TULANE STUDIES IN ZOOLOGY AND BOTANY

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THE TABANIDAE (DIPTERA) OF LOUISIANA

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CONTENTS

Abstract

A study to elucidate some aspects associated with tabanid populations was conducted with an emphasis on systematic relationships. Distribution of the Louisiana Tabanidae was correlated with six major ecological regions which were defined primarily by the characteristic vegetational forms.

Approximately 18,000 adults and 1000 larvae were collected from Louisiana and neighboring states. Twelve genera and 100 species and subspecies are recorded for Louisiana. Taxonomic keys, distributional data, and ecological information are given for the species. Emphasis is placed on phenotypic variation in local populations and intergradation in certain species complexes. Changes in the taxonomic status are included for four species and a new species is described.

Larval descriptions based on approximately 350 specimens are given for 12 species of *Chrysops*, 1 *Merycomyia*, 1 *Chlorotabanus*, 1 *Leucotabanus*, and 17 *Tabanus*. Six of the larval descriptions are given for the first time.

Introduction

The present investigation was undertaken to correlate tabanid ecological associations and distribution with the adult and larval taxonomy. Much of the early work on the Tabanidae involved adult taxonomy, and considerably less was done on larval taxonomy or the association of species with ecological habitats. Marchand (1920) gives a summary of the literature on immature tabanids up to that time. Many of the larval investigations published since Marchand's work have dealt with only a few species and in most cases give either limited or no larval descriptions. Notable exceptions are the works of Cameron (1926) and Stone (1930). Hennig (1952) reviewed the world literature and gave a listing of the species for which descriptions of the immature stages had been published. Teskey's (1969) work is the most comprehensive taxonomic treatise on the immature stages and includes complete descriptions, biological information, and literature references for 81 North American species.

Relatively few taxonomic accounts of the Louisiana Tabanidae have been published. The work of Hine (1906, 1907a) included keys and descriptions for 40 species of adults with some biological information included for most species. Jones and Bradley (1923, 1924) listed 55 species as occurring in Louisiana and described the larval habitats of 19. Wilson and Burns (1964) included 60 species in a list of the Louisiana tabanids.

In the present study, the distribution of the Louisiana Tabanidae is correlated with six major vegetational regions which are defined primarily by characteristic plant species. It should be pointed out that not all areas were sampled with the same intensity, and the collecting data in some cases may not reflect the actual distribution of species throughout the state. Twelve genera and 100 species and subspecies are recorded as occurring in Louisiana. A new species of *Chrysops* is described, and changes in the taxonomic status are included for four species. The descriptions for the larvae of 33 species are presented, 11 of which were not included in Teskey's (1969) publication, but 4 of the 11 were given in an unpublished dissertation (Goodwin, 1967). In approximately one-third of the species common to both the present work (southern U.S.) and that of Dr. Teskey (northeastern U.S. and eastern Canada), geographic variation was noted. Consideration of such variation should be made when keying larvae from different regions. Keys, distributional data, and ecological information are included for both adults and larvae.

Economic Aspects

The tabanids, commonly known as horse flies and deer flies, long have been recognized as important pests of man and other animals. When certain species are especially abundant, as in some coastal regions, man's outdoor activities may be seriously hampered. Harassment of livestock by tabanids may result in blood and weight loss and a corresponding decrease in meat and milk production.

In North America the mechanical transmission by tabanids of anaplasmosis, anthrax, equine infectious anemia, equine encephalomyelitis, and tularemia is documented by Anthony (1962) and Jones and Anthony (1964). More recently, the isolation of serotypes of California encephalitis from tabanids (Defoliart, et al., 1969), (Wright, et al., 1970), and the mechanical transmission of hog cholera virus by tabanids (Tidwell, et al., 1972) have been reported. The characteristic nature of tabanid feeding with

repeated probings and frequent moves to another host if disturbed, make them potential mechanical vectors for many disease organisms.

Biological transmission of a disease organism by North American tabanids has been demonstrated by Hibler, et al. (1969, 1970, 1971) who found that certain species of *Hybomitra* and *Tabanus* are natural intermediate hosts for *Elaeophora schneideri* Wehr and Dikmans, a filarioid parasite of elk, deer, and domestic sheep. They indicated that elaeophorosis may possibly be the most important factor responsible for the high annual mortality of elk in certain regions of the Southwest.

Life History

Female tabanids deposit their eggs singly in masses containing from 50 to 700 eggs. Depending on the species, masses may be composed of from one to several tiers and vary in color, shape, and size (generally 5 to 25 mm or more long and 2 to 10 mm wide). The females of many species exhibit oviposition site preferences, but in general the eggs are deposited on vegetation or other structures over water or moist soils. Most tabanids for which information is available breed in aquatic or semiaquatic habitats; however as research continues the list of species that breed in terrestrial habitats is increasing.

The eggs hatch generally in 5 to 8 days, and the larvae drop into the water or soil. Larval development may take a year or more although certain individuals of some species may reach the adult stage in less than 6 weeks. As the larvae complete their development, those in aquatic situations move to higher and drier areas for pupation, and, like those in terrestrial habitats, locate near the surface of the soil. A prepupal period lasting for at least 24 hours is usually characterized by the partial retraction of the head into the prothorax, protrusion of the prothoracic spiracles, and the body becoming somewhat rigid with a corresponding decrease in movement. The pupal period varies from 5 to 10 days (most *Chrysops*) to 3 weeks or more for some of the larger *Tabanus*.

Emergence from the pupal case may last several minutes and within an hour the adult may be capable of moderate flight. Mating probably occurs within 2 to 4 days, and for those females requiring a blood meal for egg development, a host is sought. A wide variety of animals may serve as natural hosts including most large mammals, certain reptiles and birds. Five to 10 days following a blood meal the female deposits a mass of eggs. A single female may oviposit several times during her life span. For sustenance, males, as well as females, feed on nectar or various plant juices and honeydew secretions of other insects.

In Louisiana, a few species are on the wing by the middle of March, but the period of greatest abundance usually extends from mid-May through the first part of July. A general reduction of the composite tabanid population occurs during late July and most of August. An upswing in the population is evident during late August through mid-September due in part to the increased appearance of some late season species as well as a second peak for certain other species.

Ecological Aspects

The area of Louisiana is approximately 48,000 square miles. Located in the Gulf Coastal Plain, it varies little in relief, with the highest elevation 535 feet. The climate is humid subtropical, with the average annual temperatures of the southern and northern portions, 68° and 65°F, respectively. The mean annual precipitation varies from 60 inches in the Southeast to 48 inches in the extreme Northwest. The number of frost free days (growing season) varies from 350 at the extreme southeastern tip to 230 in the northern regions. For additional geographic information concerning Louisiana, the reader is referred to Kniffen (1968).

The Tabanidae of Louisiana were examined in relation to six major vegetational regions modified from Brown (1945). While the delineation of the vegetational regions is broad, it should be pointed out that small disjunct or continuous areas of one region may occur within another when local conditions permit. For example, river-bottom hardwoods associated with the principal drainage systems are found throughout other vegetational regions. Therefore, the association of a specific tabanid fauna with

TABLE 1. Summary of tabanid ecological data.

Species	Mixed bottomland hardwood region	Upland hardwood region	Mixed pine-hardwood region	Longleaf-slash pine or longleaf pine region	Coastal marsh region	Prairie region
Merycomyia						
whitneyi				X		
Silvius						
quadrivittatus		XX				
Chrysops						
abatus				XX		
amazon hubbelli				X		
atlanticus				X	XX	
beameri			X			
bistellatus			XX	XX		
brimleyi		X	XX	XX		
brunneus				XX	XX	
callidus	XX	XX	XX	XX		XX
carbonarius		X	X	X		
celatus				X		
cincticornis			X	X		
cursim				X		
dacne		X		X		
dimmocki	XX			X	X	X
flavidus	XX	XX	XX	XX	XX	XX
fulvistigma			XX	XX		
geminatus geminatus			X	X		
geminatus impunctus		X				
harmani			X			
macquarti		XX	X	XX		
mocchus		X	XX	XX		
montanus			XX	XX		
niger	X	X		X		
nigribimbo				X		
obsoletus lugens				XX		
parvulus			X	X		
pikei	XX	XX	XX	XX		
pudicus			X	X		
reicherti	XX	XX	XX	XX	XX	XX
univittatus				X		
upsilon	XX		XX	XX		
vittatus	XX	XX	XX	XX		
Diachlorus						
ferrugatus	XX			X	X	
Stenotabanus						
magnicallus					X	
Chlorotabanus						
crepuscularis	XX	X	X	X		X
Whitneyomyia						
beatifica	X		X	X		
Leucotabanus						
annulatus	XX	XX	XX	XX		X
Tabanus						
abdominalis	X					
acutus				X	XX	
americanus	XX	X	X	X	X	

Table 1. (*Continued*)

Species	Mixed bottomland hardwood region	Upland hardwood region	Mixed pine-hardwood region	Longleaf-slash pine or longleaf pine region	Coastal marsh region	Prairie region
aranti			X	X		
atratus	XX	X	X	X	X	X
calens	X		X			
coarctatus		X		X		
colon				X		
cymatophorus	X					
eadsi					X	
equalis	X	X	X			
fairchildi			X	X		
fulvulus		X	X	X		
fuscicostatus	XX		X	X	X	
imitans				X		
lineola lineola	XX	XX	XX	XX	X	XX
lineola linellus				X	XX	
longiusculus				X		
maculipennis	XX			X		
melanocerus	XX	XX	XX	XX		X
moderator			X	X		
molestus	XX	XX	XX	XX		
mularis	XX	X	X	X		X
nefarius	X					
nigripes	XX		X	X		
nigrovittatus	X			X	XX	
pallidescens	XX	XX	XX	XX		X
petiolatus	XX	XX	XX	XX		X
proximus	XX		X			
pumilus	XX	X	XX	XX		
quaesitus			X	X		
reinwardti			X	X		
rufofrater				X		
sparus milleri		X	X	X		
stygius	X				X	
sublongus				X		
subsimilis	XX	X	X	X	X	X
sulcifrons	XX	XX	XX	X		X
texanus					XX	
trimaculatus	XX	XX	XX	XX		XX
turbidus	XX	XX	X			
venustus	X		X			X
wilsoni	XX	X				
zythicolor			X			
Hybomitra						
cincta				X		
difficilis		X				
lasiophthalma	XX	X	X			
trispila	X			X		
Agkistrocerus						
megerlei				X		
Hamatabanus						
annularis			X			
carolinensis			X	X		

X infrequently collected
XX commonly collected

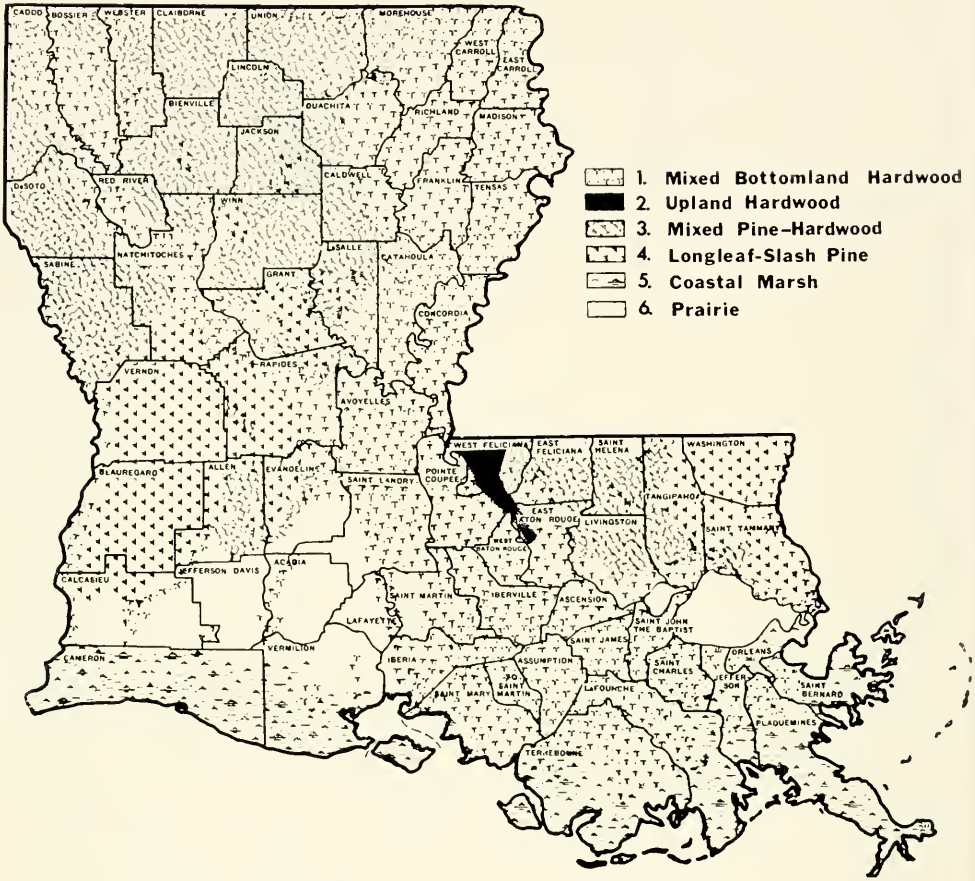


Figure 1. Major vegetational regions of Louisiana.

any given vegetational region must be made with caution. Also, species characteristically found in one vegetational region may frequently overlap with species occurring in other areas. The relative numbers of specimens obtained from the different regions will usually indicate the primary ecological habitat. Many tabanid species, however, are not limited to a particular vegetational region and may be found equally numerous in several of these major areas (Table 1).

Man has played a major role in changing the ecology of the vegetational regions. The development of flood control programs with construction of levees and drainage ditches as well as clearing and drainage of forest lands has had, no doubt, some influence on the tabanid fauna. Of the six species listed by Jones and Bradley (1923, 1924) as serious livestock pests in the vicinity of Baton Rouge, only three, *Tabanus fuscicostatus* Hine, *T. lineola* Fabr., and *Chrysops vittatus* Wied. were commonly collected from this area during the present investigation. Only the two *Tabanus* species could probably be regarded as serious livestock pests.

The principal function of defining vegetational regions is to promote understanding of some basic relationships of tabanids to their environment. The six major vegetational divisions used in this investigation are described below (Fig. 1).

1. Mixed Bottomland Hardwood Region

These forests are associated with the Mississippi floodplain and in lesser degree with the floodplains of the Red, the Atchafalaya,

the Tensas, and other smaller rivers of the state. The bottomlands contain lakes, sloughs, backwater swamps, natural levees, and slopes.

The vegetation bordering the waterways is correlated with the soil type and drainage. Cypress, *Taxodium distichum* Rich., and water tupelo, *Nyssa aquatica* L., swamps which are either permanently or periodically inundated, make up a considerable percentage of the total forest area. Characteristic of the swamp edges are natural levees and higher ridges which support American elm, *Ulmus americana* L.; Nuttall oak, *Quercus nuttallii* Palmer; red maple, *Acer rubrum* L., and other associated types. Soils poorly drained, yet generally free of standing water may have growths of sweetgum, *Liquidambar styraciflua* L.; overcup oak, *Quercus lyrata* Walt.; water hickory, *Carya aquatica* (Michx. f.) Nutt., and other hardwoods. The batture land, which receives periodic inundations, harbors a cottonwood-willow complex.

2. Upland Hardwood Region

This forest type occurs primarily in West Feliciana and East Baton Rouge parishes, but smaller and more localized areas may be found widely distributed throughout much of the state. These regions are characterized by rolling hills and the presence of white ash, *Fraxinus americana* L.; cherrybark oak, *Quercus pagoda* Raf.; Shumard red oak, *Q. shumardii* Buckley; cucumber tree, *Magnolia acuminata* L.; sugar maple, *Acer saccharum* Marsh.; and yellow poplar, *Liriodendron tulipifera* L. Other associated vegetation includes American holly, *Ilex opaca* Ait.; beech, *Fagus grandifolia* var. *caroliniana* Fern. & Rehd.; ironwood, *Carpinus caroliniana* Walt.; magnolia, *Magnolia grandiflora* L.; basswood, *Tilia caroliniana* Miller; white oak, *Q. alba* L.; black cherry, *Prunus serotina* Ehrh.; and silverbell, *Halesia diptera* Ellis.

3. Mixed Pine-Hardwood Region

These forests are associated primarily with the northwestern Louisiana uplands. Smaller areas of this forest type are found in Tangipahoa, St. Helena, Livingston, and East and West Feliciana parishes. These upland regions are characterized by gently rolling hills having permeable subsoils. For the most part, they contain shortleaf, *Pinus echinata* Mill., and loblolly pine, *P. taeda* L., and various hardwoods including southern red oak, *Quercus falcata* Michx.; blackjack oak, *Q. marilandica* Muenchh; cow oak, *Q. michauxii* Nutt.; post oak, *Q. stellata* Wang; and sugar maple, *Acer saccharum* Marsh. Other associated vegetation includes yaupon, *Ilex vomitoria* Ait.; ironwood, *Carpinus caroliniana* Walt.; blackgum, *Nyssa sylvatica* Marsh.; black cherry, *Prunus serotina* Ehrh.; Carolina beech, *Fagus grandifolia* var. *caroliniana* Fern. and Rehd.; dogwood, *Cornus* sp.; and various hickories, *Carya* spp.

4. Longleaf-Slash Pine or Longleaf Pine Region

These forests occur in the eastern area of the state in Washington Parish and in portions of Tangipahoa and St. Tammany parishes. A longleaf pine region also occurs in the mid- and southwestern areas of the state, covering major portions of Vernon, Beauregard, Allen, Grant, and Rapides parishes, as well as lesser portions of adjacent parishes.

The soils of the eastern region are more fertile and support a different, denser, second-growth forest. In the eastern flatwoods, there are extensive stands of slash, *Pinus elliottii* Engelm., and longleaf pine, *P. palustris* Mill., and lesser growths of shortleaf, *P. echinata* Mill., and spruce pine, *P. glabra* Walt. Myriad small sloughs drain the flatwoods and support such hardwood species as redbay, *Persea borbonia* (L.); Allegheny chinkapin, *Castanea pumila* Mill.; mayhaw, *Crataegus opaca* Hook. and Arn.; eastern hophornbeam, *Ostrya virginiana* (Mill.) Koch.; swamp blackgum, *Nyssa sylvatica* var. *biflora* (Walt.) Sarg.; sweetbay, *Magnolia virginiana* L.; and green ash, *Fraxinus pennsylvanica* var. *lanceolata* (Borkh.) Sarg.

In the western region, much of what was once a solid stand of longleaf pine has been cleared and is utilized for pasture. Much of this land is interlaced by streamlets known as "bay galls" and consists of hardwoods characteristically associated with stream bottoms. The longleaf pine flatwoods of southwestern Louisiana differ from those of the east most strikingly by the absence of slash pine.

5. Coastal Marsh Region

The coastal marsh is an area of over four million acres bordering the Gulf of Mexico. Farmlands and forests are negligible in this region, the latter being chiefly composed of cypress, *Taxodium distichum* Rich.; water tupelo, *Nyssa aquatica* L.; buttonbush, *Cephalanthus occidentalis* L.; black willow, *Salix nigra* Marsh.; and associated wet-land hardwoods. Throughout the salt marsh there are natural levees and ridges which support live oak, *Quercus virginiana* Mill.; hackberry, *Celtis laevigata* Willd.; marsh-elder, *Iva frutescens* L.; swampbay, *Persea palustris* (Raf.) Sarg., and other vegetation.

The coastal marshlands may be divided into a series of gradually increasing salinities from the inner freshwater region to the salt water of the Gulf. The principal vegetation from the fresh to the salt water areas is cattail, *Typha* sp.; cutgrass, *Zizaniopsis miliacea* (Michx.) Doell & Aschers; bulrush, *Scirpus robustus* Pursh.; saw grass, *Mariscus jamaicense* Crantz; couch grass, *Spartina patens* (Ait.); blackrush, *Juncus roemerianus* Scheele; quillcane, *Spartina cynosuriodes* (L.) Roth; salt grass, *Distichlis spicata* (L.) Greene; and salt cane, *Spartina alterniflora* Loisel.

6. Prairie Region

In the southwestern portion of the state, a prairie separates the marsh from the western longleaf pine region. Some typical prairie vegetation includes prairie-beardgrass, *Andropogon scoparius* Michx.; butterwort, *Pinguicula* sp.; false indigo, *Baptisia leucantha* T. & G.; Ruellia, *Ruellia pedunculata* Torr.; and compass-plant, *Silphium laciniatum* L. Forested lands comprise only 18 percent of the land area. These forested lands of typical oak and mixed hardwoods are confined predominantly to stream courses or fringes of the lower swampy areas.

Collecting Methods

Tabanid larvae and adults were collected throughout Louisiana and to a lesser extent in neighboring states. Most larvae were obtained by a search of the marginal areas of ponds and streams, and in swamps, although other habitat types occasionally proved to be suitable for some species of tabanids. Specific habitats examined included terrestrial soils, wet or dried mud, moss, within rhizomes or in plant roots, dead wood, among leaves or other debris, in tree holes, under logs, beneath carrion, and in water.

The immature tabanids were obtained by hand sorting the substratum or by using a wire screen. Small amounts of mud or soil were placed on the screen and gently agitated while submerged in water. The soil was washed away, leaving only the larger pieces of debris and any larvae present. Hand sorting was effective when searching for immature tabanids in materials such as rotten wood or matted leaf litter. A hand cultivator was utilized to rake through large areas of soil and other debris to locate larvae. In general, the depth of examination of soil was less than 20 cm. Soil samples suspected of containing larvae were brought to the laboratory and transferred to Berlese funnels to recover any immatures present.

Adult tabanids were collected with insect nets, in autos and buildings, and by the use of New Jersey light traps, Malaise, and canopy traps, the latter similar to that described by Catts (1970). The Malaise and canopy traps and auto collections were improved with the addition of CO_2, provided by several pieces of dry ice approximately one kg each. *Chrysops* were collected primarily by using an aerial net. Sweep nets were used to collect tabanids from vegetation during the day and at night. Collections were also made from horses and other livestock.

Rearing and Preservation of Immatures

For rearing, the larvae were placed individually in 20×55 mm glass vials ¼ filled with 6 mm glass beads. Water was added to cover the bottom of the vials, and screw cap lids were placed loosely on top. Using glass beads rather than natural substratum, the vial could be rinsed of unused or decaying food, and the larva or exuvia could be easily observed.

The larvae were maintained at room temperature and were offered food at least once a week. The *Tabanus* larvae were fed primarily on the semi-aquatic annelid, *Sparganophilis eiseni* Smith; however, most species

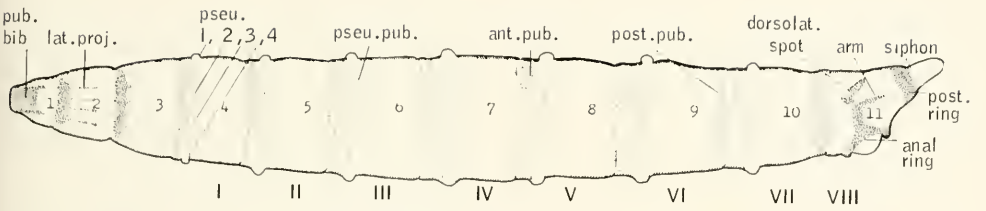


Figure 2. Larva of *Tabanus lincola* showing principal taxonomic characters.

would feed on almost any invertebrate offered, especially if it had been cut up. Liver and raw beef were also consumed by most *Tabanus* larvae. The *Chrysops* larvae seldom consumed the above foods although some fed on small aquatic Chironomidae (Diptera) larvae. Early instar *Chrysops* usually did not survive to complete development.

To facilitate microscopic study, the larvae were immersed in an ice water bath to inhibit movement (Teskey, 1969). Upon pupation, the last larval exuvia was inflated with 70 percent ethyl alcohol using a small syringe and a 27 gauge needle. Injection with alcohol helped to eliminate wrinkles which hindered the observation of diagnostic characters. The larval skin was stored in a vial of 70 percent alcohol. The pupa was placed on damp filter paper until emergence at which time the pupal case was placed with the larval skin, and the adult was allowed to harden before being killed, pinned, and labeled.

Larval Morphology

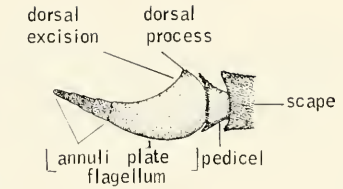
Tabanid larvae are characterized by a cylindrical form, somewhat tapered at both ends (Fig. 2). Full-grown larvae vary in length from 12 mm (small *Chrysops*) to 60 mm or more for large *Tabanus* species. Background color is typically creamy white with light beige to black pubescent patterns. The pubescent patterns are usually similar in over-all appearance but vary in extent, intensity, and configuration for each species.

Pubescence consists of minute spine-like structures, varied in size. Inconspicuous pubescence can best be seen on a section of larval exuvia using a compound microscope at magnifications of 100–430×, but most pubescence is readily observed using a dissecting scope with magnifications of less than 40× and proper lighting. Occasionally, debris may adhere to certain surfaces of the cuticle, giving an appearance of pubescence, and close observation is necessary to distinguish actual pubescent patterns.

Small longitudinal furrows in the cuticular wall are referred to as *striations*. These, when present, may vary from almost imperceptible, broken lines to conspicuous, pronounced longitudinal furrows. Striations are usually closer together on the lateral surfaces of body segments, and when present, more widely spaced on dorsal and ventral surfaces. Finer striae are present at the anterior and posterior margins of segments, and in some species very fine closely spaced striations give a shadowed effect to certain cuticular regions and may be mistaken for fine pubescence. These are found most frequently on the anterior portions of the anal segment and occasionally on the anterior regions of other abdominal segments, and are best observed using magnifications of 100× or greater. The presence or absence of striations and their relative development on different body regions and surfaces may vary among species.

The *head* is an elongated sclerotized capsule, highly movable, and retractable into the thorax. The dorsal surface of the head capsule is composed of a pair of *posterior epicranial plates* fusing anteriorly to form the *epicranium* which extends into a downwardly curved *clypeus*. The clypeus terminates anteriorly at a small upturned *labrum*. Head capsule measurements were made from the labrum to the posterior tip of the epicranial plates. Beneath the epicranial plates and extending beyond them is a pair of internal conspicuous *tentorial rods*, the posterior ends of which are ventrally directed. A detailed description and figures of the head capsule are given by Teskey (1969).

In most species the *thorax* is characterized by the presence of an anterior pubescent



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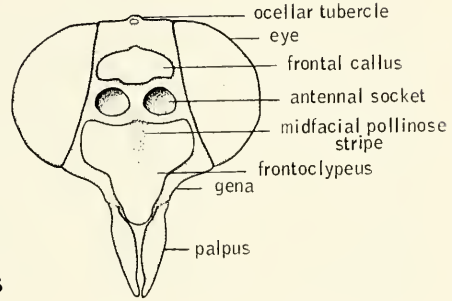

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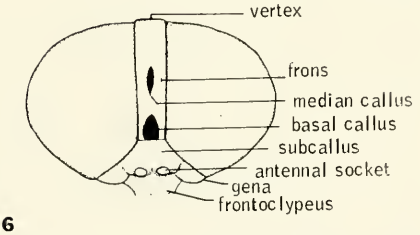

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Figures 3–6. 3, antenna of *Tabanus* (lateral view); 4, antenna of *Chrysops* (lateral view); 5, head of *Chrysops* (frontal view); 6, head of *Tabanus* (frontal view).

band (*annulus*) encircling each of the three segments. A pair of *lateral pubescent projections* (lat. proj.) may extend posteriorly on each side from the prothoracic annulus, and four from each side of the meso- and metathoracic annuli. The presence and extent of development of these projections may vary among species. In some, the area between the lateral prothoracic projections is filled with pubescence and the entire lateral pubescent pattern is referred to as a *bib* (*pub. bib*). Usually, a median ventral pubescent projection is present on the prothorax. In some species pubescence is present on the posterior margins of the meso- and metathorax. The lateral pubescent projections are associated with depressions or grooves in the integument which may appear as closely placed spots. The presence of micro-fine striae in these areas may give the appearance of thin lines of pubescence. When this condition was pronounced, it was figured on the larval drawings for aid in identification. Similar depressions sometimes visible as lateral spots also appear on abdominal segments 1–7.

The *abdomen* is composed of 8 segments, of which all but the last are characterized by the presence of 3 or 4 pairs of anteriorly located fleshy protuberances (*pseudopodia*). These are located dorsally, laterally, ventrolaterally, and ventrally, and are indicated by the numbers 1, 2, 3, 4, respectively (pseu. 1, 2, 3, 4). In those species having only 3 pairs of pseudopodia, the ventrolateral pair is lacking. The *intersegmental line* is located slightly anterior to the pseudopods. The area between this line and the pseudopods may contain pubescence termed *anterior pubescence* (ant. pub.). The pubescence found on and between the pseudopods is termed *pseudopodial pubescence* (pseu. pub.), and that found on the posterior margins of the segments is termed *posterior pubescence* (post. pub.). A gradual decrease in the intensity and extent of the anterior pubescence is found to occur successively from abdominal segments 1 through 7, whereas there is a progressive increase in the amount of posterior pubescence from abdominal segments 1 through 7. The pseudopods bear cuticular spines which may vary considerably from very small near the base of the pseudopod to much larger at the apex. In extreme cases these larger spines may even form well developed crochets.

The *anal segment*, which generally tapers posteriorly, bears a ventral *anal tubercle* and a retractable posterior *respiratory siphon*. The anal tubercle consists of a pair of finely pubescent anal lobes bordered anteriorly and posteriorly by pubescent ridges. The respira-

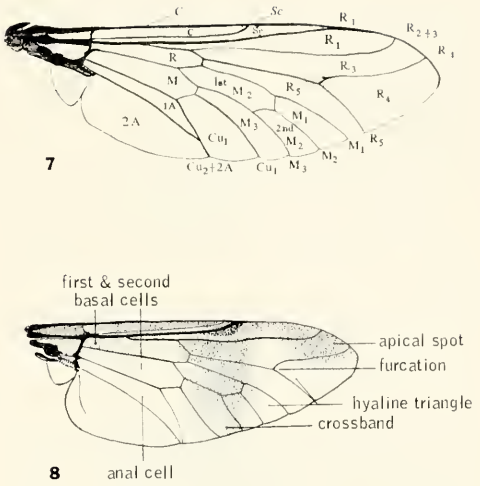
tory siphon varies in length from approximately ½ to several times its basal diameter. In many species, especially of the genus *Chrysops*, a retractable sclerotized *stigmatal spine* extends from the apex of the siphon. A conspicuous lateral pubescent configuration is usually present, as well as a pubescent annulus (*post. ring*) encircling the posterior portion of the segment. In addition, pubescence may be present on other areas. Variation in the extent and configuration of the pubescence on the anal segment is of significant importance in separating species.

Adult Morphology

Problems concerning various species complexes, phenotypic variations, and geographic distribution have often made identification of the adults rather difficult. In certain cases, specimens representing different named species show considerable variation in some key characters. Occasionally, intermediate forms are found that exhibit complete intergradation of these characters. These forms frequently cannot be accurately assigned to either taxon.

The identification of specimens is made primarily by utilizing various cephalic characters and body coloration patterns. In general, tabanids are robust, bristleless flies with hyaline or pictured wings and conspicuous calypteres. The *antennae* are composed of 3 segments; the third (*flagellum*) has a *basal portion* (*plate*) and is divided into 3–8 divisions distally (Figs. 3 & 4). The number of divisions in the 3rd antennal segment is frequently of generic significance, with the basal plate being the 1st division. A dorsal median process or projection may be present on the plate.

The *head* is wide, hemispherical with large *compound eyes*, dichoptic in females and usually holoptic in males. The eyes may bear tiny hairs (pilosity) or be entirely bare. Characteristic eye patterns are present in live specimens of most species; however, the color of this pattern is usually lost when the specimen dries. If the specimen is placed in a humidity chamber the pattern can usually be restored, but the color may be changed. Black, reddish bronze, or gold eye bands in life may appear green, purple, or various shades when viewed from different angles in relaxed specimens.



Figures 7–8. 7, wing of *Tabanus*; 8, wing of *Chrysops*.

In females, the area between the eyes from the top of the head (*vertex*) to the lower inner angle of the eyes is referred to here as the *frons* (Stone, 1938). In some genera the frons is divided by a large oval denuded raised area (*frontal callus*) immediately above the base of the antennae (Fig. 5). Occasionally, at the vertex there is a small, denuded spot (*ocellar tubercle*) which may bear three ocelli in certain groups. In some genera including *Tabanus* (Fig. 6), a denuded line or spot called the *median callus* lies beneath the vertex. Beneath the median callus and occasionally connected to it is a denuded, slightly raised area herein termed *basal callus*. The ventral margin of the basal callus marks the lower extremity of the frons. The *frons ratio* herein refers to the ratio of the frons width (at ventral margin) to the height of the frons (ventral margin to upper inner angle of eye). Above the base of the antennae and below the basal callus is the *subcallus* which may be denuded or pollinose. The *frontoclypeus* lies beneath the antennae and above the oral margin. Lateral to the general region of the clypeus and beneath the eyes lie the *genae*.

Wing veins and cells are labelled using the Comstock-Needham terminology (Fig. 7) and Curran (1934). Wing venation is usually of minor importance as it varies little throughout the family. A term frequently used is *furcation* (*fork*) which

refers to the separation of veins R_4 and R_5. Occasionally a small stump vein may be present or an isolated cloud may surround this area. Wing coloration patterns are especially helpful in separating species of certain genera, e.g., *Chrysops* (Fig. 8).

Abdominal color patterns are also used as diagnostic characters, and descriptions make use of such terms as median triangles, median dorsal stripe, or sublateral spots, the latter referring to lighter areas between the median dorsal line and the lateral margin.

Keys to the Tabanidae

Taxonomic keys are given for the larvae of 8 genera and 35 species of Tabanidae and for 16 genera and 111 species and subspecies of adult Tabanidae. The key to the genera of the larvae occurring in Louisiana and neighboring states is modified in part from Teskey (1969). The keys to the 33 species described in this paper are based on larval specimens collected and reared to the adult stage. Keys to the adults are based in part on those of Jones and Anthony (1964), Philip (1947, 1955), and Stone (1938). These keys were rewritten to include species variations and taxonomic changes. Several species not recorded from Louisiana but reported in neighboring states are included and are denoted by an asterisk (*).

