

HORSE FLIES AND DEER FLIES  
OF VIRGINIA  
(DIPTERIA: TABANIDAE)

**PUBLICATIONS** in this series are intended to serve as scientific contributions for a better understanding of the **living environment** in Virginia.

Recognizing the basic economic importance of faunistic studies, our goal is to survey methodically the local insect fauna through preparation of inventories designed to show the geographic and seasonal occurrence of insects in the Commonwealth, and to provide keys, descriptions, and illustrations to facilitate their recognition.

Insofar as possible, these studies will include data on biology and life cycles to aid in the formulation of control recommendations and information on ecological interactions—including host relationships, parasites, and predators—and the potential of various species as possible biological control agents. Knowledge gained from such studies will be used to evaluate the impact of future changes in our environment.

COMPOSITION AND PRESSWORK BY  
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY  
BLACKSBURG, VIRGINIA

# The Insects of Virginia No. 6

HORSE FLIES AND DEER FLIES

OF VIRGINIA

(DIPTERA: TABANIDAE)

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## INTRODUCTION

The Tabanidae includes the well-known horse flies and deer flies and is world-wide in distribution. They are found on all continents except Antarctica, and are unreported from Hawaii, Greenland, and Iceland. Their relatively large size, attractive appearance, and blood-sucking habits have made them objects of interest to many scientific workers, but to date, nothing has been done specifically with the species found in Virginia.

Although this is a first attempt to bring together our knowledge of Virginia Tabanidae, the first notice taken of a North American horse fly was a Virginia specimen collected nearly 400 years ago. About 1587, John White made drawings of two horse flies, one of which was from Virginia. White turned his drawings over to Thomas Penny, and referring to his "Gadfly" stated, "It is overtaken by no other fly and surpasses most of them."

White's figures and a rather complete description first appeared in Mouffet (1634), but reproduction was poor. Excellent reproductions of White's horse fly paintings are found in Hulton and Quinn (1964) where one is labeled, "A dangerous byting flye." White's specimen appears to be a *Tabanus*, but I am unable to give a positive identification of the species.

John Banister, who was actively studying the natural history of Virginia during the last quarter of the 17th century, was acquainted with Tabanidae which he called "Tabani." His discussion, in a letter dated 19 April 1689, on the role of halteres in the flight of Tabanidae and Asilidae is probably the first reference to the true function of these organs (Ewen and Ewen, 1970).

Europeans of the 18th century and American workers of the 19th and 20th have had little Virginia material to study. As a result, Virginia is rather unique in being the specific type locality of only one valid species of North American Tabanidae. This is *Hybomitra cineta* (Fabricius, 1794) one of the most attractively colored species in the family. Virginia shares with New York the source of type specimens of *Tabanus americanus* (Forester, 1771) which in bulk is the largest horse fly in the world.

References to Virginia specimens are scattered through the literature in revisional studies, catalogs, and descriptions of new species. Some of the more important of these are Osten Sacken (1875, 1876,

1878), Townsend (1895), Hine (1917), Krober (1926), Brennan (1935), Stone (1938), Philip (1936, 1942, 1947, 1950a, 1950b, 1961, 1965) and Pechuman (1949, 1960, 1964). Banks (1904) published on *Diachlorus ferrugatus* in Dismal Swamp and later (1912) included tabanid records in his paper on insects attracted to *Ceanothus* flowers in Virginia. McAtee and Walton (1918) included many Virginia records in their paper on the species of Tabanidae found in the District of Columbia area.

## BIOLOGY AND HABITS

The eggs of most Tabanidae are probably deposited in masses on objects, usually vegetation, above water, mud, or moist ground; but larvae of some species have been found in dry soil. When freshly laid, the egg masses are white but rapidly darken to various shades of brown to jet black, depending on the species. Egg masses may be deposited in one to several layers; the shape of the mass and the number of layers of eggs may be characteristic of the species, but is not known for most species.

The larvae, which taper at each end, are often whitish, but may be brownish or greenish — sometimes with dark markings. Areas of pubescence on the larvae, which vary in shape and extent with the species, are used in taxonomic studies. The pupae are brown or straw colored with a row of stiff spines encircling the apical third of each abdominal segment, with six stout, sharply pointed projections, the pupal aster, at the apex of the abdomen.

A firm base for larval and pupal taxonomy was established by Teskey (1969), and his paper should be consulted for further details on the immature stages. Other studies on immatures, some of which include species not seen by Teskey, include Jones and Anthony (1964), Hays and Tidwell (1967), Wilson (1969), Thompson (1971) and Goodwin (1972). Larval habitats are also noted in most of these papers.

It is likely that most Virginia Tabanidae have a 1-year life cycle, but some of the larger species may take 2 or 3 years to complete their development. Larvae under adverse ecological conditions may take an extra season or more to complete development. There is some indication that a few species may have a partial second brood in Virginia. The emergence of adult males of a given species is normally a few days in advance of the main female emergence.

Eggs of Tabanidae are parasitied by the hymenopterous families Trichogrammatidae and Scelionidae, and such parasitism may be

heavy in certain areas. Larvae and pupae are parasitied by Hymenoptera of the families Diapriidae and Pteromalidae, and Diptera of the families Bombyliidae and Tachinidae, but no heavy parasitism has been reported. Adults are fed upon by birds, and Snoddy (1969) found that the summer food of the cattle egret in Georgia, based on the number of individuals consumed, consisted of 59 percent horse flies. Wasps of the genus *Vespula* feed on adult Tabanidae, and other wasps in the genera *Crabro*, *Stictia*, and *Bembix* regularly provision their nests with tabanids.

The species of Tabanidae with which we are best acquainted are most active on warm sunny days when there is little wind. Only the females suck blood, and they may be found attacking wild and domestic animals and humans. Moving objects, especially those of a dark color, seem to be most subject to attack. The males are most commonly found on flowers, resting on roads in spots of sunlight in wooded areas, or hovering in glades or over hill and mountain tops. A few species are known to be crepuscular or nocturnal. Both sexes of some species are readily attracted to lights at night.

### ECONOMIC IMPORTANCE

Tabanidae, because of their bloodsucking habits, are annoying to wildlife, domestic animals, and man. Dr. Michael Kosztarab (VPI & SU) has supplied me with copies of file cards from the VPI & SU Insect Survey, and these indicate numerous cases where Tabanidae were abundant enough to have their activities recorded. Unfortunately, determinations are only to genus, so the actual species involved are unknown. Counties from which reports were received include Albemarle, Cumberland, Dickenson, Fairfax, Fluvanna, Goochland, King William, Lunenburg, Montgomery, Nansemond, Nottaway, Roanoke, and Stafford, and the cities of Norfolk and Virginia Beach. Most of these reports refer to attacks on herds of beef and dairy cattle; others refer to attacks on horses, wildlife and humans, and one records the hospitalization of a woman bitten by a deer fly in Roanoke County. A few individuals are very sensitive to tabanid bites and may become severely ill after an attack.

Tabanidae can serve as vectors for a number of diseases of animals and humans, but little is known of this relationship in Virginia. Anaplasmosis of cattle, equine infectious anemia of horses, and hog cholera are diseases present in Virginia, and in other states Tabanidae have been shown to mechanically transmit the causative organisms of these diseases.

Control of horse flies and deer flies is difficult. Some repellents give temporary relief but in general leave much to be desired. Large-scale pesticide applications to control adults have been only fairly successful, and care in the selection of the pesticide is important to preserve non-target organisms. Treatment of salt marshes to control larvae has shown promise, but to date, no insecticide has been found which does not cause considerable environmental damage.

On farms with small ponds and seepage areas, most emergent vegetation can be removed so that oviposition is concentrated on the remaining vegetation which can then be destroyed before the eggs hatch. Unfortunately, some of the important pest species live as immatures in moist sod and not in the mud around ponds.

Canopy traps baited with dry ice or some other form of carbon dioxide appear most promising for control in limited areas such as golf course greens, swimming pool areas, paddocks, and yards. Traps of this nature are described by Catts (1970), Adkins et al. (1972), and Pechuman (1972).

## COLLECTION AND PRESERVATION

Female Tabanidae can be collected as they attack animals and humans, from windows in buildings, and from cars parked with windows open. Both sexes can be taken from flowers, by sweeping vegetation with an insect net, from roads in wooded areas, and from lights at night. Excellent specimens may be taken from wasps which have preyed on tabanids as they approached their nest, or by digging specimens out the nest itself. Collecting larvae and rearing adults from them will produce about equal numbers of both sexes.

McAtee and Walton (1918) discussing the collection of the larger *Tabanus* species stated, "Most of the horse flies are active and alert and are strong fliers, so that their capture is by no means easy. In fact, collecting them appeals to one as rather a sporting proposition with the odds generally in favor of the flies." The use of canopy traps (Pechuman, 1972) reverses these odds, and these traps are a very effective means of securing a large number of specimens in a short time.

Specimens should be pinned on the day of collection, and the usual date-locality labels placed on the pin. Specimens in alcohol, or dried unpinned specimens, are of little use in taxonomic studies. Dirty and greasy specimens can be cleaned by immersion in ethyl acetate for a few hours.

## CLASSIFICATION

The most modern classification of Tabanidae on a worldwide basis is that of Mackerras (1954) and for North America, that of Philip (1957, 1965). The classification used in this paper is that of Philip (1965) with slight modifications.

The family is divided into three subfamilies, and each subfamily into tribes. A breakdown of the subfamilies, tribes, genera, and number of species found in Virginia follows, with the figure in parentheses representing the estimated total.

*Number found in Virginia*

### PANGONIINAE

#### Pangoniini

*Stonemyia* 2 (3)

#### Scionini

*Goniops* 1

### CHRYSOPSINAE

#### Bouvieromyiini

*Merycomyia* 1

#### Chrysopsini

*Chrysops* 33 (46)

*Neochrysops* (1)

### TABANINAE

#### Diachlorini

*Diachlorus* 1

*Anacimas* (1)

*Microtabanus* 1

*Chlorotabanus* 1

*Leucotabanus* 1

#### Haematopotini

*Haematopota* 1

#### Tabanini

*Atylotus* 1 (2)

*Hamatabanus* 1

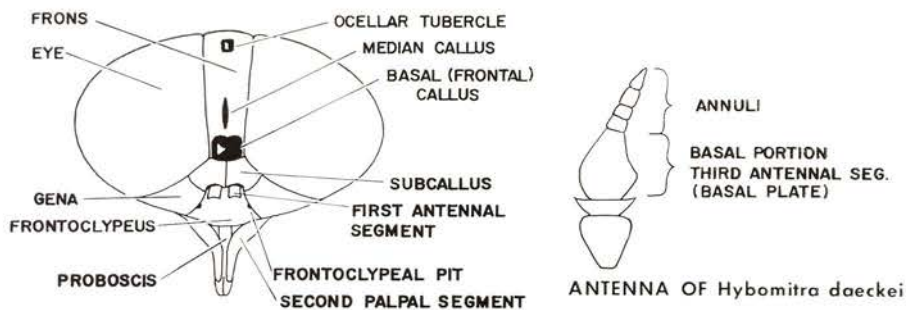
*Hybomitra* 8 (11)

*Tabanus* 43 (53)

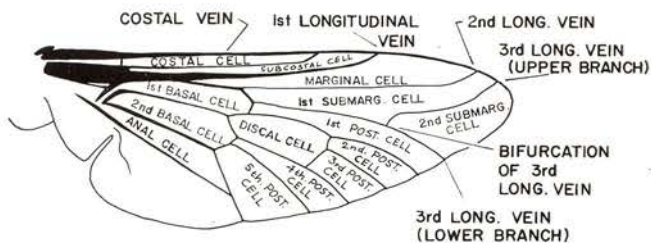
As mentioned earlier, McAtee and Walton (1918) included many Virginia records in their paper. Since 1918 there have been many changes of generic and specific names and in the interpretation of species. As an aid to those who may consult the 1918 paper, I am listing those species where a change is involved, along with the name I am using for the same species in this paper:

McAtee and Walton (1918)	This paper
<i>Pangonia pigra</i> Osten Sacken	<i>Stonemyia isabellina</i> (Wiedemann)
<i>Pangonia rasa</i> Loew	<i>Stonemyia rasa</i> (Loew)
<i>Chrysops celer</i> Osten Sacken	<i>Chrysops cincticornis</i> Walker
<i>Chrysops fallax</i> Osten Sacken	<i>Chrysops geminatus</i> Wiedemann
<i>Chrysops lugens</i> Wiedemann	<i>Chrysops dacne</i> Philip
<i>Chrysops obsoletus</i> Wiedemann	<i>Chrysops univittatus</i> Macquart
<i>Chrysops univittatus</i> Macquart	<i>Chrysops macquarti</i> Philip
<i>Tabanus flavus</i> Macquart	<i>Chlorotabanus crepuscularis</i> (Bequaert)
<i>Tabanus bicolor</i> Wiedemann	<i>Atylotus bicolor</i> (Wiedemann)
<i>Tabanus hirtioculatus</i> Macquart	<i>Hamatabanus carolinensis</i> (Macquart)
<i>Tabanus cinctus</i> Fabricius	<i>Hybomitra cincta</i> (Fabricius)
<i>Tabanus carolinensis</i> Macquart	<i>Hybomitra difficilis</i> (Wiedemann)
<i>Tabanus lasiophthalmus</i> Macquart	<i>Hybomitra lasiophthalma</i> (Macquart)
<i>Tabanus trispilus</i> Wiedemann	<i>Hybomitra sodalis</i> (Williston) and <i>Hybomitra trispila</i> (Wiedemann)
<i>Tabanus giganteus</i> DeGeer	<i>Tabanus calens</i> Linnaeus
<i>Tabanus recedens</i> Walker	<i>Tabanus fusconervosus</i> Macquart
<i>Tabanus vivax</i> Osten Sacken	<i>Tabanus fairchildi</i> Stone
<i>Tabanus fuscopunctatus</i> Macquart	<i>Tabanus imitans</i> Walker
<i>Tabanus coffeatus</i> Macquart	<i>Tabanus nigripes</i> Wiedemann
<i>Tabanus costalis</i> Wiedemann	<i>Tabanus quinquevittatus</i> Wiedemann

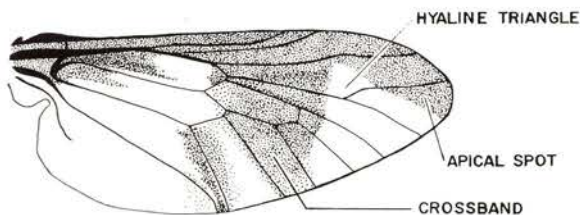
In discussing the complex composed of *Tabanus abdominalis*, *sulcifrons*, and *variegatus*, McAtee and Walton state, "A thorough overhauling of this section of the genus is needed." This is as true today as it was in 1918.



ANTERIOR VIEW OF HEAD OF *Hybomitra daeckei*



WING OF *Hybomitra daeckei*



WING OF *Chrysops dimmocki*

Figure 1

Figure 1. Taxonomic characters

## TAXONOMIC CHARACTERS

Distinctive structural characters are few in the Tabanidae, and most of them are confined to the head and its appendages. Chaetotaxy, which is so useful in many groups of Diptera, cannot be used since macrochaetae are not present. Since distinguishing structural characters are so few, much dependence must be placed on color pattern, and this must be used with caution on partly denuded specimens.

Since some of the characters of the head are restricted to the females, it is necessary to use separate keys to the males of *Chrysops*, *Hybomitra* and *Tabanus*. Since males do not attack man or animals, they are much less common in collections than females, and the male is still unknown for a number of North American species. Males are readily recognized by the contiguous eyes.

With the use of figure 1, most of the characters used in the keys may be readily understood.

For the sake of brevity in the keys, "bifurcation" is used for the bifurcation of the third longitudinal vein and "basal plate" for the broadened, non-annulate lower portion of the third segment of the antenna. The term "prescutal lobe" is the same as "antealares" and "antealar callus" used by some workers. In the male the "frontal triangle" is the area directly below where the contiguous eyes meet and above the antennae.

## DISTRIBUTION IN VIRGINIA

A detailed distributional study of Virginia Tabanidae is yet to be made, and few comments on distributional patterns can be made at this time. It is evident, however, that some species are coastal, some are restricted to the higher elevations, and others are rather generally distributed.

I have selected two species from each of the three major genera found in Virginia to illustrate what appear to be, on the limited records available, distinct distributional patterns. Figure 2 shows that *Chrysops atlanticus* is restricted to the coastal marshes, whereas *C. macquarti* is generally distributed, except at the highest elevations and immediately adjacent to the coast. In figure 3 it can be seen that *Hybomitra daeckei* is coastal and *H. difficilis* is largely

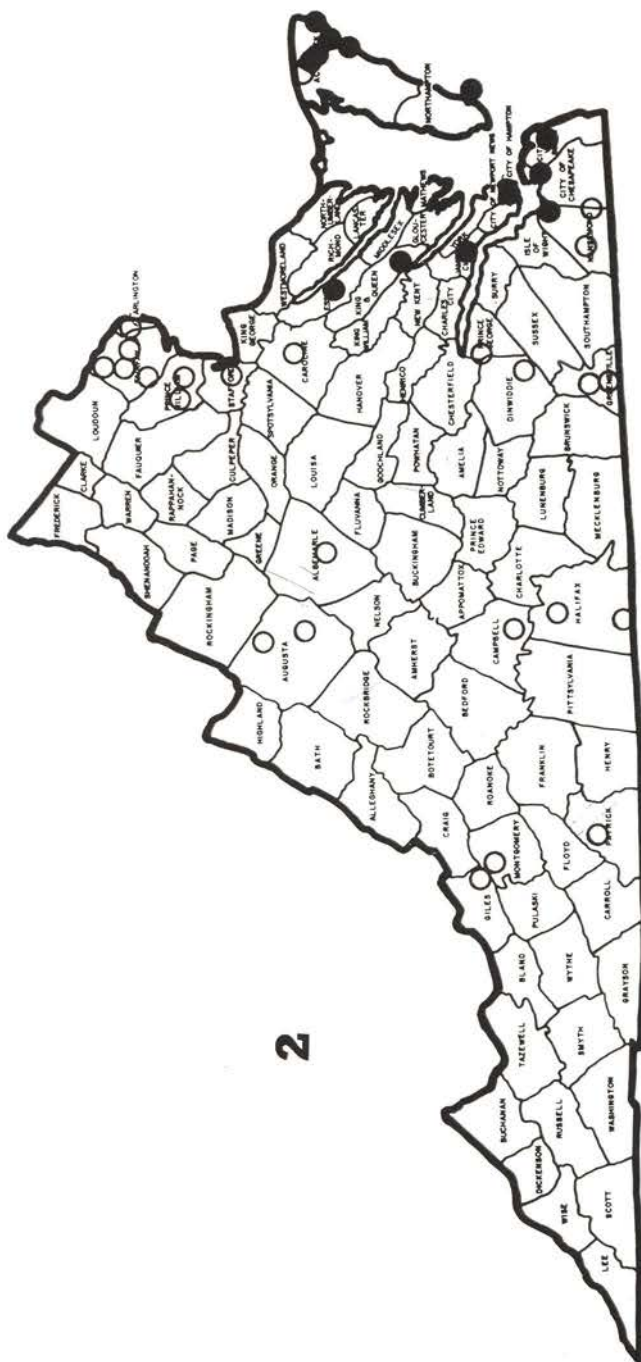


Figure 2. Distribution of *Chrysops atlanticus* (black dots) and *macquarti* (open circles) in Virginia.

restricted to the more rugged portions of the state, with only one collection on the coastal plain. *Tabanus petiolatus* and *T. sackeni* (fig. 4) have rather distinctive ranges; records of the former are almost entirely from the coastal plain and *T. sackeni* is essentially a species of the mountains.

*Chrysops pikei* is a species which probably has expanded its range into Virginia from North Carolina in recent years, and collections are concentrated in the southcentral and southeastern counties. This species in the past 35 years has expanded its range into southern Michigan, crossed Ontario north of Lake Erie, and entered northwestern New York where it is slowly spreading eastward. A northward movement probably is taking place at the same time. I suspect mountains are a barrier to this species, and to date, it is not known from Pennsylvania, New Jersey, Delaware, or Maryland. It will be interesting for future workers to note the northward progress of this species, for if it continues, it will probably reach these states from the south.

## SOURCES OF MATERIAL AND ACKNOWLEDGMENTS

Over a period of many years I have recorded the collection data from the many of thousands of Tabanidae sent to me for identification. Only a small percentage of these were from Virginia but the total added some knowledge to the Virginia fauna. These specimens are scattered in many public and private collections in North America and Europe.

There are no really extensive collections of Virginia Tabanidae and our knowledge of the group for the state is still fragmentary. I hope this attempt to bring together what is available will be a factor in inducing some future worker to make a detailed study of the Virginia tabanid fauna.

Probably the largest number of specimens from Virginia is in the U. S. National Museum (USNM). Through the kindness of George C. Steyskal, I have been able to study this material and clarify some of the records given by McAtee and Walton (1918). The great bulk of the USNM material is from the Washington, D. C. area. The next largest aggregation of Virginia Tabanidae is in the collection of Virginia Polytechnic Institute and State University (VPI&SU). Michael Kosztarab has been most cooperative in allowing me to work

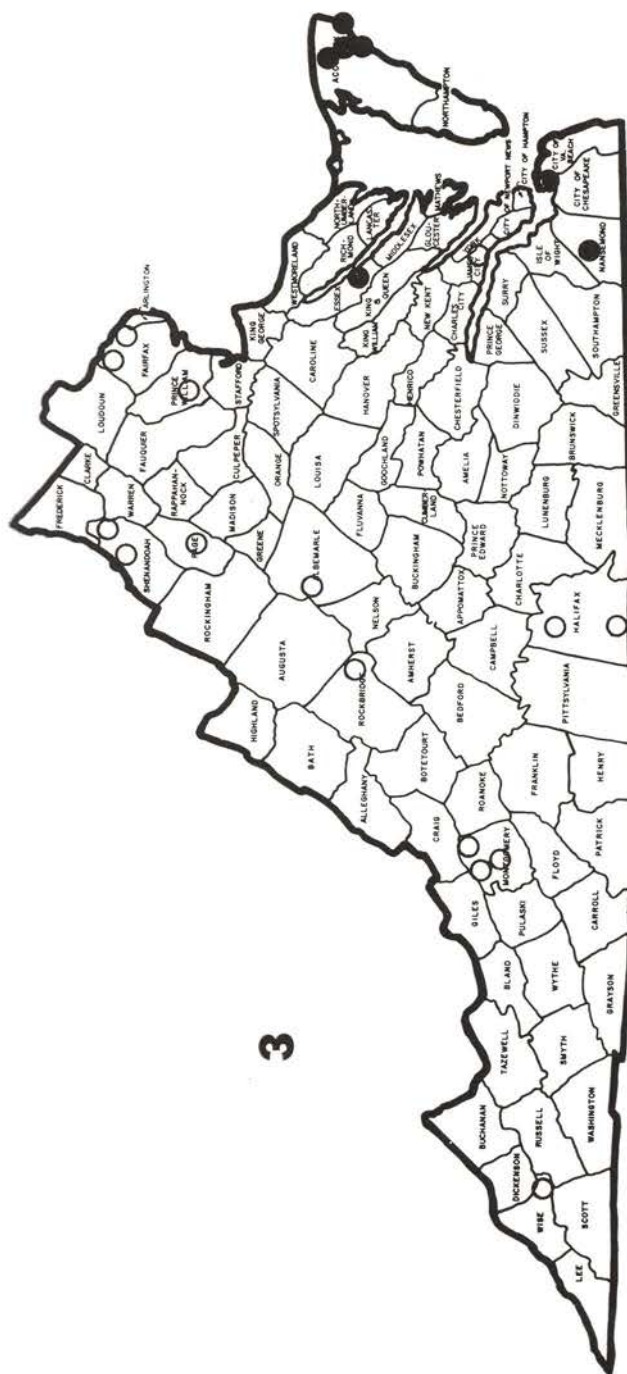


Figure 3. Distribution of *Hybomitra daeckei* (black dots) and *difficilis* (open circles) in Virginia.

with this material and has sent me additional material as it was secured. James F. Matta of Old Dominion University (ODU) has made a special point of collecting Tabanidae for this study and his help is most appreciated. Matta also arranged for me to study the Tabanidae in the collections of the Norfolk Museum and the U. S. Navy Preventative Medicine Unit. There is a fair amount of Virginia material in the Cornell University Insect Collection and in the Carnegie Museum, and I appreciate the specimens loaned by George E. Wallace of the latter institution. I have seen some specimens in the Museum of Comparative Zoology, Harvard University (MCZ) and wish to thank Howard E. Evans for the loan of specimens of interest.

