. 8 Rhyssematus palmacollis, female pronotum.
Fig. 9 Rhyssematus lineaticollis, female pronotum.
Fig. 10 Conotrachelus nenuphar, female pronotum.
Fig. 11 Rhyssematus pruinosus, female pronotum.
Fig. 12 Phyrdenus muriceus, lateral aspect of female antenna.
Fig. 13 Chalcodermus collaris, lateral aspect of female antenna.
Fig. 14 Conotrachelus juglandis, lateral aspect of female antenna.
Fig. 15 Rhyssematus pruinosus, lateral aspect of female antenna.
Fig. 16 Phyrdenus muriceus, dorsal aspect of the right female wing.
Fig. 17 Conotrachelus nenuphar, dorsal aspect of the right female wing.
Fig. 18 Rhyssematus pruinosus, dorsal aspect of the right female wing.
Fig. 19 Chalcodermus collaris, dorsal aspect of the right female wing.
Fig. 20 Phyrdenus muriceus, lateral aspect of right female pro-thoracic leg.
Fig. 21 Conotrachelus seniculus, lateral aspect of right female pro-thoracic leg.
Fig. 22 Conotrachelus integer, lateral aspect of right female pro-thoracic leg.
Fig. 23 Conotrachelus juglandis, lateral aspect of right female pro-thoracic leg.
Fig. 24 Rhyssematus pruinosus, lateral aspect of right female pro-thoracic leg.
Fig. 25 Chalcodermus collaris, lateral aspect of right female pro-thoracic leg.
Fig. 26 Phyrdenus muriceus, frontal aspect of female claw.
Fig. 27 Conotrachelus, frontal aspect of female claw.
Fig. 28 Rhyssematus, frontal aspect of female claw.
Fig. 29 Chalcodermus, frontal aspect of female claw.