Key to Genera of the Larvae of Tabanidae

1. Body pyriform; integument opaque, roughened; all segments with annular ring of small tubercles or crenulate frills ..... *Goniops chrysocoma* (Osten Sacken)

   Not as above; body cylindrical, somewhat tapered at both ends 2

2. Three pairs of pseudopodia (including dorsal ridge) on each of first five abdominal segments; anal segment hemispherical, ¼ length of preanal segment; mandibles almost straight ..... *Esenbeckia incisuralis* (Say)*

   Pseudopodia present on first seven abdominal segments; differing in other characters 3

3. Larva blackish in appearance (greenish black in living specimens), completely clothed in black, brown, and golden mottled pattern of thick pubescence; mature larva less than 35 mm long (Fig. 24) ..... *Chlorotabanus crepuscularis* (Bequaert)

   Pubescence when present usually limited to anterior and/or posterior margins, pseudopodial pubescence on 1 or more segments; if completely clothed in pubescence, pattern not mottled and mature larva over 40 mm long 4

4. Three pairs of pseudopodia present on each of abdominal segments 1–7; mature larva small, less than 20 mm long ..... *Chrysops* Meigen

   Four pairs of pseudopodia present on abdominal segments 1–7; mature larva usually over 20 mm long 5

5. Siphon composed of two lateral sclerotized plates tapering apically and conspicuous stigmatal spine extending from between plates (Fig. 23) ..... *Merycomyia whitneyi* (Johnson)*

   Siphon lacking sclerotized lateral plates; spine may or may not be present 6

6. Respiratory siphon short, about ½ its basal diameter; rather uniformly-spaced striations encircling all segments 7

   Respiratory siphon longer than ½ its basal diameter; striations, if present on all surfaces, more closely spaced on lateral aspects 8

7. Narrow bands of anterior pubescence encircling at least abdominal segments 1–3; same pubescence not peg-like; mature larva less than 25 mm long (Fig. 25) ..... *Leucotabanus annulatus* (Say)

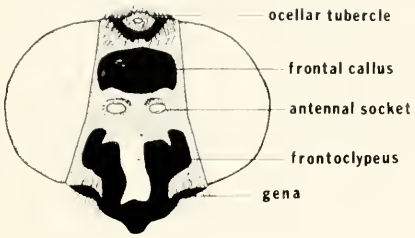
   Anterior pubescence on abdominal segments 1–3 limited to dorso- and ventrolateral bands (incomplete, not encircling segments); pubescence spiney or peg-like in appearance; mature larva over 25 mm long ..... some *Tabanus* Linnaeus

8. Median lateral surfaces of anal segment lacking pubescent markings; striations present on dorsal and ventral surfaces of all abdominal segments ..... *Hybomitra* Enderlein*

Either median lateral surfaces of anal segment with pubescent markings, or striations absent or poorly developed on dorsal and/or ventral surfaces of abdominal segments ..... *Tabanus* Linnaeus

Key to Full-Grown Larvae of Chrysops

1. Respiratory spine absent 2
   Respiratory spine present 5
2. Pubescence of anal segment varying in intensity from extremely pale to light, covering most of anterior aspects; posterior ventrolateral portion largely clear; length of respiratory siphon less than 3 times its basal diameter (Fig. 14) ..... *nigribimbo* Whitney
   Pubescence of anal segment darker, covering posterior ventrolateral portions; clear areas primarily anterior; length of respiratory siphon 3 or more times its basal diameter 3
3. Posterior pubescence of preanal segment with distinct median lateral peak; lateral striations on abdominal segments 2–7 extremely fine, appearing inconspicuous or absent (Fig. 11) ..... *brimleyi* Hine
   Posterior pubescence of preanal segment without median lateral peak; usually small dorso- and ventrolateral peaks present; lateral striations on abdominal segments normal 4
4. Length of respiratory siphon approximately three times its basal diameter; anterior pubescence encircling abdominal segments 1–4 (Fig. 13) ..... *vittatus* Wiedemann
   Length of respiratory siphon approximately four times its basal diameter; anterior pubescence encircling abdominal segment one, absent at least laterally on abdominal segments 2–7 (Fig. 12) ..... *pikei* Whitney
5. Anterior pubescent annulus of prothorax extremely faint, extending ⅔ or more length of segment; lateral pubescent projections absent from all thoracic segments (Fig. 15) ..... *niger* Macquart



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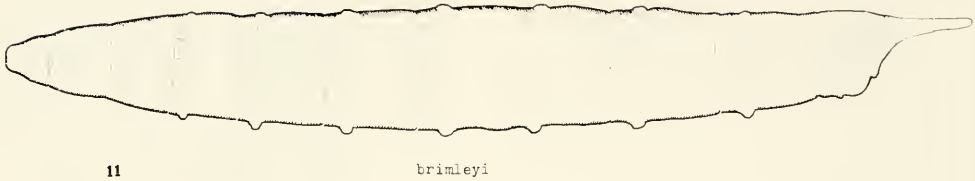
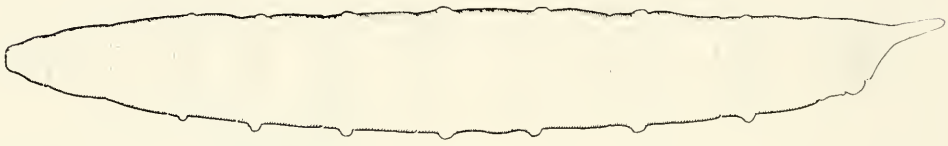
10

Figures 9–10. *Chrysops harmani* n. sp. female. 9, head (frontal view); 10, dorsal abdominal pattern.

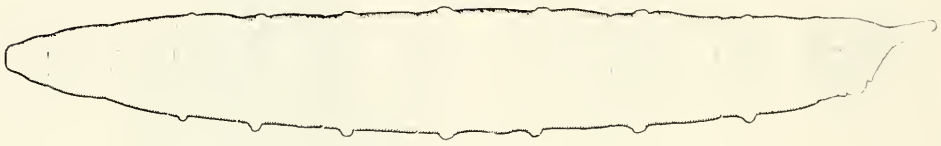
   Anterior pubescent annulus of prothorax narrow, either with paired pubescent projections or lateral bib; lateral projections usually developed at least on mesothorax 6
6. Prothoracic annulus with lateral pubescent bib on each side 7
   Prothoracic annulus with paired lateral pubescent projections on each side 9
7. Mature larva approximately 12–13 mm; posterior pubescent ring of anal segment extending approximately ¼ length of segment dorsally; pubescence somewhat reduced posteriorly before reaching respiratory siphon (Fig. 16) ..... *univittatus* Macquart and *upsilon* Philip



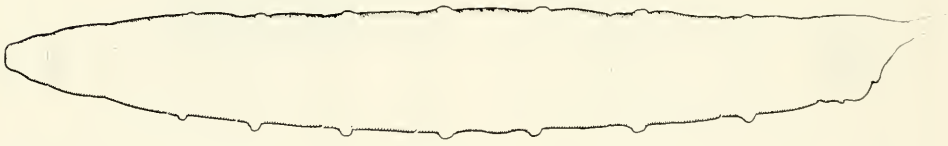
11 brimleyi



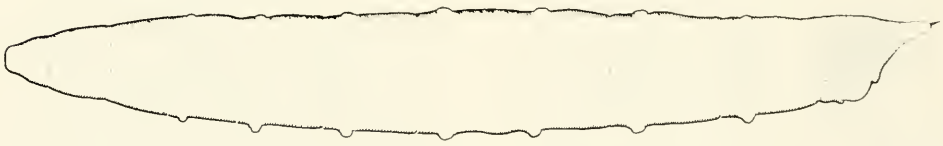
12 pikei



13 vittatus



14 nigribimbo



15 niger

Figures 11–15. Larvae of *Chrysops*.

Mature larva usually over 13 mm long; posterior pubescent ring of anal segment extending approximately ⅔ or greater length of segment dorsally; pubescence continuous to siphon 8

8. Pubescence of anal segment distinct, covering approximately ⅚ or more of segment; posterior pubescence present on abdominal segments six and seven, distinctly encircling the latter (Fig. 17) ..... *celatus* Pechuman

Pubescence of anal segment covering approximately ¾ of segment; posterior pubescence absent on abdominal segment six (Fig. 18) ..... *flavidus* Wiedemann

9. Anal segment with conspicuous isolated pubescent spots located dorsolaterally in anterior clear area; anterior pubescence of abdomen completely encircling only abdominal segments 1–2 (Fig. 22) ..... *cincticornis* Walker

Anal segment without conspicuous dorsolateral isolated pubescent spots; anterior pubescence encircling at least first three abdominal segments 10

10. Posterior pubescence broadly encircling preanal segment (Fig. 20) ..... *dimmocki* Hine

Posterior pubescence absent on preanal segment or limited to small median lateral peak 11

11. Posterior pubescence usually absent on preanal segment; if present, limited to tiny median lateral spot (Fig. 19) ..... *reicherti* Fairchild

Posterior pubescence forming median lateral peak on preanal segment (Fig. 21) ..... *callidus* Osten Sacken

Key to Full-Grown Larvae of Tabanus

1. Respiratory spine present 2

Respiratory spine absent 6

2. Prothoracic annulus with paired lateral pubescent projections on each side 3

Prothoracic annulus with lateral pubescent bib on each side 5

3. Lateral anal arm usually not connected to anal pubescent ring; lateral prothoracic projections usually about two times longer than greatest width (Fig. 34) ..... *aranti* Hays

Lateral anal arm connected to anal pubescent ring; lateral prothoracic projections relatively narrow, usually about 2.5 times longer than greatest width 4

4. Living larva green in color; lateral pubescent projections of mesothorax expanded apically (club-shaped); anterior pubescence present dorsally on anal segment (Fig. 32) ..... *maculipennis* Wiedemann

Larva creamy white; lateral pubescent projections of mesothorax not expanded apically; no anterior dorsal pubescence on anal segment (Fig. 33) ..... *nigrescens* Palisot de Beauvois*

5. Lateral anal arm connected to anal pubescent ring; lateral pubescent projections of mesothorax slightly expanded apically; rather distinct brown pubescence on all segments (Fig. 36) ..... *stygius* Say

Lateral anal arm not connected to anal pubescent ring; mesothoracic projections seldom expanded apically; pubescence light on most segments (Fig. 35) ..... *proximus* Walker

6. Most abdominal pseudopods long and conspicuous with their apices having from 5 to 15 crochets arranged in semicircle; lateral pubescent arm of anal segment not connected to anal ring (Fig. 39) ..... *fairchildi* Stone

Pseudopods normal, without crochets 7

7. Length of respiratory siphon approximately ½ its basal diameter; striations pronounced and rather evenly spaced on all body surfaces (Fig. 26) ..... *molestus* Say

Length of respiratory siphon equal to or greater than its basal diameter 8

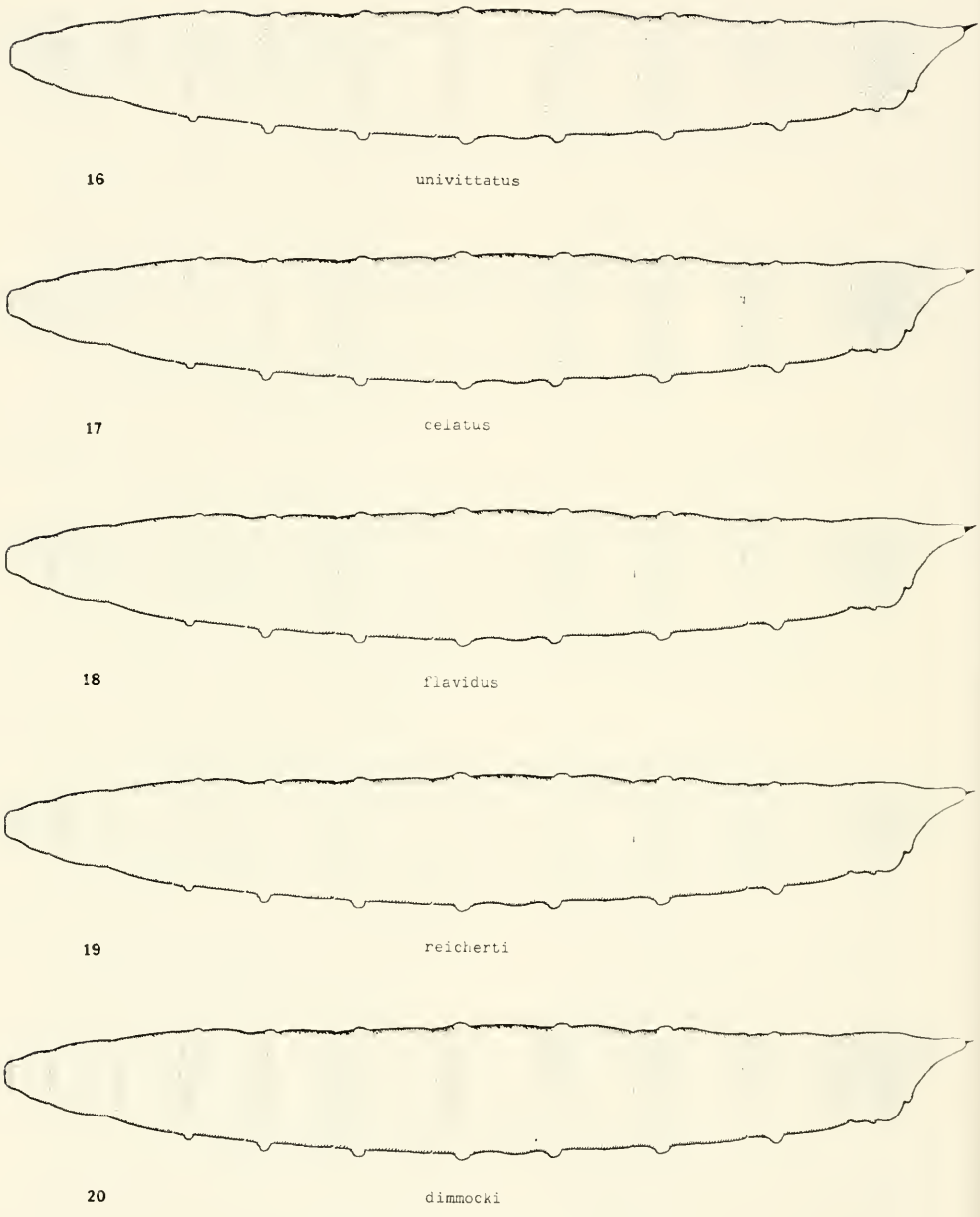
8. Anal segment elongated posteriorly, length of respiratory siphon approximately four times its basal diameter (Fig. 40) ..... *pumilus* Macquart

Anal segment not especially elongated posteriorly, length of respiratory siphon less than 2.5 times its basal diameter 9

9. Pubescence solid, covering entire body surface; large approximately 50 mm long (Fig. 38) ..... *americanus* Forster

Pubescence not entirely covering surface, usually limited to anterior and/or posterior margins of most segments and to pseudopodial pubescence of abdominal segments 1–7 10

10. Pubescence dark and extensive on all



Figures 16–20. Larvae of *Chrysops*.

segments; dorsolateral pubescent bars connect anterior and posterior pubescence on abdominal segments 1–7 (Fig. 37) ..... *atratus* Fabricius

Pubescence not extensive; dorsolateral pubescent bars absent on abdominal segments 1–7 11

11. Prothorax with lateral pubescent bib 12

Prothorax with paired lateral pubescent projections on each side or lateral prothoracic projections absent entirely 14

12. Larva usually 25 mm or less in length; length of respiratory

siphon approximately equal to its basal diameter; lateral pubescent arm of anal segment not reaching posterior pubescent ring (Fig. 2) ..... *lineola* Fabricius

Mature larva over 30 mm in length; respiratory siphon longer than width at base; lateral pubescent arm of anal segment connecting or almost so to pubescent ring ... 13

13. Respiratory siphon about 1.3 times as long as width at base; pubescent arm of anal segment connected to posterior pubescent ring; short lateral posteriorly directed pubescent peak between pseudopods one and two on preanal segment; striations pronounced on dorsal surface of preanal segment (Fig. 31) ..... *reinwardti* Wiedemann

Length of respiratory siphon about twice its basal diameter; pubescent arm of anal segment usually not connected to posterior pubescent ring; no short posteriorly directed pubescent peak between pseudopods one and two on preanal segment; dorsal striations on preanal segment absent or weak (Fig. 30) ..... *trimaculatus* Palisot de Beauvois

14. Faint anterior and posterior pubescence present on abdominal segments 1–7; anterior pubescent annuli of thorax with lateral projections on all segments (Fig. 28) ..... *sulcifrons* Macquart

Anterior and posterior pubescence absent on abdominal segments 1–7; lateral pubescent projections absent at least from meso- and metathoracic segments 15

15. Lateral pubescent arm present to some degree on anal segment (Fig. 29) ..... *melanocerus* Wiedemann and *petiolatus* Hine

Lateral pubescent arm absent on anal segment (Fig. 27) ..... *nigripes* Wiedemann

Key to Genera of Adult Tabanidae

1. Hind tibiae with two apical spurs matching those of middle tibiae (small in *Merycomyia*); three ocelli at vertex 2

Hind tibiae without spurs; no functional ocelli, though tubercle may be present 6

2. Antennae 9–10 segmented (flagellum with at least seven divisions, the basal one not greatly differentiated) 3

Antennae with not over seven segments (flagellum with at most five divisions, the basal one considerably elongated) 4

3. Eyes of female with upper angles sharply acute; wings with wide, sharply marked, irregular brown pattern; cell R_5 broadly open ..... *Goniops* Aldrich

Eyes of female normal; wings of uniform color; cell R_5 petiolate ..... *Esenbeckia* Rondani*

4. Third antennal segment with three divisions (two annuli) ..... *Merycomyia* Hine*

Third antennal segment with five divisions (four annuli) 5

5. Pedicel of antenna about ½ as long as scape; wings usually spotted; eyes speckled ..... *Silvius* Meigen

Pedicel of antenna more than ½ as long as scape; wing usually with dark band; eye with patterned maculations ..... *Chrysops* Meigen

6. Frons of female without callosity; body compact, uniformly greenish yellow in life ..... *Chlorotabanus* Lutz

Frons of female with callosity; color of body not as above 7

7. Third antennal segment with forward-projecting hook-like process above; eye pilose 8

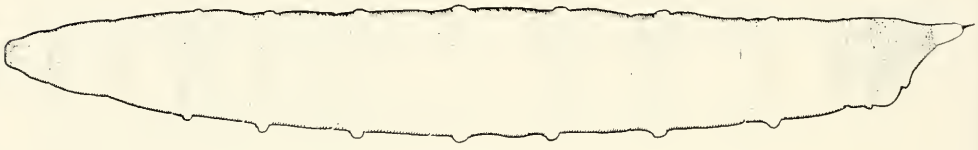
If third antennal segment has forward-projecting process, eye is bare; if eye is hairy, there is no forward projecting process on third antennal segment 9

8. Subcallus with erect black hairs laterally ..... *Agkistrocerus* Philip

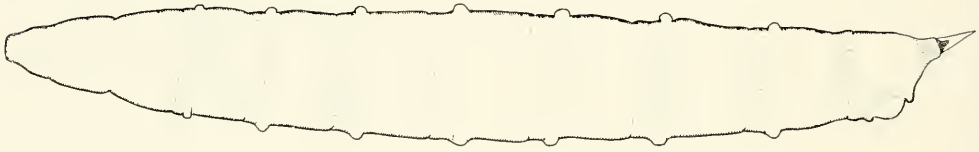
Subcallus without such hairs ..... *Hamatabanus* Philip

9. First antennal segment considerably longer than thick; third antennal segment with four divisions (three annuli); eye in life and wing with

21 callidus



22 cincticornis



23 whitneyi

24 crepuscularis

25 annulatus

Figures 21–22. Larvae of *Chrysops*.
Figure 23. Larva of *Merycomyia*.
Figure 24. Larva of *Chlorotabanus*.
Figure 25. Larva of *Leucotabanus*.

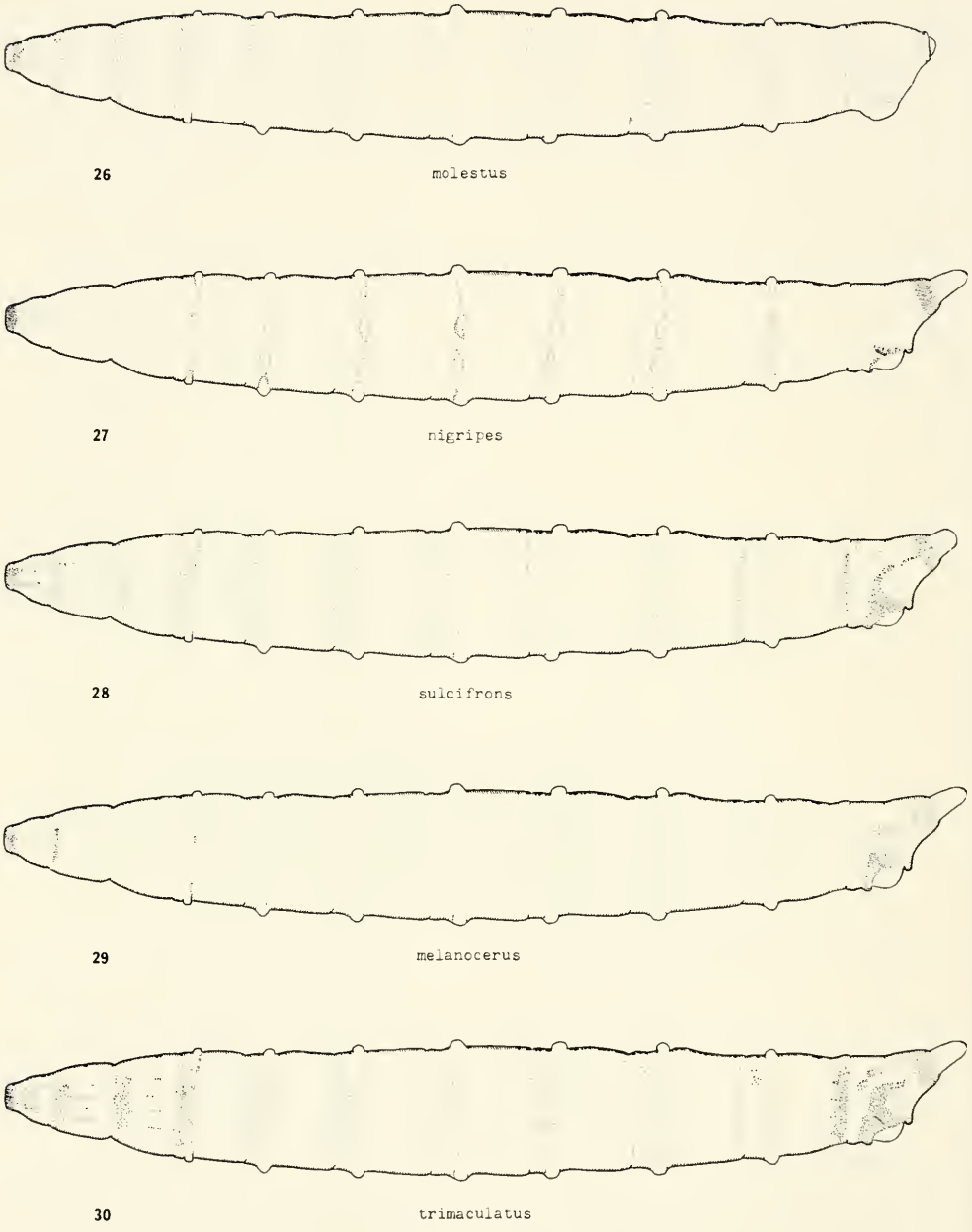
irregular bands and spots ..... *Haematopota* Meigen*

First antennal segment scarcely longer than thick; third antennal segment usually with five divisions (four annuli), if less, then wings hyaline; eye in life with regular bands or unicolorous 10

10. Vertex with distinct ocelligerous tubercle 11
Vertex without such tubercle; if vertex is raised in male, it is pollinose 12
11. Eye ostensibly bare; frons narrow, callosity long and narrow; scutellum pallid ..... *Leucotabanus* Lutz
Eye usually pilose; frons variable in width, basal callus correspondingly broad; scutellum dark ..... *Hybomitra* Enderlein
12. Subcallus very swollen and shiny; genae denuded, shiny; third antennal segment slender; black species; medium sized, 13–16 mm ..... *Whitneyomyia* Bequaert
Not with above combination of characters 13
13. Basicosta bare 14
Basicosta with hairs like those on costal vein 15
14. Frons of female narrow, height seven times width at base, median callus a slender line; wing with at least subapical brown spot ..... *Diachlorus* Osten Sacken
Frons less than six times as high as wide; wing hyaline, usually with stump vein at furcation ..... *Stenotabanus* Lutz
15. Small fly, 7–9 mm; annulate part of third antennal segment with three divisions ..... *Microtabanus* Fairchild*
Annulate part of third antennal segment with five divisions; length of fly variable ..... *Tabanus* Linnaeus

Key to Females of Chrysops

1. Wing entirely hyaline; small black species ..... *hyalinus* Shannon*
Wing infuscated, occasionally faint; if faint, at least face yellowish 2
2. Apex of wing beyond crossband usually hyaline, if trace of infuscation along costa, then submedian areas on first two abdominal tergites yellow 3
Apex of wing beyond crossband infuscated; i.e., apical spot present (narrow in some *brimleyi*) 7
3. Midfacial pollinose stripe beneath antennae ½ to ¾ distance to oral margin 4
No midfacial pollinose stripe (occasionally short stripe less than ⅛ distance to oral margin in *fulvistigma*) 5
4. Cell Cu_1 with basal hyaline lunule ..... *carbonarius* Walker
Cell Cu_1 entirely infuscated basally ..... *cincticornis* Walker
5. Wing picture with crossband saturate and reaching or nearly reaching hind margin, abdomen entirely dark ..... *niger* Macquart
Wing picture dilute, crossband fading well before hind margin or if crossband distinct submedian areas on 1st and 2nd abdominal tergites yellow 6
6. Both basal cells entirely hyaline; abdomen with yellow pattern basally ..... *fulvistigma* Hine
First basal cell dilutely infuscated; abdomen entirely dark ..... *nigribimbo* Whitney
7. Face with distinct median pollinose stripe usually extending ½ or more distance to oral margin; if stripe shorter then abdomen dark with median dorsal yellow stripe 8
Face bare, if stripe present, not extending more than ⅛ distance to oral margin 12
8. Abdomen yellow with black middorsal markings, usually forming solid longitudinal band; terminal segments darker 9
Abdomen otherwise marked 10
9. Fore coxae entirely yellow; apical spot terminating in middle ½ of cell R_4 ..... *dorsovittatus* Hine*
Fore coxae dark; apical spot usually filling all of cell R_4 and occasionally entering cell R_5 ..... *abatus* Philip
10. Abdomen with at least faint trace of yellow middorsally; first basal cell mostly hyaline or with at most only trace of infuscation throughout its length ..... *upsilon* Philip
Abdominal integument entirely black; first basal cell noticeably infuscated although clear window may be present distally 11
11. Both basal cells infuscated except for hyaline windows distally .....



Figures 26–30. Larvae of *Tabanus*.

amazon hubbelli Philip

First basal cell completely infuscated, second basal cell hyaline ..... *separatus* Hine

12. Base of vein R_4 (fork) with isolated spot or this may be extension from cross band (may be faint in *brimleyi*) 13

Fork with no prominent spot though area may be included in apical tinting of wings 14

13. Outer margin of crossband nearly

Key to Females of Chrysops (continued)

straight or gently bowed; apical spot narrow usually just reaching into outer corner of cell R_4 ..... *brimleyi* Hine

Outer margin of crossband usually strongly bowed; apical spot broad and drop-shaped; occasionally hyaline areas faintly infuscated ..... *fuliginosus* Wiedemann*

14. First basal cell completely infuscated, if hyaline spot in apex, it does not plainly cross cell; crossband reaching hind margin 15

First basal cell with at least subapical hyaline spot crossing cell, sometimes cell almost entirely hyaline (in *montanus* spur occasionally reaches apex); crossband not always reaching hind margin 29

15. Entire apex of wing infuscated except for isolated clear spot in cell R_3 above fork ..... *bistellatus* Daecke

Apical wing pattern otherwise 16

16. Wing pattern with usual hyaline areas luteous or tinted; usually yellowish brown species; if black, thorax with conspicuous yellow stripe on each side above wing base 42

Wing pattern in sharper contrast with definite hyaline areas 17

17. Abdomen bicolored, two basal tergites yellow, remainder black ..... *tiduelli* Philip & Jones*

Abdomen otherwise marked 18

18. Apex of hyaline triangle nearly reaching or crossing R_{2+3} and often going beyond (in occasional *parvulus* and *dacne*, hyaline triangle in cell R_3 is only vaguely indicated by reduced subhyaline crescentic margin along crossband) 22

Apex of hyaline triangle seldom reaching much beyond fork 19

19. Apex of hyaline triangle not extending beyond vein M_1 (rarely hyaline triangle extending into cell R_5, see variations) ..... *moechus* Osten Sacken

Apex of hyaline triangle extending beyond vein M_1 20

20. Abdomen with two submedian dark lines usually expanding posteriorly ..... *macquarti* Philip

Abdomen quadristriate 21

21. Frontal callosity and scutellum yellow ..... *vittatus* Wiedemann

Frontal callosity and scutellum predominantly dark ..... *striatus* Osten Sacken

22. Frontal callosity yellow often with brown upper margin 23

Frontal callosity black or occasionally with brown shades 24

23. Hyaline triangle with wide base on hind margin behind cell R_4; crossband usually not invading cell Cu_1 ..... *beameri* Brennan

Hyaline triangle very narrow, more crescentic, apical spot usually invading cell M_1, crossband often crossing cell Cu_1 as lighter shadow ..... *hinei* Daecke*

24. Abdomen yellow with either single median longitudinal black band or two prominent submedian black stripes; two sublateral stripes usually present on tergites 3–5 25

Abdomen otherwise marked 26

25. Abdomen with single median longitudinal black band; first basal cell lightly infuscated; apical spot fading in cell R_4 ..... **harmani** n. sp.

Abdomen with two submedian black stripes; first basal cell saturate, same color as crossband; apical spot extensive, filling all of cell R_4 and occasionally entering apex of M_1 ..... *pikei* Whitney

26. Abdomen yellow with four black stripes ..... *sequax* Williston

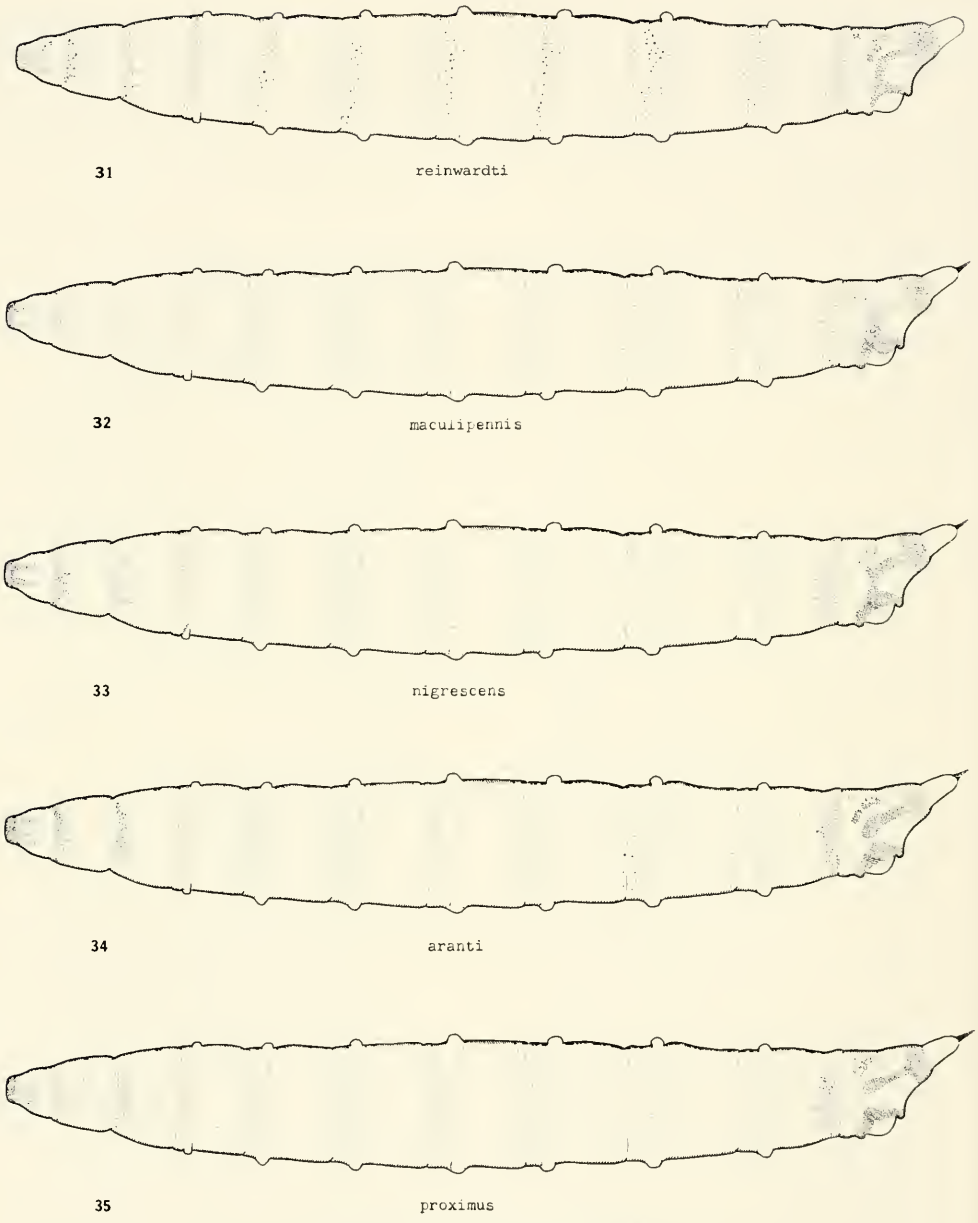
Abdomen otherwise marked 27

27. Thorax with conspicuous yellow stripe on each side above wing base 43

Thoracic bands confined to pleura 28

28. Hind legs predominantly yellowish to brown; abdomen usually with at least suggestions of one or three gray or yellowish stripes; apical spot crossing into cell R_5 at least as shadow ..... *dacne* Philip

Hind legs predominantly fuscous; abdomen dark, seldom with obscure pattern on tergite two;



Figures 31–35. Larvae of *Tabanus*.

apical spot usually fading in cell R_4 ..... *parvulus* Daecke

29. Apical spot just wider than cell R_1 at its origin and only exceptionally expanded distally; about ⅓ and ¼ of respective two basal cells infuscated; crossband fading well before hind margin; frontal callosity customarily yellow with brown upper margin rounded and almost as tall as broad; tergites one and two yellow with connected, sharp black hourglass-shaped spot; sternites two and

Key to Females of Chrysops (continued)

three with sublateral spots ..... *sackeni* Hine*

Without this combination of characters 30

30. Abdomen quadristriate or quadrivittate, usually with median inverted "V" on tergite two; apical spot drop-shaped, usually filling at least ½ of cell R_4, apex of hyaline triangle often reaching or even slightly crossing vein R_{2+3} ..... *montanus* Osten Sacken

Without this combination of characters 31

31. Apex of hyaline triangle clearly reaching or crossing vein R_{2+3}; first basal cell infuscated to about ½ or less than ½ its length 32

Apex of hyaline triangle not reaching vein R_{2+3} 37

32. Apical spot narrow, seldom widened apically; cell Cu_1 partially infuscated; hind femora black ..... *callidus* Osten Sacken

Apical spot widened beyond its origin, drop-shaped and usually extending into more than just apex of cell R_4; if apical spot narrow then cell Cu_1 mostly clear; hind femora variable in color 33

33. Abdomen predominantly blackish with long middorsal yellow stripe attenuated caudally, sometimes with abbreviated stripes on either side ..... *univittatus* Macquart

Abdomen predominantly yellow and otherwise patterned 34

34. Apical spot practically or quite separated from crossband by apex of hyaline triangle and occupying nearly whole of cell R_4; crossband at least filling cell M_3 to margin 35

Apical spot joined to crossband by about width of cell R_1 36

35. Second abdominal segment with two submedian dark dashes ..... *geminatus geminatus* Wiedemann

Second abdominal segment entirely yellow ..... *geminatus impunctus* Krober

36. Hind femora yellow; median spot on tergite one inconspicuous or very reduced; crossband may be dilute or saturate ..... *cursim* Whitney

Hind femora dark; conspicuous spot beneath scutellum on tergite one; crossband saturate; (occasional *dimmocki*, see couplet 38) ..... *pudicus* Osten Sacken

37. Apical spot extending along whole hind margin of wing enclosing pronounced contrasting subhyaline streak (sickle) along outer border of crossband; scapes strongly swollen; callus yellow; frontal callosity protuberant; body rich brownish with indefinite abdominal pattern ..... *brunneus* Hine

Without this combination of characters 38

38. Inverted "V" on tergite two tall, black, completely crossing tergite; hind femora and tibiae usually brown to black; frontal callus usually black ..... *dimmocki* Hine

Inverted "V" usually flattened, brownish, only occasionally attaining anterior margin; frontal callus yellow; usually hind femora and tibiae predominantly yellow 39

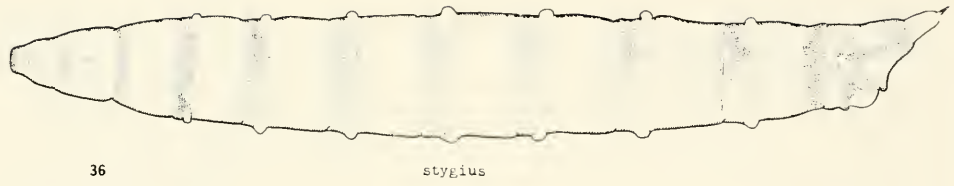
39. Wing pattern not sharply outlined, usual hyaline areas tinted; scapes moderately swollen but not to extent in *brunneus*; mesonotum typically grayish green with dark stripes (coastal species) ..... *atlanticus* Pechuman

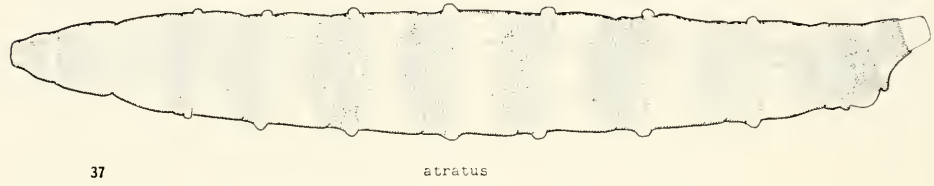
Wing pattern distinctly outlined or if usual hyaline areas slightly tinted then anterior ½ of second tergite pale translucent yellow; scapes of antennae but little swollen 40

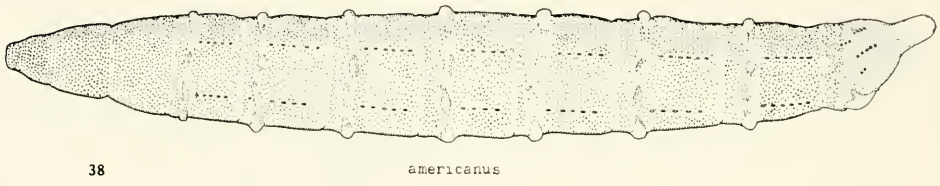
40. Thorax typically yellowish with brown stripes; outer margins of crossband usually rather straight; inverted brown "V" on tergite two not especially flattened, sides of this tergite brownish yellow ..... *flavidus* Wiedemann

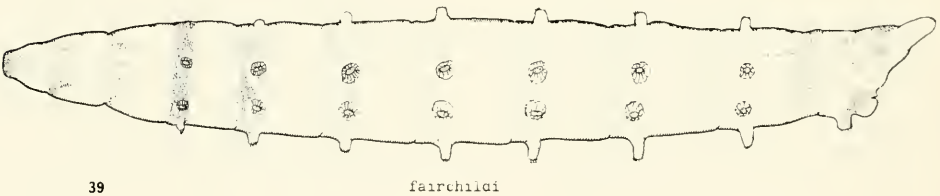
Differing in one or more of these characters 41

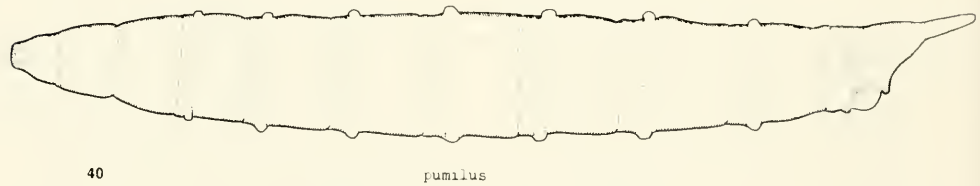
41. Tergite two with median "V" flattened to about ½ the length of tergite leaving anterior "collar" of pale translucent yellow; thorax











Figures 36–40. Larvae of *Tabanus*.

with yellow and brown stripes ..... *reicherti* Fairchild

Tergite two not as above; thorax grayish green with fuscous stripes ..... *celatus* Pechuman

42. Mostly black species 43
Yellowish brown species 44

43. Abdominal pattern usually consisting of three yellowish stripes, sometimes obsolescent laterally ..... *obsoletus* Wiedemann

Abdomen dark, without pattern or only trace of median yellow stripe ..... *obsoletus lugens* Wiedemann

44. Apical spot extending along whole hind margin of wing enclosing pronounced contrasting subhyaline streak (sickle) along outer

border of crossband; mesonotum yellowish with dark brown stripes; scapes strongly swollen ..... *brunneus* Hine

Subhyaline streak beyond crossband, if present, not pronounced; mesonotum grayish green with dark stripes; scapes moderately swollen ..... *atlanticus* Pechuman

Key to Males of Chrysops (excluding *abatus, amazon hubbelli, bistellatus, harmani,* and *tidwelli*).