Edward S. Saugstad, Walter Reed Army Institute of Research (WRAIR) sent a number of specimens from Assateague Island. John F. Burger of the same institute shared with me the results of his intensive work on Tabanidae in 1972 at Assateague and I also wish to thank him for supplementary information on specimens of some species in the U. S. National Museum.

Members of the faculty and students at Virginia Polytechnic Institute and State University were most cooperative in collecting Tabanidae during the course of this study; of the former I wish to thank W. A. Allen, C. B. Dominick, W. H. Robinson, and E. C. Turner Jr. and students Robert H. Perry, R. W. Rummel, A. H. Showalter, G. B. Straley, G. Tanner, R. Voshell and P. H. Willoughby.

Others who furnished material include George W. Byers (University of Kansas), Charles V. Covell (University of Louisville), Richard L. Hoffman and Jay B. Karren (Radford College), Patrick H. Thompson (U. S. Dept. of Agriculture), Karl Simpson (New York State Dept. of Health) and Karl Valley (Pennsylvania Dept. of Agriculture). Herbert J. Teskey (Entomology Research Institute, Ottawa, Canada) gave me the results of his 1972 larval collections in Virginia. I appreciate the loan of cotypes of *Tabanus fuscicostatus* from Ohio State University through Charles A. Triplehorn and for many specimens of this species from Mississippi from Richard H. Roberts (USDA). My own collecting in Virginia, in which I was assisted by John J. S. Burton (Cornell), was very limited.

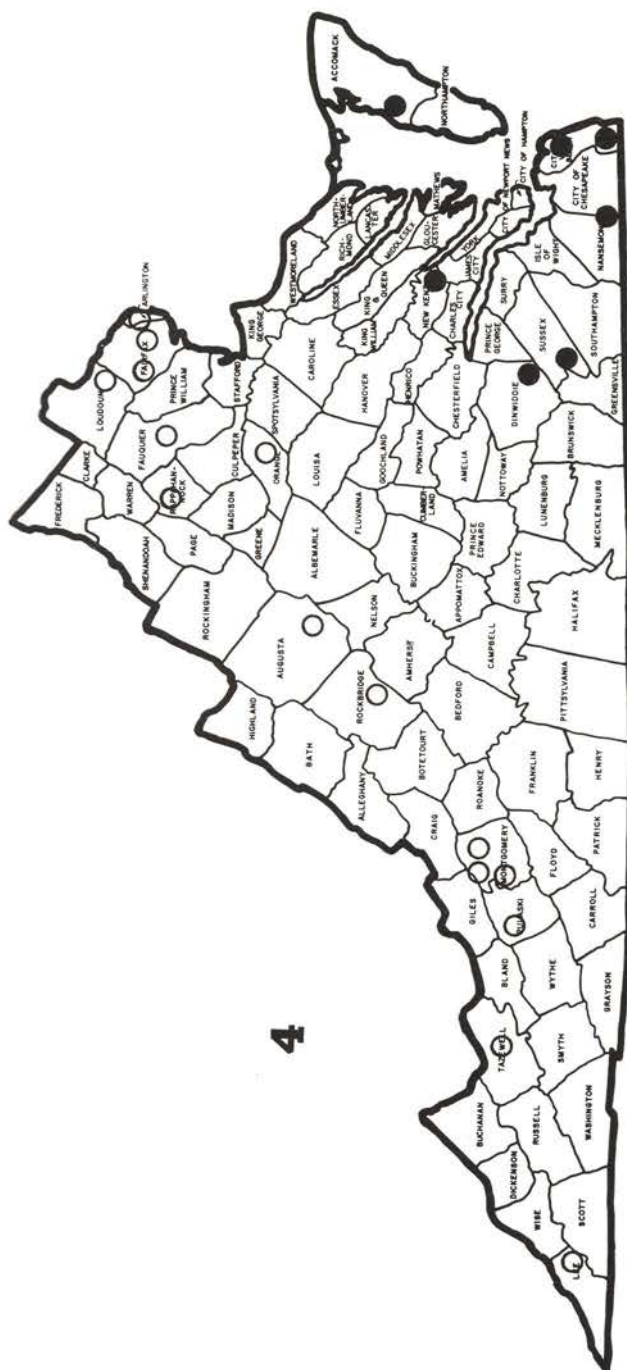


Figure 4. Distribution of *Tabanus petiolatus* (black dots) and *Tabanus sackeni* (open circles) in Virginia.

The wing photographs were made by Howard H. Lyon, Cornell University, Department of Plant Pathology, from specimens prepared by William R. Harrigan, Cornell University, Department of Entomology. Their work is much appreciated. R. J. Klare edited this publication.

## KEY TO GENERA OF VIRGINIA TABANIDAE

1. Hind tibiae with 2 apical spurs -----2  
Hind tibiae without apical spurs -----6
2. Third segment of antenna with 8 distinct annuli -----3  
Third segment of antenna with 5 or less distinct annuli -----4
3. Eyes of female with upper inner angles acute; frons  
broader than width of eye; wings with a dark pattern  
----- *Goniops* (p. 17)  
Eyes of female normal; frons narrower than width of eye;  
wings hyaline ----- *Stonemyia* (p. 16)
4. Third antennal segment composed of a rather broad basal  
plate and 2 or 3 annuli; first antennal segment only  
slightly longer than wide and total length of antennae  
equal to or shorter than thickness of head; larger  
species with very small hind tibial spurs -----  
----- *Merycomyia* (p. 17)  
Third antennal segment with a rather narrow basal por-  
tion and 4 annuli; first antennal segment usually at  
least twice as long as wide and total length of anten-  
nae greater than thickness of head; hind tibial spurs  
pronounced -----5
5. Abdomen globose, wider than thorax, with 2 rows of  
dark spots; wings rather evenly fumose -----  
----- *Neochrysops* (p. 55)  
Abdomen slender and variously marked or unpatterned;  
wings only rarely evenly fumose ----- *Chrysops* (p. 18)
6. First antennal segment longer than wide; frons of fe-  
male widened below, broader than high; wing gray  
with white maculations ----- *Haematopota* (p. 57)  
First antennal segment usually scarcely longer than wide;  
frons of female higher than broad; wing pattern, if  
any, not as above -----7

7. Third antennal segment with no dorsal angle; frons of female narrow; median callus a narrow line; wings with a dark pattern; eyes bare; no ocellar tubercle; fore tibiae swollen; basicosta (subepaulets) bare-----  
----- *Diachlorus* (p. 56)  
Not with this combination of characters -----8
8. Third segment of antenna with 2 or 3 annuli and with articulations indistinct; small flies usually under 10 mm; basal callus of female small or absent-----  
----- *Microtabanus* (p. 56)  
Third segment of antenna with 4 distinct annuli; size variable, usually more than 10 mm; frontal callus present or absent -----9
9. Small but distinct ocelli present; frons narrow; frontal callus narrow and ridgelike, well removed from eyes  
----- *Leucotabanus* (p. 57)  
No ocelli, but an ocellar tubercle may be present; frons, and callosities if present, variable -----10
10. Frontal callosities lacking -----11  
Frons with at least a basal callus -----12
11. Eyes hairy; labella fleshy; dark yellowish, gray or brownish species ----- *Atylotus* (p. 58)  
Eyes bare; labella with sclerotized plates; greenish species in life ----- *Chlorotabanus* (p. 57)
- 12 Third antennal segment with a hooklike projection from basal plate nearly reaching base of annulate portion; eyes sparsely hairy ----- *Hamatabanus* (p. 58)  
Third antennal segment rarely with such a projection but if present, eyes bare -----13
13. Vertex with a distinct denuded ocellar tubercle in female and in male with an elevated anteriorly shining tubercle; eyes usually hairy ----- *Hybomitra* (p. 59)  
Vertex without an ocellar tubercle; if an elevated tubercle is present in the male, it is completely pollinose -----14
14. Annulate portion of third antennal segment hairy; palpi blunt and stout with erect hairs; proboscis small --  
----- *Anacimas* (p. 56)  
Annuli without conspicuous hairs and differing in at least one other character from the above -- *Tabanus* (p. 63)

## Genus STONEMYIA Brennan

The species of this genus are not known to suck blood but are found on flowers and resting on the ground in openings in wooded areas. Nothing is known of the biology of the group.

Until this genus was erected, the species of *Stonemyia* were placed in various genera, most commonly in *Pangonius* and *Buplex*. Two species are known from Virginia and a third is probably present.

### KEY TO SPECIES OF VIRGINIA STONEMYIA

1. Yellowish species including antennae and legs ----- *isabellina*  
Antennae at least partly dark; legs reddish to black -----2
2. Legs reddish-brown; posterior margins of abdominal segments with grayish hairs ----- *rasa*  
Legs black; posterior margins of segments with yellow hairs ----- *tranquilla*

#### *Stonemyia isabellina* (Wiedemann)

I have seen ten collections of this species from Virginia of which six are from Fairfax County. The other collections are from Arlington and Nansemond Counties. Dates of collection range from 6 June to 5 July with eight of the collections in June. Several collections indicate that both sexes were collected on the flowers of *Ceanothus americanus*.

This species was described as a species of *Silvius*, and for many years was unrecognized. *Pangonia pigra* Osten Sacken is a synonym of *S. isabellina*, and most literature references prior to 1950 will be found under this name.

#### *Stonemyia rasa* (Loew)

The only Virginia specimen I have seen was taken by A. C. Cole at Mountain Lake, Giles County in July 1948 (Univ. Tenn.).

#### *Stonemyia tranquilla* (Osten Sacken)

This species is not known from Virginia. It has been collected in West Virginia, Tennessee, and North Carolina, and will undoubtedly be found eventually in the higher mountainous portions of Virginia.

## Genus GONIOPS Aldrich

### *Goniops chrysocoma* (Osten Sacken)

This is the only species in the genus, and neither sex is likely to be confused with any other tabanid. They are stout-bodied insects 10 to 15 mm long with the fore part of the wings infuscated.

The Snow Entomological Museum, University of Kansas, has a series of both sexes of this species taken at localities near the Mountain Lake Biological Station, Giles County, between 30 July and 20 August at altitudes ranging from 2900 to 4100 feet. All other specimens I have seen, except one, were taken at various localities in Fairfax County between 23 June and 26 July. One specimen was collected by W. Robinson in Nelson County, 28 June 1920 (USNM).

The eggs are laid on the underside of tree leaves above damp ground in wooded areas. The female normally remains with the eggs until they hatch, and when disturbed, makes a loud buzzing sound. The larvae are found in the lower layers of deep leaf mould and in damp soil. The adult is not known to attack man or animals.

## Genus MERYCOMYIA Hine

### *Merycomyia whitneyi* (Johnson)

Only two adults of this large and conspicuous, but rarely collected species, are known from Virginia. One was collected by W. L. McAtee at Dyke, Fairfax County, 16 July 1916 (USNM) and the other by E. Shoemaker at Mt. Vernon, Fairfax County, 6 June 1918 (MCZ). H. J. Teskey (*in litt.*) took the larva in May 1972 from the edge of a pond near Carson, Dinwiddie County.

This species has been observed ovipositing on emergent vegetation over rather deep water, and larvae have been found under deep water, in a partially submerged log, in silty ooze accumulated among submerged tree limbs on a creek margin and along the bank of a pond at water's edge.

The relative abundance of larvae seems to indicate that adults are uncommonly collected not because of their rarity, but because they have habits which cause them to be infrequently encountered in the field. More details on this interesting species may be found in two other papers (Pechuman, 1964; Goodwin, 1971).

## Genus CHRYSOPS Meigen

This genus includes the common deer flies. The eyes are bright green and gold with dark markings, and the wings usually have characteristic dark markings. The bright eye colors disappear shortly after death. The deer flies are annoying pests of man but probably are of less importance as pests of livestock than the larger *Hybomitra* and *Tabanus* species.

They are most abundant in wooded areas, but may also be found in other surroundings. Some species are restricted to the vicinity of salt marshes. The main flight season of many species is relatively short, rarely over 2 or 3 weeks, but individual specimens may be found throughout the season. In a few species, collection records show an upswing in populations a month or more after the initial records of the season. This may indicate these are two brooded, but no biological studies have been made to learn if this is the case.

To aid in identification, illustrations of the wing patterns of the *Chrysops* found in Virginia are included in this paper. All the wing photographs are of females, and all are at the same magnification.

### KEY TO SPECIES OF VIRGINIA CHRYSOPS

#### I. Females

1. Apex of wing beyond crossband hyaline -----2  
Apex of wing infuscated so an apical spot is present -----8
2. Frontoclypeus with a pollinose stripe extending from  
below antennae one half or more the distance to the  
oral margin -----3  
Frontoclypeus without a pollinose stripe -----5
3. Lateral pale area present on first two abdominal seg-  
ments ----- *euclux*  
Integument of abdomen wholly black -----4
4. Fifth posterior cell with hyaline area at base; hairs of  
pleurae gray or yellowish ----- *carbonarius*  
Fifth posterior cell dark at base; pleurae with yellow to  
orange-red pile ----- *cincticornis*
5. Wing pattern pale; crossband does not reach hind mar-  
gin of wing -----6  
Wing pattern dark; crossband reaches hind margin of wing --7

6. Abdomen completely dark; first basal cell dilutely infuscated ----- *nigribimbo*  
Abdomen with a yellow pattern; both basal cells hyaline ----- *fulvistigma*
7. Bare integument runs from ocellar area to occiput uninterrupted by pollinose areas; thoracic stripes very distinct ----- *calvus*  
Bare integument of ocellar area and occiput interrupted by pollinose areas; thoracic stripes indistinct ----- *niger*
8. Frontoclypeus with a pollinose stripe or projection below antennae ----- 9  
No pollinose stripe or projection on frontoclypeus ----- 12
9. Abdomen completely black ----- *separatus*  
Abdomen with a yellow and black pattern ----- 10
10. First basal and costal cells lightly infuscated to nearly hyaline; abdomen black with middorsal yellow stripe and often shorter lateral stripes ----- *upsilon*  
First basal cell and costal cells heavily infuscated; abdomen yellow with a black pattern ----- 11
11. Frontoclypeus black; abdomen yellow with a single broad mid-dorsal black stripe ----- *dorsovittatus*  
Frontoclypeus yellow; abdomen with four black stripes ----- *sequax tau*
12. Crossband and apical spot broken by dilute areas along veins; abdomen striate ----- *shermani*  
Dark markings of wing not broken by dilute areas ----- 13
13. Wing markings rather pale; a conspicuous spot which is often connected to strongly bowed crossband covers the bifurcation; apical spot fills second submarginal cell; dull blackish species ----- *fuliginosus*  
Not with above combination of characters; if spot is present at bifurcation, apical spot is narrow ----- 14
14. Apical spot dilutely extended around wing reducing hyaline triangle to a subhyaline area not reaching hind margin of wing; large brown species with swollen first antennal segment and little or no trace of abdominal markings ----- *brunneus*  
Not with above combination of characters ----- 15

15. Wing pattern pale and not distinctly outlined; usual hyaline areas dilutely infuscated; antennae short and somewhat swollen ----- *atlanticus*  
 Markings of wing clear cut; no infuscation of usual hyaline portions of wing except occasionally in anal area; antennae slender ----- 16
16. First basal cell completely infuscated, rarely with a subhyaline spot at apex ----- 17  
 First basal cell always at least half hyaline, sometimes almost entirely so ----- 34
17. Apex of wing infuscated reducing hyaline triangle to a roundish spot largely restricted to the first submarginal cell ----- *bistellatus*  
 Wing with a hyaline triangle ----- 18
18. Hyaline triangle small but clear and distinct, restricted to apices of second and third posterior cells ----- *moechus*  
 Hyaline triangle extending toward costal margin of wing beyond second posterior cell ----- 19
19. Apical spot narrow, entering only upper corner of second submarginal cell; blackish species ----- 20  
 Apical spot broad, usually covering at least half of second submarginal cell ----- 21
20. Bare integument runs from ocellar area to occiput, uninterrupted by pollinose areas; thoracic stripes distinct; apical spot a narrow line; only rarely a small spot at bifurcation ----- *calvus*  
 Extensive pollinose areas in ocellar area and occiput; thoracic stripes indistinct; apical spot broader; normally a dark spot at bifurcation ----- *brimleyi*
21. Hyaline triangle reaching and sometimes crossing second longitudinal vein but sometimes upper portion tinted so it is indistinct, often narrow and crescent shaped ----- 22  
 Hyaline triangle not extending much beyond the bifurcation and not crescent shaped ----- 29
22. Frontal callus yellow ----- 23  
 Frontal callus black or deep brown ----- 24
23. Apical spot reaches into first and sometimes second posterior cell; fifth posterior cell usually with some infuscation; 2 central stripes of abdomen heavier and darker than lateral stripes; thorax often with a greenish cast ----- *hinei*

	Apical spot rarely reaches into first posterior cell except as a pale shadow; fifth posterior cell usually entirely hyaline; 4 stripes of abdomen of about equal intensity or central stripes only slightly accentuated; thorax between stripes usually bright yellow -----	<i>beameri</i>
24.	Yellowish species with abdomen conspicuously black striped -----	25
	Predominantly black or fuscous species with pale abdominal markings, if any, as abbreviated stripes -----	26
25.	Abdomen with 2 prominent submedian black stripes; sublateral stripes absent on tergites 1 and 2 and sometimes 3; hyaline triangle rounded at apex -----	<i>pikoi</i>
	Abdomen with 4 complete black stripes; hyaline triangle pointed apically -----	<i>sequax</i>
26.	A yellow or grayish stripe laterally on thorax above wing base -----	27
	No stripe on thorax above wing base -----	28
27.	Abdomen usually with 3 dull yellow stripes which are often much reduced, especially the lateral ones -----	<i>obsoletus obsoletus</i>
	Abdomen dark without pattern or only traces of a pale median stripe -----	<i>obsoletus lugens</i>
28.	Hind legs predominantly dark; rarely with any trace of abdominal pattern; apical spot usually not extending beyond second submarginal cell -----	<i>parvulus</i>
	Hind legs predominantly yellow or brownish; abdomen usually with distinct traces of pale median line and occasionally with traces of lateral lines; apical spot usually extends into the first posterior cell -----	<i>dacne</i>
29.	Abdomen with 4, more or less complete, dark longitudinal stripes -----	30
	Abdomen not striped or with less than 4 stripes -----	33
30.	Most of fifth posterior cell infuscated; scutellum yellow ----	31
	Fifth posterior cell almost entirely hyaline; scutellum dark, with or without paler apex and/or sides -----	32
31.	Black abdominal and thoracic stripes distinct; apical spot with at most a spur in first posterior cell --	<i>vittatus vittatus</i>
	Brownish or blackish abdominal stripes indistinct; thoracic stripes reddish brown; apical spot continuous into first posterior cell -----	<i>vittatus floridanus</i>

32. Apical spot nearly fills second submarginal cell; 2 central stripes of abdomen rarely joined on second segment; frontal callus usually yellow, sometimes brown or black ----- *aberrans*  
 Apical spot only about half fills second submarginal cell; 2 central abdominal stripes usually join on second segment; frontal callus usually black, sometimes brownish, rarely yellowish ----- *striatus*
33. Apical spot fills out most of second submarginal cell and extends into first and sometimes second posterior cell, usually connecting with crossband by an infuscated streak in the first posterior cell; abdomen with 2 stripes which are sometimes reduced to faint lines or enlarged to cover most of abdomen on each side of a yellow stripe; scutellum usually with considerable yellow ----- *macquarti*  
 Apical spot fills only about half of second submarginal cell and does not extend further; abdomen not striped; scutellum dark ----- *indus*
- 34(16) Apical spot narrow including at most only extreme apex of second submarginal cell ----- 35  
 Apical spot broad, entering second submarginal cell over at least one third of upper branch of third longitudinal vein ----- 38
35. Apical spot just beyond where it leaves crossband slightly wider than marginal cell; frontal callus usually yellow, often bordered with black or brown, occasionally black ----- 36  
 Apical spot at base narrower or just as wide as marginal cell; frontal callosity black ----- 37
36. Black spot on second abdominal segment practically joins with that on first segment; second and third sternites with black sublateral spots; robust species ---- *sackeni*  
 Black spot on second segment usually does not attain anterior margin of the segment; no sublateral spots on sternites; more slender species ----- *pudicus* (in part)
37. Crossband dilute and leaving about half of the discal cell hyaline; cheeks black; frontoclypeus with a large black spot on each side ----- *delicatulus*  
 Crossband saturate and covering discal cell; frontoclypeus and cheeks yellow or orange ----- *callidus*

38. Blackish species with a mid-dorsal yellow (occasionally grayish) abdominal stripe and often with shorter sub-lateral stripes ----- 39  
 Abdomen with a different pattern and showing more yellow ----- 40
39. Infuscation of costal cell distinctly paler than crossband; apical spot often nearly filling second submarginal cell ----- *upsilon*  
 Costal cell same color as crossband; apical spot variable but rarely filling as much as half of second submarginal cell ----- *univittatus*
40. Hyaline triangle distinctly crosses second longitudinal vein, nearly separating apical spot from crossband ----- 41  
 Hyaline triangle at most reaches second longitudinal vein ----- 43
41. Apical spot occupies only about half of second submarginal cell; crossband usually does not reach hind margin of wing ----- *lateralis*  
 Apical spot occupies almost all of second submarginal cell; crossband reaches hind margin of wing ----- 42
42. Second abdominal segment with a black inverted "V" or a pair of oblique spots ----- *geminatus geminatus*  
 Second abdominal segment entirely yellow -----  
 ----- *geminatus impunctus*
43. Abdomen with 4 rows of spots, but lateral spots on second segment may be reduced or absent; median figure on second segment an inverted "V"; scutellum and frontal callus normally dark but latter sometimes brownish ----- *montanus*  
 Abdomen normally not with 4 rows of spots ----- 44
44. Hyaline triangle reaches second longitudinal vein ----- 45  
 Hyaline triangle does not reach second longitudinal vein ----- 46
45. Crossband dilute and basal portion of discal cell pale or hyaline; frontal callus and hind femora yellow; usually no dark spot under scutellum ----- *cursim*  
 Crossband not very dilute and basal portion of discal cell usually concolorous with rest of crossband; frontal callus yellow or fuscous and hind femora usually dark at base; there is a dark spot under scutellum -----  
 ----- *pudicus* (in part)

46. Abdominal markings black and median marking of second segment usually reaches anterior margin; frontal callus normally black but sometimes yellow; usually at least basal portion of hind femora black ----- *dimmocki*  
 Abdominal markings brown, often quite pale; median marking of second abdominal segment rarely attains anterior margin; frontal callus yellow; hind femora yellow or pale brown ----- 47
47. Thorax greenish-gray with fuscous stripes; outer margin of crossband usually sinuous ----- *celatus*  
 Thorax yellow brown with dark brown stripes; outer margin of crossband concave, straight or sinuous ----- 48
48. Dark median marking of second abdominal segment reaching only about half way across segment, leaving an anterior greenish yellow area; outer margin of crossband sinuous; legs usually a rather uniform mahogany color ----- *reicherti*  
 Dark median marking of second abdominal segment reaching about two thirds of way across segment and pale anterior area usually without greenish tinge; outer margin of crossband usually straight or somewhat concave; legs yellow or pale brownish ----- *flavidus*

## KEY TO SPECIES OF VIRGINIA *CHRYSOPS*

### II. Males

1. Apex of wing beyond the crossband hyaline ----- 2  
 Apex of wing infuscated beyond crossband so that an apical spot is present ----- 8
2. Frontoclypeus black with a midfacial pollinose stripe which begins below antennae and runs at least half way to the oral margin ----- 3  
 Frontoclypeus black or yellow without a midfacial pollinose stripe ----- 5
3. First 2 abdominal segments with small reddish or yellowish spots laterally ----- *euclux*  
 Abdomen completely black ----- 4
4. Fifth posterior cell with a hyaline area at base --- *carbonarius*  
 Fifth posterior cell infuscated at base ----- *cincticornis*

