

AN ABSTRACT OF THE THESIS OF

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Title: THE TABANIDAE (DIPTERA) OF OREGON

Abstract approved: Redacted for privacy  
John D. Lattin

Fifty species and subspecies and six varieties in eight genera of the family Tabanidae are recognized from Oregon. The following genera are represented in Oregon: Apatolestes Williston, Pilimas Brennan, Stonemyia Brennan, Silvius Meigen, Chrysops Meigen, Atylotus Osten Sacken, Hybomitra Enderlein and Tabanus Linnaeus. Adults and larvae were collected from various parts of Oregon. A Malaise trap baited with carbon dioxide gas was used for the collection of adults. Materials in the collections of Oregon State University and other institutions in and outside Oregon were examined.

General information on the biology and morphology of the various life stages are presented. Zoogeographical information, as given here, includes distribution and analysis of the Oregon fauna. Over 3,000 specimens were examined. A description of each species is given together with label data of examined specimens, a discussion of the taxonomy, distribution and immature stages.

Difficulties were encountered with some species of Hybomitra, including H. sonomensis (Osten Sacken) and H. fulvilateralis (Macquart). The status of these species is not clear since some of the characters used in the separation of tabanid species are subject to considerable variation. This problem is discussed in the conclusion

of this study and under each appropriate species.

Tabanus fratellus Williston is removed from the subgenus Glaucops Zsilady and placed in the subgenus Tabanus Linnaeus, since some specimens have four annulated antennae. Hybomitra hirtula (Bigot) is treated as a full species on the basis of consistently denuded subcallus that separates it from H. tetrica (Marten). H. phaenops Osten Sacken is also treated as full species rather than as variety of H. sonomensis Osten Sacken because they differ in a number of characters.

The Tabanidae (Diptera) of Oregon

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## THE TABANIDAE (DIPTERA) OF OREGON

### INTRODUCTION

Tabanidae is a large and widely distributed family of flies. Members of this family are blood suckers and are known by a variety of names; such as, horse flies, deer flies, clegs, green heads, breeze flies, and mango flies. The adult is fairly large and heavy bodied, varying in length from 6-25 mm, depending on the species. The larvae are predators and may be aquatic or semi-aquatic in habit. In the temperate zone, the adult lives for a few weeks during the summer, while the most of the life cycle, including overwintering, is spent in the larval stage (James and Harwood 1969).

Tabanids have received considerable attention from scientists, especially since the second half of the nineteenth century. Most of the work was reported from North America, Japan and various parts of Europe, e.g., the U.S.S.R. In the United States, much of the research on tabanids was done in the eastern and southern parts of the country. The fauna has not been well investigated in many parts of the west. To date, only the Tabanidae fauna of California, Arizona, Utah and Idaho have been reported in the literature. Very few papers have concerned themselves exclusively with Oregon Tabanidae. Most of the information on the Oregon fauna was included in publications of a more general nature, such as catalogs and revisions. Cole and Lovett (1921) listed the species of Tabanidae from Oregon. Gjullin and Mote (1945) published an account of the biology of Chrysops discalis Will. based on

studies from Summer Lake. Another paper on C. discalis at Summer Lake was published by Roth and Lindquist (1948). But, since then, no work on Oregon Tabanidae has been published.

This gap in the knowledge of the group from Oregon, coupled with the writer's interest in medical entomology, prompted this study. The emphasis has been on the adult stage together with efforts to collect and rear larvae where possible.

## LITERATURE REVIEW

Literature on Tabanidae has appeared in various parts of the world, but most of the publications have been reported from the United States. This review will mainly concentrate on the literature of North America.

Osten Sacken's (1875-1878) "Prodrome of a monograph of the Tabanidae of United States" was the first comprehensive publication on this group. In this monograph, he recognized 91 species, many of which were newly described and/or revised. The series of papers by Hine (1903) Tabanidae of Ohio, (1904) Tabanidae of United States and Canada, and (1906) the "North American species of Tabanus with uniform middorsal stripes," is very valuable. In his 1906 paper, he described in detail the process of oviposition and successful rearing of Hybomitra lasiophthalma (Macq.) from egg to adult. In 1907, he produced two papers on the Tabanidae of Louisiana. Jones and Bradley (1923, 1924) published on Tabanidae of Louisiana and reported some successful rearing procedures. Webb and Wells (1924) described the life cycle of a number of tabanid species including T. monensis as a new species, T. punctifer Osten Sacken, H. phaenops Osten Sacken, and Atylotus incisuralis Osten Sacken. Cameron (1926) published a very comprehensive paper on the species of Tabanidae of the Canadian prairie. He studied 18 species and gave detailed accounts on the methods of collection, rearing, oviposition, and emergence. Philip (1931), in his publication on Minnesota Tabanidae, discussed the biology of some species and gave detailed accounts of the taxonomy of adults and keys to the immature stages. Brennan (1935) produced an excellent publication on Nearctic Pangoniinae describing two new genera, Stonemyia and Bequaertomyia (now



in the family Plecorhynchidae), and two new subgenera, Pilimas and Comops, both of which are now elevated to generic status. He treated 93 species and gave a detailed description of each. Schwardt (1936) studied the life histories of 21 horse fly species from Arkansas. Stone's (1938) monograph on "The horse flies of the subfamily Tabaninae of the Nearctic region" added much to the knowledge about this group. He gave detailed descriptions of 154 species and produced keys to the species. Pechuman (1938) described two new Silvius species. Many new contributions to the literature on the Tabanidae of North America were made by C.B. Philip. During the last four decades, he published about 40 papers and monographs. He described many new species and revised many taxa. He updated the family in his two outstanding catalogs (1947) "A Catalog of the Blood-Sucking Fly Family Tabanidae (Horse flies and Deer flies) of the Nearctic Region North of Mexico" and "The Family Tabanidae" in Stone et al. (1965). McAlpine, in 1961, published his excellent paper on the variation of H. frontalis (Walker). Fairchild (1975) listed 38 species of Silvius from North America.

The last 30 years have witnessed extensive research on the Tabanidae of United States. Many new species have been described and a number of faunal studies of different states and geographical regions have been published. Thus, Middlekauff (1950), California (65 spp.); Roberts and Dicke (1959), Wisconsin (71 spp.); Jones and Anthony (1964), Florida (118 spp.); Pechuman (1972), New York (105 spp.), 1973, Virginia (95 spp.); Thompson (1973), Texas, Coastal Marsh (20 spp.); Burger (1974), Arizona (43 spp.); Ezell et al. (1974) listed 113 species and subspecies from South Carolina; Burton (1975), Indiana (Chrysops, 28 spp.) and Nowierski and Gittins (1976), Idaho (71 spp.).

The main emphasis of the literature has been on the adult stage, especially those publications produced during the last three decades. Few publications dealt with immature tabanids. Roberts and Dicke (1964) reported on some Nearctic immature stages. The most outstanding work is the excellent monograph by Teskey (1969) "Larvae and pupae of some eastern North American Tabanidae." He described various methods of collecting, rearing, and handling the larvae, and produced detailed keys to the species and illustrated them with beautiful drawings. He described the larvae of 43 species for the first time and recognized a total of 81 species. Goodwin, in his series of papers (1972-1976) followed the line of Teskey but on species from regions which have not been covered by the latter. Other contributions to the immature stages were presented by Thompson (1967, 1970) on the immature Tabanidae of Great Swamps, New Jersey and (1975) on the larval habitats of Tabanus in southeast Texas; Hays and Tidwell (1967) and Ellis and Hays (1973) published on the habitats of some larvae from Alabama and Florida. Lane (1975) published a paper on the immature stages of some tabanids from California, and (1976) on "Density and diversity of immature Tabanidae in relation to habitat type in Mendocino County." He described for the first time larvae and pupae of Silvius notatus (Bigot) and S. philipi Pechuman.

Valuable contributions towards the techniques and methods of adult collection were made by Roberts in his series of papers (1969-1975) in which he dealt with the use of Malaise traps in relation to CO<sub>2</sub> as a bait.

## MATERIAL AND TECHNIQUES

### Field Collection

Adults: Representative sites in different parts of Oregon were surveyed for three consecutive seasons (1976-1978). Collections of tabanid adults were made from various geographical localities at various altitudes. Malaise traps, baited with carbon dioxide gas, were the main means of collection (Roberts, 1970). These traps were usually operated for a certain number of hours during the day. The flies were recovered from the trap at intervals of one to two hours, killed with ethyl acetate, and kept in small cardboard containers lined with tissue paper. Another method used in collection was the sweep net for those flies that swarmed around or inside cars and those that came around people. Manitoba traps were operated a number of times on hot sunny days, but the results were unsatisfactory (Thompson 1969).

Immature Stages: Extensive surveys were carried out to locate the breeding sites of tabanids. Localities with high adult densities were usually selected for larval sampling. Samples of mud, sod or moss were collected by digging or hand picking. The collected material was either washed from mud on the spot or transferred in polyethylene bags for washing and sieving later, depending on the availability of water in the field (Teskey 1962). Double layered sieves of 10- and 20-mesh per inch were used to collect the larvae. The washing process removed the soil, leaving behind the vegetative portion on the upper mesh. Small larvae that escaped through the upper mesh were recovered from the fine lower mesh. The vegetative material was then transferred to Berlese (Tullgren) funnels from which the larvae were collected in jars containing wet

vegetative material from natural habitats. Materials, like moss, which contained no soil, were transferred directly to the funnel without being washed. Larvae were picked by hand from materials like hard mud and moss that allowed easy hand collection. The small number of pupae collected were picked by hand from the breeding sites.

### Laboratory Procedures

Adults: More than 3000 specimens of Tabanidae from Oregon were examined by me during this study. This number included the collection made by the writer during the last four years, plus the collection that already existed in the Department of Entomology, Oregon State University. Material from Oregon in the collections of the California Academy of Science, Oregon State Department of Agriculture, Salem, Oregon, Oregon State Department of Health, Portland State University, Southern Oregon State College, University of California at Berkeley, University of California at Davis, United States National Museum and Washington State University, were also examined when most of these institutions were visited by the writer, while the others loaned their collections.

Descriptions were made for each species recorded from Oregon. The description was made from those specimens identified either by C.B. Philip or L.L. Pechuman. Whenever possible, more than one specimen was examined for the description of each species. A micrometer attached to a stereoscopic microscope was utilized for measurements of body parts. Wherever appropriate, a millimeter ruler also was used.

Terms small, medium and large as used in this text, refer to less than 10 mm, from 10 to 14 mm, and more than 14 mm, respectively. The same body parts and characters were used in the description of each species for easy comparison. A generic description was made for each genus from the available Oregon specimens. Keys were constructed for the genera and species. All of the undetermined specimens in the collections were identified by means of these keys.

Synonymical bibliographies for the family, genera and species are based on Philip (1947), with some modification in their presentation. Information published after 1947 was obtained directly from the journals or reprints. Information about types and distribution followed Philip's catalogs (1947, 1965).

Label data for specimens examined from Oregon and neighboring states are recorded separately. Information is presented under each county in alphabetical and chronological order. Labels start with the locality of collection followed by the date, and the last name of the collector. An abbreviation for the names of the institution in which the specimens are deposited is in parenthesis following the collector's name. The abbreviations for each institute are as follows: California Academy of Science (CAS), Oregon State Department of Agriculture (OSDA), Oregon State Department of Health (OSDH), Oregon State University (OSU), Portland State University (PSU), Southern Oregon State College (SOSC), University of California at Berkeley (UCB), University of California at Davis (UCD), Washington State University (WSU).

Illustrations of the important parts of the body that separate the three subfamilies are given. Photographs of the wings of

all Oregon Chrysops are presented for a more realistic view. The distribution of each species in Oregon is plotted on Oregon state maps.

The dense spots on species distribution maps in the northeastern portion of Oregon are mostly the results of the intensive malaise trap collection undertaken by Dr. William Turner and his team from Washington University, Pullman from 1975-1977. This part of the map should be interpreted with caution since it represents a concentration of collecting in a limited area.

Immature Stages: The larval stage was the only immature stage that was studied. The procedures described by Teskey (1969) were followed in the microscopic examination of larvae. Living specimens were examined in ice cold water, a technique that helped limit their movements. Some specimens were kept for rearing while one or more were killed in boiling water and preserved in 70% alcohol.

The larvae were reared in containers of different sizes and types including baby food jars and plastic containers with mesh covers. Each larva was reared separately in medium taken from the natural breeding habitat. They were fed on house and blow fly larvae and sometimes on earthworms. Various trials for rearing were made under cold chambers, cold room and at room temperature, but all the larvae but those of Silvius gigantulus Loew failed to pupate in spite of the fact that many of them remained alive all the summer. Some of the preserved larvae were identified by Dr. Robert Lane while the larval stages of other species will remain unidentified until they can be reared and described. Available information on immature stages of each species is presented under the discussion for that species.

Areas of Intensive Collection  
of Tabanidae in Oregon

A number of localities representing various geographical and topographical regions of Oregon have contributed and will continue to contribute more tabanid specimens than the other parts of the state. These localities are generally rich in the fauna of various other insect groups. This is the reason why they have been regular sites for collection by entomologists. A brief description of these areas is given below.

Mary's Peak, Benton County: This is the highest mountain in the Coast Range (1249 meters), and has a very rich insect fauna and natural flora. It contains a number of streams that provide good habitats and food for aquatic insects. Sixteen tabanid species are known from Mary's Peak, half of this number are Hybomitra species, which constitute more than 95% of the collected specimens. The best site for adult tabanid collection is the area between the campground and upper Parker Creek. The rocks around Parker Creek Falls are unusually rich in tabanid larvae which inhabit the moss.

Summer Lake, Lake County: This is a large lake, with an area of about 60 square miles. It is fed by streams and has no outlet. As a result, its water has a very high concentration of salts (McArthur 1974). It represents a characteristic lake in the arid region of Oregon. The swampy shores of this lake attract many aquatic insects, particularly biting flies like mosquitoes and tabanids. It has been a regular collecting site for the United States Department of Agriculture medical entomologists from 1944 to 1966. Studies of Chrysops discalis

Williston, that is the vector of tularemia, were conducted in the Summer Lake area. Along with this, many specimens of other tabanid species were collected. The most abundant tabanid species around the lake are C. discalis, H. sonomensis (Osten Sacken), H. phaenops (Osten Sacken) and Atylotus incisuralis (Macquart).

Northeastern parts of Oregon, Baker and Union Counties: An intensive malaise trap collection was carried out during the summers of 1975-1977 by a team from Washington State University, Pullman, lead by Dr. William Turner. Ten localities in the two counties were surveyed. Twenty-eight species of tabanids were collected during the course of this study, but the most abundant are H. atrobasis (McDunnough), C. noctifer pertinax Williston and H. melanorinha (Bigot). The other common Hybomitra species, except sequax, occur in fairly large numbers. The collections were made from areas around creeks like Big Creek, Jordan Creek, Goose Creek and others.

Other areas that contributed many tabanid specimens include: Lobster Valley, 8-12 miles southwest of Alsea, from which many specimens of Silvius gigantulus (Loew) were collected together with a few specimens of other tabanid species. Monument Peak (Linn County), Klamath Lake, Klamath Marsh, Crater Lake (Klamath County), Malheur Experimental Station (Harney County), Government Camp and other areas around Mount Hood, are locality names that are commonly seen on tabanid labels.



## BIOLOGY

Life Cycle: The life cycle of tabanids is partitioned between the aquatic or semi-aquatic immature stages and the terrestrial adult stage.

Egg: The oviposition season in Oregon is usually towards the end of the summer. The eggs are laid on vegetation overhanging moist soil or water. They are usually in masses of one (Chrysops) or more layers (Hybomitra, Tabanus), depending on the species. The duration of the egg stage is from five to seven days depending on the temperature (Johannsen 1935).

Larva: After hatching, the larva moves into its aquatic habitat, which could be moist soil where the larvae of some species such as I. punctifer spend their life in the mud. Some Chrysops larvae live in water while those of Silvius inhabit moss on the beds of streams. Moss on rocks is inhabited by some Hybomitra and Tabanus larvae. The larvae grow rapidly for the remainder of the summer before they start the overwintering period, during which they either grow very slowly or may cease to grow entirely. They resume active development late in spring. Most of the temperate region species produce one generation per year but some have two (James and Harwood 1969). Most tabanid larvae are carnivorous. They feed on the larvae of other insects, snails, earthworms and other animals. Sometimes, they take to cannibalism. The feeding habit of Chrysops larvae is not well understood, but Oldroyd (1964) reports that some of them feed on vegetation.

Pupa: Pupation in Oregon usually takes place late in the spring or during summer, depending on the species. The last instar larva moves

to a drier site prior to pupation. The pupa is usually inactive and remains in one place. The pupation period varies from five days to three weeks, depending on the species.

Adult: Emergence of adults in Oregon starts in April (H. procyon) and continues through the early months of summer depending on the species. The adults usually survive for several weeks (Oldroyd 1964) during which they achieve their role of reproduction. Blood is required by females for production of eggs in the subfamily Tabaninae and Chrysopsinae but in the nonblood feeder Pangoniinae, flower nectar is the substitute. Tabanid adults are mostly diurnal, but Jones and Anthony (1964) reported some nocturnal species from Florida. Most species seek their blood meal from the morning to early afternoon (the writer's personal observation), but some species of Chrysops bite after sunset (Pechuman 1972). No information about host preference is reported in the literature, but attack of livestock, especially cows and horses, is very common.

Male tabanids are nectar feeders and so are rarely encountered by man. Copulation takes place immediately after emergence. It is also believed that there is one mating per female life (Jones and Anthony 1964).

Oviposition of one Oregon species (C. discalis) has been observed by Gjullin and Mote (1945). The female was facing downward during the egg laying process. Then the eggs are deposited one by one for a period of about 25 to 50 minutes (Roth and Lindquist 1948). The egg mass is glued to the surface of the vegetation.

Most adults are very strong flyers. They move at a high speed and

can change direction and glide fast. They are usually attracted to shining objects such as motor cars. The idea of the Manitoba trap shining ball is based on this behavior. Adults are usually more active during warm sunny days.

Longevity of individual specimens is not well known. Jones and Anthony (1964) obtained variable results from their cage study.

### Natural Enemies

Parasites: The hymenopteran Telenomus emersoni (Girault), (Scelionidae) is known as an egg parasite of Tabanidae. Webb and Wells (1924) encountered this parasite in the eggs of Tabanus punctifer (O.S.). Cameron (1926) found the same parasite in eggs of Chrysops aestuans Wulp and C. mitis Osten Sacken. Philip (1931) reported the same parasite in eggs of three Chrysops species. Other known Scelionidae parasites of tabanid eggs include Telenomus goniopsis Crawford and T. tabanivorus (Ashmead) (Jones and Anthony 1964). Trichogramma evanescens (= T. semblidis (Auriv.)) (Trichogrammatidae) was reported as an egg parasite of C. aestuans and C. mitis by Cameron (1926).

Several species of Diptera parasitize tabanid larvae. Phasiops flava Coquillett, Ormia punctata Rogineau-Desvoidy, Carinosillus tabanivorus (Hall) (Tachinidae) and Villa lateralis (Say) (Bombyliidae) are known parasites of the larvae of various species of Tabanidae (Jones and Anthony 1964). Some nematodes are also known as parasites of tabanid larvae. Two species of the family Mermithidae, Paramermis tabanivora and Gastromermis macrosoma, were reported on Hybomitra and Tabanus species by Rubtsov and Andreeva (1974). Recently Poinar and Lane (1978) reported Pheromeris myopis on T. punctifer larvae.

Tabanid pupae are also parasitized by Hymenoptera. Thus,

Diglochis occidentalis Ashmead, (Chalcididae) Trichopria tabanivora Fouts (Diapriidae) reported (Cameron 1926) from tabanid pupae.

Predators of the Adults: Predation of adult tabanids by some other organisms was reported by Hine (1906, 1907), Webb and Wells (1924), Philip (1931), and others. Among the well known predators are some wasps, robber-flies, dragonflies, lizards, birds, and spiders. The horse guard wasp, Sticta carolina Fabricius, had been observed (Hine 1906) flying around horses; as soon as an adult horse fly lit on the horse the wasp captured it, completely paralyzed it and flew away with it. I witnessed the wasp Dolichovespula maculata (Linn.) capturing, and feeding on Silvius gigantulus Loew in the Malaise trap in which I was collecting in Lobster Valley, Oregon.

Dragonflies encounter their prey tabanids while the latter come close to water source accompanying their hosts or possibly while they are breeding.

#### Economic Importance

Tabanidae are well known for their economic and medical importance. They cause enormous losses on livestock. This may result from one or more factors. The degree of loss depends on the degree of infestation as well as the species involved. Several kinds of losses have been observed (Jones and Anthony 1964). In one type, the host animals were completely distracted from grazing as they tried to dislodge the flies from their bodies. In another type, the animals were forced to abandon the grazing ground and seek shelter for protection.

Blood loss sustained by livestock due to bites of tabanids can be enormous and may result in a serious situation depending on the density of the flies and the degree of infestation. Webb and Wells (1924) estimated that 25-30 horse flies, feeding continuously for six hours,

caused an average blood loss of at least 100 cc. Philip (1931) estimated that 100 flies feeding to satiation would consume an average of 10 cc of blood. He stated that an animal would lose a minimum of 300 cc of blood in a steady attack by 50 flies at any one time throughout a ten-hour period of activity in one day. These estimates did not include the loss by bleeding from punctures caused by the fly's bite, which is usually significant, especially in the cases of large flies. Jones and Anthony (1964) observed 75-100 cc of blood oozing from a single puncture made by a Tabanus atratus Fabricius.

Wounds that develop at the site of bite may attract secondary invaders such as flies that cause myiasis and/or pathogenic microorganisms. The tabanid's habit of intermittent feeding on various hosts greatly enhance the mechanical transmission of diseases from one host to the other (Philip 1931). They may transmit a number of diseases to man and/or his animals. Among the diseases transmitted to man are tularemia, a bacterial disease caused by Francisella tularensis (McCoy and Chapin) and vectored by Chrysops discalis (Williston), and loiasis (in tropical Africa), which is caused by the microfilaria Loa loa (Cobbold) and is vectored by Chrysops silacea (Austin) and C. dimidiata (Van der Wulp). Diseases that are transmitted to animals include anaplasmosis in cattle, equine infectious anemia and anthrax among domestic mammals and possibly man (James and Harwood 1969). They also transmit Trypanosoma evansi (Steel), a protozoan that causes a disease known as surra among horses. It has recently been reported by Ormond (1976) that T. evansi and possibly T. brucei and T. vivax are transmitted by tabanids in the Sahel region

of West Africa. While he did not specify the host, it is apparent that he was referring to cattle.

The association of C. discalis with the transmission of tularemia in Oregon was reported by Gjullin and Mote (1945). Rabbits harbor the natural reservoir of the disease. The destruction of rabbits at Summer Lake helped eliminate the cases of tularemia in the area in 1944.

