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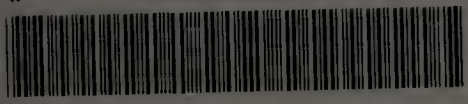
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STUDIES ON NORTH AMERICAN EMPIDIDAE

FARR - 1953

STUDIES ON NORTH AMERICAN
EMPIDIDAE

Thomas H. Farr

Thesis submitted in partial fulfillment
of the requirements for the degree
of Doctor of Philosophy,

University of Massachusetts, Amherst

1953.

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INTRODUCTION

The taxonomy of the species of North American Empididae is in a confused state because much of the descriptive work has been based on characters which do not serve to separate the species in large genera and indeed are of doubtful value in smaller genera. Much emphasis has been placed on color and, to a lesser extent, on wing venation and setation. Very little attention has been paid to other morphological characters and even where such characters are mentioned, the written descriptions are seldom supplemented with figures.

The first section of this work presents a detailed description supplemented with figures of the external anatomy of a species of the type genus Empis. The species Empis obesa Loew was chosen for examination because it is typical of the genus and is of a relatively large size. No such detailed study of an empid fly has ever been presented and it is hoped that the present study will stimulate, and serve as a reference for, further work on the morphology of the Empididae.

The second and third parts of this work are concerned with morphological and taxonomic investi-

gations in the genus Clinocera using the information gained from the study of Empis as a guide in the study of the external anatomy of Clinocera. The genus Clinocera was chosen because it is one of the empid genera in which it is difficult to identify the species based on our present descriptions and keys.

All specimens examined were first cleared in potassium hydroxide solution and then placed in glycerine for study.

PART I

THE EXTERNAL ANATOMY OF EMPIS OBESA LOEW

HEAD

(Figs. 1-14)

REGIONS OF THE HEAD CAPSULE

The head capsule of most Diptera has very little evidence of a division into separate sclerites, and therefore it has been the custom to describe the parts as regions and areas.

At the top of the head, i.e., the vertex, there is a rather prominent tubercle, the ocellar tubercle (ot). In the female there is a sclerotized band extending from this tubercle to the antennal fossae. This area is often referred to in Diptera as the frons or front. In the male of Empis obesa, this band is nearly obliterated by the approximation of the compound eyes above the antennae. There is no definite demarcation between the frons and vertex. In fact, some authors consider the vertex as being the area occupied by the ocellar tubercle and the area above the antennae.

The area beneath the antennae is broader than the frons, and in Diptera may be referred to as the

frontoclypeus (fcl) or face.

The gense (ge) are almost obliterated by the downward extension of the compound eyes, and are best seen in a ventral view of the head.

A ventral view of the head also reveals the subcranial cavity (scv) into which the base of the proboscis may be withdrawn. In this fly the base of the proboscis occupies the posterior portion of the subcranial cavity. Also located within the cavity are a pair of sclerotized structures which Crampton (1942) designates as the anteclypeus (ac) and Peterson (1916) the tormae. The anteclypeus is articulated to the front edge of the subcranial cavity, i.e., the lower edge of the frontoclypeus. Posteriorly it is attached to the labrum. The rest of the cavity is lined with a membrane. Pressure applied to this membrane from inside so as to force it outward causes the anteclypeus to swing anteriorly and ventrally from its point of articulation with the frontoclypeus. The proboscis is simultaneously pushed ventrally and slightly forward and its base projects beneath the margin of the subcranial cavity.

The occiput (oc) is here considered to occupy the upper half of the posterior margin of the head behind the compound eyes. The occiput merges in the lower half of the head with the postgenae (pge).

Two occipital condyles (occ) (Fig. 5) which project into the lumen of the occipital foramen, aid in locating the greatly reduced postocciput (poc). This sclerite appears as a narrow marginal rim on the dorsal portion of the occipital foramen.

A thickening of the head capsule in the region surrounding the occipital foramen is probably an external manifestation of the tentorium, which Peterson terms the tentorial thickening (tt).

The compound eyes (eye) are large and except for the mouthparts are the most conspicuous parts of the head. The males of this species are holoptic and the females dichoptic. In the male, but not in the female, the facets of the upper half of the eye are noticeably larger than those of the lower half.

The ocelli (o), three in number and conspicuous, are borne on a triangular elevation, the ocellar tubercle (ot), on the vertex of the head. They are

present in both sexes.

ENDOSKELETAL STRUCTURES

Observable endoskeletal structures of the head capsule of the fly consist of the tentorium, ocular sclerites, and the fulcrum.

The tentorium (tn) of this species of Empis is similar to that of Empis clausa figured by Peterson (1916). It is reduced to two internal ridges on the ventral surface of the head capsule. A dorsal projection present on each of these ridges may represent what is left of the dorsal or of the anterior arm.

The ocular sclerites (os) are two ridges which extend into the head cavity from the vertical and anterior portion of the head capsule. They are apparently formed by an infolding of the head capsule on the inner margins of the compound eyes.

The fulcrum (fu) is closely associated with the appendages of the head and is discussed in the section dealing with those structures.

HEAD APPENDAGES

The appendages or movable portions of the head capsule are as follows: antennae, labrum, hypopharynx, maxillae, maxillary palpi and labium, (Figs.

1, 2, 6-13).

The antennae (ant) are composed of three distinct segments. The base of the scape (s) is embedded in a membranous fossa (af) and bears a few fine hairs. The pedicel (p) is the smallest of the three segments and it also bears a few hairs. The flagellum (f) is conical in shape, thickly beset with short hairs, and bears a two-segmented stylus (sty). The distal segment of the stylus is sharply pointed.

The labrum (lr) is rigid, elongate, convex, and tapers toward the bifurcate tip. The branches of the bifurcation are sharply pointed. Under a compound microscope, these branches are seen to have slightly scalloped lateral margins and a set of spine-like teeth. A membranous lobe, probably the apex of the epipharynx (ep) is located between the branches of the bifurcation.

A row of tiny spine-like teeth can be seen on each side of the mid-line of the adoral surface; they extend, slightly divergent, from the basal, mesal angle of the labral forks approximately to mid-length of the labrum.

The labrum articulates posteriorly on each side of the head capsule at points at the posterior ends of the anteclypeus (Fig. 8). Anteriorly and laterally, the labrum is connected to the anteclypeus by a membranous area.

The lateral margins of the labrum curve edgewise and when the labrum is viewed in a cross-section (Fig. 9) taken at about mid-length, the hypopharynx (hp) is seen to be held between these lateral margins. Thus the dorsal and lateral portions of the food channel (fc) are formed by the labrum and the floor is formed by the hypopharynx.

The fulcrum (fu) is a stirrup-shaped structure fused to the basal end of the labrum and is one of the most prominent features of the interior of the head capsule. The so-called false floor (ff) of the fulcrum is barely visible within that structure.

The hypopharynx (hp) normally lies within the labrum and must be forced out of the latter in order to be seen. It articulates on each side of the labrum by means of two slender, sharply pointed condyles. The hypopharynx is tubular throughout most of its length but in its distal portion it is trough-

shaped, and terminates in a somewhat concave, three-pointed apex.

At the proximal end of the hypopharynx and extending into the interior of the head capsule is the salivary bulb (sb) or syringe. The anterior wall of this structure is more heavily sclerotized than its lateral or posterior walls.

The maxillae (mx) consist of the stipites and galeae. The elongate galeae (g) are somewhat more flexible than either the labrum or hypopharynx. They are crescent-shaped in cross-sectional outline throughout most of their length, but are flattened in their distal portions and have sharply pointed tips. The position of the galeae in relation to the other mouthparts is shown in Figure 9.

The stipites (st) are elongate and slender and project into the head capsule.

The maxillae are connected to the head capsule by a membrane. Actually this membrane enveloping the bases of the maxillae also provides the means of attachment to the head for the labium.

The maxillary palpi (mp) are single-segmented, porrect, and are normally held close to the ventral

surface of the head capsule.

The labium (Figs. 2, 9, 11) is a rather flexible organ and is the longest of the mouth parts. It is divided into three well-developed regions: mentum, prementum, and ligula: the latter is composed of two lobes, the labella.

On the aboral surface of the mentum (Fig. 13, a) is a transverse line or groove along which the mentum can be folded back on itself. In the specimens examined the mentum was always folded back, but could easily be unfolded by pulling on the labium with a needle.

Embedded in the extensive membranous areas of the labium are numerous closely set sclerotized platelets which bear pointed spicules. On the prementum and labella, these platelets have a flagstone arrangement, but on the mentum, they overlap producing a scale-like effect. The spicules vary in length from one to about nine microns. They are generally straight but those found near the tip of the labella are sharply curved. The platelets and spicules are illustrated in Figure 14.

The prementum (pme) is the longest portion of the labium. The aboral surface is sclerotized and transversed by a median longitudinal groove. The adoral surface is largely membranous, but a pair of sclerotized bands is to be seen extending from the mentum all the way to the labella. These are separated from one another for most of their length, but become approximated in the distal fifth of the prementum. Except for the sclerotized structures described below, the labella are largely membranous.

Each labellum bears a set of three articulated sclerites on its aboral surface. These sclerites are here termed posterior labellar sclerites (pls), a term suggested by Crampton.

The main trunks of the pseudotracheae (Fig. 12 ptr) arise on the mesal aspect of the adoral surface of the labella at the point where the rods of the prementum terminate. Each labellum has but a single pseudotracheal trunk from which arise approximately 22 pseudotracheal branches. The terminations of the pseudotracheal branches have been studied by Cregan (1941). She examined representative forms of several genera in the Dolichopodidae

and noted that there was considerable variation in these endings from genus to genus. A drawing of such a terminalia as found in Empis obesa is included here (Fig. 12) showing the irregular basal thickening (tet) and the sense peg (spg). The term sense peg is borrowed from Cregan who used it for the protuberance occurring at the tip of the pseudotracheal branch. She presents no evidence however that the structure actually functions as a sense organ.

On the mesal aspect of the aboral surface, a thin supporting rod may be seen extending along the entire length of each labellum at the tip of which it ends abruptly. The labellae bear setae as shown in Figure 13. In addition to these setae, each labellum has a band of spicules on its adoral surface (Figs. 10, 12).

CERVIX OR NECK

(Figs. 17 and 20)

Two pairs of lateral cervical sclerites and a pair of dorsal cervical sclerites are located in the membranous region between the head and the thorax.

Lateral cervical sclerites. The largest of the

three pairs of cervical sclerites are the subtriangular anterior lateral cervical sclerites (alc). The anterior corner of each is forked (Fig. 17). The lower fork is bent dorsad and articulates with the occipital condyle of the head. The upper fork is bent slightly ventrad and I was unable to find any point of articulation for it. The posterolateral angle of the triangle projects beneath and is fastened to the anteroventral margin of the anterior pronotum. The rest of the posterior margin of each sclerite (Fig. 20) is closely connected to the very narrow posterior lateral cervical sclerite (plc). This sclerite is in turn connected by a narrow strip of membrane to the anterior margin of the prothoracic sternal region.

The dorsal cervical sclerites (dc) are small subtriangular bodies, the posterior portions of which are normally hidden beneath the anterior pronotum. Anteriorly each articulates with a protuberance on the postocciput.

THORAX

(Figs. 15-27)

THORACIC TERGA (Figs. 15-18)

Pronotum: The pronotum consists of the anterior pronotum and the posterior pronotum.

The anterior pronotum (apn) is a narrow collar-like sclerite which merges in its lateral margins with the proepisternum. Posteriorly it is separated from the mesonotum and posterior pronotum by a suture.

The posterior pronotum (ppn) appears as two lobes, one on each side of the thorax just in front of the anterior portion of the mesothoracic tergum. A narrow, lateral, triangular-shaped extension of the posterior pronotum contacts the anterodorsal corner of the proepimeron.

Mesonotum: The mesonotum consists of three main regions: scutum, scutellum, and postnotum (postscutellum). In this fly, the prescutum is not differentiated from the scutum.

The scutum (sct) is the most conspicuous portion of the dorsum of the thorax. It is longer than broad, roughly rectangular in shape and slightly convex. A pair of crescentic sutures can be seen on each side of the sclerite at about its midlength. These sutures

are all that remains of the transverse suture (ts). A narrow, shelf-like projection, the paratergite (pat) extends along the lateral margin of the scutum from the posterior pronotum to the region of the wing base. Immediately posterior to the paratergite is another lateral projection of the scutum, the anterior notal wing process (anw). It is subtriangular in shape and the posterior side of the triangle articulates with the first axillary sclerite.

The scutellum (scl) is a shelf-like projection of the mesonotum lying immediately posterior to the scutum and set off from the latter by the scutoscutellar suture (scs). The parascutellum (Fig. 16, pas) is an anteroventral projection of the scutellum terminating in a flat, bluntly forked process. Each of the forks articulates with a process on the first axillary sclerites. The posterior notal wing process (pnw) arises at the anteroventral corner of the scutellum. It is a very slender, sclerotized band for most of its length but broadens at its articulation with the fourth axillary sclerite. Also originating on the scutellum, immediately beneath the

posterior notal wing process is the axillary cord (cor) which is confluent with the wing margin.

The postnotum (pao) or postscutellum is a very large sclerite, shaped like an inverted scoop and projecting slightly posteriorly from beneath the scutellum. It appears subtriangular in lateral view and extends laterally as far as the anepimeron of the mesothorax. The only evidence of a former division of the postscutellum into median and lateral sclerites (as is the condition of some Diptera) is a slightly elevated region in its anterolateral portions.

Metanotum: The metanotum (Fig. 18, mtn) is normally covered by membrane of the basal region of the abdomen and a portion of the metepimeron. It appears as a slightly rounded band which crosses the postnotum at about midlength of that sclerite and terminates on each side just behind the posterior thoracic spiracles.

THORACIC PLEURA (Figs. 17-20)

Propleuron: This sclerite is divided into an anterior and posterior portion by the prothoracic pleural suture (ps 1) which extends caudodorsally

from the pleural coxal articulation to the postero-ventral corner of the pronotum.

The anterior portion of the sclerite thus divided would ordinarily be termed the proepisternum. Since, however, the proepisternum merges ventrally with the probasisternum, the combined sclerites are here termed the sternopleurite (spl).

Anteriorly the sternopleurite is bounded by the cervical membrane and posteriorly by the pleural suture.

Dorsally the proepimeron (em 1) or posterior portion of the propleuron is separated from the greatly enlarged mesoepisternum by a suture. Its anterodorsal corner meets the pronotum as previously described. Ventrally it forms part of the lateral boundary of the first coxal cavity. The posterior margin of the proepimeron is practically fused with the mesoepisternum although a faint indication of a suture still exists.

The pleural coxal articulation (cf 1) or coxifer is formed by a ventral prolongation of both the sternopleurite and the proepimeron.

Mesopleuron: The episternum and epimeron of the mesothorax are both divided into a pair of large and fairly well defined sclerites. A toruous pleural suture (ps 2) extends from the pleural articulation of the second coxa dorsally into the pleural wing process (wp). In Mapis obesa, the pleural suture curves slightly posteriorly as it ascends from the pleural coxal articulation. It then curves anteriorly and levels off to meet the anepisternal cleft (aec). At this point it turns abruptly dorsal, assumes a nearly vertical position, and follows the posterior edge of the anepisternal cleft up into the pleural wing process. Here the pleural suture curves posteriorly again and fades out. The posterior margin of the anepisternal cleft and the pleural wing process are therefore actually a part of the mesoepisternum. This condition according to Crampton (1942) is characteristic of muscoid Diptera.

The secondary divisions of the mesoepisternum are the dorsal anepisternum and the ventral katepisternum. Their separation is not quite complete for

the suture between them fades out in its anterior portion.

Dorsally the anepisternum (aes) is separated from the tergum by a distinct cleft. Ventrally it is bounded by the proepimeron and the katepisternum. Its anterior limits are demarked by the anterior thoracic spiracles and the posterior pronotum.

The anepisternum bears three projections on its dorsal margin which are associated with the wing base. The anterior-most of these projections, the anterior basalare (ab), lies in a crescent-shaped notch in the posterodorsal corner of the anepisternum. It maintains connection with the anepisternum by means of a very short, sclerotized pedicel. Dorsally it is attached to the margin of the scutum. The surface of the anterior basalare is marked by a deep groove, the outward manifestation of a thin blade-like apodeme. Part of this apodeme is derived from the posterior basalare (pb) located immediately posterior to the anterior basalare. The posterior basalare is triangular in shape and has a diagonal cleft cut in its posterior margin. The sharply pointed postero-

dorsal angle of the triangle fits into the membrane of the wing base beneath the tegula. The posterior-most of the dorsal projections of the anepisternum is the pleural wing process (wp). This projection bears a posteriorly bent "neck" which articulates with a ventral projection of the second axillary sclerite.

The katapisternum (kes) is partially fused anterodorsally with the anepisternum. Ventrally it is indistinguishably united with sternal elements. Anteriorly it is partially united with the proepimeron. Posteriorly, however, it is definitely limited by the mesothoracic pleural suture.

The secondary division of the mesoepimeron are the dorsal anepimeron and the ventral katepimeron. They are separated from each other by a well defined suture, the epimeral suture (ems).

The anepimeron (asa) is cut transversely by a deep cleft. The region above this cleft is occupied by the subalare (sa) which bears an elongate, posteriorly-directed finger-like process. The ventral

boundary of the anepimeron is formed by the epimeral suture and the mesothoracic pleural suture. The pleural suture also delimits it anteriorly. Posteriorly the anepimeron is bounded by the lateral portion of the postnotum and by the posterior thoracic spiracle (sp 2).