5. Wing picture very faint; face often entirely black -----6  
Wing picture dark; frontoclypeus yellow in middle -----7
6. Abdomen entirely black ----- *nigribimbo*  
Abdomen with yellow markings ----- *fulvistigma*
7. Thoracic stripes fairly distinct; rarely a spot at bifur-  
cation ----- *calvus*  
Thoracic stripes almost obsolete; often a spot at bifur-  
cation ----- *niger*
8. Frontoclypeus with a midfacial pollinose stripe -----9  
Frontoclypeus without such a stripe -----11
9. Abdomen entirely black (if all coxae not black and if  
apical spot not clearly separated from crossband, see  
*parvulus*) ----- *separatus*  
Abdomen with pale markings -----10
10. Abdomen yellowish with a mid-dorsal black stripe -----  
----- *dorsovittatus*  
Abdomen black with a narrow yellowish mid-dorsal line  
and occasionally similar shorter sublateral lines ---- *upsilon*
11. Abdomen black with no yellow markings; hind femora black \_12  
Abdomen with yellow markings; hind femora variable -----15
12. Apical spot not covering all of second submarginal cell -- *brimleyi*  
Apical spot includes all of second submarginal cell -----13
13. Hyaline triangle clear, restricted to apices of second and  
third posterior cells; thorax usually with at least a  
trace of a pale stripe above wing base; facial area  
with considerable yellow ----- *moechus*  
Hyaline triangle dilutely infuscated; no trace of a pale  
stripe above wing base; yellow of facial area re-  
stricted to a narrow stripe in center of frontoclypeus ---14
14. Pleurae with some pale markings; first 2 antennal seg-  
ments and fore coxae and femora with considerable  
yellow ----- *parvulus*  
Pleurae, antennae and all coxae and femora black -- *fuliginosus*
15. Crossband and apical spot broken by dilute areas along  
veins ----- *shermani*  
Crossband and apical spot not broken by dilute areas  
although entire wing pattern may be pale -----16
16. Wing pattern dilute and indefinite or hyaline triangle  
represented by a narrow subhyaline or hyaline area  
not reaching hind margin of wing; first antennal  
segment somewhat swollen -----17

- Wing pattern clear-cut and hyaline triangle open at hind margin of wing (except probably in *bistellatus* the male of which is undescribed); first antennal segment not especially swollen, often very slender -----18
17. Dull yellowish species with pattern of dark spots on each abdominal segment except first; wing pattern dilute and indefinite; first antennal segment moderately swollen ----- *atlanticus*  
Brown species with no definite abdominal pattern, although dark markings may be indicated by dark shadows; hyaline triangle indicated by clear area along edge of crossband and not usually extended beyond center of third posterior cell; first antennal segment considerably swollen ----- *brunneus*
18. Black species; abdomen with a yellowish median longitudinal stripe, occasionally with a similar abbreviated stripe on each side; hyaline triangle crosses second longitudinal vein; apical spot rarely occupies more than half of second submarginal cell, often less -- *univittatus*  
Not with above combination of characters -----19
19. Apical spot very little broader at its apex than at its origin, crossing upper branch of third longitudinal vein at its apex and occupying very little of the second submarginal cell -----20  
Apical spot considerably broadened towards its apex, crossing at least half of upper branch of third longitudinal vein -----22
20. Hyaline triangle not reaching second longitudinal vein -- *sackeni*  
Hyaline triangle reaching or crossing second longitudinal vein -----21
21. Frontoclypeus with a large black spot on each side -- *delicatulus*  
Frontoclypeus entirely yellow or, at most, with some dark shading around frontoclypeal pits ----- *callidus*
22. Abdomen bright yellow and black; large black figure of second abdominal segment broadly joined to black figure of first segment; median yellow triangles do not reach the anterior border of the segments; apical spot occupying one-half to two-thirds of second submarginal cell -----23  
Not with above combination of characters -----24

23. Abdomen with a sublateral row of black spots; median yellow triangles moderate in size; hyaline triangle extending beyond bifurcation, sometimes reaching second longitudinal vein ----- *montanus*  
 Abdomen without a sublateral row of black spots; median triangles very small, sometimes obsolete; hyaline triangle ends at bifurcation ----- *indus*
24. Apical spot filling about half or less of second submarginal cell -----25  
 Apical spot filling all or nearly all of second submarginal cell, sometimes extending into first posterior cell -----31
25. Frontoclypeus with a black spot on each side; hyaline triangle crosses second longitudinal vein ----- *lateralis*  
 Frontoclypeus entirely yellow; hyaline triangle does not cross second longitudinal vein -----26
26. First basal cell infuscated, except for subhyaline area near apex; second basal cell at least half infuscated; hind femora usually partly black ----- *dimmocki*  
 First basal cell usually not more than half and second basal cell one third infuscated; hind femora often entirely yellow; dark markings on second abdominal segment not reaching the anterior margin -----27
27. Thorax yellow or brownish in ground color with brown stripes -----28  
 Thorax greenish gray with fuscous stripes -----29
28. Outer margin of crossband nearly straight; ground color of abdomen rather uniformly yellow; legs yellow --- *flavidus*  
 Outer margin of crossband sinuous; base of second abdominal segment often with a greenish cast; legs pale mahogany ----- *reicherti*
29. Crossband dilute, base of discal cell nearly hyaline; ground color of abdomen bright yellow; hind femora entirely yellow ----- *cursim*  
 Crossband saturate or nearly so, discal cell not paler at base; ground color of abdomen dull yellow; hind femora variable -----30
30. Hind femora usually dark at base; a black spot beneath scutellum; dark abdominal markings usually saturate ----- *pudicus*

- Hind femora usually entirely yellow; black spot beneath  
scutellum very pale or absent; dark abdominal mark-  
ings often faded ----- *celatus*
- 31(24) Hyaline triangle crosses second longitudinal vein;  
yellow species with black abdominal markings not in  
the form of stripes ----- 32
- Not with above combination of characters ----- 33
32. Second abdominal segment with 2 oblique spots which  
frequently are joined to form a single inverted "V"  
----- *geminatus geminatus*
- Second abdominal segment completely yellow or with  
traces of 2 spots at posterior margin -- *geminatus impunctus*
33. Hyaline triangle reaches or nearly reaches second longi-  
tudinal vein (if subhyaline beyond bifurcation of third  
longitudinal vein; predominantly black species with  
pale abdominal markings reduced) ----- 34
- Hyaline triangle scarcely extends beyond bifurcation of  
third longitudinal vein; predominantly yellowish spe-  
cies with dark abdominal markings ----- 40
34. Blackish species, with reduced pale abdominal markings --- 35
- Yellow species with black abdominal markings ----- 37
35. Thorax without a yellow stripe above wing base; lower  
border of second basal cell not more heavily infuscated  
than adjoining portion of cell ----- *dacne*
- Thorax with a yellow stripe on each side above wing  
base; lower border of second basal cell infuscated ----- 36
36. Abdomen with a dull yellowish median stripe, frequently  
with a shorter stripe on each side ----- *obsoletus obsoletus*
- Abdomen with only traces of longitudinal stripes ----  
----- *obsoletus lugens*
37. Frontoclypeus with a large dark spot on each side and  
cheeks with considerable black ----- 38
- Frontoclypeus and cheeks mostly yellow ----- 39
38. No sublateral spots on first and second tergites; second  
basal cell not more than half infuscated, sometimes  
almost entirely clear; hyaline triangle rounded at apex -- *pikei*
- Sublateral stripes completely cross first two tergites;  
second basal cell largely infuscated with a subhyaline  
area near apex; hyaline triangle pointed at apex ---- *sequax*
39. Second basal cell hyaline; thoracic stripes distinct, yel-  
lowish ----- *beameri*

- Second basal cell largely infuscated; thoracic stripes  
indistinct, greenish ----- *hinei*
40. Abdomen with a median yellow stripe with a longitudinal  
black band on each side; lateral margins of segments  
narrowly yellow ----- *macquarti*
- Abdomen yellow with 4 more or less complete rows of  
black spots ----- 41
41. Ground color of thorax and scutellum yellow ----- 42
- Ground color of thorax plumbeus; scutellum sometimes  
with some yellow ----- 43
42. First posterior cell with at most an infuscated spur; black  
abdominal spots distinct; thoracic stripes blackish  
brown ----- *vittatus vittatus*
- First posterior cell almost completely infuscated; abdom-  
inal spots pale brownish or obsolete; thoracic stripes  
reddish brown ----- *vittatus floridanus*
43. Apical spot completely fills second submarginal cell; the  
sublateral rows of abdominal spots are about as dark  
as the median rows ----- *aberrans*
- Apical spot not completely filling second submarginal  
cell; sublateral rows of abdominal spots paler than  
median rows ----- *striatus*

*Chrysops aberrans* Philip (fig. 5)

This species is not known from Virginia. However, since it is present in Maryland, it may be found here.

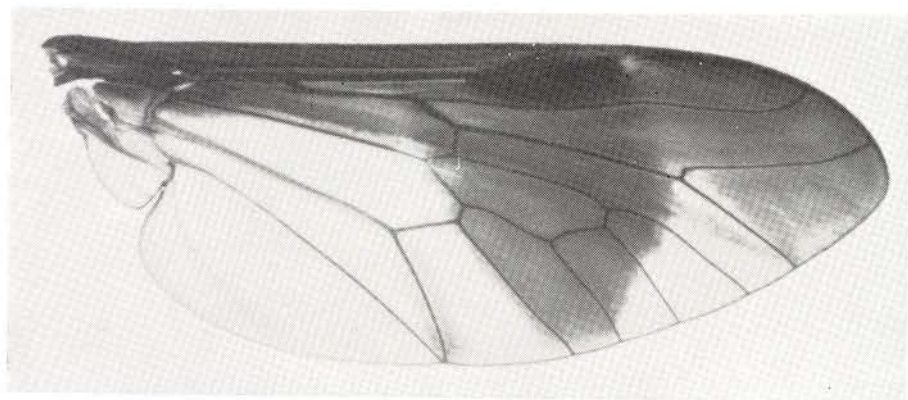


Figure 5. *Chrysops aberrans*

*Chrysops atlanticus* Pechuman (fig. 2, 6)

This species was long confused with *C. flavidus* but the smoky wing and usually darker thorax will distinguish it. It is a common pest species in the vicinity of salt marshes and is sometimes abundant enough to drive people from such areas.

I have seen specimens from the counties of Accomack, Essex, James City, King and Queen, Nansemond, Northampton, and York and the cities of Chesapeake, Hampton, and Virginia Beach. Collection records range from 6 June to 31 August with about half the records in June. John F. Burger informs me that this species was on the wing from 13 June to 11 September on Assateague Island, Accomack County in 1972.

The larvae are probably restricted to salt marshes and brackish pools.

*Chrysops beameri* Brennan (fig. 7)

I have seen only three specimens of this species from Virginia. One was collected by G. W. Underhill at Richmond, July 1929 (VPI&SU); one, a male, by C. T. Greene at Falls Church, 12 August 1912 (USNM); and one by Alan Stone at Westmoreland State Park, Westmoreland County, 5 August 1945 (USNM).

This species and closely related *C. hinei* fly late in the season, and collecting in late August and September, when most other species have disappeared, will probably produce additional records. Some specimens are difficult to separate from *C. hinei*.

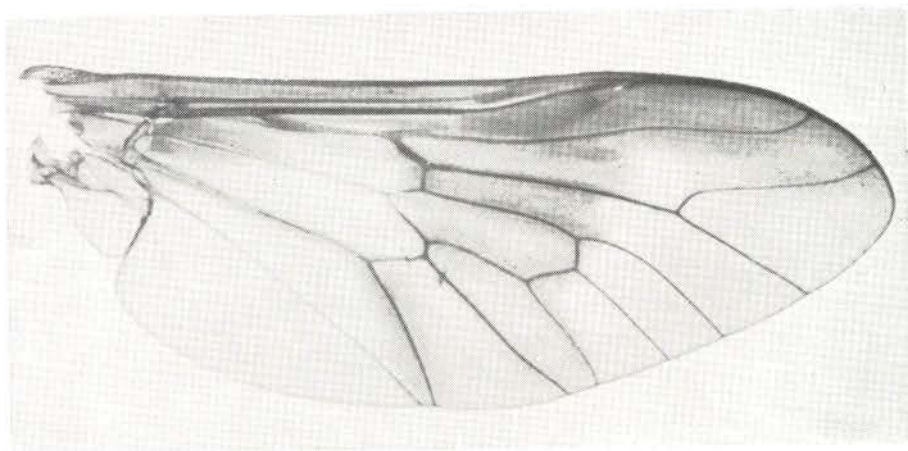


Figure 6. *Chrysops atlanticus*

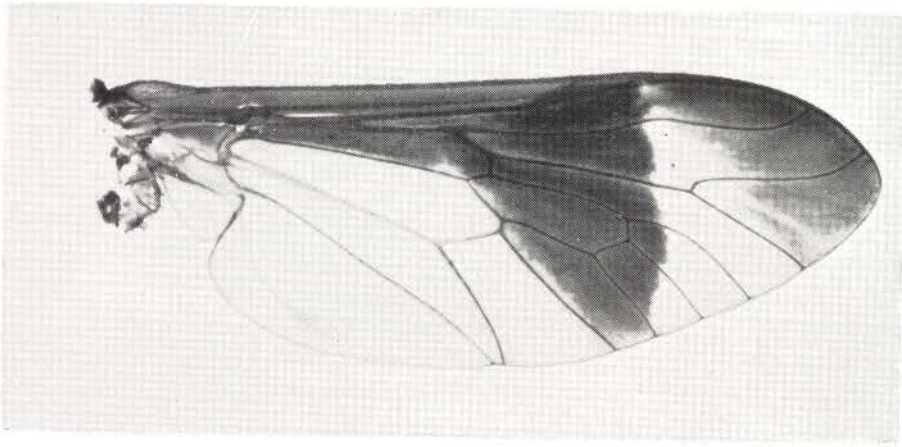


Figure 7. *Chrysops beameri*

*Chrysops bistellatus* Daecke (fig. 8)

Only two Virginia specimens were seen during this study. One was taken by G. W. Underhill at Richmond, 13 June 1932 (VPI&SU); the other by D. R. Whitehead at Bowling Green, Caroline County, 8 July 1961 (Whitehead).

*Chrysops brimleyi* Hine (fig. 9)

This little species is not uncommon in Virginia. Most records are from near the coast, but it is found inland as well.

I have seen specimens from Dismal Swamp, the counties of Accomack, Arlington, Fairfax, Greensville, Montgomery, Nansemond, and Stafford and the city of Virginia Beach.

The larvae have been found in moss and highly organic sandy soil along streams and ponds and in bogs.

*Chrysops brunneus* Hine (fig. 10).

Although McAtee and Walton (1918) report this species from Virginia, no specimens from Virginia are in the U. S. National Museum. A specimen of *C. celatus* from New Alexandria, one of the localities mentioned by McAtee and Walton, has the same collection data they reported for *brunneus* and may have been one of the specimens before them.

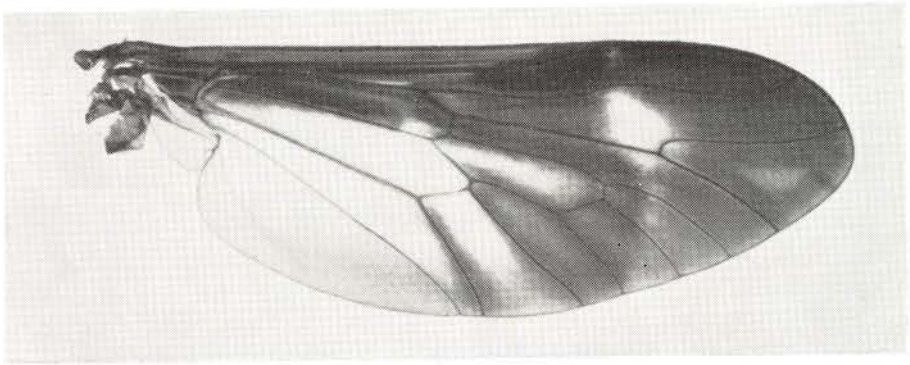


Figure 8. *Chrysops bistellatus*

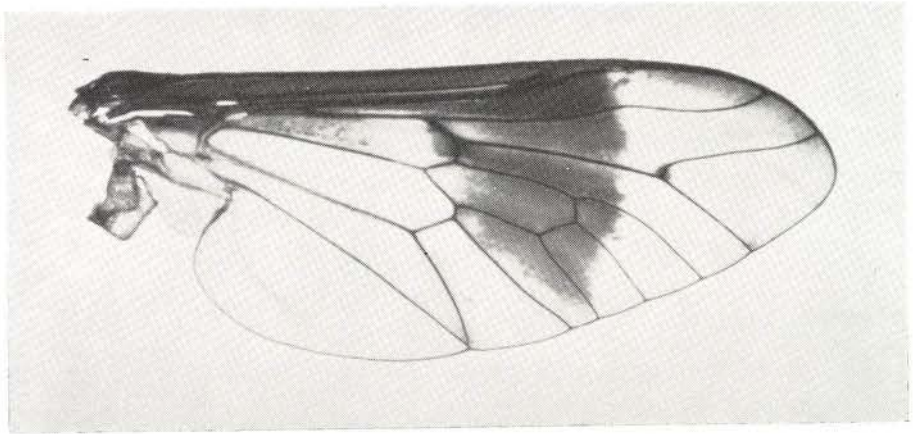


Figure 9. *Chrysops brimleyi*

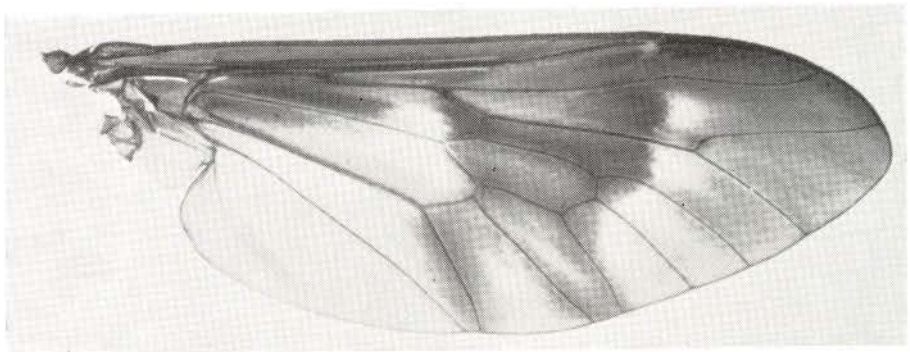


Figure 10. *Chrysops brunneus*

I saw two specimens of *C. brunneus* collected by James Matta at Virginia Beach, 31 August 1972. Although the first antennal segment is less inflated than in most *brunneus*, they conform in other respects, and I am confident they are *brunneus*.

*Chrysops callidus* Osten Sacken (fig. 11)

This species is widespread in Virginia. I have seen it from Dismal Swamp, the counties of Alleghany, Arlington, Augusta, Campbell, Charlotte, Fairfax, Frederick, Greensville, Halifax, James City, King and Queen, Montgomery, Nansemond, New Kent, Page, Prince William, Pulaski, Shenandoah, Stafford, Surry, and Westmoreland and the cities of Chesapeake, Norfolk and Virginia Beach. Dates of collection range from 7 May to 31 July with 54 percent of the collections in June.

What I presume to be a variant of this species, sometimes found near the coast, has the black markings of the abdomen considerably reduced, and often the coxae and femora are partly or all yellow. I have seen such specimens from Dismal Swamp, King and Queen County and the cities of Chesapeake and Virginia Beach. John J. S. Burton and I collected a series of such specimens at Aquia, Stafford County on 25 May 1970.

The larvae are found in a variety of wet situations, including mud on the edge of ponds, stream margins, wet organic material, and the edge of brackish pools. On 31 May 1970 I swept freshly emerged adults of both sexes from vegetation growing in water-soaked sod along the edge of a pond near Stephenson, Frederick County.

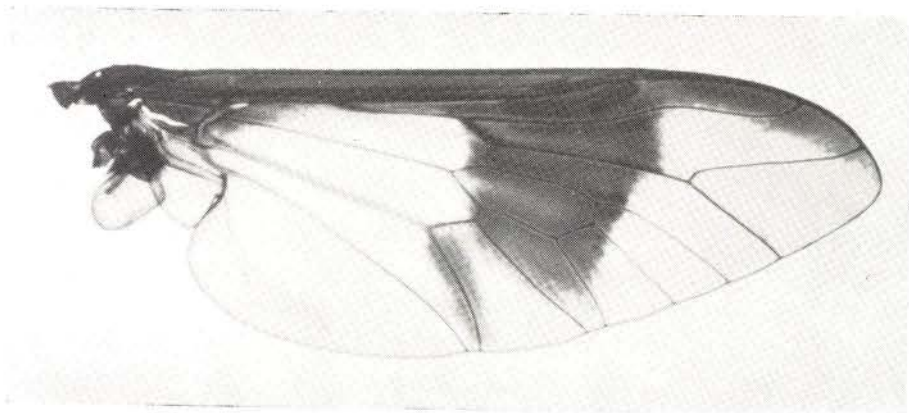


Figure 11. *Chrysops callidus*

*Chrysops calvus* Pechuman and Teskey (fig. 12)

This species was rather recently separated from *C. niger* (Pechuman and Teskey, 1967) and seems to be less common in Virginia than that species. I have seen specimens of *C. calvus* from Arlington, Carroll, Montgomery, and Stafford counties. All specimens were collected between 1 May and 19 June.

Larvae have been taken from saturated clay soil on the banks of a pool in a flood channel of a brook (Teskey, 1969).

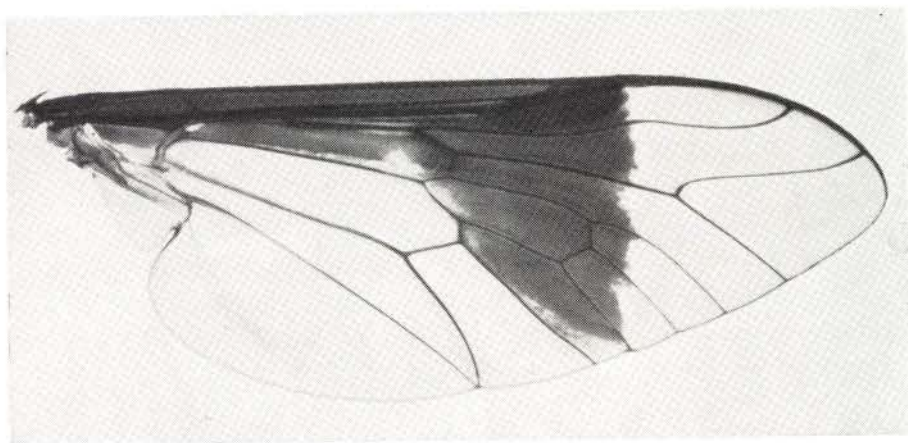


Figure 12. *Chrysops calvus*

*Chrysops carbonarius* Walker (fig. 13)

I have seen this species from the counties of Arlington, Dinwiddie, Fairfax, Giles, Greensville, James City, and Stafford. Collection records extend from 2 May to 1 August, but most fall from late May to mid-June.

Larvae are found in saturated habitats along streams; the more rapidly flowing streams seem to be preferred.

Related *C. ater* Macquart is known from a high elevation locality in West Virginia, and may possibly be present in Virginia. It is distinguished from *carbonarius* by the crossband not broadly reaching the hind margin of the wing and having a more irregular outer border; also the hyaline spot at the base of the fifth posterior cell is less clearcut and distinct.

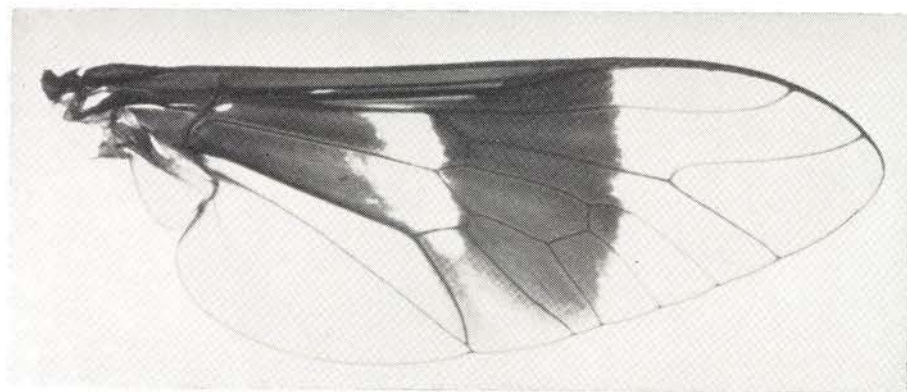


Figure 13. *Chrysops carbonarius*

*Chrysops celatus* Pechuman (fig. 14)

This species is probably more abundant than the scattered records indicate. I have seen it from the counties of Accomack, Caroline, Dinwiddie, Fairfax, and King and Queen.

*C. celatus* has been collected between 26 May and 8 July.