### Sequential Baited Malaise Trap Collections

An investigation was undertaken at the Mary's Peak Summit Campground (Benton County) to study the daily activity and feeding habits of the local adult tabanid species. A malaise trap, baited with carbon dioxide gas, was used for the collection and monitoring of the flies, which were recovered hourly. Three morning-early afternoon collections were conducted, from 9am to 3pm (on August 1, 1978, July 17 and 19, 1979) and two afternoon collections, from 3pm to 6pm (on July 22 and 24, 1979).

Results: Results obtained are tabulated below for Hybomitra atrobasis, H. californica, H. captonis, H. fulvilateralis, H. sequax and H. sonomensis, that visited the trap regularly. Other species were caught in very limited numbers and for this reason are not included in this table. These include: Tabanus aegrotus, I. fratellus, I. kesseli, Hybomitra melanorhina, Chrysops noctifer pertinax and C. proclivis.

Table 1. Sequential Baited Malaise Trap Collections

Results of Morning Collections (9am - 3pm)\*

SPECIES	<u>H. atrobasis</u>		<u>H. californica</u>		<u>H. captonis</u>		<u>H. fulvilateralis</u>		<u>H. sequax</u>		<u>H. sonomensis</u>	
TIME	Total (Average)		Total (Average)		Total (Average)		Total (Average)		Total (Average)		Total (Average)	
9am-10	102	(34)	36	(12)	210	(70)	-	-	33	(11)	6	(2)
10-11	153	(51)	24	(8)	189	(63)	-	-	21	(7)	12	(4)
11-12	90	(30)	21	(7)	201	(67)	9	(3)	18	(6)	21	(7)
12-1pm	72	(24)	12	(4)	51	(17)	6	(2)	9	(3)	3	(1)
1-2	27	(9)	6	(2)	51	(17)	-	-	9	(3)	-	-
2-3	-	-	-	-	27	(9)	-	-	-	-	-	-

Results of Afternoon Collections (3 - 6pm)\*

SPECIES	<u>H. atrobasis</u>		<u>H. californica</u>		<u>H. captonis</u>		<u>H. fulvilateralis</u>		<u>H. sequax</u>		<u>H. sonomensis</u>	
TIME	Total (Average)		Total (Average)		Total (Average)		Total (Average)		Total (Average)		Total (Average)	
3-4	12	(6)	-	-	48	(24)	-	-	12	(6)	-	-
4-5	6	(3)	-	-	22	(11)	-	-	4	(2)	-	-
5-6	-	-	-	-	-	-	-	-	-	-	-	-

\*During the period of these collections, the sun rose at 5:43 - 5:57 and set at 8:53 - 8:39.

Discussion: Fewer collections than originally planned were conducted because the conditions were not favorable for tabanid collection during the summer of 1978. A number of collecting trips were undertaken to Mary's Peak but the results were negative.

The results obtained from the morning collections showed a gradual decline in the number of flies visiting the trap from morning to afternoon. The afternoon collections were conducted to see whether any of the species had an afternoon activity period beyond 2 - 3pm. As it appears from the data, three species, H. atrobasis, H. captonis and H. sequax are active in the afternoon hours until 5pm, but in lesser numbers than in the morning. The other three species did not fly into the trap after 2pm.

The interpretation of the above results is necessarily limited in the light of the available information about the biology of the group. The knowledge of their emergence time, their longevity and their sensitivity to the climatic conditions are all factors that would influence their behavior. It is also possible that trapping, as an artificial sampling method, could possibly interfere with the natural behavior of the flies.



## ZOOGEOGRAPHY

Distribution.--The distribution of each subfamily of Tabanidae is treated separately.

Subfamily Pangoniinae: Mackerras (1954) divided this group into specialized and generalized genera. The specialized are more closely related to the other two subfamilies. The specialized genera, Pilimas and Stonemyia, of the tribe Pangoniini are found in the Palaearctic, Nearctic and Neotropical regions, while the generalized genera are found in the Nearctic, southern Neotropical, and Australian regions excluding Tasmania, New Guinea and the Austro-Malayan area. The tribe Scionini is more specialized than the generalized Pangoniini. It is represented in the Nearctic by Goniops, in the southern Neotropical by Mycteromyia and in the Australian by Scaptia which is also found in extreme southern part of Africa. The tribe Philolichini occurs exclusively in Africa and India.

Subfamily Chrysopsinae: The tribe Bouvieromyiini occurs in Africa, Australia, North and South America. It is represented in the Nearctic region by the genus Merycomyia, and in the southern Neotropical region by Veprius. It is well developed in the Ethiopian and Australian regions. The genus Eucompsa is the only representative in the Oriental region.

The tribe Chrysopsini, which is believed to have arisen from the Bouvieromyiini, is predominantly Holarctic. The genus Chrysops is distributed over most parts of the world except the tundra of Europe and Asia and most of Australia. The other genera are predominantly

Nearctic. The tribe Rhinomyzini is confined to Africa, India and the eastern parts of China.

Subfamily Tabaninae: The specialized forms of Diachlorini are confined to South America and the southern parts of the United States, while the generalized forms are found in the Ethiopian region, Southeast Asia and Australia. The tribe Haematopotini is found in the Ethiopian, Palaearctic and Nearctic regions and central and southern Asia. The Tabanini, the largest tribe, is the most widely distributed group. It occurs in all the zoogeographical regions excluding the deserts of Africa, Australia, and South America, as well as the tundra region of North America and Siberia (Mackerras 1954).

#### Distribution in the Nearctic Region

The subfamily Pangoniinae is represented in this region mainly by the tribe Pangoniini. Some genera of Scionini are in the eastern parts of the United States. The tribe Philolichini does not occur in this region. The subfamily Chrysopsinae is mainly represented by three genera, Silvius, Chrysops and Neochrysops, all of the tribe Chrysopsini. The tribe Bouvieromyiini is confined to the eastern United States while Rhinomyzini does not occur in this region. The tribe Tabanini is well represented by all of its three subfamilies. Diachlorini is confined to the southern part of the United States. A total of 25 genera and 298 species (excluding the varieties) have so far been reported from North America.

#### Geography of Oregon

Oregon is a large state with an area of 121,681 square kilometers

(Anderson 1976). The state has wide diversity of topographic and climatic regions including mountain ranges, valleys, basins and desert plateaus.

The state is bounded on the west by the Pacific Ocean which is separated from the Coast Range by a narrow coastal plain. The Coast Range is oriented north-south, and has an average elevation of 450 to 750 meters (Franklin and Dyrness 1973), the highest summit of the range is Mary's Peak (1249 meters). The area receives an annual rainfall of 170 to 300 centimeters and is covered with dense coniferous forests.

The state is divided west-east by the Cascade Range that extends from the Canadian border to northern California. This range has average elevation of 1800 to 2600 meters and is containing numerous streams and lakes. It receives heavy precipitation in the form of rainfall in the fall and spring, and snow in the winter. Many of its summits are covered with snow for many months and some, like Mount Hood (3427 meters), Mount Jefferson (3199 meters) and the Three Sisters (3062 to 3157 meters), have permanent snow and glaciers. The area is dominated by coniferous forests.

Other highlands in Oregon are the Blue Mountains in the northeast, the Steens Mountains in the southeast, and the Klamath Mountains in the southcentral part of the state. The Blue Mountains have forests at higher elevations and shrub-grassland and grassland at lower areas, while the Steens Mountain are mostly dry with sage and grasses. The Klamath Mountains have similar features to the southern part of the Cascades, but with some lakes and less dense forests.

The Coast and Cascade Ranges are separated by the Willamette Valley which extends from the Columbia River almost to Cottage Grove,

with a length of about 200 kilometers and a width of 30 to 50 kilometers. The valley is mostly flat with alluvial soil. Many streams, arising from the neighboring highlands, run through the valley. The average annual rainfall varies from 80 to 120 centimeters in the Willamette Valley. It is the most densely populated area in Oregon.

The region east of the Cascade Range is mostly cold desert with plains and high plateaus. It is drier than the other parts of the state, with an annual precipitation of 25 to 50 centimeters. The vegetation consists of shrubs and savanna type grasses. The region is characterized by the presence of some lakes, marshes, rivers and warm springs.

The northcentral portion of Oregon contains the Columbia Basin, oriented east-west. It is an area of moderate elevations (300 to 600 meters), with deep canyons and rivers that feed the Columbia River. The vegetation is mostly shrub-grassland.

For more information on the subject, the reader should consult Baldwin (1964), Geology of Oregon, Dicken (1973) Oregon Geography, Franklin and Dyrness (1973) Natural Vegetation of Oregon and Washington, and Loy et al. (1976), Atlas of Oregon.

#### Distribution in Oregon

The family is represented by species of all the three subfamilies. The only tribe from Pangoniinae in Oregon is Pangoniini and it is represented by Apatolestes, Pilimas and Stonemyia. Apatolestes is distributed in the far western parts of the United States. It is mainly found in the southern parts of Oregon. Pilimas occurs in the

mountainous parts of the state. Stonemyia is mostly found in the Cascade Range. One tribe, Chrysopsini, from the subfamily Chrysopsinae is found in Oregon. Chrysops is the major and common genus in the state. Its species are widely distributed chiefly in woodlands and around water. Some species inhabit higher elevations. Silvius is less common, and has fewer species in Oregon. Only one species, S. gigantulus Loew, is common around water and in woodlands, the other species are rather rare. The Tabaninae is represented by genera from the tribe Tabanini. The most common genus is Hybomitra which is the dominant genus of the family in Oregon. Its species occur mainly at higher elevations but some are found around water at lower elevations. The genus Tabanus is less common in Oregon than in the eastern parts of the United States. Its species are evenly distributed but are not common. Some of them are rare and scattered in distribution, but mostly at lower elevations. The third genus, Atylotus, is even less common than Tabanus. Its species occur at low elevation around water in woodlands.

It is apparent from the existing collections that most of the species inhabit higher elevations in the Coast Range, the Cascade Range, and the northeastern parts of the state. Some other localities like the lakes of central Oregon have large populations.

#### Analysis of the Tabanid Fauna of Oregon

The family Tabanidae is represented in Oregon by a total of 56 species, subspecies and varieties, in eight genera. The majority of the Oregon species are confined in distribution to the area west of the Rocky Mountains and north of Arizona. The western portion of the United States has a very high percentage of species confined to that region.

Most of the Oregon tabanids occur at higher elevations in the Coast Range, (Mary's Peak), the Cascade Range (Monument Peak), and the northeastern mountains. Comparatively few species occur in the desert area east of the Cascades, mostly around water, e.g., Summer Lake. Very few specimens of Tabanidae have been collected from along the coast.

The Oregon fauna of Tabanidae is dominated by species of the subfamily Tabaninae. They constitute more than 65% of the species and about 80 to 85% of the collected specimens. The genus Hybomitra is the most abundant, with 20 species and varieties and more than 60% of the specimens. The majority of the Hybomitra species occur at higher elevations of the mountain ranges, but a few species occur at lower elevations. This predominance of Hybomitra has been a general trend in the neighboring states like Idaho (Nowierski and Gittins 1976). It has been observed that Hybomitra is less common in the southern and southeastern parts of the United States (Jones and Anthony 1964, Florida; Ezell et al., 1974, North Carolina; Burger, 1974, Arizona). The genus is a member of a tribe that is predominantly Palaearctic and Nearctic (Mackerras 1954). The tribe is not well represented in the Neotropical or the Australian regions. These facts suggest that the genera of this tribe arose somewhere within the Holarctic region. The Hybomitra species of Oregon are mostly confined to the cooler, higher elevations and extend to the north into Canada. A number of species of Hybomitra show variations, some of which have not yet been investigated.

The genus Tabanus is less common in Oregon than Hybomitra. It has only nine species compared with 16 in Arizona, 56 in Florida, 34 in New York, 43 in Virginia and ten in Idaho. Eight Idaho species occur

in Oregon. Their distribution in North America is predominantly eastern, with more species in the south. In Oregon, the species of Tabanus are of limited frequencies and scattered distribution, mostly at lower elevations. It is most likely that western species of Tabanus, including Oregon species, have radiated from the eastern parts of North America.

The genus Atylolus is represented in Oregon by two species that exhibit a wide range of color variation. They occur around lakes at lower elevations. The genus is poorly represented in Nearctic region and the available information on the biology of the included species is scarce.

Two genera, Chrysops and Silvius, of the subfamily Chrysopsinae occur in Oregon. Both of them belong to the tribe Chrysopsini. Chrysops is the predominant genus with 14 species in the state, second to Hybomitra, but is still not well represented compared to eastern parts of the United States. There is consistency in number and kind of species between Oregon and the neighboring states, California and Idaho. The distribution of the genus in Oregon is predominantly around water in woodland situations, e.g., Government Camp, Clackamas County. A few species, like C. surdus O.S. occur at higher elevations. The frequency of most of them is moderate to rare, only one species, C. nocifer pertinax, is very common, possibly the most common tabanid species in Oregon.

Silvius has only three species in Oregon, only one of these, S. gigantulus, is common while the others are rare in collections. Like Chrysops, they occur around water in woodlands at lower elevations.

The tribe Chrysopsini is widely distributed throughout the region. Due to the many intermediates between Chrysops and Silvius in the Nearctic region, it is likely that Chrysops developed there (Mackerras 1954). The distribution of Silvius in the Nearctic region is predominantly west of the Rocky Mountains with limited extensions north into Canada. This suggests that the genus might have arisen in this region.

The subfamily Pangoniinae is represented in Oregon by three genera, Apatolestes, Pilimas and Stonemyia, all belonging to the tribe Panogoniini. The genus Apatolestes is only known from the western part of North America from British Columbia to Montana, California and Arizona (Philip 1965). All 12 species and their varieties occur in California. Only two species and two varieties were reported from Oregon, but they are very rare in collections and the pattern of their distribution is not clear. It could be anticipated that they have radiated from California, where they might have evolved. The genus Pilimas has the same pattern of distribution in North America as Apatolestes, but with only four species, one of which occurs in the Cascade Range and the northeastern mountains of Oregon. Stonemyia is closely related to Pilimas but is more widely distributed in northeastern and midwestern United States. The only subspecies that occurs in Oregon, S. tranquilla fera (Will.), is distributed throughout the northern half of the United States from the east to the west coast. It has a low frequency in Oregon, being found mainly in the Cascade Range. Both Pilimas and Stonemyia are considered among the specialized forms in the tribe. These forms are found in the Palaearctic, the Nearctic and the Neotropical regions. Their greatest development is in Central and Tropical America (Mackerras 1954).



It is suspected that some other species of Pangoniinae and possibly larger numbers of specimens will be found in Oregon. They are uncommon in the collections because they are not blood feeders and thus are not attracted to man or animals.

## MORPHOLOGY AND TAXONOMIC CHARACTERS

External Morphology

Egg: Most tabanids lay their eggs in masses, but the individual egg is cylindrical, tapering at both ends (Johannsen 1935). When laid, the egg mass is white but it soon darkens.

Larva: Body cylindrical, elongate, fusiform, with tough transparent leathery skin; sclerotized head capsule; three thoracic, and eight abdominal segments, and a terminal respiration siphon (Oldroyd 1964). The color of the body ranges from white to yellow, with various shades of brown to green. The head capsule is retractable and can rotate 180° (Teskey 1969). The head is composed of the epicranium, antennae, maxillary palpi, cephalic brush and mouth parts consisting of a sclerotized sickle-shaped mandibles, lacinea and labrum. The clypeus forms the anterior prolongation of the epicranium. Very small spiracles lie in the lateral vertical slit between the pro and mesothorax. Each abdominal segment is surrounded by a ring of pseudopodia that bears a variable number of small pigmented spines. The anal segment varies from spherical to slender pear-shape. The anal aperture is surrounded by two anal lobes which are equipped with fine pubescence and short spines. The respiratory siphon is attached posteriorly to the anal segment. (For more details see Johannsen 1935, Teskey 1969).

Pupa: Body obtect, arched dorsally and recurved ventrally, with various colors and shades. The head is separated from the thorax by the cephalothoracic suture. The antennal sheaths are articulated anteriolaterally and are separated by transverse antennal ridges, the

callus setae arise about the ridges from a pair of tubercles. The head is divided into frontal plates enclosed by the arms of the epicranial suture through which the adult emerges (Teskey 1969). Below the frontal suture is the frontoclypeus. The orbital area lies lateral to the frontal plates. The eyes are dorsolaterally positioned.

The thorax is composed of two visible segments. The mesothorax has prominent spiracles on its anteriorlateral margins. The metanotum is also narrow, with two to three setae. The sheaths of the wings and various limbs are fused together and to the ventral side of the thorax, projecting posteriorly on the first abdominal segment.

All of the abdominal segments, except the first and the last, are differentiated into a tergum, sternum and two pleura. The first seven segments have spiracles, and possibly some spines. The anal segment terminates in an aster. The ventral preanal comb of spines is uninterrupted in the male, but has a median gap in the female (Teskey 1969).

Adult: The head of the adult is dominated by the eyes that are contiguous in the male and separated by the frons in the female. In life, the eyes are colored with green and blue stripes, but these fade in dead specimens. The upper part of the head between the eyes is the vertex which carries the ocelli and the ocellar tubercles. The frons has one or two calli, the median and the basal (frontal) both of which are usually denuded. Below the basal callus lies the subcallus. In the male, the frons is reduced to a frontal triangle. The antennae arise from the lower margins of the subcallus. They are short and compact; of three segments, the first segment is known as the scape, the second as the pedicel, and the third segment as the flagellum and

is composed of a large basal portion and an attenuated annulate portion. The number of annuli varies from three to seven, depending on the sub-family. Below the antennae is the clypeus, with the genae on its sides. The mouth parts are well developed for biting and sucking. They are composed of the mandibles, maxillae, hypopharynx, and labrum-epipharynx, all of which are ensheathed in the labium. The maxillary palps arise from the sides of the proboscis.

Like other Diptera, the thorax is dominated by the mesothorax which carries the pair of wings. These are of major importance as diagnostic features for the family.  $R_4$  and  $R_5$  diverge to enclose the wing tip. The anal vein is either straight or gently curved. The lobes on the mid-lateral part of the mesonotum are known as notopleura (prescutal lobes) are important in the diagnosis of some species.

The abdomen is compact, but is not featuring special morphological characters.

#### Evaluation of Taxonomic Characters

Tabanids lack many of the useful taxonomic characters that most other Diptera possess. Chaetotaxy cannot be used with tabanids since macrochaete are not present (Stone 1938, Pechuman 1972). The limited number of characters used in the separation of tabanids are mainly those on the head, such as the antennae, the palpi, and the callosities. Due to this limitation, characters such as the color of the various body parts, presence or absence of pollen (pollinose or denuded) and the presence or absence of hair (pilose or bare) is very useful in the separation of species since they are fairly stable and persistent in most of the species. Wing venation is of major importance in the

separation of the family from other Brachycera, while the wing maculation pattern is one of the major characters that is used to separate Chrysops species. The presence or absence of apical spurs on hind tibiae and the number of annuli on the antennae are the characters that are used to separate the subfamilies.

It is apparent from the foregoing discussion that the rarity of useful taxonomic characters in the Tabanidae paved the way for the use of secondary characters that, in many cases, are unstable and subject to rapid changes. The status of many species, particularly those of Hybomitra, is unsatisfactory simply because many of them are separated by the mere color of a single character or by the absence or presence of pollen or hair on a certain part of the body. Even the characters that are used in the separation of the genus Hybomitra from Tabanus are not consistent (see discussion under Tabanus).

## TAXONOMY

### Evolution

The ancestors of tabanids are believed to have arisen during the Mesozoic (Mackerras 1954). They were probably low-flying species of medium build, bare eyes and ocelli; frons diverging in the female; antennae short, third segment with eight annulations; proboscis short, stout; palpi subcylindrical. The legs have spurs on mid and hind tibiae; the wings have vein Sc bare,  $R_4$  with a well developed "appendix," squamae moderately developed. The ninth tergite is entire in both sexes; the male has a simple style and one segmented cerci.

The first cleavage among the groups was marked by the splitting and reduction of the ninth segment. The more primitive elements, represented by modern day Pangoniinae, retain an entire ninth segment while the more advanced groups, Tabaninae and Chrysopsinae, shortened their body.

According to Mackerras (1954), the Pangoniinae have a separate evolutionary history from the other two subfamilies. The feeding habit was one of the first trends that marked the two lines of evolution. The Pangoniinae evolved with the ancestors of the flowering plants, and developed stouter body, longer legs and a longer, more slender proboscis that enabled them to reach and suck the nectar of flowers. The blood sucking subfamilies (Chrysopsinae and Tabaninae) on the other hand, evolved with their vertebrate hosts. They developed more compact body and a short strong proboscis. During the course of evolution, the Tabaninae became more specialized; they developed a compact third antennal segment and lost the spurs on the hind tibiae and the ocelli,

separating them from Chrysopsinae.

A further trend of evolution took place in the immature stages. While the larvae of the Pangoniinae have a soft body and inhabit damp soil where they feed on soft-bodied creatures, the larvae of Chrysopsinae and Tabaninae are stronger and more vigorous predators that can even attack their own kind.

#### Position of the Tabanidae in the Diptera

The Diptera is one of the largest insect orders, containing about 150,000 species. The order is divided into the suborders Nematocera and Brachycera. The latter is further subdivided into two divisions, Orthorrhapha and Cyclorrhapha. The family Tabanidae is placed into the superfamily Tabanoidea in the Orthorrhapha. The Brachyceran flies are stout bodied and have short antennae. Members of the Orthorrhapha are distinguished from Cyclorrhapha by the obtect pupa and by the partially rotated male terminalia. The superfamily Tabanoidea is characterized by the enlarged, pad-like empodia, the generalized wing venation and the aquatic or terrestrial larvae (Colless and McAlpine 1970).

The closest associates to the Tabanidae are the Rhagionidae (Snipe flies), which share some characters with the primitive tabanids. They have eight annulated antennae segments, apical spurs on the hind tibiae, and one to two-segmented cerci in the female. The tabanids are distinguished by the wing venation and the shape of their antennae.

Oldroyd (1964) found a relationship between the tabanids and the gnats and midges (Nematocera). He believed that both groups are partially aquatic, both have the same construction of adult mouthparts,

the members of both groups were traced back to one blood sucking ancestor.

The larvae of Tabanidae have the mandibles moving parallel to one another in vertical plane, which is a general characteristic of Brachycera. In addition to this, tabanid larvae are distinguished by the three to four pairs of pseudopodia on the first seven abdominal segments, and the retractable anal spine.