The katepimeron (kem) lies ventral to the anepimeron. Posteriorly it is bounded by a membranous area immediately beneath the posterior thoracic spiracle and by the metepisternum. Ventrally, the katepimeron forms part of the lateral boundary of the second coxal cavity and the anterior and lateral boundaries of the third coxal cavity. A longitudinal ridge, the pleurotrochantin (pta) extending along the ventrolateral margin of the katepimeron, bears the pleural coxal articulation (cf 3) of the metathoracic leg.

Metapleuron: This pleuron is also divided into an episternum and epimeron but unlike the mesopleuron it is not secondarily subdivided.

The metepisternum (es 3) is a narrow, triangular sclerite wedged between the katepimeron of the

mesothorax and the metepimeron. It is completely cut off from the sternal region by the latter sclerites as shown in Figures 17 and 20. Dorsally it ends at the metanotum.

The metepimeron (em 3) takes the shape of an elongate band which is attached to the metanotum.

A chain of small, oval impressions can be seen on the metepimeron. Young (1921) observed similar markings on such dipterous families as the Therevidae, Asilidae, Nemestrinidae and Rhagionidae.

Brosley (1926) found them on the metepimeron of the tabanid, Tabanus atratus Fab. They are generally called sensory areas (sa) although there seems to be no proof that they actually function as such.

THORACIC STERNA (Figs. 17, 20)

Prosternum: The ventral region of the prothorax is made up of the presternum, sternopleurite and furcasternum or sternellum.

The presternum (pst) is a small subtriangular sclerite located in the cervical membrane just anterior to the main portion of the prothoracic sternal

region.

The basisternum is indistinguishably incorporated into the lateroventral portions of the proepisternum. I do not believe that the basisternum is invaginated to such an extent that it is entirely an internal structure since the prosternal apophyses are not borne on an internal median ridge as is the condition when such an invagination has occurred. Therefore I choose to call this part of the prosternum, i.e., the combined proepisternum and probasisternum, the sternopleurite (spl). This term has been used by Bromley (1926) and Young (1921) to indicate a similar condition. The posterior margins of the sternopleurite are prolonged posteriorly forming the mesal and anterior boundaries of the coxal cavities of the fore legs. A longitudinal median sternal groove extends throughout the length of the sternopleurite.

The furcasternum (fs 1) is represented by a small oval area immediately behind the sternopleurite. The furcal pits are hidden beneath the posterior margin of the sternopleurite.

Mesosternum: The greater part of the mesosternum is occupied by the ventral prolongations of the katepisterna. The basisternum has apparently been carried inward by a process of invagination and is represented by a median ridge on which the mesosternal apophyses are borne. This is according to the theory of Rees and Ferris (1939)

The furcasternum (fs 2) has also been involved in this invagination but is still represented externally by a pair of elongate processes which project posteroventrally and bear the ventral coxal condyles (vcc). A median sternal groove (msg) marks the line of invagination.

Metasternum: The katepimeron and the pleurotrochantin occupy part of the metasternal region.

The furcasternum (fs 3) resembles that of the mesothorax and is attached to a bridge (br) which connects it to the inner surface of the mesopleuron. Crampton was of the opinion that the bridge represented the basisternum.

SPIRACLES (Figs. 17, 19)

The location and general appearance of the

thoracic spiracles (s 1 and s 2) is shown in Figure 17. The atrial orifice of each spiracle is filled with a mass of white processes which arise from the peritrene and branch dendritically (Fig. 19). The branches are drawn out into very fine threads which intermingle with each other and with similar threads from the opposite side of the peritrene. The whole system undoubtedly acts as a filtering mechanism.

WINGS (Figs. 15, 16, 21)

In dried specimens, the wings of Empis obesa are about twice as long as the abdomen. They have a well-developed anal lobe (alo) but the alulae (alu) and calypters (cal) are relatively small. The membrane of the wing and all the veins except the costa are covered with tiny, dark-brown bristles (microtrichiae). The costal vein bears much larger bristles than those of the wing membrane or of the other veins. The margin of the wing from the distal tip of the costa to the axillary excision (axe) bears a narrow fringe of white hairs. The alulae and the calypters also bear a fringe of white hairs

but they are much longer than those of the rest of the wing margin.

Articulation with the Thorax.

The tegula, humeral plate, and axillary sclerites lie in the membrane of the wing between the bases of the wing veins and the thorax.

The tegula (tg) or epaulet lies in the membranous area between the anterior notal wing process and the base of the costal vein.

The small humeral plate (hu) is located between the base of the costal vein and the tegula. The greater part of this sclerite is located on the anteroventral surface of the wing.

The axillary sclerites include the first, second, and fourth which are well defined, the third which is poorly defined, and a pair of median plates.

The first axillary sclerite (1) is a plate which bears an elongate "neck." The tip of the "neck" articulates with the base of the subcostal vein. The proximal edge of the "neck" is attached to the anterior notal wing process. The proximal edge of the first axillary sclerite posterior to the "neck"

bears a pair of protuberances which are attached to the parascutellum (Fig. 16).

According to Snodgrass, the second axillary sclerite (2) articulates with the base of the radial vein and bears a ventral process which rests upon the pleural wing process. By this definition the second axillary sclerite of Empis obesa would consist of two parts, an anterior portion which articulates with the base of the radius and a posterior portion which bears the process resting on the pleural wing process. Proximally the second axillary sclerite hinges on the first axillary sclerite.

The third axillary sclerite (3) is poorly defined. It is represented by an irregular sclerotized thickening on the calypter. Part of this thickening projects above the rest of the sclerite forming a blunt process which overlaps the median plates. Distally, the third axillary sclerite merges with the bases of the veins in the anal region of the wing. A thinly sclerotized extension of the main body of the third axillary sclerite con-

nects it proximally with the fourth axillary sclerite.

The fourth axillary sclerite (4) is a relatively long, sclerotized band, hinged proximally to the posterior notal wing process.

The median plates (m) consist of a pair of sclerites located between the second and third axillary sclerites. The proximal sclerite of the pair is subtriangular in shape and is hinged along its outer margin to the other member of the pair which is irregularly crescentic in shape.

Wing venation. (Fig. 21)

The Comstock-Needham system as modified by Tillyard (1919) and Alexander (1929) is used here.

Costa (C) round the tip of the wing and stops at vein R_5

Subcosta (Sc) parallels vein R_1 very closely and is incomplete, i.e., it fades out without reaching the wing margin, nor does it join any of the other veins.

Radius (R) has the following branches:

$R_1 + 2$ which except for Costa is the strongest vein in the wing;

R_s, the radial sector, a very weak vein;

R₂ + 3 + 4 the apical portion of which represents vein R₃;

R₄ its basal connection to vein R₂ + 3 + 4 has been lost and it is joined to vein R_s by a supernumerary cross-vein;

R₅.

Media (M) is three-branched, as indicated in Figure 21.

Cubitus is two-branched as follows:

Cu₁, which is recurrent, paralleling very closely the anterior margin of the first anal vein;

Cu₂, a very weak vein lying immediately behind Cu₁:

The only anal vein which is easily recognized is the first anal (1 A).

Cross-veins. The humeral, radio-medial, medial, and medio-cubital cross-veins are present.

Cells. It is important to note that cell 1st M₂ (discal cell) is present and separated from cell 2nd M₂.

HALTERES (Figs. 22, 23)

The halteres have long been recognized as highly modified metathoracic wings. The major regions of the haltere according to the terminology of Loane (1893) are the scabellum, scape, and capitellum.

The scabellum (scb) is the swollen basal portion of the haltere. Associated with the attachment of the scabellum to the thorax are a number of sclerites which are believed to be homologous with the sclerites found at the base of the mesothoracic wings. Using the descriptions and drawings of Snodgrass (1909), Rees and Ferris (1939), and Bonhag (1949), I have attempted to identify these sclerites as they are found at the base of the haltere of Empis obesa. The pleural wing process (pw) is easily identifiable. It arises from the posterodorsal corner of the metepisternum and is connected to the latter by means of a short, narrow pedicel. The posterior notal wing process (pnw) arises on the lateral portion of the metanotum. It is a flat sclerite, somewhat boot-shaped in outline and is separated from the postnotum. The anterior notal

wing process (anw) also arises on the metanotum, just anterior to the posterior notal wing process and is partially hidden by the latter. It is an irregular, narrow, sclerotized band. Located on the membrane of the haltere itself are the axillary sclerites. The first axillary sclerite (1) is L-shaped in outline and articulates with the anterior notal wing process. Distally it articulates with the second axillary sclerite (2). The latter sclerite is subrectangular in dorsal view with its two anterior corners drawn out to acute angles. In lateral view the second axillary sclerite is seen to have a ventral projection which articulates with the pleural wing process. Located posteroventrally in relation to the other axillary sclerites is a very small, band-shaped structure which probably represents the third axillary sclerite (3). I could discover no actual point of articulation for it. The tegula (tg) is located on the dorsal surface of the scabellum. Two other sclerites are present on the anterior dorsal surface of the scabellum but since their homologies are very uncertain I have labelled them only as sclerite "x" and sclerite "y."

Sclerite "x" is an elongate oval sclerite, the distal end of which is prolonged into a sharp point. The point projects downwardly toward but does not quite meet the first axillary sclerite. Sclerite "y" lies immediately posterior to sclerite "x." It consists of a narrow sclerotized band which closely parallels the proximal edge of the outer angle of the second axillary sclerite. These two sclerites may represent the bases of rudimentary veins.

A conspicuous grid-like area is found on the dorsal surface of the scabellum. This area was called the cupola (ca) by Hicks in 1857 and Lowne used the same term for it in 1893 although he also referred to it as the basal plate. Under high magnification the area presents the appearance of a plate pierced by numerous oval holes arranged in nine regular files. Between the files are numerous spine-like protuberances. There is histological evidence that the cupola is actually a sensory area and Wigglesworth (1950) presents a good bibliography of the subject.

The scape (sh) is a short, membranous stalk covered with minute setae. It bears dorsal and ventral sensory areas which Lowne designated as scapal plates (sca). Under high magnification, each area is seen to be transversed by sclerotized bands within which oval areas are delimited. Within each of the latter is a round, somewhat refractive body and stretching across the entire structure is a pair of convex bars. Each oval area with its refractile body and bars represents the external manifestation of a campaniform organ. These are very complicated sense organs and a good account of them is to be found in Wigglesworth.

The capitellum (cp) is the greatly enlarged, bulbous distal portion of the halter. In addition to the minute setae which cover it, the capitellum bears a set of ten relatively large setae on its posterodorsal surface and a similar set of six setae on the ventral surface.

LEGS (Figs. 24-27)

The legs of Empis obesa are long and slender and covered with setae. The metathoracic legs are

the longest while the pro- and mesothoracic legs are about equal to each other in length.

The coxae (cx) are closely approximated mesally and lack sutures. Those of the fore legs (cx1) are the longest and are separated by a distance of nearly their own length from the mesothoracic coxae (cx2). The anterodistal margins of the fore coxae and the posterodistal margins of the middle and hind coxae are emarginate. These emarginate areas allow for a greater dorsal adduction of the coxae. The ventral surface of the mesothoracic coxa is membranous except for a small, spindle-shaped, sclerotized bridge which transverses the membranous region at about mid-length of the coxa (Fig. 25). An articulatory point at the tip of the ventral coxal condyle of the mesothoracic furcasternum fits into a small pit on the mesal surface of this bridge (Fig. 25a). This arrangement probably serves to strengthen the coxa, which would be greatly weakened because of the lack of sclerotization on its ventral surface. A somewhat similar situation is found in the metathoracic coxae. The coxa here is unsclerotized in the upper half of its ventral surface. A pit (Fig. 25b) is

present at the middle of the rim of the upper edge of the sclerotized portion. An articulatory point at the tip of the ventral coxal condyle of the metathoracic furcasternum fits into this pit.

The trochanter (tr) articulates with the coxa by means of a dorsal and a ventral condyle borne on the coxa. Distally the trochanter is so firmly united with the femur that the two segments act as a unit.

The femora (fe) of the metathoracic legs are longer than those of the other legs. The metathoracic femora are noticeably enlarged distally, those of the pro- and mesothoracic legs are of about the same width throughout.

The tibia (ti) articulates with the femur by a dicondylic hinge. Each tibia is about equal in length to the femur of the same leg and each is slightly enlarged at its distal end.

The tarsus consists of five segments (ta) each of which is somewhat more slender than the one immediately basal to itself. The segments are linked together by monocondylic hinges borne at

their basal ends. The basitarsus is about equal in length to the combined lengths of the three succeeding segments.

The pretarsus consists of claws, pulvilli, basipulvilli, unguitractor and empodium. The claws (un) articulate at the dorsal claw-bearing process (unguifer) of the distitarsus. They are strongly curved and have sharply pointed apices. The pulvilli (pv) are elongate, fleshy lobes borne on a pair of sclerotized basipulvilli (bp). The basipulvilli articulate dorsally at the unguifer, lateral to the articulation of the claws. The unguitractor (u) is a median sclerite to which the unguitractoral tendon is attached. The unguitractor terminates distally in a sharply pointed apex, generally termed the empodium (emp).

ABDOMEN

(Figs. 28-32)

The abdomen in each sex consists of nine visible segments.

PREGENITAL SEGMENTS

The genital openings in each sex are between the

eight and ninth sternites. The first seven abdominal segments are therefore considered the pregenital segments.

The male pregenital segments are covered with a gray pruinosity. The spiracles are seven in number on each side of the abdomen and are borne in the pleural membrane of the first seven abdominal segments. They are much smaller than the thoracic spiracles but their atrial orifices are occluded by the same type of dendritically branched processes found in the thoracic spiracles.

The first abdominal tergite is much narrower than those following it. Conspicuous dark-brown pits (se) arranged in groups of three are to be seen on the ventrolateral margins of the tergites. Similar markings arranged in a chain-like pattern extend up over the anterodorsal surfaces of the tergites. When the abdomen is in an expanded condition, these markings are to be found on the second through the sixth segments. It has been supposed that they have a sensory function although this has never been proven.

The first abdominal sternite is fused with the second sternite although a groove is still visible along the line of union. The seventh sternite is greatly enlarged and bears a row of large, black, flattened setae along its posterior margin.

The female pregenital segments differ from those of the male in that all the abdominal tergites beyond the fifth are black and shiny. These segments are also noticeably smaller in diameter than those which precede them. The seventh sternite does not differ markedly from the others, as it does in the male.

TERMINALIA

Male. The male terminalia are limited to the eighth and ninth segments. The eighth tergite is divided longitudinally into two subrectangular plates. The eighth sternite is a greatly enlarged, cup-shaped body which normally surrounds the lateral and posterior portions of the base of the ninth segment. The rim of the cup bears a row of bristle-like setae. A pair of protuberances is present on each anterolateral surface. A group of six to eight

setae, similar to but smaller than those of the seventh sternite, are to be found on the apices of these protuberances.

The ninth tergite is greatly enlarged and is divided into two lateral halves which are joined anteriorly by a broadly Y-shaped structure (Fig. 29). The "arms" of the Y are joined to the inner surface of each lateral half of the ninth tergite. Its base or stem rests upon the phallobase (phb).

The two portions of the ninth tergite are further subdivided into halves. The upper halves have been termed the surstyli (sur) by Cole (1927) and the upper lamellae by Collin (1933) who says that they may represent the tenth tergite. The ninth sternite is represented by an irregularly shaped pair of flattened sclerites which are normally hidden by the cup-shaped eighth sternite. Posterolaterally, each member of the pair is united to the ventral edge of the lower half of the ninth tergite. Anteriorly, each is connected to the phallobase.

The sedeagus (se) is a long, somewhat flattened tube possessing a spring-like resiliency. It is

normally held in the position shown in Figure 31, the greater part of it being hidden, however, by the ninth tergite. The base of the aedeagus, phallobase (phb), which is broadly T-shaped in anterior view, bears an ejaculatory apodeme (ej). This latter structure consists of a thin, oval plate arranged in a saggital plane with a pair of much smaller lateral plates extending from it. Each of the arms of the "T" of the phallobase is connected to the anterior ends of the ninth sternite: dorsally, the phallobase meets the Y-shaped structure of the ninth tergite as previously described. In lateral view, the portion of the aedeagus immediately posterior to the phallobase is seen to be a stout tube on the ventral surface of which are two step-like protuberances. The middle third of the aedeagus is flattened and bears a large keel. The distal third is a slender, tapering tube.

Female. The eighth and ninth segments can be withdrawn into the seventh segment. The sternite of the eighth segment projects beneath the ninth. The ninth segment is very much reduced in size and

although its tergite is well sclerotized, the sternite is very weakly sclerotized except along its posterior margin. A membranous area bearing the cerci (ce) projects slightly beyond the ninth segment. I can find no trace of the tenth or eleventh segments although the membranous area just described may represent what is left of a fusion product of the two.

CHAETOTAXY

CHAETOTAXY OF THE HEAD CAPSULE. Setae are absent from the front of the head capsule in both sexes of Empis obesa. The posterior region of the head is well provided with setae. The setae of the upper half of the head are black, those of the lower half are white and bristle-like. Their position, general arrangement and the names generally applied to them are indicated in Figure 5.