1. Wing hyaline, at most only trace of infuscation; palpi black; small black species ..... *hyalinus* Shannon*
   Wing infuscated to varying degree, if faint and species black, then face and palpi with yellow 2
2. Apex of wing beyond crossband hyaline, at most occasional indefinite trace of infuscation along costa 3
   Apical spot present and distinct 7
3. Wing picture saturate, infuscated and hyaline areas contrasting 4
   Wing picture dilute (crossband distinct in occasional specimen of *fulvistigma*) 6
4. Frontoclypeus yellow with black lateral facial calli; midfacial pollinose stripe absent or reduced to small peg-like projection; apical portion of first and second basal cells usually partially hyaline; clear area in apex of second basal cell occasionally extending into base of cell Cu_1 ..... *niger* Macquart
   Frontoclypeus black with midfacial pollinose stripe that extends at least ½ the distance to oral margin; apical portion of first and second basal cells completely hyaline 5
5. Well defined clear lunule in base of cell Cu_1 ..... *carbonarius* Walker
   Cell Cu_1 without basal clear lunule ..... *cincticornis* Walker
6. Abdomen and first basal cell entirely dark brown to black ..... *nigribimbo* Whitney
   Abdomen with basal yellow patterns; first basal cell not infuscated ..... *fulvistigma* Hine
7. Entirely black; apical spot distinctly separated from crossband; both basal cells infuscated ..... *separatus* Hine
   Not as above 8
8. Abdomen yellowish with contrasting middorsal black stripe; distinct midfacial pollinose stripe ..... *dorsovittatus* Hine*
   Not as above 9
9. Midfacial pollinose stripe present and lateral facial calli often protuberant; apical spot broad including cell R_4 10
   Midface bare, or abbreviated spur on usually less than upper ⅓ of face; facial calli only exceptionally protuberant; apical spot variable 12
10. Apex of hyaline triangle exceeding vein R_{2+3}; prominent midfacial pollinose stripe ..... *upsilon* Philip
    Apex of hyaline triangle seldom extending much beyond fork; midfacial pollinose stripe reduced to very thin broken line or represented by short stump that extends approximately ⅓ or less distance to oral margin 11
11. Midfacial pollinose stripe very thin, extending most of distance to oral margin; facial pollinosity yellow; occasionally trace of yellow median line on abdominal dorsum ..... *dacne* Philip
    Midfacial pollinose stripe extending less than ⅓ distance to oral margins; facial pollinosity gray; abdomen entirely black ..... *parvulus* Daecke
12. Whole apical area of wing smoky, enclosing hyaline triangle; usually wing pattern dilute and indefinite; second basal cell often extensively hyaline (some *cursim, pudicus,* and *celatus* with very faint wing infuscation, see couplet 27) 13
    Wing pattern normally saturate, sharp and contrasting with definite apical spot although latter may occasionally be contiguous with faint infuscation in hyaline areas along posterior wing margin 18

Key to Males of Chrysops (continued)

13. Primarily dark species; frontoclypeus pale yellow with dark brown or black facial calli and gena 14
Yellow or tan species; entire face bright yellow 16
14. Yellow stripe on each side of thorax above wing base 35
Thorax darker, not as above 15
15. Scape, fore coxa, femur, yellow to brown; pleura with obvious plumbeous stripes ..... *parvulus* Daecke
Scape, fore coxa, femur, black; faint stripes on pleura ..... *fuliginosus* Wiedemann*
16. Basal ½ of tergite two pale translucent yellow ..... *reicherti* Fairchild
Basal ½ of tergite two straw yellow to brownish yellow 17
17. Robust scapes; median series of indefinite geminate spots on abdomen; indefinite infuscated wing pattern although crossband and apical spot may be somewhat darker ..... *atlanticus* Pechuman
Distinctively swollen scapes; indefinite abdominal pattern; wing pattern distinct, pronounced enclosed hyaline sickle or window beyond crossband ..... *brunneus* Hine
18. Apical spot widened including practically all of cell R_4, often invading cell R_5 (occasional *univittatus* with cell R_4 infuscated, see couplet 23) 30
Apical spot seldom reaching beyond ½ of cell R_4 19
19. Apical spot relatively slender, hardly widened beyond its juncture with crossband and reaching narrowly into apex of cell R_4; dark brown to black hind femora; at least apices of first and second basal cells clear 20
Apical spot noticeably widened beyond origin; occasionally separated from crossband, usually invading about ½ of cell R_4; femora variable in color; first and second basal cells may or may not be infuscated 21
20. Apical spot at its origin somewhat wider than cell R_1 ..... *sackeni* Hine*
Apical spot at its origin not wider than cell R_1 ..... *callidus* Osten Sacken
21. Body without yellow markings; usually definite cloud on base of vein R_4 at fork 22
Body with various yellow patterns; no cloud on fork 23
22. Outer margin of crossband noticeably bowed (see also couplet 33) ..... some *fuliginosus* Wiedemann*
Outer margin of crossband nearly straight ..... *brimleyi* Hine
23. Lateral facial calli and lower genae dark brown to black; abdomen fuscous with conspicuous middorsal yellow stripe attenuated caudally ..... *univittatus* Macquart
Face and cheeks entirely yellow 24
24. Second basal cell predominantly hyaline; abdomen pale yellow, often with indefinite light brown or fuscous markings, that on tergite two and inverted "V" usually not reaching anterior margin 25
Second basal cell at least ½ infuscated; abdominal pattern otherwise 29
25. Ground color of thoracic dorsum and scutellum typically yellow-brown 26
Ground color of thoracic dorsum and scutellum typically green-gray 27
26. Tergite two with broad pale translucent yellow basal band above flat, broad, brown inverted "V"; outer margin of crossband often gently sinuous; posterior hyaline areas along wing margin often lightly tinted ..... *reicherti* Fairchild
Base of tergite two straw yellow, about same color as others, median figure usually taller; outer margin of crossband straight; hyaline areas usually clear ..... *flavidus* Wiedemann
27. Inner margin of crossband dilute, bases of discal (first M_2) and R_3 cells extensively subhyaline ..... *cursim* Whitney
Inner margin of crossband practically filling discal and R_3 cells to their bases 28

Key to Males of Chrysops (continued)

28. First basal cell infuscated with prominent distal hyaline area; facial calli not noticeably swollen ..... *celatus* Pechuman
First basal cell entirely infuscated at least faintly; facial calli slightly protuberant ..... *pudicus* Osten Sacken
29. Abdomen quadrivittate, tergite two with sublateral black spots ..... *montanus* Osten Sacken
Abdomen not vittate, tergite two yellow on either side of median figure ..... *dimmocki* Hine
30. Body predominantly dark, abdomen sometimes with one or three light stripes 31
At least abdomen with extensive yellow and dark pattern 36
31. Femora and fore coxae black; usually no suggestions of abdominal stripes and no yellow thoracic stripes though pleura may have plumbeous markings 32
Femora and much of fore coxae yellow; sides of thorax and often abdomen with yellow stripes 34
32. Hyaline triangle sharply limited to apices of cells M_1 and M_2 (cell R_5 entirely infuscated) ..... *moechus* Osten Sacken
Hyaline triangle at least invading cell R_5 33
33. Outer border of crossband gently bowed, apex of hyaline triangle crossing vein R_{2+3}; small isolated spot at fork; hyaline areas in apices of basal cells ..... *brimleyi* Hine
Outer border of crossband sinuous, sometimes connecting along vein R_{4+5} with spot at fork, thus isolating diagonal dash in cell R_3, which represents apex of hyaline triangle; whole apex of wing and apices of basal cells may otherwise be tinted ..... *fuliginosus* Wiedemann*
34. No yellow stripe on thorax above wing base, gray to yellowish stripes confined to pleura ..... *parvulus* Daecke
Yellow stripe on each side of thorax above wing base 35
35. Abdomen with one or three definite yellowish lines ..... *obsoletus obsoletus* Wiedemann
Abdomen dark, at most trace of median line on tergite two ..... *obsoletus lugans* Wiedemann
36. Wing mostly infuscated except hyaline areas in distal portion of first basal cell, most of second basal cell, and along distal margin of crossband; abdominal pattern indefinite brown bands on pale yellow 37
Wing with hyaline areas usually more extensive, hyaline triangle usually open to hind margin; abdomen variable, usually striate 38
37. Dorsum of thorax grayish green with three fuscous stripes ..... *celatus* Pechuman
Dorsum of thorax with brown and yellow stripes ..... *reicherti* Fairchild
38. Apex of hyaline triangle nearly or quite reaching vein R_{2+3} and occasionally crossing it 39
Apex of hyaline triangle just enveloping fork 45
39. Apex of hyaline triangle usually terminating in cell R_3; abdomen with two to four black lines 40
Apex of hyaline triangle usually separating the apical spot from crossband; abdominal tergite two mostly yellow with or without pair of small dark dashes 41
40. Facial calli and lower gena predominantly brown to black 42
Facial calli and gena predominantly yellow, sometimes with narrow darkened area near lateral margin 43
41. Second abdominal segment with two submedian dashes ..... *geminatus geminatus* Wiedemann
Second abdominal segment yellow ..... *geminatus impunctus* Krober
42. Lateral abdominal stripes incomplete, not reaching tergite one ..... *pikei* Whitney
Lateral abdominal stripes complete to tergite one ..... *sequax* Williston
43. A median black figure on tergite two broadly joined to black figure of tergite one; the median yellow triangles do not reach anterior

Key to Males of Tabanus (continued)

borders of tergites ..... *montanus* Osten Sacken

Abdomen dorsally with four longitudinal dark stripes 44

44. Abdomen with four black lines equal in length and attaining tergite one; hind tibiae not swollen; cell Cu_1 and 2nd basal cell predominantly hyaline ..... *beameri* Brennan

Abdomen with two submedian black lines and two shorter sublateral lines which do not attain tergite one; hind tibiae slightly expanded; cell Cu_1 and 2nd basal cell considerably infuscated ..... *hinei* Daecke*

45. Abdominal pattern transverse; first basal cell hyaline in apex ..... occasional dark *flavidus* Wiedemann

Abdominal pattern linear; first basal cell infuscated to apex 46

46. Ground color of thorax and scutellum yellow ..... *vittatus* Wiedemann

Ground color of thorax and scutellum plumbeous 47

47. Dorsum of abdomen predominantly dark with trace of yellow on the sides and conspicuous yellow median stripe ..... *macquarti* Philip

Dorsum of abdomen predominantly yellow with four more or less complete black stripes, occasionally lateral ones reduced to small isolated spots ..... *striatus* Osten Sacken

Key to Females of Tabanus

1. Eye sparsely pilose; body length 10–14 mm; abdomen brownish with row of thin median spots and rounded sublateral spots; second palpal segment slender; wing hyaline; eye in life green with single diagonal purple band 2

Not agreeing entirely with the above 3

2. Frons 2.5–3.5 times as high as wide, the basal callus usually transverse; base of third antennal segment slender ..... *quaesitus* Stone

Frons about four times as high as wide, the basal callus higher than wide; base of third antennal segment rather stout ..... *exilipalpis* Stone*

3. Abdomen dorsally with both median and sublateral pale spots or triangles which may or may not be contiguous on consecutive tergites (sublateral spots very faint on *acutus* but midstripe prominent, coastal species) 4

Abdomen dorsally unicolorous (except dark markings on some *abdominalis*), or with single median row of pale spots or triangles which sometimes arise from pale apical bands; these bands may widen laterally but do not form distinct sublateral spots or triangles (sublateral pale spots sometimes present on tergite two only) 29

4. Abdomen dorsally with median, parallel-sided pale stripe 21

Abdomen dorsally with median row of pale spots or triangles, which may be contiguous but do not form parallel-sided stripe 5

5. Mesonotum covered with golden yellow hair, without longitudinal stripes; conspicuous middorsal golden abdominal stripe widening posteriorly on each tergite; frons ratio 1:5 or greater, widened above 6

Without this combination of characters 7

6. Palpi creamy yellow; genae and pleurae with yellow hair; third antennal segment with annulate part black; femora gray to black ..... *fulvulus* Wiedemann

Palpi white; genae and pleurae with white hair; third antennal segment usually orange, often annulate portion darkened; femora yellowish ..... *pallidescens* Philip

7. Length usually 12 mm or more; frons variable, usually parallel-sided or only slightly widened above 8

Length less than 12 mm; frons distinctly widened above; dark gray to black species 19

8. Wing distinctly mottled or varie-

Key to Females of Tabanus (continued)

gated; frons ratio approximately 1:3 ..... *venustus* Osten Sacken

Wing not variegated; frons ratio variable 9

9. Dark gray species with hyaline wing; third antennal segment with basal portion entirely black; second palpal segment stout; eye in life with single band ..... *fairchildi* Stone

Without this combination of characters 10

10. Wing mostly hyaline with conspicuous isolated spots on cross veins and fork; moderate to large, dark gray species 11

Wing without conspicuous isolated spots on cross veins and fork; medium to small, dark brown to orange-brown species 12

11. Frons ratio approximately 1:4.5; basal callus distinctly higher than wide ..... *cymatophorus* Osten Sacken

Frons ratio 1:2.5–1:3; basal callus subquadrate ..... *reinwardti* Wiedemann

12. All wing veins margined with brown; frons ratio 1:3 to 1:3.5 ..... *gracilis* Wiedemann*

Longitudinal veins not margined with brown 13

13. Third antennal segment uniformly orange-brown; eye in life with two bands; dorsum of thorax with yellowish cast ..... *zythicolor* Philip

Third antennal segment with annulate part black; number of eye bands variable; thorax usually darker 14

14. Frons ratio less than 1:3; eye in life with single band (coastal species) ..... *texanus* Hine

Frons ratio 1:3 or greater; eye in life with two or more bands 15

15. Frons ratio 1:4 to 1:5; plate of third antennal segment only slightly longer than broad; costal cell rather intensely yellow; legs primarily yellowish brown; fore femora, apices of tibiae, and tarsi, darkened ..... *longiusculus* Hine

Without this combination of characters 16

16. Frons broad, ratio approximately 1:3; 2nd palpal segment swollen at base ..... *sagax* Osten Sacken

Frons narrow, ratio usually greater than 1:3.5; 2nd palpal segment usually not much enlarged 17

17. Frons distinctly widened above ..... *sackeni* Fairchild*

Frons at most only slightly widened above 18

18. Frons ratio less than 1:5; plate of third antennal segment long and slender, about twice as long as width at widest portion ..... *sublongus* Stone

Frons ratio greater than 1:5; plate of third antennal segment broad, only slightly longer than width at widest portion ..... *wilsoni* Pechuman

19. Eye in life or relaxed specimens with two bands; median callus subquadrate; palpus not strongly swollen basally and not sharply pointed ..... *pumilus* Macquart

Eye unicolorous or with one purple band; median callus slender; palpus strongly swollen basally with apex acute 20

20. Eye unicolorous ..... *sparus* Whitney*

Eye with single purple band ..... *sparus milleri* Whitney

21. Length 16–21 mm; fork with small dark spot ..... *acutus* (Bigot)

Length usually 9–15 mm; fork without dark spot 22

22. Eye in fresh or relaxed specimens with single reddish purple band; frons nearly parallel-sided; costal cell colored, sometimes faintly 23

Eye in fresh or relaxed specimens with at least 2 bands; frons usually widened above; costal cell as hyaline as rest of wing 27

23. Palpi and pleurae yellow to creamy yellow; costal cell infuscated; dorsum of thorax yellowish usually with conspicuous golden pollinosity 24

Palpi white or creamy white; pleurae grayish, dorsum usually grayish to cinereous, occasionally yellowish; costal cell variable 25

24. Frons ratio 1:3.4 or less (coastal

Key to Females of Tabanus (continued)

species of Louisiana and Texas) ... *eadsi* Philip

Frons ratio usually about 1:3.5 or greater ... *quinquevittatus* Wiedemann*

25. Abdomen predominantly yellowish laterally; costal cell yellowish to clear; femora mostly black (coastal species) ... *nigrovittatus* Macquart

Abdomen tan to dark brown or black laterally, sublateral pale spots faint; costal cell deeply infuscated; femora variable ... 26

26. Basal callus usually brown; legs usually yellowish brown to dark brown; abdomen light to medium brown with light median stripe and small sublateral rounded spots ... *fuscicostatus* Hine

Basal callus dark brown to black; femora, apical portions of tibiae and tarsi, black; abdomen dorsally dark brown to black at least posteriorly, with light median stripe and occasionally faint sublateral spots ... *mularis* Stone

27. Scutellum reddish at posterior margin ... *subsimilis* Bellardi

Scutellum and thorax concolorous, dark ... 28

28. Abdomen predominantly yellow-brown; the two submedian dark stripes reduced (coastal form) ... *lineola hinellus* Philip

Dorsum of abdomen predominantly dark with sublateral pale stripes reduced ... *lineola lineola* Fabricius

29. Abdomen unicolorous, usually dark, lacking middorsal triangles (some *abdominalis* with median dark spots) ... 30

Abdomen bicolorous; faint to distinct pale median triangles or spots with or without apical bands, or bands only ... 41

30. Abdomen deep reddish brown to reddish purple; wing hyaline with furcation and cross veins distinctly margined with brown, costal cell brown; prominent tufts of hair above and below wing base; frons 3–3.5 times higher than basal width, parallel sided; antennae orange ... 64

Without above combination of characters ... 31

31. Subcallus protuberant, shiny; wing dark brown, no distinct spot at furcation ... 32

Subcallus pollinose, not protuberant; wing variable ... 33

32. At least upper ½ of genae shiny brown to black; frons ratio approximately 1:2 to 1:2.5 ... *atratus* Fabricius

Genae pollinose; frons ratio 1:3 to 1:4 ... *wiedemanni* Osten Sacken

33. Reddish brown species; antennae brown; frons widened above, ratio 1:6.5 or greater; occasionally very faint small abdominal triangles; wings faintly tinted, occasionally with faint spots at furcation and cross veins, cell R_5 not narrowed apically ... *aar* Philip

Without above combination of characters ... 34

34. Hair of genae and pleurae, pale to yellow ... 35

Genae (at least hair), and entire pleurae dark brown to black ... 37

35. Spot at furcation; fore femora black ... 68

No spot at furcation; fore femora orange to reddish brown ... 36

36. Wing hyaline, costal cell dark brown; genae orange yellow; pronounced tufts of white hair above and below wing base ... *americanus* Forster

Wing uniformly dilute brown; genae pale to gray; tufts at wing base not especially pronounced ... *calens* Linnaeus

37. Frons ratio approximately 1:6, widened above; median callus long and slender; wings subhyaline with prominent spot at furcation; thorax deep reddish brown to reddish purple ... *proximus* Walker

Frons ratio less than 1:5.5 and differing in at least one other character ... 38

38. Abdomen black with bluish pruinosity; 3rd antennal segment mostly black; frons ratio approximately

Key to Females of Tabanus (continued)

1:4 to 1:5; wing uniformly dark ..... *aranti* Hays
Not agreeing entirely with above 39
39. Mesonotum covered with distinct white hair and pollen ..... *stygius* Say
Mesonotum dark brown to black 40
40. Wing nearly hyaline distad of basal cross vein ..... *nigrescens* Palisot de Beauvois*
Wing nearly uniformly dark ..... *colon* Thunberg
41. Fork without infuscation 42
Fork with infuscation, either distinct spot or extension of vein margin infuscation (spot faint in some *coarctatus, equalis, molestus,* and *turbidus*) 51
42. Medium sized fly; scutellum with distinct white pile; abdomen with conspicuous pale triangles or spots, spot on tergite 2 distinctly smaller than those on tergites 3 and 4; abdominal venter without median dark stripe 55
Without above combination of characters 43
43. Medium sized brownish fly with median row of pale abdominal triangles; wing clear, costal cell deeply infuscated; frons approximately 4.5 times higher than basal width; third antennal segment dirty orange; legs entirely brownish ..... *kisliuki* Stone*
Without above combination of characters 44
44. Median abdominal spots, if present, not contrasting sharply with remainder of tergites; palpi slender, tan to reddish brown 45
Contrasting median abdominal triangles present dorsally; palpi thicker basally, whitish to cream colored 47
45. Medium sized fly; costal cell hyaline to faintly tinted ..... *rufofrater* Walker
Large fly; costal cell yellow or brown 46
46. Wing hyaline, costal cell dark brown; abdomen usually with apical bands ..... *americanus* Forster
Wing uniformly dilute brown ..... *calens* Linnaeus
47. Subcallus denuded or very thinly pollinose; small compact fly not over 16 mm long; brownish black with single median row of triangles on abdomen arising from pale posterior bands; fore tibiae not distinctly bicolored, although there may be pale hair basally ..... *nigripes* Wiedemann
Subcallus not denuded 48
48. Abdomen black with median white triangles confined to segments 3–5; if very small triangle remains on tergite two, then fore tibiae entirely dark 49
Abdomen gray to brownish black, white median triangles or spots on segments 1–6 50
49. Fore tibiae distinctly bicolored; no median spot on abdominal tergite two although two sublateral pale spots may sometimes be present ..... *trimaculatus* Palisot de Beauvois
Fore tibiae entirely dark; very small median pale spot on abdominal tergite two ..... *superjumentarius* Whitney*
50. Cell R_5 narrowed to closed; abdominal triangle of tergite two sometimes not attaining anterior margin; hind tibia usually with extreme apex dark ..... *melanocerus* Wiedemann
Cell R_5 usually petiolate; abdominal triangle of tergite two usually attaining anterior margin, slightly expanded; hind tibiae usually entirely yellowish ..... *petiolatus* Hine
51. Abdomen with contrasting, pale median spots or triangles 52
Abdomen with indistinct median spots or triangles 63
52. No median spot on tergite two; fore tibia distinctly bicolored; venter of abdomen with distinct median brownish black stripe ..... *trimaculatus* Palisot de Beauvois
Median pale spot usually present on tergite 2 or at least posterior margin pale; differing in at least one other character 53

Key to Females of Tabanus (continued)

53. Median spot on tergite 2, if present, distinctly smaller than those on tergites three and four; scutellum with distinct pale pile 54
Without this combination of characters 56

54. Abdomen black with small median triangles; venter grayish with wide median black stripe ..... *superjumentarius* Whitney*
Abdominal triangles rather large and broad; venter not as above 55

55. Frons less than six times as high as basal width, only moderately widened above; middle and hind tibiae pale to dark reddish brown, apices not markedly darker ..... *molestus* Say
Frons more than 6 times as high as basal width, wider above; middle and hind tibiae creamy white, extreme apices dark ..... *moderator* Stone

56. Fore tibia bicolored, basal part yellowish brown to cream with pale hair, apical part dark brown with black hair ..... *sulcifrons* Macquart
Fore tibia unicolorous, or rarely base brownish with orange hair and apex darker 57

57. Venter of abdomen black with strongly contrasting, rather broad white bands ..... *trijunctus* Walker*
Venter of abdomen brownish, pale bands, if present, not strongly contrasting 58

58. Medium sized; plate of third antennal segment with very slight or no dorsal excision; frons ratio approximately 1:4 with parallel sides; basal callus, antennae, palpi, legs, mostly brown; abdomen brown with gray median triangles; tergites with grayish posterior margins which expand laterally; wing almost hyaline with infuscation at fork and cross veins; cell R_5 somewhat narrowed apically; body length usually less than 18 mm ..... *endymion* Osten Sacken
Without this combination of characters 59

59. Frons ratio 1:5 or greater; legs uniformly orange brown; cell R_5 closed or strongly narrowed apically; wings subhyaline with dark infuscation at fork and cross veins; abdomen brown with median row of small grayish yellow triangles ..... *nefarius* Hine
Without this combination of characters 60

60. Abdomen dorsally orange brown or grayish brown with moderate to rather large median triangles 61
Abdomen dark reddish purple to nearly black with small median white spots that may be longer than broad 64

61. Cell R_5 narrowed apically; frons ratio 1:4 to 1:5.6; fore femora dark brown to black ..... *sulcifrons* Macquart
Not agreeing entirely with above 62

62. Frons 2.5–3.5 times as high as wide with parallel sides; cell R_5 narrowed apically ..... *cheliopterus* Osten Sacken
Frons about four or more times as high as basal width, widened above; cell R_5 not narrowed apically 70

63. Deep reddish brown to reddish purple species; prominent tufts of hair around wing base; wing hyaline to subhyaline with dark infuscation at furcation and cross veins; antenna, palpus, legs, orange brown; subcallus, clypeus, genae, yellowish brown; frons ratio approximately 1:3 to 1:3.5 64
Without this combination of characters 65

64. Plate of 3rd antennal segment dorsally with prominent forward-projecting tooth-like process; eye in life or relaxed specimens with narrow median band and broad band at lower eye margin ..... *imitans* Walker
Dorsal process of plate without prominent tooth-like process; eye in life or relaxed specimens with 2 median bands ..... *maculipennis* Wiedemann

Key to Females of Tabanus (continued)

65. Cell R_5 narrowed or closed apically ... 66
Cell R_5 not narrowed apically ... 69
66. Frons ratio 1:5 or greater; legs uniformly orange-brown; cell R_5 closed or strongly narrowed apically; wings subhyaline with dark infuscation at fork and cross veins; abdomen brown, median row of triangles faint or absent ... *nefarius* Hine
Without this combination of characters ... 67
67. Legs predominantly orange-brown ... *cheliopterus* Rondani
Legs, at least femora, predominantly black ... 68
68. Abdomen reddish brown; mesonotum with lavender tone and narrow gray lines; hind tibia reddish brown to dark brown; palpus slender, strap-like, with apex truncate ... *gladiator* Stone
Abdomen orange; mesonotum yellowish with dark lines; hind tibia orange except apical ¼, which is dark brown to black; palpus moderate in width, tapering to narrow apex ... *abdominalis* Fabricius
69. Clypeus, genae, and pleurae brownish with concolorous hair; abdomen orange-brown with at most only faint suggestions of middorsal triangles, occasionally lateral margins dark; body length 18–25 mm ... *aar* Philip
Clypeus, genae, and pleurae gray to grayish brown with pale hair; abdomen with or without faint middorsal triangles, usually with lateral pale areas arising from pale posterior margins of each tergite ... 70
70. Costal cell clear; legs brown, fore femora dark brown to black; hair on fore femora black, tibial fringes mostly black; white or mixed black and white hair on rest of legs ... *rufofrater* Walker
Costal cell infuscated; legs uniformly reddish to reddish brown with white or concolorous hair ... 71
71. Third antennal segment entirely black, basal portion with rather obtuse dorsal process and only slight dorsal excision; palpi beige with mostly pale hair; wing veins not margined with brown (occasionally margin of R_{2+3} lightly tinted); body length usually less than 17 mm ... *coarctatus* Stone
Not agreeing entirely with above ... 72
72. Wing veins margined with brown; frons usually six or more times greater than basal width; third antennal segment mostly orange ... *turbidus* Wiedemann
Wing veins usually not margined or at most faintly margined with brown; frons height usually 5.5 times or less than basal width; third antennal segment mostly black ... *equalis* Hine

Key to Males of Tabanus (not including *exilipalpis, kisliuki,* and *nefarius*)

1. Eye with dense long pile; body length 10–14 mm; antenna slender; abdomen brownish with row of thin median spots and rounded sublateral spots ... *quaesitus* Stone
Not agreeing entirely with above ... 2
2. Abdomen dorsally with both median and sublateral pale spots or triangles, or sublateral spots only; median pale markings may form parallel-sided stripe (sublateral spots very faint but median stripe pronounced on *acutus*, coastal species) ... 3
Abdomen dorsally unicolorous (except dark markings on some *abdominalis* and *gladiator*), or with single median row of pale spots or triangles, which sometimes arise from pale apical bands; these bands may widen laterally but do not form distinct sublateral spots or triangles; (sublateral pale spots sometimes present on tergite two only) ... 27
3. Abdomen dorsally with median, parallel-sided pale stripe ... 19
Abdomen dorsally with median row of pale triangles or spots, which may be contiguous but do not form parallel-sided stripe; some-

Key to Males of Tabanus (continued)

times only sublateral spots present 4

4. Length 11 mm or less; small dark gray to brownish species; costal cell hyaline; median abdominal triangles faint or absent, sublateral spots rounded 5
   Length 11 mm or more; if less, costal cell infuscated 7
5. Femora mostly brownish, concolorous with tibiae or nearly so; eye in life or relaxed specimens with two narrow green bands, the upper partially covered by large facets ..... *pumilus* Macquart
   Femora mostly black, basal portion of tibiae light tan; eye in relaxed specimens with single purple band or none 6
6. Eye with single purple band ..... *sparus milleri* Whitney
   Eye without band ..... *sparus* Whitney*
7. Dark gray species; third antennal segment with plate entirely black; wing hyaline without spot at furcation ..... *fairchildi* Stone
   Without this combination of characters 8
8. Wing mostly hyaline with conspicuous isolated spots on cross veins and fork 9
   Wing without conspicuous isolated spots on cross veins and fork 10
9. Eye bare to sparsely pilose, upper and lower eye facets strongly differentiated; antennae mostly orange ..... *cymatophorus* Osten Sacken
   Eye distinctly pilose, upper and lower eye facets not sharply differentiated; antennae mostly blackish ..... *reinwardti* Wiedemann
10. Costal cell darkly infuscated 11
    Costal cell clear or faintly tinged yellow 13
11. Antenna entirely light orange ..... *zythicolor* Philip
    Antenna with annulate portion black 12
12. Sublateral abdominal spots extensive and contiguous (coastal species) ..... *texanus* Hine
    Sublateral abdominal spots reduced and isolated ..... *longiusculus* Hine
13. Palpi creamy yellow; genae and pleurae with yellow hairs; third antennal segment with annulate portion black; femora gray to black; areas of large and small eye facets not sharply differentiated ..... *fulvulus* Wiedemann
    Without this combination of characters 14
14. Hair of thoracic dorsum yellow; sublateral abdominal spots yellow 15
    Hair of thoracic dorsum gray to dark; sublateral abdominal spots pale brownish gray or brownish yellow 17
15. Annulate portion of third antennal segment usually yellowish; conspicuous golden yellow pollen and pile on dorsum of thorax; palpi white to creamy ..... *pallidescens* Philip
    Annulate portion of third antennal segment black; ground color of thoracic dorsum gray with golden yellow pile; palpi variable 16
16. Median abdominal stripe broad; hair of genae yellowish white; second palpal segment stout, yellow-brown ..... *sagax* Osten Sacken
    Median abdominal stripe narrow; hair of genae pale gray; second palpal segment relatively slender, creamy white ..... *sublongus* Stone
17. Third antennal segment uniformly orange-brown; wing veins usually margined with brown ..... *gracilis* Wiedemann*
    Third antennal segment with annulate portion black; wing veins not margined with brown 18
18. Areas of large and small eye facets sharply differentiated ..... *sackeni* Fairchild*
    Areas of large and small eye facets not sharply differentiated ..... *wilsoni* Pechuman
19. Fork with small dark spot ..... *acutus* (Bigot)
    Fork without dark spot 20
20. Annulate portion of third antennal segment as long or longer than base; costal cell usually infuscated 21

Key to Males of Tabanus (continued)

Annulate portion of third antennal segment shorter than base; costal cell hyaline 25

21. Palpus, pleura, costal cell yellowish; thorax and yellowish stripe of abdomen golden pollinose 22
Palpus white or creamy white; pleura grayish; dorsum usually grayish to cinereous; costal cell variable 23

22. Costal cell brownish; gena, pleural pile, light yellow; (coastal species of La. and Texas) ..... *eadsi* Philip
Costal cell yellow; gena, pleural pile, darker yellow ..... *quinquevittatus* Wiedemann*

23. Eye in life or relaxed specimens with single reddish purple band readily visible just beneath upper eye facets; abdomen predominantly yellowish laterally; costal cell yellowish to clear (coastal species) ..... *nigrovittatus* Macquart
Without this combination of characters 24

24. Legs predominantly yellowish brown; abdomen extensively yellowish brown ..... *fuscicostatus* Hine
Femora, apical portions of tibiae and tarsi, black; abdomen predominantly dark brown to black, at least so apically ..... *mularis* Stone

25. Scutellum reddish at posterior margin ..... *subsimilis* Bellardi
Scutellum and thorax concolorous, dark 26

26. Palpi usually pale yellow; median pale abdominal stripe broad (coastal form) ..... *lineola hinellus* Philip
Palpi creamy white; median pale abdominal stripe thinner ..... *lineola lineola* Fabricius

27. Abdomen unicolorous, except dark abdominal markings on some *abdominalis* and *gladiator* 28
Abdomen bicolorous; faint to distinct pale median triangles or spots with or without apical bands, or bands only 39

28. Fork without dark spot, although whole wing may be infuscated 29
Fork with distinct dark spot 32

29. Entirely black species 30
Otherwise colored 42

30. Frontal triangle and genae shiny brown to black ..... *atratus* Fabricius
At least genae pollinose 31

31. Frontal triangle pollinose and flattened in profile ..... *aranti* Hays
Frontal triangle denuded and somewhat raised in profile ..... *wiedemanni* Osten Sacken

32. Deep reddish brown to reddish purple species; tufts of prominent hair around wing base; wing hyaline to subhyaline with dark infuscation at furcation and cross veins; antennae, palpi, legs, orange-brown; clypeus, genae, yellowish to grayish yellow; upper eye facets distinctly enlarged, sharply differentiated from lower facets 58
Without this combination of characters 33

33. Genae light to dark gray ..... *proximus* Walker
Genae dark brown or yellow; if genae gray then abdomen reddish orange 34

34. Abdomen black, first tergite with bluish pruinosity; third antennal segment entirely black ..... *aranti* Hays
First abdominal tergite lacking bluish pruinosity; antennae variable, not entirely dark 35