#### Classification of the Family Tabanidae

The family Tabanidae is divided into four subfamilies; each is further subdivided into tribes as follows (after Mackerras 1954):

##### Subfamily Pangoniinae

Tribe Pangoniini

Tribe Scionini

Tribe Philolichini (Not in North America)

##### Subfamily Scepsidinae (Not in North America)

##### Subfamily Chrysopsinae

Tribe Bouvieromyiini

Tribe Chrysopsini

Tribe Rhinomyzini (Not in North America)

##### Subfamily Tabaninae

Tribe Diachlorini

Tribe Haematopotini

Tribe Tababnini



## FAMILY TABANIDAE

Osten Sacken, 1875-6, Mem. Boston Soc. Nat. Hist. 2(4):365-397, 421-479, 555-560; Williston, 1886, Trans. Kans. Acad. Sci. 10:129-142; Hart, 1896, Bull. Ill. Lab. Nat. Hist. 4:220-247; Hine, 1903, Ohio State Acad. Sci. Spec. Pap. No. 5, 63 pp. (Cat.), 1904 Ohio Nat. 5:217-248 (Rev.); Aldrich, 1905, Smithn. Misc. Coll. 46:192-209; Malloch, 1917, Bull. Ill. Lab. Nat. Hist. 12:355-361; Marchand, 1920, Monog. Rock. Inst. Med. Res. No. 13, 203 pp.; Surcouf, 1921, Gen. Ins. Fasc. 175, 205 pp. (World Cat.); Enderlein, 1922, Mitt. Zoo. Mus. Berlin 10(2):333-351; 1925, Ibid. 11(2):255-409; Bequaert, 1924, Psyche 31:24-40; Krober, 1934, Rev. Ent. 4:222-276, 291-333 (Cat.); Philip, 1941, Can. Ent. 73:2-14; 1942, Proc. New Eng. Zoo. Club 21:55-58; 1947, Amer. Midland Nat. 37(2):257-324 (Cat., Near. Reg.); Mackerras, 1954, Aust. J. Zoo. 2(3):431-454; Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:320-342 (Cat., Amer.).

Diagnosis.--The adults are of various sizes and body coloration. The head is dominated by the large eyes which are separated in the female and contiguous in the male. The antennae are three-segmented, with various proportions of segments length, the third segment is attenuated and annulated. The apex of the wing is included in cell  $R_4$ ; the hind tibiae with or without apical spurs; the empodia have pad-like shape; the squamae large and conspicuous.

The eggs are deposited on vegetation in masses of one or more layers. The larvae have cylindrical bodies with three or four pairs of pseudopodia on the abdominal segments; mouth parts retractable and rotatable.

### Classification of Oregon Tabanidae

This classification and North American species numbers follows Philip (1965), the most recent and most accepted classification of the Tabanidae of North America. The family is divided into three subfamilies, each of which is further subdivided into two or more tribes. Only those tribes and genera represented in Oregon are considered below:

	<u>No. of North American Species</u>	<u>No. of Oregon Species</u>
Subfamily Pangoniinae		
Tribe Pangoniini		
Genus <u>Apatolestes</u>	10(2)*	2(2)*
Genus <u>Pilimas</u>	4(1)	1(1)
Genus <u>Stonemyia</u>	6	1
Subfamily Chrysopsinae		
Tribe Chrysopsini		
Genus <u>Silvius</u>	8(2)	3
Genus <u>Chrysops</u>	75(22)	13(1)
Subfamily Tabaninae		
Tribe Tabanini		
Genus <u>Atylotus</u>	7(1)	2(1)
Genus <u>Tabanus</u>	94(14)	9
Genus <u>Hybomitra</u>	<u>54(6)</u>	<u>19(1)</u>
TOTAL	258(48)	50(6)

\*Number of varieties, not included in the species figures.

Key to the Female and Male  
Genera of Oregon Tabanidae\*

- 1 - Hind tibiae with two apical spurs . . . . . 2  
     Hind tibiae without apical spurs . . . . . Tabaninae 6
- 2 - Antenna seven-segmented (annuli five) . . . . . Chrysopsinae 3  
     Antenna ten-segmented (annuli seven) . . . . . Pangoniinae 4
- 3 - Wings with distinct infuscation . . . . . Chrysops Meigen  
     Wings hyaline or with small spots . . . . . Silvius Meigen
- 4 - Proboscis about one and a half times the length of  
     palpus, antennae and palpi black . . . . . Stonemyia Brennan  
     Proboscis less than one a half times the length of  
     palpus . . . . . 5
- 5 - Second palpal segment slender, body clothed with  
     dense golden hair, antennae and palpi yellow . . . Pilimas Brennan  
     Second palpal segment swollen basally, body  
     pubescence not as above . . . . . Apatolestes Williston
- 6 - Eyes in dried specimens yellow to rusty red,  
     with diagonal streak . . . . . Atylotus Osten Sacken  
     Eyes in dried specimens mostly black, without  
     diagonal streak . . . . . 7
- 7 - Ocellar tubercle well-developed, mostly  
     denuded; eyes mostly pilose . . . . . Hybomitra Enderlein  
     Ocellar tubercle pollinose or if denuded,  
     eyes bare . . . . . Tabanus Linnaeus

\*This key is based on the Oregon fauna and may only be applied to the Oregon genera.

SUBFAMILY PANGONIINAE  
(Figures 4, 7)

Diagnosis.--Size varies from small to large; body with various colorations. Hind tibiae with two apical spurs; antennae ten-segmented (annuli seven); proboscis longer than palpus; frontal calli present or absent, ocelli present.

Discussion.--This subfamily is represented in Oregon by only three genera, each with one or two species. The species are scarce and have limited and scattered distribution. The subfamily is considered the most primitive in relation to the other two subfamilies. It has a separate history of evolution associated with the flowering plants, upon which the Pangoniinae of today feed.

Genus Apatolestes Williston 1885

Apatolestes Williston, 1885, Ent. Amer. 1:12; Hine, 1903, Ohio State Acad. Sci. Spec. Pap. No. 5:31; 1904, Ohio Nat. 5:218; Brennan, 1935, Univ. Kans. Sci. Bull. 22:370 (Rev.); Philip, 1941, Can. Ent. 73:9; 1941, Bull. Brooklyn Ent. Soc. 36:187; 1947, Amer. Midland Nat. 37(2):262 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):1-2; Philip, 1954, Rev. Brasil. de Ent. 2:13-60 (Rev.); 1965, U.S.D.A., Agr. Handb. No. 276-320 (Cat.); Burger, 1974, Proc. Ent. Soc. Wash. 76(3):252-254 (Syst.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:5 (Syst.).

Type-Species, A. comastes Williston.

# Diagnosis.--

Female: Size varies from small to large, body black to brown orange. Eyes separated, bare; frons widened below; calli present or absent; vertex with three ocelli; face pollinose; antenna ten-segmented (annuli seven), color varies; palpi mostly yellowish. Thorax black; wings hyaline or fumose,  $R_4$  with stump vein; hind tibia with spurs; color of legs varies. Abdomen black to brown orange.

Male: Eye contiguous. Size and color as in female.

Discussion.--Apatolestes is one of the smaller tabanid genera, containing ten species from North America, all of which are confined to the western region (Philip 1965), particularly California. Two species, A. comastes Williston and A. albipilosus Brennan, are known from Oregon. Two varieties of the former species, A.c. fulvipes Philip and A.c. willistoni Brennan, also occur in Oregon. Both species and varieties occur in low frequency and show an irregular pattern of distribution. They are found mostly in the southern parts of Oregon.

## Key to the Females of Oregon Apatolestes

- 1 - Frons without basal callus; body yellowish;  
     antennae yellow; legs entirely yellow . . . . . albipilosus Brennan  
     Frons with basal callus; body black . . . . . comastes Will. 2
- 2 - Second palpal segment with black hair . . . . . 3  
     Second palpal segment with white hair . . . comastes comastes Will.
- 3 - Coxae and femora black to dark brown . comastes willistoni Brennan  
     Coxae and femora tawny . . . . . comastes fulvipes Philip

Apatolestes albipilosus Brennan  
(Map 1)

Apatolestes albipilosus Brennan, 1935, Univ. Kans. Sci. Bull. 22:371 (Orig. Descrip.); Philip, 1941, Bull. Brooklyn Ent. Soc. 36:197; 1947, Amer. Midland Nat. 37(2):263 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):7 (Tax.); Philip, 1960, Ann. Ent. Soc. Amer. 53(3):365 (Rev.); 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:320 (Cat.); Cole, 1969, Flies West. N. Amer., p. 162.

Diagnosis.--Size large, body dull brown to orange. Frons denuded yellow, without calli, with two brown bands extending from the vertex ventrally by the sides of the eyes, antenna predominantly yellow; palpi yellow with longitudinal ridge. Thorax black, with longitudinal orange stripes; wings fumose; legs entirely yellow. Abdomen predominantly orange, with dense black hair.

Description.--

Female: Length 15 mm.

Head: Frons denuded orange with two brown stripes extending from the vertex ventrally by the sides of the eyes for about two-thirds of the length of frons; calli wanting; subcallus pollinose grayish yellow; upper genae concolorous with subcallus; lower genae and clypeus gray, the former with black hair, the latter with tall creamy and short black hair. First two antennal segments yellow, third broken in this specimen, but according to Brennan (1935), it is yellow except the apex, black. Palpi yellow, with black hair, second segment swollen basally.

Thorax: Mesonotum black, with longitudinal orange stripes and orange hair; scutellum yellowish orange; wings fumose yellow, veins yellow,  $R_4$  with stump vein. Sternites I-IV yellow, II with considerable black, V-VII dark brown.

Male: Not seen from Oregon.

Type: University of Kansas, Lawrence, Kansas.

Type locality: Lemon Cove, California, 26 July 1929.

Distribution: California and Oregon.

#### Material Examined

Oregon: One specimen from Corvallis, VIII-18-43 (CAS).

Discussion.--The above description was based on the single Oregon specimen borrowed from the California Academy of Science. Philip (1960) examined this same specimen, and stated that it resembles the Brennan type. This species is larger in size than the other Oregon species of Apatolestes. Superficially it resembles some Hybomitra but may be separated easily by the number of the antennal annuli, presence of spurs on the hind tibiae, and by the shape of the frons.

#### Apatolestes comastes Williston (Map 1)

Apatolestes comastes Williston 1885, Ent. Amer. 1:12 (Orig. Descrip.); Hine, 1904, Ohio Nat. 5:230 (Rev.); Cole, 1923, Proc. Calif. Acad. Sci. 12:458; Brennan, 1935, Univ. Kans. Sci. Bull. 22:372 (Tax.); Philip, 1941, Bull. Brooklyn Ent. Soc. 36:188; 1947, Amer. Midland Nat.

37(2):263 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):7 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:320 (Cat.); 1966, Ann. Ent. Soc. Amer. 59(3):520 (Rev.); Cole, 1969, Flies West. N. Amer., p. 162; Burger, 1974, Proc. Ent. Soc. Wash. 76(3):252, 255-256; Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:5 (Syst.).

Apatolestes comastes willistoni Brennan, 1935, Univ. Kans. Sci. Bull. 22:373 (Orig. Descrip.); Philip, 1941, Pan. Pac. Ent. 36:189; 1947, Amer. Midland Nat. 37(2):263 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):7 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:320 (Cat.); Cole, 1969, Flies West. N. Amer., p. 162; Burger, 1974, Proc. Ent. Soc. Wash. 76(3):252, 256; Lane, 1976, J. Med. Ent. 12(6):684 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:5 (Syst.).

Apatolestes comastes fulvipes Philip, 1960, Ann. Ent. Soc. Amer. 53(3):364 (Orig. Descrip.); 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:320 (Cat.).

Diagnosis.--Size small, body black, slender. Frons very much widened below, shiny black; basal callus large, black; first two antennal segments gray; third segment black. Palpi yellow gray, with dense white hair. Thorax black, with longitudinal gray stripes; wings hyaline,  $R_4$  with stump vein; legs predominantly dark.

#### Description:

Female: Length 10-11 mm; slender.

Head: Frons very wide at subcallus, about two times its width at



vertex, shiny black; vertex pollinose, basal callus large, its width about four times its length, touching eyes, shiny black, separated from rest of frons by a groove, median callus not well differentiated; subcallus pollinose white; clypeus and genae concolorous with subcallus, with dense white hair. First two antennal segments have black background that is obscured by gray pollen and white hair; third segment black, slender. Palpi yellowish gray with dense long white hair and a dorsal groove.

Thorax: Black, with longitudinal gray stripes dorsally and dense white hair ventrally; wings hyaline, cell  $R_1$  with brown band,  $R_4$  with stump vein; coxae and femora black, tibiae brownish orange, with black hair, tarsi black, metatarsi with some orange.

Abdomen: Predominantly black; posterior margins of segments gray, tergites II-IV with median white hair triangle; dorsum with black hair, venter with white hair.

Male: Not seen from Oregon.

Type: University of Kansas, Lawrence, Kansas.

Type locality: California.

Distribution: British Columbia to Montana, California and Arizona.

#### Material Examined

California: Fresno Co., Van Vleet Ranch, VII-19-67, Hoy (OSU).  
Riverside Co., Pinyon Flat, VI-6-70, Cazier (CAS), Santa Rosa Mts.,  
VI-14-37, Basinger (CAS). S. Diego Co., Borregó V-20-41, Van Dyke (CAS).

Tuolumne Co., Claim, VII-6-67, Arnaud (CAS).

Discussion: All specimens of A. comastes from Oregon, seen by the writer, belong to either the variety fulvipes or willistoni, but no specimens of the typical comastes were seen although Philip, in his catalog (1965), recorded its distribution from British Columbia to California.

Brennan (1935) described willistoni as a subspecies of comastes. He separated willistoni from the typical species by the black hair on the second palpal segment and the bright orange legs. Philip (1965) treated willistoni as a variety of comastes.

Specimens of willistoni were examined from the following localities:

Oregon: Baker Co., Big Cr., VII-29-77, Davis (WSU); Cougar Cr., VII-23-77, VIII-2-77, Davis (WSU); U. Goose Cr., VIII-(18-20)-77, Davis (WSU). Jackson Co., Siskiyou Pass, VII-8-70, Westcott (OSDA). Lake Co., 6-8 mi S Valley Falls, VII-24-70, Westcott (OSDA). Union Co., Ladd Cyn., VII-(24-30)-77, VIII-(10-13)-77, Davis (WSU), L. Lick Cr., VIII-(18-20)-77, Davis (WSU). Wasco Co., The Dalles, VIII-7-68, (OSDA).

California: Mendocino Co., Hopland Fld. Sta., VII-16-67, Hoy (OSU).

Type of A.c. willistoni: University of Kansas, Lawrence, Kansas.

Type of locality: San Diego Co., California, 7 July 1929 collected by Paul Oman.

Distribution: British Columbia to Montana, California and Arizona.

Philip (1960) described fulvipes as a new variety of comastes. He separated it from the typical species by the tawny legs and the definite clouds on the cross veins and fork of the wings. In addition to these characters, I also noticed that the second palpal segment of fulvipes had black hair mixed with white, while that of the typical species had entirely white hairs. Philip indicated that the body of A. fulvipes is sometimes larger than that of the typical species. This is true, since the size of fulvipes varies. I examined two specimens, one was 9 mm long while the other was 13 mm.

The following specimens of fulvipes were examined:

Oregon: Jackson Co., Union Cr., VIII-(7-20)-50, Malkin (CAS).

California: Sonoma Co., Mines Rd., VIII-13-78, Opp (CAS).

Type of A.c. fulvipes: California Academy of Science, San Francisco, California, No. 6393.

Type locality: Red Bluff, Tehama Co., California, 12 June 1931.

Distribution: California and Oregon.

#### Genus Pilimas Brennan

Brennan, 1941, Proc. Ent. Soc. Wash. 43:130 (Established Genotype); 1935, Univ. Kans. Sci. Bull. 22:366 (As Subgenus); Philip, 1941, Can. Ent. 73:4; 1947, Amer. Midland Nat. 37(2):264 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):3 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:321 (Cat.); Burger, 1974, Proc. Ent. Soc. Wash. 76(3):257-258 (Syst.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:5 (Syst.).

Type-Species, Diatomineura californica Bigot

Diagnosis.--Size medium to large, body yellowish brown with some black, densely pilose. Eyes separated, pilose; frons widened below, pollinose, calli wanting, vertex with three ocelli; subcallus pollinose; face black, with golden hair; antennae rounded, ten-segmented bright yellow, apex black, flagellum swollen basally; palpi slender, yellow. Thorax black, with dense golden pubescence; wings hyaline,  $R_4$  with stump vein; legs black basally, yellow distally, hind tibia with spurs. Abdomen yellow, with black spots and golden hair.

Male: Eyes contiguous, palpi reduced, shaggy. Size and body color as in female.

Discussion.--This genus is represented in Oregon by P. californicus (Bigot) and its variety, beameri Philip. The former occurs in considerable numbers, but the latter is rare. Usually more males are collected than females. The latter inhabit trees and need some effort to collect them, possibly by beating the branches.

The above two taxa, especially beameri, superficially resembles Stonemyia tranquella fera (Williston), but may be separated from it by the latter's unusually long proboscis (more than one and a half the length of the palpi) and the entirely black color of its antennae and palpi.

The genus is Nearctic in distribution (Mackerras 1954). It has three species in North America, all of which occur only in the western parts of the United States, mainly California (Philip 1965).

Pilimas californicus (Bigot)  
(Figure 1, Map 7)

Diatominura californica Bigot, 1892, Mem. Soc. Zoo. de France 5:618 (Orig. Descrip.); Ricardo, 1900, Ann. Mag. Nat. Hist., Ser. 7, 5:169.

Pilimas californicus, Brennan, 1935, Univ. Kans. Sci. Bull. 22:366 (Synon.); Philip, 1941, Proc. Ent. Soc. Wash. 43:114 (Synon.); 1947, Amer. Midland Nat. 37(2):265 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):8 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:321 (Cat.); Cole, 1969, Flies West. N. Amer., p. 162; Burger, 1974, Proc. Ent. Soc. Wash. 76(3):252, 258 (Syst.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:5 (Syst.).

Pangonia dives Williston, 1887, Trans. Kans. Acad. Sci. 10:130; Hine, 1904, Ohio Nat. 5:227 (Rev.).

Diatomineura dives, Surcouf, 1821, Gen. Ins. Fasc. 175, p. 131; Ricardo, 1900, Ann. Mag. Nat. Hist. Ser. 7, 5:169.

Silvius jonesi Cresson, 1919, Proc. Acad. Nat. Sci. Philad., p. 175.

Stonemyia (Pilimas) jonesi, Brennan, 1935, Univ. Kans. Sci. Bull. 22:367.

Diagnosis.--Size large, robust; body yellow brown. Frons widened below, pollinose; subcallus pollinose; antennae yellow, except three to four apical annuli black; palpi orange. Thorax black; wing hyaline, R<sub>4</sub> with stump vein; legs predominantly orange. Abdomen predominantly yellowish brown, with black spots.

Description.--

Female: Length 15-16 mm.

Head: Frons widened below, pollinose yellowish gray, flat; subcallus pollinose, concolorous with frons. Clypeus and genae black, with yellowish gray pollen and golden hair. Antennae bright orange except apical three to four annuli black; scape and pedicel with black hair; flagellum excised. Palpi slender, orange with black hair.

Thorax: Black, with yellowish gray pollen and golden hair, pleura with dense creamy and golden hair, venter with denser hair than dorsum; wings hyaline, coastal cell fumose yellow,  $R_4$  with short stump vein, veins brown; coxae and ventral half of femora black, balance of legs bright orange, with black and golden hair; fore tarsus tinged with black.

Abdomen: Tergites I-III yellow, with median black spot and black hair, IV-VII black, with yellow posterior margin; sternite I yellow; anterior half of II-IV black, posterior half yellow; V-VII black, posterior margins gray; all segments with golden posterior fringe.

Male: Same size and shape of female; the only difference, beside the contiguous eyes, is the shape of palpi which are reduced and slender in male, with pronounced long dense hair (shaggy).

Type: British Museum (Natural History), London, England.

Type locality: California.

Distribution: British Columbia to Montana, S. to Utah and California.

## Material Examined

Oregon: Baker Co., Anthony Lk. Rd., VIII-10-29, Scullen (OSU); Baker, VII-8-22, Van Dyke (CAS); Floodwater Flat, Anthony Lk., VIII-13-75, Westcott-Penrose (OSDA); L. Goose Cr., VIII-(24-31)-75, Davis (WSU); Pine Cr., VIII-10-37, Bolinger-Jewett (OSU); Velvet Cr., VIII-(3-9)-75, Davis (WSU). Clackamas Co., 25 mi. E. Estacada, IX-2-62, Goeden (OSDA). Douglas Co., Eagle Rock, 55 mi. E. Roseburg, VII-26-45, Scullen (OSU). Grant Co., Falls Mt., Lookout Tr., VII-14-36, Scullen (OSU). Hood River Co., Hood Rv., VII-26-14, Childs (CAS, OSU). Jackson Co., Ashland, VII-10-25 (OSU); Colestin, VIII-10-54, Bishop (OSU); Mt. Ashland Rd., VIII-10-41, Stone (OSU); 16 mi. N.E. Ashland, VIII-1-62 Relling (SOSC). Josephine Co., VII-19-29, Chamberlin (OSU). Klamath Co., Badland, NE.  $\frac{1}{4}$  Sec. 9, VIII-7-71, Westcott (OSDA); Eagle Ridge, Klam. Fox (CAS); Klam. Falls, VII-8-34, Van Dyke (CAS). Lake Co., Warner Cyn., Lakeview, VII-12-51, Leech (CAS). Linn Co., Santiam Pass, VII-19-51, Scullen (OSU). Marion Co., Breitenbush, VII-21-57, Jewett (CAS). Union Co., Ladd Cyn., VII-(13-19)-75, Davis (WSU); L. Lick Cr., VIII-(3-9)-75, Davis (WSU).

Washington: Yakima, VII-26-22, Lovett (OSU).

Discussion.--P. californicus is larger than the variety beameri. They may be separated further by the black hair on the antennae and palpi of the typical form. Both californicus and beameri are distinguished from Stonemyia species by the bright yellow antennae and palpi, which are entirely black in Stonemyia.

Usually more males of californicus are encountered in collections than females, the latter are mainly plant feeders, and not attracted by

man and animals. They may be collected by beating plants.

Philip (1942) described beameri as a full species and recorded it so in his catalog (1947), but in 1965, he downgraded it to a variety of californicus. It differs from the typical species by the entirely golden hair on the antennae and palpi. The type is in the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts. The type locality is Colton, California. It occurs in California and Oregon.

#### Material of P.c. beameri Examined

Oregon: Baker Co., Cougar Cr., VIII-2/9-77, Davis (WSU); Velvet Cr., VIII-29-31)-76, Davis (WSU). Klamath Co., Ft. Klamath, VI-25-52, Schlinger (CAS). Union Co., Ladd Cyn., VII-31-77, Davis (WSU).

