Second report upon the horseflies of Louisiana

James Stewart Hine

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AGRICULTURAL EXPERIMENT STATION

OF THE

Louisiana State University
and A. and M. College,

BATON ROUGE.

SECOND REPORT UPON THE HORSEFLIES OF LOUISIANA.

BY

JAS. S. HINE.

BATON ROUGE:
The State, Official Journal, State of Louisiana,
1907.
The Bulletins and Reports will be sent free of charge to all farmers, on application to the Director of the Stations, Baton Rouge, La.
LETTER OF TRANSMISSION.

Prof. W. R. Dodson, Director, Louisiana State University Experiment Stations, Baton Rouge, La.:

Dear Sir—During the summer of 1905 Mr. Jas. S. Hine of the State University of Ohio, recognized as an authority upon the group of insects known as "Tabanidae" (horseflies and earflies), was employed jointly by the Gulf Biologic Station and the State Crop Pest Commission to make a preliminary study of these insects in Louisiana.

The fact that outbreaks of anthrax (charbon) spread rapidly when occurring coincidently with a great abundance of horseflies gave rise to the suspicion that these insects were instrumental in spreading the disease. While the observations have not thus far resulted in the actual finding of the anthrax bacillus in or upon the horseflies, much evidence has been accumulated pointing to the relationship sustained by these insects to the spread of this dread disease of live stock and has but emphasized the importance of continuing the investigations until really satisfactory means of control present themselves.

The results of Mr. Hine's investigations during 1905 were published concurrently as Bulletin No. 5 of the Gulf Biologic Station and Circular No. 6 of the Crop Pest Commission. Among other things contained in these publications, measures for protecting animals from the attacks of these insects were given and facts pointing towards ultimate future control of the pests were recited.

During the summer of 1906 Mr. Hine continued his investigation under the direction of the Crop Pest Commission. I beg to hand you herewith Mr. Hine's report upon his investigations of 1906, and would recommend that same be published as Bulletin 93 of the Experiment Stations.
Contrary to what was anticipated, the work during 1906 did not bring to light more than a few additional points of immediate practical application in solving the horsefly problem. On the other hand, the life history studies and extensive observations made by Mr. Hine incidental to his study of the strictly economic phases of the subject have enabled him to prepare what is perhaps the most complete treatise on any group of Louisiana insects yet given to the scientific world.

The present paper is a valuable contribution to entomological science, and forms a solid foundation upon which future investigators can work in pursuing this investigation to a satisfactory conclusion and in solving the horsefly problem, which is of so much importance to the stock raisers of Louisiana.

Respectfully submitted,

WILMON NEWELL,

Entomologist, Louisiana State University Experiment Stations.

Baton Rouge, La., March 30, 1907.
PREFACE.

During the winter of 1906, the State Crop Pest Commission outlined a paper entitled "A Preliminary Report on the Horse-flies of Louisiana, with a Discussion of Remedies and Natural Enemies." Another season in the field has resulted in adding a number of species of horse-flies to the known fauna of the State, as well as in procuring some new facts regarding breeding habits, life histories and natural enemies. The purpose of a second paper is to record these additions, and especially to give a systematic treatise of the species that have actually been taken in Louisiana.

I wish to express my appreciation for courtesies bestowed by the Louisiana State Crop Pest Commission, by whom I was employed during the progress of the work. Mr. Wilmon Newell, the Entomologist, gave numerous suggestions and aided in various ways. Messrs. J. B. Garrett and C. W. Flynn collected several of the species that have been added to the State list as given in a former paper. Messrs. E. C. Cotton and Harper Dean, Jr., aided by taking some of the photographs herein reproduced from half-tones. It is my desire to give all of these full credit for the help they have given me, but as one can hardly enumerate every item of assistance in a paper, it is proper to state that I am under obligations for many more favors than those mentioned or suggested.

Many of the drawings of species of Tabanus, herein published for the first time, were made by Mrs. Lumina C. Riddle Smyth of Topeka, Kansas.

COLUMBUS, OHIO, March 15, 1907.

JAMES S. HINE.
Fig. 1.—A locality near Baton Rouge where the eggs of horseflies were taken in numbers. The plants growing in the water are mostly specimens of Sagittaria, on the leaves of which the eggs were found. The horsely egg-parasite was reared from eggs taken in this locality. (Photo by E. C. Cotton.)
Second Report Upon the Horseflies of Louisiana.

By Jas. S. Hine.

During the summer of 1906 I was in Louisiana from the 10th of June to the 1st of September, and during that time was in several sections of the State and studied the conditions especially favorable to the presence of horseflies. Observation in different localities proved conclusively to my mind that most species of these insects are distinctly partial to wooded areas. In fact, when driving along the roads in well cleared sections only one or two of the species least abundant in the number of individuals caused the team any annoyance, but as soon as woodland was reached, flies were abundant and the horses suffered much in consequence. One species, the black horsefly, appeared to be everywhere, but as this is one which is not usually plentiful, as compared with some of the common species known as greenhead flies, it is not so much to be dreaded by stock as are the others. The American horsefly and a few more are often met with in open fields also.

At New Roads, Pointe Coupee Parish, there is a section of what was once the bed of the Mississippi River, which is now cut off so that it forms a body of standing water, and is called a lake. By wagon road it is said to be nearly twenty-five miles around this lake, and for almost the entire distance the land on the lake front is cleared and under cultivation. It was close to the middle of June when a visit was made to the locality. One could drive a team through the cleared country for hours and scarcely ever see a horsefly, but upon turning to a side road that led through woodland, several species appeared in abundance and caused the team a great deal of annoyance. The insects did not decrease in numbers during the stay in the woods, but were easily left behind upon again returning to the cleared country.

In the State there is plenty of low land that has not been cleared, or anything attempted except, perhaps, to cut off some
of the more valuable timber. Such areas are often many square miles in extent and are called swamps. During dry summer months they are accessible to drive through, but it seems that horseflies could not be more abundant than they are, no matter how favorable the conditions for their production. I visited such a swamp near Baton Rouge on June 27th, and since that time have had a much better idea of the injury that may be caused by horseflies than I ever had before. One would fail in an attempt to describe the exact conditions, for to be fully appreciated they must be seen.

The coast region of the State is well supplied with horseflies in season. A trip to Plaquemines Parish July 10th, showed that these insects were very abundant in that section at the date mentioned. The flies were observed to take refuge from the heavy rains that were then occurring, in the orange trees and the clover crops beneath them.

A stay at the Gulf Biologic Station at Cameron, La., for a week resulted in collecting the same species as reported from that section last year and one additional. Mr. McCall, who has been on the ground there for several years, is of the opinion that horseflies were noticeably less plentiful the season through than they were for the past four or five years previous to this one. The opinion seems to prevail that the Horse Guard is accomplishing something toward reducing the numbers of the flies. It is quite evident to my mind that this predaceous insect must be considered an important enemy of horseflies where it is present, and especially where it is so numerous and where conditions are as favorable for its development as at Cameron and in some other of the places visited.

The largest number of species of horseflies from a single locality were taken at Lecompte, in Rapides Parish, from August 23d to 25th. Five species of Chrysops and eleven species of Tabanus, making sixteen in all, is the record for three days. I do not know how to account for the occurrence of so many species at so late a date except it be that a number of those occurring in early spring are double brooded, thus making it possible for them to appear in late summer at the same time as Tabanus sulcifrons and others of the autumn species.
Anthrax, which is known as charbon in Louisiana, appeared in various sections of the State during the summer and the result was the loss of many farm animals. It is to be regretted that more definite data is not at hand concerning the part that the Tabanidæ play in the transmission of this disease. That these insects do transmit the charbon with their bites is quite universally believed in all sections. The Experiment Station at Baton Rouge is now carrying on investigations along this line, and it is hoped that reliable experimental data will soon be at hand.

That one can get some idea of the species of horseflies in a locality by making observations while riding through on a train is proven by the fact that no less than ten species were actually recorded as appearing on the windows and other parts of the cars while
traveling in the State. I am not prepared to say what attracts them to the train, except it may be the movement. At various times a number of species comprising dozens of specimens were observed following the train and here, it appeared, they would fly for long distances, sometimes for miles, after which they quite often alighted on some part of the car. They appeared to have no difficulty in keeping up in any case observed, so I am sure that it is not impossible for these insects to fly at the rate of at least thirty miles per hour.

It appears like going a long way for relief from horseflies, and perhaps suggesting some seeming impossibilities, to state that Louisiana in all probability will be less and less troubled with the horsefly nuisance as more and more of her territory is cleared and placed under cultivation. It is suggested at the present time that there will always be a great deal of waste land in the State, but I dare say this area will not be so extensive at some future time as present conditions may seem to indicate, and although some species will not be controlled by cutting away the forests, those which are accustomed to confining their operations largely to wooded areas will most certainly be reduced in numbers, as has been the case in other parts of the country where almost all of the land has been placed under cultivation.

THE EGGS OF CHRYSOPS AND TABANUS.

The eggs of one species of Chrysops and at least one species of Tabanus were observed several times while in the State. In the latter part of June I located a small stream a mile or two south of Baton Rouge where the flies were ovipositing in numbers. The eggs were placed on leaves of a common water plant known as Sagittaria, which margined either bank and in places spread almost across the stream.

The species of Chrysops which laid the eggs was proven to be C. flavidus, for the females were observed in the act of egg-laying. These are well shown in the illustration, which is from a photograph by E. C. Cotton. This was my first observation of the kind for the particular fly, but nothing peculiar to the species was noted. The mass of eggs is rather large, composed of 200 or more specimens, and attached firmly to the leaf in a
single layer. At first this mass is clear white, but gets darker with age and eventually becomes shining black.

As to the species of Tabanus which placed its eggs on the leaves of Sagittaria, sometimes in close proximity to those of Chrysops mentioned, I was not able to conclude. Several large horseflies were observed in the vicinity, but none were found laying. The masses were large, brownish in color and contained nearly 500 specimens. In most cases larvae appeared the next day or so after the eggs were procured, indicating that they were deposited four or five days before.