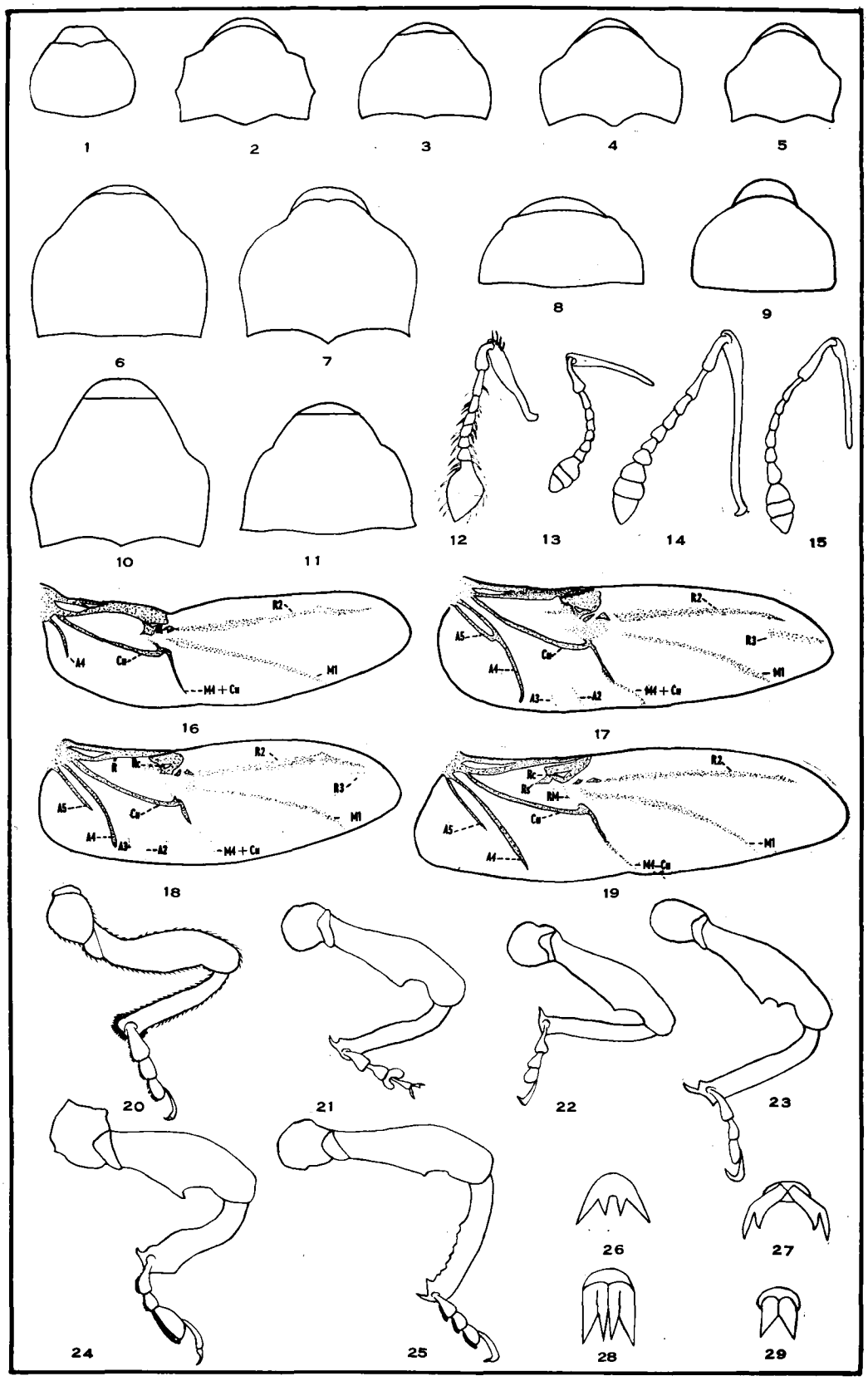

PLATE I

PLATE II

Figs. 30 & 31. Phyrdenus muriceus, ventral and lateral aspect of female genitalia.

Figs. 32 & 33. Rhyssematus pruinosus, ventral and lateral aspect of female genitalia.

Figs. 34 & 35. Rhyssematus palmacollis, ventral and lateral aspect of female genitalia.

Figs. 36 & 37. Chalcodermus aeneus, ventral and lateral aspect of female genitalia.

Figs. 38 & 39. Rhyssematus lineaticollis, ventral and lateral aspect of female genitalia.

Figs. 40 & 41. Conotrachelus juglandis, ventral and lateral aspect of female genitalia.

Figs. 42 & 43. Chalcodermus collaris, ventral and lateral aspect of female genitalia.

Figs. 44 & 45. Conotrachelus seniculus, ventral and lateral aspect of male genitalia.

Figs. 46 & 47. Phyrdenus muriceus, ventral and lateral aspect of male genitalia.

Figs. 48 & 49. Conotrachelus nenuphar, ventral and lateral aspect of male genitalia.

Figs. 50 & 51. Chalcodermus aeneus, ventral and lateral aspect of male genitalia.

Figs. 52 & 53. Rhyssematus palmacollis, ventral and lateral aspect of male genitalia.

Figs. 54 & 55. Chalcodermus collaris, ventral and lateral aspect of male genitalia.