#### Genus Stonemyia Brennan

Stonemyia Brennan, 1935, Univ. Kans. Sci. Bull. 22:360 (Orig. Descrip.); Philip, 1941, Proc. Ent. Soc. Wash. 43:113; 1947, Amer. Midland Nat. 37(2):265 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):3 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:321 (Cat.); Pechuman, 1972, Cornell Univ., Agr. Expt. Sta. Search 2(5):7; 1973, Ins. Virg. No. 6, Res. Div. Bull. 81:16; Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:6 (Syst.).

Type-Species, Pangonia tranquilla Osten Sacken (Orig. Designation).

Diagnosis.--Refer to S. tranquilla fera below.



Discussion.--The species of this genus usually feed on plants. They do not suck blood. They mainly inhabit open forests and woody areas (Pechuman 1972, 1973). Little information is available on the biology of the species in this genus.

Only the subspecies S. tranquilla fera (Williston) is known from Oregon.

Like other tabanids, the male is separated from the female by its contiguous eyes.

The genus is Nearctic (Mackerras 1954), with only six species and subspecies (Philip 1965). Only two of these, S.t. fera and S. velutina (Bigot), have western distribution. The others are mostly in the eastern and southern parts of the United States (Philip 1965).

Stonemyia tranquilla fera (Williston)  
(Figure 4, Map 3)

Pangonia fera Williston, 1887, Tran. Kans. Acad. Sci. 10:130 (Orig. Descrip.); Hine, 1904, Ohio Nat. 5:227 (Rev.).

Corizoneura fera, Ricardo, 1900, Ann. Mag. Nat. Hist., Ser. 7, 5:169; Surcouf, 1921, Gen. Ins., Fasc. 175, p. 134.

Buplex fera, Bequart, 1924, Psyche 31:33.

Stonemyia fera, Brennan, 1935, Univ. Kans. Sci. Bull. 22:361.

Stonemyia tranquilla fera, Philip, 1947, Amer. Midland Nat. 37(2):266 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):9 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:321 (Cat.); Cole, 1969, Flies West. N. Amer., p. 162; Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:6 (Syst.).

Diagnosis.--Size medium, body brown yellow. Frons with parallel sides, without any callus; vertex with three ocelli; subcallus pollinose; antennae black; palpi grayish orange. Thorax black; wing hyaline; legs black to dark brown. Abdomen black, with sublateral orange on segments I-III, posterior margins of segments yellowish.

Description.--

Female: Length 12-15 mm, eyes separated.

Head: Eyes bare; frons with parallel sides, flat, pollinose, without calli; ocellar tubercle pollinose, with three shiny ocelli; subcallus pollinose gray to white; clypeus and genae concolorous with subcallus, with long creamy hair. Antennae black, scape and pedicel with gray pollen and black hair; basal segment of flagellum relatively short, excision shallow. Palpi slender, grayish orange, with black hair. Proboscis exceptionally long, about one and a half times the length of palpus.

Thorax: Black to dark brown, with creamy yellow hair; wings hyaline, coastal cell yellow, veins brown; legs entirely black to dark brown with black hair.

Abdomen: Black, brown and yellow, segments II-IV brownish yellow, with median black spot and creamy yellow hair; segment I and V-VII black, with yellowish gray posterior margins; posterior margins of all segments with golden fringe; pleurae predominantly yellowish orange.

Male: First palpal segment with tufts of creamy yellow hair, second segment with long black hair. Other characteristics as in female.

Type: University of Kansas, Lawrence, Kansas.

Type locality: Mt. Hood, Oregon.

Distribution.--British Columbia to California and Maine to Tennessee.

Material Examined

Oregon: Clackamas Co., Still Cr. Meadow, Mt. Hood, VII-19-78, Mahmoud (OSU). Hood River Co., Alpine Camp, VIII-2-70, Westcott (OSDA); H.R. Meadow, VII-28-65, Goeden (OSDA), H.R., W. End Rd., VIII-2-70, Westcott (OSDA). Jackson Co., Mt. Ashland, VII-20/31-62, Gilman (SOSC), VIII-14-62, Reiling (SOSC). Jefferson Co., Horse Lk., VII-25,09, Bridwell (OSU). Klamath Falls, Crater Lk., VIII-3-68, Goeden (OSDA); Lk. of Woods, VII-20-30, Scullen (CAS), VII-12-35, Ferguson (OSU), VII-11-40, VII-20-50, Scullen (OSU). Lake Co., Horse Mt., VII-26-09, Bridwell (OSU). Lane Co., Mck. Pass, VI-20-34, Childs (CAS); Willa. Pass, 20 mi. S.E. Oakridge, VII-12-62, D. Smith (OSU). Linn Co., Cascade Range, Tlkenick Cr., VII-25-74, Westcott (OSDA); Monument Pk., VII-16-60, VII-21-68, Goeden (OSDA), VII-5-70, Westcott (OSDA). Marion Co., Pamela Lk., VII-21-07, Bridwell (OSU). Union Co., Ladd Cyn., VI-(13-16)-76, VI-29-VII-2-77, VII-8-VIII-3-77, Davis (WSU).

Washington: Mt. Rainier, VIII-10-38, Crumb (OSU).

Discussion.--This is the only Stonemyia species known from Oregon. It is characterized by the lack of frontal calli and the very long proboscis; its antennae and palpi are entirely black. The last character separates it from Pilimas species that superficially

resemble it.

Its distribution in Oregon is along the Cascade Range and in the mountains of northeastern Oregon. The adult usually is on the wing during July and August.

Immature stages are not yet known.

SUBFAMILY CHRYSOPSINAE  
(Figures 3, 6, 10)

Diagnosis.--Size small to medium, body with various colorations. Hind tibiae with two apical spurs; antennae seven-segmented (annuli four); frons widened below or with parallel sides, calli present, ocelli present; wings hyaline or maculated.

Discussion.--The subfamily is represented in Oregon by the tribe Chrysopsini. The genus Chrysops is more abundant than the other genus, Silvius. Thirteen species of Chrysops and three species of Silvius occur in Oregon.

Chrysopsinae is associated with the Tabaninae; the females of both subfamilies suck blood and the antennae in both are four-annulated. However, Chrysopsinae is considered less advanced since it retains the apical spur on the hind tibiae and have less compact antennae than the Tabaninae. The feeding habits of some Chrysopsinae larvae are not understood, but some of the Chrysops are herbivorous.

Genus Silvius Meigen

Silvius Meigen, 1820, Beschreib. Europ. Zweifl. Ins. 2:27; Osten Sacken, 1875, Mem. Boston Soc. Nat. Hist. 2:365; Hine, 1903, Ohio State Acad. Sci. Spec. Pap. No. 5:31; 1904, Ohio Nat. 5:224; Philip, 1931, Minn. Expt. Sta. Tech. Bull. No. 80:79; Brennan, 1935. Univ. Kans. Sci. Bull. 22:351, Pechuman, 1938, Can. Ent. 70:165 (Synon.); Philip, 1941, Can. Ent. 73:4, 9; 1941, Bull. Brooklyn Ent. Soc. 36:185 (Synon.); 1947, Amer. Midland Nat. 37(2):266 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):3; Philip, 1965, U.S.D.A., A.R.S., Agr.

Handb. No. 276:323 (Cat.); Burger, 1974, Proc. Ent. Soc. Wash. 76(3):261; Lane, 1975, Ann. Ent. Soc. Amer. 68(5):815 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:6 (Syst.).

Type-Species, Tabanus vituli Fabricus.

#### Diagnosis.--

Female: Size small, body coloration varies from golden to black, eyes bare, separated; frons and face pollinose; frontal callus present; vertex with three ocelli; antenna seven-segmented (annuli four), color varies; palpi more than half the length of proboscis, color varies. Thorax mostly black; wings hyaline, with or without spots; color of legs black to yellow. Abdomen varies from golden to black.

Male: Eyes contiguous, with two facets; palpi usually reduced, with long hair. Size equal to or smaller than female.

Discussion.--The genus Silvius is predominantly Holarctic in distribution (Mackerras 1954). Philip (1965) reported four subgenera, Silvius Meigen, Griscosilvius Philip, Zeuximyia Philip and Assipala Philip, from North America. He listed nine species under the four subgenera, mostly distributed in the western parts of the United States.

The genus is represented in Oregon by three species, each of which belongs to a separate subgenus. While S.(S). gigantulus (Loew) is very common and has a wide range of distribution in the state, the other two species, S.(G). notatus (Bigot) and S.(Z). philipi Pechuman are rare. Only the hototype of the last species is known from Oregon.

The relationship between Silvius and Chrysops and their line of evolution has been discussed above under "Evolution."

Key to the Females of Oregon Silvius

- 1 - Body golden yellow, wings entirely hyaline . . . gigantulus (Loew)  
     Body black, wings with brown spots . . . . . 2
- 2 - First antennal segment shorter than the third . . . notatus (Bigot)  
     First antennal segment longer than the third . . . philipi Pechuman

Subgenus Silvius Meigen

Diagnosis.--Size small, body with various colorations; third antennal segment longer than the first two segments; wing hyaline, with or without stump vein.

Discussion.--Only two species of this subgenus are Nearctic, one of them, S.S. gigantulus (Loew) occurs in Oregon.

Type-species, Tabanus vituli Fabricus.

Silvius (Silvius) gigantulus (Loew)  
 (Map 4)

Chrysops gigantulus Loew, 1872, Dept. Amer. Sept. Ind., II, p. 233.

Silvius gigantulus, Osten Sacken, 1877, West. Dipt., p. 215 (Synon.); Hine, 1904, Ohio Nat. 5:229 (Rev.): Cole and Lovett, 1921; Proc. Calif. Acad. Sci. 11(15):235; Wehr, 1924, Nebr. Univ. Stud. 22:110; Brennan, 1935, Univ. Kans. Sci. Bull. 22:352 (Tax.); Rowe and Knowlton, 1936, Ohio J. Sci., 36:254; Pechuman, 1938, Can. Ent.

70:170 (Tax.); Philip, 1947, Amer. Midland nat. 37(2):266 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):9 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:323 (Cat.); Cole, 1969, Flies West N. Amer., p. 163; Lane, 1975, Ann. Ent. Soc. Amer. 68(5):815 (Immat.); 1976, J. Med. Ent. 12(6):684 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:6 (Syst.).

Silvius trifolium Osten Sacken, 1875, Mem. Boston Soc. Nat. Hist. 2:395.

Diagnosis.--Size small to medium, body golden. Eyes bare; frons with parallel sides, pollinose; basal callus black; subcallus pollinose; antennae predominantly golden yellow; palpi slender, yellow; thorax black, with dense yellow pollen; wings hyaline,  $R_4$  with stump vein; legs yellow; abdomen golden yellow.

Description.--

Female: Length 9-14 mm.

Head: Eyes bare; frons wide, about three-fourths of its length, sides parallel, pollinose grayish yellow, with golden hair, median callus wanting; basal callus shiny black; subcallus pollinose, concolorous with frons; genae pollinose concolorous with subcallus; clypeus denuded brown, with large median pollinose yellow band. Antennae golden yellow except annuli black, first two segments with black hair. Palpi slender, yellow, with black hair.

Thorax: Mesentum black, with golden hair, sometimes with dense yellow



pollen; wings hyaline, costal cell yellow,  $R_4$  with stump vein, veins yellow; pleurites with tufts of golden hair; venter gray, with golden hair; legs golden, with golden hair, joints and tarsi with some black coloration.

Abdomen: All segments golden yellow, with black hair and median black spot on tergite and sternite I and II.

Male: Eyes with two zones, one with metallic red facets and the other with small black ones; first two antennal segments with long black hair; palpi reduced with long yellow hair. Size and other features same as in female.

Type: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, No. 4024.

Type locality: California.

Distribution.--British Columbia to California, N. Mexico and Nevada.

#### Materials Examined

Oregon: Baker Co., Anthony-Dutchflat Trail, Blue Mts., VIII-8-29, Scullen (OSU); Big Cr., VII-27-VIII-2-75, VIII-(10-16)-75, VII-(25-28)-76, VIII-8-IX-8-76, VI-29-VII-22-77, VII-7-VIII-3-77, Davis (WSU); Cougar Cr., VII-(25-28)-76, VIII-(12-25)-76, VII-7/16/23-77, VIII-2/9-77, Davis (WSU); L. Goose Cr., VII-(6-19)-75, VII-27-VIII-2-75, VII-(25-28)-76, VIII-(4-7)-76, VII-7-VIII-3-77, Davis (WSU); Pine Cr., 14 mi. W. Baker, VII-25-68, Goeden-Westcott (USDA); Sumpter, VII-20-57, Baker (OSU); U. Goose Cr., VII-(20-26)-75, VII-(18-20)-76,

VII-13-VIII-3-77, Davis (WSU); Velvet Cr., VII-(3-9)-75, VI-(26-28)-77, VII-(13-23)-77 Davis (WSU). Benton Co., Camp Adair, VII-28-65, Gresbrink (OSU); Corvallis, 1965, Langiton (UCB), VII-31-66, DMC (OSU); 8 mi. W. Alsea, VIII-2-77, VII-24-78, VIII-10-78, reared from VI-15 emerged VII-4-78, Mahmoud (OSU); 15 mi. S.W. Alsea, Lobster Vall., VI-5-76, Lattin ((SU); VIII-10-76, VIII-2-77, Mahmoud (OSU); N. Fork, Alsea Rv., VI-17-61, Lattin (OSU); Wood Cr., 7 mi. W. Philomath, Schuh-Gray (OSU). Clackamas Co., 25 mil E. Estacada, VII-12-61, Goeden (OSDA); U. Clackamas Lk., VII-28-73, Johnson (OSU). Columbia Co., Vernonia, VIII-1-61, Jewett (OSU). Crook Co., Marks Cr., VII-27-63, Jewett (OSU). Curry Co., Foster Cr., VIII-29-48, Schuh (OSU); Spr. Flats Camp, Scott Rv., VII-9-39, Schuh (WSU). Deschutes Co., Richmond, VI-27-35, Schuh (CAS). Douglas Co., Drain, VIII-1-53, Hopkins (OSU). Grant Co., Dixie Pass, VII-11-53, Roth-Beer (OSU); Kooney Camp Spr., Sheep Mt., VII-19-36, Rieder (OSU); Strawberry Lk. VII-17-36, Scullen (OSU). Jackson Co., Ashland, VI-25-58. Lawrence (SOSC); Beaver Sulphur, VI-18-74, F.C. (SOSC); Woodruff Mead., 10 mi. N. Prospect, VIII-9-44, Scullen (OSU). Jefferson Co., Camp Sherman, Metolius Rv., VII-12-72, Jewett Jr. (OSU). Lake Co., 14 mi. S. Lakeview, VII-12-60, Pitman (OSU); Vic Happy Camp, VII-25-72, Jewett Jr. (OSU). Lane Co., H.J. Andrews Expt. For. Blue Rv., VI-28-72, VII-6-72, Nagel (OSU); Lucky Boy Camp, Blue Rv., VIII-5-35, Scullen OOSU); Mck. Brid., VIII-17-24, Scullen (OSU); 10 mi. N.E. Oakridge, VII-16-59, Kettunen (CAS). Lincoln Co., Calapooya Rv., VII-18-65, Phibbs (OSU); 10 mi. N.W. Nashville, VII-12/31/21-62, VII-31-63, VIII-11-64, Lewis (OSU). Linn Co., Cascadia, VIII-8-24, Scullen (OSU). Marion Co., Mehamia, VII-19042, Rieder (OSU). Polk Co., Black Rock,

10 mi. S.W. Dallas, VII-22-60, Allen (OSU); Pee Dee, 1905, Vincent (OSU). Union Co., Grande Ronde Rv., VII-18-65, Langston (UCB); 13 mi. W.S.W. La Grande, VIII-8-67, Goeden (USDA); Jordan Cr., VII-(29-31)-76, VII-(17-20)-77, Davis (WSU); Ladd Cyn., VII-(21-24)-76, VIII-(8-11)-76, VIII-(22-25)-76, Davis (WSU); L. Lick Cr., VII-27-VIII-2-75, VIII-(22-25)-76, VII-(21-23)-77, Davis (WSU); Starkey, VII-10-62, Capizzi (OSDA); U. Lick Cr., VII-(11-14)-76, VII-(25-28)-76, VII-(27-30)-77, Davis (WSU); Whiskey Cr., VII-27-VIII-2-75, Davis (WSU); Whitman N.F. VII-(11-12)-14, Chamberlin (OSU). Wallowa Co., Joseph, VII-18-65, Langston (UCB); Lost Lk., VIII-15-41, Rieder (OSU); Wallowa Lk., Aneriod Cr. Tr., VII-24-29, Scullen (CAS, OSU); Wallowa Mt. Tr., Ice Lk., VII-24-65, Goeden (OSDA). Wasco Co., Big Eddy, IX-4055, Jewett Jr. (OSU). Wheeler Co., Crystal Cr., Ochoco N.F. VII-17-71 Westcott (OSDA).

Extralimital: California; Santa Clara Co., Alum Wood Park; IX-18-60, Sturgess (OSU). Idaho; Schafer Butte, (no date), Hasbrouck (OSU).

Discussion.--S. gigantulus is distinguished from other Oregon Tabanidae by the golden body. It is a weak flier, sluggish and can be collected easily while biting. It is preyed upon by some Hymenoptera and possibly other insects. I caught a specimen of Dolichovespula maculata (Vespidae) preying on a S. gigantulus in a malaise trap.

S. gigantulus has been collected throughout Oregon except in the eastern desert region and along the coast. It is particularly common around water at lower elevations. Adults occur mainly in July and August.

The larvae of this species live in moss on sand substrate at the edge of streams and rivers. I collected larvae and pupae from the bed of a small creek about eight miles south of Alsea, Benton County. One larva was reared to the adult stage.

Subgenus Griseosilvius Philip

Diagnosis.--Size small, body color black; third antennal segments longer than the first two; wings hyaline with dark brown spots on furcation and cross veins.

Discussion.--Philip (1965) recorded five species of this subgenus from North America, of which only one S.G. notatus (Bigot) occur in Oregon.

Type-species, Chrysops quadrivittatus Say.

Silvius (Griseosilvius) notatus (Bigot)  
(Figure 25, Map 4)

Diachlorus notatus Bigot, 1892, Mem. Soc. Zoo. de France 5:623 (Orig. Descrip.).

Silvius notatus, Philip, 1941, Bull. Brooklyn Ent. Soc 36:186 (Synon.); 1947, Amer. Midland Nat. 37(2):267 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):10.

Silvius (Griseosilvius) notatus, Philip, 1962, Soc. Roy. Ent. Belg., Bull. et Ann. 97:171; 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:323 (Cat.); Cole, 1969, Flies West. N. Amer., p. 163; Lane, 1975, Ann. Ent. Soc. Amer. 68(5):815 (Immat.); 1976, J. Med. Ent. 12(6):683-690 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:6-7 (Syst.).

Silvius laticallus Brennan, 1935, Univ. Kans. Sci. Bull. 22:353

(Tax.); Pechuman, 1938, Can. Ent., 70:170 (Tax.).

Diagnosis.--Size small, slim; body gray with black spots; wings with characteristic brown spots. Frons and face gray; antennae predominantly black; palpi with groove; legs black and yellow.

Description.--

Female: Length 8-9 mm.

Head: Frons pollinose gray, with black hair, sides parallel; basal callus large, shiny black; subcallus small, gray concolorous with frons and with clypeus and genae. Antennae slender, entirely black, base of scape tinged with orange; scape about four times the length of pedicel. Palpi grayish yellow, with black hair and characteristic longitudinal dorso-lateral groove.

Thorax: Mesonotum black, with longitudinal gray stripes; scutellum gray; venter gray; wings hyaline, with characteristic dark brown spot on the middle of cell  $R_1$ , furcation and cross veins; legs with black coxae, joints, apical third of femora, spines of tibiae, tarsi except basal half of mid and hind metatarsus; balance of legs, yellow.

Abdomen: Predominantly black, with gray hair; tergites II-VII with one median and two sublateral gray spots.

Male: Eyes with a large area of yellow spotted facets and a small area of black facets; palpi reduced, with long gray hair. Size and other features same as in female.

Type: British Museum (Natural History), London, England.

Type locality: California.

Distribution: Washington, Oregon and California.

## Material Examined

Oregon: Grant Co., 9.5 mi. E. Daysville, VII-25-69, Westcott (OSDA).

California: Alameda Co., Arroyo Mocho, VI-27-65, Arnaud (CAS).

Fresno Co., IV-21-69, Hoy (OSU). Mendocino Co., Hopland Field Sta., VI-19-67. Hoy (OSU). Stanislaus Co., Del Puerto Cany., VII-5-71, Arnaud (CAS). Tulare Co., 1.5 mi. N. Lemon Cave, VIII-8-67, Hoy (OSU).

Discussion.--The type S. laticullus Brennan, which is a synonym of S. notatus, was collected from Hermiston, Oregon, but the species is still very rare in Oregon. Only one specimen in the collection of OSDA, Salem, was seen by the author from Oregon. It is more common in California.

The brown spots on the cross veins and the furcation of the wing are characteristics that are shared by this species and S.(Z). philipi. The latter is distinguished by the length of the first antennal segment which is longer than the third segment.

Immature stages of S. notatus were described from California by Lane (1975). He collected the larvae from sand and silt along the banks of rivers and creeks.

## Subgenus Zeuximyia Philip

Diagnosis.--Size small, body black; first antennal segment swollen, subequal in length to the third segment; wings with dark brown spots at furcation and cross veins.

Discussion.--Philip (1941) separated this subgenus from Silvius by the shape and length of the first antennal segment in proportion to the third segment. Only one species, S.(Z). philipi Pechuman, is known so far in this subgenus and it is only known from California and Oregon.

Type-species, Silvius philipi Pechuman.

Silvius (Zeuximyia) philipi Pechuman  
(Map 4)

Silvius (Zeuximyia) philipi Pechuman, 1938, Can. Ent. 70:165 (Orig. Descrip.); Philip, 1941a, Bull. Brooklyn Ent. 36:186 Subgenus); 1947, Amer. Midland Nat. 37(2):267 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):10 (Tax.); Philip, 1965, U.S.D.A., A.R.S. Agr. Handb. No. 276:323 (Cat.); Lane, 1975, Ann. Ent. Soc. Amer. 68(5):816 (Immat.); 1976, J. Med. Ent. 12(6):683-690 (Immat.).

Description.--

Female: Superficially similar to S. notatus, but it may be distinguished by the shape of the antennae. The scape in this species is slightly swollen and subequal in length to the flagellum; the pedicel is little more than half the length of the scape. The second palpal segment is dorso-ventrally flattened and lacks the groove of S. notatus. All other characteristics are similar to those of S. notatus. Proboscis subequal to antennae.

Male: One specimen examined was smaller than the female. Eyes with a large zone of metallic red facets and a smaller zone of black facets; palpi reduced, with long grayish hair.

Type: L.L. Pechuman collection, Cornell University, Ithaca, New York.