CHAETOTAXY OF THE THORAX (Figs. 15, 17). Prothorax. The anterior pronotum, the posterior pronotum, and the lateral portions of the sternopleurite all bear numerous, white, hair-like setae. Each lobe of the posterior pronotum also bears a single, long, dark-brown humeral seta (hs).

Mesothorax. A single row of thin, dark-brown achrostical setae (ase) occurs on each side of the meson of the scutum. The dorsocentral setae (dsc) are biserial in the anterior half of the scutum and uniserial in the posterior half. Those of the uniserial series are about twice as long as those of the biserial series. The area immediately behind the pronotum bears numerous white, hair-like setae

and three to four dark-brown, bristle-like post-humeral setae (phs). The supra-alar setae (sas), five in number and located anterodorsally to the base of each wing, are the strongest setae of the thorax. Posterior to the supra-alars is a row of six to eight intra-alar setae (ise). The scutellum bears eight, strong scutellar setae (sse) on its posterior margin. The postnotum bears a patch of white, hair-like setae, the so-called metanotal setae (ms), on a slightly elevated region just dorsal to each haltere (Fig. 13).

Metathorax. Setae do not occur on the metathorax.

The legs (Figs. 24-27) of Empis obesa are covered with dark-brown or white setae which for the most part arranged in irregular, longitudinal rows.

The coxae of all the legs bear numerous white, hair-like setae on their anterior and dorsal surfaces. In addition to the hair-like setae, the coxae of the meso- and metathoracic legs bear four to five dark-brown setae on their dorsal surfaces.

The trochanters have a sparse covering of hair-like and bristle-like setae.

The femora of the prothoracic legs bear numerous bristle-like setae on all except their ventral surfaces. The ventral surfaces bear somewhat finer setae, which are less numerous and white in color. The setae of the meso- and metathoracic femora are similar to the thoracic femora except that they are somewhat coarser. The hind femora of the female bear (in addition to the ordinary setae) a row of scale-like or feather-like setae on the apical halves of their ventral surfaces (Fig. 27).

The tibiae are well provided with bristle-like setae. Spine-like setae are also present, especially along the dorsal surface and at the distal end. A comb-like row of very small setae can be seen on the ventral surface at the distal end of the metathoracic tibia (Fig. 26).

The tarsi bear bristle-like setae on all their segments. Spine-like setae occur at the distal ends of all the tarsomeres except the distitarsus.

CHAETOTAXY OF THE ABDOMEN. Dorsally, the abdo-

men bears numerous black setae and laterally it has a sparse covering of long, white hair-like setae. The setae of the male terminalia have already been discussed in the description of those structures.

PART II

THE EXTERNAL ANATOMY OF THE GENUS CLINOCERA

HEAD

(Figs. 33-39)

The head capsule and especially the mouthparts of Clinocera differ considerably from those of Empis.

REGIONS OF THE HEAD CAPSULE

The compound eyes of both sexes are widely separated (dichoptic) and hence the frons is present in both the male and the female.

The anteclypeus (acl) is represented by a pair of sclerotized ridges located ventrally on each side of the head capsule. Anteriorly these ridges are firmly attached to the inner or posterior surface of the frontoclypeus (fcl). Posteriorly they are attached to the labrum.

The genae are narrow and are separated from the frontoclypeal region by a suture.

The occipital region does not differ greatly from that of Empis except that the tentorial thickening is less pronounced.

The compound eyes are nearly as long as the height of the head capsule. Their width is well over half their length, so that the compound eyes of Clinocera although oval give the impression of being much more nearly round than those of Empis. The compound eyes of both sexes are covered with a fine pubescence, and the facets are of uniform size throughout.

The ocelli are three in number and as in Empis are borne on a pronounced ocellar tubercle.

ENDOSKELETAL STRUCTURES

The tentorium (tn) of Clinocera is similar to that of Empis.

The ocular sclerites (os) are much wider than those of Empis.

HEAD APPENDAGES

The antennae are three-segmented and are attached well above the middle of the head. In shape, the scape is subcylindrical, the pedicel subglobose and the flagellum pyriform. The flagellum bears a long, slender, two-segmented style.

The labrum (lr) is a narrow visor-like sclerite,

the posterior or proximal edge of which is overlapped by the frontoclypeus. Anteriorly, the labrum is attached to the frontoclypeus and posteriorly to the anteclypeus (Fig. 36, ac).

The epipharynx (ep) lies immediately posterior to the labrum and is connected to the latter by a membrane. The ventral margin bears a set of peg-like teeth, between which bristle-like setae are located. Posteriorly, on each side of the head capsule, the epipharynx broadens into a flattened, sharply pointed tooth-like process. These processes bear 10-12 stiff setae on their mesal surfaces.

The maxillae are completely lacking in Clinocera but a pair of clavate maxillary palpi are still present.

The hypopharynx (hp) is a short T-shaped sclerite tapering apically to a sharp point. The arms of the "T" are broad and very thinly sclerotized along their lower margins. The adoral surface of the salivary bulb is composed of a membranous region within which is set an umbrella-shaped sclerite. Its aboral surface is entirely sclerotized.

The labium is normally held close to the ventral surface of the head capsule and at its fullest extension, its length is about one-half the height of the head capsule.

The mentum is not discernible in Clinocera.

The premental region has a heavily sclerotized posterior plate (pp) which reminds one somewhat of an outline of a rabbit or owl head. A longitudinal ridge is present along the midline of its interior surface. Dorsally the ridge forks and sends an extension along the inner edge of each "ear." Ventrally the ridge bears a pair of paramedial protuberances. Each protuberance articulates with the posterior end of the labellar sclerite on its side.

A pair of flattened lateral labellar rods (Figs. 38, 39, lrd) extends the length of the labium and projects into the head capsule. I was unable to detect a point of attachment for the proximal ends of these rods. Distally, however, they are connected to the discal sclerites (dls) of the labella.

The labella are the largest portions of the labium. Their lateral areas are nearly opaque and

are rather distinctly set off from the transparent mesal areas. The semi-opacity of the lateral areas is caused by the presence of myriads of sclerotized plaques very similar to those described for the labium of Empis.

There is but one large labellar sclerite (ls) on the lateral surface of each labellum.

Located on the dorsomesal surface of each labellum is a crescent-shaped sclerite, the discal labellar sclerite (dls). Extending ventrally from each of these sclerites are rows of tiny, closely-set sclerites, the surfaces of which are produced into peaks of varying sharpness. These represent the prestonal teeth (te) in Clinocera.

The pseudotracheal branches (Fig. 39, psd), ten on each labellum, are barely visible beneath the membrane of the mesal labellar surfaces. They lack the internal, sclerotized processes described in Empis. Sense pegs (spg) consisting of short, tube-like projections, each of which is tipped with a sharply-pointed, cone-like process, are present at the end of each pseudotracheal branch.

Between the labella lie the so-called glossae (gl) which are united along their mesal edges forming a single sclerite. If, however, one considers the labella to represent highly modified labial palpi, the sclerite in question could also be either the ligula or the combined paraglossae.

CERVIX OR NECK

The sclerites of the neck region of Clinocera resemble in shape and arrangement those of Empis and hence will not require a separate description.

THORAX

(Figs. 40-41)

THORACIC TERGA

Pronotum: The pronotum of Clinocera is similar in shape to that of Empis but does not extend as far lateroventrally.

The anterior pronotum (apn) in Clinocera is placed relatively higher in relation to the rest of the thorax than that of Empis. The actuality of this condition can be substantiated by drawing a line anteriorly from the posteroventral corner of the scutellum parallel to the longitudinal axis of the

thorax. It will then be seen that the dorsum of the anterior pronotum of Clinocera is nearly on a level with such a line while the dorsum of the same sclerite in Empis is located some distance below such a line.

The posterior pronotum (ppn) is well-demarcated anteriorly and dorsally but its lateroventral limits have been obliterated by a complete fusion with pleural elements.

Mesonotum: The sclerites of the mesonota of two genera are very similar except that the scutum of Clinocera is less convex and there are also differences in the chaetotaxy.

Metanotum: The metanotum is very similar to that of Empis.

THORACIC PLEURA

Propleuron: The proepimeron (em 1) has fused completely dorsally with the anepisternum of the mesothorax and there is no evidence of its former separation from the katepisternum of the mesothorax. In Empis the proepimeron is separated from the anepisternum of the mesothorax and there is also a

very faint line present between the proepimeron and mesothoracic katepisternum.

Mesopleuron: The pleural suture (ps2) curves slightly posteriorly and then anteriorly to meet the anepisternal cleft (aec) but its curvature is not as sharp as that in Empis. The anepisternal cleft is noticeably wider in Clinocera than in Empis.

The mesoepisternum does not differ greatly from that of Empis except that it has fused completely with the proepimeron.

The mesoepimeron is also similar to that of Empis but there is a difference in the position of the epimeral suture (ems). In Empis the epimeral suture is nearly horizontal, but in Clinocera this suture is tilted so that its caudal extremity is at a higher point than its anterior extremity.

The sclerites of the mesopleuron associated with the wing base are not significantly different from those of Empis.

Metapleuron: The sclerites of the metapleuron resemble those of Empis but the metepimeron (em3) is

almost completely desclerotized and can hardly be distinguished from the membrane associated with the attachment of the abdomen to the thorax.

THORACIC STERNA

The sternal region presents no modifications significantly different from the sternal region of Empis.

SPIRACLES

The atrial orifices of the thoracic spiracles of Clinocera are many times smaller than those of Empis. Slender processes occlude the atrial orifices, but unlike those of Empis, they are unbranched.

WINGS (Fig. 42)

In contrast to Empis, the anal lobe of the wing of Clinocera is not developed and there is no axillary excision.

Articulation with the Thorax: The axillary sclerites are very similar to those described for Empis.

Wing venation: Costa (C) continues around the entire wing margin although it is noticeably weaker

posterior to the tip of vein M_1 .

Subcosta (sc), although a weak vein, is separate from the costa and joins the latter at about midlength of the wing.

Radius has the following branches: $R_1 + 2$, radial sector (Rs), R_3 , R_4 (the base of which may or may not be present in the different species), and R_5 .

Media is three branched as follows: $M_1 + 2$, M_3 and M_4 .

Cubitus has but one branch, Cu_1 . As in Empis, Cu_1 is recurrent in the direction of the anal margin of the wing. The greater part of the recurrent portion is confluent with the first anal vein (1A). Cu_2 is completely lacking unless a slight thickening in the wing membrane immediately posterior to Cu_1 represents a remnant of Cu_2 .

The apical and basal thirds of the first anal vein are present as separate entities but the mid-portion of this vein is confluent with Cu_1 . The second and third anal veins are not present.

Crossveins present are the humeral, radio-medial, medial, and medio-cubital. Connecting veins R_4 and R_5 is a short supernumerary crossvein (s).

HALTERES

The capitellum of the haltere of Clinocera is noticeably less swollen than that of Empis. In all other respects the halteres of Clinocera resemble those of Empis.

LEGS

The legs of Clinocera are relatively long and slender. The fore legs are about four-fifths as long as the middle legs and the hind legs are slightly longer than the middle legs.

The coxae of the fore legs are about twice as long as the coxae of the middle or hind legs. As in Empis, the meso- and metathoracic coxae are closely appressed mesally. The attachment of the coxae to the thorax is essentially the same as in Empis.

The femora of the fore legs are noticeably narrowed apically; those of the middle and hind

legs are subcylindrical.

The tibiae are subcylindrical.

The tarsi are 5-segmented, the basal segment nearly equaling in length the combined lengths of the four segments distal to it. The empodium is styliform and the claws are well-developed. It should be noted that in the subgenus Bergenstamia the empodia are wanting or vestigial.

ABDOMEN

(Figs. 42-43)

The abdomen in each sex consists of nine visible segments.

PREGENITAL SEGMENTS

The first seven or pregenital segments of the male and female are very similar and will be discussed together. The tergites are olivaceous in color and the sternites are covered with a gray-white pruinosity.

As in Empis, the first tergite is much narrower than the tergites following it.

The first sternite is separated from the second

sternite and the latter is subdivided transversely. The seventh sternite of the clinoceran male, unlike that of Empis, is not enlarged.

The abdominal spiracles have an arrangement similar to those of Empis, i.e., seven spiracles on each side located in the pleural membranes of the first seven segments.

Sensory pits very similar to those observed on the abdomen of Empis are present on the abdomen of Clinocera.

TERMINALIA

Male. The eighth tergite is represented by a very narrow sclerite but the eighth sternite does not differ greatly from the sternites anterior to it.

The ninth tergite is divided into two lateral halves which are connected dorsally at their antero-ventral corners by a narrow sclerotized band. Each half of the ninth tergite is partially divided by a deep cleft into a broad anterior lobe (al) and a narrow posterior lobe (pl).

The surstyli (Figs. 42-43, sur) which are borne on the anterior lobes of the ninth tergite exhibit a great variation in shape among the different species of the genus. A pair of thinly sclerotized subovate plates (op) is present in the membranous region just anterior to the bases of the surstyli. I am certain as to the homologies of these structures.

Mesally, the surstyli are united at their bases by a narrow sclerotized bridge which also extends posteriorly where it joins a structure similar to the Y-shaped process associated with the ninth tergite of Empis. In Clinocera this process has also a pair of very narrow posterior arms which are attached to the anteromesal edge of the posterior lobe of the ninth tergite.

The ninth sternite, which is generally subtriangular in lateral outline and subcampanulate in dorsal outline projects beyond the posterior edge of the ninth tergite. The mesonal region of its dorsal surface is membranous.

The phallobase (Fig. 43, phb) projects into the ninth sternite and from its ventral surface there extends a narrow sclerotized ribbon-like structure (ri).

This ribbon follows a sinuous course just beneath the membranous dorsal surface of the ninth sternite to the anterior margin of the base of aedeagus to which it is attached.

The aedeagus consists of two rather well defined regions, namely, a basal tubular portion (tu) and a distal filamentous portion (fi).

The tubular portion may bear a lateral keel-like ridge on each side which extends basad, depending on the species, less than a third to about half the length of the tubular portion. Basally the tubular portion is hinged at its posterior margin to the distal rim of the ninth sternite. Its connection to the ribbon-like sclerite which extends from the phallobase has already been mentioned.

The filamentous portion of the aedeagus is a continuation of the posterior surface of the

tubular portion.

A membranous cape (mc) covers the apex, posterolateral and posterior surfaces of the distal third or half of the tubular portion. A part of this same membrane also covers the posterior surface of the filamentous portion.

The membranous cape of C. longifurca was examined under an oil immersion lens and found to have embedded in it plaques arranged in a scale-like pattern. The apices of the individual plaques bear one to three sharp points. These scale-like bodies are concentrated on the apicolateral portions of the cape. They are fewer in number posteriorly and are not present on that part of the cape covering the filamentous portion.

CHAETOTAXY

(Figs. 35, 41)

CHAETOTAXY OF THE HEAD. The head capsule is practically devoid of setae except posteriorly where a well developed seta is present. Their arrangement and character are shown in Figure 35.

The antennal segments are covered with setulae and the scape and pedicel each bear a circlet of bristle-like setae.

The labial palpi are covered with small hair-like setae.

The labella have a few setae scattered over their lateroventral surfaces and along the posteroventral margin of the posterior labellar plate.

CHAETOTAXY OF THE THORAX. The anterior pronotum bears a single seta on each side of the meson. Each lobe of the posterior pronotum bears a single humeral seta.

The scutum bears well developed setae which are according to standard terminology as follows

(the numbers indicated are for one side of the thorax only): acrostichals, lacking; dorsocentrals, five; intraalars, three; prealars, one; postalars, one.

A pair of setae are present on the apical margin of the scutellum and a patch of so-called metanotal setae occurs in front of each haltere.

The pleura are devoid of setae except for a few white hairs scattered over the anterior portion of the sternopleurites.

CHAETOTAXY OF THE LEGS. The coxae have a few whitish setae grouped for the most part at the apices of their anterodorsal surfaces.

In general the rest of the leg segments bear a moderate number of relatively fine setae arranged in more or less regular rows.

CHAETOTAXY OF THE ABDOMEN. A sparse covering of white hair-like setae is present on all the abdominal segments of both male and female. The setae on the oval plates and the ninth tergite of the male are noticeably longer and

stronger than the setae elsewhere on the abdomen. In the figures of the male terminalia presented in connection with the taxonomic section of this paper these setae are not included. The surstyli of most of the species examined bear on their apicomesal surfaces, stout, peg-like setae.

PART III

TAXONOMY OF THE SPECIES OF CLINOCERA
IN NORTH AMERICA

THE GENUS CLINOCERA

The name Clinocera (which is adopted in this paper) is one of those names involved in the Meigen 1800 vs. Meigen 1803 controversy. In his 1800 paper, Meigen used the name Atalanta but included no species under it. In his 1803 paper, he used the name Clinocera and included one species within it.

When Hendel (1908) republished Meigen's 1800 paper he indicated that Atalanta and Clinocera were synonymous and that Atalanta was the correct name for the genus. Melander (1927) in disagreeing with Hendel's choice, gave the following reasons: "As Meigen mentions no species in this early paper the type dates from Hendel's interpretation in 1908, reason enough for disregarding the name Atalants." In spite of the reasonableness of Melander's argument, the name Atalanta is the valid name under the International Code of Nomenclature.

Since 1908, authors have used both names. Following is a listing of some of these authors indicating which name they have chosen to use:

<u>Clinocera</u>	<u>Atalanta</u>
Collin	Engel (1918 and 1940)
Coquillett	Kertesz
Curran	Ringdahl
Engel (1931)	
Frey	
Goetghebuer	
Lundbeck	
Melander	

Engel, who has done considerable work with the genus, has used Atalanta in two of his papers but he has also described a new species using the name Clinocera so one might infer that he is somewhat undecided as to which of the two names to employ.