THE HORSEFLY EGG-PARASITE, PHANURUS TABANIVORUS fast ASH-MEAD.

This little parasite, of the eggs of at least one species of the genus Tabanus, is of much interest, and from the range it is now known to have must be of value from an economic standpoint. I am not aware that it has been reared from eggs of
any but the black horsefly, but there are strong indications that it has other hosts. At Baton Rouge, on June 22d, were collected three masses of eggs of *Tabanus* like those mentioned above. These were placed in a breeding cage, and after a few days scores of the minute parasites issued, thus indicating that the insect is not rare in Louisiana, and, what is more, I feel almost certain that the material from which the rearing was made was not the eggs of the black horsefly (*Tabanus atratus*). Since the species is now known from at least three States as widely separated as Illinois, Ohio and Louisiana, it is probable that it is a member of the fauna of a great part of the territory east of the Mississippi River, and no more than likely is to be found west of this river.

It is difficult for some to understand how a parasite so small as the one under consideration can accomplish a noticeable result toward controlling enemies so formidable as are the horseflies, but parasites no larger than this have been known to be of inestimable value. Why not the horsefly egg-parasite?
THE HORSE GUARD, MONEDULA CAROLINA DRURY.

This predaceous wasp is found in many parts of Louisiana and several colonies were located and part of them studied. Since the species is considered to be doing noticeable good in reducing horseflies in certain localities, it seems worth while to consider its life history and habits at this time, perhaps repeating some things that were published in my paper last year.

The eggs are white in color, five millimeters in length and about one-fourth as broad; the form is elongate and somewhat curved, making the general outline kidney-shaped. The past summer, during the latter part of July a number of these eggs were procured from the burrows of the wasps, and I am satisfied that no food material is carried into a burrow until the egg hatches. The female watches the nest closely, however, and as soon as the young larvæ appear begins the irksome task of carrying in insects to satisfy the active appetite of her worm-like young. The egg appears to hatch very soon after it is deposited—at least all the eggs taken from burrows were kept in cages and in all cases hatched the next day after they were collected. From this I am not willing to state what the hatching period really is, but from conditions it could not have been more than a few days. The fact that no food is carried into the burrow before the egg is laid, in case of the horse guard, Monedula carolina, proves that its habit in this regard is different from its near relative of the same family, Sphecius speciosa, for Riley found that the latter species, after digging its nesting burrow, caught and carried in a Cicada, upon which to place its eggs.

The wasps do not make all their burrows exactly alike, but usually there is a close resemblance. The first part of the burrow usually goes downward at an angle of about 45 degrees for a few inches, and then a turn is made at nearly right angles to this part. This latter direction is followed until a suitable place for the placing of the egg is reached. The wasp appears to have some notion about drainage, for the end of the burrow is often in the coarsest material to be found; that is to say, instead of the egg being placed in or upon a section of fine sand that has some ability to hold water, such a section is penetrated, and a place for the egg located upon a section composed of small particles of shells and the like.
The observations that it was possible to make this season fully agree with those of last year in that horseflies appear to be a favorite diet of the wasps. Burrows were found in 1905 in which the remains of more than sixty specimens of horseflies were in evidence, and these later observations showed some burrows into which nearly as many had been carried, proving that the habits of the wasps are perpetuated.

Last year I gave an extended account of the habits of the horse guard in its different stages. I believed then that it is an insect which is capable of doing notable work in combating horseflies, and further acquaintance with it has not changed this opinion.

In traveling over Louisiana one often sees other species of wasps belonging to the same family to which the horse guard belongs. From collections already made in the State it is known that at least seven species of these wasps occur, not in a single locality at the same date, however, for they were taken in different sections and at different dates during my residence of three months. Several of these species were observed to catch flies from horses and cattle, and four were observed to be similar in their nesting habits to the horse guard. I am not able to say whether or not each of the species of the family is as important
an enemy of horseflies as is the horse guard, but what I have seen leads me to suspect that some of them are not far behind it when equal numbers are considered.

HORSEFLIES TROUBLE SOME ANIMALS MORE THAN OTHERS.

I am not able to state why horseflies, or other biting flies for that matter, show a preference for some animals, but it is a fact that certain horses or cattle may be attacked and bitten often and severely, while others in the same pasture may be bitten only occasionally. Some animals are more persistent in their efforts to drive flies away, but this does not explain all, for the flies do not attempt to attack some animals as often as others. Neither does difference in color or anything else observed seem to offer a satisfactory explanation as to why the majority of biting flies that are attracted to a herd of animals get a large part of their food from certain animals and only occasionally attack the others.

TERMS USED IN DESCRIBING AND CHARACTERIZING HORSEFLIES.

It is impossible to fully describe a particular species of insect, without bringing into use a term now and then not in use in common language, so in order to explain such terms it seems proper to introduce at this point a few statements concerning the anatomy of the autumn horsefly, *Tabanus sulcifrons*, which is common in parts of Louisiana in season.

HEAD OF FEMALE.—The anterior part of the head is largely occupied by the compound eyes, which are brown in color, and each is crossed by two green bands, quite narrow and slightly curved.

The *antennae* are located on the lower middle of the head, and each is composed of three segments, of which the third bears near the base an angular prominence, which is usually called the upper angle or basal prominence of the third antennal segment. Also this segment is compound, being composed of five rings or annulations, of which the basal one is longer than the other four taken together.
The *front* or *frons*, which is the region between the eyes above the antennæ, is nearly of the same width throughout. The space just above the antennæ, the *subcallus*, is pollinose in this species. Above the subcallus is the *frontal callosity*, which is naked and shining, and occupies nearly the whole width of the lower part of the front. It is quadangular in form, with a narrow, elongate extension upward from its upper side.

The upper part of the front is the *vertex*, and the limit of the front above is the *vertical margin*. The *face* occupies the space bounded by antennæ, eyes and oral margin, or, in other words, is the region between the eyes below the antennæ.

The middle part of the face beneath the antennæ is swollen, while on each side is a less elevated area known as the cheek. The lower part of the face passes to the margin of the mouth, or oral margin, and the *proboscis*. The part of the proboscis which is visible is largely *labium*. This labium is grooved on the upper side, and into the groove the other mouth parts, with the exception of the palps, are received. It may be likened to a sheath, for the edges of the groove are extended and meet above, for at least a part of the length. Its distal part is furnished with an enlargement, the *labellum*, which, when the insect is taking food, becomes a sucking disc.

The mouth parts, which are received into the groove of the labium consist of six stylets, or needle-like parts, which are light brown in color and otherwise resemble one another. If these be separated from the labium, the *labium* may be seen farthest forward, and just behind it the smaller *hypopharynx*. Next in order, passing backward, are the *mandibles*, placed side by side, while the *maxillae*, the narrowest of the mouth parts, lie posterior to the mandibles. Each maxilla has attached to its base a large *maxillary palp*, which is composed of a shorter basal, and longer distal segment. These maxillary palps, in their natural position, are very prominent; the proximal segment projects forward so that the large distal segment is carried before all the other mouth parts.

The rear of the head is usually referred to simply as the *occiput*, near the middle of which the head is joined to the thorax, a narrow strip lying above this junction being sometimes referred
as the *nape* or *cervix*. The cervix in this species is quite obviously bounded by sutures.

**Head of Male.**—The head is larger and approaches nearer to hemispherical than in the female. The eyes are united for a long distance, and thus the front is divided into two parts, called the *vertical* and *frontal triangles*. The former is very small and is bounded above by the vertical margin and bears no ocelli, or simple eyes in this species. The latter is limited below by the antennae and includes the subcallus. Because of the increased size of the head the antennae appear to have their origin higher up.

The face in this sex is different from that of the female. The sides, or cheeks, are about in the same plane with the surface of the eyes, while the middle part is much depressed. The mouth parts differ also; the mandibles are lacking and some of the other parts are reduced. The second segment of the maxillary palp is smaller and shorter than in the female, and turns upward to lie against the face. The uppermost green band of the eye is abbreviated outwardly, and just above it, next the frontal triangle, is the division between the lower area of small facets and the upper area of enlarged facets of which the eye is composed. On the outer and upper margin of the eye the area of small facets is extended to where the eye meets the vertical triangle.

**Thorax.**—The three primary divisions of the thorax are not easily separated, but the *mesothorax* comprises nearly all the space visible from above, including the posterior, somewhat triangular portion called the *scutellum*.

The *prothorax* is small but easily located from the fact that it bears the anterior pair of legs. A small lobe of the prothorax, easily distinguished by being lighter in color, is closely applied to each anterior corner, or *humerus*, of the mesothorax. Between the attachment of the anterior leg and the humerus are two small prominences and just posterior to these latter is the *anterior thoracic spiracle*.

The metathorax is small and the *metanotum*, which is the part of it visible from above, may be seen beneath the scutellum by viewing it from behind. Passing downward on each side we observe a prominence on each side called the *lateral callosity of*
the metathorax. Behind the lateral callosities are located the poisers or halteres, and just beneath them the posterior thoracic spiracles.

The prothorax bears the front pair of legs, the mesothorax the middle pair of legs and the wings, and the metathorax the posterior pair of legs and the halteres.
The legs are each composed of five sections; the coxa, next the thorax, and following in succession the trochanter, a very short segment, the femur, tibia and tarsus. Each tarsus contains five segments, of which the fifth or last bears a pair of claws, a pair of pads, or pulvilli, beneath the claws, and between the pulvilli a single empodium, which is like the pulvilli in appearance. The prothoracic coxae are slightly more than half as long as the femora of these legs, while the coxae of the other legs are very much shorter.

There is no notable difference between the legs of the male and female, except in the front feet the male claws, pulvilli and empodia are larger than in the female.

By taking a specimen of Tabanus with wing spread and following the posterior border of this wing toward the body, one finds toward the base an incision, the axillary incision, between which and the scutellum are three membranous lobes. These, in order, are called allula, antitegula and tegula.

The allula, bordering the axillary incision, is considered as a part of the wing proper, but the other two, called tegulae when taken together, are usually considered as accessory. In closing the wing the antitegula moves with the wing, while the tegula, which, although joined to the antitegula, is also securely joined to the thorax, remains practically stationary. When the wing is closed the antitegula fits over the tegula and nearly hides it from view. The halteres have their attachment beneath the tegula on each side; therefore their basal parts are concealed, but the knob-like apical parts are always visible.