I collected a hovering male at the edge of a pond near Carson, Dinwiddie County on 26 May 1972 and Teskey (*in litt.*) collected several larvae from mud on the edge of this pond on the same date. He also found the larvae along the edge of a sluggish stream in a swamp near Jarratt, Sussex County.

*Chrysops cincticornis* Walker (fig. 15)

It is not likely that this large black species with conspicuous orange hairs laterally on the thorax will be mistaken for any other species. Some individuals of *C. carbonarius* may have yellowish hairs on the thorax but in that species there is a clear spot at the base of the fifth posterior cell.

*Chrysops cincticornis* will readily attack humans, but fortunately it rarely appears in large numbers, although it is widely distributed in Virginia. Specimens were studied from Dismal Swamp, the counties of Arlington, Campbell, Culpeper, Fairfax, Frederick, Greensville, Montgomery, Pulaski, Rockingham, and Stafford and the city of Norfolk. Dates of collection ranged from 12 May to 31 July, but nearly 80 percent of the specimens was taken in late May and early June.

The larvae are found in a variety of saturated substrates along the edges of ponds and streams.

McAtee and Walton (1918) report *Chrysops mitis* Osten Sacken from Potomac Run, Stafford County, which is well south of the known range of the species. No Virginia specimens of *C. mitis* were located in the U.S. National Museum, but *cincticornis* collected by McAtee and Walton from Potomac Run is present. It is likely they considered a denuded *cincticornis* as *mitis*.

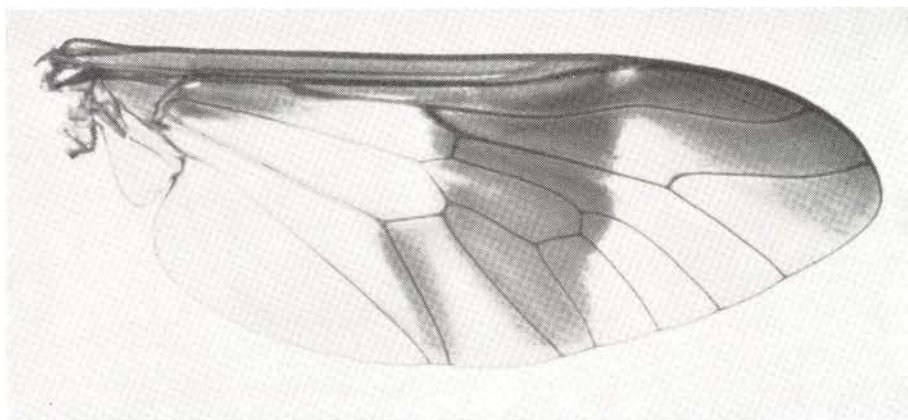


Figure 14. *Chrysops celatus*

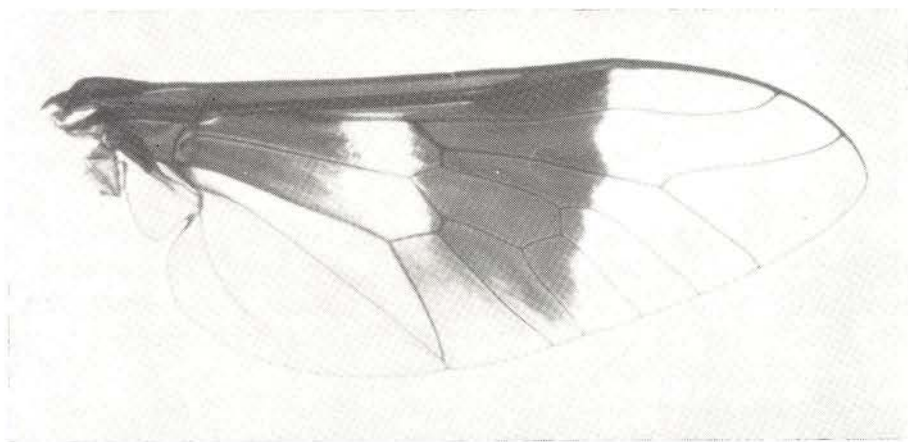


Figure 15. *Chrysops cincticornis*

*Chrysops cuclux* Whitney (fig. 16)

Only a few Virginia individuals of this species were studied. Specimens were seen from the counties of Fairfax, Fauquier and Frederick. Collection dates ranged from 8 May to 3 June. Since this species is found in the mountains south to Georgia, it is likely that early collecting at the higher elevations will produce more specimens.

The larvae are known from wet mud along streams and occasionally from pond margins.

*Chrysops cursim* Whitney (fig. 17)

This species has not been collected in Virginia, but since it is known from Maryland, Tennessee, and North Carolina, it probably occurs in the state.

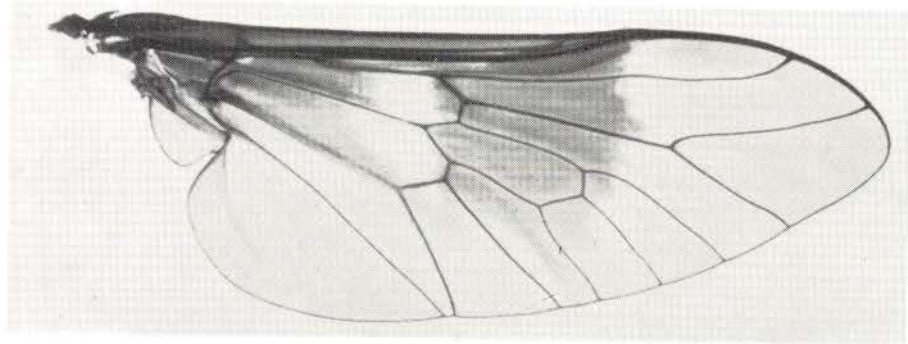


Figure 16. *Chrysops cuclux*

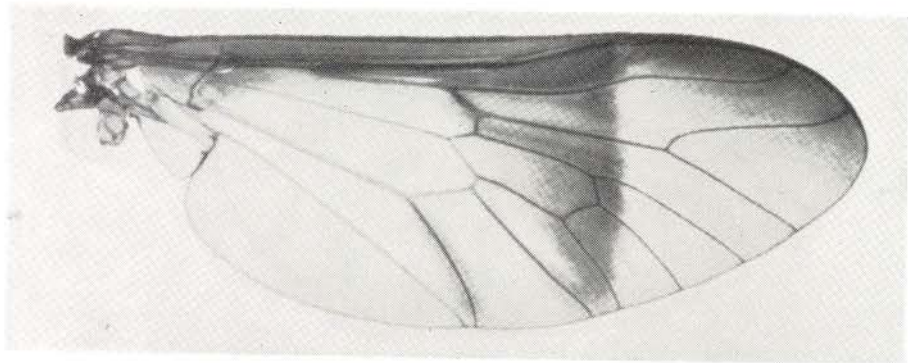


Figure 17. *Chrysops cursim*

*Chrysops dacne* Philip (fig. 18)

Most records of this species are from eastern Virginia, but it probably is generally distributed, except at the higher elevations. I have seen specimens from the counties of Arlington, Fairfax, King and Queen, New Kent, and Sussex and the cities of Charlottesville and Richmond.

Dates of collection range from 9 June to 10 August, but most specimens were taken from mid-June to early July.

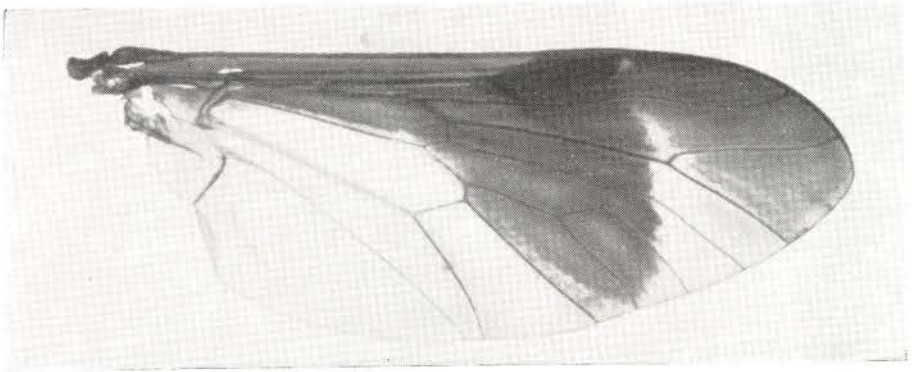


Figure 18. *Chrysops dacne*

*Chrysops delicatulus* Osten Sacken (fig. 19)

No specimens of this species were seen from Virginia. However, it is found in Maryland and very likely will be collected in Virginia eventually.

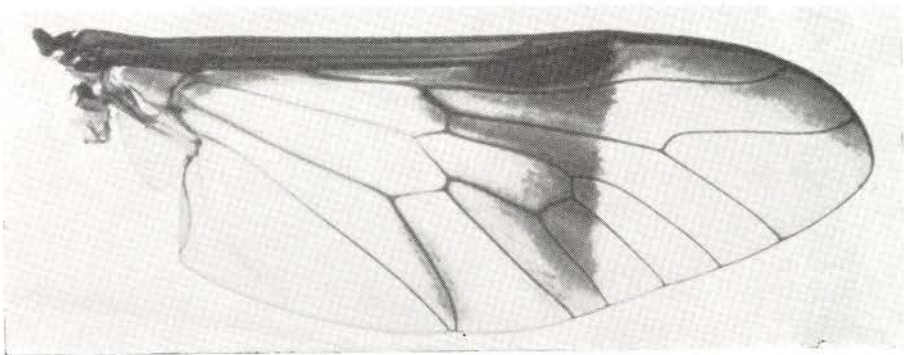


Figure 19. *Chrysops delicatulus*

*Chrysops dimmocki* Hine (fig. 1, 20)

This species was seen from Dismal Swamp, the counties of Greenville, Nansemond, and Stafford and the cities of Chesapeake and Virginia Beach. I was unable to find in the U. S. National Museum the specimen reported by McAtee and Walton (1918) from Great Falls. John J. S. Burton and I collected it in considerable numbers near Aquia, Stafford County on 25 May 1970; it attacked us aggressively.

Records range from 23 May to 28 June with one record (Virginia Beach) on 14 August.

The larvae have been collected from saturated sand and silt, mixed with considerable organic material, along pond margins and in swamps.

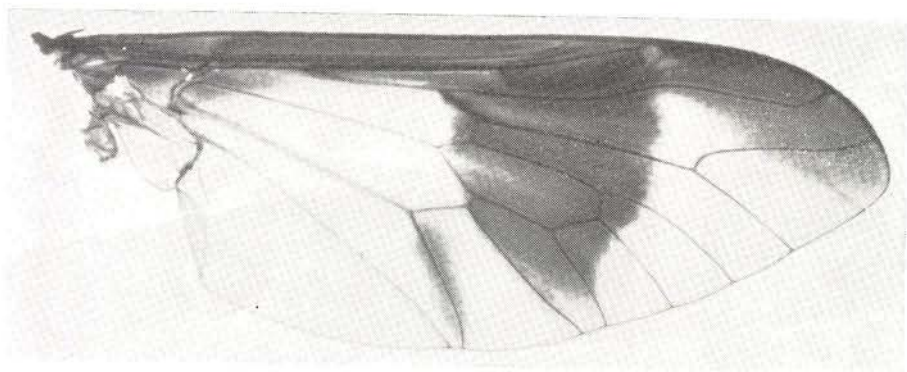


Figure 20. *Chrysops dimmocki*

*Chrysops dorsovittatus* Hine (fig. 21)

The only specimens of this species seen from Virginia were in a short series collected by John J. S. Burton and myself near Skippers, Greensville County, on 26 May 1970.

*Chrysops flavidus* Wiedemann (fig. 22)

This species is generally more common near the coast but is taken inland as well. Specimens were seen from Dismal Swamp, the counties of Accomack, Dinwiddie, Frederick, Greenville, New Kent, Northampton, Smythe, Sussex, and Westmoreland and the cities of Chesapeake, Norfolk, and Virginia Beach.

Collection dates range from 4 May to 31 August, with about half the records in July. John F. Burger (*in litt.*) found some individuals still on the wing 26 September 1972 on Assateague Island, Accomack County.

The larva is known from a variety of wet habitats, along ponds, lakes, and streams and in swamps.

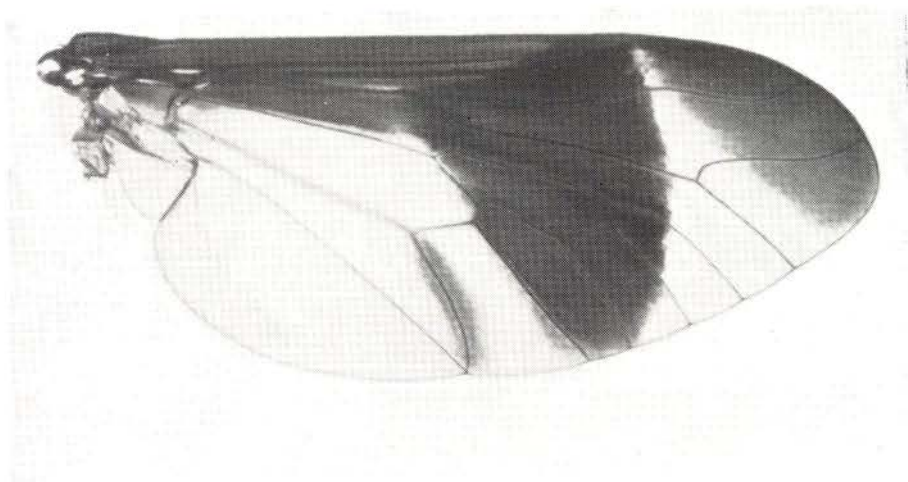


Figure 21. *Chrysops dorsovittatus*

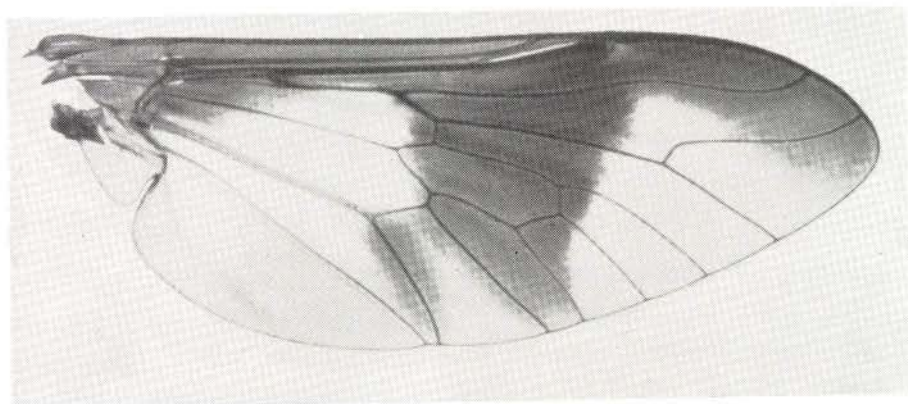


Figure 22. *Chrysops flavidus*

*Chrysops fuliginosus* Wiedemann (fig. 23)

This coastal form may be abundant and pestiferous along the coast early in the season. I have seen specimens only from Accomack County and the cities of Norfolk and Virginia Beach, but it probably is found in all salt marsh areas. Collection dates range from 7 April to 27 May. John F. Burger (*in litt.*) found that the flight season in 1972 lasted until 13 June on Assateague Island, Accomack County.

The larvae are found in salt marshes.

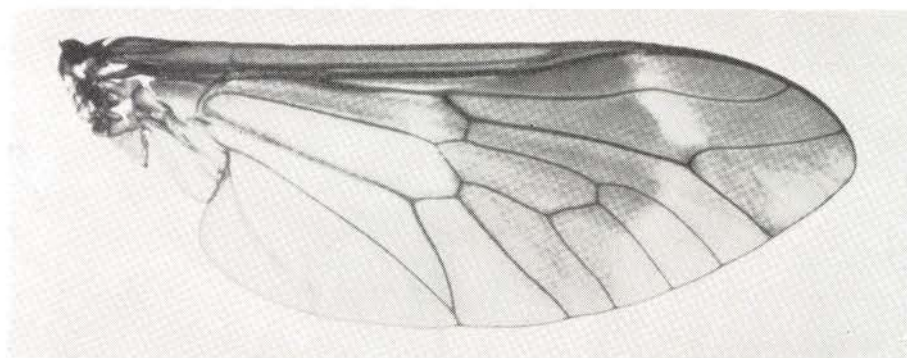


Figure 23. *Chrysops fuliginosus*

*Chrysops fulvistigma* Hine (fig. 24)

This species has not been reported from Virginia. It is known from Maryland and North Carolina and probably is found in Virginia. It is not commonly collected anywhere in its known range.

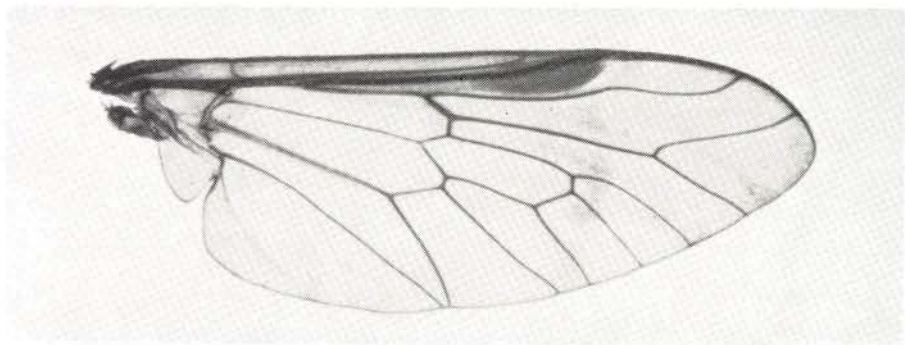


Figure 24. *Chrysops fulvistigma*

*Chrysops geminatus geminatus* Wiedemann (fig. 25)

This species is most commonly found in wooded areas where the terrain is hilly or mountainous. Specimens were seen from the counties of Arlington, Fairfax, Giles, Greensville, King and Queen, Montgomery, Page, Rockbridge, and Stafford and the city of Radford. Extreme collection dates are 26 May and 19 August, but most records are in late June and July.

The larvae seem to favor mossy habitats in spring-fed drainage beds, but are also found in swamps and along streams.

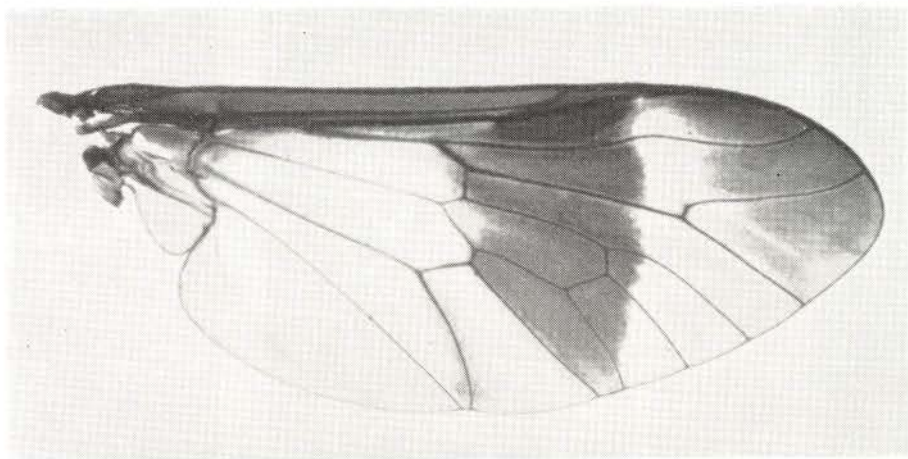


Figure 25. *Chrysops geminatus geminatus*

*Chrysops geminatus impunctus* Krober (fig. 26)

Only three Virginia specimens of this form were seen. Two, in the U. S. National Museum, were collected by H. A. Allard: Blue Ridge, Paris, 4 July 1934 (Fauquier Co.) and Bull Run Mountains, 28 June 1936 (in Fauquier and Prince William counties). The third specimen was collected by John F. Burger in the Massanutten Mountains, 3 miles north of Fort Valley, Shenandoah County, 8 July 1972 at 1500 feet (Burger collection).

Little is known about this form and additional material supported by information on its biology may show it is a distinct species.

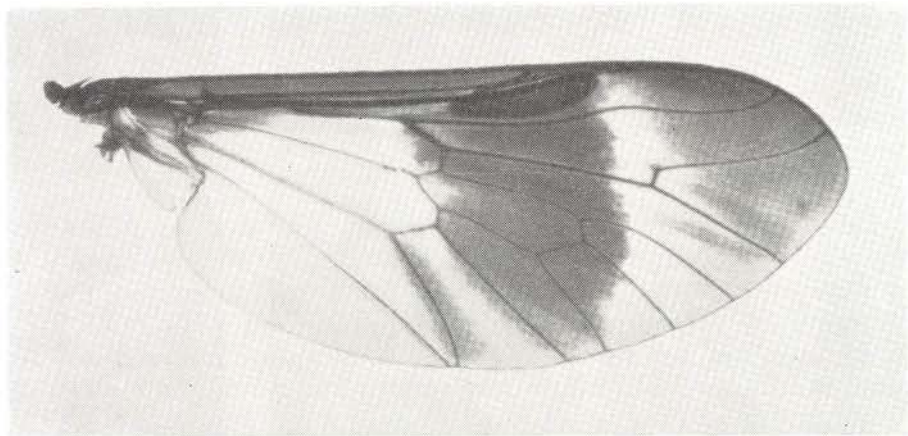


Figure 26. *Chrysops geminatus impunctus*

*Chrysops hinei* Daecke (fig. 27)

Only a few specimens of this late flying species were seen, all from the same general area. Specimens studied were all taken between 1 and 16 September in Dismal Swamp and the city of Virginia Beach.

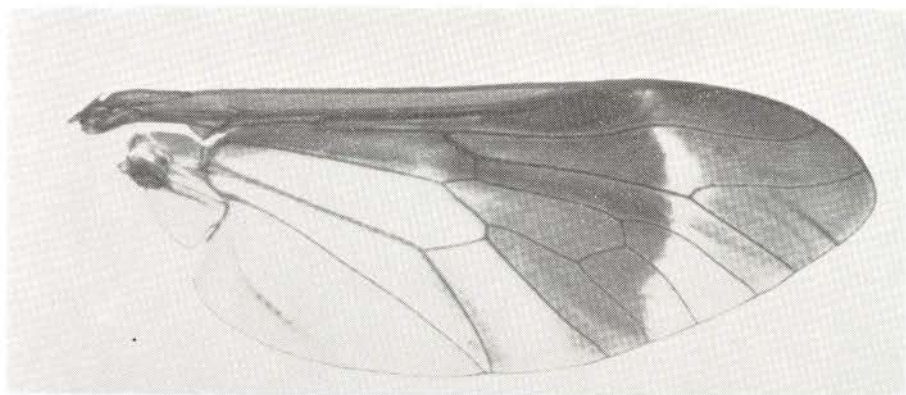


Figure 27. *Chrysops hinei*

*Chrysops indus* Osten Sacken (fig. 28)

Three females collected by W. R. Walton at Potomac Run, Stafford County, 31 July 1916 (USNM), are all I have seen of this species from Virginia. It is likely these represent a disjunct population, since the locality is well south of the known range of *indus*.

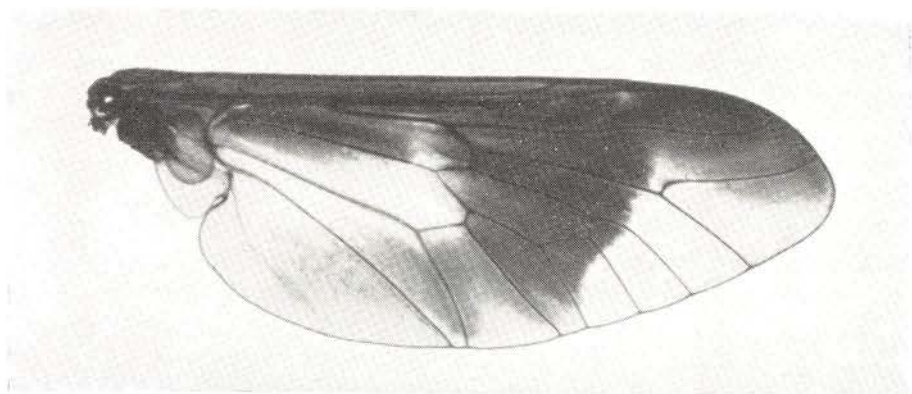


Figure 28. *Chrysops indus*

*Chrysops lateralis* Wiedemann (fig. 29)

No specimens of this species are known from Virginia, but since it is found at rather high elevations in Maryland and West Virginia, it probably will be found in the Virginia mountains.