I have chosen to use the name Clinocera because it is the name which has had the greatest usage since 1908 and, so far as I have been able to determine, it was the only one of the two names used prior to that date.

Mik (1881) recognized five separate genera which are now included in the single genus Clinocera. These genera were: Bergenstammia,

Clinocera, Heleodromia (in part), Kowarzia and Phaeobalia. It should be mentioned that he maintained Wiedemannia as a separate genus, and likewise four other groups generally given subgeneric rank under Wiedemannia.

In an extensive review of the European species of the genus, Engel (1918) concluded that the genera recognized by Mik, including Wiedemannia, deserved only subgeneric rank under Atalanta (= Clinocera). Heleodromia was recognized as a separate genus, but Macquart's genus Hydrodromia which had been formed from certain species of Heleodromia was retained as a subgenus of Clinocera. A full account of the history of the genus Hydrodromia is presented by Melander in Genera Insectorum.

Melander (1927) accepted Engel's arrangement with the important exception that Wiedemannia was restored to generic rank. The subgenera of Clinocera recognized by Melander in Genera Insectorum were: Bergenstammia, Clinocera, Hydrodromia, Kowarzia and Phaeobalia.

The most recent changes in the genus were made by Frey (1949) who erected two subgenera, Archiclinocera and Hypoclinocera, based on material collected in the Azores.

Melander's arrangement of subgenera is followed here.

A summary of the characters of the genus follows.

Head capsule wider than high, the frontoclypeal region not protuberant; with the genae narrow and separated from the frontoclypeal region by a more or less distinct suture. Antennae porrect, three segmented with the flagellum pyriform and bearing a long, relatively thick arista. Proboscis short and thick and may be partially hidden by the visor-like labrum.

Thorax elongate and only slightly convex; dorsocentral setae present but acrostichal setae lacking.

Wings cuneiform, no anal angle; with the costal vein continuing around the entire margin; with the apical portion of vein R_4 present and

its base present or absent; with the first cubital vein strongly recurrent in the direction of the anal margin of the wing.

Legs long and slender with the fore coxae about half as long as the fore femora.

Abdomen with male terminalia having the ninth tergite divided into two lateral lobes each of which is subdivided into an anterior and posterior lobe and with each of the anterior lobes bearing a well developed surstylus: aedeagus elongate tubular, hinged to the posterior margin of the ninth sternite.

The genus Clinocera is most closely related to Wiedemannia. However, in Wiedemannia the genae are not separated from the frontoclypeal region by a suture and the frontoclypeal region is protuberant. Furthermore, all of the North American species of Wiedemannia have acrostichal setae though they may be poorly developed.

THE SPECIES OF THE GENUS CLINOCERA

A total of 54 recognized species are known

at the present time. Their distribution in the six major faunal regions is as follows:

Region	Number of Species
Palaearctic	31
Nearctic	15
Neotropical	3
Oriental	3
Ethiopian	2
Australasian	0

The above list indicates that the genus Clinocera is almost entirely a Holarctic genus. It might however be argued that with more intensive collecting additional species will be reported from other regions, and that the preponderance of Clinocera in the Holarctic subrealm may be more apparent than real. This may indeed be true for the Oriental and Ethiopian regions where our knowledge of the empid fauna is very poor. Our knowledge of the empid fauna of the Neotropical region is not much better but at least we do have Collin's study (1933) of the Empididae of Patagonia and southern Chile. Al-

though much of the collecting that provided the specimens for the above study was done in areas where one might expect to take Clinocera, only two species were taken. It is possible that the time of year at which the collecting was done (November and December) should be taken into account before coming to any conclusions regarding the numbers of species of Clinocera in that area. No Clinocera have been reported from Australia or New Zealand and it is evident from the papers of Miller (1923), Collin (1929) and Hardy (1930) that the whole subfamily Clinoceratinae is very poorly represented in the Australasian region.

Workers on North American species of Clinocera have depended much on coloration of the body and wings for separating the species. Such characters are helpful but are certainly only secondary to characters based on morphological differences.

Variations in color among the species of this genus are sometimes so slight that it is

almost impossible to express in words the degrees of difference.

Furthermore the color of older specimens tends to fade, rendering identification even more difficult. Specimens which are allowed to become wet may acquire an abnormally dark gray color, thereby obscuring the normal coloration.

Wing markings and wing venation aid in separating the species into groups but cannot be used for accurate species determinations.

Chaetotaxy of the various species of Clinocera is remarkably similar and offers very little aid in their recognition.

An examination of available material has shown however, that the male terminalia offer excellent characters for distinguishing the species. This is particularly true of the surstyli which vary considerably in shape. There is also some variation in the shape of the posterior lobes of the ninth tergite and ninth sternite. The aedeagi of the various species differ in the shape and length of the filamentous portion, the

degree of development of the lateral keels, the nature of the membranous cape and in variations in the lateral outline of the tubular portion.

Large series of specimens were not available for this study so that some caution should be expressed regarding male terminalia as the final criterion for species differentiations in this group. Although large series of specimens, particularly from adjacent areas, might possibly reveal that there are intergradations between the different forms, those discussed here must be regarded as species until such time as intermediates may be demonstrated.

The workers on the North American species of Clinocera have paid scant attention to the terminalia in their written descriptions and they have illustrated none. Therefore the descriptions and drawings of the male terminalia included here add, I believe, important information to those original diagnoses.

Melander (1927) recognized sixteen species of

North American Clinocera. Of this number I regard one (taos Melander) as a synonym and another (dolicheretma Melander) as belonging to the genus Wiedemannia. One new species is described in this paper so that the total number now stands at fifteen.

The male terminalia of eight of them are described and figured herein.

The original descriptions of the species of North American Clinocera are included because they present adequate accounts of the coloration and general appearance of these flies. I have included additional notes of my own in some instances to point out certain important characters which the original author appears to have overlooked.

The following abbreviations are employed to designate collections in which the specimens used in this study are now located:

- AMNH American Museum of Natural History,
New York.
- C Cornell University, Ithaca, N.Y.
- CA California Academy of Sciences,
San Francisco, Calif.

- MCZ Museum of Comparative Zoology,
Cambridge, Mass.
- THF the author's collection
- UM University of Massachusetts,
Amherst, Mass.
- USNM U.S. National Museum, Washington,
D. C.

Clinocera (Hydrodromia) conjuncta Loew

(Figs. 42, 43)

1860. Loew, Clinocera conjuncta n. sp. male,
Wien. Ent. Monatschr. 4: 80 (original
description, no figs.).
1902. Melander, C. conjuncta, Trans. Amer. Ent.
Soc. 28: 242, 346 (partial translation of
original description, note, no figs.).
1902. Ibid. pp. 242-243, C. taos, New Synonymy.
1918. Engel, Atalanta (?Phaeobalia) conjuncta,
Deutsche Ent. Zeitschr. 1918: 48 (partial
translation of original description, Mel-
ander's note, no figs.).
1927. Melander, C. (Hydrodromia) conjuncta and
C. (H.) taos, Genera Insectorum, p. 326
(key, no figs.).

"Olivaceous, thorax with two black vittae,
pleurae and coxae shining white, legs entirely
black, wings fusco-maculate, second longitudinal
vein connected with the anterior branch of the

third by a cross-vein. Body length 2.7 mm., wing length 3.2 mm.

"Frons olivaceous, face shining white; genae scarcely prolonged ventrally; palpi black. Upper thorax olivaceous, marked with two well defined black lines, between which is a narrow cinereous vitta. Scutellum darker, bearing two apical setulae. Upper pleurae mostly olivaceous, lower pleurae shading to a blue-gray with a white pollinosity. Abdomen olivaceous black. Anal valves large, aedeagal filament recurved. Coxae with a black ground color and a white sheen, with a few pale hairs and with yellow hairs crowded at the apex. Tarsi black, no apical setae on the femora. Halteres dirty yellow, pedicel rather dark. Wings cinereous, fusco-maculate; first spot very faint, located between the second and third longitudinal veins and basad of the cross-vein connecting them; the second spot ascends from the third longitudinal vein to the fusco-cinereous stigma; the third encloses the basal part of the anterior branch of the third

longitudinal vein and the cross-vein by which it is connected to the second longitudinal vein; the fourth is found on the veins that close the small discal cell very obliquely apically; and finally, the fifth spot can be seen at the apical end of the fourth vein. Anterior wing margin completely without setulae. Washington (Osten-Sacken)" (Translated from Loew, 1860.)

Male terminalia: Surstyli subrectangular in lateral view with anterior margins nearly straight and anteroapices produced nipple-like, with posteroapical margins broadly rounded and posterior margin slightly sinuate; with setae of apicomesal surface peg-like, bluntly pointed.

Ninth tergite with anterior lobes broadly rounded dorsally and posterior lobes subspatulate in lateral outline.

Ninth sternite subtriangular in lateral outline.

Aedeagus with tubular portion slightly sinuate in lateral outline and with anteroapical margin not projecting. Lateral keels not present.

Filamentous portion narrow, tapering, nearly circular in cross-section.

This species is near longifurca as discussed under that species.

Specimens examined:

Type: Lectotype, male, here designated, Washington, D. C. (Osten-Sacken).

Alaska: Palmer, Aug. 1, 1948, male (Sailer and Ridenour) (USNM).

Colorado: Tennessee Pass, alt. 10,240 ft., July, male (J. M. Aldrich) (USNM).

Labrador: Great Caribou Island, July 27, 1906, male (Allen); Nain, Aug. 18, 1908, 4 females (Bryant) (MCZ).

Montana: Glacier National Park, Logan Pass, alt. 6,000 ft., July 27, 1947, male (C. P. Alexander) (UM).

New Hampshire: Mt. Washington, Tuckerman's Ravine, Sept. 2, 1940, male (J. F. Hanson) (UM); Ammonoosuc Ravine, Aug. 2, 1944, 2 males (J. F. Hanson) (THF).

New York: male, 2 females (Osten-Sacken) (MCZ).

Pennsylvania: male, 2 females (Osten-Sacken) (MCZ).

New synonymy: Clinocera taos Melander is here considered a synonym of C. conjuncta Loew for reasons which are presented below.

Separation of the two species in Melander's

key (1927) is based on the following characteristics: mesonotum bivittate in conjuncta and with a single median white line in taos; stigma faint in conjuncta and distinct in taos. An examination of the holotype of taos (the species was described from a single female) shows it to have the mesonotum bivittate with a median cinereous line between the vittae. This pattern is identical with that found on the mesonotum of conjuncta. Furthermore, the stigma is not very distinct in the holotype although it may have faded with age. The wing markings are practically identical with those of the type of C. conjuncta.

The two supposed species occur very close together in nature. Certain specimens of conjuncta used in this study (see "Specimens examined") were collected within a few miles of Franconia, New Hampshire, the type locality for taos. This, together with the fact that the species cannot be separated on the basis of present knowledge, provides good reason for synonymising taos.

In addition, it should be stated that there are relatively few species in the genus Clinocera and there are to my knowledge no "clusters" of species with identical color patterns.

Clinocera (Clinocera) lineata Loew

(Fig. 44)

1862. Loew, Clinocera lineata n. sp., female, Berl. Ent. Zeitschr. 1862: 207 (original description, no figs.).
1902. Melander, C. lineata, Trans. Amer. Ent. Soc. 28: 244 (partial translation of original description, additional descriptive notes, key, 2 figs.).
1918. Engel, Atalanta (Atalanta) lineata. Deutsche Ent. Zeitschr. 1918: 34 (complete translation of original description, no figs.).
1927. Melander, C. (C.) lineata, Genera Insectorum, p. 236 (key).

"Olivaceous black, ground color of thorax black, tarsi yellow, wings fusco-cinereous, a cross-vein located between the costa and second longitudinal vein. Body length 2.0 mm., wing length 2.8 mm.

"Olivaceous black, subopaque. Antennae black, genae moderate, face white pollinose; palpi black.

Two shining vittae on the dorsum of the thorax separated by a dark line and each vitta margined outwardly by a dark line. Scutellum of the same color as the thorax; lower half of the pleura covered with a white pollen. Abdomen somewhat shining. Legs slender, nearly bare, the greater part of the coxae, knees, apices of tibia and the last tarsal segments always fuscous; femoral setulae lacking near the apex; pulvilli small equaling the empodium in size; claws small. Halteres dark brown, costal setulae lacking, a cross-vein extending from the second longitudinal vein to the wing margin; third longitudinal vein undulating, anterior branch very little decumbent as compared to other species; a light spot at the extreme apex of the discal cell. Pennsylvania, (Osten-Sacken).

"Note: Between Clinocera and Ardoptera, but the shape of the head and conformation of the mouthparts show it to be closer to Clinocera."
(Translated from Loew, 1862).

To Loew's original description, Melander, 1902, added the following descriptive note: "The

postocular bristles are regularly arranged in an interrupted row of about fifteen in number, and are not supplanted by pale cilia beneath. The two outer vittae of the thorax bear the dorsal bristles. The cross-vein in the marginal cell is wanting in the western specimens, but its place is indicated by a sharp upward bend of the second vein; but a trace of the anal vein is left."

Male terminalia: Surstyli fusiform, about $4\frac{1}{2}$ times as long as their greatest width; with setae of the apicomesal surface very short, thorn-like. Ninth tergite with anterior lobes broadly and evenly rounded dorsally and posterior lobes semicircular in lateral outline with their apical or anterior ends beak-like in outline.

Ninth sternite subtriangular in lateral outline.

Aedeagus slightly sinuate at the base in lateral outline and anteroapical margin curving anteriorly. Lateral keels very prominent apically and extending basad less than a fourth of

the length of the tubular portion. Filamentous portion whip-like, longer than the tubular portion, nearly circular in cross-section and with its base projecting posteriorly at nearly a right angle to the longitudinal axis of the tubular portion. The membranous cape is stretched tautly in the angle between the posteroapical surface of the tubular portion and the base of the filamentous portion.

The specimen upon which this description and accompanying figure are based was compared with the female type and found to resemble it very closely. The shining mesonotal vittae are unique among described North American Clinocera and their presence on the above described male is the basis of the present correlation with the type.

There are apparently no species closely related to lineata in North America. In a key based on color and venation, lineata comes closest to fuscipennis. It is easily distinguished from the latter by the shining mesonotal vittae and by differences in the male terminalia. The surstyli of fuscipennis are broadened apically and the

posterior lobes of the ninth tergite are elongate structures, not semicircular. Furthermore in fuscipennis, the lateral keels are not pronounced and the tubular portion tapers basally.

Specimens examined:

Type: Lectotype, female, here designated. Pennsylvania (Osten-Sacken) (MCZ).

Manitoba: Aweme, Nov. 12, 1924, male (E. Cridle) (THF).

New York: Ithaca, Apr. 5, 1902, Oct. 25, 1944, 2 females (C).

Oregon: Mt. Hood, Homestead Inn, July 12, 1932, female (J. M. Aldrich) (USNM).

Pennsylvania: No locality, 2 females, 1 male (Osten-Sacken) (MCZ).

Clinocera (Clinocera) fuscipennis Loew

(Fig. 45)

1876. Loew, Clinocera fuscipennis n. sp. female, Zeitschr. Ges. Naturw. 48: 324 (original description, no figs.).
1902. Melander, C. fuscipennis, Trans. Amer. Ent. Soc. 28: 245 (partial translation of original description, key, no figs.).
1918. Engel, Atalanta (Atalanta) fuscipennis, Deutsche Ent. Zeitschr. 1918: 33 (partial translation of original description, no figs.).
1927. Melander, C. (C.) fuscipennis, Genera Insectorum, p. 326 (key, no figs.).

"Ficeous, front and face concolorous, dorsum of the thorax not vittate, legs fuscous, wings wholly, uniformly subfuscous, stigma scarcely darker, costa free from setulae, second submarginal cell narrower than the end of the first, last section of the fourth vein exceeding by a little the length of the discal cell. Body length 2.5 mm., wing length 3.6 mm.

"Brownish black in color. The entire head, including the antennae and mouthparts black, the frons with a grayish pollinose spot; posterior head region and genae with a grayish white pollinosity, the latter very narrow, broadened behind only. The lusterless thoracic notum is covered laterally with a whitish pollen and the specimen under consideration does not have the usual vittae; when examined in a very oblique position, it has a very gray appearance. Thoracic pleura and venter slate gray with a whitish pollinosity, while the brownish, black dorsum of the abdomen appears somewhat gray only when it is viewed in a very oblique position. Legs slender, the hind

tarsi somewhat longer than their tibiae; the anterior coxae brownish black, posterior coxae dark brown; femora red-brown; narrowing toward the apex, very bare, the apex without the hair-like setae present in many other species; tibiae and tarsi dark brown. All of the legs show, according to the lighting and the manner of observation a lighter or darker color. Wings of a brownish color throughout, the anterior margin without a trace of setulae. Stigma scarcely darker than the rest of the wing and therefore easily overlooked. The anterior branch of the third longitudinal vein arises at a fairly wide angle but is strongly bent not far from its point of origin and in its outer course lies considerably nearer to the third longitudinal vein than to the second; discal cell somewhat shorter than the last section of the fourth longitudinal vein and at its end occurs the anterior section of the posterior cross-vein; a considerable portion of the sixth longitudinal vein projects beyond the end of the anal cell. New Hampshire (Osten-Sacken)".