The wing contains a number of characters which are of value in classification. In order that the various parts of the wing may be referred to it is necessary to have an acquaintance with the veins and cells of which it is composed. It is easiest to make these plain by means of a drawing prepared for this purpose, so a detailed description will not be attempted in this place.

Many species of Tabanus have their wings entirely transparent, while others have dark areas which furnish distinctive characters. In T. sulcifrons dark markings are located at the furcation of the third vein and along the veins at the distal end of the discal cell; when markings are present on the wings of various species of Tabanus it is more common to find them where
Fig. 7.—Wing of a horsefly, Tabanus stygius: I, II, III, IV, V, VI, first, second, third, fourth, fifth and sixth longitudinal veins, respectively; VII, costa or costal vein; VIII, auxiliary vein; IX, humeral cross-vein; X, small cross-vein; XI, posterior cross-vein; XII, anterior branch of the third vein; XIII, posterior branch of the third vein; XIV and XV, second and third branch of the fourth vein, respectively; XVI and XVIII, first and second branch of the first vein, respectively; XVII, basal cross vein; 1, anal angle; 2, alula; 3, antitegula; 4, tegula; 5, axillary incision; 6, axillary cell; 7, 8, 9, first, second and third costal cells respectively, or costal cell; 10, marginal cell; 11 and 12, first and second submarginal cells, respectively; 13, 14, 15, 16 and 17, first, second, third, fourth and fifth posterior cells, respectively; 18, discal cell; 19 and 20, first and second basal cells, respectively; 21, anal cell; 22, humeral cell; 23, small section of the thorax, to which the wing is attached.
the third vein branches and along the veins or parts of veins which are most nearly transverse. Exceptions to this may be seen by reference to *T. venustus* and *turbidus*.

**ABDOMEN.**—The markings of the abdomen in *T. sulcifrons* consist of rather broad white triangles and white posterior margins on most of the segments. These markings are formed by the color and arrangement of the vestiture of the body. This vestiture is easily rubbed off in most specimens, and in case it is rubbed off the appearance of a specimen is much changed and rendered difficult of determination. Therefore care should be used in collecting material which it is desired to determine.

Seven abdominal segments are visible to the unaided eye. The circumference decreases from the second backward, and concealed by the seventh are what may be considered as three very much reduced additional segments, which are easily removed by aid of a needle, and which can only be differentiated satisfactorily by the use of a microscope or strong lense.

**A BRIEF STATEMENT OF THE CHARACTERS OF THE FAMILY TABANIDAE.**

As a usual thing the horseflies are easily recognized at sight by their habits, form and general appearance. The accompanying drawings will serve to get the form and structure of these insects fixed in the mind of the reader. It is the aim to figure nearly all the characters referred to in the text, consequently frequent reference to these figures will be found profitable, in case the names used are unfamiliar or not self-explanatory.

The antennæ are each composed of three segments. The third segment is composed of rings or annulations, but has no style or arista, like that found in the house fly.

Each foot is composed of five segments, and the fifth bears a pair of claws and three cushion-like pads beneath the claws. The two outer of these pads are known as the pulvilli and the middle one as the empodium. Thus the empodia are pulvilliform, as some authors state it.
None of the species are really small; the head is large, larger and hemispherical in the male, smaller and somewhat flattened in the female.

The eyes are separated in the female and united in the male. They have an area of enlarged facets above, in the males of many species, and in living specimens of both sexes are marked with green and purple markings. Simple eyes are present in some species, but in others are absent. The proboscis projects, being much elongated in some species, and the maxillary palps are large and two-segmented.

The wings are rather large and encompassed by the marginal vein, two submarginal and five posterior cells present, basal cells elongate, anal cell usually, and sometimes some of the posterior cells, closed. Abdomen composed of seven visible segments, broad, never constricted.

**KEY TO THE GENERA OF TABANIDAE FOUND IN UNITED STATES.**

1. Hind tibiae with spurs at tip ........................................... 2
   Hind tibia without spurs at tip ........................................ 6

2. Third segment of the antenna composed of eight rings, the first of which is only a little longer than the following ones .............................................. 3
Third segment of the antenna composed of only five rings, the first of which is much longer than any of the following ones.................. 5

3. Front of the female narrow; simple eyes present or absent; fourth posterior cell at least open........ *Pangonia*
   Front of female broad with a large denuded callus; ocelli present ........................................ 4

4. Eyes in the female not acutely angulated above; wing in both sexes hyaline.......................... *Apatolestes*
   Eyes in the female acutely angulated above, wing in both sexes with a dark picture.................... *Goniops*

5. Second segment of the antenna about half as long as the first; eyes in life with numerous small dots........ *Silvius*
   Second segment of the antenna as long as or but little shorter than the first; eyes in life with irregular green patches .................................................. *Chrysops*

6. Third segment of the antenna with a well-developed basal process ........................................... *Tabanus*
   Third segment of the antenna without, or with only a rudimentary basal process........................ 7

7. Front in the female as broad as long, the callus transverse ............................................. *Haematopota*
   Front of the female narrow............................... *Diachlorus*

So far only two of the above genera, *Chrysops* and *Tabanus*, are known from Louisiana, but three others, *Pangonia*, *Silvius* and *Diachlorus*, have been taken in adjoining states. In the United States, *Pangonia* is represented by several species, but *Silvius* and *Diachlorus* are small genera, the former of three and the latter of a single species. It is probable that one or more of the three genera last mentioned will be taken in Louisiana in the future. There should have been more early spring collecting with the species of these genera in mind, so that more definite statements could have been made in regard to them.

THE GENUS *CHRYSOPS*.

Of the 40 species of horseflies collected in Louisiana, 13 belong to the genus *Chrysops*. These flies are medium-sized species with green markings on the eyes in life and usually with wings hyaline and black or brown. It sometimes happens that
the males and females of a species are very different in appearance, but as a usual thing the sexes are so nearly alike that they are quite easily associated, especially when both are taken in the same locality. They are distinguished from members of the genus Tabanus quite readily by their smaller size, but in a few cases size is not a safe guide to follow. In all cases the spines at the end of the hind tibiae and the absence of a process at the base of the third antennal segment are distinctive, and reference to the accompanying figures will aid one in deciding the presence

![Diagram](image)

Fig. 10.—1, wing of Chrysops: E, cross-band; G, apical spot; H, hyaline triangle. 2 and 3, front of the head of male and female Chrysops, respectively: I, frontal callosity; J, facial callosity; K and L, antennæ; M, palpus; O, proboscis. (Note the spotting of the compound eyes, which are shown as seen in the living specimen.)

or absence of these characters. Simple eyes, or ocelli, are present in all species of Chrysops, but are at most only indicated in the species of Tabanus. The coloration of the wing is quite constant in each species, so this is relied upon to a large extent in the following descriptions of the various species. In order to locate these colors properly the names of the cells of the wing are often referred to. These cells have the same appearance and name as in the species of Tabanus, a wing of which, with the veins and cells numbered and named, is figured on a previous page. On ac-
count of the constant pattern of the color of the wing of *Chrysops* it is possible to give definite names to various regions; consequently "cross-band," "apical spot" and "hyaline triangle" are terms often appearing in the descriptions. Reference to the accompanying wing drawing will make these points clear. The color of the abdomen is often referred to, and it will be noted that the abdomen is made up of segments, which are numbered from one to seven, beginning with one next to the thorax.

**KEY TO THE LOUISIANA SPECIES OF *CHRYSOPS*.**

1. Hyaline triangle represented by a small spot mostly in the first submarginal cell. ............................................. *histellatus*
   Hyaline triangle not confined to a small spot, but reaching the posterior border of the wing. ............ 2
2. Whole body brown. ......................................................... 3
   Abdomen and wings marked with clear black... ... 4
3. Abdomen brown with small yellow triangles on the segments above. ............................................. *brunnneus*
   Abdomen pale at base and followed by dark brown; posterior border of each segment pale............. *flavidus*
4. Both basal cells of the wing hyaline. ............................... 5
   First basal cell black................................................ 8
5. Abdomen black with a mid-dorsal yellow stripe... *obsoletus*
   Abdomen not so colored............................................. 6
6. Cross-band of the wing very narrow or lacking altogether .......... *fulvistigma*
   Cross-band of the wing normal, abdominal segments with gray hind borders................................. 7
7. Apical spot narrow, extreme apex of the first submarginal cell black............................................. *callidus*
   Apical spot wider, the greater part of the apical half of the first submarginal cell black.......... *pudicus*
8. Hyaline triangle confined to the apices of the second and third posterior cells............................................. *moechus*
   Hyaline triangle reaching across the first posterior cell. 9
9. Apical spot not reaching beyond the second submarginal cell............................................. *vittatus*
   Apical spot large, invading the first posterior cell..... 10
10. Abdomen with four black stripes........................................ 11
Abdomen not marked.......................... 12

11. Black stripes reaching the whole length of the abdo-
men .......................................... *sequax*

Two middle black stripes entire, two outer ones not
present on the first and second segments........... *pikei*

12. Abdomen with a broad yellow stripe enclosed between
two black areas........................... *univittatus*

Abdomen uniformly black, or black with three yellow
stripes ..................................... *lugens*

DESCRIPTION OF LOUISIANA SPECIES OF *CHRYSOPS*.

*Chrysops bistellatus* Daecke.—Length 8 millimeters.

Face and facial callosities yellow, frontal callus black. First
antennal segment yellow, second and base of third brownish,
annulate portion of the third black. Thorax vittate with light
colored stripes alternating with dark ones. The wing is largely
black, the hyaline triangle being represented by a small spot
located near the furcation of the third vein, mostly in the first submarginal cell. Nearly the
entire first basal, anal and axillary cells are
hyaline, as is the base of the fifth posterior. Legs
with much yellow, anterior tibiae, apices of other
tibiae and all the tarsi brownish. Abdomen
largely yellow, a rather wide mid-dorsal yellow
stripe bounded on each side by a somewhat dif-
fuse black stripe. In the Louisiana specimen
the last two segments of the abdomen are en-
tirely blackish.