A single Virginia specimen in the U.S. National Museum determined as *lateralis* is, in my opinion, a specimen of *C. univittatus* with an unusual amount of yellow on the abdomen.

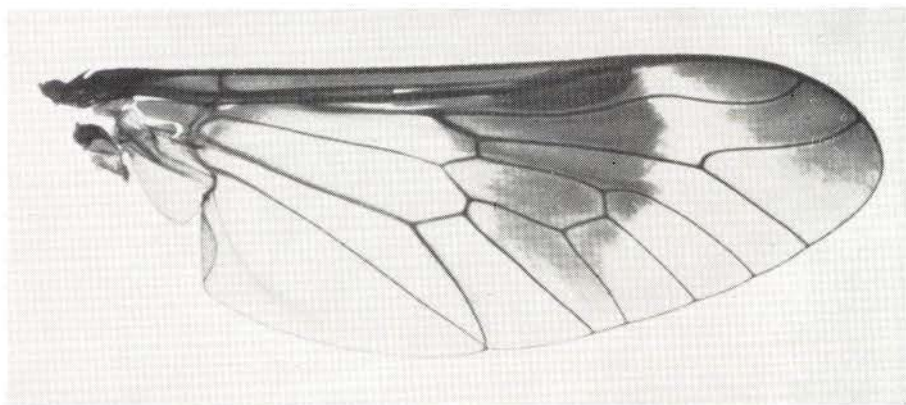


Figure 29. *Chrysops lateralis*

*Chrysops macquarti* Philip (fig. 2, 30)

This species is abundant and widely distributed in Virginia, and in wooded areas can be a pest of humans. It is relatively quiet in its attack, and for this reason often manages to bite the victim before he knows he is being attacked.

I have seen specimens from Dismal Swamp, the counties of Accomack, Augusta, Arlington, Campbell, Caroline, Chesterfield, Dinwiddie, Fairfax, Giles, Greenville, Halifax, King and Queen, Montgomery, Nansemond, Patrick, Prince Edward, Prince William, and Stafford and the cities of Charlottesville and Staunton.

Extreme collection dates range from 11 May to 1 September, with 20 percent of the records in May, 47 percent in June, 27 percent in July and 6 percent in August and September.

The larvae are found most commonly in saturated soils adjoining sluggish streams, and seem to prefer a substrate with an acid reaction. Teskey (*in litt.*) collected the larva along the edge of a stream near Carson, Dinwiddie County.

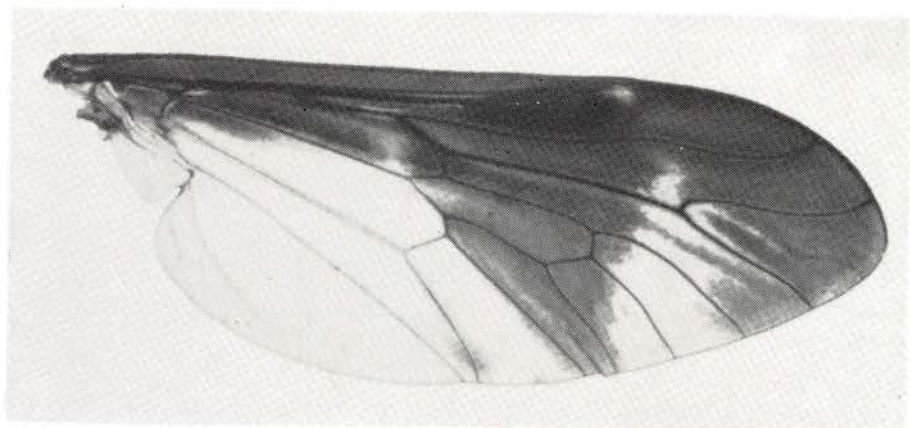


Figure 30. *Chrysops macquarti*

*Chrysops moechus* Osten Sacken (fig. 31)

This distinctive appearing species is rather widely distributed in Virginia. I have seen it from the counties of Arlington, Fairfax, Frederick, Giles, Halifax, Rockbridge, Rockingham, and Shenandoah. The collection records range from 22 May to 1 August, with over half the records in June.

Egg masses of *C. moechus* are deposited over running water, usually on leaves of trees overhanging the stream, and frequently at a considerable distance above the water. The larvae have been collected in wet mud, sometimes under water, along streams.

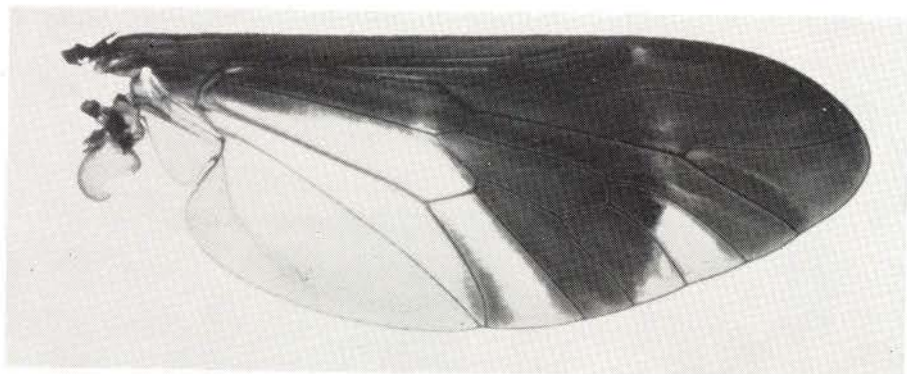


Figure 31. *Chrysops moechus*

*Chrysops montanus* Osten Sacken (fig. 32)

Few specimens of this species were seen during this study. One specimen was collected by W. Palmer at Great Falls, Fairfax Coun-

ty, July 1907. John J. S. Burton and I collected a short series near Skippers, Greenville County, 26 May 1970. Teskey (*in litt.*) collected 21 larvae along the edges of a pond near Carson, Dinwiddie County in May 1972.

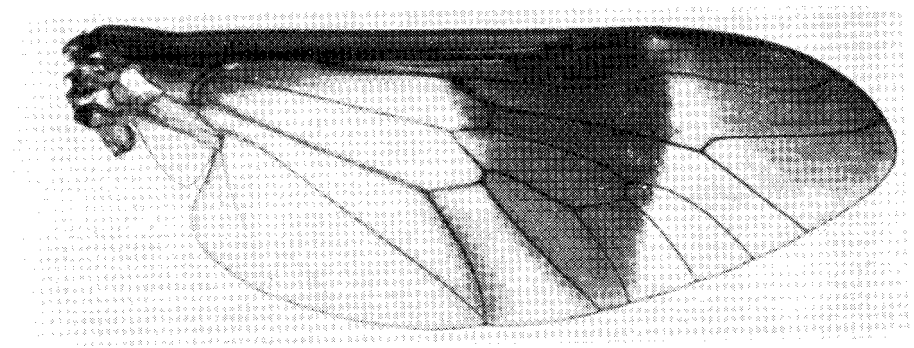


Figure 32. *Chrysops montanus*

*Chrysops niger* Macquart (fig. 33)

This is a common pest species with a wide distribution in Virginia. Specimens were examined from Dismal Swamp, the counties of Accomack, Arlington, Fairfax, Frederick, Greene, Loudoun, Montgomery, Prince William, Rockbridge, Shenandoah, Stafford, and Tazewell and the cities of Charlottesville and Virginia Beach.

Most of the collection records fall between 9 May and 15 July, but there is one record for 15 August and one for 18 September. However, peak emergence is early in the season, with 75 percent of the records in May.

The larvae are found in a variety of semiaquatic habitats along streams, ponds, lakes, in swamps and in boggy soil.

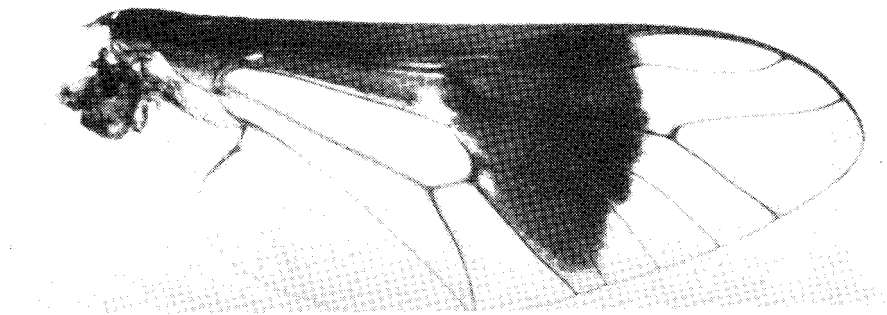


Figure 33. *Chrysops niger*

*Chrysops nigribimbo* Whitney (fig. 34)

This small species is not known from Virginia to date. Since it is found in Maryland, Tennessee and North Carolina, it undoubtedly is also present in Virginia.

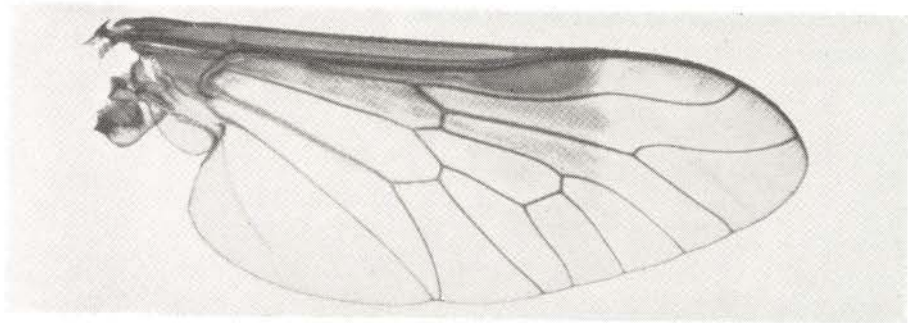


Figure 34. *Chrysops nigribimbo*

*Chrysops obsoletus* Wiedemann (fig. 35)

This species seems to be restricted to the eastern portion of Virginia. I have seen it from the counties of Accomack, Arlington, Fairfax, New Kent, Prince William and the city of Virginia Beach.

Collection dates extend from 20 June to 31 August with 80 per cent of the records in July.

A variation of this species, *C. obsoletus lugens* Wiedemann, with the pale abdominal stripes absent, or greatly reduced, is found in the southeastern United States. I have seen no such specimens from Virginia, although the extent of pale markings on the abdomen is variable.

Larvae have been reported from both freshwater and salt marsh habitats.

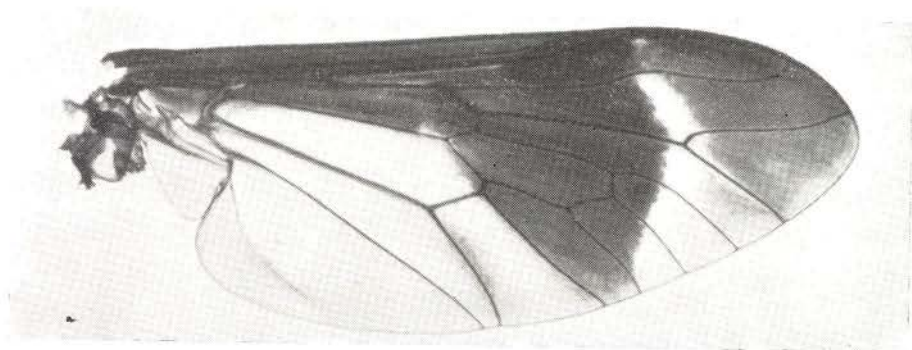


Figure 35. *Chrysops obsoletus*

*Chrysops parvulus* Daecke (fig. 36)

This species was recorded from Dead Run, Fairfax County, by McAtee and Walton (1918). However, I could not find this specimen or any others from Virginia in the U.S. National Museum. *C. parvulus* ranges from New Jersey to Florida and is probably present in Virginia. In other areas I have found it quite local in distribution.

*Chrysops pikei* Whitney (fig. 37)

This distinctive little species has a rather unusual distribution in Virginia since it has not been collected other than near the coast and in some of the southern counties inland. It probably has moved north into Virginia during the past 40 years.

I have seen specimens from Dismal Swamp, the counties of Halifax, Greenville, Nansemond, New Kent, Sussex, and Southampton and the city of Norfolk. Extreme records are 22 May and 8 August; about half of these are in June.

The larvae are found in saturated organic silt along the banks of ponds and streams.

*Chrysops pudicus* Osten Sacken (fig. 38)

It is strange that no Virginia specimens of this species were in any of the collections studied. It is found from New England to Florida, and in some portions of its range it can be a pest. Unquestionably it will be found in Virginia.

*Chrysops reicherti* Fairchild (fig. 39)

Collection records indicate that this species is not widely distributed in Virginia, but from the number of specimens I have seen, it is not uncommon at certain localities. Specimens were seen from Dismal Swamp, the counties of Greenville and New Kent and the city of Chesapeake.

Dates of collection range from 30 May to 20 July with one record on 8 September; 75 percent of the records fall between 10 and 25 June.

Teskey (*in litt.*) found the larva of this species in mud and organic debris along a sluggish stream near Emporia, Greenville County.

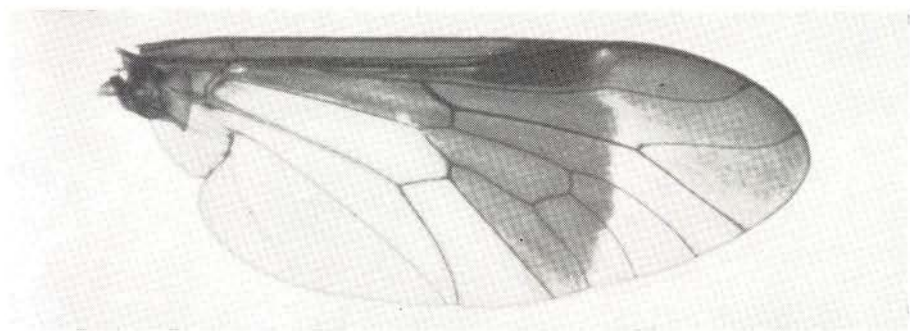


Figure 36. *Chrysops parvulus*

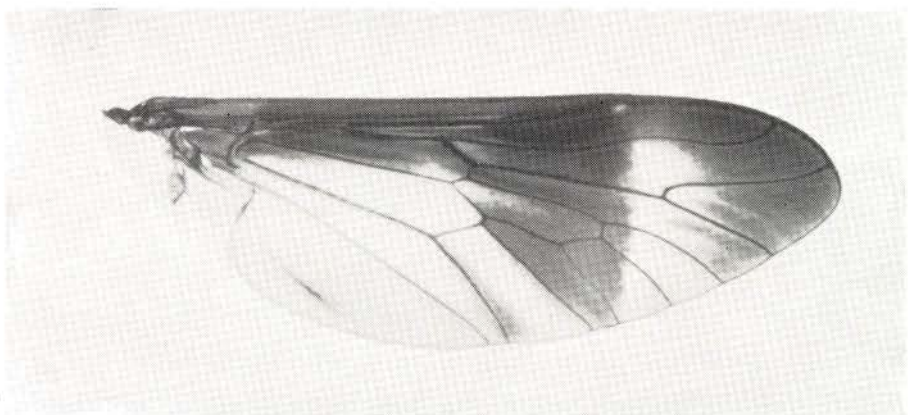


Figure 37. *Chrysops pikei*

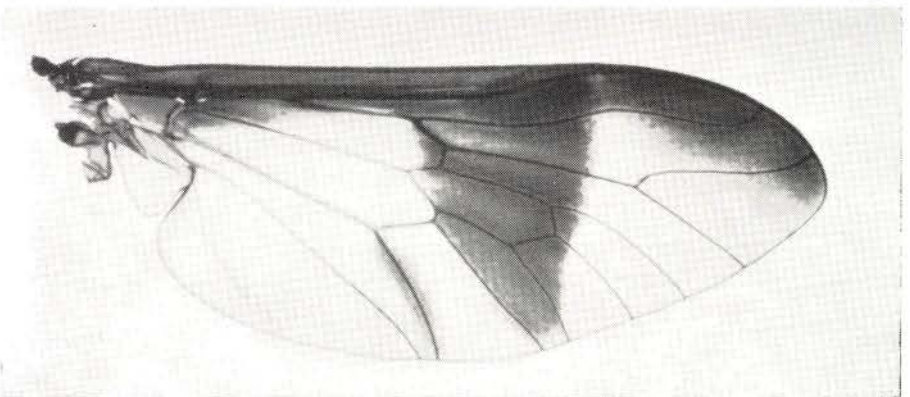


Figure 38. *Chrysops pudicus*

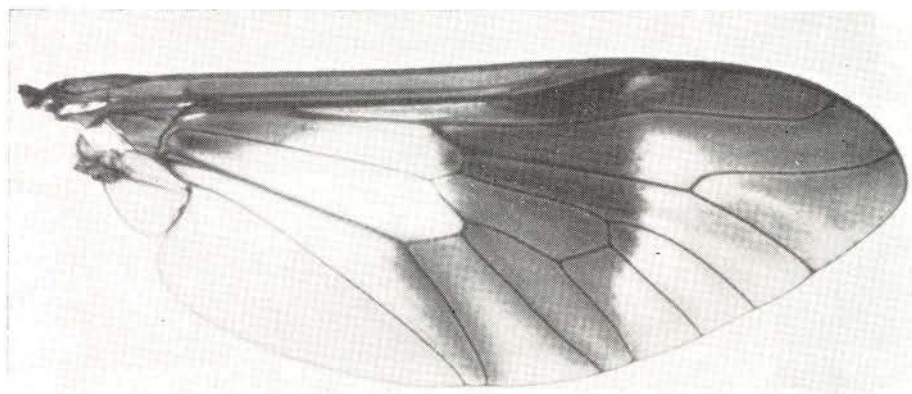


Figure 39. *Chrysops reicherti*

*Chrysops sackeni* Hine (fig. 40)

No specimens of this species were seen from Virginia. But since it is reported from Maryland, Tennessee and North Carolina, it may be present in Virginia.

*Chrysops separatus* Hine (fig. 41)

Since this species is found in Maryland, Kentucky, Tennessee, and North Carolina, it probably will be collected in Virginia. It is not commonly collected anywhere in its range and probably requires a specialized habitat.

*Chrysops sequax* Williston (fig. 42)

A single specimen of this species is in the U. S. National Museum. It was collected by O. Heidemann, 28 August 1912 from "Cazanova" (probably Casanova in Fauquier County). All other specimens reported as *C. sequax* from east of Ohio, including those of McAtee and Walton (1918) from Maryland and Virginia, which I have been able to check are either *C. beameri* or *C. hinei*. This specimen has the apical spot slightly less extensive than in specimens from further west but otherwise matches the current interpretation of *C. sequax*. The specimen belongs to the variety *tau* Philip, which is distinguished from the typical form by a short pollinose projection below the antennae on the frontoclypeus.

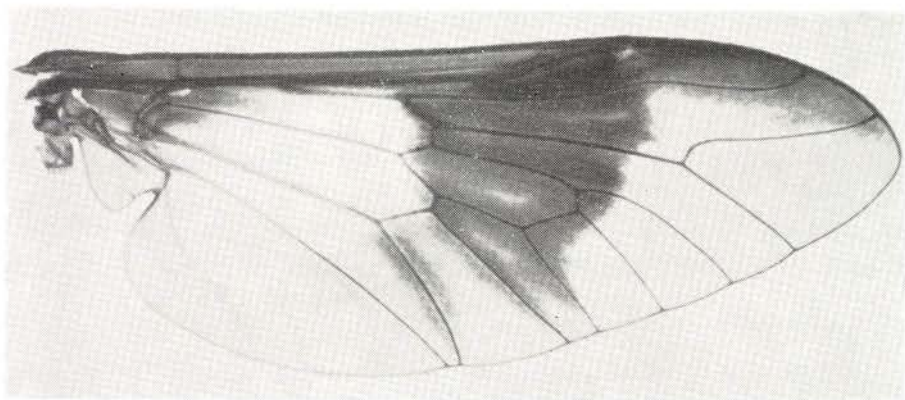


Figure 40. *Chrysops sackeni*

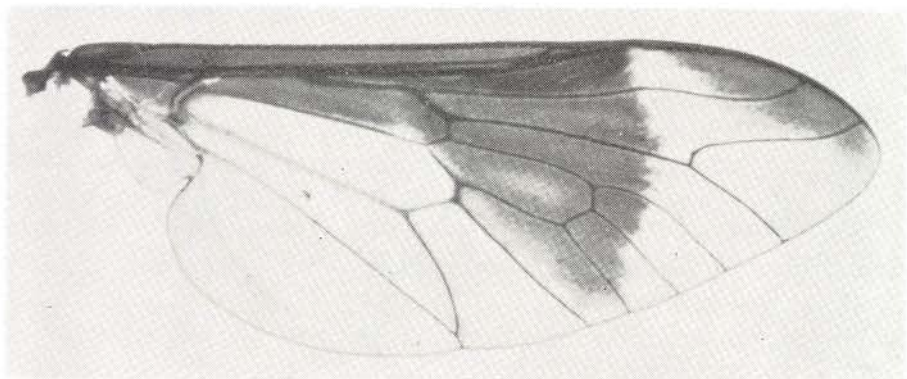


Figure 41. *Chrysops separatus*

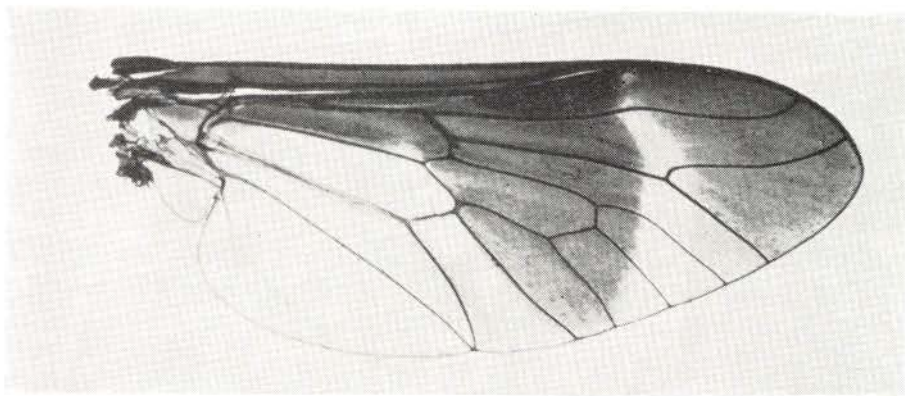


Figure 42. *Chrysops sequax*

*Chrysops shermani* Hine (fig. 43)

This species with its fenestrate wing pattern is not likely to be confused with any other species. I have seen one specimen taken by E. C. Turner, Jr. at Nature Camp, near Vesuvius, Rockbridge County, 8 July 1971 (VPI&SU) and four specimens from three localities in Giles County collected between 26 June and 11 August at altitudes ranging from 2800 to 3850 feet (Univ. Kansas). It should be present in a number of other localities in the mountains.

*Chrysops striatus* Osten Sacken (fig. 44)

McAtee and Walton (1918) report this species from Great Falls in Fairfax County but no specimens of *striatus* from Virginia were found in the U. S. National Museum. It is unlikely that this northern form is in Virginia, but a disjunct population could be present.

*Chrysops univittatus* Macquart (fig. 45)

This little species, which is common and widely distributed in Virginia, is rather quiet but persistent in its attack and often is successful in piercing the skin before the victim knows of its presence.

I have seen it from Dismal Swamp, the counties of Arlington, Fairfax, Fauquier, Frederick, Greensville, Montgomery, Prince William, Roanoke, Rockbridge, Rockingham, and Sussex and the city of Fredericksburg.

The flight period extends from 26 May to 25 August with 80 percent of the records in July and August.

Larvae have been collected in mud and plant debris on the edges of ponds and streams. On 31 May 1970 I swept numbers of freshly emerged adults of both sexes from vegetation along the edge of a pond near Stephenson, Frederick County.

*Chrysops upsilon* Philip (fig. 46)

The only specimens I have seen from Virginia are from Dismal Swamp. All were collected by James F. Matta on 25 June, and 9, 24 July 1970 (ODU).

Typically *C. upsilon* has a short pollinose stripe on the frontoclypeus below the antennae. However, occasional specimens, agreeing with *upsilon* in other characters, lack this stripe or have it reduced to a small disjunct spot. I have seen no such specimens from Virginia, but I have seen some from Maryland, and for this reason have taken *upsilon* out in two sections of the key.