35. Wing almost uniformly dark ..... *colon* Thunberg
Wing subhyaline or at least lighter apically 36

36. Antenna mostly orange; entirely dark chocolate brown species, dorsum of thorax with lighter hair and ground color ..... *stygius* Say
Not agreeing entirely with above; if entirely dark species, thorax concolorous with rest of body, antenna usually with at least annulate part brown 37

37. Abdomen blackish brown; entirely chocolate brown species ..... *nigrescens* Palisot de Beauvois*
Abdomen orange to reddish brown 38

Key to Males of Tabanus (continued)

38. Cell R_5 not narrowed apically ..... *aar* Philip
Cell R_5 narrowed or closed apically .. 61
39. Wing variegated; first tergite black, second with narrow, sometimes incomplete, posterior, pale band nearly uniform in width ..... *venustus* Osten Sacken
Not as above 40
40. Fork without infuscation 41
Fork with infuscation, either distinct spot or extension of vein margin infuscation (faint in some *aar, equalis, turbidus* and *coarctatus,* and legs reddish to orange-brown) 48
41. Median abdominal spots, if present, not contrasting sharply with remainder of tergites 42
Median abdominal triangles present dorsally and contrasting with dark brown to black abdomen; if faint, frontal triangle shiny, denuded 44
42. Medium sized fly; costal cell hyaline ..... *rufofrater* Walker
Large fly; costal cell yellow or brown 43
43. Wing hyaline, costal cell dark brown; abdomen usually with apical bands ..... *americanus* Forster
Wing uniformly dilute brown ..... *calens* Linnaeus
44. Scutellum with distinct white pollen and pile, thorax darker with brown stripes 51
Scutellum without white pollen and pile except around margin; or, if present, not contrasting sharply with that of thorax 45
45. Frontal triangle denuded, shiny, swollen; brownish black species with single median row of triangles on abdomen arising from pale posterior bands ..... *nigripes* Wiedemann
Without this combination of characters 46
46. Abdominal triangles wanting at least on tergite 2 ..... *superjumentarius* Whitney*
Abdominal triangle present on tergite 2 47
47. Enlarged eye facets occupying about ½ the total area of eye; cell R_5 usually petiolate ..... *petiolatus* Hine
Enlarged eye facets occupying ⅔ to ¾ total area of eye; cell R_5 usually narrowed but not petiolate ..... *melanocerus* Wiedemann
48. Abdomen with contrasting, pale median spots or triangles 49
Abdomen with indistinct median spots or triangles 57
49. No median spot on tergite two; fore tibia usually bicolored; areas of large and small eye facets distinctly differentiated; dorsum of abdomen blackish with three median white triangles; venter of abdomen with distinct median black stripe; furcation and cross veins faintly margined with brown ..... *trimaculatus* Palisot de Beauvois
Without this combination of characters 50
50. Median spot on tergite two, if present, distinctly smaller than those on tergites three and four; scutellum with distinct pale pile; fore tibia nearly uniform in color (some *moderator* with extreme base pale) 51
Without this combination of characters 52
51. Middle and hind tibiae pale to dark reddish brown, apices not markedly darker ..... *molestus* Say
Middle, hind tibiae creamy white, extreme apices dark brown to black ..... *moderator* Stone
52. Plate of third antennal segment mostly orange with prominent dorsal excision, annulate portion black; palpi and fore femora dark brown to black; upper eye facets distinctly enlarged, sharply differentiated from lower; abdomen orange-brown ..... *sulcifrons* Macquart
Without this combination of characters 53
53. Venter of abdomen black with strongly contrasting, rather broad white bands ..... *trijunctus* Walker*
Venter of abdomen brownish; pale bands, if present, not strongly contrasting 54

Key to Males of Tabanus (continued)

54. Medium sized; plate of third antennal segment with very slight or no dorsal excision; antennae, palpi, legs, mostly brown; abdomen brown with gray median triangles which may be somewhat flattened and obscured by apical bands; tergites with grayish posterior margins which expand laterally; wing almost hyaline with infuscation at fork and cross veins; cell R_5 somewhat narrowed apically ..... *endymion* Osten Sacken

Without this combination of characters 55

55. Abdomen dorsally orange-brown or grayish brown with rather large median triangles 56

Abdomen dark reddish purple to nearly black with small median white spots that may be longer than broad 58

56. Antennae wholly orange; enlarged facets occupying ¾ total area of eye; cell R_5 narrowed apically ..... *cheliopterus* Osten Sacken

Not as above 64

57. Deep reddish brown to reddish purple species; tufts of prominent hair around wing base; wing hyaline to subhyaline with dark infuscation at furcation and cross veins; antenna, palpus, legs, orange-brown; clypeus, genae, yellowish to grayish yellow; upper eye facets distinctly enlarged, sharply differentiated from lower facets 58

Without this combination of characters 59

58. Plate of 3rd antennal segment dorsally with prominent forward-projecting tooth-like process ..... *imitans* Walker

Dorsal process of plate without prominent tooth-like process ..... *maculipennis* Wiedemann

59. Cell R_5 narrowed or closed apically 60

Cell R_5 not narrowed apically 62

60. Legs predominantly orange-brown ..... *cheliopterus* Rondani

Legs, at least femora, predominantly black 61

61. Mesonotum with lavender tone, with narrow gray lines; eye facets not noticeably differentiated ..... *gladiator* Stone

Mesonotum yellowish with dark lines; upper eye facets moderately enlarged, differentiated from lower facets ..... *abdominalis* Fabricius

62. Legs, especially fore femora, dark brown to black; hair on fore femora black, tibial fringes mostly black; black or mixed black and white hair on rest of legs; pale abdomen contrasting with dark brown thorax; posterior pale bands of tergites wide, nearly obscuring median pale triangles ..... *rufofrater* Walker

Without above combination of characters; legs uniformly reddish to reddish brown with white or concolorous hair 63

63. Clypeus, genae, and pleurae, brown with concolorous hair; abdomen orange-brown with at most only faint suggestions of middorsal triangles, occasionally lateral margins dark ..... *aar* Philip

Clypeus, genae, and pleurae, gray to grayish brown with pale hair; abdomen with or without faint middorsal triangles, usually with lateral pale areas arising from the pale posterior margins of each tergite 64

64. Third antennal segment black except at extreme base; annulate portion shorter than basal portion, latter with only slight dorsal excision; costal cell distinctly infuscated; upper eye facets moderately enlarged, areas of large and small facets not sharply differentiated ..... *coarctatus* Stone

Not agreeing entirely with above 65

65. Wing veins distinctly margined with brown; third antennal segment mostly orange; upper eye facets distinctly enlarged, differentiated from lower facets ..... *turbidus* Wiedemann

Wing veins usually not margined

with brown at most only faint trace of infuscation; third antennal segment mostly dark; upper eye facets only moderately enlarged, line of demarcation between large and small facets not distinct ..... *equalis* Hine

Key to Species of Hybomitra

1. Clypeus and gena shiny black; much of wing infuscated ..... *hinei* (Johnson)*
   Not as above 2
2. Black species with broad band of orange across first three abdominal segments; wings dark ..... *cincta* (Fabricius)
   Coloration not as above 3
3. Subcallus pollinose; wings entirely infuscated ..... *trispila* (Wiedemann)
   Subcallus bare; wings with at least distal or apical regions clear 4
4. Wings with prominent infuscation at furcation and cross veins; abdomen broadly yellowish orange laterally ..... *lasiophthalma* (Macquart)
   Wing mostly hyaline with costal cell and wing base infuscated; abdomen not as above ..... *difficilis* (Wiedemann)

Key to Species of Agkistrocerus

1. Hind margins of tergites and sternites with black hair; longitudinal veins in basal ⅔ of wing broadly margined with brown; median callus of female broadly joined to basal callus ..... *megerlei* (Wiedemann)
   Hair on lateral margins of tergites and hind margins of sternites pale; longitudinal veins basally not broadly margined with brown; median callus very slender line ..... *finitimus* (Stone)*

Key to Species of Hamatabanus

1. Abdomen with 3 rows of pale spots; wing hyaline ..... *carolinensis* (Macquart)
   Abdomen without sublateral pale spots; wing with at least costal cell brown 2
2. Dorsum of abdomen with dark median portion; antennae nearly black ..... *annularis* (Hine)
   Dorsum of abdomen without noticeably darkened median portion; antennae mostly orange ..... *sexfasciatus* (Stone)*

Species Accounts

In the following section, a general descriptive statement is included for all species recorded from Louisiana and several from neighboring states that are likely to occur in Louisiana. Morphological variations and ecological and distributional information are given for most species. Specimens were checked for variations by comparing them to the original descriptions and/or the descriptions given by Brennan (1935) and Stone (1938). The brief descriptions and variations are based primarily on Louisiana females unless otherwise indicated. It should be remembered that eye patterns are usually absent in dried material, and the patterns referred to herein are based on either live or relaxed specimens. The number of specimens examined refers to only those studied for variations and may not indicate the actual numbers collected. The seasonal distribution of common Louisiana Tabanidae is presented in Table II.

Changes in taxonomic status are presented for 4 species and subspecies including the synonymies of *Chrysops fulvistigma dorsopunctus* Fairchild and *Tabanus molestus mixis* Philip. *Chrysops flavidus reicherti* Fairchild and *T. maculipennis imitans* Walker are returned to specific rank. *Chrysops* ***harmani***, new species, is described; and larval descriptions based on specimens reared by the author are given for 33 species.

Subfamily Chrysopinae

Genus Merycomyia Hine, 1912

Only two Nearctic species are placed in this genus. They are robust *Tabanus*-like with small hind tibial spurs, well-developed ocelli, and the third antennal segment with three divisions (two annuli).

Merycomyia whitneyi (Johnson, 1904)

Length approximately 20 mm; abdomen dark to reddish brown, tergites four and five with distinct white patches; wing hyaline

TABLE II. Seasonal distribution of common Louisiana Tabanidae.

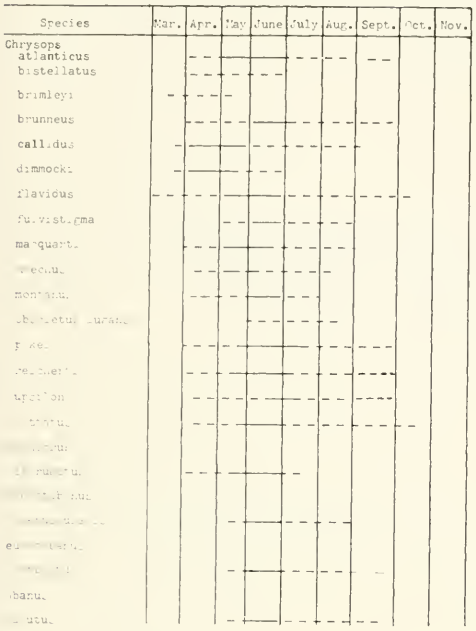


TABLE II. (*Continued*)

Seasonal distribution
Period of peak abundance

with veins faintly to strongly margined with brown.

Mature larva (Fig. 23): Approximately 40 mm long; creamy yellow with light brownish pubescent markings.

Head capsule length: Approximately 5.5 mm.

Striations: Irregular and widely-spaced laterally on segments 3–10 and at the posterior lateral margins of segments one and two; incomplete and broken dorsally and especially scanty on the ventral aspects of abdominal segments 1–7. Irregular striations present laterally on the anal segment, wide and conspicuous ventrally behind the anus; absent on the dorsum.

Thorax: Pubescence consisting of narrow pro-, meso-, and metathoracic annuli; lateral projections absent.

Abdominal segments 1–7: Anterior pubescence encircling segment one, progressively reduced laterally on segments 2–7 and ventrolaterally on segments 5–7. Pseudopodial pubescence encircles segments one and two, joined with anterior pubescence dorsolaterally on segment one and ventrolaterally on at least segments 1–3. Posterior pubescence present on segments 5–7 varying from a midventral patch on segment five to a band encircling segment seven.

Anal segment: Pubescence consisting of anal and posterior rings, the latter broadly encircling the segment.

Respiratory siphon: Consisting of two conspicuous lateral sclerotized plates, pointed apically and joined dorsally and ventrally by striated integument. A rigid prominent spine extends from between and well beyond the two plates.

Comments: This species was not collected in Louisiana; however, three larvae (one reared) were collected in the marginal region of a small lake in northwest Florida. The larvae were taken from sandy clay mud about ½ meter beneath the water's surface. This lake was located in a longleaf-slash pine forest region.

Genus SILVIUS Meigen, 1820

Most Nearctic species of this genus are Western in distribution. Only one species,

S. quadrivittatus (Say), is reported east of the Mississippi River. Members of the genus have denuded eyes speckled with small irregular spots, ocelli present, pedicel of antenna about ½ or less the length of the scape, and third antennal segment with five divisions (four annuli).

Silvius quadrivittatus (Say, 1823)

Length 6–10 mm; gray and brown; abdomen grayish with 4 rows of brown spots; wing hyaline, spotted with brown.

Variations: (Specimens examined—29) All agree with Brennan's (1935) description.

Ecology and Distribution: (May–August) An isolated population of this species was found in West Feliciana Parish in the upland hardwood region.

Genus Chrysops Meigen, 1803

Commonly known as deer flies, members of this genus are relatively small and rarely exceed 12 mm. They are characterized by the presence of ocelli; denuded, brightly patterned eyes; a prominent frontoclypeus; third antennal segment with five divisions (four annuli), the basal one elongated; pedicel of antenna more than ½ as long as scape; hind tibiae with two apical spurs; and wings usually with an infuscated pattern.

Chrysops abatus Philip, 1941
(Fig. 41)

Length 7–9 mm; abdomen yellowish, darker posteriorly, with a median middorsal black stripe; face with median pollinose stripe; apex of hyaline triangle extending beyond wing vein R_{2+3}.

Variations: (Specimens examined—98) Departures from Philip's (1941) description include the following: midfacial stripe complete to oral margin in only 12 specimens, usually extending approximately ¾ the distance to oral margin; four specimens with posterior margin of wing infuscated; most specimens with legs black, basal portion of fore tibiae and basal ¾ or less of middle tibiae, dirty yellow; 1st tarsal segment on middle and hind legs mostly yellow to brownish yellow.

Ecology and Distribution: (April–May) Five specimens of this early season species were collected from the Gulf coastal longleaf-slash pine forests in Mississippi, and 93 were taken from similar forest types in St. Tammany and Tangipahoa parishes, Louisiana.

Chrysops amazon hubbelli Philip, 1955
(Fig. 42)

Length 9–12 mm; black; face with median pollinose stripe; pleura of female with dense orange pile; apical wing spot distinct reaching into ½ of cell R_4, anal and basal areas infuscated with hyaline spots in distal portion of basal cells.

Variations: (Specimens examined—16) In general the specimens agree with Philip's (1955) comparative description.

Ecology and Distribution: (April–May) This melanistic subspecies of *C. amazon* was collected from longleaf-slash pine forests in Tangipahoa and Washington parishes.

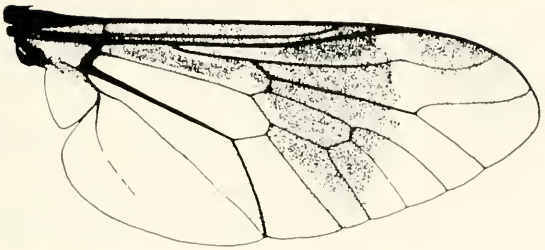
Chrysops atlanticus Pechuman, 1949
(Fig. 43)

Length 7–11 mm; mesonotum typically grayish green with dark stripes; abdomen yellowish with brown pattern; usual hyaline areas of wing dilutely infuscated.

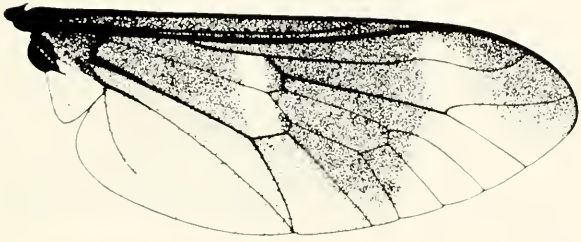
Variations: (Specimens examined—60) This species and *C. brunneus* represent coastal marsh forms of the *C. flavidus* complex in Louisiana. This complex is a confusing one as is illustrated by a statement from Pechuman (1949):

> The species which the writer has called *C. atlantica* has been known for some time but has been confused with *flavida* Wied. and *brunnea* Hine. Krober (1926, p. 291) apparently had both *atlantica* and *flavida* before him when he redescribed *flavida*. Philip (1941, p. 118) refers under *flavida* to "a northern form which approaches *brunnea* Hine." Daecke (1907, p. 146) mentions specimens of *flavida*, "in a measure resembling *brunneus*" and his figure 33A on plate VI is an excellent delineation of the wing of *atlantica*. MacCreary (1940, p. 11) mentions an anomalous form of *flavida* being more common than typical *flavida* in Delaware.

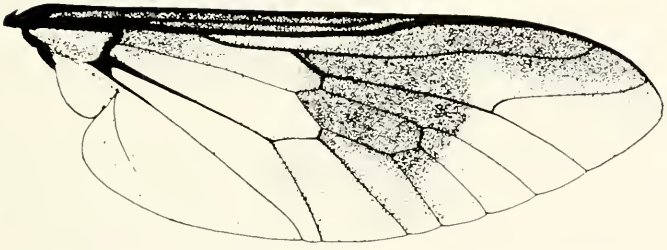
Pechuman (1949) distinguished *atlanticus* from *brunneus* in that *brunneus* has the first two antennal segments more swollen and the abdomen uniformly brown with occasional faint dark markings. Among other



41 abatus

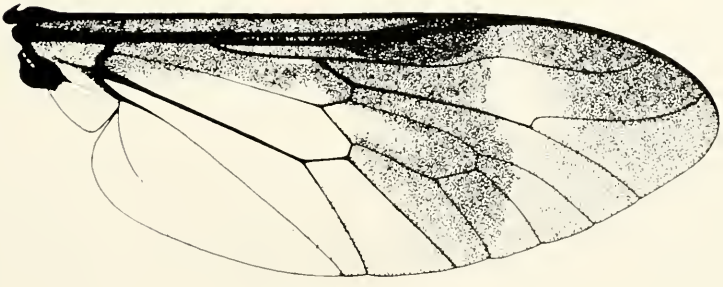


42 amazon hubbelli



43 atlanticus

44 beameri



45 bistellatus

Figures 41–45. Wing patterns of female *Chrysops*.

characters, he mentioned that the frontal callosity in *brunneus* usually is more protuberant and the wing pattern is a deeper color with the hyaline areas of the membrane lacking the yellowish tinge found in *atlanticus*. He stated that *atlanticus* differs from *flavidus* and its subspecies (now elevated to the rank of species) in that *flavidus* usually has the first two antennal segments more slender, the abdomen pale yellowish brown with faint brown markings, and the wing pattern distinctly outlined.

Pechuman also mentioned that specimens included in what is called *flavidus* show great variation and seem to form local races. He discussed a long series of the *flavidus* complex from southern Florida which have antennae much like *brunneus* but wing and body patterns close to *flavidus*. Another series of the *flavidus* form along the coast of the Carolinas, Georgia, and Florida have infuscated wing membranes but are separated from *atlanticus* by the brown thorax and different body coloration which frequently resembles *brunneus*.

Some specimens collected from the Mississippi Gulf coast during the present study resemble *flavidus* with the first and second antennal segments slender and abdomen a pale yellowish brown; however, a faint grayish blue-green cast is present on the anterior dorsum of the thorax, and the wing pattern is not distinctly outlined but faintly infuscated much like that of *atlanticus*. In addition, a series of specimens from the coastal marshes of Mississippi and Louisiana includes both "typical" *brunneus* and *atlanticus*, as well as intermediate forms. Most were collected flying together at many of the locations sampled including two inland sites in the longleaf-slash pine forests of Tangipahoa and St. Tammany parishes.

Pechuman (personal correspondence) would tend to limit the distribution of *atlanticus* to the Atlantic coastal states. Therefore, it is possible that the Mississippi and Louisiana specimens of *atlanticus* may represent an undescribed species, or be variants of *brunneus* or *flavidus*. I prefer to consider these specimens as geographic variants of the more eastern *atlanticus*. While it is possible to readily distinguish "typical" *atlanticus* from *brunneus*, and these in turn from "typical" *flavidus* by color and morphological characters, the variability and degree of intergradation between members of this complex indicate that the true relationships among these forms are yet to be resolved.

Ecology and Distribution: (April–September) *C. atlanticus* was collected from the coastal marshes and adjacent longleaf-slash pine forests. This species and *C. brunneus* are the major pest *Chrysops* near coastal regions.

Chrysops beameri Brennan, 1935
(Fig. 44)

Length 8 mm; mesonotum greenish yellow with dark stripes; abdomen yellow with four complete black stripes; apex of hyaline triangle extending above wing vein R_{2+3}.

Variations: (Specimens examined—2) Both agree with Brennan's (1935) description. Specimens of *C. beameri* are often difficult to separate from *C. hinei* Daecke and *C. sequax* Williston. Watson (1968) listed all three species from Alabama, and stated that key characters are insufficient to separate all specimens. He further indicated that the Alabama specimens determined as *sequax, beameri*, and *hinei* may have merely represented variation between local populations of the same species.

Ecology and Distribution: (June) One specimen was collected in Louisiana from a mixed pine-hardwood forest in Natchitoches Parish.

Chrysops bistellatus Daecke, 1905
(Fig. 45)

Length 7–11 mm; dorsum of thorax greenish gray with dark brown stripes; abdomen yellow with two submedian dark stripes; hyaline triangle of wing represented by an isolated spot in cell R_3.

Variations: (Specimens examined—147) Departures from Brennan's (1935) description include the following: palpi usually fuscous.

Ecology and Distribution: (April–June) This species was collected from the mixed pine-hardwood forests throughout the state and from the longleaf-slash pine regions of Tangipahoa and Washington parishes. Hine (1907a) reported this from Beauregard Parish.

Chrysops brimleyi Hine, 1904
(Fig. 46)

Length 6–9 mm; blackish; dorsum of thorax and abdomen with faint gray pubescence; apical spot of wing narrow; faint spot at furcation.

Variations: (Specimens examined—69) All specimens vary from Brennan's (1935) description in the following characters: frontal callus, lateral projections of frontoclypeus, lower margins of genae, palpi, black. Variations occasionally encountered include antennae dark brown to black with only basal ½ of scape yellowish; legs black. Two specimens taken in Rapides Parish have a broad apical spot entering the upper ¼ of cell R_4. In coastal areas, *C. brimleyi* may be confused with *C. fuliginosus*, but the latter is usually distinguished by having a more extensive apical spot and outer margin of crossband strongly bowed.

Ecology and Distribution: (March–May) This early season species was collected primarily from the mixed pine-hardwood forests of Rapides, St. Helena, and Union parishes. It was also taken from the longleaf-slash pine region of St. Tammany Parish and the upland hardwood area of West Feliciana Parish.

Mature larva (Fig. 11): Approximately 13–15 mm long; pubescence extremely pale to light brown, darkest on anal segment.

Head capsule length: 1.6 mm.

Striations: Encircling all segments, extremely fine and inconspicuous laterally on abdominal segments 2–7, in front of pseudopods, and on the anterior portion of anal segment.

Thorax: Anterior pubescent annuli faint, extending laterally approximately ⅔, ½, and ¼ the length of the pro-, meso-, and metathorax, respectively.

Abdominal segments 1–7: Anterior pubescence extremely faint and inconspicuous, encircling segments 1–4, progressively reduced on remaining segments. Pseudopodial pubescent rings complete on segments 1–4, joined with anterior pubescence dorsolaterally on segments 2–5 and ventrolaterally on 1–5. Posterior pubescence limited to a band encircling the preanal segment.

Anal segment: Pubescence consisting of a broad band encircling approximately the middle ½ of the segment, its anterior margin irregular with a prominent dorsolateral thumb-like projection and a shorter less conspicuous lateral projection. Additional pubescence consists of a conspicuous isolated spot somewhat anterior and ventral to the thumb-like projection and one or two small spots located near the segmental line.

Respiratory siphon: 0.71–0.76 mm long, approximately four times its basal diameter.

Comments: The description is based on two larvae from northwest Florida. They were collected from the margin of a lake in a longleaf-slash pine forest.

Chrysops brunneus Hine, 1903
(Fig. 47)

Length 8–12 mm; orange-brown; first two antennal segments swollen; wing mostly infuscated with clear areas anterior and posterior to crossband.

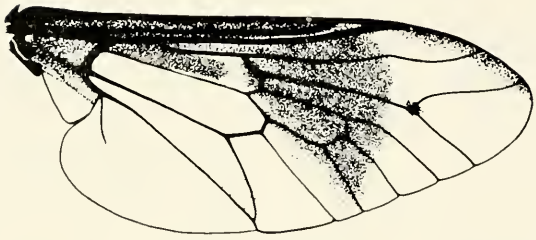
Variations: (Specimens examined—109) Most specimens agree with Hine's (1903) and Brennan's (1935) descriptions. They are separated from *C. atlanticus* by the characters listed by Pechuman (1949) (see discussion under *C. atlanticus*).

Ecology and Distribution: (April–September) This species was common along the coastal marshes and frequently was taken inland in the adjacent longleaf-slash pine forests of Florida, Alabama, Mississippi, and Louisiana. Hine (1907a) reported this species from the coastal marshes of Cameron and Plaquemines parishes and indicated that it was persistent and abundant throughout the day.

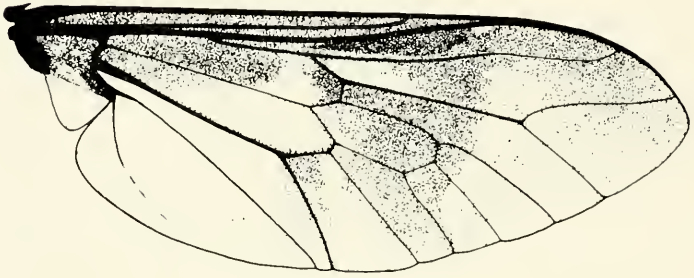
Chrysops callidus Osten Sacken, 1875
(Fig. 48)

Length 7–10 mm; dorsum of abdomen black with a median row of yellow triangles; lateral areas of tergites one and two and posterior margins of tergites, yellow; apical spot of wing narrow; both basal cells of female mostly hyaline.

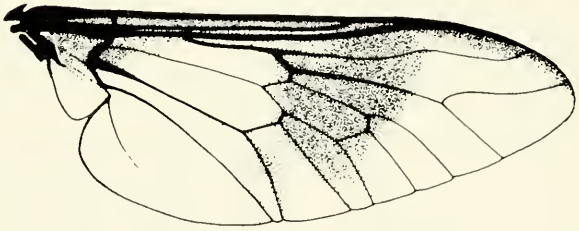
Variations: (Specimens examined—121) Departures from Brennan's (1935) description include the following: occasionally, legs yellow to dark brown lacking the typical black coloration; some specimens with basal ⅔ of fore femora and entire fore tibiae yellow-brown. Superficially this species re-



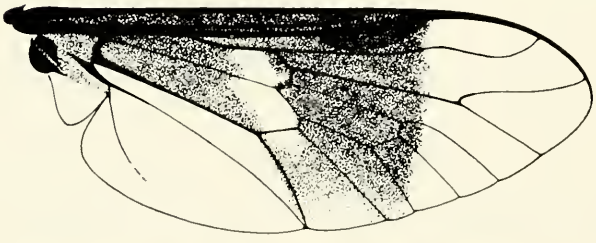
46 brimleyi



47 brunneus



48 callidus



49 carbonarius

50 celatus

Figures 46–50. Wing patterns of female *Chrysops*.

sembles *C. dimmocki* Hine and *C. pudicus* O.S., but can be separated from them by characters given in the key.

Ecology and Distribution: (March–September) This species was collected in all major vegetational regions except the coastal marsh. Although specimens were taken throughout the fly season, it was most abundant during April and May and was in many areas the most commonly collected species. On several occasions, it was observed feeding on female red-eared turtles (*Pseudemys scripta elegans*). Hine (1907a) noted *C. callidus* as an important livestock pest during the spring.

Mature larva (Fig. 21): 15–17 mm long; creamy white with pale golden brown pubescent markings.

Striations: Encircling all segments, somewhat closer together laterally.

Thorax: Anterior pubescent annuli narrow with thin lateral projections extending approximately ½ the length of the pro- and mesothorax, and ⅓ the length of the metathorax.

Abdominal segments 1–7: Anterior pubescence broadly encircling segments 1–3, reduced laterally on four, absent laterally on five or 6–7. Pseudopodial pubescent rings complete and joined with anterior pubescence dorso- and ventrolaterally on all segments. Posterior pubescence consists of a small midlateral pointed projection on the preanal segment.

Anal segment: Pubescence encircling segment excluding a median dorsal clear window and a lateral to ventral anterior clear area, the former (dorsal) portion occupying from ¼ to ⅓ the length of the segment, the latter sometimes considerably reduced. Scattered patches of anterior pubescence lie immediately adjacent to the segmental line.

Respiratory siphon: 0.46–0.55 mm, slightly longer than its basal diameter and possessing a stigmatal spine.

Comments: Eighteen larvae were collected from East Baton Rouge, East Feliciana, and St. Landry parishes. They were associated with aquatic habitats in mixed pine-hardwood and mixed bottomland hardwood forests. Most larvae were collected from the margins of small ponds or lakes and were seldom more than a few centimeters from the water. Some specimens taken during the winter months were collected at the bottom of ponds as far as ten meters from the shore and one meter beneath the water's surface. Jones and Bradley (1923) reared this species from a larva taken in mud at the bottom of a small brook.

Chrysops carbonarius Walker, 1848
(Fig. 49)

Length 7–9 mm; black; face with a median pollinose stripe; apical spot absent; cell Cu_1 with basal hyaline lunule.

Variations: (Specimens examined—13) All agree with Brennan's (1935) description.

Ecology and Distribution: (April–May) Specimens were collected in the upland hardwood forests of West Feliciana Parish, from the mixed pine-hardwood forests of Rapides Parish, and from the longleaf-slash pine region of Washington Parish. This early season species was seldom taken throughout the southeastern states.

Chrysops celatus Pechuman, 1949
(Fig. 50)

Length 7–9 mm; dorsum of thorax bluish green at least anteriorly, with dark stripes; abdomen yellowish with brown pattern.

Variations: (Specimens examined—127) In general the specimens agree with Pechuman's (1949) description for *C. flavidus celatus*. Variations include the reduction in size and darkening of the antennal segments becoming more *flavidus*-like in appearance, a reduction in the bluish green color of the thorax, leg color dirty yellow to fuscous with the apices of the fore and hind femora and tibiae dark, and wings faintly infuscated posteriorly.

Chrysops celatus is separated from *flavidus* by its grayish blue-green color on the mesonotum. However, intermediate forms exist in which the bluish color is extremely faint, and these specimens tend to approach *flavidus* in appearance. Teskey (1969) reared a larva of *flavidus* and 14 larvae of *celatus*, and on the basis of the differences of the larvae and pupae of these 2 forms considered *celatus* a distinct species.

During the present study 11 larvae of

celatus and 34 of *flavidus* were reared. While they were quite similar, *celatus* could usually be distinguished by its overall darker pubescence, the presence of posterior pubescence on abdominal segment 6, and the almost entirely pubescent anal segment. It is possible that the coincident separation of the larvae and the adults may be an example of concordant variation between the larval stage and the adult, and may not necessarily indicate two distinct populations.

Ecology and Distribution: (April–August) *C. celatus* was collected from the longleaf pine forests of St. Tammany, Rapides, Washington, and Winn parishes.

Mature larva (Fig. 17): 13–16 mm long; with light to medium golden brown pubescent markings.

Head capsule length: 1.5–1.6 mm.

Striations: Encircling all segments, somewhat closer together laterally.

Thorax: Prothoracic pubescent annulus with a lateral bib on each side extending approximately ½ the length of the segment; meso- and metathoracic annuli with lateral projections extending approximately ⅓ and ¼ the length of the segments, respectively.

Abdominal segments 1–7: Anterior pubescence encircling segments 1–5 to 7, reduced laterally on at least 6 and 7. Pseudopodial pubescence complete and joined with anterior pubescence dorso- and ventrolaterally on segments 2–7 and 1–7, respectively. Posterior pubescence present on segments 5 or 6–7, varying from a faint lateral trace when present on 5 to a distinct band encircling 7.

Anal segment: Pubescence extensive, covering almost the entire segment; hyaline portions include a narrow anterior area varying in extent from a thin line to approximately ⅛ the length of the segment, and one to several ventrolateral clear windows varying in size and situated posterior to the anus.

Respiratory siphon: 0.46–0.55 mm long, approximately 1.5 times its basal diameter and possessing a stigmatal spine.

Comments: The description is based on 11 larvae collected in northwest Florida. All were taken from a lake's margin in a longleaf-slash pine forest region.

Chrysops cincticornis Walker, 1848
(Fig. 51)

Chrysops celer Osten Sacken. Brennan, 1935, Kans. Univ. Sci. Bull. Vol. 22, p. 275.

Length 8–12 mm; black; face with a median pollinose stripe; pleura of female with dense orange pile; apical spot of wing absent.

Variations: (Specimens examined—36) Departures from Brennan's (1935) description include the following: usually scape of antenna yellowish brown, remainder dark brown to black; considerable variation in the extent of wing infuscation in the anal area, varying from almost clear with only a trace of infuscation along distal portion of vein $Cu_2 + 2A$, to almost entirely smoky. In the latter case, these specimens would fit the description (Fairchild, 1937) of *C. cincticornis* var. *nigroptera*. The writer has not seen type specimens of this form but feels that its status may be in question. The tendency of the wings to be folded over the abdomen in most pinned specimens helps to conceal any infuscation in the anal areas. In specimens from Louisiana, Alabama, and North Carolina, varying degrees of infuscation were observed when the wings were extended.

C. cincticornis resembles *C. carbonarius* Wlk., but the former can be distinguished by the complete infuscation of cell Cu_1 basally and also in the female the presence of dense orange pile on the thoracic pleura.

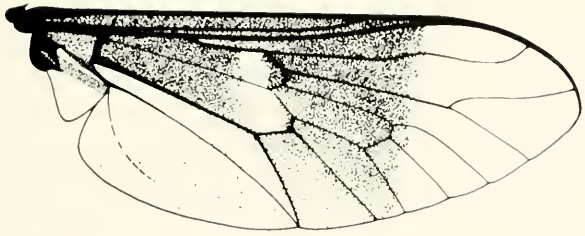
Ecology and Distribution: (April–May) This early season species was collected in the mixed pine-hardwood forests of East Feliciana, Rapides, and St. Helena parishes, and in the longleaf-slash pine forests of Tangipahoa, Vernon, and Washington parishes.

Mature larva (Fig. 22): 18 mm long; creamy white with pale to light golden brown pubescent markings.

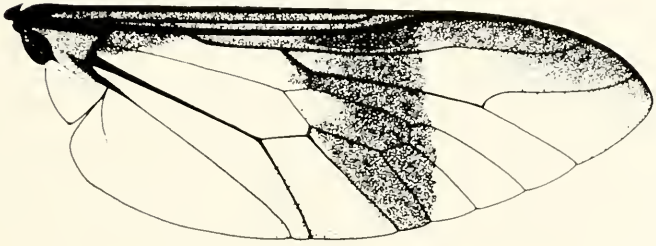
Head capsule length: 1.9 mm.

Striations: Encircling all segments, slightly closer together laterally.

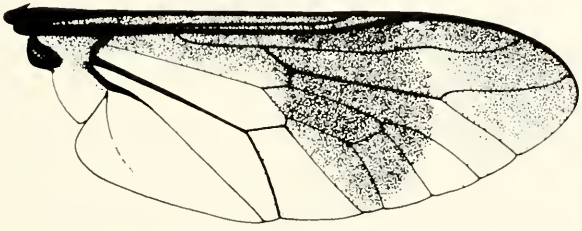
Thorax: Anterior pubescent annuli narrow with thin faint lateral projections extending at least ½, ⅓, and ¼, the length of the pro-, meso-, and metathorax, respectively.



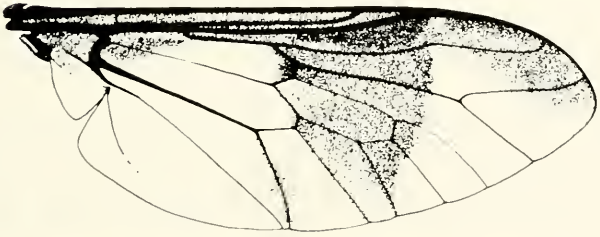
51 cincticornis



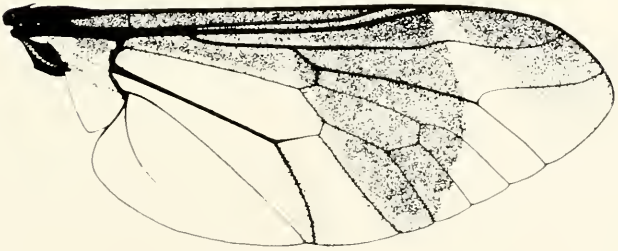
52 cursim



53 dacne



54 dimmocki



55 dorsovittatus

Figures 51–55. Wing patterns of female *Chrysops*.