Type locality: 10 mi. S.E. Lebanon, Oregon (collected by George Ferguson 8/25/1935).

Distribution: Oregon and California.

### Material Examined

Oregon: None.

California: Stanislaus Co., Del Puerto Cany., Frank Raines Park, VII-3-71, Arnaud (CAS).

Discussion.--Pechuman (1938) described this species from Oregon as S. philipi. Philip (1941) placed it in a separate subgenus, Zeuximyia, on the basis of the antennal shape.

Although the type of this species is from Oregon, no other specimen has been reported from the state since the original description. The species has been collected from California. Lane (1975) described the immature stages from California. He collected the larvae from sand and silt along margins of creeks and rivers (1976).

### Genus Chrysops Meigen

Chrysops Meigen, 1800, Nouv. class., p. 23; 1803, Illiger's Mag. 2:267; Osten Sacken, 1875, Mem. Boston Soc. Nat. Hist. 2:369; Williston, 1886, Trans. Kans. Acad. Sci. 10:131; Hine, 1903, Ohio State Acad. Sci. Spec. Pap. No. 5:32; 1904, Ohio Nat. 5:219; Daecke, 1906, Ent. News, 17:39; Malloch, 1917, Bull. Ill. Lib. Hist., 12:356; Brennan, 1935, Univ. Kans. Sci. Bull. 22:254 (Synon.); Philip, 1941, Proc. Ent. Soc. Wash. 43:113-130; 1947, Amer. Midland Nat. 37(2):268 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):3; Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:323 (Cat.); Teskey, 1969, Mem. Ent. Soc. Can. No. 63:22 (Immat.); Pechuman, 1972, Cornell Univ. Agr. Expt. Sta., Search 2(5):8; 1973, Ins. Virginia No. 6, Res. Div. Bull. 81:18; Burger, 1974, Proc. Ent. Soc. Wash. 76(3):262; Lane, 1975, Ann. Ent. Soc. Amer. 68(5):806 (Immat.); Nowierski and Gittins, 1976, Univ.



Ida., Agr. Expt. Sta., Res. Bull. No. 96:7 (Syst.).

Type-species, Tabanus caecutiens Linnaeus.

Diagnosis.--

Female: Size small; body black and yellow to black; wings infuscated. Eyes separate, bare; frons very wide, mostly with parallel sides; frontal callus large, black, brown or yellow vertex with three ocelli; face black or yellow, mostly denuded; antennae seven-segmented with various coloration; palpi varies in color and shape. Thorax mostly black; wings always infuscated; legs with variable color, hind tibia with a pair of apical spurs. Abdomen yellow and black or entirely black.

Male: Eyes contiguous; size same or smaller than female; body color varies.

Discussion.--Chrysops has a worldwide distribution. Philip (1965) treated the North American species of Chrysops under two subgenera, Chrysops Meigen and Liochrysops Philip. The former has 97 species, subspecies and varieties while the latter has only two North American species. Most species have regional distributions.

Thirteen species of Chrysops, all belonging to the subgenus Chrysops, are known from Oregon. They form the second largest group of tabanids in the state.

All species are characterized by their small size and the pictured wings. The various patterns of wing maculation serve as good diagnostic characters for the separation of the species; especially so since species of Chrysops are the only Oregon tabanids with pictured wings.

Chrysops are known to attack man more than any other group of Tabanidae. This could be the reason why they are associated with human

diseases more than the other taxa. Disease like loasis in Africa, transmitted by C. dimidiata and C. silacea, and tularemia in North America, transmitted by C. discalis (and possibly others) are transmitted cyclically (not mechanically). This is an indication of the close association between the vector and its host. But this relation with man is known only for a very limited number of Chrysops species. Oldroyd (1964) reported that each group of flies of Tabanidae has evolved with the animal host that they feed on. He indicated that Chrysops, although belonging to an older branch of the family, is a genus of recent evolution associated with open plains and scattered woodlands.

Males of Oregon Chrysops are very rare in collections. The obvious reason for this is their feeding habits on sources other than blood (mostly plants). Thus they are, like the males of most other dipterans, less associated with man and animals.

Like other tabanids, Chrysops lay their eggs in masses attached to leaves or branches hanging over water or on wet soil. The larvae of Chrysops of Oregon are very poorly known. Their habitats and biologies are yet to be worked out. In general, the feeding habits of many Chrysops larvae are not known, some are known to feed on vegetable detritus, but not on each other (Oldroyd 1964).

The most recent complete and comprehensive work on the systematics of Chrysops in North America is that of Brennan (1935). Philip (1941) dealt with some groups of species. He updated the genus in his catalogs of 1947 and 1965. Oldroyd (1964) discussed the general biology and bionomics of Chrysops.

#### Key to the Females of Oregon Chrysops

- 1 - Basal callus yellow . . . . . 2

- Basal callus black or dark brown . . . . . 3
- 2 - First antennal segment slender, discal  
 cell of wing hyaline . . . . . coloradensis Bigot  
 First antennal segment stout, discal  
 cell entirely infuscated . . . . . wileyae Philip
- 3 - Abdomen entirely black; sometimes with white hair . . . . . 4  
 Abdomen with black and yellow or orange  
 coloration . . . . . 5
- 4 - Apex of wing beyond cross band hyaline . . . . . mitis O.S.  
 Apex of wing beyond cross band  
 infuscated . . . . . noctifer pertinax Will.
- 5 - Frontoclypeus black, sometimes with yellow  
 pollinose band . . . . . 6  
 Frontoclypeus yellow . . . . . 8
- 6 - Apex of wing beyond cross band entirely  
 hyaline, second abdominal tergite with  
 median gray triangle . . . . . excitans Walker  
 Apex of wing beyond cross band at least  
 partially infuscated . . . . . 7
- 7 - Abdominal tergites I and II black, with  
 yellow lateral spots; fore tibia entirely  
 black or dark brown . . . . . noctifer O.S.  
 Abdominal tergites I and II yellow, with  
 median black spot; fore tibia yellow basally . . . asbestos Philip
- 8 - Discal cell of wing predominantly hyaline . . . . . 9  
 Discal cell of wing predominantly infuscated . . . . . 10

- 9 - Apex of wing entirely infuscated; abdominal tergites mostly grayish yellow, with black spots . . . . . discalis Will.  
 Apex of wing infuscated along dorsal margin only; abdominal tergites bright yellow to tan with black spots . . . . . bishoppi Brennan
- 10 - Abdominal tergite II with two lateral black spots . . . . . 11  
 Abdominal tergites II without lateral black spots . . . . . 12
- 11 - Facial lobes yellow beyond the suture to the inside; fore femor with an orange band distally; pile of pleurae golden . . . . . proclivis O.S.  
 Facial lobes entirely black; fore femor entirely black . . . . . surdus O.S.
- 12 - Genae shiny black or dark brown, with median transverse yellow pollinose stripe . . . . . proclivis var. atricornis Bigot  
 Genae at least partially yellow, denuded . . . . . 13
- 13 - Radial cell of wing predominantly hyaline . . . . . aestuans Wulp.  
 Radial cell of wing predominantly infuscated, hyaline over apical third . . . . . furcatus Walker

Chrysops aestuans van der Wulp  
 (Figure 11, Map 5)

Chrysops aestuans van der Wulp, 1867, Tijdsch. V. Ent. 10:135 (Orig. Descrip.); Osten Sacken, 1875, Mem. Boston Soc. Nat. Hist. 2:378 (Tax.); Hart, 1895, Bull. Ill. Lab. Nat. Hist. 4:227; Lugger, 1897, 2d Rep. Ent. Minn., P. 10; Philip, 1931, Minn. Expt. Sta. Tech.

Bull. No. 80:38-124 (Synon.); Brennan, 1935, Univ. Kan. Sci. Bull. 22:261 (Tax.); Rowe and Knowlton, 1936, Ohio J. Sci. 36:256; Pechuman, 1938, J. Brooklyn Ent. Soc. 33:136 (Synon.); Philip, 1947, Amer. Midland Nat. 37(2):269 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):10 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:324; Cole, 1969, Flies West. N. Amer., p. 163; Teskey, 1969, Mem. Ent. Soc. Can. No. 63:27 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:8 (Syst.).

Chrysops moerens Walker, 1848, List 1, p. 201; Ricardo, 1901, Ann. Mag. Nat. Hist. Ser. 4, 8:302; Hine, 1903, Ohio St. Acad. Sci. Pap. No. 5:40; 1906, U.S.D.A., Bur. Ent. Tech. Ser., Bull. No. 12:36-38; 1923, Ohio J. Sci. 23:205; Wher, 1924, Nebr. Univ. Stud. 22:112; Cameron, 1926, Bull. Ent. Res. 17:23 (Biono.); Krober, 1926, Stettin Ent. Ztg. 87:280 (in Philip 1947); Segal, 1936, Jour. N.Y. Ent. Soc. 44:140.

Diagnosis.--Frons whitish gray; basal callus black; face shiny yellow with transverse gray bands. Thorax with gray longitudinal stripes; legs predominantly yellow; wings with large hyaline triangle, discal cell with median hyaline zone, cell R and  $M_3$  predominantly hyaline. Abdomen color variable, with germinated black spot and pale triangles.

Description.--

Female: Length 10 mm.

Head: Frons width and length subequal, pollinose whitish gray; ocellar tubercle with three shiny ocelli; basal callus oval, black; sides of genae bordering eyes concolorous with frons, rest denuded yellow;

clypeus denuded yellow, with transverse gray band on each side.

Antennal scape and pedicel yellow, tinged with black exteriorly, scape slightly swollen, base of flagellum yellowish gray, balance black.

Palpi slender, yellow.

Thorax: Mesonotum with longitudinal black and gray stripes; scutellum and venter pollinose gray; legs yellow except mid and hind coxae, joints, distal end of fore tibia and four distal tarsal segments, black; hind femor sometimes black.

Wings: Apex mostly hyaline, with a dorsal stripe abbreviated short of cell  $R_4$  boundaries; hyaline triangle cross frucation, discal cell with median hyaline to semi-hyaline zone; cell R and  $M_3$  hyaline, with slight infuscation at two ends.

Abdomen: Tergites I and II with median black to brown spot, sometimes germinate, sides tan; tergite II with sublateral black spot; tergites III - VII with double germinated median black spots, separated by pale triangles. Sternites I and II pale, sometimes with median and/or lateral black spots; sternites III and IV pale with median and lateral black spots; remainder of sternites black, with pale posterior margins and yellow hair.

Male: Not seen from Oregon.

Type: Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands.

Type locality: "Kumlein," Wisconsin (after Philip 1947).

Distribution: Alaska to California, Oklahoma to Utah and Pennsylvania.

### Material Examined

Oregon: Lake Co., 5 mi. N. Silver Lk., VII-23-57, Miller (OSDH).  
Umatilla Co., Umatilla Nat. Wildl. Ref.; VII-14-76, Rayon (OSDH); VII-1-70, Goeden (OSDA).

Discussion.--Philip (1931) determined that C. moerens Walker was a junior synonym of C. aestuans van der Wulp. This was further confirmed by Brennan (1935).

C. aestuans is very rare in Oregon, although it is widely distributed in North America.

This species can be separated easily from its closest relative, C. furcatus, by the hyaline cell R which is predominantly infuscated in the latter.

Cameron (1926) reared and described the immature stages of C. moerens (= aestuans). Philip (1931) collected larvae from the banks of temporary ponds. He described both the larva and pupa and found the larva feeding on chironomid larvae.

### Chrysops asbestos Philip (Figure 12, Map 5)

Chrysops asbestos Philip, 1949, Ann. Ent. Soc. Amer. 42(4):455-457 (Orig. Descrip.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):10 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:324 (Cat.); Lane, 1976, J. Med. Ent. 12(6):684 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:8 (Syst.).

Diagnosis.--Size small, body yellow and black. Face black; antenna yellow basally, black distally; legs black, basally, yellow distally;

hyaline triangle of wing cross furcation, R and discal cells infuscated. Abdominal tergites I and II yellow, with median black spot; tergites III - VII with alternate black and yellow transverse stripes.

Description.--

Female: Length 9-10 mm.

Head: Sides of frons parallel, slightly longer than wide, partially pollinose; ocellar tubercle large, touching eyes, shiny black; medium callus wanting; basal callus large, occupy about half area of frons, shiny black; subcallus relatively small, pollinose concolorous with frons; genae pollinose yellow; sides and lower region of clypeus shiny black, balance pollinose yellow. Antennal scape yellow with black hair; pedicel yellow to gray brown, with black hair; flagellum black, with brown on base. Palpi slender, yellow, with dark patches and short black hair.

Thorax: Dorsum black, with gray lateral margins; pleurites with dense yellow hair. Venter dark, with dense yellowish pollen; coxae and femora black tinged with brown; tibiae dark yellow, with black hair, fore tibia dark brown distally concolorous with fore tarsus; mid and hind tarsi yellow basally, black distally, with black hair.

Wings: Coastal and  $R_1$  cell fully infuscated; apex lightly infuscated; hyaline triangle cross the furcation into cell  $R_3$ ; crossband not reaching lower margin; cell R infuscated over anterior half and distal tip; cell 2M infuscated over apical quarter; anal cell narrowly open; haltere black.



Abdomen: Segments I and II yellow with single black spot on dorsum and venter of each; segment II with pale yellow posterior margin. Segments III - VII with anterior half black and posterior half grayish yellow.

Male: Not seen from Oregon.

Type: California Academy of Science, San Francisco, California, No. 12813.

Type locality: Holotype: Ravalli Co., Montana, August 4, 1948.

Allotype: Gold Lake, Sierra Co., California, August 5, 1921.

Distribution: British Columbia to California and Wyoming.

#### Material Examined

Oregon: Baker Co., Anthony Lk., VIII-11-52, Baker (OSU); Big Cr., VI-29-VII-12-75, VII-(13-23)-77, VII-31-VIII-3-77, Davis (WSU); Cougar Cr., VI-28-77, VII-(7-23)-77, Davis (WSU); L. Goose Cr., VI-29-VII-12-75, VII-(27-30)-76, VI-(12-14)-77, VI-(26-28)-77, VII-(7-16)-77, Davis (WSU); U. Goose Cr., VI-29-VII-12-75, VII-(20-26)-75, VI-(26-30)-76, VII-(11-28)-76, VI-(26-28)-77, VII-13-VIII-3-77, Davis (WSU); Velvet Cr., VII-(6-12)-75, VII-(25-28)-76, VII-(13-23)-77, Davis (WSU). Clackamas Co., Still Cr. Mead., VII-19-78, Mahmoud (OSU). Clatsop Co., Astoria, VII-27-28, Gray-Schuh (OSU). Douglas Co., Diamond Lk., VII-27-59 (CAS). Lake Co., Adel Lk., VII-20-48, Roth (OSU). Lane Co., H.J. Andrews, Expt. Forest, Blue Rv., VII-12-72, Nagel (OSU); Eugene, V-26-60, Foster (OSDA). Linn Co., Marion Forks, VII-15-65, Christenson (OSU); Monument Pk., VII-5-70, Goeden (OSDA). Marion Co., Idanha,

VII-6-65, Christenson (OSU). Union Co., Jordan Cr., VII-(15-17)-76, Davis (WSU); Ladd Cyn., VII-(6-12)-75, VII-27-VIII-2-75, VI-(13-16)-76, VII-(4-6)-76, VIII-(18-21)-76, VII-(7-9)-77, VII-(27-30)-77, Davis (WSU); L. Lick Cr., VI-(19-22)-77, VII-(7-9)-77, VII-(21-23)-77, Davis (WSU); U. Lick Cr., VI-(26-28)-77, Davis (WSU); Whiskey Cr., VII-(6-12)-75, Davis (WSU).

Discussion.--C. asbestos is mostly a northwestern species. Its distribution in Oregon is mainly at higher elevations in the Cascade Mountains, the Coastal Range and the northeastern parts of the state. It is not well represented in collections from Oregon.

Seasonal occurrence of adults is from mid June to mid August.

It does not exhibit any taxonomic problem among Oregon species and can easily be separated by the bright yellow coloration and the transverse abdominal bands.

The immature stages are not yet known.

Chrysops bishoppi Brennan  
(Figure 13, Map 6)

Chrysops bishoppi Brennan, 1935, Univ. Kans. Sci. Bull. 22:266 (Orig. Descrip.); Philip, 1941, Proc. Ent. Soc. Wash. 43:116 (Synon.); 1947, Amer. Midland Nat. 37(2):269 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):11 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:324 (Cat.); Cole, 1969, Flies West. N. Amer., p. 164.

Diagnosis.--Size medium, body tan to yellow. Face shiny yellow, with two black spots on sides; basal callus oval, black; antenna yellow basally, black distally; palpi yellow. Thorax with longitudinal gray

stripes; legs predominantly yellow. Abdomen tan to yellow with germinate black spots on tergites I - IV, rest of tergites with black and yellow transverse stripes; venter yellow.

Description.--

Female: Length 9-11 mm.

Head: Frons wide, pollinose whitish gray, sides parallel; ocellar tubercle large, shiny black; basal callus oval, black; subcallus pollinose, concolorous with frons. Clypeus and lower parts of genae denuded yellow, upper part of genae pollinose yellow, clypeus with black spot on each side. First two antennal segments yellow with black patches dorsally and black hair; third segment black. Palpi yellow with dark patches dorsally.

Thorax: Mesonotum with alternate black and yellow longitudinal stripes and creamy yellow hair, scutellum dark gray. Pleura gray with dense creamy yellow hair. Sternum with three longitudinal gray stripes; fore coxae, femora, basal half of tibiae and hind tarsi yellow, balance of legs black, with black hair.

Wings: Apex with narrow infuscation; hyaline triangle crossing furcation to boundaries of  $R_{2+3}$ ; crossband touches lower margin at cell  $M_3$ , discal cell predominantly hyaline from anterior end to center; cell R infuscated over anterior half and posterior apex; cell 2M infuscated at anterior tip.

Abdomen: Tergites I and II pale yellow, with median germinate black spot, not reaching posterior margins; tergites III and IV with double

germinate anterior black spot, posterior half pale yellow; tergites V - VII black anteriorly pale yellow posteriorly. Sternites concolorous with corresponding tergites, but with less black laterally.

Male: Antennae entirely black; first palpal segment enlarged, black second segment stout, with long hair; cell  $M_2$  predominantly infuscated. Size and other characters essentially as in female.

Type: Female. U.S. National Museum, Washington, No. 50605.

Type locality: Topaz, California, June 7, 1919.

Distribution: California and Oregon.

#### Material Examined

Oregon: Baker Co., Anthony Lk., VII-12-53, Roth-Beer (OSU); Big Cr., VI-29-VII-12-75, VIII-(10-16)-75, VI-(27-30)-76, VI-(9-22)-77, VII-(7-16)-77, Davis (WSU); Cougar Cr., VI-(27-30)-76, VII-(1-3)-76, VII-7/23-77, VIII-22-77, Davis (WSU); L. Goose Cr., VI-29-VII-12-75, VI-(19-25)-77, VII-(21-23)-77, Davis (WSU); U. Goose Cr., VI-29-VII-12-75, VI-(26-28)-77, Davis (WSU); Pine Cr., Elkhorn Ridge, VII-25-68, Goeden-Westcott (OSDA); Velvet Cr., VI-29-VII-12-75, VI-(26-28)-77, VII-(13-16)-77, Davis (WSU). Deschutes Co., Crane Prairie Res., VII-18-76, Cobb (OSU); Davis Lk., VI-25-34, Carlson (WSU); VIII-9-35, Scullen (CAS, OSU). Grant Co., 9 mi. N. Seneca, VII-13-53, Roth (OSU). Harney Co., Alvord Desert, VI-30-78, Siebert (OSU); Frenchglen, VII-28-36, Jewett (OSU), VII-12-47, Ellertson (CAS); 14 mi. N. Burns, VII-29-69, Westcott (OSDA); Malheur Natl. For., Cow Cr., VII-13-76, Westcott (OSDA); Pike Cr. Cyn., VII-29-75, Mathis (OSU); 21 mi. N.W.

Sand Dunes, VII-14-76, Westcott (OSDA). Klamath Co., Denny Cr., U. Klam. Lk., VI-24-55, Schuh (WSU); Kirk, VIII-18-50, Roth (OSU); Klam. Falls, Algoma, VII-13-55, Schuh (CAS); 15 mi. W. Klamath Falls, VII-1-29, Johnson (OSU); Klamath Marsh, VI-25-39 (CAS); Lk. of Woods, VIII-12-35, Scullen (OSU). Lake Co., 14 mi. S. Lakeview, VII-12-60, Pitman (OSU); Summer Lk., VII-18-44, Mote (OSU), VI-30-48, VIII-19-48, VIII-10-66, Roth (OSU). Union Co., Jordan Cr., VII-(15-17)-76, Davis (WSU); Ladd Cyn., VII-(6-19)-75, VI-(27-30)-76, VII-(4-6)-76, VI-(19-22)-77, VI-(7-9)-77, VIII-(24-26)-77, Davis (WSU); L. Lick Cr., VI-(27-30)-76, VI-(19-28)-77, VII-(7-16)-77, Davis (WSU); U. Lick Cr., VI-29-VII-5-75, VII-(7-9)-77, Davis (WSU); Whiskey Cr., VII-(15-17)-76, Davis (WSU). Wheeler Co., Pisgah Lookout, Ochoco N.F., VII-17-71, Westcott (OSDA).

Discussion.--This species occurs only in California and Oregon. In spite of its presence in the eastern parts of Oregon close to Idaho, it has not been reported from that state. In Oregon, it occurs mainly east of the Cascade Mountains, but in small numbers. No specimens have been reported from western Oregon.

C. bishoppi is characterized by the considerable hyaline area in the discal cell, a character that it shares with C. discalis, but the latter has a fully infuscated wing apex.

Adult seasonal occurrence ranges from mid June to mid August.

Chrysops coloradensis Bigot  
(Figure 14, Map 6)

Chrysops coloradensis Bigot, 1892, Mem. Soc. Zoo. de France 5:605 (Orig. Descrip.); Ricardo, 1900, Ann. Mag. Nat. Hist., Ser. 7, 8:307; Hine, 1904, Ohio Nat. 5:220; Cole and Lovett, 1921, Proc. Calif.

Acad. Sci. 11(15):232; Webb and Wells, 1924, U.S.D.A. Bull. No. 1218:31; Krober, 1926, Stettin Ent. Ztg. 87:293; Brennan, 1935, Univ. Kans. Sci. Bull. 22:278; Philip, 1935, Proc. Ent. Soc. Wash. 37:158 (Partim); 1941, Proc. Ent. Soc. Wash. 43:117 (Synon.); 1947, Amer. Midland Nat. 37(2):271 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):11 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:324 (Cat.); Cole, 1969, Flies West. N. Amer., p. 164; Lane, 1975, Ann. Ent. Soc. Amer. 68(5):806-811 (Immat.), 1976, J. Med. Ent. 12(6):-683-690 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:9 (Syst.).