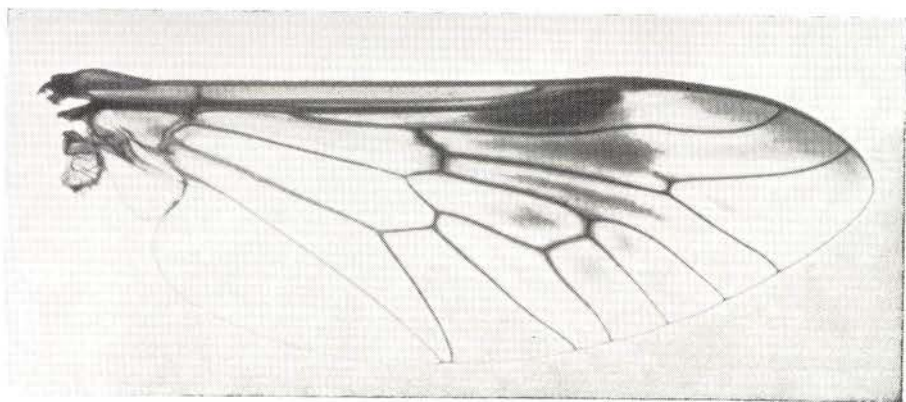


Figure 43. *Chrysops shermani*

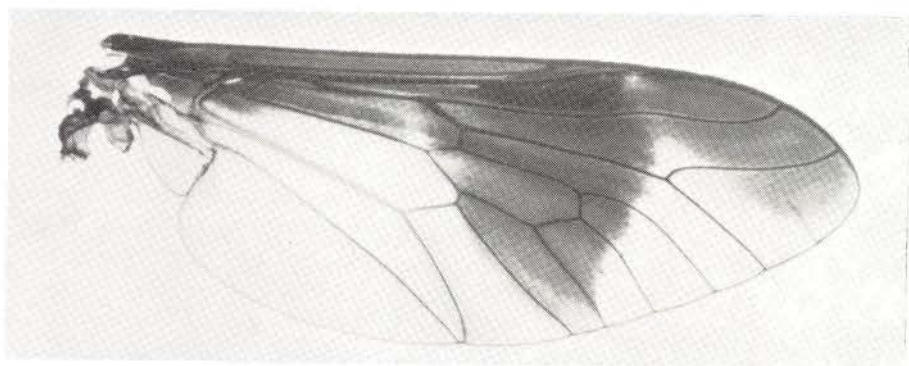


Figure 44. *Chrysops striatus*

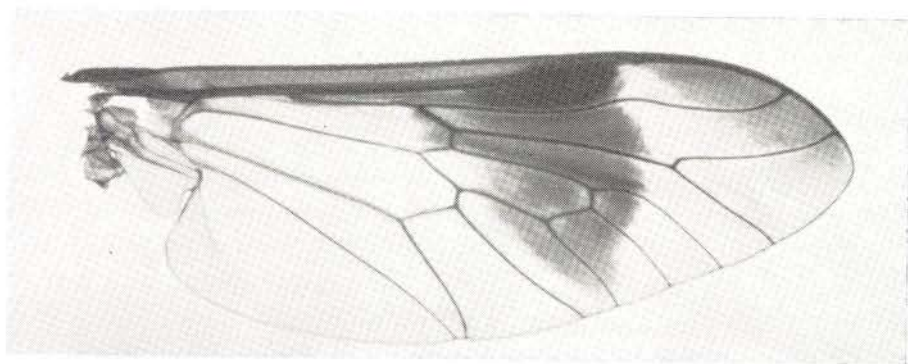


Figure 45. *Chrysops univittatus*

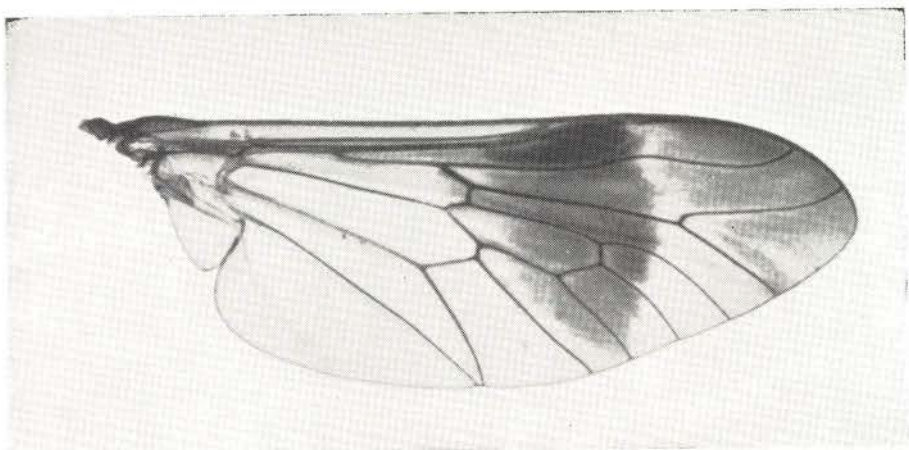


Figure 46. *Chrysops upsilon*

*Chrysops vittatus vittatus* Wiedemann (fig. 47)

This is probably the most common and widely distributed deer fly in Virginia. It is partial to wooded areas.

Specimens have been seen from Dismal Swamp, the counties of Arlington, Caroline, Dinwiddie, Fairfax, Fauquier, Grayson, Greene, Greensville, King and Queen, Montgomery, Nansemond, New Kent, Prince William, Shenandoah, Southampton, Sussex, and Westmoreland and the cities of Chesapeake, Fredericksburg, Petersburg, Richmond, and Virginia Beach.

Extreme dates of collection records range from 8 May to 30 August, but it probably flies well into September, with 65 percent of the records being from July.

Larvae have been found in almost every type of saturated freshwater habitat.

*Chrysops vittatus floridanus* Johnson (fig. 48)

Although *floridanus* was described by Johnson as a variety of *vittatus*, I have never seen intergrades between the two, and it is likely that when comparative biologies of the two are investigated, *floridanus* will prove to be a distinct species.

The only specimens from Virginia I have seen were collected by James F. Matta in Dismal Swamp, 9, 17, 19 June and 9 July, 1970 (ODU). Brennan (1935) reports it from Hickory, 3 July 1903, which is near the edge of Dismal Swamp.

Larvae have been found in highly organic soils at swamp margins and around the roots of swamp vegetation.

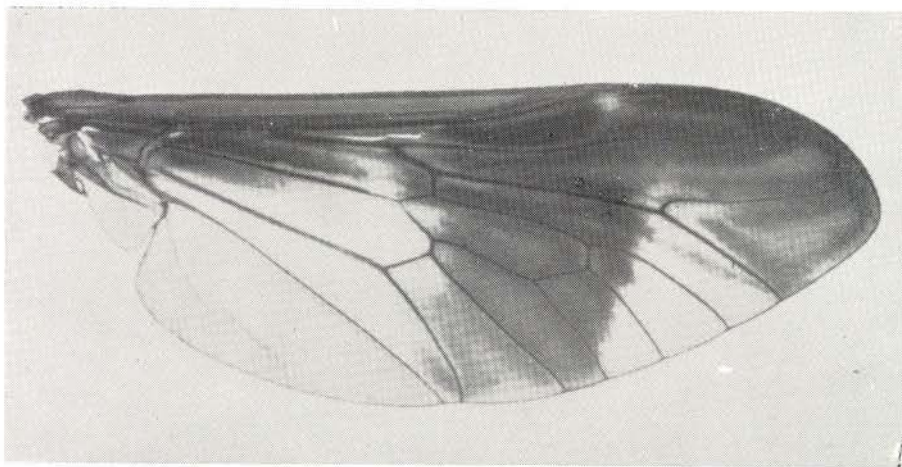


Figure 47. *Chrysops vittatus vittatus*

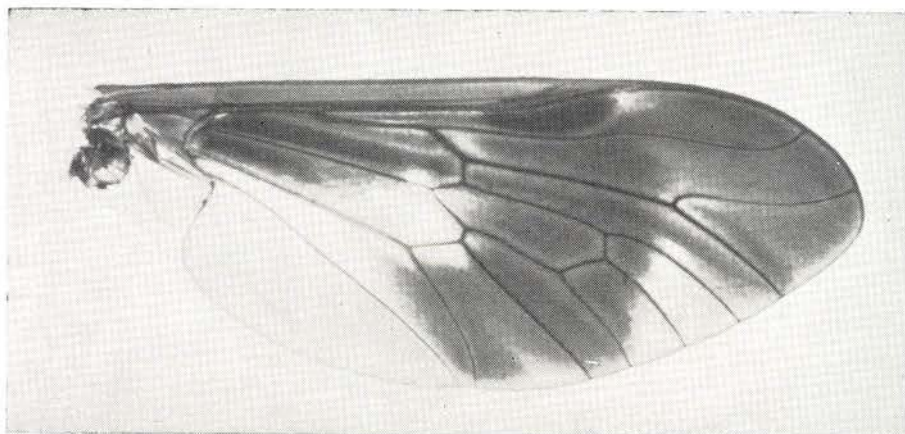


Figure 48. *Chrysops vittatus floridanus*

### Genus NEOCHRYSOPS Walton

#### *Neochrysops globosus* Walton

This is the only species placed in the genus. It is a rarely collected form known from Maryland, Delaware, Tennessee and Alabama. It eventually may be found in Virginia.

## Genus DIACHLORUS Osten Sacken

### *Diachlorus ferrugatus* (Fabricius) (fig. 49)

I have seen many specimens of this species, all from Dismal Swamp or nearby localities in the city of Virginia Beach. Banks (1904) has an interesting discussion of this species which he calls, "The Yellow Fly of the Dismal Swamp." He says it prefers to bite humans and, "is most vicious at and near twilight." Superficially, *D. ferrugatus* resembles a species of *Chrysops*.

Dates of collecting range from 28 June to 31 August; most records are in July.

Larvae have been found under shaded areas in swamps and near the margins of lakes and streams, sometimes within root mats of woody plants.

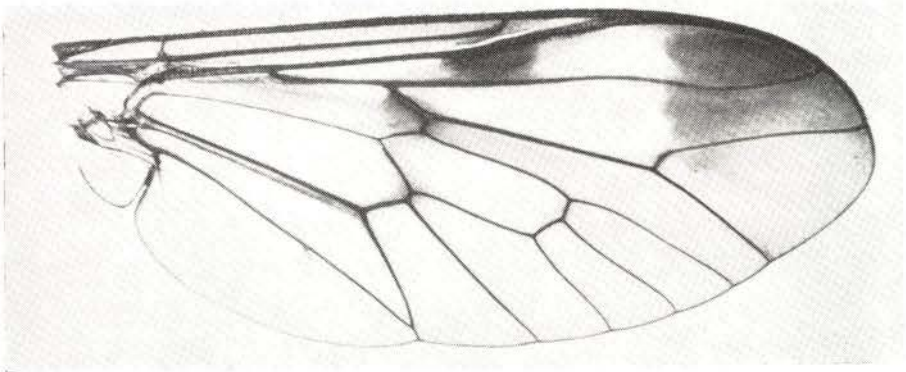


Figure 49. *Diachlorus ferrugatus*

## Genus ANACIMAS Enderlein

No species of this genus is known from Virginia. The type locality of *A. geropogon* Philip is in coastal North Carolina, and the species may be found as far north as Virginia. It is one of the earliest species of Tabanidae on the wing. It is rare in collections.

## Genus MICROTABANUS Fairchild

### *Microtabanus pygmaeus* (Williston)

I have seen a single specimen of this species from Virginia. It was taken by John F. Burger at Chincoteague National Wildlife

Refuge, Assateague Island, Accomack County on 13 June 1972 (Burger).

### Genus CHLOROTABANUS Lutz

#### *Chlorotabanus crepuscularis* (Bequaert)

The few adult specimens I have seen were taken from Dismal Swamp or its environs. It is probably more common than indicated by the collection records. It flies at dusk when most collectors are otherwise engaged. In life, this species is a beautiful shade of green, and can be mistaken for no other species found in Virginia.

Collection dates are from 21 June to 1 August.

Teskey (*in litt.*) took larvae near Jarratt, Sussex County from the edges of a slow-moving stream in a swamp.

### Genus LEUCOTABANUS Lutz

#### *Leucotabanus annulatus* (Say)

Only two specimens of this species were seen. One was collected by L. A. Hetrick in Gloucester County, 15 July 1939 (VPI&SU) and the other by James F. Matta at Norfolk, 14 July 1972 (ODU). The habits of the adults are not well understood and they may be largely nocturnal or crepuscular and thus overlooked by collectors.

The larval habitats differ from most North American Tabanidae. The immatures have been found in rot holes in trees, in decaying logs and in soil beneath forest litter.

### Genus HAEMATOPOTA Meigen

#### *Haematopota rara* Johnson (fig. 50)

In an earlier paper (1955), I reported on the first known male of this species taken at Arlington. Both sexes were taken at light by J. G. Franclemont and K. V. Krombein on four occasions between 4 and 28 June. The only other Virginia specimen I have seen was collected by R. A. Cushman at Falls Church, 25 June 1924 (USNM).

This little species with its wing maculated with brown and white is not likely to be confused with any other tabanid in Virginia. *H. punctulata* Macquart probably is not found as far north as Vir-

ginia; it may be separated from *rara* by the subapical dorsal notch on the first antennal segment and broad basal plate which is about the same length as the annulate portion of the antenna.

Nothing is known of the biology of either species.

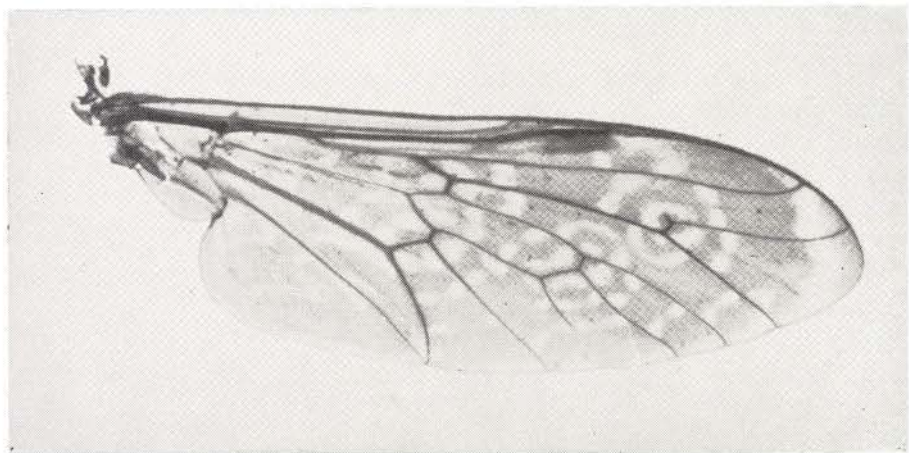


Figure 50. *Haematopota rara*

#### Genus ATYLOTUS Osten Sacken

##### *Atylotus bicolor* (Wiedemann)

Only one specimen was seen during this study. It was collected at Arlington, July 1920 (USNM). It is probably close to the southern limit of its range in this area.

Another species, *A. thoracicus* (Hine), an inhabitant of open sphagnum bogs, might be found in Virginia in suitable habitats. It is separated from *bicolor* by the gray pleural hairs (bright yellow in *bicolor*) and narrow basal plate (about as broad as long in *bicolor*).

#### Genus HAMATABANUS Philip

##### *Hamatabanus carolinensis* (Macquart)

All specimens seen but one have been from northern Virginia, the counties of Arlington, Fairfax, and Prince William. This is probably because of more collecting activity in this area, since the species is basically southern in distribution and is not known north of Maryland. The exception is a single male taken in a black

light trap by W. A. Allen at U. S. Naval Air Station, Oceana, city of Virginia Beach, 6 June 1972 (VPI&SU). It is the only male of this species I have ever seen.

Collection dates extend from 27 May to 27 June.

**Genus HYBOMITRA Enderlein**

Most species of *Hybomitra* are northern in distribution, although the genus is known in the east from as far south as northern Florida. Only a few species are known from Virginia, and these are lumped in common terminology with *Tabanus* as "horse flies." *Hybomitra lasiophthalma* is a common horse and cattle pest and both *H. daeckei* and *H. difficilis* will attack man. All of the Virginia specimens of *H. difficilis* I collected were attacking me.

**KEY TO SPECIES OF VIRGINIA HYBOMITRA**

**I. Females**

- 1. Black species with first 3 abdominal segments mostly bright orange ----- *cincta*  
Abdomen otherwise marked -----2
- 2. Subcallus denuded and shining -----3  
Subcallus pollinose -----5
- 3. Subcallus swollen; whole face below eyes denuded and shining; small species with dark wing markings ----- *hinei*  
Subcallus normal; face below eyes not shining -----4
- 4. Abdomen reddish brown laterally; all crossveins spotted with brown; eyes conspicuously hairy ----- *lasiophthalma*  
Abdomen not extensively reddish brown laterally; wings not conspicuously spotted; eye apparently bare --- *difficilis*
- 5. Abdomen black with a median row of distinct white triangles and no sublateral spots -----6  
Abdomen otherwise marked -----7
- 6. Third antennal segment sharply bicolored, basal portion entirely orange, annuli black; wing heavily and rather uniformly darkened ----- *trispila*  
Basal portion of third antennal segment partly black; infuscation of wing not uniform and not very dark -- *sodalis*
- 7. Second palpal segment stout, especially so at base -----8  
Second palpal segment slender, scarcely thickened at base ---9

8. Abdomen extensively reddish brown laterally; basal plate broad; all femora at least partly dark; prescutal lobe reddish ----- *daeckeae*  
 Abdomen not extensively reddish brown laterally; basal plate very narrow; all legs brownish; prescutal lobe black ----- *microcephala*
9. Third antennal segment slender and practically without dorsal excision; femora, except base of hind femora, brown; sides of abdomen extensively reddish brown; second palpal segment extremely slender ----- *minuscula*  
 Without this combination of characters ----- *typhus*

## KEY TO SPECIES OF VIRGINIA *HYBOMITRA*

### II. Males

1. Stiff hairs along mid-line between eyes ----- *difficilis*  
 No stiff hairs along mid-line between eyes ----- 2
2. Black species with first 3 abdominal segments mostly bright orange ----- *cincta*  
 Abdomen otherwise marked ----- 3
3. Small dark species with gray, protuberant frontal triangle; genae black, somewhat shining; a dark cloud on wing near stigma ----- *hinei*  
 Differing in one or more characters from the above ----- 4
4. Cross veins and bifurcation of third longitudinal vein with distinct dark spots; abdomen laterally, broadly orange ----- *lasiophthalma*  
 Wings hyaline, tinted or with bifurcation only having a dark spot ----- 5
5. Abdomen black, obscurely reddish laterally but no distinct sublateral spots; a conspicuous row of white median triangles ----- 6  
 Abdomen otherwise marked ----- 7
6. Third antennal segment sharply bicolored, basal portion orange, annuli black; line of demarcation between large upper eye facets and smaller lower facets distinct ----- *trispila*  
 Basal portion of third antennal segment partly darkened; upper eye facets gradually merging with smaller lower facets ----- *sodalis*

7. Small species not over 12 mm with very slender second palpal segment; sides of abdomen broadly dark orange but first segment usually completely black; third antennal segment with a very shallow dorsal excision  
----- *minuscula*  
Species usually over 12 mm but if smaller, second palpal segment stout and dorsal excision distinct -----8
8. Prescutal lobe black; basal plate very slender; legs brownish ----- *microcephala*  
Prescutal lobe reddish at least on disc; basal plate rather broad; legs variable, often with femora black -----9
9. Abdomen broadly reddish brown laterally, median black area constricted on third segment; large and small eye facets weakly differentiated ----- *daecke*  
Abdomen narrowly paler laterally but black not constricted on third segment; eye facets strongly differentiated ----- *typhus*

*Hybomitra cincta* (Fabricius)

The broad orange abdominal band, contrasting with the black color of the rest of the insect, makes this an attractive species and not to be confused with any other. I have seen it from the counties of Fairfax, Giles, Nelson, Rockbridge, and Shenandoah. The males are known to hover in clearings and over roads in wooded areas in spots of sunlight.

The specimens studied were collected between 26 June and 14 August; over half of the specimens seen were collected during the first three weeks of July.

*Hybomitra daeckei* (Hine) (fig. 1, 3)

All records for this species are near the coast, with most records from Accomack County. I have also seen it from the counties of Essex and Nansemond, and the city of Norfolk.

One collection was made on 30 March and one on 10 July; all others fall between 7 May and 20 June.

*Hybomitra difficilis* (Wiedemann) (fig. 3)

This species is widely distributed west of the coastal plain in Virginia. I have seen it from the counties of Albemarle, Fairfax, Halifax, James City, Montgomery, Page, Prince William, Rockbridge, Shenandoah, and Wise.

Specimens studied were collected between 23 May and 9 July with about 70 percent of the records in the last week of May and first 2 weeks of June.

Strangely enough, nothing is known of the biology of this common species.

#### *Hybomitra hinei* (Johnson)

All of the rather large number of specimens of this species I have seen are from Dismal Swamp or nearby localities in Nansemond County.

Dates of collection range from 27 May to 25 June. A long series was collected by James Matta (ODU) in Dismal Swamp on 11 June 1970. A dark southern variety of this species, *wrighti* Johnson, was not represented in any of the material studied.

The green larvae of *H. hinei* have been found in moss and partly decayed organic material along the banks of ponds, lakes, streams, and ditches, often around the roots of shrubs.

#### *Hybomitra lasiophthalma* (Macquart)

Although widely distributed in Virginia, this species does not seem to be as abundant or as much a domestic animal pest as in some of the states farther north.

Specimens were examined from Dismal Swamp, the counties of Accomack, Fairfax, Greensville, Highland, Montgomery, Nansemond, and Pittsylvania and the cities of Chesapeake, Newport News, Richmond, Roanoke, and Virginia Beach.

My records extend from 17 April to 4 June, with 75 percent of the collections in May. John F. Burger (*in litt.*) found occasional specimens of *lasiophthalma* as late as 11 July in 1972.

The larvae are most often found in moist or wet sod, but have also been reported from bogs, marshes, and rotting logs.

#### *Hybomitra microcephala* (Osten Sacken)

I have seen a single specimen from Virginia. It was taken by P. P. Calvert at Mountain Lake, Giles County, 2 August 1915 (Phil. Acad. Sci.). Late season collecting at higher elevations should produce more of this species. Adults will attack man, and both sexes have been found resting in sunny patches on dirt roads running through wooded areas.

*Hybomitra minuscula* (Hine)

This species is not known from Virginia. However, it has been collected in West Virginia and may be present in Virginia in suitable habitats. It is essentially an inhabitant of sphagnum bogs.

*Hybomitra sodalis* (Williston)

I have seen few specimens of *sodalis* from Virginia but suspect it is widespread in the state at higher elevations. Specimens were studied from the counties of Fairfax, Giles, Nelson, and Rockbridge. All collections were made between 2 and 20 July. It is of interest to note that in New York, where it is a common species, only an occasional specimen is found in any month other than July.

The larvae have been collected in a variety of wet habitats, especially from seepage areas and from moss in swamps. They are also known from relatively dry sod.

*Hybomitra trispila* (Wiedemann)

This species is closely related to *H. sodalis* but may be separated by the characters given in the key. Although the two species fly together, *trispila* is on the wing earlier and in general will be found at lower elevations than *sodalis*.

I have seen specimens from the counties of Arlington, Fairfax, and Nelson and the cities of Alexandria and Virginia Beach.

Collection records range from 9 May to 14 July, with over half of the records in June.

The U. S. National Museum has specimens of both sexes with the pupal case on the pin with the adult. On one of these is noted, "from larva from pad of moss in woods"; these specimens were collected by W. W. Wirth at Alexandria. Nothing further is known of the habitat of immatures of this species.

*Hybomitra typhus* (Whitney)

This species is known from the neighboring states of Maryland, West Virginia, and North Carolina but is not reported from Virginia. It will undoubtedly be collected eventually in the mountains.

**Genus TABANUS Linnaeus**

This genus of horse flies includes the largest flies found in Virginia, although some species are not much larger than a house fly.

Most are pests of wild and domestic animals, but some species occasionally attack man and other species do so regularly. The salt marsh greenhead, *T. nigrovittatus*, is a major pest of humans on beaches located near salt marshes. Some of the smaller forms such as *T. pumilus* and *T. sparus milleri* also attack man.