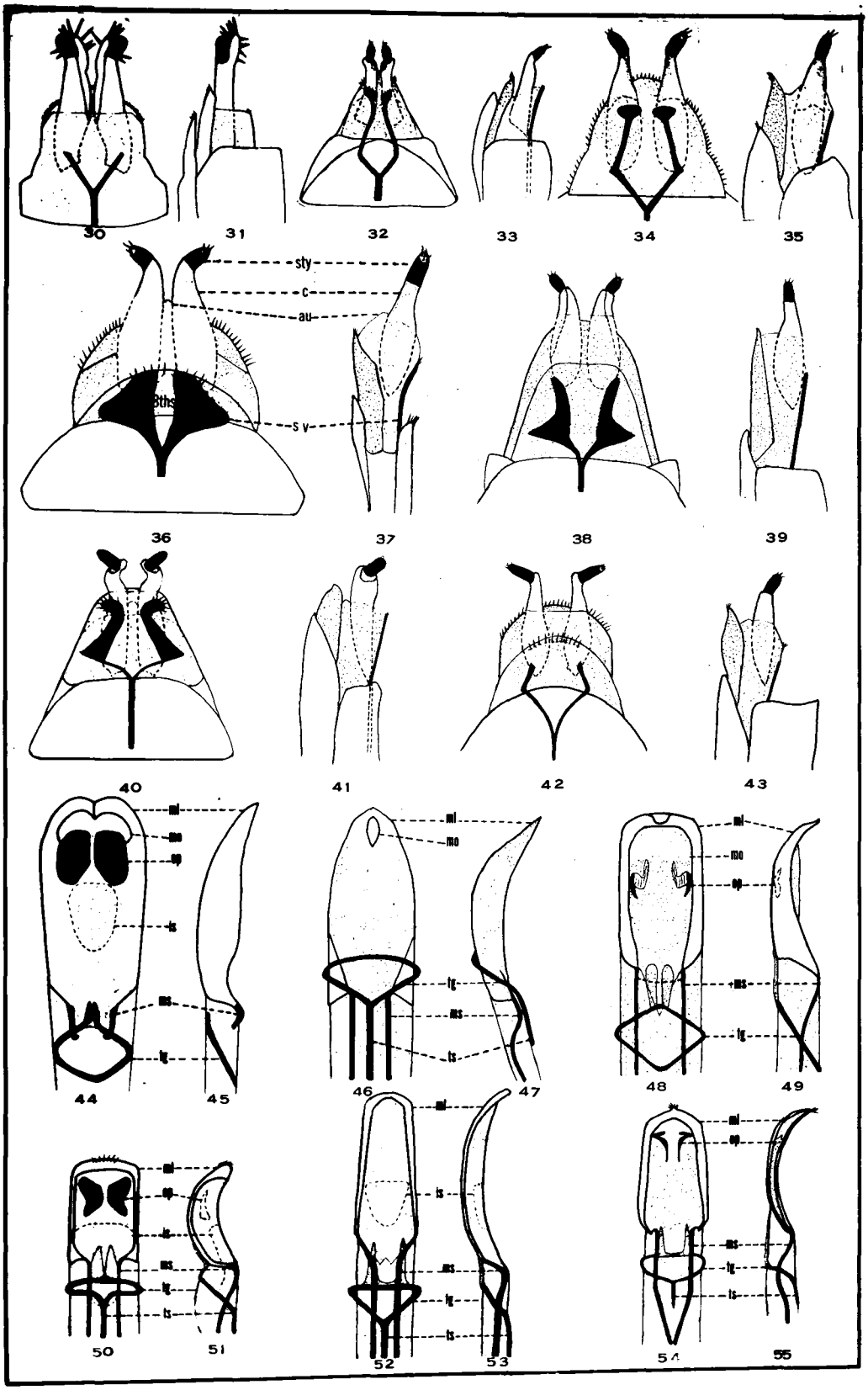
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PLATE II

PLATE III

Figs. 56 & 57. Conotrachelus juglandis, ventral and lateral aspect of male genitalia.
Figs. 58 & 59. Conotrachelus integer, ventral and lateral aspect of male genitalia.
Figs. 60 & 61. Conotrachelus floridanus, ventral and lateral aspect of male genitalia.
Fig. 62. Phyrdenus muriceus, lateral aspect of spermatheca.
Fig. 63. Conotrachelus integer, lateral aspect of spermatheca.
Fig. 64. Conotrachelus seniculus, lateral aspect of spermatheca.
Fig. 65. Conotrachelus similis, lateral aspect of spermatheca.
Fig. 66. Conotrachelus nenuphar, lateral aspect of spermatheca.
Fig. 67. Conotrachelus leucophaeatus, lateral aspect of spermatheca.
Fig. 68. Conotrachelus juglandis, lateral aspect of spermatheca.
Fig. 69. Conotrachelus floridanus, lateral aspect of spermatheca.
Fig. 70. Conotrachelus fissunguis, lateral aspect of spermatheca.
Fig. 71. Chalcodermus collaris, lateral aspect of spermatheca.
Fig. 72. Chalcodermus collaris, lateral aspect of spermatheca.
Fig. 73. Rhyssematus pruinosus, lateral aspect of spermatheca.
Fig. 74. Rhyssematus palmacollis, lateral aspect of spermatheca.
Fig. 75. Rhyssematus lineaticollis, lateral aspect of spermatheca.
Fig. 76. Phyrdenus muriceus, dorsal aspect of female elytra.
Fig. 77. Conotrachelus juglandis, dorsal aspect of female elytra.
Fig. 78. Phyrdenus muriceus, ventral aspect of female abdomen.
Fig. 79. Conotrachelus seniculus, ventral aspect of female abdomen.
Fig. 80. Rhyssematus pruinosus, dorsal aspect of female elytra.
Fig. 81. Chalcodermus collaris, dorsal aspect of female elytra.
Fig. 82. Rhyssematus palmacollis, ventral aspect of female abdomen.
Fig. 83. Chalcodermus aeneus, ventral aspect of female abdomen.