The species was described a year or so ago
and was known only from New Jersey before it
was collected by C. W. Flynn at Merryville,
Louisiana, on June 16, 1906. Nothing was
learned regarding the habits of the species ex-
cept that the specimen procured was taken while
biting a horse.

*Chrysops brunneus* Hine.—Length 8-10 millimeters. An-
tennae noticeably longer and the first two segments thicker than
in *flavidus*; first and second segments brown; third yellow at the
base with apical half black; thorax with four grayish longitudi-
nal stripes separated by brown intervals. The apical spot spreads over a large part of the apex of the wing, fading out so gradually that the real extent of it is not clearly defined; a narrow whitish hyaline band is conspicuous along the distal margin of the cross-band and occupies part of each of the first submarginal and first, second and third posterior cells; the cross-band fills out the fourth posterior cell and invades the fifth posterior; the margin of the posterior branch of the fifth vein spreads across the apex at the anal cell and communicates somewhat with the cross-band; the first basal cell is infuscated for two-thirds, and the second for about half the length.

![Fig. 12.—Chrysops brunneus, male and female.](image)

The abdomen is clear brown, often with very small yellowish triangles in the middle of the posterior part of segments two to five.

The male and female are alike, differing only in sexual characters.

The species is separated from *flavidus* by the following: The antennae are longer and have the first two segments thicker and the third colored differently at base. The basal cells are more infuscated, the apical spot less clearly defined and the abdomen more uniformly colored. In *flavidus* the abdomen is distinctly lighter in color at base, but not so in *brunneus*.

It has been reported from Ohio, New Jersey and New York. The past summer specimens were taken at Buras and Cameron, in Louisiana. It is a marsh species where I have observed it, and is one of the most persistent species of its genus. Abundant
at any time of the day, but perhaps most numerous in the evening, and its attacks are prolonged till almost dark in warm weather.

Chrysops callidus Osten Sacken.—Length, 7-9 millimeters. The width of the apical spot is equal to the distance between the costa and the second vein at the distal end of the first vein. First two segments of the abdomen yellow on the sides, and this color on the second is not encroached upon by a black triangle. Basal half or more of the venter of the abdomen plainly yellowish, but with dark stripe or some dark spots on the mid-ventral line.

Female: Frontal callosity black; facial callosity yellow; both basal cells hyaline; dorsally the abdominal segments with narrow, yellow hind margins, which expand into triangles in the middle; none of these triangles extend forward far enough to entirely divide the black of any of the segments. Lateral margins of the segments behind the third black.

Male: Both basal cells with about the apical third hyaline; the yellow on the sides of the first two abdominal segments is more prominent and the posterior margins of all the segments wider than in the male of moerens.

A common fly over most of the eastern part of the United States. Taken at Keachie, Louisiana, May 23, 1906, by J. B. Garrett. Appears to be a spring species where I have seen it, and an important stock pest at that season of the year. The eggs are laid on foliage over water along canals and the margins of ponds. The males have been procured from flowers and swept from vegetation growing near water.
Chrysops flavidus Wiedemann.—Length 7-10 millimeters. First two segments of antennæ yellowish, not noticeably thickened; basal part of third segment yellowish, with an obscure brown band on its thickest part, apical half black; the thorax has four grayish longitudinal stripes separated by brown intervals; the parts of the wing not occupied by brown are grayish hyaline, and not clear, as in most species; the hyaline triangle reaches forward to the middle of the first submarginal cell and includes about half of the second submarginal and parts of the first three posterior cells; the cross-band fills out the fourth posterior cell; the apex of the anal and part of the fifth posterior are infuscated; usually the apical half of the first basal cell and two-thirds of the second basal are hyaline, but some variation is allowable; dorsally the abdomen is brownish, lighter on the first segment and sides of second, and segments two, three and four have a prominent gray triangle in the middle of the posterior part, preceded by a dark area, which usually takes the form of a geminate spot; the anterior margins of the last three segments are black or brown, the dark markings of the abdomen are somewhat variable.

The male and female are alike, except fully half of the second basal cell is brown.

Common over a large part of the eastern United States as far west as Ohio. In Louisiana the species was taken or observed in every section of the State visited. Abundant in Plaquemines Parish the first part of July and plentiful in Rapides Parish the latter part of August. On account of its abundance the species was one of the worst stock pests of its genus observed during my stay in Louisiana. Females were seen laying eggs on leaves of Sagittaria growing in shallow water at Baton Rouge in July.

Chrysops fulvistigma Hine.—Length about seven millimeters. Palpi yellowish, antennæ slender, first segment yellowish, slightly darker at apex, second and third segments brown, annulate portion nearly black. Face shining black, covered next the eyes and on the anterior parts of the cheeks with yellowish gray pollen. Front yellowish gray, pollinose, callosity and region surrounding the ocelli shining black. Thorax dark, nearly black, with grayish pollen above, giving the impression of stripes
before the suture; coxa, basal two-thirds of femur and base of tibia of the anterior leg, and nearly the whole tibia and base of tarsus of middle leg, yellow; remainder of legs dark, nearly black. Wing almost hyaline, costal margin from base to apex and a very narrow cross-band, abbreviated behind, pale brownish, or black in some specimens, stigma conspicuous. Abdomen yellow at the base, black at apex. Dorsally, a large, nearly square, black spot beneath the scutellum, reaching the posterior margin of the first segment. Second segment with a large black triangle with its base on the posterior margin and sometimes encroached upon by a small yellow triangle within it. The remainder of the abdomen above is black, but in some specimens the third segment has a small yellow triangle. Ventrally the first two segments are mostly yellow, the exception being a linear, black spot on each lateral margin, and a suggestion of the same color at middle. The yellow also extends back on to the third segment on each side of the midventral line.


**Chrysops lugens Wiedemann.**—Length 8-9 millimeters. First segment of the antennae yellow, second variable, but usually yellow, third black, face yellow, its lateral callosities black; the hyaline triangle of the wing does not cross the second longitudinal vein; the apical spot includes nearly all of the second submarginal and the apex of the first posterior cells, so that the triangle is narrow and may be said to be lunate; the abdomen is wholly black above or marked on the basal part with three yellow longitudinal stripes.

Female: Frontal callosity black; thorax dorsally with two greenish gray stripes, narrowly separated by brown, first basal cell brown, second hyaline; the cross-band fills out the fourth posterior cell; posterior branch of the fifth vein obscurely margined.

Male: Medium stripes of the thorax more yellow than in the female; second basal, fifth posterior, and anal cells largely infuscated; to the unaided eye a subhyaline streak is visible beginning at the margin of the wing and passing the length of the
fifth submarginal cell into the second basal and thence toward, but not attaining, the base of the cell; this sex is much like the female and easily associated with it.

Known from Maryland, North Carolina, Georgia, Florida, New Jersey, Ohio and other States. Specimens were taken at Keachie, Louisiana, by J. B. Garrett in May and June, 1906. It is variable, especially in the color of the abdomen; thus specimens from different parts of the country, and even from the same locality, when placed together have the appearance of different species mixed up. The wing markings are quite constant, however, and as these are characteristic for the species, it is not difficult to determine. The hyaline triangle is narrow and reaches the second vein, and the outer margin of the cross-band is evenly curved, thus giving the wing a mark by which the species may always be known. I have never seen this species as abundant as I have some others at times, but it can bite severely, and when numbers of the specimens are considered, is as injurious as any other.

**Chrysops moechus** Osten Sacken.—Length 8 millimeters. Hyaline triangle of the wing very small, occupying only part of the second and third posterior cells.

Female: Face, palpi and base of antennae yellow, frontal callosity black; first basal cell of wing infuscated, second hyaline,

![Fig. 14.—Chrysops moechus, male and female. Enlarged.](image)

except a margin along the vein which separates it from the first, the cross-band reaches the posterior margin, filling out the fourth posterior cell; in the fifth posterior cell there is a margin along the posterior intercallary vein, and also along the posterior
branch of the fifth; the apex of the anal cell is slightly infuscated; dorsally the markings of the abdomen are variable, but four longitudinal rows of dark spots are usually visible.

Male: Face yellow, otherwise whole body, including most of the wings, black; the only trace of hyaline in the basal cells is a dot on the fourth vein near the base of the discal cell.

Known from New Jersey, Ohio, Illinois, Kentucky and other states. Taken at Many, Louisiana, June 12, 1906, by C. W. Flynn. The very small hyaline triangle which is confined to the apices of the second and third posterior cells, serves to distinguish the species from others, and also to associate the sexes, which are strikingly different in coloration.

Chrysops obsoletus Wiedemann.—Length 7-8 millimeters. Basal segments of antennæ yellow, second and third segments usually black, although the second is sometimes yellowish; face yellow, its lateral callosities black; thorax above with two medium greenish gray stripes narrowly separated by brown; the hyaline triangle of the wing crosses the second longitudinal vein and in most specimens reaches the costa; the apical spot is confined to the distal parts of the marginal and first and second submarginal cells; the cross-band nearly fills out the fourth posterior cell, leaving only an obsolete margin at its apex.

Female: Frontal callosity black, both basal cells hyaline; dorsally, abdomen black with a yellow mid-dorsal stripe on the first four segments; variations occur in which an additional yellow stripe is present on either side of the mid-dorsal one, and in some specimens the first two segments are narrowly yellow on the sides.

Male: Several specimens of this sex have the first basal cell infuscated and the abdomen black above with the single mid-dorsal yellow stripe; otherwise like the female.