(Translated from Loew, 1876).

In addition to the above, it should be stated that the base of vein R_4 is lacking in the type and in the other specimens of this species which I have examined.

Male terminalia: Surstyli subrectangular, nearly $2\frac{1}{2}$ times longer than the greatest width; with the anterior margin nearly straight, anteroapical margin obtusely angulate, posteroapical margin broadly rounded and the posterior margin broadly and shallowly emarginate; with setae of the apicomesal surface peg-like, their apices rounded. Ninth tergite with dorsal margin of anterior lobes broadly rounded and posterior lobes subspatulate in lateral outline.

Ninth sternite subtriangular in lateral outline.

Aedeagus with tubular portion curving posteriorly, with the anteroapical surface curving slightly posteriorly and the lateral keels not pronounced but extending basad about half the length of the tubular portion. Filamentous portion longer than the tubular portion and nearly

circular in cross-section.

The specimen upon which this description and figure are based was compared with the female type and found to resemble it very closely in details of color, venation and setation. The combination of unspotted wings, absence of the base of vein R_4 and lack of mesonotal vittae was used as the basis in correlating males and females of this species.

On the basis of the genitalia fuscipennis seems to be most closely related to lecta. This is most evident in the shape of the aedeagus and the posterior lobes of the ninth tergite. Differences occur however in the surstyli where in lecta the anteroapical margins are produced into nipple-like projections while those of fuscipennis are bluntly angulate. The posteroapical margins of the surstyli are much more broadly rounded in fuscipennis than in lecta.

Since the wings of fuscipennis are unspotted and those of lecta are spotted no difficulty should be experienced in separating these two species.

Specimens examined:

Type: Lectotype, female, here designated, New Hampshire (Osten-Sacken) (MCZ).

New York: Mt. Marcy, Opalescent Trail, alt. 3,500 ft., July 6, 1938 (C. P. Alexander) (THF).

Quebec: Mt. Orford, Sept. 9, 1937, male (G. E. Shewell) (THF).

Clinocera (Hydrodromia) genualis Coquillett

(Fig. 46)

1910. Coquillett, Clinocera genualis n. sp. female, Proc. Ent. Soc. Wash. 12: 124-125 (original description, no figs.).
1918. Engel, Atalanta genualis, Deutsche Ent. Zeitschr. 1918: 37 (complete translation of original description, no figs.).
1927. Melander, C. (Hydrodromia) genualis, Genera Insectorum, p. 237 (key, no figs.).

"Female. Near binotata, but the entire face is silvery, the vein at the base of the third posterior cell is curved and very oblique, etc. (sic). Black, only the apices of the femora reddish-yellow. Face separated from the cheeks by a wide notch, arista longer than the antennae proper. Front, mesonotum, and scutellum olive-brown pruinose, mesonotum without acrostichal

bristles, marked with a dorsal pair of black vittae, scutellum bare except for the apical pair of bristles; metanotum, pleura, venter, and sides of abdomen olive-gray pruinose, middle of dorsum of abdomen brownish. Femora devoid of long bristles and hairs. Wings grayish hyaline, a brown cloud on vein at base of second submarginal cell and another at apex of discal cell; only two submarginal cells, anal cells much shorter than the second basal, the sixth vein prolonged far beyond the apex of the anal cell.

"Length, nearly 3 mm.

"Banff, Canada. A single specimen collected by Mr. N. B. Sanson.

"Type: No. 13090, U. S. National Museum."

(Coquillett, 1910)

Male terminalia: Surstyli slightly more than three times as long as wide; with anterior and posterior margins nearly parallel, curving slightly anteriorly; with anteroapices obtusely angulate and posteroapical margins broadly rounded; with setae of apicomeral surface peg-like, their apices

bluntly pointed.

Ninth tergite with anterior lobes having apicodorsal margins rather sharply rounded; with posterior lobes broadened apically drawing their anteroapices angulate and the posteroapical margins broadly rounded.

Ninth sternite subtriangular in lateral outline.

Aedeagus with anterior and posterior margins nearly parallel in lateral outline, not sinuous; with anteroapical margins curving anteriorly, and lateral keels extending basad less than one-third the length of the tubular portion. Filamentous portion shorter than tubular portion, narrow and nearly cylindrical in cross-section.

The specimen upon which this description and accompanying figure are based was compared with the female type by Dr. C. W. Sabrosky and judged by him to be conspecific with the type.

As indicated by Coquillett this species is nearest binotata. A character not emphasized by him, but nevertheless useful in separating the

two species is the presence of the base of R_4 in binotata and its absence in genualis.

C. binotata was described from a single female and no topotypic males or males possessing the color pattern of the female have yet been discovered. Consequently, a comparison of male terminalia of genualis and binotata is not possible at this time.

Specimens examined:

Michigan: Keweenaw Co., Isle Royale, July 9, 1938, male (Steyskal) (USNM).

Clinocera (Hydrodromia) longifurca Melander

(Fig. 47)

1927. Melander, Clinocera (Hydrodromia) longifurca n. sp., male, Genera Insectorum, p. 231, (original description, keys, no figs.).

"Length 3.5 mm. Dark olivaceous brown above, slaty gray below. Front uniformly dark brown, face white pruinose, a narrow crescent-shaped mark beneath the antennae extending to the orbis, vertical bristles moderately coarse; cheeks very small, separated from the face; third joint of the antennae oval, arista rather slender, less than twice as long

as the antennae; palpal hairs inconspicuously black. Thorax with two dark vittae; pectal hairs very short and sparse; all the hairs of the abdomen pale; ventral piece of the epipygium conical, middle valves small dorsal valves long and narrow, shining black. Legs entirely black, hairs of the front of the coxae; front tibiae nearly as long as the femora, front femora with seven fine short black setae and six white hairs, all uniformly distributed, both sides of the hind tibiae with short setae along the outer half, empodium prominent and yellow. Halteres black. Wings rather strongly brown, veins firm and blackish, three submarginal cells, the second narrow and four times as long as its width along the costa, discal cell three times as long as broad, a little shorter than the sessile second posterior cell, its posterior oblique cross-vein strongly curved so that the apex of the discal cell has parallel sides, sections of the fifth vein equal, anal cross-vein recurved, anal vein rather short and faint.

Type from Mount Washington, New Hampshire, Mrs. Annie T. Slosson, collector. Two females from same locality were collected by C. W. Johnson, July 4, 1914. A female in the collection of C. W. Johnson, from Nain, Labrador, has no setae on the femora and the discal cell is a trifle less drawn out at the apex." (Melander, 1927).

Male terminalia: Surstyli approximately three times as long as greatest width, narrowly subtriangular in lateral outline; with setae of apicomeral surface bristle-like. Ninth tergite with anterior lobe as shown in Figure ; with apices of posterior lobes broadened and subtruncate.

Ninth sternite subtriangular in lateral outline.

Aedeagus with tubular portion sinuate in lateral outline and with anteroapical margin curving anteriorly. Lateral keels prominent, extending basad about a third of the length of the tubular portion. Filamentous portion broad, depressed, narrowly oval in cross-section and

shorter than the tubular portion.

Of the species of North American Clinocera which I have examined, longifurca seems to be nearest conjuncta. It differs from conjuncta in that its wings are unspotted. Furthermore, the subtriangular surstyli and decidedly sinuate nature of the aedeagus are very distinct from the subrectangular surstyli and only slightly sinuate aedeagus of conjuncta.

Specimens examined:

Type: Paratopotype male, Mount Washington, New Hampshire (A. T. Slosson) (MCZ).

Alaska: Eagle Summit, June 25, 1948, male, (R. I. Sailer) (USNM).

Labrador: Nain, Aug. 18, 1908, female (Bryant) (MCZ).

New Hampshire: White Mountains, Ammonoosuc Ravine, Aug. 2, 1944, 6 males (J. F. Hanson) (UM, 3) (THF, 3).

Note: The holotype which has not been available for this study is in Dr. Melander's collection.

Clinocera (Hydrodromia) maculata Loew

(Fig. 48)

1860. Loew, Clinocera maculata n. sp. male, Wien. Monatschr. 4: 79-80 (original description, no figs.).
1902. Melander, C. maculata, Trans. Amer. Ent. Soc. 28: 244 (partial translation of original description, no figs.).
1918. Engel, Atalanta (Hydrodromia) maculata, Deutsche Ent. Zeitschr. 1918: 48 (partial translation of original description, no figs.).
1927. Melander, C. (Hydrodromia) maculata, Genera Insectorum, p. 237 (key, no figs.).

"Olivaceous, thorax obsoletely bilineate, pleurae and coxae white-pruinose, venter glaucous; femora and tibiae testaceous, tarsi black. The anterior branch of the third vein is marked with a fuscous spot at its base, ascending to the apex of the second vein, and with another smaller spot at its apex. Halteres black. Body length 3 mm., wing length 3.6 mm.

"Similar to Clinocera fontinalis Hal., but a little larger. Frons dark violaceous, face white, genae moderately descending, palpi black.

Upper thorax olivaceous, marked with two dark, nearly obsolete lines. Scutellum darkly olivaceous, two apical setae. Pleurae and coxae black, with a white sheen. Metanotum cinerous. Abdomen olivaceous, lateral margins blue-gray; ventral surface gray. Femora entirely testaceous, no apical setulae, anteroventral surface armed near base with three, occasionally four setae, brown near the apex. Halteres black. Wings gray, cross-veins brown margined. Anterior branch of the third longitudinal vein with a brown spot at its base which ascends to the apex of the second vein and with a second smaller spot at the apex of the third vein; second longitudinal vein slightly undulating; apex of discal cell moderately oblique. (Washington, Osten-Sacken)" (Translated from Loew, 1860).

Although Loew did not mention it, it is important to note that the base of vein R_4 is lacking in the type and in all other specimens of this species which I have examined.

Male terminalia: Surstyli corniform, about

4½ times as long as their greatest width; with setae of apicomesal surface narrow and sharply pointed.

Ninth tergite with anterior lobes as shown in Figure 48 ; with posterior lobes expanding apically, roughly comma-shaped.

Ninth sternite subtriangular in lateral outline.

Aedeagus with a distinct bulge on the anterior surface of the tubular portion just below its midlength; with anteroapical margin curving anteriorly; with the lateral keels very prominent and extending based about a third of the length of the tubular portion. Filamentous portion oval in cross-section with its base projecting slightly posteriorly from the tubular portion and with the membranous cape stretched between the sides of the obtuse angle thus formed. The tip of the filamentous portion is missing in the specimen which I had available for study so that a comparison of its length to that of the tubular portion is not possible.

Of the North American species of Clinocera,

maculata stands closest to genualis. The group of three to four strong setae at the bases of the anterior femora in maculata is a character not present in genualis. There are also pronounced differences in the male terminalia. The surstyli of maculata taper to a point apically, while those of genualis are nearly the same width throughout. The aedeagi of the two species are also very different in lateral outline.

Specimens examined:

Type: Lectotype, male, here designated, Washington, D. C. (Osten-Sacken) (MCZ).

Michigan: Montmorency Co., Feb. 15, 1941, female (J. W. Leonard) (USNM).

New York: Inlet Brook, Sept. 13, 1924, female (C).

North Carolina: Bald Knob, Mitchell Range, alt. 5,200 ft., June 6, 1939, male (C. P. Alexander) (UM).

Pennsylvania: No locality, 1 male, 2 females (Osten-Sacken) (MCZ).

No locality: 4 males, 7 females (Osten-Sacken) (MCZ).

Clinocera (Hydrodromia) paradispilota new species

(Fig. 49)

MALE: Possessing the general morphological characteristics of the genus.

Body length 3.5 mm., wing length 4.0 mm.

Head: Lower half of the frontoclypeus with a white pollinosity; upper half of frontoclypeus and vertex olive-brown; posterior head region gray. Palpi and visible portion of mouthparts dark brown.

Thorax: Tergal portion olive-brown; mesonotum marked with a median pair of black vittae which extend longitudinally halfway to the scutellum. Pleurae covered with a grayish-white pollinosity.

Wings: Gray hyaline; veins brown; stigma indistinct; base of R_4 , the supernumerary cross-vein and the veins closing the discal cell broadly margined with brown. Base of R_4 present, apical third of first anal vein distinct.

Legs: Coxae with grayish-white pollinose condition, rest of leg segments brown. Three to

four long hair-like setae (much longer than the other setae of the legs) located on the ventral surface at the base of the femur.

Abdomen: Tergites olive-brown; sternites with a grayish-white pollinosity.

Terminalia: Surstyli subrectangular, less than twice as long as wide at the greatest width, their bases partially hidden by the anterior lobe of the ninth tergite; with their anteroapices produced into nipple-like protuberances and their posteroapical margins broadly rounded; with setae of the apicomesal surface bluntly pointed.

Ninth tergite with dorsal margin of anterior lobes rather sharply rounded and with the posterior lobes resembling ducks' heads in lateral outline.

Ninth sternite subtriangular in lateral outline.

Aedeagus not sinuous, with tubular portion enlarged in its basal half; with anteroapical margin directed anteriorly and lateral keels extending basad about a third of the length of the

tubular portion. Filamentous portion shorter than the tubular portion, broad, depressed and narrowly oval in cross-section.

FEMALE: Three specimens collected with the male and having the same color pattern, venation and setation I take to be conspecific with the male herein described.

Observations: Judging by the color similarities this species is very close to binotata and additional collecting may prove the two species to be conspecific. However because of the great geographical difference between the type localities, it is also very likely that they are distinct species. Less taxonomic confusion is likely to result by treating them as distinct species until males and females of one or the other species are definitely correlated.

Collection data: Holotype male, Mt. Diablo, C. Costa Co., Cal., April 18, 1948. Allotype female. Paratopotypes, 3 females (W. W. Wirth) (USNM).

Clinocera (Phaeobalia) lecta Melander

(Fig. 50)

1902. Melander, Clinocera (Phaeobalia) lecta
n. sp., male, Trans. Amer. Ent. Soc.
28: 243 (original description, no figs.).
1918. Engel, Atelante (Phaeobalia) lecta.
Deutsche Ent. Zeitschr. 1918: 63 (complete
translation of original description, no
figs.).
1927. Melander, C. (P.) lecta, Genera Insectorum,
p. 231 (key, no figs.).

"Length 3 mm. Black, coated above with dull dark brown pollen becoming cinereous on the face, lower occiput, pectus, pleurae, coxae, lateral spot of the mesonotum, metanotum, abdomen, knob of the halteres, and the under side of the front femora. Antennae short, black, the first two joints minute, arista subequal to the antenna. Eyes large, separating the naked face from the cheeks. Proboscis and palpi black. Occipital bristles short, arranged in a semi-circular marginal row. Mesonotum with two opaque black vittae, nowhere shining, no achrosticals, the dorsicentrals without intermediate bristles; scutellum with only two long hairs. Hypopygium recurved,

the lower portion produced as a strong heel.

Legs slender, black front femora of the male with minute bristles beneath, and with a small apical fringe of minute hairs on the front side; empodium longer than the claws or pulvilli.

Wings hyaline, with three faint spots, the first round, centering about the anterior cross-vein, the second elliptical, passing through the posterior cross-vein and extending from the marginal to the fourth posterior cells, the third spot circular, centering about the base of the second submarginal cell; stigma well-developed, elongate, elliptical; the centers of the cells purer hyaline than the margins; base of the second submarginal abrupt, and with a short adventitious spur extending into the first submarginal in the males; second posterior cell broad at the base; discal cell moderately broad and rather long, the first section of its anterior border one-fourth the length of the second section and equal to the externo-anterior edge of the second basal cell; anal and second basal cells closed together, their

outward boundary oblique, anal vein imperfect; costal setuale inconspicuous, very minute. Halteres black.

"Two males and one female; Kendrick and Lewiston, Idaho (Prof. J. M. Aldrich).

"This species belongs to Phaeobalia Mik." (Melander, 1902).

Male terminalia: Surstyli subrectangular in lateral outline, about three times as long as their greatest width, with the posterior margin broadly emarginate and with the anteroapices produced into short nipple-like projections; with peg-like setae of the apicomesal surfaces sharply pointed and interspersed with bristle-like setae.

Ninth tergite with anterior lobes broadly rounded dorsally with posterior lobes broadened apically, their anteroapices angulate and posteroapices broadly rounded.

Ninth sternite subpyriform in lateral outline, i.e. anteroapical margin strongly convex.

Aedeagus with tubular portion curving posteriorly and tapering basally, with antero-apical margin curving slightly posteriorly and lateral keels narrow but extending basad about two-thirds the length of the tubular portion. Filamentous portion narrow, tapering, longer than the tubular portion and nearly circular in cross-section.

The relationship of lecta and fuscipennis has already been commented on in the discussion of the latter.

Specimens examined:

Type: Lectotype, male, here designated, Kendrick, Idaho (J. M. Aldrich) (AMNH).

Colorado: Gothic, July 29, 1934, alt. 9,500 ft.
2 males (C. P. Alexander (1, UM) (1, THF)).

Idaho: Lewiston, male, (J. M. Aldrich) (AMNH).

Except for C. binotata, I have not seen specimens of the following species.

Clinocera (Bergenstammia) brunnipennis Melander

1927. Melander, Clinocera (Bergenstammia) brunnipennis n. sp. male, Genera Insectorum, p. 232 (original description, key, no figs.).