Chrysops pachycera Williston, 1887, Trans. Kans. Acad. Sci. 10:134; Cole and Lovett, 1921, Proc. Calif. Acad. Sci. 11(15):232.

Diagnosis.--Size small, body yellow and black. Frons pollinose; basal callus yellow; face yellow, with two black spots on sides; antennae yellow basally, black distally. Thorax with gray longitudinal stripes; cross band of wing approach lower margin; legs yellow and black. Abdomen yellow with black spots.

Description.--

Female: Length 9-10 mm.

Head: Frons pollinose grayish yellow, with golden hair, sides not quite parallel; ocellar tubercle shiny black; basal callus characteristically yellow, with black boundaries, diamond; subcallus relatively small, pollinose. Clypeus and lower parts of genae denuded orange to yellow, upper parts of genae pollinose, a pollinose yellow band cross each gena to lower borders of clypeus, clypeus with black spot on each

side. First two antennal segments yellow, second segment tinged with brown and dense black hair; third segment black, with yellow at base. Palpi slender, yellow.

Thorax: Both dorsum and venter with gray longitudinal stripes and golden hair on black background; scutellum dark gray; pleura with dense tufts of golden hair; legs yellow except mid and hind coxa, distal end of fore tibia, joints, fore tarsus and distal parts of mid and hind tarsi black.

Wings: Apex with little infuscation on posterior upper corner of cell  $R_4$ ; hyaline triangle cross beyond frucation, cross band approaches lower margin; discal cell fully infuscated; cell R infuscated over anterior two-thirds; cell  $M_2$  lightly infuscated over anterior half.

Abdomen: Tergites I - IV pale yellow; tergite I with single median black spot, II with one germinate median black spot, III and IV with double germinate black spots; V - VII black, with yellow posterior margin. Sternites I - IV yellow, each with one median and two sub-lateral black spots; V - VII concolorous with corresponding tergites.

Male: Length 8 mm; head relatively small; abdomen wider than thorax; antennae and palpi shaggy black. Thorax dark brown. First abdominal tergite dark brown, with yellow spot laterally; II - V with double germinate dark brown spots on yellow background, VI - VII entirely dark brown; venter yellow with black spots.

Type: British Museum (Natural History), London, England.

Type locality: Colorado.

Distribution: British Columbia to California and Colorado.

Material Examined

Oregon: Benton Co., Corvallis, VII-(10-15)-60, (Reared), Lewis (OSU), VII-26-64, Lewis (OSU), VII-3-77, Goulding (OSU); 8 mi. W. Alsea, VII-2-77, Mahmoud (OSU); Mary's Peak, VII-(2-3)-67, Hoy (OSU), VI-24-70, VIII-10-71, Oman (OSU). Hood River Co., Hood Rv., IX-1936 (OSU). Jackson Co., 11 mi. W. Butte Falls, VII-10-69, Westcott (OSDA); Medford, VI-(20-22)-37, Bolinger-Jewett (CAS, OSU). Klamath Co., Bly, Ted Hide Ranch, VII-27-77, Mahmoud (OSU), VII-28-77, Cobb (OSU); 15 mi. W. Klamath Falls, VII-1-29, Johnson (OSU); Klamath Falls, Geary Ranch, VII-22-58, Schuh (OSU); 2 mi. S.W. Keno, VII-23-70, Penrose-Westcott (OSDA); Lk. of the Woods, VIII-11-35, Ferguson (CAS). Marion Co., Detroit, VI-1964, Hanson (OSDH); Salem, VII-1-67, Larson (OSDA). Polk Co., Rickreal, 1905 (OSU); 2 mi. N.W. Survey, VII-16-71, Westcott (OSDA). Wheeler Co., 12 mi. E. Mitchell, V-18-64, Miller (OSDH).

Extralimital: California, Big Bear Lk., VII-31-49, Martin (OSU). Utah; Hoytsville, Rockwood (OSU). Washington; Spanaway, VI-10-39, Crumb (OSU).

Discussion.--C. coloradensis is characterized by the yellow color of the basal callus. Only one other Oregon species, C. wileyae, has this character, but it may be separated from coloradensis by the stout first antennal segment.

C. coloradensis is not well represented in collections from Oregon.

The adults of the species have a long seasonal occurrence, ranging from



June to September.

Lane (1975) gave a detailed illustrated description of the immature stages of C. coloradensis from California. He found it breeding in soil covered with moss along the banks of permanent ponds.

Chrysops discalis Williston  
(Figure 15, Map 7)

Chrysops discalis Williston, 1880, Trans. Conn. Acad. Sci. 6:245 (Orig. Descrip.); Hine, 1904, Ohio Nat. 5:221; Cole and Lovett, 1921, Proc. Calif. Acad. Sci. 11(15):232; Wher, 1924, Neb. Univ. Stud. 22:112; Cameron, 1926, Bull. Ent. Res. 17:18 (Biono.); Brennan, 1935, Univ. Kans. Sci. Bull. 22:286 (Tax.); Rowe and Knowlton, 1936, Ohio J. Sci. 37:257; Philip, 1941, Proc. Mont. Acad. Sci. 2:64-66; Gjullin and Mote, 1945, Proc. Ent. Soc. Wash. 47:236-244; Philip, 1947, Amer. Midland Nat. 37(2):272; Roth and Lindquist, 1948, J. Econ. Ent. 41(3):473; Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):13; Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:325; Kundsén and Rees, 1967, Proc. 20th Ann. Meet., Utah Mosq. Abate Assoc.; 1967, Proc. Pap. 35th Ann. Conf. Cal. Mosq. Cont. Assoc., p. 103-105; Cole, 1969, Flies West. N. Amer., p. 164; Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:10 (Syst.).

Heterochrysops discalis, Krober, 1926, Stettin Ent. Ztg. 87:236.

Diagnosis.--Size small to medium, body grayish green to yellow. Frons subquadrate, pollinose, basal callus oval, black; subcallus pollinose; antennae brown basally, black distally; palpi slender, yellow. Thorax with longitudinal gray stripes; legs predominantly yellow; apex of wings fully infuscated, discal cell hyaline. Abdominal tergites

grayish yellow to green with black spots.

Description.--

Female: Length 7-11 mm.

Head: Frons subquadrate, white pollinose, with dense white hair; vertex with three shiny ocelli; basal callus relatively small, transversally oval black; subcallus pollinose, concolorous with frons. Clypeus and lower genae pollinose white, with yellow hair; upper genae denuded pale yellow, with large black spots extending into sides of clypeus. First two antennal segments and extreme base of third brown to black, with dense black hair, balance black. Palpi slender, pale yellow.

Thorax: Both dorsum and venter with alternate black and gray longitudinal stripes; pleura with dense, creamy yellow hair; legs yellow, except mid and hind coxa, joints, distal parts of tarsi black to dark brown.

Wings: Apex fully infuscated except for a small area in cell  $R_4$ ; with a semi-rectangular hyaline region extending from boundaries of  $R_{2+3}$  through middle of cell  $R_3$  two-thirds of cell  $R_5$  to lower margin of cell  $M_2$ ; discal cell hyaline.

Abdomen: Tergites I - IV pale yellow to orange, with four large black spots, the two median spots on I and II germinate; tergites V - VII with anterior transverse black stripe and posterior yellow one. Sternite concolorous with corresponding tergites except that I - IV with single large median black spot.

Male: Eyes slightly separated; ocellar tubercle large, denuded; antennae black, with long hair; palpi with long black hair; legs predominantly black; first abdominal tergite entirely black; abdomen predominantly black. Size same as female.

Type: University of Kansas, Dept. Entomology, Lawrence, Kansas.

Type locality: Como, Wyoming, June 20, 1880.

Distribution: British Columbia to Manitoba, California to Nebraska.

#### Material Examined

Oregon: Grant Co., 7 mi. S.S.W. Prairie, VI-26-62, Goeden (OSDA). Harney Co., Andrews, Rangeland, VI-17-62, Goeden (OSDA); Burns, VII-22-48, Roth (OSU); Frenchglen, VII-(8-15)-35, Jewett (OSU), Harney Lk., sand, VIII-5-77, Cobb (OSU); Juniper Lk., VIII-5-77, Cobb (OSU); 10 mi. S.W. Whitehorse Ranch, VIII-13-67, Goeden (OSDA); Wagontire, VIII-1-62, Goeden (OSDA). Klamath Co., Bly, VIII-28-77, Cobb (OSU); Bonanza, VIII-3-56, VII-20-59, Schuh (OSU); 22 mi. E. Klamath Falls, VI-22-71, Oman (OSU); Klamath Falls, VII-20-22, VI-53, VII-16-59, Schuh (CAS); L. Klamath Lk., VIII-25-44, Schuh (OSU); 15 mi. E. Worden, VIII-5-67, Goeden (OSDA); Worden, VIII-5-67, Goeden (OSDA). Lake Co., Abert Lk., VI-17-34, VIII-2-35, Schuh (OSU), VI-18-34, Jones (CAS, OSU), VIII-2-35, VIII-16-39, Gray-Schuh (CAS, OSU), VIII-2-67, Goeden (OSDA); Ana Spr. Res., VIII-3-66, Goeden (OSDA); Hot Spr., Paisley, VII-20-44, Mote (CAS); 19 mi. N.W. Paisley, VII-11-74, Mathis (OSU); Lakeview, VIII-2-61, Goeden (OSDA); Rest Lk., VII-(20-23)-44, Mote (OSU), VIII-25-44, Scullen (OSU); Silver Lk., VIII-16-39, Schuh-Gray (CAS, OSU);

Summer Lk., VII-17-32, VII-1--42, VII-22-44, Gjullin (OSU, WSU); VI-16-38, Gray-Schuh (OSU), VII-(18-21)-44, Mote (OSU), VIII-(25-26)-44, Scullen (OSU), VIII-9-46, Davis (OSDA), VIII-16-49, VIII-10-66, Roth (OSU), VIII-24-65, VIII-1-67, Goeden (OSDA), VII-27-77, Mahmoud (OSU); N.W. Shore Alkali Lk., VII-12-74, Mathis (OSU). Malheur Co., Jordan Valley, VII-10-53, Lauderdale (OSU); Ontario, VIII-1-29, Scullen (OSU).

Discussion.--C. discalis has a wide range of distribution in western North America. It usually occurs around lakes and marshes (Gjullin and Mote 1945, Kundsén and Rees 1967). In Oregon, its distribution is mainly in the central, southern and eastern parts of the state, particularly around lakes in Klamath and Lake Counties. Gjullin and Mote (1945) gave detailed accounts of the biology, life cycle and control in Oregon. They reported its association with the transmission of tularemia to man and its severity as a pest on cattle. They collected the immature stages from mud around lakes. Kundsén and Rees (1967), studied its breeding habits and emergence around the Great Salt Lake, Utah. They confirmed its breeding in moist soil on the shores of lakes and marshes.

Taxonomically, C. discalis is characterized by the infuscation of the wing apex and the hyaline discal cell. The wing pattern has a mosaic shape that distinguishes this from other Oregon species. The grayish green color of the body of most specimens is also characteristic.

Chrysops excitans Walker  
(Figure 16, Map 7)

Chrysops excitans Walker, 1850, Dipt. Saund. 1:72 (Orig. Descrip.); Osten Sacken, 1875, Mem. Boston Soc. Nat. Hist. 2:373; Williston, 1887, Tran. Kans. Acad. Sci. 10:132; Ricardo, 1901, Ann. Mag. Nat. Hist., Ser. 7, 8:304; Howard, 1902, Insect Book; Hine, 1904, Ohio Nat. 5:222; Daecke, 1907, Ent. News, 18:139; Andrews, 1918, Occ. Pap. Mus. Zoo. Univ. Mich. No. 53:3; Cole and Lovett, 1921, Proc. Calif. Acad. Sci. 11(15):232; Cameron, 1926, Bull. Ent. Res. 17:19; Kroeber, 1926, Stettin Ent. Ztg. 87:250; Philip, 1931, Minn. Expt. Sta. Tech. Bull. No. 80:35-123 (Synon.); Brennan, 1935, Univ. Kans. Sci. Bull. 22:291 (Tax.); Segal, 1936, Jour. N.Y. Ent. Soc. 44:77; Rowe and Knowlton, 1936, Ohio J. Sci. 36:257; Philip, 1947, Amer. Midland Nat. 37(2):273 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):12; Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:325 (Cat.); Teskey, 1969, Mem. Ent. Soc. Can. No. 63:38 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:10 (Syst.).

Chrysops sordidus Washburn, 1905, 10th Rep. State Ent. Minn., p. 79; Philip, 1931, Minn. Expt. Sta. Tech. Bull. No. 80:85 (Synon.).

Diagnosis.--Size relatively large, body predominantly black. Frons subquadrate; vertex denuded black; basal callus large, diamond, shiny black; face black, with transverse and longitudinal stripes; antenna reddish basally; black apically. Thorax black, with faint gray stripes; legs black; posterior third of wing entirely hyaline, discal cell infuscated. Abdomen black with gray median triangle on tergites I and II; pile of pleura golden.

Description.--

Female: Length 10-12 mm.

Head: Frons subquadrate, pollinose grayish yellow; vertex denuded black with three ocelli; basal callus large, diamond shape, almost touching eyes, shiny black. Clypeus and genae shiny black, clypeus with longitudinal yellow pollinose stripes, genae with median transverse stripes. First two antennal segments and base of third, reddish orange with black hair on first two segment, balance black. Palpi slender, yellow, with black hair.

Thorax: Mesonotum black, with faint gray longitudinal stripes, pleura with dense white orange tufts of hair. Venter dark; legs black, with some brown on joints, basis of tibiae and mid and hind tarsus.

Wings: Posterior one-third entirely hyaline; discal cell infuscated; cell R infuscated over anterior two-thirds and posterior apex; cell 2M infuscated over anterior two-thirds, anal cell closed.

Abdomen: Dorsum black, with yellow on lateral sides of tergites I and II; tergite II with characteristic gray median triangle, posterior margins of tergites gray with golden fringe; pile of pleurae golden. Sternites black, with gray posterior margins and golden hair.

Male: Not seen from Oregon.

Type: British Museum (Natural History), London, England.

Type locality: Cape Breton Island, Nova Scotia, Canada.

Distribution: Alaska to California to New Jersey and Nova Scotia.

Material Examined

Oregon: Clackamas Co., Still Cr., Forest Camp, Mt. Hood, VIII-9-55, Jewett Jr. (OSU), VII-19-78, Mahmoud (OSU); Swim, VII-12-38, Gray-Schuh (CAS). Crook Co., Prineville, 15 mi. S.E. Eagle Rock, VI-9-68, Oman (OSU). Deschutes Co., Lava Lk., VIII-9-39, Scullen (OSU), VII-19-77, Mahmoud (OSU); Sisters, VIII-7-66, Lewis (OSU). Douglas Co., Diamond Lk., VII-23-53, VIII-5-55, VII-27-59, Jewett Jr. (OSU). Jackson Co., 5 mi. S. Fish Lk., VIII-17-69, Goeden (OSDA). Jefferson Co., Olallie Lk., VIII-5-41, Schuh-Gray (OSU); Santiam Summit, VII-(18-19)-59, Jewett Jr. (OSU). Klamath Co., Crescent Cr., Hwy. 58, VI-27-62, Goeden (OSDA); Lake of the Woods, VII-9-58, Scullen (OSU); Odell Lk., VII-6-49 (OSU), VIII-3-52, Ritcher (OSU). Lake Co., Horse Mt., Flats, VII-31-09, Bridwell (CAS). Lane Co., H.J. Andrews Expt. Forest, Blue Rv., VIII-13-78, Frost (OSU); 6 mi. W. Mck. Pass Summit, VI-20-34, Jones (OSU); Craig Lk., VI-20-34, Schuh (CAS, OSU); Mck. Pass, VIII-16-47, VIII-3-50, Roth (OSU); Waldo Lk., VII-23-69, Goeden (OSDA). Linn Co., Big Meadow N. Santiam Pass, VIII-2-48 (OSU), VII-18-65, Goeden (OSDA); Cascadia, Will. Nat. For., VII-19-77, Mahmoud (OSU), 26 mi. S.E. Idanha, VII-20-72, Mathis (OSU); 1 mi. N. Hoodoo Ski Bowl, VII-23-69, Westcott (OSDA); Marion Forks, VII-(6-15)-65, Christenson (OSU); Mt. Jefferson, VII-12-07, Bridwell (CAS, OSU). Marion Co., Breitenbush Lk., VI-23-40, Rieder (OSU), IX-13-64, Goeden (OSDA); Pamela Lk., Mt. Jefferson, VII-12-07, Bridwell (OSU).

Discussion.--C. excitans is the largest of the Oregon Chrysops. It may

be separated from other Oregon species by the gray triangle on the second abdominal tergite. It is widely distributed in the United States, but in Oregon it occurs mostly in the Cascade Mountains. The adult is usually active from mid June to early September.

Cameron (1926) and Philip (1931) reared and described the larvae and pupae. Teskey (1969) collected its larvae from moss and dead vegetation at the margins of marsh lakes, bog ponds and pools. He reared and described both the larval and pupal stages.

Chrysops furcatus Walker  
(Figure 17, Map 8)

Chrysops furcatus Walker, 1848, List 1, p. 179 (as C. furcata); Ricardo, 1901, Ann. Mag. Nat. Hist., Ser. 7, 8:302; Brennan, 1935, Univ. Kans. Sci. Bull. 22:301 (Synon.); Philip, 1935, Proc. Ent. Soc. Wash. 37:153 (Synon.); 1947, Amer. Midland Nat. 37(2):274 (Cat.); 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:325 (Cat.); Teskey, 1969, Mem. Ent. Soc. Can. 63:40 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:11 (Syst.).

Chrysops lupus Whitney, 1904, Can. Ent. 36:205; Hine, 1904, Ohio Nat. 5:224; Cole and Lovett, 1921, Proc. Calif. Acad. Sci. 11(15):232; Krober, 1926, Stettin Ent. Ztg. 87:304; Philip, 1931, Minn. Expt. Sta. Tech. Bull. No. 80:88; Bequaert, 1933, Occ. Pap. Boston Soc. Nat. Hist. 8:83; Rowe and Knowlton, 1936, Ohio J. Sci. 36:258.

Diagnosis.--Size small, body black and yellow. Frons pollinose; ocellar tubercle denuded; basal callus oval, black; face shiny yellow, with dark spots on sides; antennae yellow basally, black distally. First palpal segment black, second yellow. Thorax black, with gray



longitudinal stripes; legs predominantly yellow; apex of wing hyaline, discal cell infuscated, cell R infuscated over anterior half, cell 2M predominantly hyaline. Abdomen hyaline, with dark spots on both dorsum and venter.

Description.--

Female: Length 9 mm.

Head: Frons pollinose gray yellow; ocellar tubercle large, denuded dark brown to black; basal callus oval, shiny black. Clypeus and lower upper denuded yellow, with dark brown spots on sides of face; lower genae pollinose yellow. First two antennal segments and base of third yellow, with brown on sides of pedicel and black hair on both scape and pedicel; balance of flagellum black. Basal palpal segment black, apical segment yellow, with black hair.

Thorax: Mesonotum and venter with alternation of black and gray longitudinal stripes; scutellum black, tinged with gray. Legs yellow, with black joints, distal end of fore tibia and tarsus.

Wings: Apex with narrow strip of infuscation along upper margin; hyaline triangle cross beyond furcation; cross band touches lower margin; discal cell infuscated; anterior one-half and posterior tip of cell R infuscated; cell 2M hyaline, with little infuscation on posterior end.

Abdomen: Tergum pale yellow, with brown spots; tergites I and II with single median germinate spot, spot on II arch-shaped; tergites III - VII with four spots on each; sternites concolorous with corresponding

tergites, but I - V has three black spots each.

Male: Not seen from Oregon.

Type: British Museum (Natural History), London, England.

Type locality: Ontario, Canada.

Distribution: Alaska to Labrador, south to California and Wisconsin.

#### Oregon Material Examined

Lane Co., Oakridge, VII-16-59 (CAS).

Discussion.--C. furcatus is rare in Oregon in spite of its wide distribution in North America (Philip 1947). Only one specimen collected from Oregon was seen. The above description was made from a single specimen from Montana in the collection of Oregon State University.

C. furcatus may be separated from C. aestuans by the hyaline radial cell which is infuscated on C. aestuans. Teskey (1969) collected, reared and described the immature stages of C. furcatus. He collected the larvae from wet moss on the banks of frost ridges in an open grassy swamp meadow.

#### Chrysops mitis Osten Sacken (Figure 18, Map 8)

Chrysops mitis Osten Sacken, 1875, Mem. Boston Soc. Nat. Hist. 2:374 (Orig. Descrip.); Hine, 1904, Ohio Nat. 5:224; Daecke, 1907, Ent. News 18:140; Cameron, 1926, Bull. Ent. Res. 17:22 (Biono.); Krobe 1926, Stettin Ent. Ztg. 87:247; Philip, 1931, Minn. Expt. Sta. Tech.

Bull. No. 80:34, 89, 122 (Biosy.); Brennan, 1935, Univ. Kans. Sci. Bull. 22:314 (Tax.); Segal, 1936, Jour. N.Y. Ent. Soc. 44:125; Fairchild, 1938, Proc. New Eng. Zoo. Club 17:31; Rowe and Knowlton, 1936, Ohio J. Sci. 36:258; Philip, 1947, Amer. Midland Nat. 37(2):276 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):12 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:326 (Cat.); Teskey, 1969, Mem. Ent. Soc. Can. No. 63:45 (Immat.); Goodwin, 1966, J. Tenn. Acad. Sci. 41(3):114-115, Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:12 (Syst.).

Diagnosis.--Size small, body black. Frons pollinose; ocellar tubercle large, black; basal callus subquadrate, black; face black, with one longitudinal and transverse stripes; antennae yellow basally, black distally; palpi black. Thorax black; legs black; apex of wing hyaline; discal cell infuscated. Abdomen black with white hair.

Description.--

Female: Length 9-10 mm.

Head: Frons pollinose, whitish gray; ocellar tubercle denuded black, about same size as basal callus; basal callus subquadrate, shiny black. Clypeus shiny black with a longitudinal median pollinose stripe; genae shiny black with transverse median stripe. First two antennal segments and base of third yellow, with black hair; balance of flagellum black. Palpi black to dark brown.

Thorax: Predominantly black; tergites with faint gray longitudinal stripes, and white hair; pleura with tufts of gray yellow hair; legs

black, with little yellow on base of mid and hind tarsus.

Wings: Apex hyaline; hyaline triangle extend beyond furcation, cross band abbreviated short of lower margin; discal cell infuscated; cell R and 2M infuscated over anterior half and posterior tip.

Abdomen: Entirely black, with white and/or rusty hair; tergites I and II sometimes with median gray triangle; pile of pleuriae white.

Male: Not seen from Oregon.

Type: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, No. 4007.