This fly has been taken in many of the states from Maine to Louisiana and west to Kansas. Mr. Wilmon Newell collected it in Rapides Parish in September, 1905, and this year it was procured at Slidell and at LeCompte in July and August, respectively. At the latter place it was common and showed its ability to bite by attacking myself and team continually. According to observations the species is partial to woodland and any animals that visit such places are sure to know of its presence.
Chrysops pikei Whitney.—Length 6-8 millimeters. Face yellow, the callosities infuscated outwardly. First segment of the antennae yellow, second slightly infuscated, the third dark. Thorax black, with well defined greenish yellow stripes. First basal cell infuscated except a small hyaline spot contiguous to a spot in the discal cell; the second basal, anal, axillary and fifth posterior cells are largely hyaline; the cross-band reaches the hind margin, completely filling out the fourth posterior cell. The apical spot extends across both submarginal cells and invades the first posterior. The hyaline triangle does not cross the second longitudinal vein, and is almost as wide contiguous to that vein as at the posterior margin of the wing. Abdomen yellow, with two broad black median stripes the entire length, and two narrow abbreviated lateral stripes beginning on the third segment. The sixth segment is mostly black. Venter yellow, with slender furcate lateral lines and an abbreviated median stripe black.

This species is known from Missouri, Kansas and Ohio. It is very common in different sections of Louisiana, where it has been taken by various collectors. It attacks animals very persistently, and if any of the flies are in a locality they are pretty sure to be found on some horse's ears.

Chrysops pudicus Osten Sacken.—Length 8 millimeters. Face, including its callosities and the palpi, yellow. First two segments of the antenna and base of the third yellow, annulate portion of the third black, frontal callosity reddish with a black margin, thorax vittate in the usual way. Both basal cells of the wing hyaline with the exception of a slight infuscation of each at base, costal cells brown, cross-band reaching the hind margin of the wing, filling out the fourth posterior cell, vein between the fifth posterior and anal cells margined with brown. The hyaline triangle does not reach anteriorly across the second longitudinal vein, the apical spot fills out the greater part of the distal half of the first submarginal cell and extends to the apex of the...
wing. Abdomen largely black, first and second segments yellow on the sides, and on the second the yellow reaches across on the anterior margin. On the middorsal line there is a row of triangles in contact with yellow posterior margins of the segments.

The species is known on the Atlantic coast from New York to Florida, but is not common at any particular place so far as reported. Taken at Frierson, Louisiana, July 14, 1905.

Chrysops sequax Williston.—Length 8 millimeters. First two segments of the antennae yellow, the third black. In many specimens the frontal callosity is black, but in others it is yellow, face, including the callosities, reddish yellow. Thorax with four narrow yellow stripes separated by black ones. The first basal cell of the wing is brown, the cross-band reaches the posterior border of the wing, thus filling out the fourth posterior cell, the hyaline triangle is produced forward across the second longitudinal vein and the apical spot includes the larger part of the apical half of the first submarginal cell, almost all the second submarginal, and invades the first posterior. Abdomen with four narrow black stripes reaching the whole length and separated by yellow intervals of nearly the same width.

The species has somewhat the aspect of univittatus or striatus. It is separated from the latter by the hyaline triangle reaching or slightly transcending the second longitudinal vein, and the apical spot entering the first posterior cell, and from the former by the coloration of the abdomen.

Known from Kansas, North Carolina and New Jersey. Taken at LeCompte, Louisiana, August 25, 1906. I have never seen the species numerous enough to be a pest, but it has been taken from horses, and therefore its habits are similar to its near relatives.

Chrysops univittatus Macquart.—Length 6-8 millimeters. Basal segment of antennae yellow, second a little darker, and third nearly black; hyaline triangle of the wing reaches or nearly reaches the second vein; the apical spot is large, occupying all the marginal cell beyond the cross-band, the broad apex of the first submarginal, all the second submarginal except a small patch at base and the apex of the first posterior; the cross-band entirely fills out the fourth posterior cell.
Female: Frontal callosity black, face yellow, its lateral callosities brown or black; first basal cell brown; second basal cell with a very little brown at base; posterior branch of the fifth vein narrowly margined with brown, abdomen with a middorsal yellow, longitudinal stripe with a black stripe of about the same width on either side of it; outside the black stripes the abdomen may be entirely yellow, or all but the first two segments may be dull black, or there may be a narrow black stripe beginning on the third segment and continuing on to the fourth and fifth segments; the last three abdominal segments are often blackish, obscuring all stripes in that region.

Male: Second basal cell of wing brown on its basal two-thirds and the fifth posterior more brown than in the female; last three segments of the abdomen black, first four with a middorsal yellow stripe, on each side of which is a wider black one; and outside of the latter, on segments three and four, is an additional narrow black stripe. The three specimens of this sex which I have, present no variations. It looks much like the female and is easily associated with it.

The species has been collected in many of the states from Pennsylvania to Louisiana and west at least to Illinois. Taken at Keachie, May 10 and 18, 1906, by J. B. Garrett. In Ohio it is one of the early appearing Chrysops and is noticeable on account of its habit of attacking the ears of domesticated animals. Louisiana specimens are a little smaller than those from farther north, but otherwise there does not appear to be any difference in specimens from this State and from Ohio.

Chrysops vittatus Weidemann.—Length 8-9 millimeters. Face, palpi and base of antennae yellow; thorax dorsally with four bright yellow longitudinal stripes with brown intervals separating them; scutellum yellow; hyaline triangle of the wing rather small, occupying the apical part of the first three posterior cells and extending into the first and second submarginal in the region of the branching of the third vein; a hyaline streak in
the second submarginal cell usually follows the posterior branch of the third vein toward the margin of the wing, but does not reach this margin.

Female: Frontal callosity yellow; first basal cell of wing brown, second slightly infuscated at base, otherwise hyaline, cross-band very nearly attains the posterior margin; the fourth posterior cell, except narrow apex, fifth posterior, except at base and narrow apex and anal at apex, brown, abdomen dorsally with four longitudinal black stripes; the two inner are pale on the first segment and the two outer on the first and second segments; ventrally yellow, darkened at apex, and on either side with two narrow dark lines abbreviated before.

Male: Like the female, except the second basal cell of the wing has only the apical third hyaline.

Widely distributed over eastern North America as far west as Kansas and Iowa. In Louisiana it has been collected in nearly all sections of the State and at various dates from June 1 to September 10. At Lecompte, in Rapides Parish, the past summer the fly was exceedingly abundant and troublesome August 25, when observations were made in that region. It is rather large in size for a member of its genus, and the females are often seen on horses and cattle with their abdomens filled with blood to their utmost capacity. In such condition they are not able to fly well, and they either drop to some low growing plant that the animal passes, or fly off for a short distance and alight on a leaf or some other object, where they remain until their bounteous meal is digested.
THE GENUS TABANUS.

The species of this genus are of variable sizes. Thus some are only about the size of members of the genus Chrysops, while others may reach a length of over an inch, with a wing expanse of as much as two inches and a half. The structure is very near the same in the different forms, but some variation is apparent in the shape of the third antennal segment and in the width of the front in the females. In all cases there is an apparent enlargement or process at the base of the third antennal segment above, and the hind tibia never bears spines at its apex. These last two characters always serve to distinguish these insects from those of the genus Chrysops, although they are not often needed, for the larger size is generally sufficient for the purpose. Color, considered together with its distribution and arrangement, is of the utmost importance in separating the various species, but there is some variation in this, so it cannot be depended upon entirely in all cases. The difference in size is used with good results in most cases, but it must be remembered that specimens of the same species may have quite a range in this regard, so size, when used entirely alone, is a little risky. From the above statements it is apparent that no one character is sufficient as a means of locating species throughout the genus, but if all these characters are considered not a great deal of trouble will result from an attempt to put specimens in their proper places.

The females of all the species known are thought to be bloodsucking when the opportunity presents, but there seems to be no doubt but that almost any of them may procure their food from plants or from excretions of insects, especially of the order Hemiptera. The larger specimens take more blood from an animal at a single meal, but it is doubtful if they cause much more pain in biting than do the smaller ones. The rank of a species in regard to its injuries depends largely upon its abundance, and as some of the medium-sized horseflies are the ones that appear in greatest numbers, they are of the most importance from an economic standpoint. However, when once the adult state is reached economic treatment requires scarcely any attention to species, for all may be put in together and counted as so many horseflies. With the immature stages it is different, for there is often variation in the location of the eggs and the con-
ditions under which the larvae are found. There is much to find out about the immature stages of many species of horseflies, but what is known is sufficient to prove that the different species are variable in habits, and that it is necessary to consider each species separately, at least until it is proven that certain ones may be grouped together on account of similar life histories.

The genus *Tabanus* has many representatives in all the Southern States where careful collecting has been done, and the fact that twenty-seven species have been taken in Louisiana so far simply proves that it is no exception to the general rule. The diversified topography of the State is favorable to a large variety of species.

**KEY TO THE LOUISIANA SPECIES OF THE GENUS *TABANUS***.

1. Whole body, including the wings, black ......................... 2
   The wings, at least, not black .................................. 4
2. Front of the female unusually broad, callosity transverse ............................... *striatus*
   Front of the female not unusually broad, callosity not transverse .............................. 3
3. Narrow portion of the third antennal segment very long; shining species ..................... *lugubris*
   Narrow portion of the third antennal segment not very long; not especially a shining species ........................................... *wiedemanni*
4. Body entirely pale, as if faded ............................... *mexicanus*
   Body not having a faded appearance .................................................................................. 5
5. Abdomen black or dark brown, without stripes or spots ................................................. 3
   Abdomen not so colored .................................................................................................................. 7
6. Wings smoky, more intense spots on the cross-veins and on the furcation of the third vein ........................................... *benedictus*
   Wings hyaline, with the costal border clear brown ......................................................... *americanus*
7. Wings spotted or clouded with black or brown ................................................................. 8
   Wings hyaline except sometimes the costal border infuscated .............................................. 17
8. Wing spots extensive, giving the wing a variegated appearance ........................................ *venustus*
Wing spots confined to the margins of the veins and furcation of the third vein ........................................ 9