"Length 5 mm. Front, vertex and upper occiput dark brown, ocellar tubercle flanked by a weak cinereous spot, face entirely white, rather narrow, not carinate or tuberculate, the lower edge nearly transverse, distinctly separated from the cheeks which measure about one-eighth the eye height; upper occiput with bristles and setulae, sides with silky yellow hairs, proboscis rather large; third joint of the antennae oval, shorter than deep, without an end-process, the arista more than twice as long as the antenna, slender and tapering. Thorax not vittate, dull brown above, including the metanotum, bristles rather weak, five or six dorsocentrals, no setulae, only one notopleural; pectus nearly bare. Sides of the abdominal segments marked with cinereous, centrally brown,

epipygium small, ventral piece and base of the penis thickened, black, middle valve small, shining apically, dorsal valve narrow, corneous, shining black, incurved apically, the inner surface rugose. Legs black, hairs of the front coxae short and pale, front femora of the male with a row of flexor setulae on the basal half and distally with an irregular group of thorn-like setae, front tibiae nearly as long as the femora, denticulate within, posterior femora with loose irregular short but strong setae, middle tibiae with scattered setulae, hind tibiae with a preapical pair of bristles, pulvilli wanting, empodium of the front legs one-half as long as the claws and brown, of the posterior legs microscopic, claws black. Wings short and narrow with a brown tinge, stigma weak, brown, but distinct, basal bristle short, costal setulae small, first vein ending at the middle, two submarginal cells, the second small, discal cell blunt, long and narrow, longer than the sessile second posterior cell, sections of the fifth vein 2:1, anal cell with curved apex,

anal vein very faint but nearly reaching the margin.

"Five specimens; Palo Alto, California, August, received from Professor Doane." (Melander, 1927).

The types are in Dr. Melander's private collection.

Clinocera (Clinocera) prasinata Melander

1927. Melander, Clinocera (Clinocera) prasinata n. sp. male, Genera Insectorum, p. 232-233 (original description, key, no figs.)

"Length 4 mm. Olivaceous green, changeable in color from cinereous along the flanks to brownish dorsally. Face silvery white, front brownish, more gray when viewed from behind, no vertical bristles, the occipital setae sparse; cheeks narrow, with complete suture, palpi large, clavate, with sparse short black hairs; third joint of the antennae ovate, shorter than broad, without an end-process, the arista thick and scarcely longer than the antenna. Viewed from in front the mesonotum is bilineate, the middle stripe not

cinereous, five dorsocentrals, no setulae, metonotum and pleurae cinereous, metapleural hairs dense and yellow, pectus and front coxae with sparse yellow hairs. Abdomen greenish cinereous; epipygium large, the lower piece large, conical and projecting, penis black, slender from its base, its middle third hidden, the apical deflected part thin, middle lamella broadly oval, erect, rather hairy, the upper pieces broad but short, shining black. Legs black, more or less cinereous basally, front femora with regular biseriate short flexor bristles, front tibiae as long as their femora, with close uniform short flexor and extensor setular, posterior femora without bristles, hind tibiae with about ten extensor setulae on the outer half, pulvilli and empodium moderately large. Calypteres blackish, with a pale fringe; halteres black. Wings with a slight infumation, veins strong and blackish, costal setulae small, stigma very weak, two submarginal cells, third and fourth sections of the costa subequal, discal cell shorter than the

sessile second posterior cell, sections of the fifth vein equal, anal vein a weak fold nearly reaching the margin.

"One specimen, received from Dr. J. M. Aldrich, who collected it at Mono Lake, Calif., July 23, 1911." (Melander, 1927).

The type is in Dr. Melander's private collection.

Clinocera (Clinocera) olivacea Melander

1927. Melander, Clinocera (Clinocera) olivacea n. sp. female, Genera Insectorum, p. 233 (original description, key, no figs.).

"Length 3.5 mm. Olivaceous brown, abdomen, pleurae and base of the legs cinereous-white, face and cheeks cinereous, separated by a suture, vertex brown, with strong ocellar, vertical and occipital bristles, third joint of antennae triangularly oval, as long as broad, without a process, the arista thick and slightly longer than the antenna; palpi with short brownish hair. Five dorsocentral bristles, no setulae, metapleural hairs pale yellow. Prosternum and coxae with

conspicuous golden hair, under side of the front femora with two series of about nine short setae disposed along its length, front tibiae nearly as long as their femora, outwardly with short uniform setae, posterior femora bristleless, hind tibiae with about eleven extensor setae on the apical three-fifths, pulvilli and empodium moderate. Wings hyaline, veins weak, no stigma, costal setulae small, two submarginal cells, the second to the fifth costal sections proportioned 4:1:1.4:1.2, discal cell rather broad, a little shorter than the sessile second posterior cell, sections of the fifth vein proportioned 1:1.2, anal vein reflexed more than usual, the anal vein rather strong continuing as a fold almost to the margin.

"One specimen, Muir Inlet, Alaska, Trevor Kincaid, collector." (Melander, 1927).

The type is in Dr. Melander's private collection.

Clinocera (Clinocera) trunca Melander

1927. Melander, Clinocera (Clinocera) trunca
n. sp. female, Genera Insectorum, p. 230
(original description, key, no figs.).

"Length 3.5 mm. Black, coated above with greenish and on the sides and below with slate-colored pollen; legs black; wings brownish, veins strong. Occiput and vertex greenish, upper part of the face concave, dusky, lower part convex, white, separated from the very short dusky cheeks; eyes large; occipital bristles not numerous; palpi small, black, proboscis very short; antennae black, the third joint short, arista longer than the antennae. Mesonotum completely greenish pollinose, with faint indications of two dark vittae, no acrostichals, six uniform dorsocentrals, scutellum with two apical bristles; metapleurae with a few fine white hairs; metanotum slaty blue. Legs entirely black, front femora with a few inconspicuous setulae beneath; claws, pulvilli and empodium uniformly small. Wings unspotted but lightly infumated, the centers of the cells a little paler, veins strong, nearly black, costal setulae very minute, two submarginal cells, the second somewhat broader at the end than the first, the anterior branch of the third vein imperfect

at its origin in the type specimen, gently and evenly sinuous, first and second posterior cells nearly alike at their base, the last section of the fourth vein but slightly longer than the front edge of the discal cell, anterior crossvein placed at two-fifths the length of the discal cell, the externo-anterior edge of the second basal cell two-thirds the length of the first section of the front border of the discal, posterior crossvein elbowed at its posterior third, making nearly a right angle with the fifth vein, last two sections of the fifth vein equal, anal crossvein round, separately closing the anal cell, anal vein replaced by a fold; halteres black.

"Type specimen collected by Professor J. M. Aldrich at Dewatto, Washington, June 7, 1906. Four paratypes from Olga and Friday Harbor, Washington, May and June, differ in having three submarginal cells. However, in two of these specimens there are three submarginals in one wing and two in the other. A poorly preserved

specimen in the National Museum, from Ungava Bay, Hudson Strait, having three submarginal cells, differs in that the legs are brownish instead of fully black.

"This species agrees fairly well with Walker's brief description of longipes, except for the decidedly brown and not gray color of the wings and the lack of gray pollinosity of the legs. Osten-Sacken suggested that Walker's species is the same as Loew's simplex, but the latter has the mesonotum evittate." (Melander, 1927).

The types of this species are in Dr. Melander's private collection.

Clinocera (Hydrodromia) binotata Loew

1876. Loew, Clinocera binotata n. sp. female, Zeitschr. Ges. Naturw. 48: 325 (original description, no figs.).
1902. Melander, C. binotata, Trans. Amer. Ent. Soc. 28: 243 (partial translation of original description, key, no figs.).
1918. Engel, Atalante (Hydrodromia) binotata, Deutsche Ent. Zeitschr. 1918: 46 (partial reprinting of original description, no figs.).

"Olivaceous, front and upper half of face black, lower half of face white-pollinose, dorsum of thorax with two narrow black vittae, abbreviated behind; legs black, apex of all the femora rufescent, anterior femora thicker towards the base, and bearing a few longer hairs below; wings subcinereous, the anterior branch of the third longitudinal vein lined with black near its base, also the adventitious vein by which it is connected with the second longitudinal, and the posterior cross-vein bordered with black.

"Dull olive brown in color. Frons brownish black. Face fairly flat, in profile projecting slightly beyond the eyes and the lower edge strongly arched, broadened behind the eyes only, the upper half covered with a thick snow-white pollinosity. Genae extremely narrow, somewhat broadened posteriorly. The palpi and proboscis, short, black. Thoracic dorsum dull olive brown, with two narrow, closely approximated dark black, longitudinal vittae which barely reach the posterior

third of the thoracic notum. The notum of the thorax, external to these vittae exhibits a striking green color which continues over its posterior third; besides the two black lines noted, there is a suggestion of two dark lateral lines of equal narrowness just in front of the scuto-scutellar suture. The olive brown scutellum bears two setae. Pleurae and coxae covered with a thick grayish white pollinosity. Legs black, their apices with a broad, dull red-colored band, which is not clearly perceptible in all specimens examined; the anterior femora somewhat broadened proximally and bearing on the ventral surface at the base about four long hairs which are scarcely long enough to be called bristles. The hair-like setae present at the apices of the femora in many species of Clinocera are not present. The hind tarsi are somewhat shorter than their tibiae. Wings hyaline with a decided gray tinge and with black veins; the anterior branch of the third longitudinal is connected by a vertical cross-

vein to the second longitudinal vein. The cross-vein and the basal section of these two longitudinal veins have rather broad, black borders. The discal cell is short and almost evenly truncate apically, here also the posterior section of the cross-vein is black-bordered and nearly vertical in position; the sixth longitudinal vein projects considerably beyond the anal cell. (New York, Osten-Sacken)." (Translated from Loew, 1876).

Specimens examined:

Lectotype, female, New York (Osten-Sacken).

Clinocera (Hydrodromia) undulata Melander

1927. Melander, Clinocera (Hydrodromia) undulata
n. sp. male, Genera Insectorum, p. 230
(original description, key, no figs.).

"Length 3 mm. Olivaceous above, cinereous below, thorax narrowly bilineate with brown and centrally in front with a conspicuous cinereous vitta. Lower half of the face white, upper part blackish, front olivaceous brown, the vertical bristles strong, cheeks completely separated from

the face, narrow, palpi elliptical with short sparse black hairs. Five strong dorsocentral bristles, no setulae, metapleural hairs fine, dense and yellow, pectus nearly bare. Coxal hairs sparse and yellow, legs black, front tibiae as long as their femora, front femora with two sparse rows of about eight regularly placed, short setae, hind tibiae with about eight extensor setae on the apical half, pulvilli and empodium normally strong and whitish. Halteres black, calypteres dark and with a pale yellow fringe. Wings almost hyaline but with broad darker spaces about the cross-veins, stigma elliptical, costal setulae small, veins thin but strong, undulating, three submarginal cells, the third twice as long as its costal margin, discal cell longer than the broadly sessile second posterior cell, its outer third with parallel sides, sections of the fifth vein equal, anal cross-vein recurved, anal vein a weak fold.

"Type, Moscow Mountain, Idaho, July 6, 1912;

paratype, same locality, Sept. 16, 1917 (Melander).

"A female from Mount Rainier, Washington, August 3, 1905, submitted by Professor Aldrich, differs in that the front femora lack the flexor bristling, and the darkening of the wings is more extended, the wings being somewhat infumated but with subhyaline spaces near the centers of the short cells and near the base and apex of the longer cells." (Melander, 1927).

The types are in Dr. Melander's private collection.

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ABBREVIATIONS

- A - anal vein
ab - anterior basalare
ac - anteclypeus
ae - aedeagus
aec - anepisternal cleft
aem - anepimeron
ees - anepisternum
af - antennal fossa
al - anterior lobe of 9th tergite
alc - anterior lateral cervical sclerite
alu - alula
ant - antenna
anw - anterior notal wing process
apn - anterior pronotum
ase - acrostichal setae
axe - axillary excision
br - metathoracic bridge
bs - basisternum
C - Costa
ca - cupola
cal - calypter
ce - cerci

cf - coxifer
cor - axillary cord
cp - capitellum
Cu - Cubitus
cx - Coxa
dc - dorsal cervical sclerite
dis - discal labellar sclerite
dse - dorsocentral setae
ej - ejaculatory apodeme
em - epimeron
emp - empodium
ems - epimeral suture
ep - epipharynx
es - episternum
eye - compound eye
f - flagellum of antenna
fc - food channel
fel - frontoclypeus
fe - femur
ff - false floor of fulcrum
fi - filamentous portion of aedeagus
fs - furcasternum
fu - fulcrum
g - gales

ge - gena
gl - glossae
hp - hypopharynx
hs - humeral setae
hu - humeral plate
in - axillary incision
ise - intra-alar setae
kem - katopimeron
kes - katepisternum
li - labium
lr - labrum
lrd - lateral labellar rod
ls - labellar sclerite
M - Media
m - median plate
mc - membranous cape
me - mentum
mos - median ocellar setae
mp - maxillary palpi
ms - metanotal setae
msg - median sternal groove
mtn - metanotum
mx - maxilla
o - ocellus
oc - occiput

occ - occipital condyle
ocs - occipital setae
op - oval plate
os - ocular sclerite
ot - ocellar tubercle
p - pedicel of antenna
pas - parascutellum
pat - paratergite
pb - posterior basalare
pge - postgena
pgs - postgenal setae
phb - phallobase
phs - post humeral setae
pl - posterior lobe of 9th tergite
plc - posterior lateral cervical sclerite
pls - posterior labellar sclerites
pme - prementum
pno - postnotum
pnw - posterior notal wing process
poc - postocciput
por - post orbital setae
pos - post ocellar setae
pp - posterior plate of prementum
ppn - post pronotum

pa - pleural suture
psd - pseudotracheal branches
pst - presternum
ptn - pleurotrochantin
pv - pulvilli
R - Radius
ri - ribbon
Rs - radial sector
s - scape of antenna
sa - subalare
sas - supraalar setae
sb - salivary bulb
Sc - Subcosta
scl - scutellum
scp - scapal plates
set - scutum
sev - subcranial cavity
sd - salivary duct
se - sensory area
sh - scape of haltere
sm - scabellum of haltere
sn - abdominal sternites
sp - spiracle
spg - sense peg

spl - sternopleurite
sse - scutellar setae
st - stipites
Su - Supernumerary crossvein
sty - antennal stylus
t - abdominal tergite
ta - tarsus
te - prestomal teeth
tet - teenidial thickenings
tg - tegula
ti - tibia
tn - tentorium
tr - trochanter
ts - transverse suture
tt - tentorial thickening
tu - tubular portion of aedeagus
u - unguitractor
un - ungues or claws of tarsi
ut - unguitractor tendon
vcc - ventral coxal condyles
wp - pleural wing process
x - sclerite of haltere
y - sclerite of haltere
l - first axillary sclerite

- 2 - second axillary sclerite
- 3 - third axillary sclerite
- 4 - fourth axillary sclerite

PLATE I

- Fig. 1. Empis obesa, head capsule, cephalic view.
2. Empis obesa, head capsule, lateral view.
3. Empis obesa, head capsule, ventral view.
4. Empis obesa, head capsule, with compound eye removed to show internal structures.
5. Empis obesa, head capsule, caudal view.
6. Empis obesa, (a) apex of labrum, adoral, (b) apex of labrum, lateral, (c) apex of hypopharynx, adoral, (d) apex of galea, lateral. All as seen under compound microscope, high power.
7. Empis obesa, base of proboscis removed from the head capsule.
8. Empis obesa, caudolateral view of labrum and hypopharynx.
9. Empis obesa, cross-section of proboscis taken at about mid-length.