Type locality: Hudson's Bay, Canada.

Distribution: Alaska to California and West Virginia.

#### Material Examined

Oregon: Baker Co., Sumpter, VII-20-57, Baker (OSU); VII-27-75, JHS (Gary Peters' Pers. Coll.). Crook Co., Eagle Rock, 15 mi. S. Prineville, VI-19-70, Oman (OSU). Harney Co., Camp Cr., one-half mi. N. Malheur Cave, VI-25-47, Ellertson (OSU). Lane Co., Mck. Pass, VIII-16-49, Roth (OSU). Malheur Co., 12 mi. E. Juntura, VI-18-63, 18 mi. E. Juntura, VI-11-65, 7 mi. E. Juntura, VI-16-67, 10 mi. W. Juntura, VI-18-64, 2 mi. W. Juntura, VI-13-68, Goeden (OSDA). Union Co., Ladd Cyn., VII-27-VIII-2-75, Davis (WSU). Umatilla Co., 8 mi. S. Ukiah, VI-14-63, Baker (OSU).

Discussion.--C. mitis has a wide distribution in North America

(Osten Sacken 1975, Brennan 1935). In Oregon, it occurs east of the Cascade Mountains, but at relatively low frequency.

Osten Sacken discussed some similarity between the females of this species and those of C. excitans. However, I did not see such similarity. C. excitans has sublateral pale spots on the first two abdominal tergites, while the abdomen of C. mitis is entirely black. The former species has golden body hair and golden pile on the pleura while the pile of pleura and the body hair on the latter species is white; the gray median abdominal triangles are prominent and consistent in C. excitans while they are either absent or faint in C. mitis.

Cameron (1926) noticed that there is some resemblance between the males of the two species but I did not see the male of either species. C. mitis is closer to C. noctifer pertinax (= C. pertinax), both have black bodies with white hair, but in C. mitis the apex of the wing is entirely hyaline while in C. noctifer pertinax, the upper margin of the apex is infuscated.

Cameron (1926), Philip (1931) and Teskey (1969) have collected, reared and described the immature stages of C. mitis. Philip collected the larvae and pupae from the shore of a lake. Teskey found them in the saturated moss, silt and decaying vegetation of beaver ponds, woodland pools, alder swamps and small cattail marshes bordering small rivers.

Chrysops noctifer noctifer Osten Sacken  
(Figure 19)

Chrysops noctifer noctifer Osten Sacken, 1877, West. Dipt.  
p. 220 (Orig. Descrip.); Hine, 1904, Ohio Nat. 5:224 (Synon.); Cole,

1921/1927, Proc. Calif. Acad. Sci. 15:232, 16:420; Brennan, 1935, Univ. Kans. Sci. Bull. 22:321 (Tax.); Philip, 1941; Proc. Ent. Soc. Wash. 43:118 (Synon.); 1947, Amer. Midland Nat. 37(2):278 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):12-13 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:326 (Cat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:13 (Syst.).

Diagnosis.--Size small, body dark brown to black, with sublateral pale spot on abdomen. Frons pollinose; ocellar tubercle denuded; basal callus and face shiny brown to black; face with one longitudinal and two transverse pollinose stripes; antennae yellow basally, black distally; legs predominantly dark brown to black; apex of wing infuscated along upper margin.

Description.--

Female: Length 7-10 mm.

Head: Frons pollinose gray; ocellar tubercle large, denuded dark brown; basal callus subquadrate, shiny dark brown, clypeus and genae shiny dark brown, concolorous with basal callus, upper half of clypeus with longitudinal median pollinose gray stripe, genae with transverse median pollinose yellow stripes. First two antennal segments yellow, sometimes tinged with brown; third segment black; palpi slender, brown.

Thorax: Tergum black with faint gray longitudinal stripes; pleura with dense yellow hair; venter dark, with dense grayish yellow pollen; legs brown, base of mid and hind tarsi yellow.

Wings: Upper apical margin infuscated; hyaline triangle crossing furcation; cross band not reaching lower margin; discal cell fully infuscated; cell R infuscated over anterior two-thirds and posterior tip; cell 2M infuscated over one-half to two-thirds and posterior tip; anal cell closed.

Abdomen: Black except the yellow orange sublateral parts of segments I and II; posterior margins of segments gray, all with white hair.

Male: Unknown.

Type: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, No. 896.

Type locality: Webber Lake, California.

Distribution: Idaho and Oregon to New Mexico.

#### Material Examined

Oregon: None.

Extralimital: California; Fallen Leaf Lk., VII-1914 (OSU); Nev. Co., Sagehen Cr., VI-24-70, Lagier (WSU). Idaho, Stanley Lk., VII-5-47, Duspiva (OSU).

Discussion.--The three specimens referred to above are the only material of C. noctifer seen by the writer. Although the species is abundant in California and exists in lower densities in Idaho, not a single specimen was seen from Oregon in the collections of institutions in California and the Pacific Northwest. Philip (1941) indicated that

he had examined a female from Harney County, Oregon. It is most probable that it exists in low densities at certain foci somewhere in southeastern Oregon. It is worthwhile to note that the subspecies C. n. pertinax is the most abundantly collected tabanid in Oregon.

The immature stages have not yet been described.

Chrysops noctifer pertinax Williston  
(Figure 20, Map 9)

Chrysops pertinax Williston, 1887, Trans. Kans. Acad. Sci. 10:132 (Orig. Descrip.); Ricardo, 1901, Ann. Mag. Nat. Hist. 8:307 (Synon.); Brennan, 1935, Univ. Kans. Sci. Bull. 22:327 (Syst.).

Chrysops noctifer pertinax, Philip, 1941, Proc. Ent. Soc. Wash. 43:118 (Synon.); 1947, Amer. Midland Nat. 37(2):278 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):13 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:326 (Cat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:13 (Syst.).

Chrysops nigriventris Bigot, 1892, Mem. Soc. Zoo. France 5:604 (Tax.).

Chrysops noctifer, Hine, 1904, Ohio Nat. 5:224 (Partim); Krober, 1926, Stettin Ent. Ztg. 87:308 (Partim); Rowe and Knowlton, 1936, Ohio J. Sci. 36:322.

Description.--

Female: Length 8-11 mm.

This subspecies resembles the typical C. noctifer in every respect except that its body is entirely black, without any pale spots, but with milky white hair; tergites sometimes with median gray



triangle, pile of pleurae white.

Male: Length 7.5 mm. Generally smaller than female, especially the abdomen. Antennae entirely black, with long black hair; palpi much reduced, with long black hair. Apical band of wing broader than in female, covering a considerable portion of cell  $R_4$ , cell R and 2M almost entirely infuscated except their posterior apices, discal cell with semi-hyaline median zone.

Type: University of Kansas, Lawrence, Kansas.

Type locality: Washington Territory.

Distribution: Yukon, south to California and Colorado.

#### Material Examined

Oregon: Baker Co., Anthony Lk., VIII-9-29, Scullen (OSU); Big Cr., VI-(15-21)-75, VI-29-VII-26-75, VI-23-VII-20-76, VI-(12-14)-77, VI-21/28-77, VII-7/16/23-77, Davis (WSU); Cougar Cr., VI-(17-19)-76, VI-27-VII-6-76, VI-12/21/28-77, VII-7-77, VIII-2-77, Davis (WSU); L. Goose Cr., VI-21-VII-26-75, VI-17-VII-3-76, VII-(11-28)-76, VI-(5-14)-77, VII-31-VIII-3-77, Davis (WSU); U. Goose Cr., VI-22-VII-19-75, VI-17-VII-3-76, VII-(11-14)-76, VI-(5-14)-77, VII-23-77, Davis (WSU); Pine Cr., 14 mi. W. Baker, VII-25-68, Goeden-Westcott (OSDA); Velvet Cr., VI-22-VIII-9-75, VI-(9-12)-76, VI-(17-19)-76, VI-27-VII-3-76, VII-(18-20)-76, Davis (WSU). Benton Co., Corvallis, VII-8-25, Scullen (OSU), VII-12-38 (CAS), VII-2-64, Lewis (OSU); 11 mi. S. Alsea, VII-17-41, Ferguson (OSU); 8 mi. W. Alsea, VII-3/24-78, VIII-2-77, Mahmoud (OSU); Lobster Vall., 15 mi. S.W. Alsea, VIII-13-77, Mahmoud

(OSU); Mary's Peak, VII-11-58, Scullen (OSU), VIII-9-58, Jeffery (SOSC), VII-20-60, Hasbrouch (OSU), VII-4-72, Mathis (OSU), VII-16-76, Siebert (OSU), VII-22/27-76, VIII-8-77, VII-13/24-78, VIII-1-78, Mahmoud (OSU); McDonald Forest, VI-24-67, Goeden (OSDA); N. Forks Alsea Rv., 4 mi. N.E. Alsea, VII-3-60, VI-17-61, Lattin (OSU); Summit, VI-25-29, (OSU); 7 mi. S.W. Philomath, VI-23-59, Jewett (OSU); Woods Cr., 7 mi. W. Philomath, Schuh-Gray (OSU). Clackamas Co., Clackamas Lk., VIII-5-41, Schuh (OSU); E. Colton, VII-17-57, Lattin (OSU); 25 mi. E. Estacada, VII-12-61, Goeden (OSDA); 3 mi. N. Govt. Camp, VII-2-42, Ferguson (OSU); Still Cr., Forest Camp, VIII-9-55, Jewett Jr. (OSU), VII-19-78; Mahmoud (OSU); Swim, VII-12-38, Gray-Schuh (OSU); Timberline Lodge, VII-13-63, Jewett Jr. (OSU). Clatsop Co., Cannon Beach, VI-18-27, Van Dyke (CAS); Humburg, VI-(14-16)-63, Jewett Jr. (OSU). Columbia Co., Pittsburg, VII-27-37, Scullen (OSU). Curry Co., Foster Cr., VIII-29-48, Schuh (OSU); Kalmiopsis Wilderness, Walcan Cr., VII-5-69, Westcott (OSDA). Deschutes Co., Black Trial Spr., Elk Lk., VIII-8-35, Scullen (OSU); 10 mi. W. Bend, VI-21-39, Schuh-Gray (OSU), VII-29-64, Russel (CAS); Elk Lk., VIII-9-35, Scullen (OSU), VI-1-57, Capizzi (OSDA); 3 Cr. Meadow, 15 mi. S. Sisters, VII-10-72, Mathis, (OSU), VII-12-77, Mahmoud (OSU); Lava Lk., VIII-9-35, Ferguson (OSU); Lapine, VII-14-65, Christenson (OSU); Little Cultus Lk., VII-30-70, Lattin (OSU); 2 mi. W. Paulina Lk., VII-26-39, Schuh-Gray (OSU), 5 mi. W. Sisters, VI-26-39, Schuh-Gray (OSU), Scotts Lk., Mck. Pass, VII-30-41, Scullen (OSU), Sparks Lk., VIII-8-35, Scullen (OSU). Douglas Co., Diamond Lk., VIII-5-55, Jewett Jr. (OSU); L. Riv. Rd., V-17-47, Gentner (OSU). Grant Co., Dale, VII-21-48, Roth (OSU); John Day, VII-1-60, Ferguson (CAS); Kooney Spr. Camp, Sheep Mt., VII-19-36,

Scullen (OSU); Little Strawberry Lk., VII-18-36, Scullen (CAS, OSU);  
 Onion Cr. Meadow, VII-18-36, Rieder (OSU); Sheep Mt. Lookout, VII-19-  
 36, Scullen (OSU); 6 mi. N. Seneca, VI-3-64, Goeden (OSDA). Hood River  
 Co., Dee, VI-17-17, Cole (UCB); Hood Rv., VIII-1-17, Childs (OSU);  
 H.R. Meadows, VIII-22-64, Goeden (OSDA); Mt. Hood, VI-24-25, Van Dyke  
 (CAS), VII-23-57, Pettriger (OSU); Parkdale, VI-18-17, Cole (UCB).  
 Jackson Co., Mt. Ashland, VI-28-62, VII-3-62, Gilman (SOSC); Mill Cr.,  
 5 mi. N. Prospect, VI-24-34, Bolinger-Jewett (CAS, OSU); Prospect, VII-  
 19-34, Van Dyke (CAS). Jefferson Co., Horseshoe Lk., VII-26-29,  
 Scullen (CAS, OSU); Olallie Lk., VIII-5-41, Schuh-Gray (OSU); Suttle  
 Lk., VII-8-39, Schuh-Gray (CAS). Josephine Co., 5 mi. S.W. Cave  
 Junc., V-23-64, Goeden (OSDA); Grants Pass, VII-12-35, Beamer (CAS);  
 Lake Selmac, VII-6-64, Rude (UCB); Oregon Caves, VI-27-72, Mathis  
 (OSU); 4 mi. W. Selma, V-23-64, Goeden (OSDA). Klamath Co., Beaver  
 Marsh, VIII-10-35, Scullen (OSU), VI-27-62, Goeden (OSDA); 10 mi. N.E.  
 Bly, Deming Cr., VI-14-58, Schuh (OSU); Cherry Cr., W. side Klamath Lk.,  
 VI-28-37, Bolinger-Jewett (OSU); Crescent Cr., Hwy. 58, VI-27-62,  
 Goeden (OSDA); Crescent Lk., VII-23-59, Eppley (OSDA); Klamath Falls,  
 VII-3-65, Goeden (OSDA); 22 mi. E. Klamath Falls, VI-22-71, VII-4-71,  
 Steyskal (OSU); Klamath Marsh, VI-25-39, Aitkin (CAS, UCB); Mares Egg  
 Spr., VI-26-74, VII-2-75, Williams (SOSC); Quartz Cr., 20 mi. E. Bly,  
 VII-8-37, Bolinger-Jewett (CAS); Sand Cr., VII-3-65, Goeden (OSDA);  
 Skookum Meadow, 8 mi. S. Chemult, VII-23-36, Powell (UCB); Spencer  
 Cr., VII-5-58, Vertrees (OSU); Sprague Rv., 6 mi. E. Bly, VI-21-61,  
 Smith (OSU), VI-27-75, Mark (SOSC); Umla, VI-24-5, Hoffman (OSU);  
 U. Klamath Lk., V-28-50, Schuh (OSU), VII-27-53 (CAS). Lake Co.,  
 Drake Peak, VII-26-30, Scullen (CAS). Lane Co., H.J. Andrews Expt.

Forest, Blue Rv., V-19/27-72, Nagel (OSU), VII-13-78, Frost (OSU); Florence, VI-1-30, Wilcox (CAS); 8 mi. S. Florence, VI-29-72, Mathis (OSU); Ikenick Cr., VII-25-74, Mathis (OSU); Mck. Pass, VIII-8-50, Roth (OSU); Oakridge (Reared) VI-1-62, Lewis (OSU); 10 mi. E. Oakridge, VIII-4044, Scullen (OSU); Springfield, VI-24-65, Goeden (OSDA); Warner Mt., VI-27-53, Schuh (CAS); Willam. Pass, Hwy. 58, VI-14-66, Goeden (OSDA). Lincoln Co., Boyer, VI-25-37, EJB (PSU), 10 mi. N.W. Nashville, VII-(12-13)-62, Lewis (OSU) Newport, V-24-67, Brown-Goeden (OSDA); Tidewater, VI-21-39, Aitkin (UCB). Linn Co., Big Lk., VII-20-09, Bridwell (OSU), VII-31-66, Goeden (OSDA); Big Meadow, VII-18-65, Goeden (OSDA); Cascadia, Will. N.F., VII-7-77, Mahmoud (OSU); Hoodoo Ski Bowl, VII-25-66, Powell (UCB); Idanha, VI-2-65, Christenson (OSU); Lost Prairie, Santiam Hwy., VIII-4-48, (OSU); Monument Pk., VI-16-60, Lattin (OSU), VII-16-60, Jewett Jr. (OSU), VII-16-60, Scullen (OSU), VII-12-72, Mathis (OSU); Summit Prairie, VII-23-39, Gray-Schuh, (OSU). Marion Co., Brietenbush Hot Spr., VII-2/6-34, Scullen (OSU); Brietenbush Lk., VI-23-40, Rieder (OSU), IX-13-64, Goeden (OSDA); 4 mi. E. Brietenbush Lk., VI-5-66, Goeden (OSDA); Miami, VIII-11-19, Reeher (OSU); Mt. Jefferson, VII-12/30-07, Bridwell (OSU); 10 mi. N.E. Salem, VI-29-67, Brown (OSDA); Trail Detroit to Pamela Lk., Cascades, VII-12-07, Bridwell (OSU). Multnomah Co., 7 mi. S.E. Corbett, Trapper Cr., (OSU). Polk Co., Black Rock, 10 mi. S.W. Dallas, VI-28-60, VII-(5-12)-60, Allen (OSU). Tillamook Co., Blaine, VII-27-71, VII-14-75, Johnson (OSU); Bog 1 mi. W. Sandlake, VII-18-62, Lattin (OSU); Brown Place, Wilson Rv., VII-4-25, F.G. (OSU); Cape Meares, VII-8-70, Oman (OSU); Sandlake, VII-8-62, Goeden (OSDA). Union Co., Jordan Cr., VI-(22-28)-75, VII-(6-19)-75, VII-27-VIII-9-75, VII-(4-31)-76, VIII-(22-25)-76,

VI-(15-18)-77, VI-29-VII-2-77, Davis (WSU); Ladd Cyn., VI-(22-25)-75, VII-6-VIII-2-75, VI-(13-19)-76, VI-27-IX-4-76, VI-5-VII-9-77, VIII-12-77, Davis (WSU); L. Lick Cr., VI-15-VII-12-75, VI-23-VII-3-76, IX-(5-8)-76, VI-(12-14)-77, VI-21/28-77, VII-7/16/23-77, Davis (WSU); U. Lick Cr., VI-29-VII-20-75, VI-(17-30)-76, VII-(11-14)-76, Davis (WSU); Whiskey Cr., VI-22-VII-19-75, VI-(17-30)-76, VII-(4-31)-76, VI-(15-18)-77, VI-29-77, VII-(7-9)-77, VII-25-77, Davis (WSU); Whitman N.F., VII-12-14, Chamberlin (OSU). Wallowa Co., Aneroid Lk., VIII-1-41, Rieder (OSU); Lick Cr. Res., Wallowa N.F., VIII-16-37, Bolinger-Jewett (OSU); 17 mi. S. Lostine, VII-21-70, Oman (OSU); Wallowa Lk., Basin Trail, VII-25,29, Scullen (OSU), VII-29-41, Rieder (OSU), VI-14-47, Davis-Black (OSDA). Wasco Co., Bear Spr., VI-22-58, Jewett Jr. (OSU). Washington Co., Forest Grove, VI-1-38, Schuh (OSU). Yamhill Co., Gunaldo Falls, VI-31-39 (PSU).

Extralimital: Idaho; Stanley Lk., VII-5-47, Duspiva (OSU).

Washington; Lake Tapps, VI-10/11-36, Wilcox (OSU); Mt. Rainier, VIII-9-35, Wilcox (OSU); Olympia, V-19-35, Wilcox (OSU); Tipsoo Lk., VIII-24-35, Baker (OSU).

Discussion.--C. noctifer pertinax is the most abundant tabanid in Oregon. It is almost everywhere among the Cascade Mountains, extending west to the Pacific Coast, mostly around rivers and other water sources. It has not been collected from the eastern Oregon desert region.

Superficially, C. n. pertinax resembles C. mitis, but the latter has a hyaline wing apex.

The adults are active from early June to late August, but highest density is usually in July. In spite of the common occurrence of the adult, the immature stages have not been described.

The absence of C. n. pertinax from the southeastern parts of Oregon where the typical species were reported reflect the isolation of the subspecies from the species, i.e., they are allopatrically distributed. This is a good example of subspecies concept.

Chrysops proclivis Osten Sacken  
(Figures 10, 21, Map 10)

Chrysops proclivis Osten Sacken, 1877, West. Dipt., p. 222 (Orig. Descrip.); Ricardo, 1901, Ann. Mag. Nat. Hist., Ser. 7, 8:306 (Synon.); Hine, 1904, Ohio Nat. 5:225 (Rev.); Cole, 1921, Proc. Calif. Acad. Sci., 11(15):233; Cameron, 1926, Bull. Ent. Res. 17:24 (Biono.); Krober, 1926, Stettin Ent. Ztg. 87:320; Brennan, 1935, Univ. Kans. Sci. Bull. 22:330 (Tax.); Philip, 1935, Proc. Wash. Ent. Soc. 37:155 (Synon.); 1941 Proc. Wash. Ent. Soc. 43:119; Fairchild, 1938, Proc. N. Eng. Zoo. Club 17:33; Philip, 1947, Amer. Midland Nat. 37(2):280 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):13; Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:327 (Cat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:14 (Syst.).

Chrysops proclivis imfurcatus Philip, 1935, Proc. E. Soc. Wash. 37:157; 1947, Amer. Midland Nat. 37(2):280 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):14 (Tax.).

Chrysops atricornis Bigot, 1892, Mem. Soc. Zoo. de France 5:603 (Orig. Descrip.).

Chrysops proclivis var. atricornis, Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:327 (Cat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:14 (Syst.).

Diagnosis.--Size small, body black and yellow. Frons pollinose; ocellar tubercle denuded; basal callus diamond shaped, black; antenna black, scape with some orange coloration; palpi yellow. Thorax black, with gray longitudinal stripes, legs black and yellow; apex of wing with marginal infuscation; discal cell infuscated. Abdomen yellow, with black spots.

Description.--

Female: Length 6-10 mm.

Head: Frons pollinose grayish yellow; ocellar tubercle large, denuded black; clypeus denuded yellow; genae shiny black, with transverse yellow stripes. Antennae predominantly black, scape, and sometimes pedicel, with orange coloration. Palpi yellow, with black patches.

Thorax: Black, with longitudinal gray stripes and yellow hair on both dorsum and venter; pleura with dense tufts of yellow hair; legs black except distal third of fore tibia; mid femur, distal half of hind femur, mid and hind tibiae and metatarsi yellow.

Wings: Upper margin of apex infuscated; cross band sometimes reaches lower margin; discal cell infuscated; cell R predominantly infuscated, with posterior and hyaline, cell 2M infuscated along margins.

Abdomen: Tergite I yellow, with a median black spot; tergite II

yellow, with one germinated median and small sublateral black spot; III and IV with double germinate black spots, V - VII with a transverse anterior black and posterior yellow stripes; margins of all tergites with golden pile. Pleurite I - IV with yellow and black coloration, rest concolorous with corresponding tergites. Sternites I - IV yellow, with one median and two lateral black spots, spots on I and II merge; remainder of sternites concolorous with corresponding tergites.

Male: Not seen from Oregon.

Type: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, No. 898.

Type locality: Marin County, California.

Distribution: Yukon Territory to Alberta, California and Colorado.