9. Eyes distinctly hairy ...................................................................................................................... megerlei
   Eyes not hairy .............................................................................................................................. 10
10. First posterior cell closed ........................................................................................................... abdominalis
    First posterior cell open .............................................................................................................. 11
11. Abdomen above with a wide middorsal gray stripe ................................................................. acutus
    Abdomen not so colored .............................................................................................................. 12
12. Prevailing color of the whole body gray .................................................................................. cymatophorus
    Prevailing color of the whole body not gray ............................................................................... 13
13. Antennae entirely black, dark colored species .......................................................................... 14
    Antennae partly or wholly red, lighter species ........................................................................... 15
14. Three white triangles on the abdomen ..................................................................................... trimaculatus
    Four abdominal triangles and posterior margins of the segments white .................................. molestus
15. Front tibia brown ....................................................................................................................... fronto
    Front tibia gray on basal half ...................................................................................................... 16
16. Abdominal triangles of the female of moderate size ................................................................. exul
    Abdominal triangles of the female large and distinct ................................................................ sulcifrons
17. Abdomen with a single middorsal row of gray triangles ......................................................... 18
    Abdomen not so marked .............................................................................................................. 19
18. Prevailing color of the tibiae black ............................................................................................ coffeatus
    Prevailing color of the tibiae gray ............................................................................................. melanocerus
19. Abdomen banded, but with no stripes or spots ........................................................................ annulatus
    Abdomen with stripes or spots, or both ....................................................................................... 20
20. Abdomen with a middorsal row of unconnected triangles, with a row of rounded spots on each side ........................................................................ pumilus
    Abdomen with a middorsal stripe or row of connected triangles with a stripe or row of spots on each side ........................................................................ 21
21. Eyes in life with a single purple band. (The color of the eyes in dry specimens may be revived by moisture obtained by a few hours in a relaxing dish.) ................................................................. 22
    Eyes in life with more than one purple band ............................................................................... 24
22. Abdomen prevailing dark brown, with a regular middorsal gray stripe and a disconnected row of rounded spots on each side ...................................................................................... fuscicostatus
Abdomen with a middorsal gray stripe, with a dark brown stripe on each side, followed by yellowish. 23

23. Face whitish, thorax gray, hind tibia faintly brownish at tip .................. *nigrovittatus*
Face yellowish, thorax grayish yellow, hind tibia distinctly black at tip .................. *costalis*

24. A longitudinal row of unconnected grayish spots on each side of the abdomen above .................. 25
Abdomen not so marked .................. 26

25. Upper angle of the third antennal segment prominent, front narrow, narrowest below ............... *fulvulus*
Upper angle of the third antennal segment nearly lacking, front of normal width with sides parallel ...... *sagax*

26. Abdomen with a middorsal gray stripe with a longitudinal row of connected angular spots on each side... *lineola*
Abdomen with a middorsal gray stripe with a brown stripe on either side and these latter followed by yellowish, either diffuse or in the form of stripes .................. *quinquevittatus*

DESCRIPTION OF LOUISIANA SPECIES OF *TABANUS*.

*Tabanus acutus* Bigot.—General color, light brown; first two segments of the antenna and the base of the third light brown, apex of the third darker; wings wide, light brown and with a small dark spot at the furcation of the third vein; legs concolorous with the body, apex of each anterior tibia and all the tarsi darker; abdomen light brown, a little darker toward the apex, with a middorsal, wide, gray stripe extending for the whole length.

Female: Length 15-19 millimeters, head rather small, face and front clothed with yellowish pollen, front of normal width, sides parallel, frontal callosity large, shining chestnut in color, inferiorly not quite so wide as the front, narrowed slightly above and with a connecting line extending more than half-way to the vertex, abdomen elongate, conical, gradually narrowed toward the apex.
Male: Length 14-16 millimeters, head rather small, hemispherical; abdomen quite noticeably narrowed to two-thirds of its length, sides nearly parallel from thence to apex.

The species was described from a specimen procured near New Orleans. The past summer several males and females were taken along the Mississippi River below that city and a single female at Cameron, near the Gulf Biologic Station. Several of the specimens were taken from near the rear end of a moving train, one from the rigging of a passenger boat, while two females with their abdomens already filled were observed biting horses.

**Tabanus abdominalis Fabricius.**—Length about 20 millimeters, although some specimens are larger and some are smaller. Palpi and proboscis dark, almost black; antenna dark at base and apex, basal portion of the third segment red; face and front clothed with yellowish pollen, front rather narrow, frontal callosity rectangular, shining black and with a narrow line above. Thorax striate, wings reddish brown with the margins of the cross-veins and the fureation of the third vein decidedly darker; legs prevailing black in color, but all the tibiae are reddish at base; in fact, the middle and posterior tibiae are black only at extreme apex. Abdomen somewhat variable but more reddish than the thorax. In some specimens the abdomen is almost uniformly red, while in others there is a predominance of black or dark brown. In the latter there is a light triangle on the posterior part of the dorsum of each segment, expanding into a posterior border of the same color. Although the two kinds of specimens have a different appearance, there does not seem to be any difference in other regards than the one mentioned, and even here there is a gradation which indicates that they are inseparable.

Very close to *exul* and *sulcifrons*, but the closed first pos-
terior cell serves to distinguish the species from these as well as from some others that are somewhat like it.

Distributed from Illinois to New Jersey, southward to Florida and westward to Kansas. Taken in Louisiana, at Merryville, June 16th, by C. W. Flynn, at Baton Rouge July 6th by E. C. Cotton, and at Newellton August 15th.

Mr. C. W. Flynn observed the following conditions while driving from Singer to Merryville on June 16th: "Whenever a branch or ravine was crossed, the horseflies would simply swarm about the team. The species of Chrysops were chiefly of vittatus, flavidus and pikei. Specimens of each of these were taken, and one or two others were noted but not taken. Of the genus Tabanus, americanus was decidedly the most abundant and annoying. This species would dart around the horses once or twice so swiftly that they could hardly be seen and then alight suddenly and begin sucking immediately. Next in abundance was abdominalis, several specimens of which were taken. Two specimens of lugubris were procured from horses and mexicanus was seen but not taken.

Tabanus Americanus Forster.—Length 25-30 millimeters. The largest species of horsefly in North America. Body uniformly reddish, thorax and abdomen with gray bloom. Face and front yellowish, frontal callosity shining brown. Antenna with a very prominent basal process, largely reddish in coloration, although the annulate portion is usually somewhat darker. Side of the thorax with hair near the base of the wing. Legs very near in color to the dorsum of the thorax, wing hyaline with the costal cells and stigma brown. The male does not differ from the female except in sexual characteristics.

Common over much of southeastern United States, at least as far west as Missouri. In Louisiana it is widely distributed and no locality was visited the past summer where it was not in evidence. I have never seen it so numerous as many of the other species
which are smaller in size. Its bites are severe and it is one of the species which is found in the cleared fields as well as in the woods, and in driving along country roads the team is often attacked.

**Tabanus annulatus** Say.—Length 12-14 millimeters. This insect has an immature appearance in all cases. Proboscis dark, nearly black, palpi pale and clothed with white hairs; antennae uniformly pale brownish, third segment with a well developed angle above. Thorax gray without stripes, wings hyaline, front leg with femur, apex of tibia and tarsus nearly black, basal two-thirds of tibia pale, apex of each tarsal segment dark; hind leg colored like the middle, except the femur seems to be a little darker, at least in some specimens.

Female: The front is narrow, and what in other species is called the spindle shaped lines unite to form a very narrow raised line of nearly uniform width reaching nearly to the vertex. Abdomen brown with a gray posterior border to each segment.

Male: Head not much larger than in the other sex, area of enlarged facets distinct and extending nearly back to the occiput above. Thorax and abdomen clothed with a thick coat of long white hair, which almost entirely obscures the ground color of the body. This coating of white hair gives the male a very different appearance from the female, but in other respects the two sexes are much alike. The annulations of the abdomen, from which the insect is named, are not to be seen in this sex. The male of the species was unknown up to this time.

The species is known from Missouri, Kentucky, Georgia and Kansas. In Louisiana it is rather common, if one may be allowed to judge from last summer’s observations. It was taken often from horses and from the rear of moving trains. The under parts of animals appear to have most attractions for the species, and it flies so quietly that oftentimes it has alighted and commenced sucking before its presence is made known, and often much effort is required on the part of an animal to dislodge it.

Nothing was learned of the habits of the species in its immature stages, but a few things observed perhaps warrant a sug-
estion. Mr. C. W. Flynn procured a male and a female from a large breeding cage at Keachie on June 7th, under conditions which seem to indicate that the larvae must live in rotten logs and the like. The only way the specimens could have gotten into the cage is as follows: "The larvae may have been in the ground beneath the cage or they may have been in decaying logs which were put into the cage on account of some experiments concerning the hibernation of the cotton boll weevil. As the cage mentioned had stood in the same place during the previous year, the first means is improbable, so from what remains it is quite likely that the larvae were in the logs in question." Again I took a male specimen that was teneral and scarcely able to fly, several rods from water where it was crawling on foliage very close to an old log heap, thus arousing my suspicion that the specimen had emerged in the immediate vicinity. The species was taken in all the localities visited north of the Gulf coast region and was most abundant in woodlands.

**Tabanus atratus** Fabricius.—Length 16-28 millimeters. The male and female of this common species are easily associated, as they differ only in sexual characteristics. The whole insect is uniformly black and the thorax and abdomen in well pre-
served specimens are thinly covered with whitish dust, which is easily rubbed off when specimens are not properly cared for.

The smaller specimens resemble *wiedemanni* very closely. The wider front, the longer basal process of the third antennal segment, the shape of the frontal callosity, which is square in *wiedemanni* and wider than high in *stiatus*, are distinctive characters. Its much larger size and less shining color distinguish it from *lugubris*.

The black horsefly was observed in every locality in Louisiana visited, and it is indigenous to a large part of eastern North America. Like the American horsefly, it is often seen in the cleared fields and does not appear in enormous numbers, as is the case with *costalis* and its allies.

**Tabanus benedictus Whitney.**—Length 20-25 millimeters. A large horsefly related to *nigrescens* of the Atlantic coast states, and appearing somewhat like *atrus*. The general color of the whole body dark brown and the abdomen is furnished with a thin coating of gray dust which gives it an appearance like the same part in *atrus*. Wings a little brownish, but nearly hyaline, with darker markings on the margins of the cross-veins and at the furcation of the third vein. Legs nearly black, slightly
lighter on the base of each tibia. The two sexes are alike in coloration and easily associated. The first posterior cell of the wing is closed or much narrowed, by which character the species is characterized.