Abdominal segments 1–7: Anterior pubescence encircling segments one and two, narrowly connected laterally on two; absent laterally on remaining segments. Pseudopodial pubescent rings complete and joined with anterior pubescence dorso- and ventrolaterally on segments 2–7 and 1–6, respectively. Posterior pubescence limited to a band encircling the preanal segment.

Anal segment: A wide pubescent band encircles the segment posteriorly covering less than ½ of the dorsal aspect; laterally the pubescent pattern curves somewhat anteriorly and extends ventrally in front of the anus. Two rounded pubescent spots and a narrow anterior band are situated dorsolaterally, the latter traversing the dorsum. A small isolated clear window lies ventrolaterally in the posterior pubescence.

Respiratory siphon: 0.6 mm long, approximately equal to its basal diameter and possessing a stigmatal spine.

Comments: The description is based on one larva taken from the margin of a small stream in Lee County, Alabama (upland hardwood area). Additional larvae from Alabama were collected from the margin of a small farm pond in a loblolly-shortleaf pine forest.

Chrysops cursim Whitney, 1879
(Fig. 52)

Length 7–9 mm; thorax greenish gray dorsally with dark stripes; abdomen yellow with an inverted V-shaped marking on tergite two, remaining segments with anterior emarginate black bands.

Variations: (Specimens examined—3) All differ from Brennan's (1935) description in the following: apical ¾ of fore tibiae and ½ of hind tibiae, black; crossband dark.

Ecology and Distribution: (May) Three specimens were collected from a longleaf-slash pine region in Washington Parish.

Chrysops dacne Philip, 1955
(Fig. 53)

Length 6–8 mm; brownish black; median portion of mesonotum bluish green; abdomen usually with faint suggestions of one or three pale stripes; apical spot of wing extensive.

Variations: (Specimens examined—34) Only one specimen was collected in Louisiana. It varies from Philip's (1955) descripas follows: apex of hyaline triangle extending to vein R_{2+3}; apices of hind tibiae and entire abdomen except a faint trace of a dorsal median line, fuscous.

Specimens collected in Alabama and Florida, do not always have the abdominal pattern present and show intergradation in characters with *C. parvulus* Daecke. Some of these intermediates have a much darker abdomen and more fuscous hind femora and tibiae like those of *parvulus*. The degree of infuscation in cells R_4 and R_5 varies considerably. Further information may indicate that these two forms are actually members of the same species as also suggested by Philip (1955). (For additional comments, see *C. parvulus*.)

Ecology and Distribution: (June) The single Louisiana specimen was collected in an upland hardwood forest in West Feliciana Parish. Specimens were also taken from longleaf-slash pine forests of Alabama and Florida (May–August). Hine's (1907a) description and locality data (northwest La.) for *C. lugens* would indicate that he probably had *C. dacne* and *C. parvulus* before him.

Chrysops dimmocki Hine, 1905
(Fig. 54)

Length 7–10 mm; abdomen black with a median row of small yellow triangles; lateral areas of tergites one and two, and posterior margins of tergites, yellow; apical spot of wing widened.

Variations: (Specimens examined—149) Departures from Brennan's (1935) description include the following: more uniformly darkened hind femora and tibiae; palpi dark brown to black; apex of hyaline triangle sometimes reaching wing vein R_{2+3}; number of black spots on abdominal venter usually reduced; black spot on tergite 2 not always attaining anterior margin.

C. dimmocki closely resembles *C. callidus* O.S., but the former can easily be separated by the greater extent of the apical spot. Several specimens from Vermilion and Tangipahoa parishes and Hancock County, Mississippi, show intergradation with *C. pudicus* O.S. These specimens have the apex

of the hyaline triangle just reaching vein R_{2+3} and the black spot on tergite two not reaching anterior margin, but in other characters they resemble *C. dimmocki*.

Ecology and Distribution: (March–June) This species was taken commonly along marshes of the mixed bottomland hardwood forests and occasionally from pine forests adjacent to the riverbottom swamps. It was collected from Ascension, Iberville, Livingston, St. Tammany, Tangipahoa, and Vermilion parishes.

Mature larva (Fig. 20): 14–18 mm long; creamy white with extremely pale to light brown pubescent markings.

Head capsule length: 1.6–1.8 mm.

Striations: Encircling all segments, somewhat closer together laterally.

Thorax: Anterior pubescent annuli with lateral projections extending approximately ⅔, ½, and ⅓, the length of the pro-, meso-, and metathorax, respectively.

Abdominal segments 1–7: Anterior pubescence encircling segments 1–4; narrowly connected laterally on 4; absent laterally on remaining segments. Pseudopodial pubescent rings complete and joined to anterior pubescence dorso- and ventrolaterally on segments 1–7. Posterior pubescence consists of a broad band encircling the preanal segment, a faint band encircling segment six and occasionally faint lateral traces on five.

Anal segment: Posterior pubescence encircling segment, covering at least ½ its length, enclosing the anus ventrally. A rather prominent dorsolateral thumb-like projection extends from the anterior margin of the posterior ring. Anterior pubescence consists of a narrow irregular lateral band.

Respiratory siphon: 0.46–0.58 mm, slightly longer than its basal diameter and possessing a stigmatal spine.

Comments: Numerous larvae were collected in Livingston Parish, in moist organic muck at the bases of gum trees in a tupelo gum-cypress swamp. Immediately adjacent to the swamp was an extensive cattail marsh. A single larva was collected from a rice field levee in the prairie region of Acadia Parish.

Chrysops flavidus Wiedemann, 1821
(Fig. 56)

Length 7–11 mm; yellowish with brown thoracic stripes and abdominal pattern.

Variations: (Specimens examined—380) In general the specimens agree with Brennan's (1935) description, omitting the key characters listed herein for *C. atlanticus, C. celatus*, and *C. reicherti. Chrysops flavidus* usually can be separated from these closely related species by using the following characters: first and second antennal segments slender, mesonotum yellowish with brown stripes, abdomen pale yellowish brown with faint brown markings, wing pattern distinctly outlined, and outer margin of crossband not sinuate. For comments concerning intermediates of the *C. flavidus* complex, see discussions under *C. atlanticus* and *C. celatus*.

Ecology and Distribution: (March–October) *C. flavidus* was one of the most commonly collected deer flies throughout the state. It was found in all major vegetational divisions, being most common in the swamps of the mixed bottomland hardwood regions. Hine (1906, 1907a) described this species as one of the worst stock pests in Louisiana although he may have been referring to other members of the complex as well.

Mature larva (Fig. 18): 15–17 mm long; creamy white with very pale to light golden brown pubescent markings.

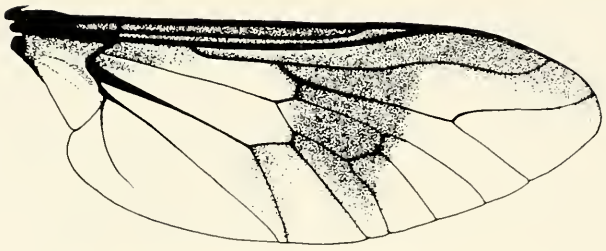
Head capsule length: 1.5–1.6 mm.

Striations: Encircling all segments, somewhat closer together laterally.

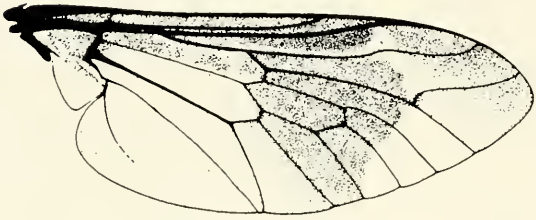
Thorax: Anterior pubescent annuli with a lateral prothoracic pubescent bib and lateral mesothoracic projections extending approximately ½ the length of the segments; lateral projections of metathorax poorly developed.

Abdominal segments 1–7: Anterior pubescence encircling segments 1–4 or 5, absent laterally on 6 and 7. Pseudopodial pubescent rings complete and joined with anterior pubescence dorso- and ventrolaterally. Posterior pubescence limited to a band usually completely encircling the preanal segment.

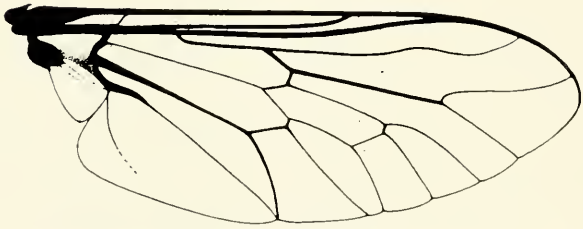
Anal segment: Posterior pubescence encircling the segment, covering approxi-



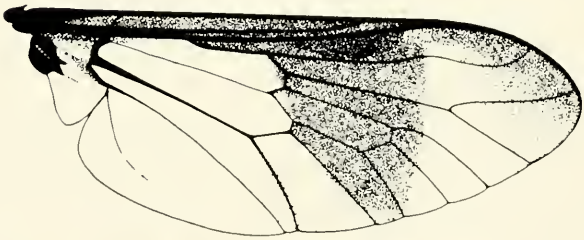
56 flavidus



57 fuliginosus



58 fulvistigma



59 geminatus

60 harmani

Figures 56–60. Wing patterns of female *Chrysops*.

mately ⅔ of the dorsal aspect; dorsolaterally the pubescence curves and widens extending short anteriorly directed projections; ventrally the pubescence encloses the anus. Anterior pubescence consists of a dorsal to dorsolateral band frequently joined with projections of the posterior pubescence; generally, two small inconspicuous pubescent spots are visible in the anterior ventrolateral clear area.

Respiratory siphon: 0.38–0.55 mm, slightly longer than its basal diameter and possessing a stigmatal spine.

Comments: Numerous larvae were collected throughout the state. In general they were more frequently taken at the margins of ponds and waterways in the mixed bottomland hardwood forests than in the other forest divisions of the state. Jones and Bradley (1923) reared a single larva taken from the bottom of a small brook.

Chrysops fulvistigma Hine, 1904
(Fig. 58)

Chrysops fulvistigma Hine, 1904, Can. Entomol. 36: 55; cotypes females, Raleigh, N.C.; Ohio State Univ. Brennan, 1935, Univ. Kans. Sci. Bull. 22: 300. Philip, 1947, Amer. Midland Natur. 37: 274.

Chrysops fulvistigma var. *dorsopuncta* Fairchild, 1937, Fla. Entomol. 19: 59; female, Lloyd, Jefferson Co., Fla. Philip, 1947, Amer. Midland Natur. 37: 274. (New Synonymy)

Length 6–8 mm; blackish; first two abdominal segments mostly yellow with median black markings; wing pattern usually extremely faint.

Variations: (Specimens examined—110) Occasional departures from Brennan's (1935) description include the following: a short midfacial pollinose stripe; faint apical wing spot; a dark infuscated crossband, the latter being quite distinct from the typical form. Hine (1907a, p. 30) also listed this variation, but it was apparently overlooked by Brennan. Some specimens have the second abdominal tergite with a single black median triangular or rectangular spot, or variation thereof. Hine's (1907a) description of *C. fulvistigma* from Louisiana included a large median black triangle on the second abdominal tergite. This and the dark crossband were the only features that varied from his original description (1904). In the abdominal characters, these specimens would fit the description of Fairchild (1937) for *C. fulvistigma dorsopunctus*.

In a series of over 100 specimens, of which approximately 25 percent were the *dorsopunctus* form, certain individuals exhibit intergradation in characters of the two forms. The black markings on abdominal tergite two show complete development from two small dashes to a single broad spot joined to the black marking of tergite one. Specimens representing *fulvistigma*, *fulvistigma dorsopunctus*, and intermediates all have partial midfacial pollinose stripes, and members of both forms and intermediates exhibit the presence of a saturate crossband. These specimens were collected together in Natchitoches, Rapides, St. Tammany, and Tangipahoa parishes. Based on the above information, I consider both forms as a single taxon.

Ecology and Distribution: (May–August) This species was collected from the longleaf-slash pine forests and mixed pine-hardwood forests of southeastern Louisiana. Specimens were also taken from similar forest types in Natchitoches, Rapides, and Winn parishes. Jones and Bradley (1924) reported this species in the vicinity of Baton Rouge.

Chrysops geminatus geminatus Wiedemann, 1828
(Fig. 59)

Length 6–8 mm; thorax grayish yellow with dark stripes; abdomen yellow with black pattern, second tergite with two oblique spots; apex of hyaline triangle extending well beyond vein R_{2+3}.

Variations: (Specimens examined —62) Departures from Brennan's (1935) description include the following: occasionally pedicel and entire third antennal segment black; a few specimens have fore femora brown, entire tibiae black, entire middle femora, proximal and distal portions of middle tibiae, black; occasionally inverted V of tergite two reaching hind margin.

Ecology and Distribution: (May–July) *C. geminatus geminatus* was collected in the longleaf-slash pine and the mixed pine-

hardwood forests of Beauregard, East Feliciana, Rapides, St. Tammany, and Washington parishes.

Chrysops geminatus impunctus Krober, 1926
(Fig. 59)

Length 6–8 mm; thorax grayish yellow with dark stripes; first and second abdominal segments yellow, last three segments mostly black; apex of hyaline triangle extending well beyond vein R_{2+3}.

Variations: (Specimens examined—14) Departures from Brennan's (1935) description include the following: occasionally faint submedian dark dashes anteriorly directed from the posterior margin of tergite two; intermediate conditions in leg coloration approaching that of *geminatus geminatus*.

Application of the subspecific category is questionable as applied to *C. geminatus impunctus*. Both forms were found in the same general regions; however, unlike both forms of *C. fulvistigma*, the two forms of *C. geminatus* were seldom collected together during the present investigation. The *impunctus* specimens are rarely collected and may simply represent a genetic variant of *geminatus*. The possibility also exists that the two forms may actually represent distinct species; however, additional information is needed to clarify the relationship between them.

Ecology and Distribution: (May–July) *C. geminatus impunctus* was taken in the upland hardwood forests of West Feliciana Parish.

Chrysops ***harmani*** n. sp.
(Figs. 9, 10, 60)

Holotype female, 7mm. Antennae normal, first segment yellow, second brownish, third dark brown to black with basal portion somewhat lighter. Frons with grayish yellow pollen; frontal callosity black, somewhat broader than tall. Ocellar area black with some yellowish gray pollen. Area around base of antennae and sides of face with golden yellow pollen, a short pollinose spur extending obliquely below each antenna on the frontoclypeus. Frontoclypeus mostly black with a narrow median yellowish brown area. Lower genae black. Palpi brownish.

Dorsum of thorax dark with grayish green pollen and five dark stripes, the median one narrow. A yellowish gray stripe is present above wing base. Scutellum black with some grayish green pollen. Pleura with two grayish yellow stripes on black background. Fore coxae, most of fore femora, and base of tibiae, yellow; extreme apical portion of fore femora, apical ¾ of tibiae and entire tarsi, dark brown to black. Middle and hind femora ½ and completely black, respectively. Middle tibiae and first two tarsal segments yellowish, remaining tarsal segments darker. Hind tibiae yellowish except for extreme apical portions which are black; first tarsal segment yellow, remaining tarsal segments darker.

Wing with crossband complete to hind margin. Apical spot fading posteriorly in cell R_4. First basal cell mostly infuscated with an apical hyaline area not clearly crossing the cell.

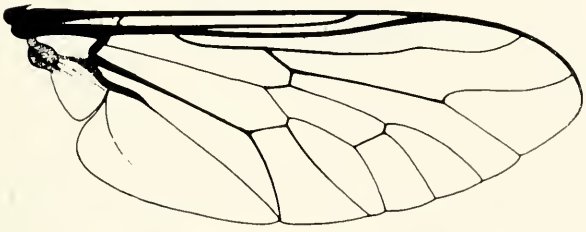
Abdomen yellow and black with a broad mid-dorsal black band the length of the abdomen; this band with faint indications of a median dorsal yellow stripe on segments three and four. A sublateral black band extends posteriorly on each side from tergite three, widening progressively caudally. Apical portion of abdomen dark brown to black. Venter yellow with a pronounced median dark brown band attenuated anteriorly, terminating with an isolated spot on sternite two. Dark lateral bands extend from segment two posteriorly.

From a mixed pine-hardwood region of St. Helena Parish, La., La. 1045, 13 May 1970 (Mac Tidwell). Holotype in the National Museum of Natural History, No. 72107.

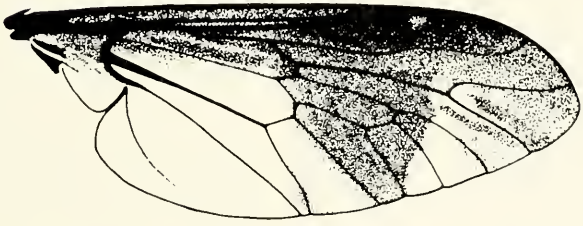
This species has affinities with and would key out to *C. pikei* Whit. in Philip's (1955) *Chrysops* key. It is separated from *pikei* by the presence of a mid-dorsal black stripe on the abdomen, the greater extent of the hyaline triangle crossing vein R_{2+3}, the less extensive apical spot, the frontoclypeus mostly black, and the overall darker color of the thorax.

The writer takes pleasure in naming this species after Dr. Walter J. Harman, Head, Department of Zoology and Physiology, Louisiana State University, who has so kindly provided encouragment and assistance throughout this study.

61 hinei

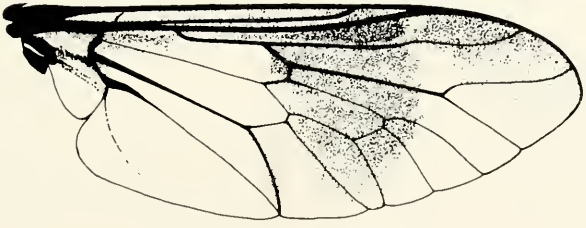


62 hyalinus



63 macquarti

64 moechus



65 montanus

Figures 61–65. Wing patterns of female *Chrysops*.

Chrysops macquarti Philip, 1961
(Fig. 63)

Chrysops univittatus of authors. Brennan, 1935, Kans. Univ. Sci. Bull. Vol. 22, p. 344.

Length 6–8 mm; thorax greenish gray above with dark stripes; abdomen yellow with two submedian dark lines expanding posteriorly; apical spot of wing extensive; apex of hyaline triangle usually attaining at least furcation.

Variations: (Specimens examined—55) In general the specimens agree with Brennan's (1935) description and Philip's (1961) variations. Variations noted in some Louisiana specimens include the following: palpi darkened; most of fore tibiae black, extreme basal portions lighter; two fuscous abdominal stripes extensive covering greater portion of dorsum; only first two abdominal segments with lateral margins yellow; entire venter fuscous except anterior lateral yellow areas. Some specimens of *C. macquarti* resemble *C. moechus* O.S., however, the former can be separated by its more extensive hyaline triangle.

Ecology and Distribution: (April–August) This species was collected primarily during May and June in the upland hardwood forests of West Feliciana Parish and from the longleaf-slash pine region in Washington Parish. One other specimen was taken in a mixed pine-hardwood forest of DeSoto Parish. The *C. univittatus* reported from Louisiana by Hine (1907a) was actually *C. macquarti*.

Chrysops moechus Osten Sacken, 1875
(Fig. 64)

Length 7–10 mm; mesonotum greenish gray with dark stripes; abdomen yellow, darker posteriorly usually with four black stripes; apical spot of wing extensive; hyaline triangle not exceeding vein M_1.

Variations: (Specimens examined—165) Departures from Brennan's (1935) description include the following: hyaline triangle sometimes slightly exceeding vein M_1; dorsum of abdomen often with two solid, rather than broken, black median stripes; broken black stripe on each side present or absent; venter with a median black stripe sometimes attaining the anterior abdominal margin; occasionally base of middle femora and entire hind femora except extreme apices, black. Certain of these characters may approach those of *C. macquarti* Phil. The extension of the hyaline triangle into cell R_5 is rarely observed in *moechus*, and specimens exhibiting this character usually lack the extensive darkening of the median dorsal abdominal lines posteriorly as found in *macquarti*.

Localized populations of *C. moechus* in St. Helena and East Feliciana parishes (37 specimens examined) have a characteristic appearance and exhibit the following characters either singly or in combination: hyaline areas present in cell R_5 which appear as an extension of the hyaline triangle; sublateral black abdominal stripes often reaching well into tergite one; basal portion of frontal callus frequently with yellowish shades; converging black markings on tergite two broadly joined to prominent spot beneath scutellum.

Ecology and Distribution: (April–August) This species was collected most often along streams or roads in thick wooded areas. It was taken in the mixed pine-hardwood forests of DeSoto, Natchitoches, St. Helena, St. Tammany, and East Feliciana parishes. Specimens were also taken from the upland hardwood region of West Feliciana Parish and from the longleaf-slash pine forests of Washington Parish. Hine (1907a) recorded this species from Sabine Parish.

Chrysops montanus Osten Sacken, 1875
(Fig. 65)

Length 7–10 mm; thorax grayish green with dark stripes; abdomen yellow and black, second tergite with two oblique dark spots; tergites 3–5 with four rows of black spots; apical spot broad filling at least ½ of cell R_4.

Variations: (Specimens examined—168) Departures from Brennan's (1935) description include the following: palpi variable, yellow to fuscous; frequently frontal callus black with yellowish brown maculations; median black spots on venter of abdominal segments may be absent; occasionally base of middle femora and basal ¾ or more of hind femora, black; apical ¼ of hind tibiae, fuscous. Variations rarely observed include first basal cell entirely infuscated; hyaline triangle reaching or crossing vein R_{2+3};

crossband terminating in cell M_3 and not crossing base of cell Cu_1. Specimens exhibiting the latter character together with infuscation of first basal cell may key to *C. striatus* O.S. in Philip's (1955) key to the *Chrysops*.

Ecology and Distribution: (April–July) This species was collected in the longleaf pine forests of Evangeline and Tangipahoa parishes, and from the mixed pine-hardwood forests of Claiborne, Rapides, and Winn parishes. Jones and Bradley (1923, 1924) reported this species from East Baton Rouge Parish.

Chrysops niger Macquart, 1838
(Fig. 66)

Length 6–9 mm; black; frontoclypeus yellow; wing hyaline beyond crossband.

Variations: (Specimens examined—18) Departures from Brennan's (1935) description include the following: first basal cell and sometimes costal cell may be almost completely hyaline with only a trace of infuscation; occasionally middle and hind metatarsi fuscous.

Ecology and Distribution: (April–May) This early season species was taken from the upland hardwood forests of West Feliciana Parish and the longleaf-slash pine region in Washington Parish. A single specimen was taken in the mixed bottomland hardwood region of Ascension Parish.

Mature larva (Fig. 15): 12–16 mm long; creamy white with extremely faint to moderately intense pubescent markings.

Head capsule length: 1.6–1.7 mm.

Striations: Encircling all segments, finer on prothorax and somewhat closer together laterally.

Thorax: Anterior pubescent annuli extremely faint extending approximately ¾, ⅓, and ¼, the length of the pro-, meso-, and metathorax, respectively; lateral projections absent.

Abdominal segments 1–7: Anterior pubescence limited to pale, inconspicuous and much reduced traces. Pseudopodial pubescent rings incomplete. Posterior pubescence limited to a small midlateral patch on the preanal segment.

Anal segment: A broad posterior pubescent band covers over ½ the length of the segment; its anterior border irregular with prominent rounded projections laterally and ventrolaterally; the clear area between the projections club-shaped with the head directed posteriorly; ventrally the pubescence encloses the anus. Anterior pubescence consists of a narrow irregular band. Dorsolaterally, a pubescent spot is situated in the clear area between the anterior and posterior rings.

Respiratory siphon: 0.50–0.53 mm, slightly longer than its basal diameter and possessing a stigmatal spine.

Comments: Eight larvae were collected from the margins of a small stream in the longleaf-slash pine region of Washington Parish, and one specimen was found at the margin of a small farm pond in a pine woods region of Alabama.

Chrysops nigribimbo Whitney, 1879
(Fig. 67)

Length 5–8 mm; black; wing pattern faint.

Variations: (Specimens examined—10) Departures from Brennan's (1935) description include the following: palpi variable, yellow to fuscous; pleurae shiny black with a pronounced ventrolateral white stripe, dorsolateral stripe inconspicuous.

Ecology and Distribution: (May) Five specimens were collected in a longleaf-slash pine forest in St. Tammany Parish. The forest was situated on a ridge overlooking a cypress swamp on the Pearl River. Five other specimens (northwest Florida) were collected in longleaf-slash pine forests immediately adjacent to small lowland swamps.

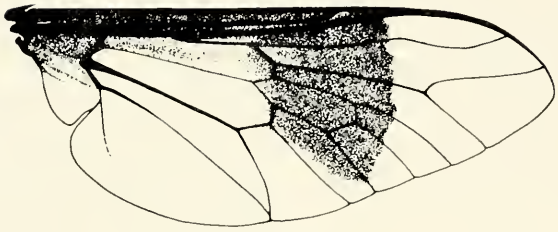
Mature larva (Fig. 14): Approximately 12 mm long, with extremely pale to light brown pubescent markings.

Head capsule length: 1.3–1.4 mm.

Striations: Encircling all segments, appearing prominent and irregular, somewhat more closely spaced laterally.

Thorax: Anterior pubescent annuli extending less than ¼ the length of the segments; only slight indications of lateral projections.

Abdominal segments 1–7: Anterior pubescence encircling segment one, reduced laterally; absent laterally and becoming progressively reduced ventrolaterally on 2–7. Pseudopodial pubescence complete on seg-

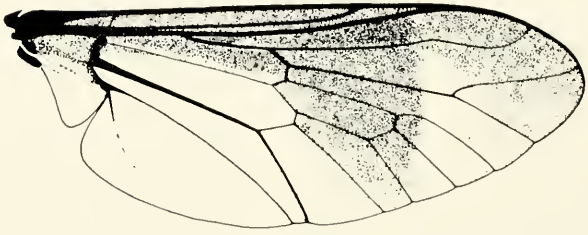


66 niger

67 nigribimbo

68 obsoletus

69 parvulus



70 pikei

Figures 66–70. Wing patterns of female *Chrysops*.

ments 1–4, joined with anterior pubescence dorsolaterally on 2–7 and ventrolaterally on segments 1–2 or 3. Posterior pubescence limited to a narrow band encircling the preanal segment.

Anal segment: Pubescent configuration irregular varying in intensity from faint to very light brown, covering most of the anterior aspects; posterior ventrolateral portion largely clear.

Respiratory siphon: Approximately 0.50 mm, slightly over twice its basal diameter.

Comments: The description is based on two larvae collected from a lake margin in northwest Florida (longleaf-slash pine forest region).

Chrysops obsoletus obsoletus Wiedemann, 1821
(Fig. 68)

Length 7–9 mm; blackish; yellow stripe on thorax above wing base; abdominal dorsum with three more or less obsolete yellow stripes; hyaline triangle extending to vein R_{2+3}; apical spot extensive; tinting in posterior region of wing often lighter than figured.

This form was not collected in Louisiana by the author. Hine's (1907a) description of *C. obsoletus* would indicate that his specimens were either *C. upsilon* Phil. or *C. univittatus* Macq. *Chrysops obsoletus* was also reported from the state by Jones and Bradley (1923, 1924), Wilson (1963), and Wilson and Burns (1964). Descriptive information for their specimens was not given. However, since *C. obsoletus* is a coastal species, the ecological information provided by both Jones and Bradley (1924) and Wilson (1963) would indicate that they were probably working with a different taxon.

Chrysops obsoletus lugens Wiedemann, 1821
(Fig. 68)

Chrysops ultima Whitney. Brennan, 1935, Kans. Univ. Sci. Bull. Vol. 22, p. 343.

Length 7–8 mm; blackish; yellow stripe on thorax above wing base; abdomen dark, occasionally with faint middorsal line; hyaline triangle extending to vein R_{2+3}; apical spot extensive; wing as figured, tinting in posterior region usually darker than in *C. obsoletus obsoletus*.

Variations: (Specimens examined—84) Departures from Brennan's (1935) description include the following: usually most of hind femora and occasionally entire fore and hind tibiae, fuscous; sometimes wing completely infuscated.

Ecology and Distribution: (June–August) *C. obsoletus lugans* was locally abundant in the longleaf-slash pine forests along the Gulf coast of Florida, Alabama, and Mississippi. In Louisiana it was collected in longleaf-slash pine forests adjacent to the coastal marsh in St. Tammany Parish.

Chrysops parvulus Daecke, 1907
(Fig. 69)

Length 6–8 mm; brownish black; median portion of mesonotum bluish green; apical spot of wing extensive.

Variations: (Specimens examined—7) Only one specimen was collected in Louisiana. In general the specimens agree with Brennan's (1935) description. *Chrysops parvulus* closely resembles *C. dacne* Phil., and intermediate specimens cannot be placed with certainty into either taxon. Watson (1968) collected both forms and intermediates in Alabama, and stated that there was almost complete intergradation between the two species as recognized during his study. (For further comments, see *C. dacne*.)

Ecology and Distribution: (June) The single Louisiana specimen was taken from a longleaf pine forest in Rapides Parish. Other specimens were collected in Alabama and Florida.

Chrysops pikei Whitney, 1904
(Fig. 70)

Length 6–9 mm; yellow and black; abdomen with 4 black stripes, the lateral ones shorter; apex of hyaline triangle terminating in wing cell R_3.

Variations: (Specimens examined—430) Departures from Brennan's (1935) description include the following: palpi tan to dark brown, frequently anterior reddish tan, posterior dark; base of hind femora black, sometimes extending the length of the segment; distal ⅔ of fore tibiae dark; usually scutellum entirely dark; in rare cases apex of hyaline triangle extending to vein R_{2+3};

occasionally hyaline triangle only just encompassing fork; midventral abdominal black spots sometimes absent; posterior lateral regions of the abdominal dorsum often completely fuscous, and rarely faint indications of lateral lines extending to base of abdomen.

Ecology and Distribution: (April–September) *C. pikei* was one of the most commonly collected deer flies. It was taken throughout the state from all major vegetational regions except the prairie and coastal marsh. Hine (1906, 1907a) reported this species a common pest in many portions of the state.

Mature larva (Fig. 12): 13–14 mm long; creamy white with very faint to moderately intense pubescent markings.

Head capsule length: 1.3–1.5 mm.

Striations: Encircling all segments, somewhat more closely spaced laterally.

Thorax: Anterior pubescent annuli extremely pale and inconspicuous, occupying approximately ⅔, ⅓, and ¼, the length of the pro-, meso-, and metathorax, respectively; lateral projections absent.

Abdominal segments 1–7: Anterior pubescence faint, encircling segment one; becoming progressively reduced laterally on remaining segments and ventrolaterally on six and seven. Pseudopodial pubescent rings complete and joined with anterior pubescence dorsolaterally on segments 1–7 and ventrolaterally on at least 1–5. Posterior pubescence limited to a narrow irregular band encircling the preanal segment.

Anal segment: Posterior pubescent ring distinct, covering approximately ½ the segment and fading posteriorly; dorsally its anterior border extends paired rounded projections; ventrally it encloses the anus. Anterior pubescence consists of pale dorsal and midlateral patches. A distinct isolated pubescent spot is situated dorsolaterally in the anterior clear area of the segment.

Respiratory siphon: Long and slender, 0.84–0.88 mm, approximately four times its basal diameter.

Comments: Four larvae were taken from debris in a narrow, sandy-bottom stream draining a mixed pine-hardwood forest in East Feliciana Parish. Jones and Bradley (1924) reared this species from a larva collected from the muddy margin of a stagnant pool in East Baton Rouge Parish.

Chrysops pudicus Osten Sacken, 1875
(Fig. 71)

Length 7–8.5 mm; thorax bluish gray with dark stripes; abdomen yellow with black pattern, inverted V of tergite two usually not reaching anterior margin of segment; apical spot slightly widened, usually including only apex of cell R_4; apex of hyaline triangle usually attaining vein R_{2+3}.

Variations: (Specimens examined—59) Departures from Brennan's (1935) description include the following: usually apex of fore femora, at least distal ½ of fore tibiae, and entire hind femora, black; rarely specimens with a more extensive apical spot like that of *C. dimmocki* Hine and hyaline triangle not reaching vein R_{2+3}. This species is close to *C. dimmocki* but can usually be separated by a combination of key characters. (See also under *C. dimmocki*.)

Ecology and Distribution: (May–August) Specimens were collected from the mixed pine-hardwood forests of Rapides Parish, and the longleaf-slash pine region of Tangipahoa and St. Tammany parishes. Hine (1907a) reported this species from DeSoto Parish.

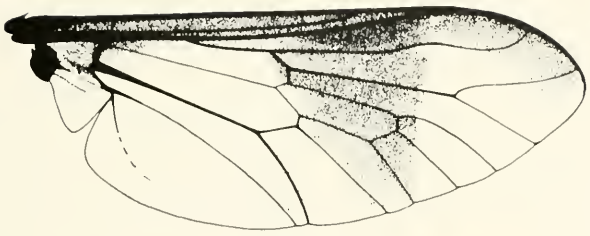
Chrysops reicherti Fairchild, 1937
(Fig. 72)

Chrysops reicherti Fairchild, 1937, Fla. Entomol. 19: 60–61.

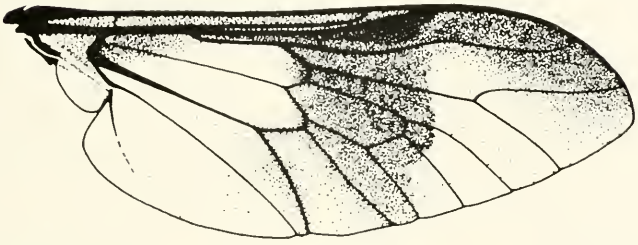
Chrysops flavida subsp. *reicherti* Fairchild. Philip, 1947, Amer. Midland Natur. 37: 273.

Length 7–11 mm; yellowish with brown thoracic stripes; base of abdomen with a pale greenish yellow color, remainder straw yellow to brown; outer margin of crossband sinuous; faint tinting in the usual hyaline areas along posterior wing margin.

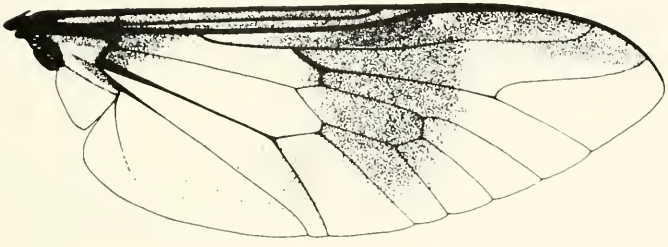
Variations: (Specimens examined—358) In general the specimens agree with Fairchild's (1937) description and are similar to a paratype supplied through the courtesy of Dr. L. L. Pechuman. Some observed variations include: wing tinting of usual hyaline



71 pudicus



72 reicherti



73 sackeni

74 separatus

75 sequax

Figures 71–75. Wing patterns of female *Chrysops*.

areas pale to dark; hind femora varying from dark brown to black; rarely second segment of abdomen straw yellow; and apical spot occasionally completely filling second submarginal cell.

Chrysops reicherti is separated from *C. flavidus* by its almost translucent greenish yellow color of the first and second abdominal segments, and the sinuous outer margin of the crossband. Even though the larvae of this species are similar to *flavidus*, the latter can be separated by the presence of a prothoracic pubescent bib and a posterior pubescent band on the preanal segment. Both *reicherti* and *flavidus* are sympatric throughout much of the Southeast, with *flavidus* extending a little more north and west than *reicherti*. Based on the distinctiveness of the larvae, and the present knowledge of adult morphology and distribution, I consider *C. reicherti* a distinct species and return it to specific rank.

Ecology and Distribution: (April–September) This species was taken throughout the state in all major vegetational regions, being most common in the swamps of the mixed bottomland hardwood forests.

Mature larva (Fig. 19): 16–18 mm, creamy white with pale to light brown pubescent markings.

Head capsule length: 1.6–1.7 mm.

Striations: Encircling all segments, somewhat more closely spaced laterally.

Thorax: Anterior pubescent annuli pale with lateral projections extending approximately ½ the length of the pro- and mesothorax, and ¼ the length of the metathorax.

Abdominal segments 1–7: Anterior pubescence encircling segments 1–3 or 4; absent laterally on remaining segments and progressively reduced ventrolaterally on 5–7. Pseudopodial pubescent rings complete and joined with anterior pubescence dorso- and ventrolaterally. Posterior pubescence, when present, limited to a tiny midlateral spot on the preanal segment.