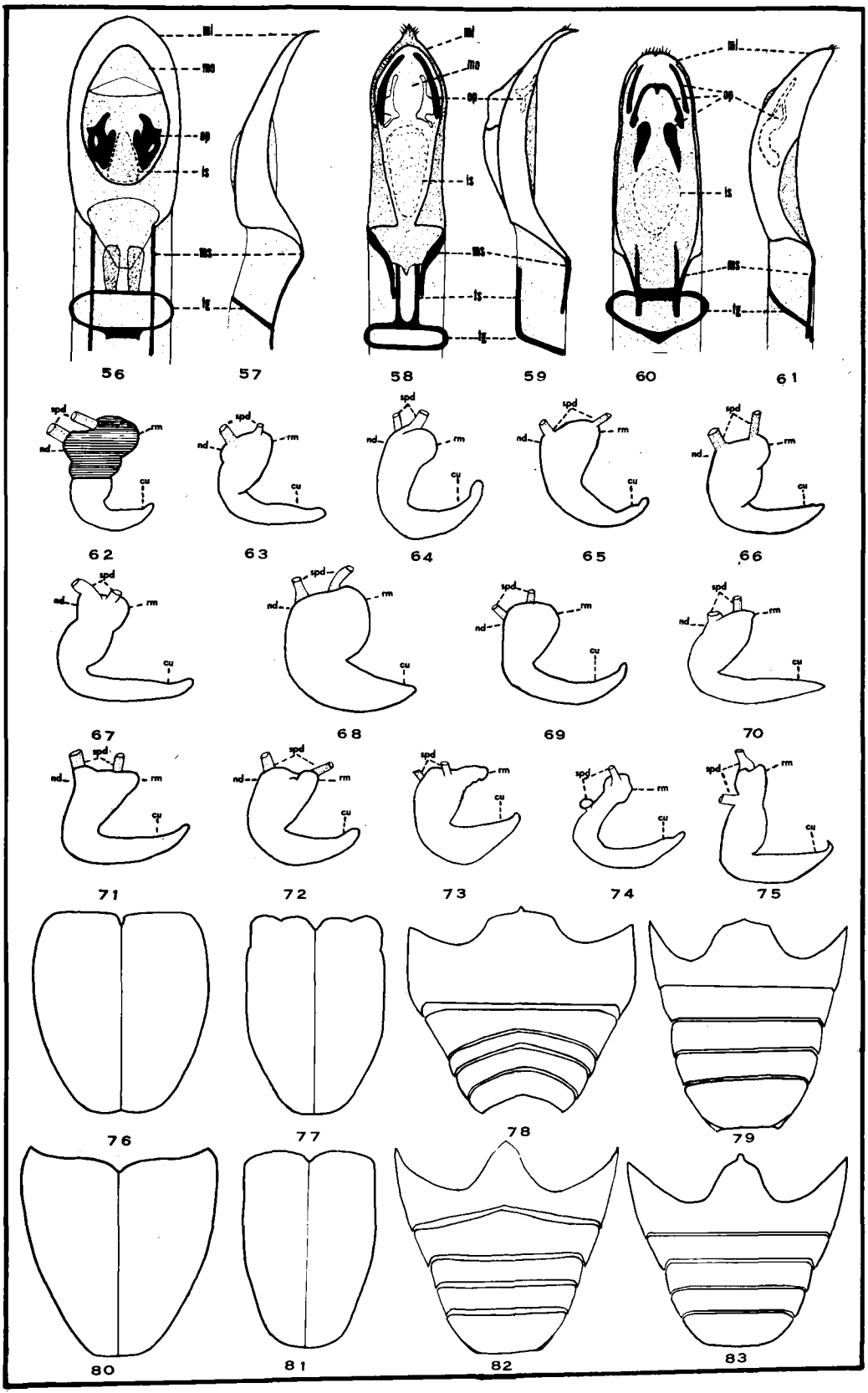
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PLATE III