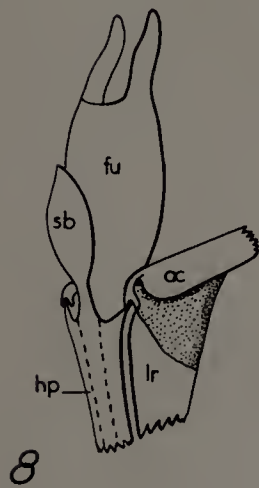
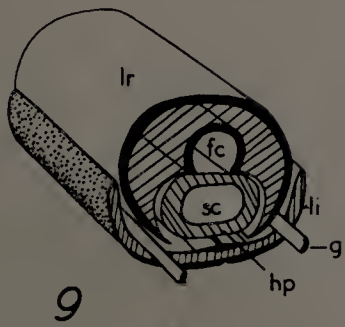
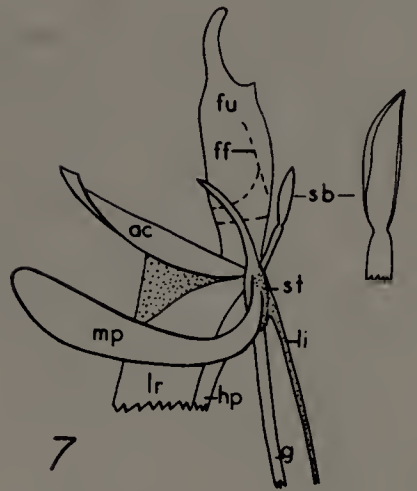
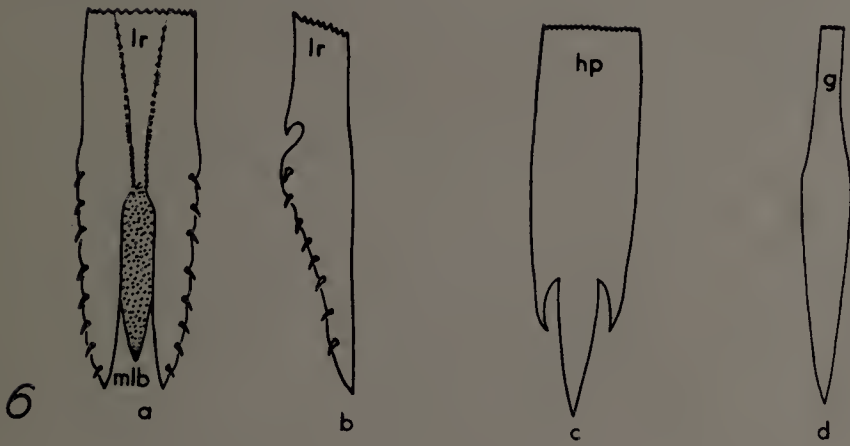
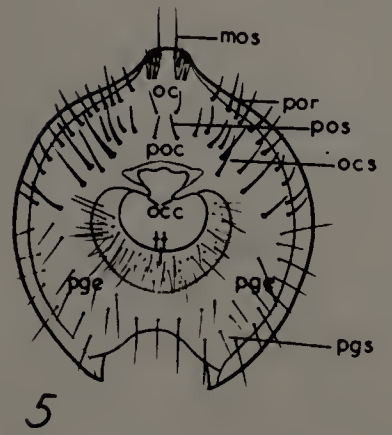
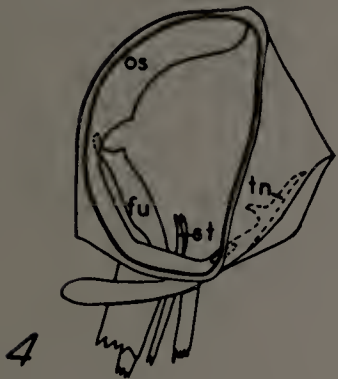
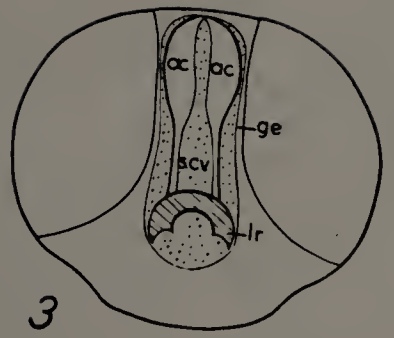
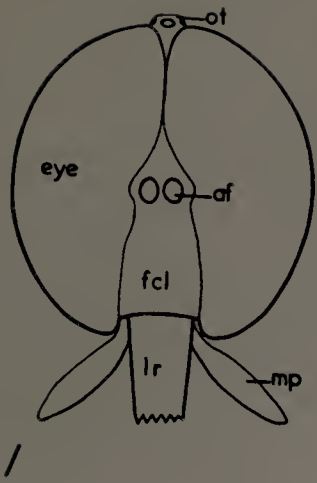


PLATE II

- Fig. 10. Empis obesa, labium, adoral view.
11. Empis obesa, labium, aboral view.
12. Empis obesa, labellum, mesal aspect as seen under a compound microscope.
13. Empis obesa, lateral aspect as seen under a compound microscope.
14. Empis obesa, (a) spicule bearing platelets of the prementum, (b) platelets and spicules from near the tip of the labellum. (Both as seen under oil immersion).
15. Empis obesa, thorax, dorsal view.
16. Empis obesa, articulation of the 1st axillary sclerite with the mesonotum.
17. Empis obesa, thorax, lateral view.
18. Empis obesa, metanotum.
19. Empis obesa, spiracular filter mechanism.

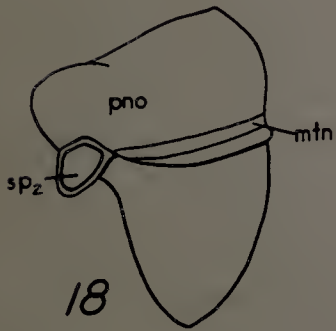
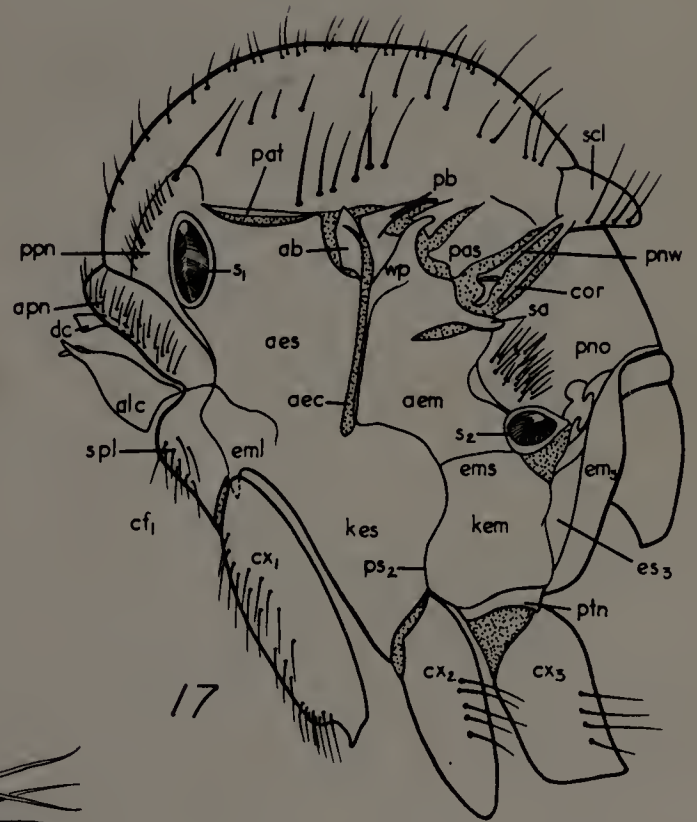
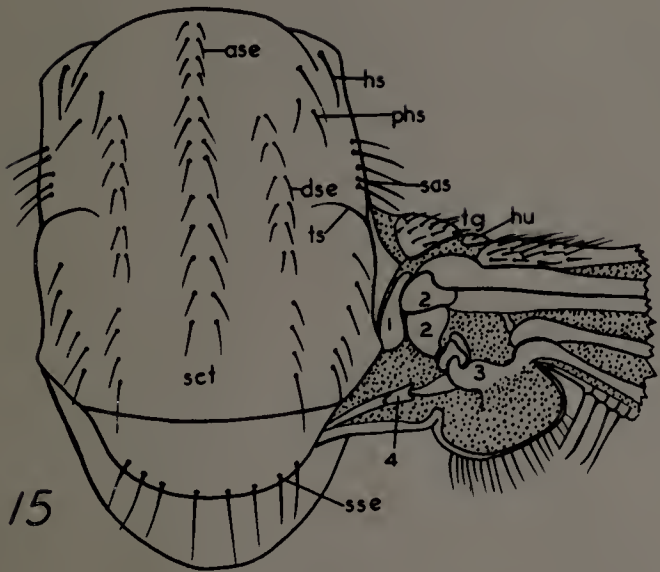
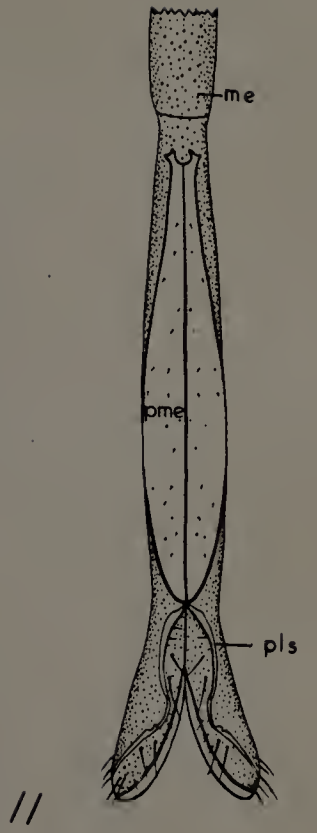
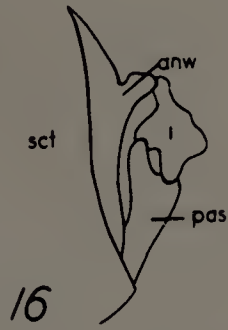
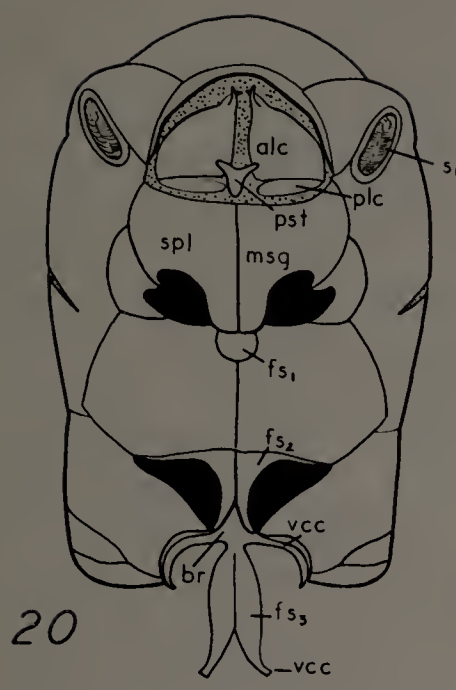
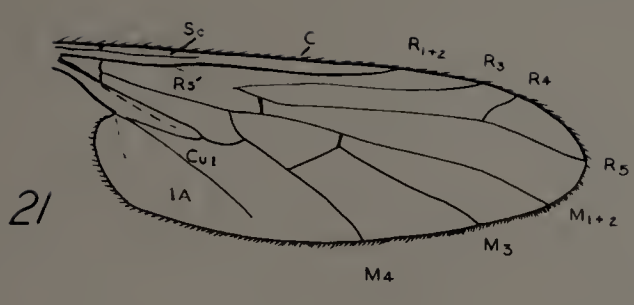


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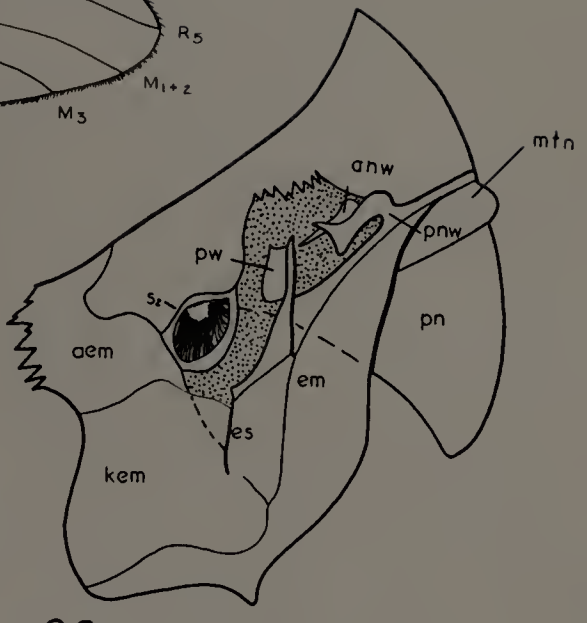
- Fig. 20. Empis obesa, thorax, ventral view.
21. Empis obesa, wing.
22. Empis obesa, posterolateral region of the thorax with the halteres removed.
23. Empis obesa, haltere, dorsal view.
24. Empis obesa, prothoracic leg.
25. Empis obesa, coxae, mesal aspect, (a) mesothoracic leg, (b) metathoracic leg.
26. Empis obesa, ventroapical surface of hind tibia.
27. Empis obesa, female, posterior femur.
28. Empis obesa, male, abdomen, lateral view.



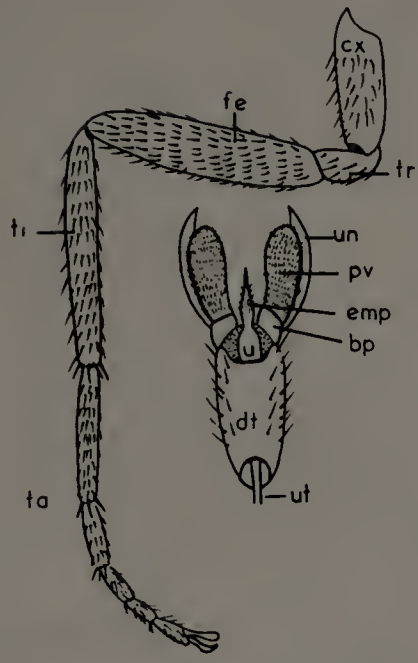
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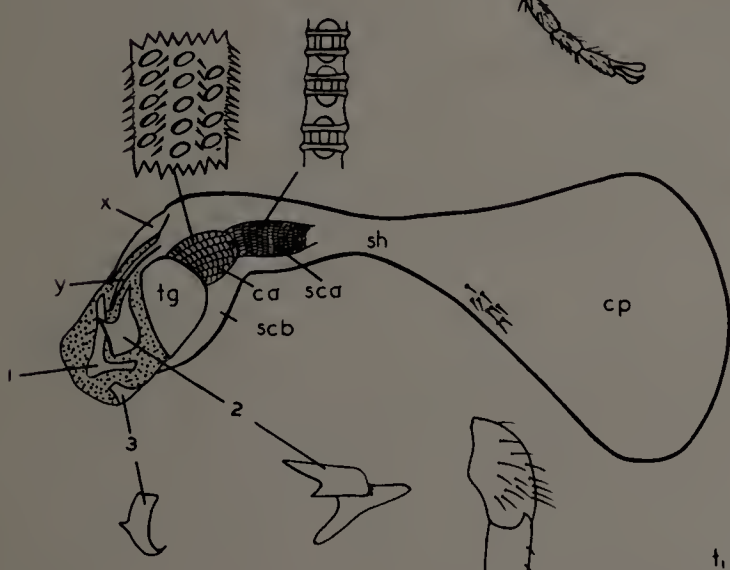
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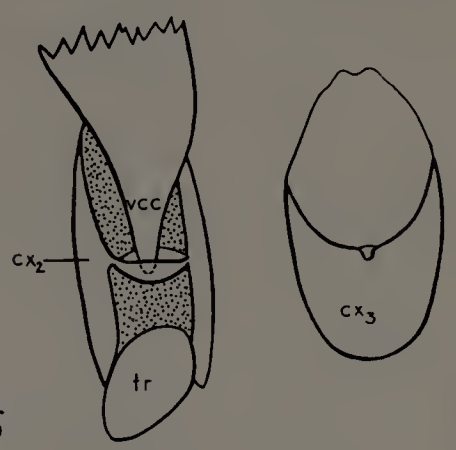
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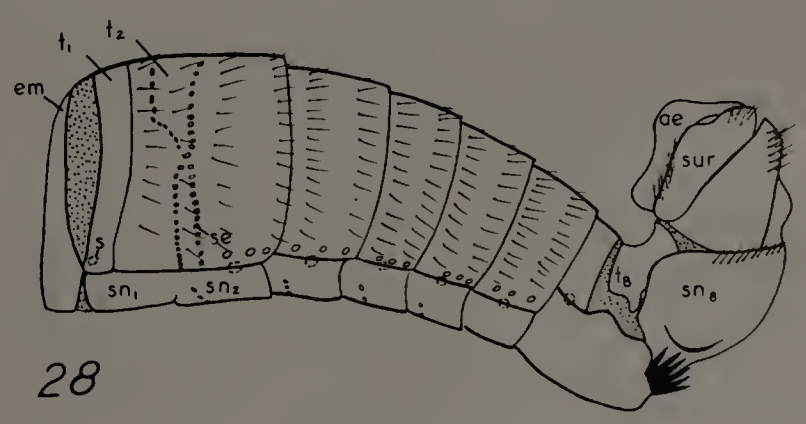
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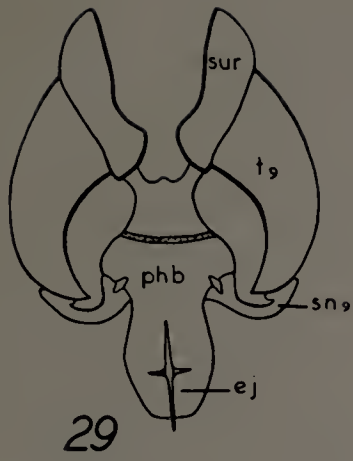
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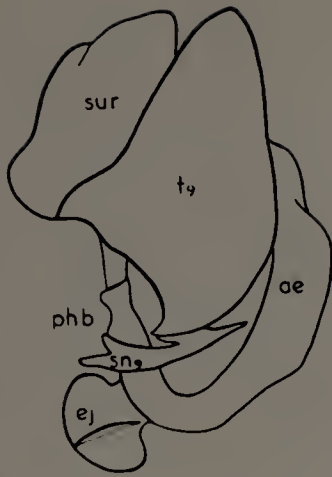
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PLATE IV

- Fig. 29. Empis obesa, male, ninth abdominal segment and phallobase, anterior view.
30. Empis obesa, male, ninth abdominal segment and aedeagus, lateral view.
31. Empis obesa, male, aedeagus, lateral view.
32. Empis obesa, female, terminalia, lateral view.
33. Clinocera, head capsule, lateral view.
34. Clinocera, head capsule, compound eye removed to show ocular sclerite and tentorium.
35. Clinocera, head capsule, caudal view.
36. Clinocera, lateral aspect of labrum-epipharynx detached from head capsule.
37. Clinocera, hypopharynx and salivary bulb, adoral.