Anal segment: Pubescence consisting of an irregular narrow anterior ring and a wide posterior ring encircling the segment, the latter occupying over ½ of the segment dorsally and joined dorsolaterally with the anterior pubescence; ventrally the posterior pubescence encloses the anus.

Respiratory siphon: 0.42–0.50 mm, slightly longer than its basal diameter and possessing a stigmatal spine.

Comments: Nine larvae were taken from several small ponds in a mixed bottomland hardwood forest and from the margin of a small lake in a cypress swamp. The collecting sites are located in St. Landry and St. Tammany parishes.

Chrysops separatus Hine, 1907
(Fig. 74)

Length 7–9 mm; black; face with median pollinose stripe; apical spot of wing separated from crossband.

Variations: (Specimens examined—3) In general all agree with Brennan's (1935) description with the exception that cell Cu_1 was not infuscated and the apical spot was somewhat reduced in two specimens.

Ecology and Distribution: (April) The author examined a single specimen collected by W. G. Bradley from East Baton Rouge Parish. Two other specimens were collected from Arkansas and Alabama in upland hardwood forests. A distinctive species but seldom collected—prior to the present investigation it was reported from Mississippi, North Carolina, Oklahoma, and Louisiana. Jones and Bradley (1923) reported a female of this species feeding on a cow in East Baton Rouge Parish.

Chrysops sequax Williston, 1887
(Fig. 75)

Length 8–9 mm; frontal callus black; mesonotum yellowish green with dark stripes; abdomen yellow with four complete black stripes; apical spot extensive filling apex of cell R_5 and occasionally entering cell M_1; apex of hyaline triangle extending above vein R_{2+3}.

Ecology and Distribution: This species was reported from Rapides Parish (August) by Hine (1907a). However, based on his description of *sequax* (p. 34), he apparently had specimens of *C. beameri* or a mixed population of both species before him (see also discussion under *C. beameri*). *C. sequax* was also recorded from Louisiana by Wilson and Burns (1964).

Chrysops striatus Osten Sacken, 1875
(Fig. 76)

Length 7–10 mm; frontal callosity usually black; abdomen yellow above with four black stripes, the lateral ones reduced; first basal cell infuscated; hyaline triangle not reaching vein R_{2+3}.

This species was reported from Louisiana by Philip (1947) and Wilson and Burns (1964). However, since the separation of *C. aberrans* Phil. from this complex, this southern extension of the range of *striatus* may be doubtful. Some variants of *C. montanus* with infuscated first basal cell and infuscation not crossing cell Cu_1, may key to *C. striatus* in Philip's (1955) key to the *Chrysops*.

Chrysops univittatus Macquart, 1855
(Fig. 78)

Length 6.0–8.5 mm; mesonotum dark greenish blue; abdomen brownish black with a middorsal yellow stripe; costal cell infuscated; apical spot variable, usually filling ½ or less of cell R_4, ocasionally nearly filling cell.

Variations: Resembling *C. upsilon* Phil., to be separated by characters discussed here and under *upsilon*. From four similar larvae collected during the present study, a male and female of *C. univittatus* and two males of *C. upsilon* were reared. Both of the *univittatus* specimens have a narrow apical spot and dark costal cell. In addition the male has a dark first basal cell and a small midfacial pollinose stripe extending about ¼ the distance to the oral margin. The two *upsilon* specimens have a light but broad apical spot invading cell R_5, costal and first basal cells infuscated. The midfacial pollinose stripe reaches the oral margin in one specimen, but in the other it extends approximately ½ the distance to oral margin.

These reared specimens were collected together from the same habitat and emerged within one week of each other. It is possible that both *C. univittatus* and *C. upsilon* were present in the same habitat and that their larvae are very similar. The possibility also exists that these two forms may not be distinct species; however, additional data is needed to confirm this.

The *C. univittatus* reported from the state by Hine (1907a) was actually *C. macquarti* Phil.

Mature larva (Fig. 16): 12–13 mm long; creamy white with light pubescent markings, darkest on anal segment.

Head capsule length: 1.4–1.5 mm.

Striations: Encircling all segments, somewhat more closely spaced laterally.

Thorax: Prothoracic annulus with a lateral pubescent bib extending about ½ the length of the segment; mesothoracic annulus with extremely short lateral pubescent projections; metathoracic annulus at most with only indications of lateral projections.

Abdominal segments 1–7: Anterior pubescence encircling segments 1–5 or 6, absent laterally on 7. Pseudopodial pubescent rings complete on all segments and joined with anterior pubescence dorso- and ventrolaterally. Posterior pubescence limited to a band encircling the preanal segment.

Anal segment: Posterior pubescence encircles the segment, covering about ½ of the dorsal aspect; the pubescence curves and widens covering over ¾ of the lateral aspects; the posterior pubescence forms a rather enlarged projection dorsolaterally, and ventrally encloses the anus; posteriorly the pubescence fades before reaching the siphon. Anterior pubescence consists of a spot or small projection located dorsally to dorsolaterally, and one to two spots located laterally to ventrolaterally.

Respiratory siphon: 0.53–0.56 mm, nearly 1.5 times its basal diameter and possessing a stigmatal spine.

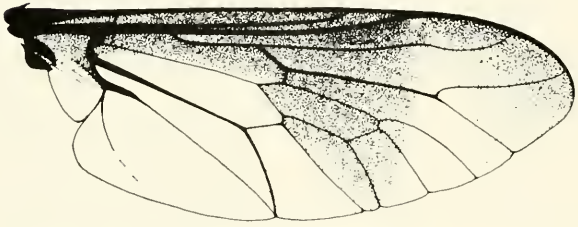
Comments: The larvae were taken from the margins of a small stream draining a longleaf-slash pine region in Washington Parish.

Chrysops upsilon Philip, 1949
(Fig. 79)

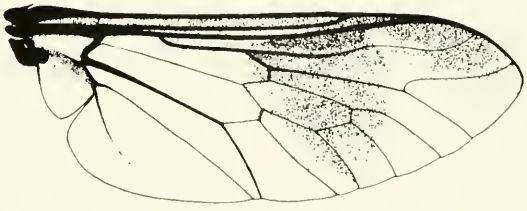
Length 7–9 mm; face with a median pollinose stripe; mesonotum dark blue-green; abdomen brownish black with a median yellow stripe; costal cell usually hyaline; apical spot broad, including most of cell R_4 and entering cell R_5.

Chrysops upsilon is frequently confused with *C. univittatus* Macq., and Philip (1949)

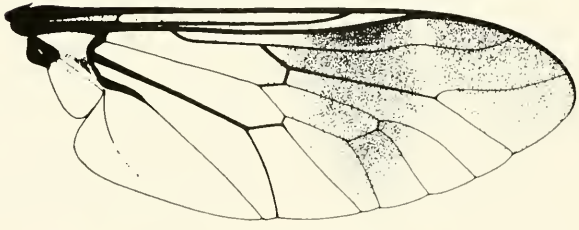
76 striatus



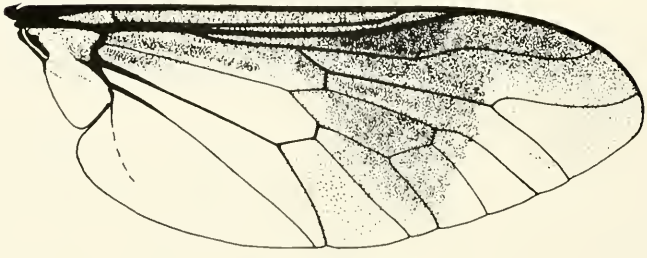
77 tidwelli



78 univittatus



79 upsilon



80 vittatus

Figures 76–80. Wing patterns of female *Chrysops*.

separates the former by the presence of an upsilon or T-shaped pollinose marking on the frontoclypeus beneath the antennae, a clear or lightly infuscated costal cell in the female, and a wider apical spot.

Variations: (Specimens examined—162) Departures from Philip's (1949) written description include the following: midfacial pollinose stripe varied in length, sometimes less than ⅓ the distance to oral margin in both sexes; basal ¾ of hind femora black; apical wing spot sometimes very faint; apex of hyaline triangle may extend to costal vein; usually first basal cell lightly infuscated; occasionally costal cell dark. Philip (p. 459) stated that *C. upsilon* had an almost hyaline costal cell although his wing figure shows a dark costal cell.

Male description: The male is herein described for the first time. Scape of antenna yellow, pedicel and base of flagellum brown, apex black. Palpi black. Face yellow, tubercles black and slightly swollen with a T-shaped yellow pollinose marking between them, the stem of which tapers and reaches the oral margin. Lateral areas of face with a band of yellow pollinose above cheeks. Lower margin of gena with a black spot. Dorsum of thorax fuscous with a broad median blue-green pollinose area concolorous with scutellum. Faint blue-green stripe above wing base, area between this and median stripe covered with golden reddish pollen. Pleura fuscous with two yellow pollinose stripes. Legs yellow, distal ½ of fore tibiae and entire tarsi black; basal ¼ and ½, respectively of middle and hind femora black; extreme apices of hind tibiae and apical tarsal segments of middle and hind tarsi, fuscous. Wing similar to female but with costal and first basal cells infuscated, and a streak in second basal cell reaching ¾ the length of the cell. Abdomen dark with a narrow yellow middorsal line extending to segment five; traces of submedian and lateral spots on segments 1–4. Venter of abdomen with a median fuscous stripe widening posteriorly; lateral areas of segments 1–3 yellow with the usual lateral stripes present.

The description is based on a specimen collected in St. Landry Parish, Louisiana, 2 July 1965. Variations observed in nine other Louisiana males are as follows: two specimens with the midfacial pollinose stripe extending approximately ½ the distance to oral margin, and in one of these, the infuscated streak in the second basal cell is considerably reduced and a faint infuscation is present in cell Cu_1.

The males of *C. upsilon* would key to couplet 25 in Philip's (1955) key to *Chrysops* males. Not agreeing with either alternative, they would be separated by the first basal cell entirely infuscated and second basal cell mostly hyaline with at most an infuscated streak not reaching apex.

Ecology and Distribution: (April–September) This species usually was associated with the mixed bottomland hardwood forests of the rivers and streams throughout the state. It was also collected in the longleaf-slash pine and mixed pine-hardwood regions of the state.

Mature larva: This species could not be separated from *C. univittatus* in the short series examined. In general, the overall pubescent pattern of *upsilon* is darker; the posterior pubescence on the preanal segment more extensive, being somewhat wider on the lateral surfaces. (see also under *C. univittatus*)

Chrysops vittatus Wiedemann, 1821
(Fig. 80)

Length 6–10 mm; yellow; frontal callus yellow; abdomen with four black stripes; apical spot of wing extensive; apex of hyaline triangle just enveloping fork.

Variations: (Specimens examined—450) The specimens agree with Brennan's (1935) description and variations.

Ecology and Distribution: (April–October) A common pest species throughout much of its range (eastern North America), it was taken frequently throughout the state in all major vegetational regions except the prairie and coastal marsh. *C. vittatus* was reported widely distributed in the state (Hine, 1906, 1907a), and Jones and Bradley (1923, 1924) listed it as one of the five most annoying pest species of livestock in Louisiana.

Mature larva (Fig. 13): approximately 12 mm long, creamy white with extremely pale to light brownish pubescent markings.

Head capsule length: 1.4–1.5 mm.

Striations: Encircling all segments somewhat more closely spaced laterally.

Thorax: Anterior pubescent annuli extremely faint, covering aproximately ½, ⅓, and ¼, the length of the pro-, meso-, and metathorax, respectively. Short inconspicuous peg-like lateral projections present on the meso- and metathorax.

Abdominal segments 1–7: Anterior pubescence encircling segments 1–4, reduced laterally on 5, and absent laterally and reduced ventrolaterally on 6 and 7. Pseudopodial pubescent rings complete and joined with anterior pubescence dorsolaterally on segments 1–7 and ventrolaterally on 1–5. Posterior pubescence limited to a band encircling the preanal segment.

Anal segment: Posterior pubescent band encircling approximately ½ the segment, fading posteriorly; its anterior margin with a dorsolateral, anteriorly-directed, finger-like projection; ventrally the posterior pubescence encloses the anus. Anterior pubescence consists of several small scattered patches. A distinct oval-shaped pubescent spot is situated laterally in the anterior clear area.

Respiratory siphon: Long, 0.67–0.70 mm, approximately 3 times its basal diameter.

Comments: Two larvae were taken from mud in a water-filled ditch located in an upland hardwood forest of West Feliciana Parish. Another specimen was taken from the margin of the Amite River in East Baton Rouge Parish. Hine (1906) gives the life history for this species.

Subfamily Tabaninae

Genus Diachlorus Osten Sacken, 1876

Diachlorus ferrugatus (Fabr.) is the only known Nearctic member of the genus.

Diachlorus ferrugatus (Fabricius, 1805)

Length 7–10 mm; yellow; frons very narrow, about seven times higher than basal width; abdomen yellow-brown sublaterally with a broad median yellow stripe; wing with broad apical spot; legs yellow with fore tibiae black and swollen.

Variations: (Specimens examined—29) All agree with Stone's (1938) description.

Ecology and Distribution: (April–July) This species is a persistent feeder and readily attacks man. It was collected from marshes and swamps in the mixed bottomland hardwood forest regions. Except for a single collection in Winn Parish, it was taken in the southcentral and southeastern portions of the state. Jones and Bradley (1923) reported this species from East Baton Rouge and St. James parishes.

Genus Stenotabanus Lutz, 1913

Most Nearctic species of this genus are found in either coastal or desert environments. They are generally small, slender flies with bare to sparsely pilose eyes. Most species are grayish or pale in color and usually have a distinct stump vein basally at vein R_4. A bare basicosta and the absence of a dorsal excision on the third antennal segment are characteristic of the genus.

Stenotabanus magnicallus (Stone, 1935)

Length 11–14 mm, slender; grayish; frons broad, about 1⅓ times higher than basal width; eye with two median bands and a third at lower margin; basal callus protuberant; abdomen cream colored, darkened when discolored; wing hyaline, vein R_4 with stump.

Variations: (Specimens examined—22) Departures from Stone's (1938) description include the following: basal callus touching eyes; median callus variable, a slender line reaching vertex, or short and widened above, not reaching denuded area at top; small denuded spot at vertex not raised; shiny brown band between eyes at vertex absent. Male: upper facets of eye distinctly differentiated in size and color from lower facets; eye with two narrow bands beneath upper facets.

A small series of 20 males and 2 females collected from Santa Rosa County, Florida, exhibit some characters similar to those of *S. pechumani* Philip. One female has a thin median callus and both females have a small denuded patch at vertex. However, all males exhibit areas of large and small eye facets sharply differentiated as is typical of *S. magnicallus*—the area of upper facets is extensive and the eyes are not divided by a narrow midfrontal area.

Ecology and Distribution: (May–June) This species was collected by sweeping sea oats, *Uniola paniculata* L., along the sandy beaches of the Gulf of Mexico in Florida. It was reported from Grand Isle, Louisiana, by Drs. L. L. Pechuman and J. H. Roberts (personal communications).

Genus CHLOROTABANUS Lutz, 1909

Chlorotabanus crepuscularis (Bequaert) represents the single Nearctic species of this genus.

Chlorotabanus crepuscularis (Bequaert, 1926)

Length 13–16 mm; greenish yellow; basal and median calli absent; wing hyaline, costal cell yellowish; vein R_4 with a short stump.

Variations: (Specimens examined—49) All agree with Stone's (1938) description.

Ecology and Distribution: (May–August) This species was found throughout the state, primarily associated with lakes, streams, and bayous in the mixed bottomland hardwood forests. At times, it was locally abundant and was collected from late afternoon until approximately 11:00 p.m. It was not collected from the coastal marsh. Hine (1907a) and Jones and Bradley (1923, 1924) variously referred to this species as *Tabanus mexicanus* L. and *T. flavus* Macq.

Mature larva (Fig. 24): 22–29 mm long, body completely dark in appearance, clothed in black, brown, and golden mottled pubescence; preserved specimens brownish black in color; living larvae dark with greenish hues.

Head capsule length: 3.2–3.7 mm.

Striations: If present, obscured by pubescence.

Respiratory siphon: 0.75–0.84 mm long, approximately equal to its basal diameter.

Comments: Numerous larvae were collected from aquatic habitats in most of the vegetational regions of the state. This was one of the few species frequently collected swimming. It was locally abundant in heavily vegetated swamp ponds and borrow pits, and was generally absent from clear and/or moving waters. One specimen was collected biting the author's leg as he waded through a heavily vegetated swamp pond.

Jones and Bradley (1924) reared this species from larvae collected from a lake's surface and at the muddy margin of a brook. Wilson (1969) listed six species including *C. crepuscularis* as inhabiting forest soils. This is unusual in that the larvae of these species are usually confined to aquatic or margins of aquatic habitats.

Genus WHITNEYOMYIA Bequaert, 1933

Whitneyomyia beatifica (Whitney) represents the single Nearctic species of this genus.

Whitneyomyia beatifica atricorpus Philip, 1950

Length 13–16 mm; entirely dark brown to black; eye deep purple with four blue-green bands, the upper one parallel to frons near vertex; subcallus and upper genae denuded and swollen.

Variations: (Specimens examined—9) All agree with Stone's (1938) description for *W. beatifica* (Whitney) but lack white hair on the sides of abdominal tergites 1–4 as is present in that form. Philip (1950a) considered *atricorpus* as only a possible physiological melanistic variant when he gave it subspecific rank.

Ecology and Distribution: (April–June) The specimens were collected from mixed bottomland hardwood regions in Allen, Beauregard, Lafayette, Iberia, St. Landry, and Vermilion parishes; from a mixed pine-hardwood region of St. Helena Parish; and from a longleaf-slash pine forest in Tangipahoa Parish. Hine (1907a) referred to this species as *Tabanus lugubris* Macq.

Genus LEUCOTABANUS Lutz, 1913

This genus contains two Nearctic species and may be characterized by the following: denuded or sparsely pilose eyes; an ocellar tubercle; frons of female very narrow with long, slender median callus; third antennal segment with five divisions (four annuli); scutellum pallid.

Leucotabanus annulatus (Say, 1823)

Length 9–12 mm; gray to brownish; median callus a thin line and joined to basal callus; posterior margins of abdominal segments pale; wing hyaline; male, whitish.

Variations: (Specimens examined—62) All agree with Stone's (1938) description.

Ecology and Distribution: (May–September) This species was collected throughout the state except in the marsh region. Hine (1907a) and Jones and Bradley (1923, 1924) reported this species from Louisiana under the name of *Tabanus annulatus*.

Mature larva (Fig. 25): Rather small,

19–22 mm long; white with extremely faint to light golden-brown pubescent markings.

Head capsule length: 2.9–3.4 mm.

Striations: Distinct on all surfaces with rather uniform spacings.

Thorax: A narrow anterior pubescent annulus encircling each segment; paired lateral pubescent projections present on the prothorax extending approximately ⅓ the length of the segment.

Abdominal segments 1–7: Anterior pubescence narrowly encircling segments 1–3 or 4, incomplete on remaining segments becoming progressively reduced posteriorly. Pseudopodial pubescence complete except between pseudopods 2 and 3 on segments 2–5 and occasionally incomplete on segments 6–7. Posterior pubescence encircling segments 6–7, incomplete and often only faint or inconspicuous traces on segments 3–5.

Anal segment: Blunt and rounded; pubescence consists of a narrow posterior band, and the anal ring somewhat expanded laterally.

Respiratory siphon: 0.3–0.4 mm long, about ½ its basal diameter.

Comments: Numerous larvae were collected throughout the state with the exception of the marsh region. Especially productive were hardwood logs in advanced stages of decomposition. Occasionally, larvae were taken from forest floor litter and from tree holes. The holes ranged in depth from 8 to 40 cm. and were located from ground level to elevations of more than eight meters. Organisms most frequently noted in association with these larvae included millipedes, centipedes, mites, pseudoscorpions, isopods, annelids, snails, and numerous species of insects. Especially numerous were the larval forms of Mycetophilidae, Anthomyiidae, Scenopinidae, Limoniidae, Psychodidae, Muscidae, Stratiomyidae, and other Diptera. Other insects present were Collembola, elaterids, formicids, and lepidopterans.

Jones and Bradley (1923) collected larvae and pupae of this species from rotten logs and stated that with the exception of a single specimen of *Tabanus fulvulus*, no other species (tabanid) was reared from larvae found in such material.

The larvae of *L. annulatus* superficially resemble those of terrestrial *Tabanus molestus*. Both have distinct striations, somewhat reduced pubescent pattern, and a blunt rounded anal segment with the respiratory siphon about ½ as long as its basal diameter.

Genus TABANUS Linnaeus, 1758

This is the largest Nearctic genus of the Tabanidae and contains most of the economic pest species. Commonly known as horse flies, members of the genus vary considerably in size from small (8 mm) to over 30 mm, have bare to sparsely pilose eyes, and have a third antennal segment with five divisions (four annuli).

Tabanus aar Philip, 1941

Length 18–25 mm; reddish brown; eye purple with two green bands; frons at least 6.5 times higher than basal width; abdomen with a median row of small indistinct grayish triangles; wing faintly infuscated, darker along vein margins.

Ecology and Distribution: This species was not taken in Louisiana during the present study but was listed from the state by Philip (1950b). It was collected in northwest Florida and lower Mississippi in longleaf-slash pine forests. *Tabanus aar* is somewhat similar in appearance to *T. turbidus* Wied. and like *turbidus* it is commonly collected in late evening to well after dark. Both species were frequently taken in light traps.

Tabanus abdominalis Fabricius, 1805

Length 18–25 mm; orange to brown; eye purple with two green bands; frons at least five times higher than basal width; abdomen usually with a median row of dark spots on anterior of tergites; fore tibia bicolored; wing fuscous, furcation and cross veins margined with brown; cell R_5 closed.

Variations: (Specimens examined—11) Departures from Stone's (1938) description include the following: basal callus occasionally not touching eyes at base; occasionally scutellum concolorous with olive brown mesonotum, black when discolored.

Members of this species are highly variable, and some individuals resemble specimens of *T. sulcifrons* Macq. so closely that positive separation of the two species is difficult. The criteria used in separating this species from *T. sulcifrons* were given

by Pechuman (1954) and are as follows: narrow frons, closed first posterior cell (cell R_5), no evident abdominal triangles, and wholly black femora.

Ecology and Distribution: (June–August) This species was collected from the mixed bottomland hardwood forests of Calcasieu, DeSoto, East Baton Rouge, East Feliciana, Grant, Iberville, Lafayette, Tangipahoa, and Winn parishes. Hine (1907a) reported this species from Beauregard and Tensas parishes, and Jones and Bradley (1923, 1924) recorded the seasonal occurrence from June to October.

Tabanus acutus (Bigot, 1892)

Length 16–21 mm; pale brownish with a broad median light stripe on abdomen; eye green with three purple bands, frons 3.5–4 times higher than basal width; wing lightly fuscous with a spot at furcation.

Variations: (Specimens examined—60) Departures from Stone's (1938) description include the following: third antennal segment occasionally darkened toward the distal portion; middle and hind tarsi usually darkened.

Ecology and Distribution: (May–September) This species is active in daylight as well as after dark and is commonly collected at lights. Specimens were taken along the coastal marshes from Florida to Texas. Occasionally, a few individuals were collected inland from these areas. Hine (1907a) reported this species from Cameron and Plaquemines parishes.

Tabanus americanus Forster, 1771

Length 24–33 mm; dark with deep reddish hues; eye bright green; frons about four times higher than basal width; wing hyaline with infuscated costal cell; tufts of white pile about wing base.

Variations: (Specimens examined—65) Departures from Stone's (1938) description include the following: dorsal projection of third antennal segment varying from short and rounded to prominent, almost reaching the annulate portion. Genal and pleural hair occasionally white.

Ecology and Distribution: (April–August) This species was commonly collected throughout the state from all major vegetational regions except the prairie. Hine (1907a) also reported this species widely distributed in the state.

Mature larva (Fig. 38): large, 51–55 mm; completely clothed in grayish brown to dark brown pubescence, varying somewhat in intensity from darker dorsally to slightly lighter ventrally. Pubescence darkest on anal and preanal segments. Small pale spots present in a patterned arrangement on abdominal segments (approx. 20 per segment).

Head capsule length: 6.1–6.6 mm.

Striations: If present, obscured by pubescence.

Respiratory siphon: 1.9–2.2 mm, somewhat longer than its basal diameter.

Comments: The description is based on larval exuviae—in general living specimens are somewhat lighter in appearance. Four larvae were collected from mixed bottomland hardwood forest regions of St. Landry and Assumption parishes. The larvae were terrestrial in moist areas of the forest floor. These areas were occasionally flooded for a few days to several weeks during periods of heavy rains, especially during December, January, and May for the St. Landry location and during July, August, and September for the Assumption area; however, most of the year no standing water was present at the collecting sites. All specimens were removed from decaying logs. One specimen was taken from frass of passalid beetles in a partially-decomposed, water tupelo log. Other associated insects were mycetophilids, scenopinids, psychodids, and Collembola.

Jones and Bradley (1924) collected three larvae (reared) from the muddy margin of a shallow pool.

Tabanus aranti Hays, 1961

Length 15–22 mm; black; eye deep purple with two dark bronze bands; frons usually 4–5 times higher than basal width; wing dark.

Variations: (Specimens examined—28) Departures from Hays (1961) description include the following: occasionally height of frons greater than five times its basal width.

This species superficially resembles *T. atratus* Fabr. but is readily distinguished by its smaller size, narrower frons, and pollinose

genae. It is more closely related to *T. nigrescens* P. de B. and *T. colon* Thun. but may be separated by the characters listed in the key.

Ecology and Distribution: (May–June) This species was not commonly collected. One specimen was collected in Washington Parish, Louisiana. It was reared from a larva taken at the margin of a small stream in a longleaf-slash pine region. Two adults were taken in Tangipahoa Parish and others in Alabama.

Mature larva (Fig. 34): Rather large, 40–47 mm long; creamy white to light yellow with extremely pale to medium brown pubescent markings.

Head capsule length: 5.4–6.0 mm.

Striations: Present laterally on segments 1–10; absent or inconspicuous on dorsal and ventral aspects. Anal segment with conspicuous striations below the lateral pubescent arm and posterior to the anus. Anterior ⅓ of segment with very fine striations visible under high magnifications giving this area a shadowed appearance.

Thorax: Anterior pubescent annuli somewhat wider laterally. Lateral surface of prothorax with two pubescent arms tapering posteriorly and extending about ¾ the length of the segment. Meso- and metathorax with lateral pubescent projections, the middle pair extending approximately ¾ and ½ the length of their respective segments; the dorso- and ventrolateral projections extending approximately ½ and ⅓ the length of the meso- and metathorax, respectively. These projections may appear to traverse the entire length of the segment due to the presence of many fine striations and/or fine adherent debris.

Abdominal segments 1–7: Anterior pubescence encircling at least segments 1–4, becoming less conspicuous and somewhat reduced on remaining segments. Pseudopodial pubescent rings usually complete and connected with anterior pubescence ventrolaterally on segments 1–6. Posterior pubescence present on all segments ranging from inconspicuous colorless traces on anterior segments to a wide conspicuous band on the preanal segment.

Anal segment: Pubescence distinct, consisting of anal and posterior rings, the latter joined laterally with an anteriorly-directed, clubbed arm covering about ½ the length of the segment. Generally, three pubescent spots varying in size and intensity located somewhat dorsal to the arm.

Respiratory siphon: 1.5–1.7 mm long, less than 1.5 times its basal diameter and possessing a stigmatal spine.

Variations: Anterior and posterior pubescence in certain areas of the abdomen may be very faint and seen only as slight shadows, if at all. This may be especially true for the anterior pubescence in front of pseudopods 2, 3, 4, and posterior pubescence of the anterior abdominal segments. The lateral pubescent arm of the anal segment may be incomplete, not reaching the posterior pubescent ring. In some cases, the lateral arm may narrowly join the anal ring pubescence.

Comments: In addition to the Louisiana specimen, 38 larvae were collected from Lee County, Alabama. Most were taken from the margin of a shallow beaver pond situated in a hardwood forest. (See also Comments under *T. nigrescens*.)

Tabanus atratus Fabricius, 1775

Length 20–31 mm; black; eye dark with a narrow black median band and a wider black band below; frons 2–2.5 times higher than basal width; wing dark.

Variations: (Specimens examined—50) All agree with Stone's (1938) description.

Ecology and Distribution: (April–October) This species was found throughout the state from all major vegetational regions; however, it was collected most frequently in the mixed bottomland hardwood forests and seldom in the open pine woods. Hine (1906) gives the life history of this species and (1907a) lists *T. atratus* (in key *T. striatus*, lapsus) as state wide in occurrence.

Mature larva (Fig. 37): Large, 50–63 mm long; cream colored with conspicuous medium to dark brown pubescent markings on all segments.

Head capsule length: 6.3–7.3 mm.

Striations: Present laterally on segments 1–10 and occasionally ventrally behind the anus where they are faint and broken; absent elsewhere.

Thorax: Prothoracic annulus with a distinct lateral pubescent bib extending about ¾ the length of the segment. Meso- and metatho-

racic annuli with conspicuous lateral projections; usually one meso- and all metathoracic projections joined with posterior pubescent rings; two or three mesothoracic arms often merging into a solid mass and extending at least ¾ the length of the segment.

Abdominal segments 1–7: Anterior and pseudopodial pubescence joined broadly and connected with posterior pubescent rings by a dorsolateral pubescent bar on all segments; most segments with lateral and ventrolateral projections extending from the pseudopodial pubescence and directed toward corresponding projections from the posterior pubescent rings; these may form one or more continuous lateral bars on segments 1, 6, and 7. Middorsally, a pubescent projection extends posteriorly from the pseudopodial annulus ¼ to over ½ the length of the segments.

Anal segment: Pubescence extensive, covering segment with the exception of a dorsal to dorsolateral saddle-shaped clear area and ventral clear areas anterior and posterior to the anal lobes.

Respiratory siphon: Truncate apically, 1.7–2.3 mm long; about equal to its basal diameter.

Variations: In several specimens the middorsal pubescence extends the length of all abdominal segments and joins the posterior pubescence, forming a dark, wide dorsal band continuous on the anal segment where it isolates a small dorsolateral clear window on each side. In general, in these variants, the pubescence is much more extensive than on the normal body pattern, especially the lateral pubescence which may form two or more continuous bars on abdominal segments 1–7. This increase in the amount of pubescence may be the result of the larvae going through additional instars since early instar larvae exhibit less pubescence than older and more mature larvae.

Comments: Numerous larvae were found throughout the state in all major vegetational regions; however, they were collected most frequently from aquatic habitats on the floodplains of the larger rivers. Larvae were collected from the sandy beaches of fast-flowing streams, flood-control ditches, artificial impoundments, cattle water troughs, and marsh and swamp lakes. They were usually associated with the organic muck at the water's edge although some individuals were collected swimming near the surface.

Jones and Bradley (1923) collected and reared numerous larvae of this species. The larvae were maintained in moist sand in small glass jars and fed earthworms. Attempts to rear them on nutrient agar were unsuccessful.

Tabanus calens Linnaeus, 1758

Tabanus giganteus Degeer. Stone, 1938, USDA Misc. Publ. 305, p. 84.

Length 22–28 mm; brown with blackish abdomen; eye unicolorous; frons 4.5–5 times higher than basal width; antenna brownish orange; wing faintly infuscated.

Variations: (Specimens examined—6.) All agree with Stone's (1938) description.

Ecology and Distribution: (August) Specimens were taken from bottomland forests in Caddo, Claiborne, and St. Landry Parishes. Jones and Bradley (1923, 1924) referred to this species as *T. giganteus* and collected it July–October near Baton Rouge.

Tabanus cheliopterus Rondani, 1850

Length 15–21 mm; orange-brown; eye purple with two green bands; frons 2.5–3.5 times higher than basal width; abdomen with a median row of pale triangles; wing lightly fuscous with furcation and veins margined with brown.

Variations: This species is variable in certain characters. Lighter specimens (*T. cheliopterus cheliopterus*) usually have palpi, legs, and venter of abdomen light reddish brown. *Tabanus cheliopterus* var. *fronto* is a slightly larger, darker form with the above features brown to dark brown. In a small series (42 specimens) of *T. cheliopterus* (U.S. National Museum and the author's collection) there is intergradation in both leg and body coloration, and it may be that the varietal status for the darker form is unwarranted.

Ecology and Distribution: Hine (1907a) recorded this species under the name of *T. fronto* O.S. The description he gives (p. 48) could have included both light and dark forms. A single Louisiana specimen examined by the author (USNM) was a light colored male *T. cheliopterus* collected at New Orleans in August.

Tabanus coarctatus Stone, 1935

Length 14–18 mm; brownish; eye purple with two blue-green bands; frons 5–7 times higher than basal width; abdomen with a median row of pale triangles; wing nearly hyaline with a faint spot at furcation.

Variations: (Specimens examined—10) All specimens exhibit variation from Stone's (1938) description in the following characters: apical portion of fore tibiae and all tarsi fuscous; posterior bands of abdominal tergites not forming sublateral triangles. Two specimens have the scutellum with white hair. Certain specimens are similar to *T. equalis* Hine but can usually be separated by using the combination of characters given in the key.

Ecology and Distribution: (May–June) This species was collected from the longleaf-slash pine forests of Florida, Alabama, Mississippi, and Louisiana, and from an upland hardwood forest in West Feliciana Parish.

Tabanus colon Thunberg, 1827

Tabanus nigrescens var. *atripennis* Stone. Stone, 1938, USDA Misc. Publ. 305, p. 93.

Length 20–26 mm; dark brown to black; eye dark golden with three purple bands, the upper one fading; frons about 3.5–4.5 times higher than basal width; wing uniformly smoky with a spot at furcation.

Variations: (Specimens examined—9) Departures from Stone's (1938) description include the following: height of frons may be nearly 4.5 times its basal width; occasionally third antennal segment, except extreme apical tip, orange. Closely related to *T. nigrescens* P. de B., *T. colon* is separated by its uniformly infuscated wing.

Ecology and Distribution: (June–July) Seldom collected, this species was taken in the longleaf-slash pine forests of Florida and Mississippi, and five specimens were taken from longleaf pine forests in Washington and Tangipahoa parishes.

Tabanus cymatophorus Osten Sacken, 1876

Length 17–22 mm; gray and brown; eye purple with two green bands; frons about 4.5 times higher than basal width; abdomen with a median row of pale triangles and a sublateral row of pale oblique spots on each side; wing nearly hyaline, furcation and cross veins margined with brown.

Variations: (Specimens examined—11) All agree with Stone's (1938) description. Superficially resembling *T. reinwardti* Wied., *T. cymatophorus* is readily distinguished by its narrower frons.

Ecology and Distribution: (May–October) This species was associated primarily with the mixed bottomland hardwood forests in Acadia, Ascension, Calcasieu, East Baton Rouge, and Iberville parishes. Hine (1907a) recorded this species from Acadia Parish and stated that it was not known to be abundant. Jones and Bradley (1924) collected a larva (reared) from the edge of a shallow pool in East Baton Rouge Parish.

Tabanus eadsi Philip, 1962

Length 10–12 mm; yellowish and brown; eye green with one reddish purple band; frons about 3–3.5 times higher than basal width; abdomen with a middorsal pale stripe and two submedian brownish stripes; first three tergites yellowish laterally; wing hyaline, costal cell infuscated.

Variations: (Specimens examined—7) Departures from Philip's (1962) description include the following: frontal index varying from 1:2.8 to 1:3.4; basal callus narrowly joined to median callus; color of palpal hair varying from entirely yellow to mixed black and yellow; fore coxae concolorous with pleurae, occasionally with black hair; middle and hind femora and all tarsi, black; sides of first three abdominal tergites and venter of first three sternites, dull yellow-orange.

This species is very similar to *T. quinquevittatus* Wied., and geographic variation could account for observed differences. The males of *T. eadsi* cannot be consistently separated from those of *quinquevittatus*. The antennae, palpi, and extent of upper eye facets in a male *quinquevittatus* (Fairfield Co., Ohio) is nearly identical to that of a paratype (U.S. National Museum) of *eadsi* from Galveston, Texas. While it is possible that *eadsi* is only a subspecies of *quinquevittatus*, the restricted habitat and their early seasonal appearance give support for their distinctiveness.

Ecology and Distribution: (April–May) Four specimens were taken from the coastal marsh of Cameron Parish and two from the coast of Chambers Co., Texas. They were collected flying with *T. nigrovittatus* Macq.

Tabanus endymion Osten Sacken, 1878

Length 13–18 mm; brownish; eye purple with two blue-green bands; frons about four times higher than basal width; third antennal segment with no dorsal excision; abdomen with a median row of pale triangles; wing nearly hyaline, furcation and cross veins margined with brown.

Ecology and Distribution: (July–August) This species was collected from the longleaf-slash pine forests of northwest Florida but was not collected in Louisiana during the present study. It was reported from the state by Philip (1950b).