## KEY TO SPECIES OF VIRGINIA *TABANUS*

### I. Females

1. Abdomen unicolorous or with narrow indistinct posterior bands ----- 2  
Abdomen with one or more median triangles or a median stripe ----- 15
2. Subcallus denuded ----- 3  
Subcallus not denuded ----- 5
3. Mesoscutum with orange hair laterally ---- *atratus fulvopilosus*  
Mesoscutum entirely black ----- 4
4. Wing uniformly dark brown to black ----- *atratus atratus*  
Wing brown with a yellowish tinge along posterior border  
----- *atratus nantuckensis*
5. Bifurcation with a distinct spot or entire wing dark ----- 6  
Bifurcation without a distinct spot; wing essentially hyaline ----- 14
6. Palpi dark brown to black ----- 7  
Palpi pale to reddish brown ----- 12
7. Mesonotum white pollinose ----- 8  
Mesonotum dark brown ----- 9
8. Frons orange brown, moderate in width; wing veins not margined with brown although darker clouds may be present ----- *stygius*  
Frons gray, broad; wing veins margined with brown ----- *subniger*
9. Frons narrow, widened above; antennae mostly orange including first two segments ----- *proximus*  
Frons wider, parallel sided; first two antennal segments black and third often partly black ----- 10
10. Wing mostly hyaline, with dark spots ----- *nigrescens* Palisot  
Wing rather uniformly dark or with veins broadly outlined with dark infuscation ----- 11

11. Abdomen with bluish-white bloom; median callus a slightly widened line; basal plate dark or yellowish basally\_\_*aranti*  
 Abdomen brownish black without bloom; median callus narrowly spindle-shaped; basal plate usually with considerable yellow, sometimes entirely so ----- *colon*
12. All femora black; first posterior cell narrowed at wing margin; thorax with a lavender cast ----- *gladiator*  
 Legs mostly yellowish or brown; first posterior cell usually not narrowed; thorax otherwise colored -----13
13. Frons narrow, about 6 times as high as width at base, distinctly widened above; antennal tooth not especially long ----- *aar*  
 Frons not more than 3 or 4 times as high as wide, and not widened above; a long antennal tooth reaches nearly to the first annulus ----- *imitans imitans*
14. Wing hyaline with a dark brown costal cell; abdomen usually with narrow gray posterior borders ----- *americanus*  
 Wing uniformly dilutely infuscated; costal cell yellow; abdomen sometimes with traces of small median triangles ----- *calens*
15. Abdomen orange brown with a median dark area; wings spotted; femora black ----- *abdominalis*  
 Abdomen with pale median stripe or spots -----16
16. Abdomen with a longitudinal median stripe which may or may not be widened at posterior margins of segments -----17  
 Abdomen with median markings not forming an uninterrupted stripe -----32
17. Spots forming median abdominal stripe nearly parallel sided; lateral markings usually form a shorter stripe on each side of median stripe and parallel to it but this stripe may be broken into separate spots or obsolete --18  
 Spots forming median stripe widened at posterior margins of abdominal segments; lateral markings broken into separate, often roundish spots -----24
18. Prescutal lobe usually paler than mesonotum; frons widened above; annulate portion of third antennal segment usually shorter than basal plate; costal cell usually hyaline; eye in life with 2 purple bands -----19

- Prescutal lobe concolorous with rest of mesonotum; frons nearly parallel sided; annulate portion of third antennal segment usually longer than basal plate; costal cell infuscated; eye in life with a single purple band -----21
19. Scutellum and thorax concolorous ----- *lineola*  
Scutellum reddish, sometimes faintly, on posterior margin -----20
20. Legs predominantly reddish; sublateral abdominal stripes essentially parallel sided ----- *similis*  
Femora of at least fore and hind legs darkened; sublateral abdominal stripes offset between second and third segments ----- *subsimilis subsimilis*
21. Palpi, pleurae and costal cell yellow ----- *quinquevittatus*  
Palpi white; pleurae gray, sometimes with a yellowish tint; costal cell pale yellow to dark brown -----22
22. Costal cell pale yellow; yellowish or grayish species ---  
----- *nigrovittatus*  
Costal cell dark yellow to brown; brownish or blackish species -----23
23. Costal cell dark brown; pleurae very pale, strongly contrasting with dark thoracic dorsum; frons about 4 to 4½ times as high as width at base ----- *fuscicostatus*  
Costal cell dark yellow; pleurae scarcely contrasting with dorsum of thorax; frons 3½ to 4 times as high as wide ----- *mularis*
24. Dorsum of thorax covered with yellow hairs, without longitudinal stripes; abdominal stripes yellow; frons very narrow; antennal plate broad; costal cell colored ----25  
Without this combination of characters -----26
25. Annulate portion of third antennal segment black; femora dark; palpi yellow; face and pleurae yellow-haired ----- *fulvulus*  
Third antennal segment usually entirely orange yellow; femora pale, sometimes darkened at base; palpi white; face and pleurae pale-haired ----- *pallidescens*
26. All wing veins margined with brown ----- *gracilis*  
Wing hyaline -----27
27. Third antennal segment uniformly yellow brown ---- *zythicolor*  
Annulate portion of third antennal segment black -----28
28. Frons narrow, widened above ----- *sackeni*  
Frons broader, parallel sided -----29

29. Basal plate of antennae about as wide as long; costal cell heavily infuscated ----- *longiusculus*  
 Basal plate higher than wide; costal cell hyaline or lightly infuscated ----- 30
30. Second palpal segment much swollen basally; median abdominal stripe broad ----- *sagax*  
 Second palpal segment not very swollen basally; median abdominal stripe narrow ----- 31
31. Pale markings of abdomen yellowish brown, the sublateral spots touching the hind margins of the segments ----- *sublongus*  
 Pale markings grayish, the sublateral spots small and separated from the hind margins ----- *longus*
- 32(16) No pale median spot on second abdominal segment but occasionally 2 small sublateral spots; fore tibiae distinctly bicolored; thorax white pollinose ----- *trimaculatus*  
 Second abdominal segment with a pale median spot ----- 33
33. Abdomen with both median and sublateral spots ----- 34  
 Abdomen without sublateral spots although abdomen may be paler laterally ----- 41
34. Bifurcation with a dark spot; grayish species ----- 35  
 Bifurcation without a dark spot; color variable ----- 36
35. Median and sublateral spots broadly joined along base of abdominal segments; frons narrow, basal callus higher than wide ----- *cymatophorus*  
 Median and sublateral spots narrowly or not at all joined along base of abdominal segments; frons broad, basal callus almost square ----- *reinwardtii*
36. Small species, usually 12 mm or less; frons widened above; costal cell hyaline ----- 37  
 Larger species, usually 13 mm or more and differing in at least one other character from above ----- 39
37. Median callus large; palpi not swollen basally or sharply pointed; eye in life with 2 purple bands ----- *pumilus*  
 Median callus slender; palpi swollen basally but with apex acute; eye in life unicolorous or with a single purple band ----- 38
38. Eye unicolorous in life ----- *sparus sparus*  
 Eye with a single purple band ----- *sparus milleri*

39. First antennal segment swollen above; sides of subcallus  
with a few hairs laterally ----- *fairchildi*  
First antennal segment not swollen above; sides of sub-  
callus without hairs -----40
40. The sublateral white abdominal spots considerably larger  
than the small median triangles and usually reaching  
anterior border of second and third segments --- *marginalis*  
The median triangles are relatively larger and sublateral  
spots smaller, rarely extending to anterior border of  
segments ----- *vivax*
- 41(33) Pale spot on second abdominal segment distinctly  
smaller than spots on third and fourth segments; scu-  
tellum with pale pile; fore tibiae unicolorous -----42  
Pale spot on second segment not markedly smaller than  
those on two following segments -----45
42. Abdomen black with very small median triangles -----  
----- *superjumentarius*  
Abdomen usually brownish, at least in part; median tri-  
angles large -----43
43. Frons very narrow, at least 6 times as high as width at  
base and widened above; middle and hind tibiae white,  
extreme apices darkened; first and second longitu-  
dinal veins margined with brown ----- *moderator*  
Frons less than 5 times as high as wide and scarcely  
widened above; middle and hind tibiae uniformly red-  
dish brown; first and second longitudinal veins not  
margined with brown -----44
44. Genae, pleurae and venter pale haired ----- *molestus molestus*  
Genae, pleurae and venter brown haired ----- *molestus mixis*
45. No spot at bifurcation -----46  
Bifurcation with a conspicuous spot -----50
46. Wings with a smoky tinge; costal cell heavily colored;  
large species with median triangles small or obsolete ----47  
Wings hyaline; costal cell hyaline or slightly tinted;  
smaller species with conspicuous median triangles -----48
47. Third antennal segment reddish yellow; median abdomi-  
nal triangles faint and arising from faint posterior  
bands; first posterior cell narrowed toward margin --- *calens*  
Third antennal segment partly black; median triangles  
small but distinct and not arising from bands; first  
posterior cell not narrowed ----- *catenatus*

48. Tibiae unicolorous although fore tibiae may be slightly paler at base; first posterior cell slightly or not at all narrowed at margin; subcallus thinly pollinose or denuded; usually under 15 mm ----- *nigripes*  
 At least fore tibiae bicolored; first posterior cell much narrowed and may be closed or petiolate; subcallus pollinose; usually over 15 mm -----49
49. Frons over 6 times as high as width at base; hind tibiae uniformly yellowish-white, barely darkened at apex; median triangle on second abdominal segment usually crossing segment and joining spot on first segment; first posterior cell usually closed, frequently petiolate ----- *petiolatus*  
 Frons less than 6 times as high as wide; hind tibiae often extensively dark toward apex; median triangle rarely crossing second abdominal segment; first posterior cell may be open or closed but rarely petiolate -- *melanocerus*
50. Fore tibiae bicolored, basally pale with pale hair -----51  
 Fore tibiae unicolorous or occasionally base somewhat brownish with orange hair -----52
51. Frons narrow, 5 times or more as high as wide; first posterior cell normally closed; all femora black - *abdominalis*  
 Frons moderately wide, about 4 times as high as wide; first posterior cell normally open although often much narrowed at margin; at least middle femora brownish ----- *sulcifrons*
52. Frons narrow, not less than 6 times as high as width at base and widened above -----53  
 Frons not more than 3½ times as high as wide and parallel sided -----54
53. Dark species with obvious mid-dorsal abdominal triangles; wing rather heavily infuscated along longitudinal veins; pleurae paler than dorsum of thorax which is obviously striped; basal plate narrow ---- *turbidus*  
 Rather palid species with evanescent abdominal triangles; wing infuscation pale; pleurae concolorous with thoracic dorsum which has only traces of stripes; basal plate rather broad -----*aar*
54. Abdomen pale to dark brown with yellowish bands on abdominal segments which form rather large but sometimes indistinct median triangles -----55

- Abdomen dark brown to black with small white median triangles not arising from bands -----56
55. Palpi, pleurae, legs and most of abdomen yellowish; abdominal triangles often indistinct; wing markings sometimes pale and occasionally forming bands along veins ----- *cheliopterus cheliopterus*
- Darker species with palpi, pleurae, legs and abdomen predominantly mahogany to dark brown; abdominal triangles distinct; wing markings heavy - *cheliopterus fronto*
56. Basal plate with a long forward projecting tooth which nearly reaches first annulus; abdominal triangles very small and usually equilateral ----- *imitans imitans*
- Basal plate not with a long tooth; abdominal triangles slender, much higher than wide ----- *fusconervosus*

## KEY TO SPECIES OF VIRGINIA TABANUS

### II. Males

1. Eyes hairy -----2  
Eyes bare -----4
2. Abdomen with a conspicuous parallel sided median longitudinal white stripe and similar more irregular sub-lateral stripes ----- *subsimilis subsimilis*  
Abdomen not with a parallel sided median stripe -----3
3. Crossveins and bifurcation with distinct dark spots; first antennal segment not swollen above; hair on eyes heavy ----- *reinwardtii*  
Wing without distinct spots; first antennal segment strongly swollen above; hair on eyes sparse -----  
----- *fairchildi* (in part)
- 4(1) Abdomen unicolorous or with narrow indistinct pollinose bands -----5  
Abdomen with median markings -----15
5. Frontal triangle denuded and shining; third antennal segment with a rather long tooth; black species with heavily infuscated wings -----6  
Frontal triangle pollinose and differing in at least one other character from the above -----7
6. Wing completely black ----- *atratus atratus*  
Wing brownish to black with a yellowish tinge along posterior border ----- *atratus nantuckensis*

7. Bifurcation without a distinct spot .....8  
    Bifurcation with a distinct spot or wing mostly black .....9
8. Wing dilutely infuscated, costal cell darker; hind tibial  
    fringe black ..... *calens*  
    Wing hyaline, costal cell deep yellow; hind tibial fringe  
    orange ..... *americanus*
9. Genae gray ..... *proximus*  
    Genae brown to black .....10
10. Rather uniformly brownish species including antennae  
      ..... *aar* (in part)  
    Blackish-brown to black species .....11
11. Wing almost completely black or with broad heavy in-  
    fuscation along all veins .....12  
    Wing subhyaline .....13
12. Abdomen with at least traces of whitish bloom; basal  
    plate entirely dark or with some yellow near base ---- *aranti*  
    Abdomen without whitish bloom; basal plate with con-  
    siderable yellow ..... *colon*
13. Lower margin of area of large facets of eye somewhat  
    sinuate and at lowest point about on level with top  
    of antennal pits ..... *subniger*  
    Lower margin of large facets more nearly straight and  
    somewhat higher than antennal pits .....14
14. Integument of thoracic dorsum brown, contrasting with  
    black abdomen; wing membrane, except for spots,  
    rather uniformly dilutely infuscated ..... *stygius*  
    Integument of thoracic dorsum dark brown to black, usu-  
    ally contrasting but slightly with black abdomen; apex  
    of wing, except for spots, almost hyaline ..... *nigrescens*
- 15(4) Abdomen broadly orange laterally with conspicuous  
    black median spots and no evident pale median mark-  
    ings; large and small eye facets little differentiated;  
    femora black; wings spotted and first posterior cell  
    narrowed or closed at wing margin .....16  
    Abdomen with pale median markings and differing in  
    at least one other character from the above .....17
16. Thorax with a lavender tint, narrowly and inconspicu-  
    ously striped; second palpal segment slender, at least  
    3 times as long as thick ..... *gladiator*  
    Thorax brown, broadly and conspicuously striped; sec-  
    ond palpal segment about twice as long as thick ----  
      ..... *abdominalis* (in part)

17. All veins outlined by a pale brown infuscation; third antennal segment uniformly brownish; abdomen with a median row of pale triangles which usually do not quite cross segments and with pale sublateral spots; moderate sized species not over 16 mm ----- *gracilis*  
Without the above combination of characters ----- 18
18. Abdomen with a longitudinal stripe which may or may not be somewhat widened at posterior margins of segments ----- 19  
Abdomen with median markings not forming an uninterrupted stripe ----- 31
19. Spots forming median abdominal stripe parallel sided; sublateral spots similar but often more irregular, rarely broken into roundish spots ----- 20  
Median spots widened at posterior margin of each segment so that stripe is not parallel sided; sublateral spots usually roundish ----- 25
20. Prescutal lobe usually paler than mesonotum; annulate portion of third antennal segment usually shorter than basal plate; costal cell usually hyaline ----- 21  
Prescutal lobe usually concolorous with mesonotum; annulate portion of third antennal segment as long or longer than basal plate; costal cell infuscated ----- 22
21. Scutellum and thorax concolorous; hind femora usually dark ----- *lineola*  
Scutellum reddish, sometimes faintly, on posterior margin; hind femora usually reddish ----- *similis*  
(If scutellum partly reddish, upper eye facets enlarged and femora dark, see *subsimilis*, Couplet 2)
22. Palpi, pleurae and costal cell deep yellow ----- *quinquevittatus*  
Palpi and pleurae grayish or white; costal cell variable ----- 23
23. Costal cell lightly tinted; coastal species ----- *nigrovittatus*  
Costal cell deeply colored; coastal and inland species ----- 24
24. Abdomen rather broadly reddish laterally; pale pleurae contrasting rather sharply with dark thoracic dorsum; large eye facets reaching occipital border with little reduction in size ----- *fuscicostatus*  
Abdomen narrowly reddish laterally; dark-gray pleurae not sharply contrasting with thoracic dorsum; small eye facets extend upward along eye margin nearly reaching ocellar area ----- *mularis*

25(19)	Costal cell brown or dark yellow .....	26
	Costal cell hyaline or pale yellow .....	27
26.	Third antennal segment sharply bicolored, basal plate orange, annuli black .....	<i>longiusculus</i>
	Third antennal segment uniformly orange brown ...	<i>zythicolor</i>
27.	Hair and pollen of pleurae and face yellow; area of large and small eye facets scarcely differentiated .....	<i>fulvulus</i>
	Hair and pollen of pleurae and face pale; large and small eye facets distinctly differentiated .....	28
28.	Third antennal segment entirely orange; long hairs on dorsum of thorax yellow .....	<i>pallidescens</i>
	Third antennal segment with at least annuli dark; long hairs on dorsum of thorax gray to black .....	29
29.	Costal cell hyaline; short recumbent hairs of thoracic dorsum gray; sublateral abdominal spots gray .....	<i>sackeni</i>
	Costal cell tinted; short hairs of thorax often yellowish; sublateral abdominal spots usually yellow or with a yellowish tint .....	30
30.	Median abdominal stripe broad; face below eyes with many black hairs, beard yellowish white; second pal- pal segment stout, yellow brown with many black hairs .....	<i>sagax</i>
	Median abdominal stripe narrow; face with almost no black hairs, beard pale gray; second palpal segment relatively slender, pale yellowish white with few black hairs .....	<i>sublongus</i>
31(18)	Frontal triangle bare and somewhat protuberant; ab- dominal triangles sometimes indistinct; small, chunky species usually under 13 mm .....	<i>nigripes</i>
	Frontal triangle pollinose .....	32
32.	Abdomen with median spots or triangles and at least some segments with sublateral spots .....	33
	Abdomen with median spots or triangles; no distinct sub- lateral spots although some segments may be paler laterally .....	39
33.	First antennal segment swollen above; third antennal segment entirely black; eyes sometimes with sparse hairs .....	<i>fairchildi</i>
	First antennal segment not swollen; third antennal seg- ment variable; eyes bare .....	34

34. Larger species (over 18 mm) with a distinct spot at bifurcation ----- *cymatophorus*  
 Smaller species (under 16 mm); if spot is present at bifurcation it is very faint ----- 35
35. Fore tibiae entirely black; sublateral spots very large often crossing second and third segments; third antennal segment black ----- *marginalis*  
 Fore tibiae paler at base; sublateral spots smaller; third antennal segment rarely entirely black ----- 36
36. Moderate sized species, 14-15 mm; second palpal segment yellow brown about twice as long as wide; median triangles fairly large, sometimes crossing segment; sublateral spots reaching posterior margin on at least second segment; anterior portion of wing somewhat tinted ----- *vivax*  
 Small species usually under 11 mm; second palpal segment whitish, less than twice as long as thick; median triangles small, never crossing segment; sublateral spots small, rarely reaching posterior margins of segments; wing entirely hyaline ----- 37
37. Tibiae same color as reddish-brown to brown femora or slightly paler basally; antennae yellowish often with annulate portion somewhat darker; basal plate  $2\frac{1}{2}$  to 3 times as long as wide; occipital tubercle prominent and often projecting above level of eyes ----- *pumilus*  
 Tibiae distinctly paler than dark femora except apex of fore tibia which is dark; antennae uniformly dull brownish; basal plate about twice as long as wide; occipital tubercle inconspicuous and compressed, usually not reaching level of eyes ----- 38
38. Eyes in life without stripes ----- *sparus sparus*  
 Eyes in life with a single purple stripe ----- *sparus milleri*
- 39(32) Pale spot on second abdominal segment much smaller than those on third and fourth segments or absent ---- 40  
 Pale spot on second abdominal segment not markedly smaller than those on two following segments ----- 44
40. Abdomen blackish with large white triangles not arising from bands on third to fifth segments; fore tibiae bicolored ----- *trimaculatus*  
 Not with this combination of characters ----- 41

41. Middle and hind tibiae largely white; abdominal triangles arising from pale bands ----- *moderator*  
All tibiae dark reddish brown ----- 42
42. Abdominal triangles very small, not arising from bands; scutellum concolorous with thorax; area of eye facets occupying about half of total eye area and sharply demarcated ----- *superjumentarius*  
Abdominal triangles moderate in size, often arising from bands; scutellum white pollinose, contrasting with dark thorax; area of large facets occupying about  $\frac{2}{3}$  of total area but not sharply demarcated ----- 43
43. Face and cheeks gray pollinose; abdominal spots arise from pale bands which may cover basal half of third and fourth segments; venter with wide gray bands ----- *molestus molestus*  
Face and cheeks mostly brown pollinose; abdominal bands if present very narrow on dorsum and venter -----  
----- *molestus mixis*
44. No spot at bifurcation ----- 45  
Bifurcation with a conspicuous spot ----- 48
45. Little differentiation in size of eye facets and line of demarcation indistinct; large species with very small median triangles and dark yellow legs and antennae -- *calens*  
Large eye facets distinctly set off from small facets; third antennal segment at least partly dark; size variable ----- 46
46. Large species (over 21 mm) with legs uniformly brown and very small median abdominal triangles; first posterior cell not narrowed at wing margin ----- *catenatus*  
Smaller species (under 20 mm) with dark femora and paler tibiae and conspicuous median triangles; first posterior cell narrowed or closed at wing margin ----- 47
47. Median triangle crosses second abdominal segment; hind tibiae usually completely pale; large eye facets occupy about half of total area ----- *petiolatus*  
Median triangle does not cross second abdominal segment; hind tibiae darkened at apex; large eye facets occupy about  $\frac{2}{3}$  of total area ----- *melanocerus*
48. Abdomen, thorax, legs and antennae rather uniformly brownish; abdominal spots evanescent, apparently not arising from bands; wing markings pale ----- *aar* (in part)  
More contrastingly marked species or abdominal triangles arising from bands ----- 49

49. Median abdominal spots not arising from bands .....50  
 Median abdominal spots arising from bands .....51
50. Basal plate with a long forward projecting tooth; abdominal triangles very small ..... *imitans imitans*  
 Basal plate without a long tooth; abdominal triangles long and slender ..... *fuscconervosus*
51. Legs rather uniformly yellowish to dark brown and fore tibiae not paler at base .....52  
 Legs with femora darker than tibiae and fore tibiae paler at base .....54
52. Antennae very slender; basal plate at least twice as long as its greatest width, narrower than height of first antennal segment and equal in length to annulate portion; larger species (over 20 mm) ..... *turbidus*  
 Antennae not especially slender; basal plate less than twice as long as its greatest width, wider than height of first antennal segment and longer than annulate portion; smaller species (under 20 mm) .....53
53. Palpi, pleurae, legs and most of abdomen yellowish; abdominal triangles often indistinct; wing markings rather pale ..... *cheliopterus cheliopterus*  
 Darker species with palpi, pleurae, legs and abdomen predominantly mahogany to dark brown; abdominal triangles distinct; wing markings heavy---*cheliopterus fronto*
54. Pale median abdominal triangles conspicuous; middle femora often brownish; wing membrane lightly tinted ..... *sulcifrons*  
 Pale median abdominal triangles obsolete but with heavy median black spots; all femora deep black; wing heavily tinted especially anteriorly ..... *abdominalis* (in part)

#### *Tabanus aar* Philip

I have seen only one collection of this species from Virginia. Two specimens were collected by Wills Flowers in Dismal Swamp, 2 August 1968 (Cornell). Previously it has not been reported north of North Carolina. This species is crepuscular and nocturnal and has been taken at lights at night.

#### *Tabanus abdominalis* Fabricius

This species belongs to the difficult *sulcifrons* complex, and a revision of this portion of the genus is long overdue. I have seen

only one Virginia specimen which agrees with my interpretation of the species. It was taken by J. McD. Grayson at Chatham, Pittsylvania County, 22 July 1943 (P. Thompson).

*Tabanus americanus* Forster

This is the largest horse fly in North America — probably in the world. It is not uncommon in Virginia, and I have seen specimens from Dismal Swamp (where it has been collected many times), the counties of Accomack, Bath, Botetourt, Fairfax, Lee, Montgomery, Nansemond, Nelson, Surry, and Wythe, and the cities of Newport News, Norfolk and Virginia Beach.

*T. americanus* has a long flight season: from June to October. Most records fall between 25 June and 10 September, and the bulk of these are in July and August.

*Tabanus aranti* Hays

Only two adults from Virginia were seen. One was collected by J. McD. Grayson at Chatham, Pittsylvania County, 26 June 1943 and the other is labeled James City with no other data (ODU).

Larvae of *T. aranti* have been found along the mucky edges of ponds where the area is shaded by trees.