The species has been reported only from Missouri and Louisiana. In the latter state specimens have been taken at Crowley, Montgomery, Frierson, Baton Rouge and Newellton, but so far as my information goes, is not particularly numerous in individuals in any case.

*Tabanus coffeatus* Macquart.—Length 13 to 14 millimeters. General color black, but with the thorax with white stripes and with middorsal row of white triangles on the abdomen. Front of normal width with the sides nearly parallel, frontal callosity rectangular with a line above, all shining dark brown; face clothed with white hair, palpi slightly darkened, antennae and proboscis black. Thorax plainly marked with white and black alternating stripes. Wings nearly hyaline, sometimes with a very small dark spot at the furcation of the third vein and with a distinct brown stigma, first posterior cell wide open. Legs black. Abdomen black with white posterior borders, which expand into triangles at the middle, on the segments. The last two segments are usually entirely black. The male of this species was not procured, but is said to resemble the female, although the white markings of the abdomen are reduced.

The species is reported from Massachusetts southward, and as far west as Indiana. In Louisiana two specimens were taken from a horse August 25, 1906, at LeCompte, in Rapides Parish. I have never heard of its being abundant enough to become a serious pest, but its habits suggest that it is very persistent in its attacks upon animals, so if abundant would call for more than ordinary attention.

*Tabanus costalis* Weidemann.—Length 12-14 millimeters. Palpi yellowish, antennae brownish with the annulate portion darker; thorax, including the scutellum, uniformly grayish yellow pollinose; legs largely black, base of front tibiae and the mid-
dle and hind tibiae except at apex yellowish; wings hyaline with the costal cells yellowish, veins yellowish; abdomen above alternately striped with black and grayish yellow.

Female: Frontal callosity black, above with a very much narrowed prolongation, the part of which adjacent to the callosity is sometimes obliterated, leaving the upper part as a separate spot.

Male: This sex is much like the female and easily associated with it, but there is a tendency toward obliteration of the distinct markings of the abdomen, the black of the female is replaced by brownish and the stripes may blend so that the whole base of the abdomen is practically one color.

![Fig. 24.](image-url)

Reported for eastern North America in general. In Louisiana taken at Buras and Cameron and at a number of other points, especially along the Gulf coast. Its group comprises the most annoying and injurious species of the family because the various forms become so abundant in individuals in certain localities.

**Tabanus cymatophorus Osten Sacken.**—Length 20 millimeters. Some specimens smaller. General color gray with dark colored legs and spotted wings. Front gray, frontal callosity and line above shining black, antennæ and palpi dark, third segment of the antennæ reddish at base; eyes bare. Thorax gray with lighter, not plainly marked, stripes; legs black with all the tibiae light on basal parts; wings hyaline with distinct dark margins to the cross veins and furcation of the third vein; abdomen mostly gray, only the anterior border of each segment
dark. The species is distinct, somewhat resembling *reinwardtii*, but the latter has hairy eyes and so far has not been taken in Louisiana.

Known from Illinois, Kentucky and Georgia. Taken near Crowley, Louisiana, in June, 1905. Not known to be abundant in any locality.

**Tabanus exul Osten Sacken.**—Length 18 to 20 millimeters. Much like *abdominalis* described above. The first posterior cell is open, but much narrowed at the apex, front broad, frontal callosity of corresponding width. The gray triangles on the abdominal segments are more distinct than in *abdominalis*, but not so large as in *sulcifrons*. These three species are often mixed in collections, and it is a fact that when specimens from many localities are brought together the task of determination is not an easy one, for there appears to be some variation according to locality. Specimens that appear to be typical are at hand from Frierson, Louisiana, taken in July, 1905.

Osten Sacken reported specimens from New Jersey, Pennsylvania, Maryland and the District of Columbia, and it has been identified from a number of localities since.

**Tabanus fronto Osten Sacken.**—Length 16-18 millimeters. General color brown with the posterior border of each abdominal segment lighter, legs and antennae reddish, and wings brownish, darker on the margins of some of the veins. Front rather wide, frontal callosity wide, rectangular and with the line above shining reddish. Antennae and palpi mostly reddish, face clothed with dull yellowish pollen. Thorax brown, striped with gray, legs reddish with darker tarsi. Veins of the wings margined with brownish, cross-veins and furcation of the third vein margined with dark brown, almost black, middle part of some of the cells of the wing almost hyaline. Each segment of the abdomen brown, or nearly black in front, with the posterior margin yellowish and expanding into a small triangle at the middle.
Known from the Carolinas, Florida and Texas. Taken in Louisiana in 1905.

**Tabanus fulvulus Wiedemann.**—Length 15 to 18 millimeters. Front narrow, narrowest before, frontal callosity small, shining brown and not connected with the line above; antennae reddish with the exception of the annulate portion of the third segment, which is black, basal process of the third segment of the antennae prominent. Thorax yellowish, unstriped; legs largely reddish, but usually the bases of the femora and the tarsal segments are partially blackish; wings hyaline, costal border dilute yellowish and stigma distinctly brownish yellow. Ground color of the abdomen dark brown, a dorsal stripe, narrow posterior margin of each segment and a row of rounded spots on each side gray.

Known from New Jersey and Kentucky southward in eastern United States. Taken at Baton Rouge, New Roads, Keachie, Crowley and at several other points in Louisiana. Specimens were observed to be plentiful at one or two places visited and it appeared to be characteristic of them to attack the under parts of animals. When they once alighted they were difficult to dislodge and one could easily put the cyanide bottle over them while they were engaged in procuring blood.

**Tabanus fuscicostus Hine.**—General color fuscous; front of normal width, yellowish gray in color, sides nearly parallel, frontal callosity brown, nearly square and with a line, usually unconnected above, antennae rather long, basal segment slender, third segment with a well defined basal process above and with the annulate portion black or at least dark, palpi white, proboscis black; face, sides and ventral part of the thorax clothed with white pollen and pile; disc of the thorax gray, unstriped; legs reddish in general coloration, all the femora often cineros on basal part, apical part of each anterior tibia and all the tarsi brownish; wing hyaline with the costal cell dark, fuscous in most specimens; abdomen with a distinct middorsal stripe which has
a tendency to increase slightly in width at the posterior border of each segment, and a row of spots on each side. Length of the female 10-15 millimeters.

Type locality Baton Rouge, Louisiana, but specimens are at hand from various parts of that state. From dry specimens the species can easily be placed under *sagax*, for the color of legs and abdomen are right for that, but when the living specimens are studied it is found that the eye is crossed by only a single purple band, which, with the colored costal cell, would denote relationship with *costalis*. The male was not procured.

Common in wooded areas, and in such places one of the most abundant and persistent species observed in the localities where it was present. It belongs to the *costalis* group, most members of which are of more than ordinary importance from an economic standpoint.

**Tabanus lineola** Fabricius.—Length 12-15 millimeters. Palpi white, antennae reddish, annulate portion of the third segment darker; thorax brown and gray striped, the latter color not prominent; wings hyaline; legs reddish, apex of the front tibia plainly, apices of middle and hind tibiae faintly, and all of the tarsi dark brown; abdomen above brown or black with three prominent gray stripes.

The males and females of this species are easily associated. In the latter sex there is sometimes a confusion of colors; the dark is replaced by reddish, but the gray middorsal stripe is always prominent in all well preserved specimens.
Common in eastern North America and known from as far west as Arizona. During the time I spent in Louisiana it was among the first species to be taken in each locality visited. It often appears in large numbers and at such times is to be considered among the worst of its family.

Tabanus lugubris Macquart.—Length 12-14 millimeters. Entirely black all over, including the wings. Front wide with a prominent shining black callosity, upper part gray pollinose. Subcallus, region of the antennæ and the face shining black; antennæ located on a slight prominence, the third segment long with a distinct angle above at base. The shining black color of the thorax and abdomen is distinctive.

Known from South Carolina and Florida. Taken at Merryville, Louisiana, June 16, 1906, by C. W. Flynn. Two specimens were collected from horses.

Tabanus megierlei Wiedemann.—Length 18 millimeters. Front of normal width, dark in color; callosity shining black; antenna black with the exception of the base of the third segment, which is red, basal portion of the third segment with a prominent projection above; palpi and proboscis black; eyes distinctly hairy, even in the female. Thorax dark colored, but with narrow gray stripes above; legs black with the exception of the tibiae, which are largely reddish; wings hyaline with dark dots on the cross-veins and furcation of the third vein, costal cells distinctly brown. Abdomen reddish, with a broad, black stripe in the middle, somewhat narrowed on the second and third segments.

Known from Florida. Taken on the Experiment Station farm at Calhoun, Louisiana, April 7, 1905, by Mr. Wilmon Newell. Collected from a mule.

Tabanus melanocerus Wiedemann.—Length 15 to 18 millimeters. Front narrow, callosity elongate and shining black, antennæ black, palpi pale with black hairs; thorax gray with lighter gray stripes above, wings hyaline, prevailing color of the legs black, front tibiae gray on basal half, other tibiae reddish except at extreme apex. Abdomen nearly black, although in most specimens there is a reddish tinge, first segment with a white spot beneath the scutellum, second to fifth segments each with a dis-
distinct white triangular spot which almost reaches the anterior border, sixth and seventh segments usually black, although the former may have a white triangle of small size. Center of the abdomen reddish except the last two segments, which are largely black. In all the Louisiana specimens taken the first posterior cell is closed and petiolate, but this is not the case in specimens from some other states, although this cell is always distinctly narrowed at the apex.

Known from many of the Atlantic States from New Jersey southward. In Louisiana taken at Morgan City, July 17th, and at Lecompte, August 25, 1906. Taken from horses in every case.

**Tabanus mexicanus Linnaeus.** Length 13-15 millimeters. This specimen cannot be confused with any other in the United States. The whole body is pale yellowish, slightly tinged with greenish. Wings hyaline with the costal border of the same color as the abdomen, legs also concolorous with the body. Front in the female narrow without callosity. Head in the male very large, with an extensive area of enlarged facets.