Tabanus equalis Hine, 1923

Length 16–25 mm; reddish brown; eye purple with two green bands; frons 4–5.5 times higher than basal width; third antennal segment dark brown to black; legs uniformly reddish brown; wing usually hyaline, veins in basal portion occasionally margined with brown, usually spot at furcation; abdomen with a median row of pale triangles.

Variations: This species is similar to *T. turbidus* Wied. but usually can be distinguished by the presence of a black third antennal segment, frons ratio less than 1:5.5, and wing veins not margined with brown. *Tabanus turbidus* usually exhibits an orange third antennal segment, frons ratio 1:6 or greater, and wing veins margined with brown. Some intermediate specimens from Louisiana have frons ratios as great as 1:6.5, but in other characters they are similar to *equalis*. Other intermediate specimens exhibit certain *turbidus* characters such as frons ratio 1:6 and light brown infuscation along wing vein margins; however, the third antennal segment is black. Most *equalis* specimens examined from Louisiana exhibit an entirely black third antennal segment; whereas, specimens from more northern areas (Kansas, Missouri and Iowa) usually exhibit a third antennal segment with black in the middle but brown on the apical and basal portions. Certain intermediate specimens are difficult to assign to either taxon. In a series of 873 specimens from 15 states from Florida to Iowa and Oklahoma to North Carolina (*turbidus* exhibits a southeastern distribution while *equalis* is somewhat more to the north and west), 98 intermediates were seen. Most of the intermediates came from Louisiana, Arkansas, and Tennessee.

A comparison of the variation in populations of *equalis* and *turbidus* indicates that these two forms could be members of the same species, each representing a geographically defined subspecies with some degree of overlap in certain areas. However, at this time it seems unwarranted to change the status of these two well known species to subspecific rank. Until conclusive information is available they are best treated as distinct species with, perhaps, a limited amount of hybridization occurring in regions of overlap.

Ecology and Distribution: (April–August) *Tabanus equalis* and *turbidus* were primarily associated with the mixed bottomland and upland hardwood forests throughout the state. They were collected frequently from late afternoon until after dark, and large numbers were taken using light traps. Jones and Bradley (1923, 1924) listed *T. turbidus*, *T. aequalis* (= *T. equalis*) and *T. uniformis* (= *T. equalis*) from the state.

Tabanus fairchildi Stone, 1938

Length 13–18 mm; grayish black; eye bronze green with one purple band; frons 3.5–4 times higher than basal width; antenna black; abdomen with a median row of pale triangles and a sublateral row of pale spots on each side; wing hyaline.

Variations: (Specimens examined—15) All specimens exhibit variation from Stone's (1938) description in the following characters: sublateral spots of abdomen touching hind margins of most tergites; median abdominal triangles varying from very slender to medium in width; triangle on second tergite not noticeably larger than others; mesial surface of fore femora dark brown to black.

A comparison of Louisiana adults with specimens provided by Dr. L. L. Pechuman (collected Ludlowville, N. Y.—near type locality) did not show any major variation although larvae from this location described by Teskey (1969) show variations from Louisiana specimens. Larvae from Tennessee and North Carolina described by Goodwin (1967), at least in some characters, appear to be closer to the La. specimens than the New York larvae.

Ecology and Distribution: (April–June)

T. fairchildi was taken near small streams that drain mixed pine-hardwood forests in East Feliciana and Natchitoches parishes. It was also taken from the longleaf-slash pine region of Tangipahoa and Washington parishes.

Mature larva (Fig. 39): Moderate in size, 30–36 mm long; cream colored with light to medium brown pubescent markings.

Head capsule length: 4.0–4.1 mm.

Striations: Present laterally and dorsally on segments 1–10 and ventrally on 4–10; incomplete or absent ventrally on thoracic segments. Anal segment with relatively wide striations dorsally and posterior to the anus; very fine and inconspicuous on anterior ⅓ of segment.

Thorax: Anterior pubescent annulus of prothorax with a lateral bib; meso- and metathoracic annuli with lateral projections extending approximately ¾ the length of the segments. Traces of posterior pubescence occasionally present laterally and middorsally on the metathorax.

Abdominal segments 1–7: All except dorsal pseudopods on segments 1–4 or 5 long and conspicuous with from 5 to 15 curved spines arranged in a semicircular pattern. Anterior pubescence encircling segments 1–2, incomplete and diminishing progressively on remaining segments. Pseudopodial pubescence encircling segments 1–2 or 3, continuous with anterior pubescence on segment one, and joined with anterior pubescence dorso- and ventrolaterally on two. Posterior pubescence present on all segments becoming progressively more conspicuous on posterior segments. A pubescent bar is present dorsolaterally on abdominal segment seven.

Anal segment: Pubescence distinct, consisting of anal and posterior rings, the latter expanded dorsally and extending an anterior projection occupying about ⅓ the length of the segment. Remaining pubescence consists of a lateral pubescent bar and one conspicuous and usually two smaller, less distinct pubescent spots dorsal to the bar. Immediately anterior to the anus, a ventral row of curved spines is situated on a protruding lip or anal pseudopod.

Respiratory siphon: 1.0–1.2 mm long, less than twice its basal diameter.

Variations: In some specimens the lateral arm of the anal segment appears to be joined to the median middorsal pubescent projection. An accumulation of adherent debris was present on several specimens being especially apparent on the anal segment.

Comments: Six larvae were taken beneath a layer of moss covering a partially submerged log in a beaver dam. Large numbers of aquatic insects were present in the dam which crossed a narrow, sandy-bottom stream. This stream was located in a mixed pine-hardwood forest in East Feliciana Parish. The above habitat is unusual in that the larvae of this species have been recorded only from beneath stones in riffle areas of streams (Stone, 1938; Roberts, 1962; Teskey, 1969).

Tabanus fulvulus Wiedemann, 1828

Length 12–16 mm; orange-yellow; eye green with three reddish purple bands; frons 5–7 times higher than basal width; palpi yellowish; pleurae and genae with yellow hair; abdomen with three rows of pale yellow spots, those of median row contiguous; wing subhyaline to hyaline with costal cell lightly infuscated.

Variations: 70 specimens were examined from Louisiana, Mississippi, Alabama, Florida, Tennessee, and North Carolina. Departures from Stone's (1938) description include the following: height of frons ranging from about 5.5 to 7 times its basal width; mesonotum dark golden; wing usually subhyaline; occasionally distal ½ of fore tibiae, extreme apices of middle and hind tibiae, dark; hind femora sometimes orange-brown with gray pollen.

Tabanus fulvulus closely resembles *T. pallidescens* Phil. (For additional information see discussion under latter species.)

Ecology and Distribution: (May–July) *T. fulvulus* was collected in the mixed pine-hardwood forests of East Feliciana, St. Helena, and Winn parishes. It was also taken from the upland hardwood forests of West Feliciana Parish and the longleaf-slash pine regions of Tangipahoa and Washington parishes.

Jones and Bradley (1923) recorded a larva of *T. fulvulus* (reared) from a rotten log; however, Pechuman (1962) stated that the *fulvulus* of Jones and Bradley was actually *T. pallidescens*, and the *fulvulus* recorded

by Hine (1907a) included, in part, *T. pallidescens* and *T. wilsoni* Pech.

Tabanus fuscicostatus Hine, 1906

Length 10–14 mm; brown; eye green with one reddish purple band; frons about 3.5–4 times higher than basal width; abdomen with a median pale stripe and a row of sublateral spots on each side; wing hyaline with distinctly infuscated costal cell.

Variations: (Specimens examined—130) Departures from Stone's (1938) description include the following: basal and median calli occasionally black; median callus variable, occasionally a small circular dot, or absent to very slim; thorax frequently olive-gray in appearance; apices of middle and hind tibiae usually darkened; femora usually dark brown to black; abdominal triangles occasionally widened on posterior margins; sublateral spots of tergites 2–4 sometimes reaching anterior and posterior margins, giving the abdomen a 3-striped appearance.

Forms of *T. fuscicostatus* from some areas exhibit the following characters either singly or in combination that are similar to those of *T. mularis* Stone: black basal calli, femora dark brown to black, and the lateral regions of the abdomen almost black. Certain of these specimens are difficult to assign; however, using the combination of characters given in the key, they can usually be separated.

Ecology and Distribution: (April–September) This species was found throughout the state usually associated with the bottomland hardwood forests on the floodplains of major rivers. Adults were taken from emergence cages located at the margins of small swamp pools and over the moist soils of riverbottom hardwood forests. While these areas were primarily terrestrial, they were periodically flooded by heavy rains.

Several larvae thought to be this species were taken from this habitat, but all died before emergence. Wilson (1969) reported taking *T. fuscicostatus* larvae from forest soils in St. Landry Parish.

The *T. fuscicostatus* recorded by Hine (1907a) and Jones and Bradley (1924) probably included, in part, *T. mularis*. Jones and Bradley listed *fuscicostatus* as one of the five most annoying pests of livestock in Louisiana.

Tabanus imitans Walker, 1848

Tabanus maculipennis var. *imitans* Walker. Philip, 1966, Ann. Entomol. Soc. Amer. 59: 520.

Length 20–30 mm; dark with reddish purple hues; eye in life dark with a narrow median black band and a broad black band at lower margin; frons 3–4 times higher than basal width; antenna orange to orange-brown, third segment with a prominent, forward projecting, dorsal process; wing hyaline, furcation and cross veins margined with brown, costal cell and wing base darkly infuscated.

Fairchild (1966) and Philip (1966) examined a specimen from the Berlin Museum thought to be the type of *T. maculipennis* Wied., 1828, and both concluded that it was conspecific with *T. imitans* var. *excessus* Stone, 1938. Since the name *T. maculipennis* has priority over *T. imitans* Walker, 1848, *T. imitans excessus* was placed in synonymy. The two varieties, *T. imitans imitans* Walk., 1848, and *T. imitans pechumani* Philip, 1960, were placed as subspecies of *T. maculipennis*.

However, the presence of a prominent dorsal projection of the third antennal segment, the presence of a single median black eye band and an extensive black band at lower margin, the usually long slender median callus, and the grayish lavender hues of the thoracic dorsum, make *T. imitans* distinct from *T. maculipennis*. Based on morphological characters as well as the geographic overlap of *T. maculipennis* and *T. imitans*, I consider *T. imitans* distinct from *T. maculipennis*.

The status of the form *pechumani* is uncertain to the author, but the presence of a prominent dorsal projection on the third antennal segment would indicate its closer relationship to *T. imitans*.

Variations: 126 specimens were examined from Louisiana, Mississippi, Alabama, Florida, and North Carolina. Departures from Stone's (1938) description include the following: eye coloration (see above); frons ratio of most specimens 1:3.5–1:4; median callus variable, rarely separated from basal callus and only occasionally somewhat widened; occasionally median callus reaching a denuded spot at vertex; second palpal segment occasionally strap-like; dorsum of

thorax with grayish purple hues; tufts of hair around wing base sometimes black; abdomen often lacking median row of triangles—this variation was frequently observed on the specimens 25–30 mm in length; eye (relaxed) of male with a wide median green band in the middle of small facets, a stripe of bright purple above, and the remainder with background color appearing as a dark dull reddish purple.

Ecology and Distribution: (May–July) Three specimens were taken in Washington Parish near small streams that drain the longleaf-slash pine forests. Jones and Bradley (1923) did not give descriptions for specimens they reared as *T. fuscopunctatus* Macq. and *T. imitans* Walk. It is possible that the *T. fuscopunctatus* was *T. imitans* and their *T. imitans* were *T. maculipennis.*

Tabanus lineola lineola Fabricius, 1794

Length 10–16 mm; brownish to dark gray-brown; eye purple with three green bands, the upper two joined at outer margin of eye; average frons about five times higher than basal width and widened above; abdomen with a median pale stripe and a row of sublateral contiguous spots on each side; wing hyaline.

Tabanus lineola is a member of a complex which includes *T. lineola hinellus* Phil., *T. similis* Macq. (= *T. lineola scutellaris* Walk.), *T. subsimilis* Bell., and additional forms. The *T. lineola* considered here is the dark inland form.

Variations: (Specimens examined—750) Departures from Stone's (1938) description include the following: height of frons 4.5 to over 7 times its basal width; occasionally basal callus light tan and palpi yellow-cream; sometimes hind femora light tan; median stripe occasionally widened on the posterior margins of abdominal tergites. Other variations would include intermediate conditions between the typical *T. lineola* and *T. lineola hinellus.*

Ecology and Distribution: (April–October) This species was found in all major vegetational regions but most often in the mixed bottomland hardwood forests. The subspecies *T. lineola hinellus* generally replaced typical *T. lineola* in the coastal marshes.

Hine (1906, 1907a) and Jones and Bradley (1924) listed this species as one of the most abundant and pestiferous in Louisiana. Wilson (1963) reported *T. lineola, T. vittiger schwardti* Phil. (= *T. subsimilis* Bell.), and *T. fuscicostatus* Hine constituted 90 percent of the tabanids taken using a horse in West Baton Rouge Parish.

Mature larva (Fig. 2): Small to moderate in size, 22–25 mm long; creamy beige to pinkish with light to medium brown pubescent markings.

Head capsule length: 2.8–3.4 mm.

Striations: Present laterally on segments 1–10; absent dorsally and ventrally on thoracic segments and ventrally on the first seven abdominal segments; faint, incomplete stria sometimes present dorsally on abdominal segments. Anal striations distinct, visible on all but the anterior ⅓ of the segment.

Thorax: Anterior pubescent annulus of prothorax with a lateral pubescent bib on each side, the lateral arms and central portion of which extend approximately ¾ and ½ the length of the segment, respectively; four lateral meso- and metathoracic arms extend from the anterior annuli at least ¾ and ½ the length of the respective segments. Mesothoracic arms somewhat swollen apically. A faint narrow band of posterior pubescence present on the metathorax.

Abdominal segments 1–7: Anterior pubescence encircling segments 1–5, absent laterally on 6–7. Pseudopodial pubescent connections complete and joined with anterior pubescence dorso- and ventrolaterally. Posterior pubescence present on all segments, becoming progressively more conspicuous and complete on posterior segments.

Anal segment: Pubescence distinct, consisting of posterior and anal rings, the latter extending a dorsal projection or arm which curves posteriorly on the midlateral surface tapering and not reaching the posterior pubescence. A large, irregular pubescent spot is located dorsal to, and often joins narrowly with, the pubescent arm. A small, inconspicuous spot is often present anterior and somewhat dorsal to the large spot.

Respiratory siphon: 0.8–1.1 mm long, about equal to its basal diameter.

Variations: Considerable variation of pu-

bescence on the anal segment was noted. Dorsolaterally, there may be 1–2 conspicuous pubescent spots and from 1–2 small spots none of which touch the lateral arm. In some individuals, there was more variation in the anal pubescent pattern from one side to the other as there was between different specimens. One adult identified as *T. lineola hinellus* was reared from a larva which exhibited an overall darker pubescent pattern. This larva also exhibited certain variations that were found in some of the other *T. lineola* larvae, notably on the anal segment where the large dorsolateral pubescent spot joined the pubescent arm.

Comments: Twelve larvae were collected from mixed bottomland hardwood regions of St. Landry and East Baton Rouge parishes and from the mixed pine-hardwood regions of Claiborne, Tangipahoa, Union, and Webster parishes. They were located in moist forest soils, intermittently flooded ditches, in partially submerged logs at the margins of standing bodies of water, and in other moist depressions.

Jones and Bradley (1924) collected 24 *T. lineola* larvae, most of which were taken at pond edges in open areas. Wilson (1969) reported taking the larvae of this species from forest soils in St. Landry Parish.

Tabanus lineola hinellus Philip, 1960

Length 12–16 mm; yellowish brown; eye pattern as in typical *lineola* although stripes somewhat broader; frons usually 4–4.5 times higher than basal width; abdomen with a median light stripe and a row of sublateral contiguous spots on each side; wing hyaline.

Variations: (Specimens examined—140) The specimens of this subspecies agree with Philip's (1960) description. Overall appearance is similar to that of typical *T. lineola* except that *T. lineola hinellus* is lighter in color and slightly larger. Intermediates between the two forms are occasionally found inland from the coastal marsh and usually cannot be placed with certainty into either taxon.

Ecology and Distribution: (April–September) This subspecies was collected from the coastal marsh, and occasionally a specimen was taken inland. One adult of *T. lineola hinellus* was reared from a larva collected in Tangipahoa Parish. This larva varied slightly in appearance from *T. lineola* larvae (see under *T. lineola* larval variations).

Hine (1907a) referring to this form as *T. quinquevittatus*, reported it was one of the three most common species on the Gulf Coast.

Tabanus longiusculus Hine, 1907

Length 10–13 mm; brown; eye green with two purple bands and a purple triangle above with its base on frons; frons 4–5 times higher than basal width; antenna orange with annulate portion black; abdomen with a median pale stripe widened posteriorly on each segment, and a sublateral row of pale spots on each side; wing nearly hyaline with costal cell infuscated.

Variations: Twelve Louisiana specimens agree with Stone's (1938) description.

Ecology and Distribution: (June) Two specimens were collected in a longleaf pine forest of Natchitoches Parish, and ten specimens were taken from a longleaf-slash pine forest in St. Tammany Parish. Jones and Bradley (1923) recorded this species from Mound (Madison Parish), Louisiana. Pechuman (1962) reported that a specimen collected by Bradley at Mound (determined as *T. longiusculus* by Aldrich) was actually *T. wilsoni* Pech.

Tabanus maculipennis Wiedemann, 1828

Tabanus imitans var. *excessus* Stone. Stone, 1938, USDA Misc. Publ. 305. p. 87.

Length 17–23 mm; dark with deep reddish purple hues; eye in relaxed specimens greenish purple with two narrow reddish purple bands; frons 3–3.5 times higher than basal width; third antennal segment lacking a forward projecting process; wing hyaline, furcation and cross veins distinctly margined with brown, costal cell and wing base heavily infuscated.

Variations: (Specimens examined—39) This species is similar to *T. imitans* Walk., and in addition to the key characters listed above, *T. maculipennis* usually exhibits the following: median callus spindle shaped, narrowly attached to basal callus; dorsum of thorax with deep reddish brown hues; spots on wing more extensive than in *T. imitans*; and eye (relaxed) of male with a narrow median green stripe in middle of small

facets, remainder with purplish cast. (See discussion under *T. imitans.*)

Ecology and Distribution: (May–July) This species was collected from the mixed bottomland hardwood forests of the Amite and Pearl rivers in Ascension, Livingston, and St. Tammany parishes, and from a longleaf-slash pine region in Washington Parish.

Mature larva (Fig. 32): Rather large, 43–47 mm long; green in life with light to medium brown pubescent markings.

Head capsule length: 5.0–5.6 mm.

Striations: Present laterally on segments 1–10; absent dorsally and ventrally on thorax; inconspicuous striations occasionally visible dorsally and ventrally on abdominal segments 1–7. Anal striations conspicuous below the lateral pubescent arm; absent or inconspicuous elsewhere.

Thorax: Anterior pubescent annuli with two lateral prothoracic and 4 meso- and metathoracic lateral pubescent projections on each side extending approximately ¾ the length of the segments. Posterior pubescence limited to metathorax, where it consists of narrow traces on all but the midlateral regions.

Abdominal segments 1–7: Anterior pubescence encircling segments 1–6 or 7, varied in intensity, becoming extremely faint and inconspicuous ventrolaterally on the last three segments. Pseudopodial pubescent connections complete, joined with anterior pubescence dorsolaterally on segments 1–3 or 4 and ventrolaterally on 1–6 or 7. At least faint traces of posterior pubescence on all segments, most distinct and widest on preanal segment.

Anal segment: Pubescence distinct, consisting of anal and posterior rings joined by a curved arm situated laterally on the segment; two or three isolated pubescent spots lie dorsolaterally. Anterior pubescence consists of an irregular dorsal band which extends a pair of posteriorly-directed finger-like projections; a faint anterior ventrolateral pubescent area connects with the base of the pubescent arm.

Respiratory siphon: 1.3–1.6 mm long, approximately equal to its basal diameter and possessing a stigmatal spine.

Comments: Twenty-two larvae were collected from a mixed bottomland hardwood region in St. Tammany Parish. They were located in muck along the margin of a cypress swamp. Several other specimens were taken along the marginal area of a stream in a longleaf-slash pine region of Washington Parish.

Tabanus melanocerus Wiedemann, 1828

Length 14–20 mm; brown to dark grayish; eye uniformly dark; frons usually 5–6.5 times higher than basal width; abdomen with a median row of pale triangles; fore tibia bicolored; wing hyaline to subhyaline.

Variations: For some time, the separation of this species from *T. petiolatus* Hine has been a source of confusion. The key characters most frequently used (relative development of the median abdominal triangle of tergite two, frons width to height ratio, the presence or absence of a petiolate condition of cell R_5) do not consistently separate some specimens. In general, the smaller specimens usually exhibit certain characteristics of *T. petiolatus* (frons ratio 1:7, petiolate cell R_5), while the slightly larger *T. melanocerus* usually have a frons ratio of 1:5 to 1:6 and cell R_5 open. Nevertheless, intergradation of characters was noted in a series of 255 specimens examined from Louisiana, Mississippi, Alabama, Georgia, Tennessee, Kentucky, and Florida, during the present study.

Teskey (1969) noted that the larvae of *T. melanocerus* could be distinguished from those of *T. petiolatus* primarily by the presence of lateral abdominal striations on the latter species. His *T. melanocerus* lacked such striations. The pupae that were reared from these larvae were also divisible into two concordant groups. Four pupae of one of these groups were secondarily distinguishable, and the adults reared from these were determined as *T. petiolatus*. However, the separation of the adults did not entirely agree with their immature stages, and Dr. Teskey mentioned the possibility of having to recognize three species, all of which are indistinguishable in one or more stages, recognize the presence of hybrids in the population, or to consider this group as a single polymorphic species.

The larvae of these two species reared during the present study exhibited consider-

able intergradation in the development of the lateral abdominal striations (see larval description). Some adults identified as typical *T. petiolatus* were reared from larvae that almost completely lacked lateral abdominal striations while some *T. melanocerus* had weak lateral striations present. Therefore, the two species could not be consistently separated in the larval stage. Intergradation of characters between both species was observed in the adults that were reared from these larvae.

Due to the occurrence of intermediates in both the adults and larvae of *T. melanocerus* and *T. petiolatus*, these nominal species are probably conspecific. However, until further supportive evidence is presented such as multiple rearings from a single egg mass, these well known species are treated as distinct.

Ecology and Distribution: (May–Sept.) *Tabanus melanocerus* was commonly collected throughout the state. It was most frequently taken from the hardwood forests associated with upland and lowland streams and lakes and was not collected from the coastal marsh. Hine's (1907a) Louisiana specimens were actually *T. petiolatus*.

Mature larva (Fig. 29): Moderate in size, 28–34 mm long; creamy white; pubescence scanty, extremely pale to light brown where present.

Head capsule length: 4.3–5.0 mm.

Striations: Usually present laterally on the thorax where they vary in different specimens from weak to fairly distinct. Striations may be completely absent on abdominal segments 1–7 or present on from several to all segments varying in different individuals from faint and inconspicuous to complete and distinct. Anal striations occasionally absent; generally present below lateral pubescent arm and to some degree above the arm.

Thorax: Pubescence consists of a light brown anterior prothoracic annulus and a faint anterior mesothoracic, lateral band on each side; lateral pubescent projections and metathoracic pubescence absent.

Abdominal segments 1–7: Anterior and posterior pubescence absent; pseudopodial pubescent connections incomplete on all segments.

Anal segment: Pubescence light to moderate in intensity, consisting of rather distinct anal and posterior rings. A pubescent arm located dorsal to and sometimes joined with the anal ridge extends to the midlateral portion of the segment where it curves toward and occasionally connects with the posterior pubescent ring. In specimens where the lateral arm pubescence does not connect with the posterior and/or anal rings, the impression of the complete arm is evident due to the presence of fine striations.

Respiratory siphon: 1.1–1.3 mm long, less than twice its basal diameter.

Comments: Fourteen larvae of *T. melanocerus-petiolatus* were collected from East and West Feliciana, Natchitoches, and St. James parishes. All but one specimen taken in St. James Parish were associated with small, sandy-bottom streams found in pine or upland hardwood forests. Those specimens collected in East Feliciana Parish were found in a beaver dam.

Jones and Bradley (1924) collected a larva (reared) in mud at the edge of a swift flowing stream (East Baton Rouge Parish).

Tabanus moderator Stone, 1938

Length 17–21 mm; dark brown; eye purple with two blue-green bands; frons at least seven times higher than basal width and widened above; scutellum white; abdomen with a median row of pale triangles; wing faintly fuscous, furcation and cross veins margined with pale brown.

Variations: (Specimens examined—9) Departures from Stone's (1938) description include the following: frons ratio 1:7 to 1:8.5. Rarely, certain specimens resembling *T. molestus* Say and with frons ratios approximately 1:6.5 could not be assigned with certainty to either taxon.

Ecology and Distribution: (May) This species, active in late afternoon until well after dark, was taken from mixed pine-hardwood forests in St. Helena Parish and from a longleaf-slash pine region in Tangipahoa Parish.

Tabanus molestus Say, 1823

Tabanus molestus Say, 1823, J. Acad. Nat. Sci. Philad. 3: 31, female. Stone, 1938, USDA Misc. Publ. 305. p. 97. Philip, 1947, Amer. Midland Natur. 37: 310.

Tabanus molestus mixis Philip, 1950, Ann. Entomol. Soc. Amer. 43: 241. (New Synonymy)

Length 14–22 mm; dark brown to black; eye dark with two blue-green to bronze bands; frons 4–6 times higher than basal width; scutellum white; abdomen with a median row of pale triangles, spot on tergite two reduced; wing lightly fuscous, furcation and cross veins faintly margined with brown.

Variations: In general the specimens agree with Stone's (1938) description and variations.

During the present investigation, 423 specimens from Louisiana, Mississippi, Alabama, Florida, and Kentucky, were studied. Numerous characters were examined including facial pollinosity color, antennal and palpal color, ventral and pleural hair color, infuscation of the wings, and shape of abdominal triangles, as well as overall appearance. While typical representatives of both forms are quite distinct, discordant variation and the intergradation of many characters were observed.

Both subspecies are collected together and are sympatric throughout much of their range. Since this does not conform to the usage of the term subspecies (geographically defined populations), the utilization of the subspecific category is unwarranted. Consideration of the two forms as distinct species is not supported by the available evidence. Based primarily on the above reasons, I consider both of these forms as a single taxon.

Ecology and Distribution: (April–August) This species was commonly taken throughout Louisiana in all regions except the prairie and coastal marsh. It is especially active in late afternoon and will continue its activity after dark. Hine (1906, 1907a) and Jones and Bradley (1924) listed this species as common in Louisiana during June.

Mature larva (Fig. 26): Moderate in size, 29–37 mm long; creamy yellow with rather pale pubescent markings.

Head capsule length: 3.8–3.9 mm.

Striations: Distinct, rather evenly spaced and completely encircling all segments; finer anterior to the pseudopods and on the anterior portion of the anal segment.

Thorax: Anterior pubescent annuli present; lateral surface of prothorax with two pubescent projections extending approximately ¾ the length of the segment. Only the most dorsal and ventral of the lateral meso- and metathoracic projections developed, extending about ¼ and ⅓ the length of the respective segments.

Abdominal segments 1–7: Narrow dorso- and ventrolateral bands of anterior peg-like, spiney pubescence on all segments, becoming progressively fainter and reduced on posterior segments. Pseudopodial pubescent connections incomplete, broken between the lateral and ventrolateral pseudopods (pseu. two and three) on all segments and pseudopods one and two on segments six and seven. Pseudopodial pubescence differing somewhat on segments 6–7 by the presence of isolated pubescent spots between pseudopods two and three. Posterior pubescence limited to a narrow band on the preanal segment. Three evenly spaced lateral lines present, often only faintly visible on segments 1–4.

Anal segment: Pubescence consisting of an anal ring with a small dorsal projection and a narrow posterior ring usually extending a short lateral, anteriorly-projected point. Anterior to the point is a small isolated patch of lateral pubescence.

Respiratory siphon: Short, 0.4–0.5 mm long, about ½ its basal diameter.

Comments: Nine specimens were collected from several locations in the upland hardwood and mixed pine-hardwood regions of East and West Feliciana parishes. The larvae were usually taken from beneath moss on the steep banks of small, sand-bottom streams. These streams were intermittently flowing especially during July, August, and December. The larvae are listed as primarily terrestrial since they were collected a meter or more above the high water mark on the banks of these streams.

A female of *T. molestus* was captured and held following a blood meal on a mule. She oviposited six days later on the nylon cover of her container. A second egg mass was obtained six days following a blood meal from the author's arm (and 11 days after oviposition of first egg mass). The larvae emerged 11 and 10 days, respectively from the two

egg masses. The egg mass is distinct from those of other *Tabanus* known to the author and is described as follows: mass approximately 8 × 5 mm, slightly pointed at each end, eggs deposited in a single upright tier (on the under surface of nylon hose). The mass contained approximately 250 creamy white (2.6 mm long) eggs that turned black in a few hours. However, the entire mass was covered with a clear mucous-like secretion which was draped across the eggs and hardened into a white coating much like frosting on a cake.

Tabanus mularis Stone, 1935

Length 10–12 mm; eye green with one reddish purple band; frons 3–4 times higher than basal width; mesonotum olive gray; abdomen dark with a median pale stripe and usually indications of a sub-lateral row of pale spots on each side; wing hyaline with costal cell distinctly infuscated.

Variations: (Specimens examined—50) Departures from Stone's (1938) description include the following: height of frons usually closer to three times its basal width; genae and clypeus below antennae not tinged with yellow; sublateral abdominal stripes occasionally extensive, similar to those found in darker forms of *T. nigrovittatus* Macq. Certain specimens of *T. mularis* are difficult to separate from *T. fuscicostatus* Hine (see discussion under latter species).

Ecology and Distribution: (May–September) This inland species of the *T. nigrovittatus-quinquevittatus* complex was taken primarily from the mixed bottomland hardwood forests associated with upland and lowland streams and waterways. It was less frequently collected from the mixed pine-hardwood, longleaf-slash pine, and prairie regions.

Tabanus nefarius Hine, 1907

Length 20–24 mm; brown; eye dark with two green bands; frons usually 5–6 times higher than basal width; abdomen with a median row of pale triangles; wing fuscous with furcation and cross veins distinctly margined with brown; cell R_5 nearly or completely closed apically.

Variations: (Specimens examined—13) Departures from Stone's (1938) description include the following: basal callus light tan to chestnut brown; usually subcallus and most of genae light tan: clypeus grayish; second palpal segment variable, occasionally very slender; one specimen with frontal index 1:6.6; most without light-colored posterior borders on abdominal tergites.

This species resembles *T. sulcifrons* Macq. but can usually be separated by characters given in the key.

Ecology and Distribution: (June–August) Specimens were taken primarily from the mixed bottomland hardwood forests on the lower extremity of the Mississippi floodplain. They were collected in Iberia, Iberville, Jefferson, Lafourche, Livingston, and St. Tammany parishes. Hine's (1907b) original description of *T. nefarius* was based on three females, one taken near New Orleans and two taken at LeCompte, Louisiana. Jones and Bradley (1924) reported this species from St. John the Baptist Parish.

Tabanus nigrescens Palisot de Beauvois, 1809

Length 20–24 mm; dark brown to black; eye dark with three purple bands, the upper one fading; frons 3.5–4.5 times higher than basal width; wing fuscous, paler posteriorly, furcation and cross veins margined with brown.

Variations: (Specimens examined—3) Departures from Stone's (1938) description include the following: annulate portion of third antennal segment about ½ the length of basal portion.

Ecology and Distribution: (June–July) Collection of this species from the state was not confirmed during the present study (see under larval comments) although Louisiana would fall within the distribution listed by Philip (1965). Adults were collected from Mississippi and Alabama.

Mature larva (Fig. 33): Large, 50–55 mm long; creamy white with light to medium brown pubescent markings.

Head capsule length: 6.1–6.7 mm.

Striations: Present laterally on segments 1–10; absent on dorsal and ventral aspects; anal striations distinct below lateral pubescent arm, inconspicuous elsewhere. Anterior ⅓ of anal segment with extremely fine striations (visible under high magnifications) giving this area a shadowed appearance.

Thorax: Anterior pubescent annuli somewhat wider laterally; prothorax laterally with two pubescent arms extending over ½ the length of the segment. Meso- and metathorax with four lateral pubescent projections, the middle pair extending about ¾ and ½ the length of their respective segments; the dorso- and ventrolateral projections extending approximately ½ and ⅓ the length of the meso- and metathorax, respectively. These projections may appear to traverse the entire length of the segment due to the presence of many fine striations and/or presence of fine adherent debris.

Abdominal segments 1–7: Anterior pubescence varying in intensity, encircling segments 1–3 or 4; incomplete and becoming progressively reduced on remaining segments. Pseudopodial pubescent rings complete on segments 1–5 or 6, and joined with anterior pubescence ventrolaterally on at least 1–5. Posterior pubescence consists of a wide distinct band encircling the preanal segment and faint inconspicuous traces dorso- and ventrolaterally at least on segments 4–6.

Anal segment: Pubescence distinct, consisting of anal and posterior rings and a curved arm extending dorsally from the anal ring where it bends in the midlateral portion of the segment and reaches the posterior pubescent ring. One distinct, and 1–2 faint pubescent spots situated dorsolaterally above the arm.

Respiratory siphon: 1.5–1.7 mm, slightly longer than its basal diameter and possessing a stigmatal spine.

Comments: Two larvae were collected from the margin of a beaver pond in Lee County, Alabama. These resembled eight specimens collected from a small ditch in a similar habitat of upland hardwood forest in West Feliciana Parish, Louisiana. However, none of the latter was reared, and positive identification could not be made.

The larvae of *T. nigrescens* are very close to those of *T. aranti* Hays, the latter species having the prothoracic arms slightly wider with a more diffuse appearance, and the lateral pubescent arm of the anal segment usually not connected to the anal ring. Specimens of *T. aranti* are smaller in total body length and have a shorter head capsule.

Tabanus nigripes Wiedemann, 1821

Tabanus coffeatus Macquart. Stone, 1938, USDA Misc. Publ. 305. p. 100.

Length 11–16 mm; grayish black; eye uniformly dark; frons 4.5–5 times higher than basal width; subcallus usually partially denuded; abdomen with a median row of whitish triangles; posterior margins of tergites pale; wing hyaline.

Variations: (Specimens examined—83) All agree with Stone's (1938) description.

Ecology and Distribution: (April–September) *T. nigripes* was found primarily in the mixed bottomland hardwood forests of the Mississippi floodplain. It was also collected from hardwood forests associated with streams in Rapides, St. Tammany, Washington, and Winn parishes. Hine (1907a) referring to this species as *T. coffeatus*, indicated that it was not commonly collected.

Mature larva (Fig. 27): Small to moderate, 25–28 mm long; whitish with few pubescent markings.

Head capsule length: 4.0–4.6 mm.

Striations: Inconspicuous or absent; when present, usually faint or broken and visible only on lateral aspects of thorax and one or more abdominal segments.

Thorax: Prothoracic annular ring with a ventrolateral projection and usually a faint sparsely pubescent dorsolateral projection on each side, all extending approximately ¾ the length of the segment. Narrow inconspicuous anterior pubescent bands present laterally on the meso- and metathorax, the former with indications of short, peg-like lateral projections.

Abdominal segments 1–7: Anterior pubescence present only as faint traces midventrally on segments 1–2; pseudopodial connective pubescence incomplete, and posterior pubescence absent on all segments.

Anal segment: Pubescence moderate in intensity, limited to anal and posterior rings.

Respiratory siphon: 1.3–1.4 mm long, almost twice its basal diameter.

Comments: The larval description is based on four specimens collected in Lee County, Alabama. These were found at the margin of a small pond in a mixed pine-hardwood region.

Tabanus nigrovittatus Macquart, 1847

Length 9–16 mm; eye green with one reddish purple band; frons 3–4.5 times higher than basal width; mesonotum grayish to yellow; abdomen yellowish sublaterally with a pale median stripe; wing hyaline, costal cell lightly infuscated.

Variations: (Specimens examined—200) Departures from Stone's (1938) description include the following: rarely, palpi yellowish; basal callus occasionally with brown shades, and may be connected to median callus; costal cell hyaline to faintly infuscated. Color patterns range from dull and inconspicuous to bright and distinct.

The coastal marsh specimens of *T. nigrovittatus* are larger and lighter, while the occasional inland specimens are usually darker and exhibit intergradation in appearance with *T. mularis* Stone. Frequently, demes are recognized by the overall similarity of the specimens collected. A series from the Chandeleur Islands tend to be dull in overall body coloration with yellowish palpi and costal cells nearly hyaline.