*Tabanus atratus atratus* Fabricius

Although widely distributed in Virginia, adults are not often encountered in large numbers. This large, black species, with denuded subcallus and cheeks, is not likely to be mistaken for any other; the abdomen often has a whitish or bluish bloom.

I have seen specimens from Dismal Swamp, the counties of Accomack, Fairfax, Frederick, James City, Montgomery, Nelson, New Kent, Northampton, Pulaski, Rockbridge, Shenandoah, and Washington, and the cities of Chesapeake, Hampton, Norfolk, Richmond, and Virginia Beach.

Collection records are rather evenly spread over a period from 23 May to 12 September, and I saw one specimen from York County with an October collection date. John F. Burger (*in litt.*) found this species still flying on Chincoteague Island, Accomack County on 26 September 1972.

H. J. Teskey (*in litt.*) found the larvae in mud along a sluggish stream in a swamp near Emporia, Greensville County and in moss and mud along the margins of a pond near Carson, Dinwiddie County. Larvae have been reported in a variety of semiaquatic habitats.

*Tabanus atratus fulvopilosus* Johnson

Except for variable amounts of orange-yellow hair on portions of the thorax, *fulvopilosus* resembles the typical form. The male has not been recognized. It is a coastal form throughout its range.

Only five specimens from four localities were seen during this study: Surry, Surry County, 1 August 1972 (ODU); Dahl Swamp near Cashville, 22 July 1962 by L. D. Miller (Carnegie); Wallops Station (near Wattsville), 29 August 1972, and Assateague Island, 1 September 1972, both by John Burger (Burger); the latter three localities are in Accomack County.

*Tabanus atratus nantuckensis* Hine

I was able to study an interesting series of this form collected by John F. Burger in 1972 on Assateague Island, Accomack County. He collected two females on 1 September and two females and three males on 11 September. The amount and intensity of the yellowish shading on the wings in this series shows considerable variation. Another specimen collected by G. W. Underhill at Richmond, 10 June 1929 (VPI&SU) has yellow shading in the form of streaks and patches. It may be an aberration of the typical form rather than *nantuckensis*.

*Tabanus calens* Linnaeus

This is one of the largest species found in Virginia, and for many years was recognized under the rather appropriate name of *Tabanus giganteus* DeGeer.

I have seen it from the counties of Craig, Fairfax, King George, Montgomery, Nelson, New Kent, Orange, Pittsylvania, Rockbridge, and York, and the cities of Portsmouth and Richmond.

It is a late flying species, and collection records range from 5 August to 17 September; over half the records are in August.

*Tabanus catenatus* Walker

I have seen only two specimens of this species from Virginia. One was taken by M. Hebbard at Hot Springs, Bath County, 8 August 1916 "at light" (Phil. Acad. Sci.) and the other by Karl V. Krombein at Arlington, 6 September 1948 (LLP). It is crepuscular and nocturnal, and has frequently been taken at lights at night in other areas.

The larva probably is terrestrial (Pechuman, 1972).

*Tabanus cheliopterus cheliopterus* Rondani

Stone (1938) lists Virginia as within the range of this species and Philip (1965) lists *T. cheliopterus fronto* Osten Sacken from Virginia. No specimens of either form from Virginia could be found in the U. S. National Museum or in any other institution to which inquiries were sent.

*Tabanus colon* Thunberg

This form was described by Stone as *atripennis* and placed as a variety of *nigrescens*. It appears that *colon* is an earlier name, and until its true relationships are better understood, I prefer to treat it as a full species. It is difficult to distinguish from *T. aranti* and caution must be used in separating the two forms.

I have seen only one specimen, a male, from Virginia; it was collected by H. A. Allard at Bull Run Mountains near Broad Run on the line between the counties of Fauquier and Prince William, 8 July 1934.

*Tabanus cymatophorus* Osten Sacken

This species is reported from Maryland, Kentucky, Tennessee, and North Carolina, but I have seen no Virginia specimens. It very likely is present in the state, but probably is very local in distribution.

*Tabanus fairchildi* Stone

I have seen this species only from the counties of Fairfax, Rockbridge, and Rockingham, but it probably is present in most habitats suitable for the larva. It is not often field-collected by usual means, but in New York I have taken it in numbers in canopy traps baited with carbon dioxide.

Collection dates range from 3 to 25 July with one record, a male, 5 June.

The larval stage of *T. fairchildi* is found under rocks in swift flowing streams.

*Tabanus fulvulus* Wiedemann

This species is widely distributed in Virginia. I have seen it from Dismal Swamp, the counties of Augusta, Buchanan, Caroline, Charlotte, Dinwiddie, Fairfax, Hanover, James City, Nelson, New Kent, Pittsylvania, Prince William, Roanoke, and Surry and the cities of Richmond and Virginia Beach.

Collections are rather evenly spaced between 4 June and 22 July with one 2 August record.

*Tabanus fuscicostatus* Hine

Only two specimens were seen from Virginia. Both were collected by James F. Matta at Backbay, City of Virginia Beach, 28 June 1970 (ODU). This is the furthest north this species has been recorded.

There has been much confusion about the identity of specimens of what I have now decided are dark variants of *T. fuscicostatus* from the Atlantic coastal states. Hine (1906) gave the type locality as Baton Rouge, Louisiana, but he did not designate a type; it is obvious that his description is based on more than one specimen. Dr. Charles A. Triplehorn sent me six cotype specimens from Ohio State University of Hine's original Baton Rouge series, all collected 27 June 1906. All are in agreement with each other and with Hine's description. I designate one of these as lectotype, and it is so labeled.

The lectotype has a yellow-brown frontal callus and essentially yellow-brown coxae, femora, and tibiae; the basal two-thirds of the fore and basal one-half of the hind femora are pale cinereous, and the middle femora have a faint cinereous cast; the apical half of the fore tibiae has a brown cast.

Most specimens I have seen from Mississippi, Alabama, and Georgia, and all I have seen from South Carolina, North Carolina and Virginia have a very dark-brown or black frontal callus, black coxae and femora and dark yellow-brown tibiae; the extreme apex of the femora frequently is yellow brown. A few specimens from Louisiana have dark legs and frontal callus, but most specimens I have seen match the lectotype in this respect. A few other specimens agreeing with the lectotype on color of legs and frontal callus have been seen from Mississippi and Alabama. Numerous specimens showing varying degrees of intermediate leg color have been seen from Mississippi and a few from Alabama, the Florida panhandle and Okefenokee Swamp, Georgia.

In general, the frontal callus of the lectotype, and of most Louisiana specimens, is larger than in the dark eastern specimens, but this seems to be a variable character in both populations. I can detect no other morphological differences.

It is my opinion that Hine had before him representatives of a pale population of *fuscicostatus*, but that over most of its range, it is a darker species.

*Tabanus fusconervosus* Macquart

Two specimens of this species were collected by James F. Matta and were the only ones seen from Virginia. They were collected in 1970 in Dismal Swamp on 19 and 25 June (ODU).

*Tabanus gladiator* Stone

Virginia specimens of this species were seen from the counties of Giles, James City, and Pittsylvania, and the city of Virginia Beach. It is a late flying species with collection dates ranging from 14 August to 18 September.

Teskey (*in litt.*) collected larvae along a stream near Carson, Dinwiddie County.

*Tabanus gracilis* Wiedemann

One specimen, a male, was seen from Virginia. It was collected by C. N. Smith at Fort Monroe, Hampton, 6 August 1928 (USNM). *T. gracilis* is probably largely crepuscular, and I suspect it is more common in Virginia than this single record indicates. I have seen both sexes of this species which were taken at light at night in other areas.

*Tabanus imitans imitans* Walker

Occasional specimens of this species have been collected in Maryland, and it is not uncommon locally in North Carolina. It probably is present in Virginia but no specimens were seen.

*Tabanus lineola* Fabricius

This is a fairly common species in Virginia and at times may reach pest status. Along the coast, however, it never reaches the abundance of the salt marsh greenhead *T. nigrovittatus*. The two species may fly together and in life can be separated by two purple eye bands on a green background in *lineola* and a single purple band in *nigrovittatus*.

Specimens of *lineola* are of two types in Virginia. Those from near salt-marsh areas have a paler abdomen, with a broader mid-dorsal abdominal stripe and wider frons than the darker form, which is also found along the coast, but is more common inland. These may represent populations breeding in brackish water versus one breeding in fresh water. Future biological studies may determine if more than one species is involved.

I have seen specimens from Dismal Swamp, the counties of Accomack, Arlington, Bath, Caroline, Charlotte, Dinwiddie, Greenville, Montgomery, and New Kent, and from the cities of Chesapeake, Hampton, Norfolk, Richmond, and Virginia Beach.

Collection dates range from 31 May to 10 August with 40 percent of the records in June and 50 percent in July. However, John F. Burger (*in litt.*) found *lineola* on Assateague Island, Accomack County until 11 September in 1972.

The larvae of *lineola* have been found in a variety of brackish and freshwater habitats.

#### *Tabanus longiusculus* Hine

This little species is reported from the neighboring states of Tennessee and North Carolina. I have seen no Virginia specimens, but it may be present in the state.

#### *Tabanus longus* Osten Sacken

I have seen only five collections of this species, all from one locality in Rockbridge County and three localities in Bath County. It is probably distributed throughout the mountains of western Virginia, but its habits are obscure and it is not often collected. The male is unknown.

It is a late flying species and collection dates range from 15 July to 24 August.

*T. longus* belongs to a group in which frontal, antennal and palpal characters seem to be quite plastic. Care must be used in separating it from related forms.

#### *Tabanus marginalis* Fabricius

This is a northern species, but disjunct populations exist in mountainous areas and swamps as far south as South Carolina. It has been found in the neighboring states of Maryland, West Virginia, and Tennessee. In the southern portion of its range it is usually found in cool, wooded swamps, and it may be found in such a habitat in Virginia.

#### *Tabanus melanocerus* Wiedemann

This does not seem to be an abundant species in Virginia but it may be locally common at times. I have seen it from Dismal Swamp, the counties of Accomack, Fairfax, Frederick, James City,

Montgomery, Nansemond, and Surry and from the cities of Fredericksburg and Virginia Beach.

Records range from 25 June to 13 August.

The larvae have been taken from mud and organic debris at the edge of streams, ditches, ponds, and lakes. Thompson (1971) found many larvae in Maryland under leaf litter near flooded areas of a swamp.

*Tabanus moderator* Stone

I have seen this species from Tennessee and it probably will be found in Virginia. It is uncommonly collected throughout its range.

*Tabanus molestus molestus* Say

I have seen this form from the counties of Accomack, Arlington, Bath, Fairfax, Gloucester, Nelson, Pittsylvania and Rockbridge and the cities of Norfolk, Virginia Beach and Williamsburg.

All but two collection records fall between 9 June and 15 July. I saw one specimen dated 24 August and another 1 September.

*Tabanus molestus mixis* Philip

The status of this form is uncertain. I have seen no intergrades with the typical form in the Virginia material examined. Both the typical form and *mixis* were collected by Bridwell at Clifton, Fairfax County, 11 June 1933 (USNM).

I have seen specimens from the counties of Fairfax, Montgomery, Nansemond, Nelson, Pittsylvania, and Prince William.

Records cover a period of 5 June to 8 August with about half the records in June; I saw one specimen from Blacksburg, Montgomery County labeled, "Sept. 1965" (VPI&SU).

*Tabanus mularis* Stone

Only a few specimens of this species from Virginia were seen during this study. Localities represented include the counties of Accomack, Fairfax, Goochland, Greensville, Loudoun, and Shenandoah, and the city of Portsmouth.

All specimens were taken between 20 and 29 June — except two females collected by W. H. Robinson at Emporia, 10 August 1972 (VPI&SU).

In addition, I have seen 4 females taken by E. Saugstad (WRAIR) on Assateague Island, 9 August 1970, "in vehicle," which for the

present, I am treating as a variant of *mularis*. These agree with *mularis* except for the abdominal pattern which consists of four straight dark stripes on a grayish background. Another female loaned to me by Patrick Thompson has a similar abdominal pattern; it also comes from Assateague Island, 15 August 1969.

*Tabanus nigrescens* Palisot de Beauvois

This large dark species is common and widespread in the state, and I have seen more specimens from Virginia than from any other state. Specimens were examined from the counties of Bath, Essex, Fairfax, James City, Montgomery, Nansemond, Nelson, Rockbridge, Shenandoah, Surry, and Westmoreland and from the city of Richmond.

Collection records range from 22 June to 12 August with 64 percent of the records in July.

*Tabanus nigripes* Wiedemann

This species is widespread in Virginia but not often seen in numbers. I have seen it from the counties of Accomack, Fairfax, Floyd, Greenville, Montgomery, Rockbridge, and Shenandoah and from the city of Alexandria.

Records cover a period of 5 June to 22 August.

The larvae have been found most commonly in wet habitats with a high organic content (Teskey, 1969), but Thompson (1971) found them on the edge of a pond in mostly mineral soil.

*Tabanus nigrovittatus* Macquart

This is the annoying "greenhead" of salt marshes and beaches along the coast. At the peak of its activity it is the bane of bathers, campers, and fishermen, as well as residents of the area.

Flying with the more yellowish specimens is a larger, grayish-yellow form which was described as *simulans* by Walker. It is now generally placed as a synonym of *nigrovittatus*, but studies on the biology of these two forms may show they are distinct.

I have seen specimens of *T. nigrovittatus* only from the counties of Accomack, Gloucester, James City, and Mathews and from the cities of Chesapeake and Virginia Beach; but I would expect it in all the salt marsh areas of Virginia. I have also seen specimens from Dismal Swamp, and these probably are individuals that have moved inland from the coast; it is unlikely that it breeds there.

In the material studied, collection dates ranged from 16 June to 31 August with the collections rather evenly distributed over June, July, and August. However, in 1972, Burger (*in litt.*) working on Assateague Island, Accomack County found the first specimens on 13 June; the species was still abundant on 1 September and in fair numbers on 11 and 12 September. After these dates only an occasional individual was seen until 22 September when the last specimen of the season was collected.

The larvae have been found only in salt marshes.

#### *Tabanus pallidescens* Philip

I have seen but three specimens from Virginia. Two were collected by C. B. Dominick at Chatham, Pittsylvania County, 18 August 1938 (VPI&SU) and one by C. V. Covell at Ladysmith, Caroline County, 27 June 1969 (Univ. Louisville).

#### *Tabanus petiolatus* Hine (fig. 4)

All I have seen of this species from Virginia are from the eastern portion of the state. Specimens were studied from Dismal Swamp, where it is a common species, the counties of Accomack and New Kent and the city of Virginia Beach.

Collection records cover a period of 11 June to 11 August with over half the records in July.

H. J. Teskey (*in litt.*) found the larvae in mud along a sluggish stream in a swamp near Jarratt, Sussex County and near Carson, Dinwiddie County, both along a stream and in moss and mud at the edge of a pond.

#### *Tabanus proximus* Walker

Virginia is close to the northern edge of the range of this large species, and I saw only two specimens. One was taken by C. B. Dominick at Chatham, Pittsylvania County, 11 September 1970 (VPI &SU) and the other, a male, by C. T. Greene at Great Falls, Fairfax County, 1 September 1920 (USNM).

#### *Tabanus pumilus* Macquart

This is the smallest *Tabanus* in Virginia, some specimens not being much larger than a house fly. It will attack humans much like a deer fly.

All the specimens I have seen are from the eastern portion of the state. James F. Matta collected it on several occasions in Dismal Swamp, and it probably is not uncommon there. I have also seen it from the counties of Accomack, Arlington, Caroline, Greensville, King and Queen, and Montgomery.

The range of collections covers 23 May to 20 July with one 10 August collection. About half the records are in June.

Most larvae of *T. pumilus* have been taken from saturated, highly organic habitats in swamps and along streams.

#### *Tabanus quinquevittatus* Wiedemann

This "greenhead" is widely distributed in Virginia but never seems to reach the abundance that it does in some more northern states. Faded specimens are difficult to distinguish from *T. nigrovittatus* and *T. mularis*, and I have noted that in some fresh specimens, the yellow color of the palpi and face is less intense than in more northern populations.

I have seen this species from the counties of Arlington, Bath, Fairfax, Frederick, Loudoun, Montgomery, Prince William, Shenandoah, and Wythe and from the cities of Chesapeake and Norfolk.

Collections range from 10 June to 16 September, but 75 percent of the records are from late June through July.

Most larvae have been found in moist pastures, but they tolerate a wide range of moisture conditions and have been found in dry sod and along the margins of brooks.

#### *Tabanus reinwardtii* Wiedemann

The habits of the adults of this species are obscure, and it is not commonly collected. It is probably widespread in Virginia, but I have seen it only from the counties of Arlington, Bath, Charlotte, Fairfax, Montgomery, and Westmoreland.

All specimens were collected between 23 June and 17 July.

The larvae of *T. reinwardtii* are frequently taken in considerable numbers in areas where few adults have been collected. They are found in mud, sand, gravel, and silt at the margins of streams and ponds. Teskey (*in litt.*) collected a single larva along the edge of a stream near Carson, Dinwiddie County.

#### *Tabanus sackeni* Fairchild (fig. 4)

Most of the specimens I have seen are from the more rugged portions of Virginia. *T. sackeni* is a crepuscular or nocturnal spe-

cies, although occasional specimens are taken during the day. Adults of both sexes have been taken in large numbers at lights at night.

*T. sackeni* belongs to the "*longus*" group and, as noted under that species, characters which are reasonably stable in most species may show considerable variation in *longus* and its relatives. In *sackeni*, the third antennal segment is characteristically long and narrow, but in some specimens it is rather broad. No other species in the group has the frons widened above, but even here the degree of widening is variable.

I have seen *T. sackeni* from the counties of Arlington, Augusta, Fairfax, Fauquier, Lee, Loudoun, Montgomery, Orange, Pulaski, Rappahannock, Rockbridge, and Tazewell.

Collection dates range from 17 June to 8 September; about half the records are in August.

Nothing is known of the larval habitat or immature stages of *T. sackeni*.

#### *Tabanus sagax* Osten Sacken

No specimens of this species were seen. However, *Tabanus baal* Townsend (1895) is placed as a synonym of *sagax*, and the type of *baal* is from Dixie Landing, Arlington County. It was collected 22 June.

*T. sagax* has a wide range but is not common in collections except for a few short series which have been taken at lights at night. There are specimens of *sagax* in the U.S. National Museum from Maryland, and there is little doubt that the species is present in Virginia.

#### *Tabanus similis* Macquart

If *T. similis* is found in Virginia, it is at its southern distributional limit in eastern North America. I have seen two females from Virginia which may be *similis*, but the best diagnostic characters to separate it from *subsimilis* are found in the males. I have seen many males of *subsimilis* from Virginia but no males of *similis*.

One female collected by W. S. Hough is labeled "Va.", 23 July 1924 (VPI&SU) and has most of the diagnostic characters of *similis*. Another female collected by J. E. Lloyd at Bull Run Mountains, Prince William County, 11 June 1962 (Cornell) has the pale legs of *similis* but the offset abdominal stripes of *subsimilis*; I suspect it is an unusually pale *subsimilis*.

*Tabanus sparus milleri* Whitney

This is a common form in Virginia. It is similar to *pumilus* in general appearance but may be separated by the characters in the key. Like *pumilus* it readily attacks man. *Tabanus sparus sparus* Whitney lacks an eye band in life, whereas *milleri* has a single eye band. All I have seen in life from Virginia or have relaxed to restore the eye pattern have had such a band. It was not possible to restore the eye band in all dry specimens I saw so I am assuming all are *milleri*.

I saw specimens from Dismal Swamp, the counties of Arlington, Craig, Essex, Fairfax, Greene, Greensville, Halifax, Montgomery, Page and Shenandoah and from the city of Charlottesville.

Collection records range from 26 May to 14 August with 76 percent of the records in June and July.

*Tabanus stygius* Say

This large dark species with a pale thorax in the female is not likely to be mistaken for any other tabanid known from Virginia. Of eastern species, only *Tabanus subniger* Coquillett has a pale thorax and is as large as *stygius*; it is not known from Virginia but is included in the key.

I have seen only four specimens of *stygius* from Virginia: 1 mi. SE of Lanexa, New Kent County, 18 June 1962 by N. D. Richmond (Carnegie); Ft. Lee, Petersburg, 23 June 1962 by A. B. Gurney (USNM); Backbay, city of Virginia Beach, 28 June 1970 by James Matta (ODU); James City with no other data (ODU).

The larvae have been found on the muddy banks of ponds and streams and among roots of aquatic vegetation.

*Tabanus sublongus* Stone

I have seen but two specimens of this species, but I think late season collecting at higher elevations will produce more material. One specimen was collected by H. Staley in Giles County, August 1938 (VPI&SU) and the other by Alan Stone at Westmoreland State Park, Westmoreland County, 31 July 1945 (USNM).

*Tabanus subsimilis subsimilis* Bellardi

This is a fairly common species in Virginia. Both sexes have been rather frequently collected at lights at night in the state. Some female specimens are difficult to separate from *T. similis*, but the males are easily distinguished by the large upper eye facets which are hairy.

I have seen specimens from the counties of Accomack, Arlington, Fairfax, Greensville, Loudoun, Mecklenburg, New Kent, Pittsylvania, Shenandoah, and Smyth and from the cities of Chesapeake, Hampton, Richmond, and Virginia Beach.

Almost all collection dates are included between 30 May and 26 July with 80 percent of the records in June. There are two August records, and I have seen a male collected 4 September 1949 in Fairfax County.

The larvae have been found in mud along the edges of streams and ponds and in seepage areas.

*Tabanus sulcifrons* Macquart

As mentioned under *T. abdominalis*, the complex to which *sulcifrons* belongs is in need of revision. A number of names have been used in the past, and the types of these should be studied. Biological work probably will be necessary to support taxonomic studies of the adults. Under our present concept of this species, *sulcifrons* is a common pest species of horses and cattle in Virginia.

Specimens were seen from the counties of Accomack, Arlington, Augusta, Bath, Botetourt, Charlotte, Chesterfield, Craig, Fairfax, Fauquier, Frederick, James City, Loudoun, Mecklenburg, Montgomery, Nansemond, Pittsylvania, Prince William, Rockbridge, Shenandoah, and Surry and from the cities of Fredericksburg, Newport News, Norfolk, Petersburg, and Virginia Beach. Some collection labels indicate that both sexes have been taken "at black light."

A form which probably represents a distinct species and is rather common in the Carolinas, was represented by a few specimens in the Virginia material examined. These specimens are darker than most *sulcifrons*, with very distinct abdominal triangles, dark slender palpi, and narrower frons. I have seen such specimens from the counties of Augusta, James City, Montgomery, Pittsylvania, and York and from the city of Newport News.

Collection dates of *T. sulcifrons* fall largely between mid-July and 13 September. I saw four June-collected specimens, one dated 26 September and one 14 October. About 50 percent of the records are in July, 24 percent in August, and 22 percent in September.

The larval stage is generally regarded as terrestrial, but adults of the *sulcifrons* complex have also been reared from larvae found in wet situations.

*Tabanus superjumentarius* Whitney

Only a few specimens of this species were seen in the collections examined, and all were from Fairfax and Montgomery Counties, with all collection dates between 1 and 19 July. These records probably more accurately show the distribution of entomologists in Virginia than they do the true range of *T. superjumentarius*.

The larvae have been taken from mud and moss along stream banks.

*Tabanus trimaculatus* Palisot de Beauvois

This attractively marked species is widely distributed in Virginia and was represented in most of the collections studied.

Specimens were seen from Dismal Swamp, the counties of Charlotte, Fairfax, Loudoun, Mecklenberg, Montgomery, Nansemond, Nelson, New Kent, Pittsylvania, Rockbridge, and Shenandoah and from the cities of Chesapeake, Newport News, and Virginia Beach.

The seasonal distribution ranged from 2 May to 22 August with 70 percent of the records in June.

H. J. Teskey (*in litt.*) collected larvae of *trimaculatus* from the margins of slow streams in swamps at Jarratt, Sussex County, and Emporia, Greensville County in May 1972.

*Tabanus turbidus* Wiedemann

This species is not known from Virginia, but since it is recorded from Kentucky, Tennessee and North Carolina, it may be present in the state.

*Tabanus zythicolor* Philip

When Philip (1936) described this species he noted that the male allotype was from Cape Charles (Northampton County), collected 1-20 July 1933.

I have seen only five other specimens: Richmond, 8 August by E. S. G. Titus (USNM); Norfolk, 2 September 1910 by F. A. Johnston (USNM); Newport News, October 1971 by James Matta (ODU); Chesapeake, 24 August 1972 (a male) (ODU); Dismal Swamp, 31 August 1972 (ODU). It is obviously a late season species.

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