This peculiar species appears to be common, but as it flies mostly in the evening or early morning and remains in hiding during the day, it is not often seen. It was taken from cows a number of times so late in the evening that it was seen with difficulty. Also taken a few times in dark woods in the daytime.

Known from New Jersey southward to Brazil. Taken in Louisiana at New Roads, Baton Rouge and other places in June and July.

**Tabanus molestus Say.**—Length 18-20 millimeters. Front rather wide, callosity and line above shining brown, antennæ
usually black, but some of the segments may show a trace of reddish. Ground color of the thorax brown, but with gray stripes above and clothed with white pubescence beneath; legs usually uniform brown in color, but somewhat variable and in some specimens decidedly darker than in others; wings subhyaline, veined brown and with brown margins to the cross-veins and furation of the third vein, stigma distinctly brown. Ground color of the abdomen brown, darker in some specimens than in others; posterior margin of each segment gray and expanding at the middle to form a spot of triangle. These triangles are large on the third, fourth and fifth segments, but smaller on the other segments; in some specimens almost lacking. Male not differing from the other sex except in sexual characters.

Known from New Jersey to Kansas and southward. In Louisiana taken in various localities, mostly in the central and northern parts of the State. It has not been taken later than June 20th, although it may occur later.

**Tabanus nigrovittatus** Macquart.—General color similar to *costalis*; antenna reddish, first segment slender; third segment with an angle above, annulate portion black, slightly longer than the basal; thorax gray with a faint yellowish tinge; abdomen black in ground color, except each side of the first three segments, which is red, a gray middorsal stripe and on the last three or four segments indications of gray lateral stripes; wings hyaline with the costal cell dilute yellowish; extreme apices of all the femora, basal part of anterior tibia and all except the extreme apices of the other tibiae yellow, otherwise legs dark brown or black.

Female: Length 9-11 millimeters, front clothed with gray pollen, sides parallel, callosity nearly square, shining and with a line above.

Male: Length 11 millimeters, head small with only a few large facets on the disc of each eye.

Known from several of the Atlantic States. Its occurrence in Louisiana is based on a specimen taken at Buras, Plaquemines
Parish, in July. Although it is to be expected that the species is indigenous to the State, the specimen in question is not typical and further collections are necessary in order to be exact.

Much like costalis, but usually smaller. The thorax is less yellowish in coloration and the hind tibia is brown at tip, instead of black as in costalis.

**Tabanus pumilus** Macquart.—Length 8-10 millimeters. First segment of the antennæ and annulate portion of the third black, thorax black with distinct gray stripes, wings hyaline; abdomen above black with narrow gray margins to the segments, a middorsal row of gray triangles, each in connection with the posterior margin of its segment, and on either side of this row of triangles a row of small, nearly round gray spots, none of which touch either margin of the segments.

Female: Front distinctly wider above, frontal callosity shining black, nearly square and occupying nearly the whole width of the front. Abdomen sometimes reddish on the sides.

Male: Head large, the division between large and small facets well marked, and there is a striking difference in the size of the facets. The abdomen in some specimens has a suggestion of reddish on the sides.

Known from the Middle and Atlantic States and southward. In Louisiana, taken at Shreveport, Frierson and Logansport.

In appearance very much like *fratellus* of the Northwest, and *sparus* described from New Hampshire. In the latter species the gray spots on the sides of the abdomen above are larger, and on the second and third segments are broadly contiguous with the hind margin. The third antennal segment is noticeably narrowed in *fratellus*, while in *pumilus* it is wide, with a distinct basal process.

In the field this species has habits much like a *Chrysops*, for it persists in its attacks on the collector. Specimens are easily
taken with the net at such times. It is often observed annoying horses and cattle.

**Tabanus quinquevittatus** Wiedemann. — General color much as in *costalis*. Head large; first segment of the antenna somewhat enlarged and furnished with short black hairs above, third segment rather wide, basal portion red and with a well defined angle above, annulate portion about as long as the basal; thorax yellowish gray; wing hyaline with a small yellow stigma; front legs black with the exception of the basal parts of the tibiae, which are yellow, apices of femora of the other legs, tibiae and metatarsi of the middle legs, and tibiae except apices, and the metatarsi of the posterior legs yellow, other parts brown.

![Fig. 33. — Tabanus quinquevittatus: a, female; b, male; c, front of head of female. Enlarged.](image)

Female: Length 13-16 millimeters, front of normal width, slightly narrowed below, callosity shining black and nearly square; abdomen above with the margin on each side and three stripes yellow, intervals between the yellow dark brown or black.

Male: Length as in the other sex, head very large, area of enlarged facets extensive, a narrow band of small facets next the occiput above; abdomen somewhat variable; the middorsal stripe well marked and margined with fuscous on either side, remainder usually pale yellowish without well defined markings.

Known from Louisiana, Texas and Mexico. In Louisiana it is common along the Gulf Coast, having been taken at Buras and at Cameron. In appearance much like *costalis* and its relatives. At Cameron it is one of three species which are common and which are much alike in appearance. The following differences were noted:
Tabanus costalis has the stripes on the sides of the abdomen continuous, the front border of the wing is brown and in living specimens the eye is green crossed by a single purple band. Tabanus lineola has the markings on the sides of the abdomen in the form of a series of elongate spots which do not form continuous stripes; the wings are hyaline all over and the eyes each have other purple markings besides the single band. Tabanus 5-vittatus is the largest of the three. It has the abdomen almost as in costalis and the wings as in lineola. The color of the eyes in living specimens is of the same pattern as in lineola, but the purple markings are not so extended.

Tabanus sagax Osten Sacken.—Length 12 to 15 millimeters. Front of normal width, frontal callosity dark, shining; antenna reddish except the annulate portion of the third segment, which is black, basal segment with a very blunt angle; thorax above yellowish pollinose, beneath with gray hairs, wings hyaline with the costal cells yellow; legs mostly red, apex of front tibia and the tarsus black, other tarsi beyond the apex of the metatarsi black. Abdomen brown in ground color, a rather wide middorsal stripe with a row of rounded spots on each side and very narrow posterior margin of each segment gray or at least yellowish. Eyes in life crossed by more than one band.

Known from Illinois, Minnesota, Massachusetts and New Jersey. Taken in Louisiana at Shreveport, June 14, 1905, by Wilmon Newell; Frierson, July 14, and Logansport, Sept. 6, 1905, by J. B. Garrett.

The species is much like fulvulus, but the wider front and the lack of a prominent angle at the base of the third antennal segment are distinctive. Separated from fuscicostatus in having more than one band on the eye in life. Louisiana specimens are somewhat smaller than specimens from the Northern States.

Tabanus sulcifrons Macquart.—Length 18 to 21 millimeters. Palpi brownish, antenna nearly black with the third segment brownish at base; legs dark, bases of tibiae darker; wings with a distinct brownish tinge, cross-veins and furcation of the third vein margined with brown.
Female: Front with parallel sides, frontal callosity shining brown, not quite as wide as the front, nearly square and with a linear prolongation above. Segments of the abdomen above with prominent gray hind margins, which expand into large gray triangles in the middle; usually a black mark on the anterior part of each of the second and third segments at the apex of the gray triangle.

Male: The division between the large and small facets of the eye prominent; head slightly more convex than in the female, but nearly of the same size, coloration of the whole body the same as in the female.

Known from Pennsylvania, Ohio and Illinois and southward. In Louisiana taken at LeCompte, Logansport, Keachie and Newellton. Specimens taken in August, September and October.

This species is very near *exul* and *abdominalis*. The large, gray, abdominal triangles are characteristic of *sulcifrons*. In
abdominalis the first posterior cell is closed, and the front in the female is noticeably narrowed. In exul the head of the male is sub-hemispherical and the abdominal triangles are moderate. At times this species is so abundant that it is one of the worst of stock pests.

**Tabanus trimaculatus Palisot de Beauvois.**—Length 16-19 millimeters. Antennæ dark, nearly black, palpi yellowish; thorax dorsally with whitish pollinose stripes and brownish intervals, scutellum uniformly whitish pollinose; legs black except base of all the tibiae, which are white; wings hyaline, costal cell brown, bifurcation of the third vein, cross veins and sections of veins that have a transverse direction margined with brown; abdomen dorsally black with a large white triangle in connection with the middle of the posterior margin of each of the segments three, four and five; abdomen ventrally white on the sides and a wide black median strip.

The male and female differ only in sexual characteristics.

Known from the Middle and Southern States west to Kansas and Oklahoma. In Louisiana, taken at LeCompte, August 28, 1906. Two specimens taken from a driving horse.

**Tabanus venustus Osten Sacken.**—Length 13-15 millimeters. Antennæ and palpi brownish, thorax with white stripes and brown intervals, scutellum uniformly whitish pollinose; wings variegated with brown and hyaline as follows: Base hyaline as far out as the humeral cross-vein, beyond this a brown band extending from the costa to posterior margin and occupying about half of the anal cell, then follows a shorter band partially confluent with the former and surrounding the cross-veins which close the basal cells, the brown apex of the marginal cell is confluent across the first submarginal with the prominent brown spot at the bifurcation of the third vein, the transverse veins closing the discal cell are broadly margined and a lighter brown space follows the posterior border of the wing to its apex, where it unites with the darker brown in that region.
Female: The posterior margins of the abdominal segments above are gray and expand into prominent triangles in the middle of segments two, three and four. In the middle of the venter is a wide brown stripe bordered on each side by lighter.

Male: This sex is like the other except the dorsal markings of the abdominal segments are extended laterally and give the appearance of wide posterior margins.

Known from Texas, Kansas, Oklahoma and Ohio. In Louisiana, taken at Logansport, LeCompte, Crowley and at several other places.

**Tabanus Wiedemann Osten Sacken.**—Length 20 millimeters. Black all over, including the wings and legs, and in appearance much like small specimens of the black horsefly, *T. atratus*. Separated from that species by the front of the female, which is much narrower. The frontal callosity is elongate and not transverse, as in *atrus*. The species is larger than *lugubris* and not so shining. The wings are not so dark toward the apex as at the base, and there is a larger spot at the furcation of the third vein.