Many specimens collected during this study exhibit some characters listed by Philip (1957) for *T. nigrovittatus fulvilineis*. However, these characters vary and intergrade with those of typical *T. nigrovittatus*. Some variations from Philip's description include attached median callus to a tridentate upper margin of the basal callus, and number and presence of indentations of this upper margin varying from none to several. Many specimens have the typical *T. nigrovittatus* abdominal pattern but have the apical ½ of the fore, and extreme apices of the middle and hind tibiae black, as well as the dark femora listed by Philip for some paratypes of *T. nigrovittatus fulvilineis*. It is doubtful that specimens of the latter form are anything more than occasional variants of typical *T. nigrovittatus*. However, at the present time insufficient material is available to confirm this hypothesis.

Ecology and Distribution: (April–October) This species was common on the coastal marshes, and at times extremely numerous. Occasionally, specimens were collected inland.

Hine's (1907a) description of *T. nigrovittatus* was based on one atypical specimen and is insufficient to determine what he had before him. The *T. costalis* Wied. of Hine (1907a), reported as abundant in coastal regions, was probably *T. nigrovittatus*. The *T. costalis* reported by Jones and Bradley (1924), lacking description, cannot be assigned with certainty to a known taxon.

Tabanus pallidescens Philip, 1936

Length 12–16 mm; orange-yellow; eye green with 1–3 reddish purple bands; frons about 5.5–7 times higher than basal width; palpi creamy white; pleurae and genae with white hair; abdomen with three rows of pale yellow spots, those of median row contiguous; wing hyaline to subhyaline with costal cell lightly infuscated.

Variations: Philip (1936) named *pallidescens* as a subspecies of *T. fulvulus* Wied. Variations from his description include the following: height of frons ranging from about 5.5 to 7 times its basal width; callosity light brown to black; occasionally distal ½ of fore tibiae, extreme distal portions of middle and hind tibiae, dark; middle and hind tarsi darkened.

Pechuman (1962) separated *T. pallidescens* from *T. fulvulus* at the specific level utilizing characters listed by Philip (1936), as well as some additional ones. Later Pechuman (personal correspondence) gave three characters which he found to be fairly consistent in separating *T. pallidescens* from *T. fulvulus*, and also mentioned that he had observed some intergradation in the antennal color and eye banding. The three characters which he listed for *T. pallidescens* are pale hind femora, pale coxae, and whitish palpi.

Approximately 950 specimens of *T. pallidescens* taken during the present study exhibit variations in the number of eye bands from 1 to 3, or absent, and the color of the apical portion of the third antennal segment from orange-yellow to black. In general, specimens with the darker antennae have the greater number of eye bands. The best distinguishing characters found to separate this species from *T. fulvulus* were the creamy white palpi, and the white hairs of the genae and pleurae. Utilizing these characters as criteria for separating *T. pallidescens* from *T. fulvulus*, only 39 specimens of the latter species were collected in Louisiana, and *T. fulvulus* was usually collected with *T. pallidescens*. In addition, there is an in-

tergradation of most characters and an overall similarity in appearance of the two species. This information would indicate the possibility that these are members of a single taxon exhibiting varying phenotypic expressions. However, the author is reluctant to synonymize these two well-known entities, and until larval information or genetic data are available to indicate otherwise, they are treated as distinct species.

Ecology and Distribution: (April–July) *T. pallidescens* was commonly collected throughout most of the state.

Tabanus petiolatus Hine, 1917

Length 13–17 mm; brown to dark grayish; eye uniformly dark; frons usually 6–7.5 times higher than basal width; abdomen with a median row of pale triangles; fore tibia bicolored; wing hyaline to subhyaline.

Variations: (See discussion under *T. melanocerus* Wied.)

Ecology and Distribution: (May–Sept.) This species was widely distributed throughout the state but was collected primarily in the mixed bottomland hardwood forests associated with the lower portion of the Mississippi floodplain.

Mature larva: (See description under *T. melanocerus*.)

Tabanus proximus Walker, 1848

Length 19–29 mm; brownish black with deep purple hues; eye purple with two green bands; frons 6–7 times higher than basal width; antenna orange; wing smoky with furcation and cross veins margined with brown; cell R_5 narrowed or closed apically.

Variations: (Specimens examined—40) All agree with Stone's (1938) description.

Ecology and Distribution: (June–September) This species was collected from the mixed bottomland hardwood forests associated primarily with the floodplains of major rivers. Hine (1906, 1907a) and Jones and Bradley (1923; 1924) reported this species from the state under the name of *T. benedictus* Whitney.

Mature larva (Fig. 35): Rather large, 48–54 mm long; creamy white with light to medium brown pubescent markings.

Head capsule length: 5.3–5.9 mm.

Striations: Present laterally on segments 1–10; wider, less conspicuous, and often broken dorsally and ventrally on the first seven abdominal segments; absent dorsally and ventrally on thoracic segments. Anal striations conspicuous below the lateral pubescent arm; usually weak and broken above; absent elsewhere on the segment.

Thorax: Anterior pubescent annuli somewhat broader laterally; lateral surface of prothorax with a pubescent bib, the lateral arms and central portion of which extend approximately ¾ and ½, respectively, the length of the segment; meso- and metathorax with thin lateral pubescent projections extending about ⅔ and ½ the length of the segments, respectively.

Abdominal segments 1–7: Pale anterior pubescence encircling segments 1–4 or 5; incomplete and progressively reduced on remaining segments. Pseudopodial pubescent rings complete on all segments, connected with anterior pubescence dorsolaterally on segments 1–2 or 4 and ventrolaterally on 1–5. Posterior pubescence present on segments 4–7, most conspicuous on preanal segment; scant traces may be present on segments 1–3 where they are extremely faint and inconspicuous.

Anal segment: Pubescence distinct, consisting of anal and posterior rings, the latter joined with a lateral clubbed arm extending approximately ½ the length of the segment. Two conspicuous irregular pubescent spots, and a small faint spot lie dorsolaterally above the arm; paired dorsal finger-like projections extend posteriorly a short distance from the anterior margin.

Respiratory siphon: 1.4–1.6 mm long, about equal to its basal diameter and possessing a stigmatal spine.

Variations: Occasionally the pubescent arm of the anal segment may be narrowly joined to the anal ring, and the two conspicuous dorsolateral pubescent spots sometimes join together.

Comments: Numerous larvae were collected from the mixed bottomland hardwood regions throughout Louisiana. They were found most often terrestrially in the moist floodplain soils of large rivers. Occasionally these areas were flooded during periods of heavy rains; however, most of the year no standing water was present.

Jones and Bradley (1924) reared two larvae of this species taken from the muddy margin of a slough in East Baton Rouge Parish.

Tabanus pumilus Macquart, 1838

Length 9–11 mm; dark brown to blackish; eye purple with two blue-green bands; frons 4.5–6 times higher than basal width; palpi creamy white with black hair; abdomen with three rows of pale spots; wing hyaline.

Variations: (Specimens examined—167) All agree with Stone's (1938) description. This small species superficially resembles *T. sparus* Whit. but can readily be separated by characters given in the key.

Ecology and Distribution: (April–July) This species was collected throughout the state. It was associated primarily with the bottomland hardwood and the mixed pine-hardwood regions. Hine (1906, 1907a) and Jones and Bradley (1923, 1924) recorded *T. pumilus* as a common early season pest of livestock in Louisiana.

Mature larva (Fig. 40): Rather small, approximately 18 mm long, creamy white with pale to medium brown pubescent markings.

Head capsule length: No measurement made.

Striations: Encircling all segments, slightly more closely spaced laterally; prothoracic striations inconspicuous and broken dorsally and ventrally.

Thorax: Anterior pubescent annulus of prothorax with two lateral projections on each side extending less than ½ the length of the segment; meso- and metathoracic annuli narrow, each with short pointed dorso- and ventrolateral projections.

Abdominal segments 1–7: Anterior pubescence encircling segments 1–4; incomplete and becoming progressively reduced on 5–7. Pseudopodial pubescent rings complete on segments 1–5; narrowly connected between pseudopods 2 and 3; joined with anterior pubescence dorsolaterally on segments 2–6 and ventrolaterally on 1–4. Posterior pubescence encircling segments 5–7, faint on 5; extremely pale, inconspicuous traces present on 3 and 4.

Anal segment: Pubescence consisting of an anal ring, two lateral posteriorly-pointed projections, a small isolated dorsolateral pubescent spot, and a dorsal median posterior strip.

Respiratory siphon: Long and slender, 1.1 mm long, over three times its basal diameter.

Comments: The description is based on one larva collected from the margin of a small, water-filled ditch in an upland hardwood forest of West Feliciana Parish.

Tabanus quaesitus Stone, 1938

Length 10–14 mm; brown; eye sparsely pilose with a single purple band; frons about 2.5–3.5 times higher than basal width; abdomen with three rows of pale spots, the median row slender; wing hyaline.

Variations: (Specimens examined—38) Departures from Stone's (1938) description include the following: frons noticeably narrowed above in some specimens; extent of median denuded area variable, occasionally entire vertex pollinose; basal callus light brown to black, variable in shape from transverse to nearly quadrate and rounded above; median callus variable, occasionally reduced to a small isolated spot; occasionally entire plate of third antennal segment orange; basicosta with sparse hair, sometimes almost completely bare; median triangles of abdomen occasionally absent posterior to segment two; abdominal venter entirely gray.

This species resembles *T. exilipalpis* Stone, the latter having been reported from Mississippi, Alabama, and other southeastern states. They are separated by characters listed in the key.

Ecology and Distribution: (April–June) This species was taken primarily from the mixed pine-hardwood forests of the mid-central and northern portions of the state.

Tabanus quinquevittatus Wiedemann, 1821

Length 10–13 mm; yellow-brown; eye green with one reddish purple stripe; frons about 3.5–4 times higher than basal width; thorax dull golden; abdomen brown with a median yellowish stripe and a sublateral stripe or row of spots on each side; wing hyaline, costal cell infuscated.

This species was not collected in Louisiana during the present study; however, since it is reported throughout much of central and eastern North America including Arkansas and Mississippi (Thompson and Pechu-

man, 1970), it should occur in Louisiana. The Louisiana record of *T. quinquevittatus* by Hine (1906, 1907a) was actually based on specimens of *T. lineola hinellus* Phil.

Tabanus reinwardti Wiedemann, 1828

Length 15–20 mm; dark gray; eye purple with two blue-green bands; frons about 2.5–3 times higher than basal width; abdomen with a median row of pale triangles and a row of sublateral pale spots on each side; wing hyaline, furcation and cross veins margined with brown.

Variations: (Specimens examined—3) Departures from Stone's (1938) description include the following: general color gray; denuded area at vertex absent; thoracic pleura and sternum gray pollinose with white hair; abdomen above gray to fuscous with a median row of broad white triangles which may be confluent with the sublateral spots along hind margin of each segment. Male: hair of genae white.

This species superficially resembles *T. cymatophorus* O.S. but can be distinguished by its wider frons.

Ecology and Distribution: (May) One adult was collected in a longleaf-slash pine forest of Tangipahoa Parish. Two other specimens (reared) were taken in the mixed pine-hardwood region of West Feliciana Parish.

Mature larva (Fig. 31): Moderate in size, 33–35 mm long; creamy tan with rather distinct pubescent markings.

Head capsule length: 4.5–4.6 mm.

Striations: Present laterally on segments 1–10; absent elsewhere on these segments except dorsally on 4–10 where they are faint and incomplete, most conspicuous on segment 10. Striations completely encircling anal segment.

Thorax: Anterior pubescent annuli broader laterally. Lateral surface of prothorax with a pubescent bib, the central portion and lateral arms of which extend over ½ and ¾, respectively, the length of the segment. Meso- and metathorax with lateral projections extending about ¾ and ⅔ the length of the segments, respectively. A narrow posterior pubescent band encircles the metathorax.

Abdominal segments 1–7: Anterior pubescence encircling segments 1–5; reduced laterally on 6 and laterally and ventrolaterally on 7. Pseudopodial pubescent rings complete on all segments and joined with anterior pubescence dorso- and ventrolaterally. Posterior pubescent bands encircling all segments, most distinct on the preanal segment.

Anal segment: Pubescence distinct, consisting of anal and posterior rings joined by a curved arm situated laterally on the segment. Three isolated pubescent spots lie dorsolaterally above the arm.

Respiratory siphon: 1.0–1.2 mm long, almost 1⅓ times its basal diameter.

Comments: Two larvae were collected from the marginal area of a stream in the mixed pine-hardwood region of West Feliciana Parish. Jones and Bradley (1923) collected a larva from the sandy margin of a sluggish brook near Baton Rouge.

Tabanus rufofrater Walker, 1850

Length 15–22 mm; reddish brown; eye in life brownish black with two light bronze bands; frons about 5–5.5 times higher than basal width; fore tibia unicolorous; abdomen with a median row of faint triangles; wing hyaline.

Variations: (Specimens examined—10) All specimens differ from Stone's (1938) description in the following character: hind femora with white hair and scattered black hairs on side and top.

Ecology and Distribution: (May) Four specimens were collected from the longleaf-slash pine regions in Tangipahoa and St. Tammany parishes. Specimens were also collected from the coastal longleaf-slash pine forests of Mississippi, Alabama, and Florida.

Tabanus sagax Osten Sacken, 1876

Length 12–17 mm; brownish; eye green with three purple bands; frons about three times higher than basal width; abdomen with a median pale stripe widened posteriorly on each segment, and a sublateral row of pale spots on each side; wing hyaline with costal cell infuscated.

This species was reported from Caddo and DeSoto parishes (Hine, 1906, 1907a). One Louisiana specimen in the U.S. National Museum labeled *T. sagax* (determined by Hine) was examined by the author and found to be *T. zythicolor* Phil.

Tabanus sparus milleri Whitney, 1914

Length 7.5–11 mm; grayish black; eye green with one purple band; frons about 5–5.5 times higher than basal width, abdomen with three rows of pale spots; wing hyaline.

Variations: (Specimens examined—44) Other than minor coloration differences and the occasional absence of the median abdominal triangles, the specimens agree with Stone's (1938) description. A few specimens did not reveal the single eye band when placed in the relaxing chamber, but when these individuals were submerged in water for several hours, a faint eye band could be observed. The author has not seen living specimens of typical *T. sparus* which are characterized by the absence of the purple eye band.

This species superficially resembles *T. pumilus* Macq. but can be distinguished by characters listed in the key.

Ecology and Distribution: (May–August) *T. sparus milleri* was collected primarily in the mixed pine-hardwood forests of East Baton Rouge, East Feliciana, Natchitoches, Rapides, St. Helena, and Winn parishes. It was also taken in the upland hardwood forests of West Feliciana Parish and the longleaf-slash pine region of Washington Parish.

Tabanus stygius Say, 1823

Length 19–25 mm; eye dark green with three purple bands, the upper one reduced; frons 3.5–4.5 times higher than basal width; thorax gray; abdomen black; wing smoky with furcation and cross veins margined with brown.

Variations: (Specimens examined—42) Departures from Stone's (1938) description include the following: median callus ranging from narrow to rather broad; basal callus reddish brown to black; annulate portion of antenna occasionally black.

Ecology and Distribution: (May–August) This species was taken primarily from the mixed bottomland hardwood forests in the southern part of the state. Jones and Bradley (1923, 1924) collected this species from New Orleans and Baton Rouge.

Mature larva (Fig. 36): Rather large, 48–52 mm long; creamy yellow with distinct brown pubescent markings on all segments.

Head capsule length: 5.2–5.3 mm.

Striations: Present laterally on segments 1–10; absent, or inconspicuous and broken on dorsal and ventral aspects. Striations of anal segment conspicuous, visible ventrally and ventrolaterally behind the anus.

Thorax: Anterior pubescent annuli distinct and somewhat widened laterally; lateral surface of prothorax with a pubescent bib; meso- and metathoracic segments with lateral projections extending about ¾ the length of the segments; mesothoracic projections somewhat swollen apically; a narrow band of posterior pubescence present on the metathorax and small patches present on the mesothorax.

Abdominal segments 1–7: Anterior pubescence distinct, encircling segments 1–6; incomplete ventrally on 7. Pseudopodial pubescent rings complete, joined with anterior pubescence dorso- and ventrolaterally on all segments. Posterior pubescent rings present, becoming progressively more conspicuous posteriorly from segments 1–7. Preanal segment with dorso- and ventrolateral pubescent bars connecting pseudopodial with posterior pubescence; incomplete pubescent lines present between the bars and incomplete lines present dorso- and ventrolaterally on segment six.

Anal segment: Pubescence distinct, consisting of anal and posterior rings joined laterally by a curved pubescent arm. Occasionally, a narrow band of anterior pubescence is present on the dorsal ½ of the segment. A large, irregular pubescent spot, and from one to two smaller spots are found dorsolaterally above the curve of the arm, and one laterally in front of the arm.

Respiratory siphon: 1.7–1.8 mm, slightly longer than its basal diameter and possessing a stigmatal spine.

Comments: Five larvae were collected from East Baton Rouge, Lafourche, St. Landry, and Vermilion parishes. Two specimens were taken from the margin of a ditch filled with water-hyacinth, *Eichhornia crassipes* (Mart.) Solms, in the coastal marsh region, and three were found at the margins of ponds in the mixed bottomland hardwood region.

Tabanus sublongus Stone, 1938

Length 11–15 mm; orange-brown; eye green with three purple bands; frons 3.5–4.5 times higher than basal width; abdomen with three rows of pale spots, the median row contiguous; wing nearly hyaline, costal cell faintly tinted with orange.

Variations: (Specimens examined—2) Departures from Stone's (1938) description include annulate portion of third antennal segment in one specimen brown (second specimen with antennae missing); mesonotum dark in both with sparse golden hair and yellowish pollen.

Ecology and Distribution: (June) Two specimens were collected from a longleaf pine region in Natchitoches Parish. Another specimen labeled Logansport (DeSoto Parish) is in the collection of Dr. C. B. Philip.

Tabanus subsimilis Bellardi, 1859

Tabanus vittiger schwardti Philip, 1942, Psyche, 14: 29–32.

Tabanus schwardti schwardti Philip. Philip in A. Stone et al., 1965, Agr. Handbook 276. p. 336.

Length 10–16 mm; brownish; eye purple with three green bands, the upper two joined at outer margin of eye; frons about 3.5–4.5 times higher than basal width; posterior portion of scutellum reddish; abdomen with a median pale stripe and a row of sublateral contiguous pale spots on each side; wing hyaline.

Variations: (Specimens examined—100) Departures from Philip's (1942) description include the following: frontal index less than 1:4.8; posterior ½ of scutellum occasionally with only a tinge of red; distal ¾ of hind femora in males occasionally reddish gray, and entire middle femora reddish tan; abdominal lines varying from light tan to blackish.

In overall appearance, this species is very similar to *T. lineola* Fabr., and is separated by characters given in the key. Generally, both species have similar geographic and seasonal distributions.

Ecology and Distribution: (March–October) This species was collected throughout the state but most often from the mixed bottomland hardwood forests.

Tabanus sulcifrons Macquart, 1855

Length 14–24 mm; brownish to orange-brown; eye purple with two green bands; frons 4–5.5 times higher than basal width; fore tibia often bicolored or paler basally; abdomen with a median row of pale triangles; wing lightly infuscated with furcation and cross veins margined with brown.

Variations: (Specimens examined—75) Departures from Stone's (1938) description include the following: frontal index reaching 1:5.6; specimens with narrow frons usually have hind femora mostly dark and cell R_5 closed; fore tibia occasionally unicolorous.

Tabanus sulcifrons is a highly variable species and may actually be composed of a complex of several species. It closely resembles *T. abdominalis* Fabr., and frequently intermediate specimens are difficult to determine. In general, the abdomen of *T. sulcifrons* is not as orange as that of *T. abdominalis*, and in the latter, cell R_5 is closed (see also discussion under *T. abdominalis*). *Tabanus nefarius* Hine and *T. gladiator* Stone are also members of this complex. The variability of this group makes it difficult to rely on any one specific character, but rather a combination of characters must be used to separate these forms.

Ecology and Distribution: (June–October) A late season species, *T. sulcifrons* was locally abundant and an important pest of livestock. It was taken throughout most of the state primarily from the mixed hardwood forests associated with lowland and upland streams and waterways. Hine (1907a) and Jones and Bradley (1924) recorded *T. sulcifrons* and *T. exul* O.S., the latter probably referred to *T. sulcifrons* also.

Mature larva (Fig. 28): Moderate in size, 36–38 mm long; creamy white with extremely pale to light brown pubescent markings.

Head capsule length: 4.3–4.5 mm.

Striations: Present on all aspects of segments except dorsally and ventrally on the thorax where they may be absent, or inconspicuous and broken; striations somewhat finer laterally on the first seven abdominal segments. Striations of the anal segment conspicuous only beyond the anterior ⅓ of the segment.

Thorax: Anterior pubescent annuli with

lateral projections extending about ¾ the length of the pro- and mesothorax, and ½ the length of the metathorax.

Abdominal segments 1–7: Anterior pubescence faint, encircling segments 1–4, becoming progressively reduced on remaining segments. Pseudopodial pubescent rings complete, joined with anterior pubescence dorsolaterally on segments 1–2 and ventrolaterally on 1–5. Faint bands of posterior pubescence encircling all segments, darkest on the preanal segment.

Anal segment: Pubescence consisting of anal and posterior rings connected by a lateral curved arm usually broken for part of its length into isolated pubescent spots; two or three small pubescent spots located dorsolaterally above the arm.

Respiratory siphon: 0.9–1.0 mm, slightly longer than its basal diameter.

Comments: Eight larvae were collected from several localities in St. Landry and East Baton Rouge parishes. The larvae were terrestrial and associated with the moist forest soils of the mixed bottomland hardwood regions. Wilson (1969) also reported taking this species from the forest floor in St. Landry Parish.

Tabanus texanus Hine, 1907

Length 9–14 mm; yellowish brown; eye green with a single reddish purple band; frons 2.5–3 times higher than basal width; antenna yellow-orange with annulate portion black; abdomen with three rows of contiguous pale spots; wing hyaline, costal cell infuscated.

Variations: (Specimens examined—7) Departures from Stone's (1938) description include the following: palpi variable, not especially narrowing to acute apex; femora dark, covered with fine yellowish pollen.

Ecology and Distribution: (May–June) This species was collected with *T. nigrovittatus* Macq. on the coastal marshes of Cameron Parish.

Tabanus trimaculatus Palisot de Beauvois, 1806

Length 15–18 mm; eye uniformly dark; frons usually 4–5 times higher than basal width; thorax grayish; abdomen above blackish with three distinct median white triangles; wing nearly hyaline with furcation and cross veins lightly margined with brown; costal cell infuscated.

Variations: (Specimens examined—250) Departures from Stone's (1938) description include the following: eyes in life or relaxed specimens lacking the two green bands (erroneously recorded by Osten Sacken, 1876); rarely, a small median white spot present on tergite two; rarely, median abdominal triangles reduced.

This species is closely related to *T. superjumentarius* Whit. as is indicated by their similarities in both the adult and larval stages. (For the adult description of *T. superjumentarius*, see Stone, 1938, p. 99.)

Ecology and Distribution: (April–August) This commonly collected species was taken throughout the state primarily from the mixed hardwood forests associated with streams and waterways. It was not taken from the coastal marsh. Hine (1907a) and Jones and Bradley (1924) reported *T. trimaculatus* from Louisiana but indicated that it was seldom collected.

Mature larva (Fig. 30): Moderate in size, 36–42 mm long, creamy white with light to medium brown pubescent markings.

Head capsule length: 4.2–5.1 mm.

Striations: Present laterally on segments 1–10; absent dorsally and ventrally except on the pro- and mesothorax where they are usually present only at posterior margins. Striations encircling anal segment, conspicuous beyond the anterior ⅓ of segment. Extremely fine at the anterior portion where they produce a shadowed effect.

Thorax: Anterior pubescent annuli somewhat broader laterally; lateral surface of prothorax with a pubescent bib, the central portion and lateral arms of which extend about ⅔ and ¾, respectively, the length of the segment. Meso- and metathorax with lateral projections extending at least ¾ the length of the segments; mesothoracic projections slightly expanded apically. A narrow incomplete posterior pubescent band encircles the metathorax.

Abdominal segments 1–7: Anterior pubescence encircling segments 1–5; absent later-

ally on 6 and laterally and ventrolaterally on 7. Pseudopodial pubescent rings complete on all segments and joined with anterior pubescence dorso- and ventrolaterally on segments 1–4 or 5. At least faint traces of posterior pubescence encircling all segments, most distinct on the preanal segment.

Anal segment: Pubescence distinct, consisting of anal and posterior rings, the former joined with a lateral pubescent arm which curves in the midlateral portion of the segment and narrows toward, and only occasionally reaches the posterior ring. Two closely situated pubescent spots, and occasionally a small inconspicuous spot lie dorsolaterally above the arm.

Respiratory siphon: 1.6–1.7 mm long, about twice its basal diameter.

Comments: Fifteen larvae of *T. trimaculatus* were collected from Franklin, St. Landry, and West Feliciana parishes. They were taken from mud in streams, ditches, and temporary ponds in the mixed bottomland hardwood and the mixed pine-hardwood regions. Jones and Bradley (1923) reared this species from larvae taken at the margins of pools and brooks near Baton Rouge.

The larvae of *T. trimaculatus* resemble those of *T. lineola*, but full-grown specimens of the latter are smaller in size and have a relatively shorter respiratory siphon. The larval pubescent pattern of *T. trimaculatus* is also similar to that of *T. superjumentarius*. Based on a single specimen from North Carolina, the latter species exhibits an overall darker pubescent pattern although the anterior pubescence of abdominal segments is less extensive. The lateral pubescent arm on the anal segment reaches the posterior ring and the dorsolateral spots above the arm are united. Immediately anterior to the spots is a somewhat roughened and slightly depressed area in the cuticle which expands anteriorly. Debris may be attached in this region and gives the appearance of a pubescent band.

Tabanus turbidus Wiedemann, 1828

Length 18–25 mm; reddish brown; eye in life brownish purple with two reddish bronze to green bands; frons 5.5–7.5 times higher than basal width; third antennal segment orange-brown; legs uniformly reddish brown; wing veins heavily margined with brown; abdomen with a median row of pale triangles.

This species is similar to *T. equalis* Hine. For discussion of variations, ecology and distribution, see under *T. equalis*.

Tabanus venustus Osten Sacken, 1876

Length 16–20 mm; brown and gray; eye purple with two green bands; frons about three times higher than basal width; abdomen with a median row of pale triangles, and sublateral pale spots on segments 3–6; wing hyaline, distinctly spotted with brown.

Variations: (Specimens examined—25) Departures from Stone's (1938) description include the following: pleura and sternum light tan to predominantly black.

Ecology and Distribution: (May–July) This species was collected from the mixed bottomland hardwood forests of East Baton Rouge, Franklin, and Lafayette parishes and from the mixed pine-hardwood forests of Caddo, Livingston, and Winn parishes. Hine (1907a) reported *T. venustus* from Acadia, DeSoto, and Rapides parishes. Jones and Bradley (1923) collected a larva (reared) from the muddy margin of a brook in East Baton Rouge Parish.

Tabanus wiedemanni Osten Sacken, 1876

Length 17–22 mm; entirely dark brown to black; eye purple with four green bands, the upper band short and parallel to frons; frons 3–4 times higher than basal width; subcallus protuberant and shiny; genae pollinose; wing dark brown.

Ecology and Distribution: This species was not collected in Louisiana by the author. Hine (1907a) reported *T. wiedemanni* from DeSoto Parish (June). However, the description he gave (p. 59) is insufficient to distinguish this taxon from *T. aranti* Hays, and possibly *T. colon* Thun. and *T. nigrescens* P. de B. Jones and Bradley (1923) reported rearing a larva of this species collected beneath standing water in a swampy meadow near Baton Rouge.

Tabanus wilsoni Pechuman, 1962

Length 10–15 mm; brown; eye green with three reddish purple bands; frons 5–6 times higher than basal width; antenna orange-brown, annulate portion black; abdomen with

a median pale stripe expanded posteriorly on each segment, and a sublateral row of pale spots on each side; wing hyaline.

Variations: (Specimens examined—46) Departures from Pechuman's (1962) description include the following: height of frons less than six times its basal width; median callus sometimes reaching basal callus by a very thin line.

Ecology and Distribution: (April–July) This species was collected primarily from the mixed bottomland hardwood forests of the Mississippi and Red river floodplains. Specimens were also taken in upland hardwood forests of West Feliciana Parish. Pechuman (1962) reported that the *T. longiusculus* of Jones and Bradley (1923, 1924) and the *T. fulvulus* (in part) of Hine (1907a) were actually *T. wilsoni.*

Tabanus zythicolor Philip, 1936

Length 11–14 mm; orange-brown; eye in life dull purplish green with two green bands bordered by three purple bands; frons parallel-sided, 3.5–5 times higher than basal width; antenna usually orange; abdomen with a median row of slender contiguous spots and a sublateral row of spots on each side; wing hyaline to subhyaline, costal cell infuscated.

Variations: (Specimens examined—30) Departures from Stone's (1938) description include the following: eye as described above; occasionally basal portion of third antennal segment elongate with only a slight dorsal angle and no dorsal excision; rarely some specimens exhibit the third antennal segment with annulate portion dark—these individuals may be difficult to distinguish from *T. longiusculus* Hine; however, the parallel-sided frons, eye color, and thinner palpi will usually separate *T. zythicolor.*

Ecology and Distribution: (July–October) This late season species was collected from the mixed pine-hardwood region of East Feliciana, St. Helena, and Tangipahoa parishes. A specimen (DeSoto Parish, September) seen by the author in the U.S. National Museum and determined as *T. sagax* by Hine is actually *T. zythicolor.*

Genus Hybomitra Enderlein, 1922

Most Nearctic species of this genus are more northern in distribution. Only four are reported from Louisiana. Members of the genus are rather compact flies usually with a denuded ocellar tubercle and vary in size from small to large. The eyes are usually pilose and the third antennal segment is subdivided into five parts (four annuli).

Hybomitra cincta (Fabricius, 1794)

Tabanus cinctus Fabricius. Stone, 1938, USDA Misc. Publ. 305. p. 125.

Length 18–22 mm; eye purple with four blue-green bands; frons 4–5 times higher than basal width; black with a broad band of orange across base of abdomen; wing dark.

Variations: (Specimens examined—8) Departures from Stone's (1938) description include the following: frontal index ranging to 1:5; antennal color orange-brown to black.

Ecology and Distribution: (May) This very distinctive species was seldom collected. Specimens were taken flying near a small stream in the longleaf-slash pine region of Washington Parish.

Hybomitra difficilis (Wiedemann, 1828)

Tabanus carolinensis Macquart. Stone, 1938, USDA Misc. Publ. 305. p. 126.

Length 12–15 mm; brownish; eye dark purple with four blue-green bands; frons about three times higher than basal width; subcallus denuded and shiny; abdomen with three rows of indistinct spots; wing hyaline, costal cell infuscated.

Variations: (Specimens examined—3) All agree with Stone's (1938) description.

Ecology and Distribution: (April) Three specimens were collected from an upland hardwood forest in West Feliciana Parish.

Hybomitra lasiophthalma (Macquart, 1838)

Tabanus lasiophthalmus Macquart. Stone, 1938, USDA Misc. Publ. 305. p. 128.

Length 11–16 mm; eye noticeably pilose, dark purple with four blue-green bands; frons 3–4 times higher than basal width; thorax dark; abdomen yellow-orange with a middorsal black stripe; wing nearly hyaline, costal cell lightly infuscated; furcation and cross veins margined with brown.

Variations: (Specimens examined—50) All agree with Stone's (1938) description.

Ecology and Distribution: (March–May) This species was collected most frequently in the mixed bottomland hardwood regions associated with the floodplains of major rivers. Six larvae (none reared) were found in the moist forest soils of these regions. The larval habitat was similar to that of *T. proximus* Walk. Wilson (1969) also reported taking this species from the forest floor in St. Landry Parish. Jones and Bradley (1923, 1924) recorded adults of this species from Louisiana under the name of *Tabanus lasiophthalmus.*

Hybomitra trispila (Wiedemann, 1828)

Tabanus trispilus Wiedemann. (in part), Stone, 1938, USDA Misc. Publ. 305. p. 149.

Length 13–16 mm; black; eye purple with four green bands; frons about 3–3.5 times higher than basal width; abdomen with a median row of white triangles; wing dark.

Variations: (Specimens examined—5) Departures from Stone's (1938) description include the following: palpi tan to gray.

Ecology and Distribution: (May) One specimen was taken from a mixed bottomland hardwood region in Natchitoches Parish. Four other specimens were collected from longleaf-slash pine areas in Rapides, St. Tammany, and Washington parishes.

Genus Agkistrocerus Philip, 1941

This genus contains two Nearctic species, one of which, *Agkistrocerus megerlei* (Wiedemann), is reported from Louisiana. *A. finitimus* (Stone) has been taken in Mississippi and Texas and probably occurs in Louisiana also. Members of this genus are rather robust flies with finely pilose eyes, erect black hairs laterally on the subcallus, and the third antennal segment with five divisions, the basal one with a forward projecting hook-like process above.

Agkistrocerus megerlei (Wiedemann, 1828)

Dicladocera megerlei (Wiedemann). Stone, 1938, USDA Misc. Publ. 305. p. 16.

Length 15–21 mm; orange and black; frons about three times higher than basal width; third antennal segment with prominent process; abdomen dull orange with a middorsal black stripe; wing hyaline posteriorly, furcation and cross veins margined with brown.

Variations: (Specimens examined—8) Departures from Stone's (1938) description include the following: vertex of all specimens with black triangular denuded area; occasionally rectangular black denuded area extending from basal callus to top of median callus, not triangular shaped as illustrated by Stone, p. 16; antennae orange-brown, annulate portion and occasionally more than ¾ of distal portion of plate, black; legs dark brown to black; abdomen with a faint median ventral dark line.

Ecology and Distribution: (March–April) This species was collected near small streams and rivers that drain the longleaf-slash pine forests of Florida and Alabama. A single specimen collected from Rapides Parish, Louisiana, in April was provided through the courtesy of Dr. Matt E. Dakin. This species was reported as *Tabanus megerlei* from Ouachita Parish by Hine (1907a).

Genus Hamatabanus Philip, 1941

This genus includes three Nearctic species, two of which, *Hamatabanus annularis* (Hine) and *H. sexfasciatus* (Stone), are rarely collected. Members of the genus have pilose eyes, third antennal segment with five divisions, the basal one usually with a forward projecting hook-like process above; subcallus pollinose lacking the lateral black hairs as found in the *Agkistrocerus.*

Hamatabanus annularis (Hine, 1917)

Dicladocera annularis (Hine). Stone, 1938, USDA Misc. Publ. 305. p. 17.

Length 10–12 mm; brownish; abdomen dark reddish brown above with median ⅓, black; margins of tergites with a band of yellowish gray pollen and hair; wing hyaline, costal cell infuscated.

Variations: A single Louisiana specimen, somewhat damaged, was compared with specimens in the U.S. National Museum. The antennae resembles those of *H. annularis*, although the forward projecting dorsal process of the third antennal segment does not attain the annulate portion. The palpi resemble those of *H. sexfasciatus*, and the basal callus is chestnut brown. The poor condition of the specimen makes positive

determination difficult. Dr. L. L. Pechuman (personal correspondence) indicated that this specimen was probably *H. annularis* although it is larger and darker than the *H. annularis* type series in the Ohio State University collection.

Ecology and Distribution: (April) The single specimen was collected from a mixed pine-hardwood forest in Tangipahoa Parish.

Hamatabanus carolinensis (Macquart, 1838)

Dicladocera scita (Walker). Stone, 1938, USDA Misc. Publ. 305. p. 16.

Length 13–17 mm; brownish; eye deep olive with one dark purple band; abdomen with three rows of pale spots; wing hyaline.

Variations: (Specimens examined—11) Departures from Stone's (1938) description include the following: eye only sparsely pilose in some specimens; frons ratio 1:3 to 1:3.5; occasionally median callus expanded laterally, not slender; the antennal dorsal forward projecting process may or may not be pronounced; annulate portion of third antennal segment shorter than basal portion; costal cell of wing with faint trace of infuscation.

Ecology and Distribution: (April–June) Specimens were collected along small streams in the mixed pine-hardwood regions of East Baton Rouge, East Feliciana, and St. Helena parishes and from the longleaf-slash pine region of Tangipahoa Parish. Jones and Bradley (1923, 1924) reported this species from the state under the name of *Tabanus cerastes* O.S.

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Addendum

Goniops chrysocoma and *Tabanus gladiator* have recently been collected in Louisiana.

Index to Species Accounts

* Species from neighboring states but not reported from Louisiana (included in key).