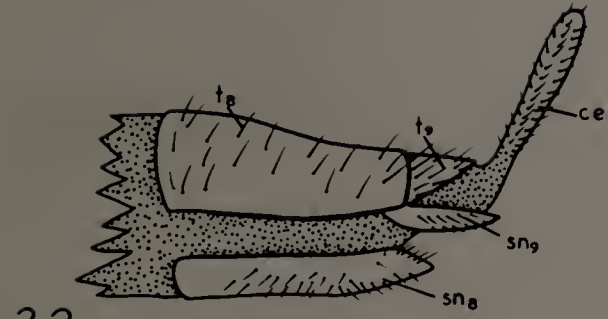
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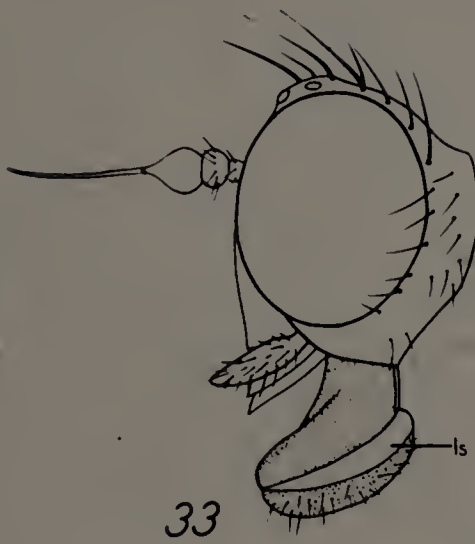
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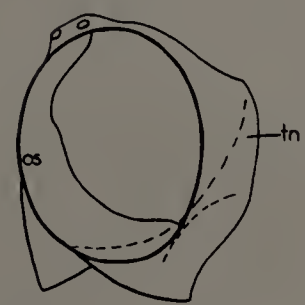
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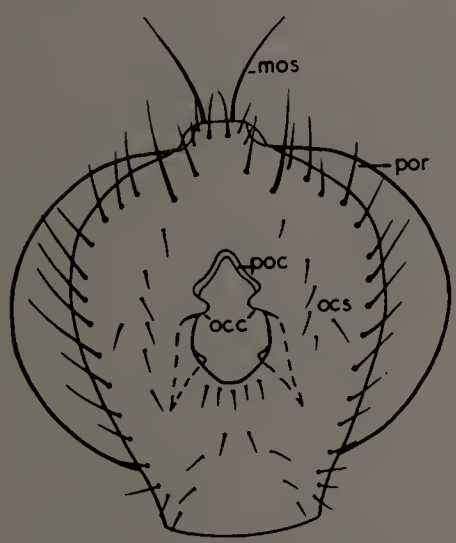
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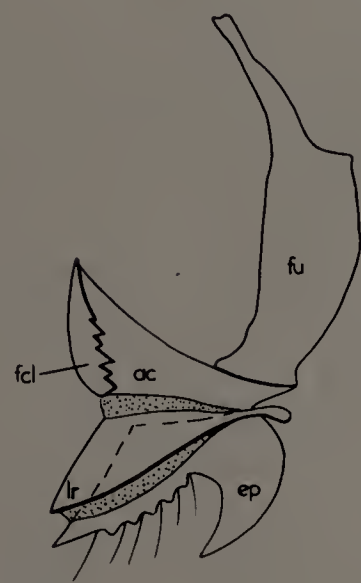
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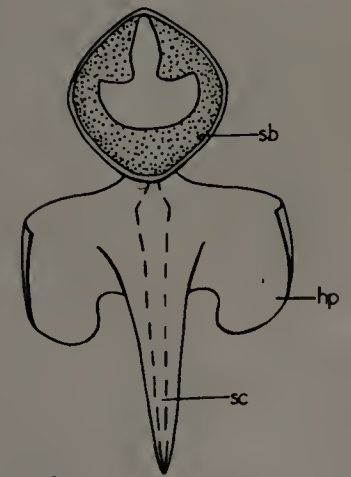
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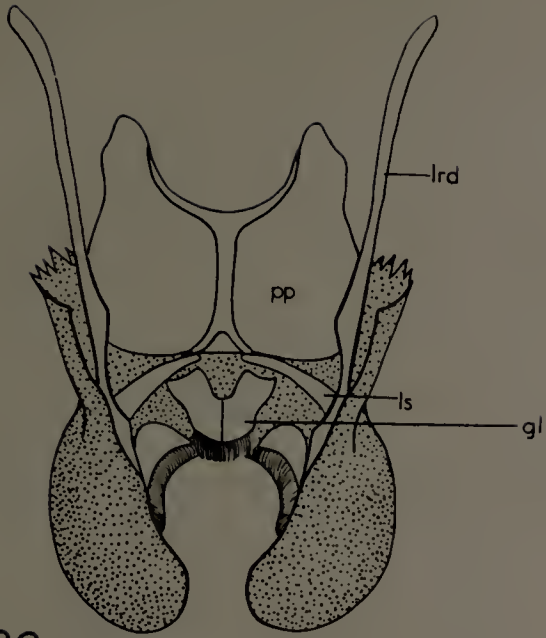
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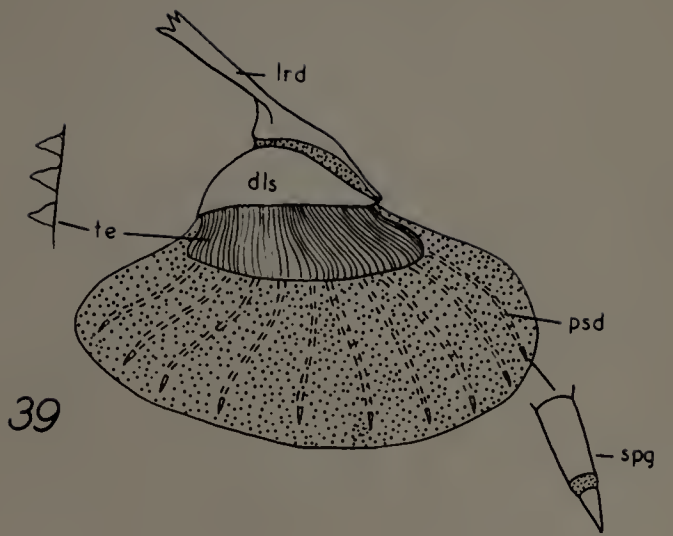
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PLATE V

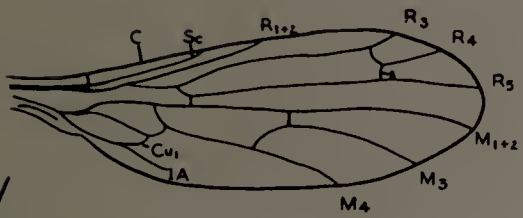
- Fig. 38. Clinocera, labium, anterodorsal aspect.
39. Clinocera, labellum, mesal aspect.
40. Clinocera, thorax, lateral aspect.
41. Clinocera conjuncta, wing. (Markings omitted)
42. Clinocera conjuncta, male, terminalia, lateral aspect.
43. Clinocera conjuncta, mesal aspect of 9th tergite.



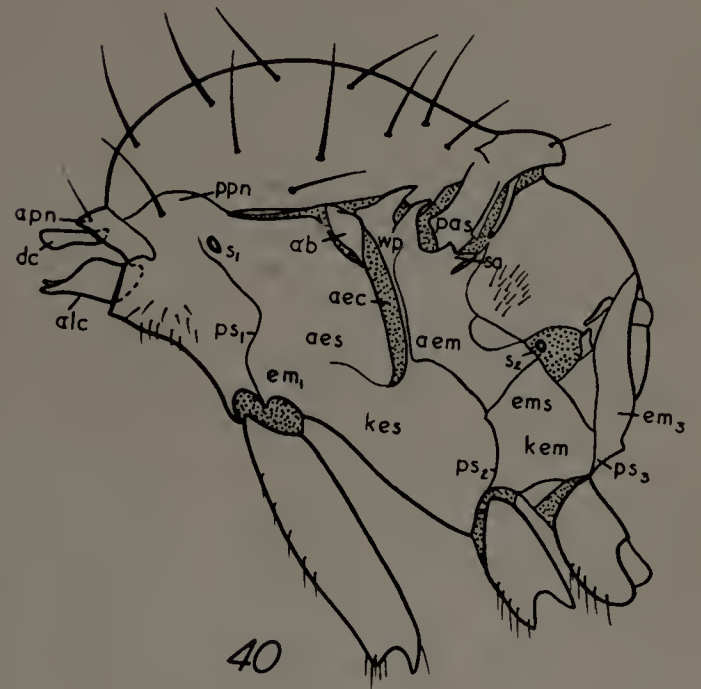
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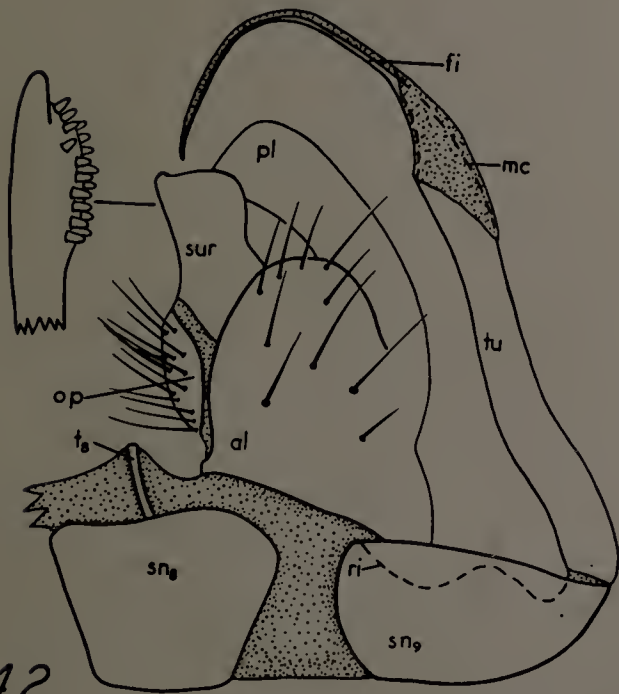
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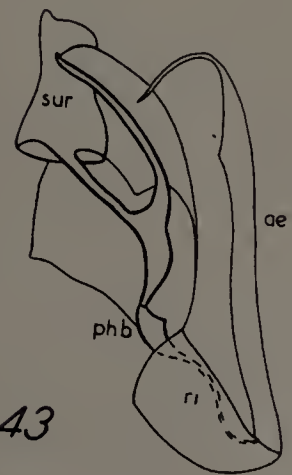
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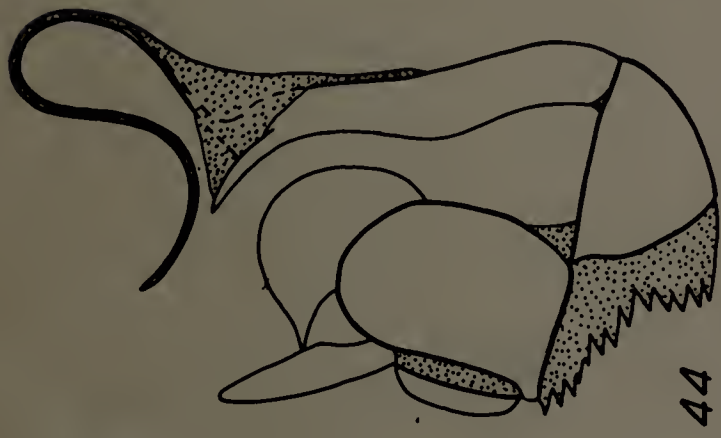
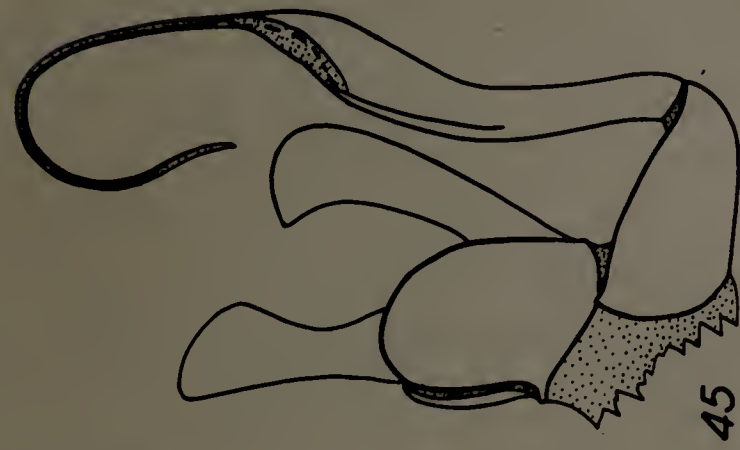
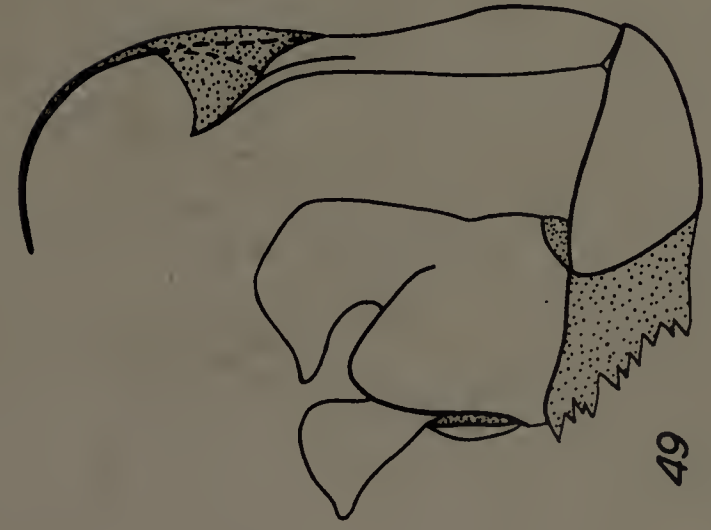
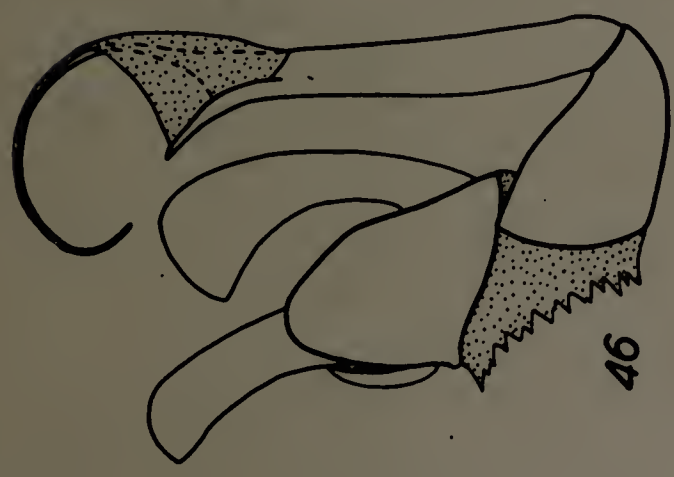
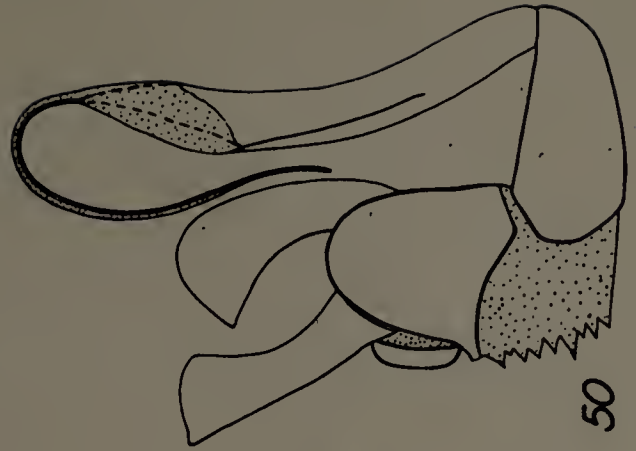
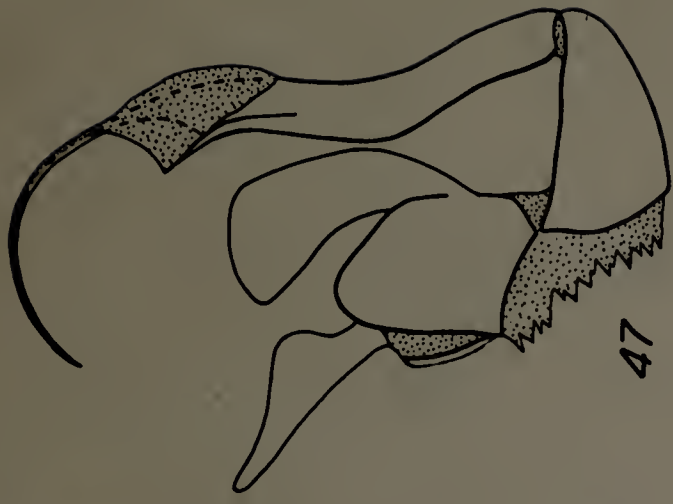
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PLATE VI

- Fig. 44. Clinocera lineata, male terminalia,
lateral view.
45. Clinocera fuscipennis, male terminalia,
lateral view.
46. Clinocera genualis, male terminalia,
lateral view.
47. Clinocera longifurca, male terminalia,
lateral view.
48. Clinocera maculata, male terminalia,
lateral view.
49. Clinocera parabinotata, male terminalia,
lateral view.
50. Clinocera lecta, male terminalia, lateral
view.



APPROVED:

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