#### Material Examined

Oregon: Benton Co., Corvallis, 1906, Eismann (UCB); Mary's Peak, VI-20-70, Westcott (OSDA), VII-4-72, Mathis (OSU), VII-24/27-76, VIII-4-77, Mahmoud (OSU); McDonald Forest, Oak Cr., VI-30-71, Steyskal (OSU). Clackamas Co., 25 mi. E. Estacada, VII-12-61, Goeden (OSDA); 2 mi. W. Govt. Camp, VII-12-42, Ferguson (CAS); Still Cr., Forest Camp, VII-14-56, Ritcher (OSU), VII-19-78, Mahmoud (OSU); Timberline Lodge, VII-13-63, Jewett Jr. (OSU). Clatsop Co., Saddle Mt., VII-8-61, Goeden (OSDA). Douglas Co., Mt. Roman Nose, VII-14-26, Ruhmann (CAS). Grant Co., Strawberry Camp, VII-18-36, Scullen (OSU). Harney Co., Malheur N.F., Cow Cr., VII-13-76, Westcott (OSDA). Hood River Co., Hood River, VI-8-17, Cole (UCB), VIII-1-17, Childs (OSU),



VI-20-24, Gillespie (OSU); H.R. Meadows, VII-13-49 K and D Fender (OSU); Mt. Hood, VI-26-25, Van Dyke (CAS); VII-21-40 (OSU); Parkdale, VI-18-17, VII-2-17, Cole (UCB). Jackson Co., Ashland, VII-3-58, Maurer (SOSC); Rogue Rv., 7 mi. S. Prospect, VII-24-37, Bolinger-Jewett (OSU). Jefferson Co., Hanson Resort, VII-29-29, Van Dyke (CAS). Josephine Co., Oregon Caves, VII-27-72, Mathis (OSU). Klamath Co., Cherry Cr., VI-28-37, Bolinger-Jewett (OSU); Crescent Lk., VII-23-59, Eppley (OSDA); 10 mi. E. Beaver Marsh, VII-24-56, Goeden (OSDA). Lane Co., Blue Rv., H.J. Andrews Expt. F., VI-28-72, VIII-1-72, Nagel (OSU); Mck. Pass, VIII-10-49, Roth (OSU); Oakridge, VII-12-59, Kattunen (CAS). Lincoln Co., Boyer, VII-23-37, VII-19-38, JCD (OSDH); 10 mi. N.W. Nashville, VII-12-62, Lewis (OSU); Tidewater, VI-21-39, Aitkin (CAS). Linn Co., Crabtree, Reeher (OSU); Marion Lk., VIII-11-64, Baker (OSU); Monument Pk., VII-16- , Goeden, VII-5-70, Westcott (OSDA). Marion Co., Miami, VIII-11-19, Keeher (OSU); Mt. Jefferson, VII-16-07, Bridwell (OSU), Pamela Lk., VII-27-07, Bridwell (OSU); Salem, VI-28-51, Duning (OSDA). Multnomah Co., Portland, VI-13-40, Ellsworth (OSU). Tillamook Co., Sandlake, VII-8-62, Goeden (OSDA).

Discussion.--C. proclivis resembles C. surdus Osten Sacken. Philip (1935, 1947) treated the latter as a subspecies of the former. The best way to distinguish them is to follow Hine (1904) who separated them by the magnitude of black color on the face. In C. proclivis, the black is confined to the outside of the facial suture while in C. surdus, the black extends inside beyond the suture leaving a narrow yellow band on the face. C. proclivis is sympatric in its distribution in Oregon with C. surdus; both occur mainly in the

Cascade Mountains and in the Coastal Range.

The adults of proclivis are usually active from mid June to mid August, which is also the same period of activity for surdus. These facts, plus the close morphological similarity, may suggest a relationship between the species. They are possibly members of the same complex group that includes C. p. atricornis (see below).

Cameron (1926) described the immature stages of proclivis from Canada, but they have not been reported in the literature since that time.

Bigot (1892) described C. atricornis as a new species and Philip (1935) described C. proclivis imfurcatus as a new subspecies, but he later realized (1965) that C. atricornis and his subspecies, imfurcatus were synonyms, he thus considered atricornis as a variety of proclivis. C. p. var. atricornis is distinguished from the typical form by the absence of black spots on the second abdominal tergite. This is consistent in the few specimens that I have examined.

Material Examined for C. p. atricornis include:

Oregon: Baker Co., Pine Cr., VII-20-52, Baker (OSU). Benton Co., Mary's Peak, VII-24-76, Mahmoud (OSU); malaise trap, VII-(2-3)-67, Hoy (OSU). Clackamas Co., Mulino, V-16-58, Jewett Jr. (OSU). Josephine Co., Grave Cr., VIII-30-25, Scullen (OSU). Lake Co., Deep Cr., 13 mi. S.E. Lakeview, VII-8-73, Jewett Jr. (OSU). Lane Co., H.J. Andrews Expt. For. Blue Rv., V-28-72, VII-26-72, Nagel (OSU); McKenzie Pass, VIII-3-50, Roth (OSU). Lincoln Co., 10 mi. N.W. Nashville, VII-12-62, Lewis (OSU). Marion Co., Elk Lk., VII-5-59, Jewett Jr. (OSU).

Type of *C. p. atricornis*: British Museum (Natural History), London, England.

Type locality: Colorado.

Distribution: British Columbia to California.

*Chrysops surdus* Osten Sacken  
(Figure 23, Map 11)

*Chrysops surdus* Osten Sacken, 1877, West. Dipt., p. 223 (Orig. Descrip.); Williston, 1887, Trans. Acad. Sci. 10:134; Hine, 1904, Ohio Nat. 5:226 (Rev.); Cole, 1921, Proc. Calif. Acad. Sci. 11(15):233; Krober, 1926, Stettin Ent. Ztg. 87:322; Brennan, 1935, Univ. Kans. Sci. Bull. 22:342 (Tax.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):14 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:327 (Cat.); Lane, 1975, Ann. Ent. Soc. Amer. 68(5):814 (Immat.); 1976, J. Med. Ent. 12(6):683-690 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:14 (Syst.).

*Chrysops proclivis surda*, Philip, 1935, Proc. Ent. Soc. Wash. 37:175 (Synon.); 1947, Amer. Midland Nat. 37(2):280 (Cat.).

Description.--

Female: Length 7-8 mm.

This species is very similar to *C. proclivis* but *C. surdus* is generally smaller in size and the black coloration on its face extends beyond the suture towards the middle leaving a narrow yellow stripe in between. Legs darker than those of *C. proclivis*; hind tibia entirely black or dark brown. Pile of

pleurae vary in various specimens.

Male: Of same size and facial characters as female, but the abdomen is predominantly black, with sublateral yellow spots on II tergite and posterior grayish yellow margin; III - VII. II pleurum yellow. Sternites I - III with sublateral yellow spots; IV - VII with posterior grayish yellow margin. Palpi black, second segment slightly swollen.

Type: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, No. 899.

Type locality: Webber Lake, Sierra County, California.

Distribution: British Columbia to Nevada.

#### Material Examined

Oregon: Baker Co., Big Cr., VI-29-VII-2-75, VII-20-VIII-9-75, VII-(25-28)-76, VI-26-VIII-7-77, Davis (WSU); Cougar Cr., VII-(1-3)-76, VII-7/16/23-77, VIII-9-77, Davis (WSU); L. Goose Cr., VII-(6-26)-75, VI-(26-28)-77, VII-(13-23)-77, Davis (WSU); U. Goose Cr., VI-29-VII-12-75, VII-(18-28)-76, VI-(26-28)-77, VII-(6-16)-77, Davis (WSU); Velvet Cr., VII-(6-12)-75, Davis (WSU). Benton Co., 8 mi. W. Alsea, VIII-10-78, Mahmoud (OSU); Mary's Peak, VIII-1-75, Mathis (OSU), VIII-1-78, Mahmoud (OSU). Clackamas Co., Still Cr. Meadow, VIII-2-70, Westcott (OSDA), VII-19-78, Mahmoud (OSU); Swim, VII-12-38 (CAS). Grant Co., 7 mi. S.S.W. Prairie City, VII-28-62, Goeden (OSDA). Hood River Co., 25 mi. S. Hood Rv., VII-21-65, Goeden (OSDA); 4 mi. S. Mt. Hood P.O., VII-13-71, Westcott (OSDA); Parkdale, VII-14-40, Gray-Schuh

(CAS). Jackson Co., Ashland, VII-18-58, Maurer (SOSC); Mt. Ashland, VI-28-62, Gilman (SOSC); 16 mi. N.E. Mt. Ashland, VII-9-62, Gilman (SOSC); Copco Rd., Shoat Spr., VI-24-74, William (SOSC). Jefferson Co., Horse Lk., VII-25-09, Chamberlin (CAS). Josephine Co., Oregon Caves, VII-(27-28)-72, Mathis (OSU); 4 mi. W. Selma, V-23-64, Goeden (OSDA). Klamath Co., Cherry, VI-28-37 (CAS); Gearheart Mt., N.E. Bly, VIII-5-66, Goeden (OSDA). Lake Co., Deep Cr., 13 mi. S.E. Lakeview, VII-8-73, Jewett Jr. (OSU); Horse Mt. Flats, VII-31-09 (CAS). Lane Co., Blue Rv., H.J. Andrews Expt. For., VII-26-72, Nagel (OSU); Mck. Pass, VIII-16-49, VIII-3-50, Roth (OSU). Lincoln Co., Boyer, VI-25-37, JCD (OSU); 10 mi. N.W. Nashville, VII-12-62, Lewis (OSU). Linn Co., Marion Forks, VII-21-69, Goeden (OSDA); VII-21-74, Westcott-Penrose (OSDA); Marion Lk., VIII-11-64, Baker (OSU); Monument Pk., VII-5-70, Westcott (OSDA), VII-21-74, Mathis (OSU); Waterloo, VII-21-77, Mahmoud (OSU). Marion Co., Elk Lk., VIII-15-64, Jewett Jr. (OSU); 2 mi. E. Idanha, VIII-4-71, Westcott (OSDA); Mt. Jefferson, VII-16-07, Bridwell (CAS, OSU); 8 mi. W. Mill City, Santiam Rv., VII-(16-17)-60, (OSU); Pamela Lk., VII-19-07, Bridwell (UCB), VIII-15-64, Jewett Jr. (OSU). Tillamook Co., Bog 1 mi. W. Sandlake, VII-8-62, Lattin (OSU). Union Co., Jordan Cr., VII-(6-12)-75, VII-(15-31)-76, VII-(7-9)-77, VII-(24-26)-77, VII-31-VIII-3-77, Davis (WSU); Ladd Cyn., VII-(6-12)-75, VI-(13-16)-76, VII-(29-31)-76, VIII-(25-28)-76, VII-(7-9)-77, VII-(21-23)-77, VIII-(10-13)-77, Davis (WSU); L. Lick Cr., VI-29-VII-5-75, VII-6-VIII-9-75, VII-(25-28)-76, VIII-(29-31)-76, VI-(26-28)-77, VII-(7-23)-77, VII-31-VIII-3, VIII-(18-20)-77, Davis (WSU); U. Lick Cr., VII-(6-12)-75, VII-(11-14)-76, VII-(25-28)-76, VII-(27-30)-77, VIII-(7-9)-77, Davis (WSU); Whiskey Cr., VII-(29-31)-76, Davis (WSU).

California: Tulare Co., 15 mi N.E. Calif. H. Spr., VI-25-74, Mathis (OSU).

Discussion.--The taxonomic status of C. surdus has been considered under C. proclivis. Its distribution in Oregon includes the Cascade Mountains, the Coastal Range, and the northeastern parts of the state where it generally inhabits higher elevations.

Lane (1975, 1976) reared and described the immature stages from California. He picked the larvae from seepages and banks of permanent ponds.

Chrysops wileyae Philip  
(Figure 24, Map 11)

Chrysops wileyae Philip, 1955, Rev. Brasil. Ent. 3:96 (Orig. Descrip.); 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:327 (Cat.); Lane, 1975, Ann. Ent. Soc. Amer. 68(5):815 (Immat.); 1976, J. Med. Ent. 12(6):683-690 (Immat.).

Diagnosis.--Size small, body yellow and black. First antennal segment very much swollen, yellow; basal callus yellow, elevated; wings about one and a half times longer than body; face yellow.

Description.--

Female: Frons subequal in length length and width, pollinose grayish yellow; ocellar tubercle dull black, with long golden hair; basal callus elevated, yellow, with black margins, diamond shape. Clypeus and genae denuded yellow, genae with transverse pollinose yellow stripes, and small black spot on sides of clypeus. First antennal

segment characteristically swollen, yellow; second segment and base of third yellow; annuli black. Palpi yellow, with red band dorsally.

Thorax: Black, with longitudinal yellowish gray stripes on both dorsum and venter; pleura with dense yellow hair; scutellum black; legs yellow, with black on joints, distal half of fore tibia and tarsus, mid and hind coxa and distal half of tarsi.

Wings: Posterior margin of apex infuscated; hyaline triangle across furcation; cross band touches lower margin; cell  $Cu_1$  predominantly hyaline; discal cell infuscated; anterior half and posterior end of cell R infuscated; anterior one-third and posterior end of cell 2M infuscated; anal cell closed.

Abdomen: Tergites I - V yellow, with black spots; I and II with a single median germinate spot; III - V with double germinate spots, VI and VII black anteriorly, yellow posteriorly. Pleurites I - V with a venterio-lateral black band extending through their length; VI - VII yellow. Sternites I - V yellow, with median black spot, VI - VII concolorous with corresponding tergites.

Male: About same size as female. Antenna same as female but with dense long hair (shaggy); face with dark patches; genae with long hair. Abdominal tergite I predominantly black, with yellow on sides; II - V with single median germinate black spot and two sublateral small ones.

Type: California Academy of Science, San Francisco, California, No. 12841.

Type locality: Baja, California.

Distribution: Oregon to Utah, California and Mexico.

Material Examined

Oregon: Douglas Co., Roseburg, VIII-7-64, Goeden (OSDA). Jackson Co., Applegate, VIII-4-52, Scullen (OSU); Ashland, 1958; October 75, Welsh (SOSC). Josephine Co., nr. Cave Junction, VI-21-63, Jewett Jr. (OSU). Lake Co., 8 mi. S. Valley Falls, VII-24-70, Penrose-Westcott (OSDA).

California: Los Angeles Co., Tanbark Flat, VII-8-52, McClay (OSU).

Discussion.--C. wileyae is characterized by the swollen first antennal segment that does not exist in any other Oregon Chrysops. It is thus easily separated from the others. Its distribution is mainly around the southwestern portion of the state along the California border. It is not very common.

Lane (1975, 1976) has reared and described the immature stages of this species from California. He collected the larvae from moist sand along creeks and rivers and also from seepages.



SUBFAMILY TABANINAE  
(Figures 2, 5, 8, 9)

Diagnosis.--Size small to large body with various colorations. Hind tibiae without apical spurs; antennae six to seven segmented (annuli three to four), compact; frons widened above or with parallel sides, calli mostly present, ocelli absent; wings hyaline.

Discussion.--This is the most abundant subfamily in Oregon. It has about 60% of the tabanids species in the state and more than 75% of the collected specimens. Hybomitra is the predominant genus in Oregon both in numbers of species and in their frequencies. The other two genera of this subfamily are Tabanus and Atylotus. The latter is poorly represented in Oregon and with limited distribution. All three genera are in the tribe Tabanini.

The Tabaninae is considered the most specialized tabanid subfamily. The larvae are carnivorous on other organisms as well as their own kind. The adults cause great blood loss and contribute to the mechanical transmission of a number of diseases.

Genus Atylotus Osten Sacken

Atylotus Osten Sacken, 1876, Mem. Boston Soc. Nat. Hist. 2:426 (Subgenus); Stone, 1938, U.S.D.A. Misc. Publ. No. 305:19; Philip, 1941, Can. Ent. 73:11; 1942, Proc. New Eng. Zoo. Club 21:56; 1947, Amer. Midland Nat. 37(2):287 (Cat.); 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:330 (Cat.); Teskey, 1969, Mem. Ent. Soc. Can. No. 63:58 (Immat.); Pechuman, 1972, Cornell Univ. Agr. Expt. Sta., Search 2(5):21; Burger, 1974, Proc. Ent. Soc. Wash. 76(4):432; Nowierski and

Gittins, 1976, Univ. Ida. Agr. Expt. Sta., Res. Bull. No. 96:14 (Syst.).

Type-species, A. bicolor Wiedemann (Hine, 1900:247).

Diagnosis.--

Female: Size medium; body coloration variable. Eyes separated, with metallic red to yellow color and a diagonal dark red to brown line; frons with parallel sides; frontal callus present; ocelli absent; face pollinose; antennae seven-segmented, with variable coloration; palpi varies in color. Thorax black, wings hyaline, stump vein present or absent; legs with variable coloration, spurs on hind tibia absent. Abdomen with wide range of color variations.

Male: Eyes contiguous, densely pilose; palpi reduced, shaggy. Size and variation in body coloration same as in female.

Discussion.--Two species and one variety are known from Oregon;

A. incisuralis (Maquart), A. incisuralis var. utahensis (Rowe and Knowlton) and A. tinguareus (Philip). Atylotus species exhibit a wide range of color variation on different parts of the body and in the pubescence. This variation has created some taxonomic problems and controversies over the status of the taxa especially incisuralis. It is most probable that incisuralis is a complex, with a number of variants or morphs. Investigations are needed in areas like the biology and bio-nomics of the adult and of the immature stages.

Species of Atylotus have no economic importance. They may be separated from Tabanus by the metallic color of the eyes in dead specimens and by the diagonal lines on these eyes. They are found mostly

around water and in open woodlands.

Philip (1965) recorded seven species of Atylotus from North America. Only the species mentioned above, plus Thoracicus occur in the west, the others are mainly eastern.

Key to the Female Species  
of Oregon Atylotus

- 1 - Postorbital bristles (on vertex) present . . . tingaureus (Philip)
- Postorbital bristles wanting . . . . . incisuralis (Macq.) 2
- 2 - Wing with stump vein, annuli
- dark . . . . . incisuralis incisuralis (Macq.)
- Wing without stump vein,
- annuli yellow . . . . . incisuralis var. utahensis (R. and K.)

Atylotus incisuralis (Macquart)  
(Map 12)

Tabanus incisuralis Macquart, 1847, Dipt. exot. nour. connus.  
Sup. II, p. 21 (Orig. Descrip.).

Atylotus incisuralis, Philip, 1941, Can. Ent., 73:105 (Synon.);  
1947, Amer. Midland Nat. 37(2):288 (Cat.); Middlekauff, 1950, Bull.  
Calif. Ins. Surv. 1(1):14 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr.  
Handb. No. 276:331 (Cat.); Cole, 1969, Flies West. N. Amer., p. 166,  
Burger, 1974, Proc. Ent. Soc. Wash. 76(4):432-433 (Tax.); Lane, 1976,  
J. Med. Ent. 12(6):683-690 (Immat.); Nowierski and Gittins, 1976,  
Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:15 (Syst.).

Tabanus intermedius Walker, 1848, List 1, p. 173; Stone, 1938,  
U.S.D.A. Misc. Publ. No. 305:165; Philip, 1941, Can. Ent. 68:158.

Tabanus insuetus Osten Sacken, 1877, West. Dipt., p. 219; Hine,

1904, Ohio Nat. 5:238; Webb and Wells, 1924, U.S.D.A. Bull. 1218, p. 26; Cameron, 1926, Bull. Ent. Res. 17:30; Rowe and Knowlton, 1935, Can. Ent. 67:242; Philip, 1936, Can. Ent. 68:158.

Atylotus insuetus, Osten Sacken, 1878, Simithn. Misc. Coll. No. 270, p. 62; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:20 (Synon.).

Tabanus utahensis Rowe and Knowlton, 1935, Can. Ent. 67:242 (Orig. Descrip.).

Atylotus incisuralis var. utahensis, Philip, 1941, Can. Ent. 73:105 (Rev.); 1947, Amer. Midland Nat. 37(2):288 (Cat.); 1960, Ann. Ent. Soc. Amer. 53(3):336; 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:331 (Cat.).

Diagnosis.--Size medium, body of various coloration. Eyes metallic rusty red to yellow; frons with parallel sides; calli denuded; subcallus pollinose; antennae yellow, orange or red. Thorax black, with or without hair; legs predominantly yellow; wing hyaline,  $R_4$  with stump vein. Color of abdomen vary with various specimens from black to gray.

Description.--

Female: Length 10-14 mm.

Head: Eyes of dead specimens metallic red to yellow, with diagonal streak from corner of contact with basal callus to opposite corner; frons with parallel sides, pollinose gray, with yellow hair; ocellar tubercle flat, pollinose; median and basal callus black, small; subcallus pollinose grayish yellow; clypeus and genae pollinose, concolorous with subcallus, with grayish yellow hair. First two antennal segments yellow, scape more than two times length of pedicel; basal portion of third segment either concolorous with first two segments or

orange, excised, with acute dorsal angle, annuli black, sometimes tinged with orange. Palpi creamy, with white and black hair, second segment swollen.

Thorax: Black, with gray pollen and creamy to golden hair on pleurites and sternites; wings hyaline, veins yellow,  $R_4$  with stump vein, legs light yellow except fore tarsus and portions of mid and hind tarsi black, with black and golden hair.

Abdomen: Dorsum either entirely black, with or without gray pollen or black with sublateral orange spots on tergites I-IV; size of orange area varies; pleurites orange to yellow; venter either entirely yellow or with black on posterior segments; all with golden hair.

Male: Eyes densely pilose, second palpal segment shorter and stouter than in female, otherwise similar to female.

Type: British Museum (Natural History), London, England.

Type locality: America.

Distribution.--Alaska to Ontario, s. to California and Colorado.

#### Material Examined

Oregon: Baker Co., Anthony Lk. (7700 feet), VII-(7-8)-29, Scullen (OSU); Big Cr., VII-(6-12)-75, VIII-(3-9)-75, VII-(25-28)-76, VIII-22-IX-8-76, VII-16/23-77, Davis (WSU); Cougar Cr., VII-(1-3)-76, VII-(25-28)-76, VIII-(22-25)-76, VII-(7-23)-77, VIII-29-77, Davis (WSU); L. Goose Cr. VII-(6-12)-75, VII-(11-14)-76, Davis (WSU); U. Goose Cr., VII-(13-19)-75, VII-(25-28)-76, VII-(13-16)-77, Davis (WSU); Velvet Cr.,

VII-(16-23)-77, Davis (WSU). Grant Co., VII-1-14 (OSU); John Day, VI-16-24, F.G. (OSU). Harney Co., Blitzen Rv., VII-26-27, Bolinger-Jewett (OSU); Frenchglen, VII-12-47, Ellertson (CAS, OSU); Hot Lk., VII-17-57, Lattin (OSU); nine mi. S. Burns, VII-13-53, Roth-Beer (OSU); Silver Cr., VII-8-06 (OSU); Wagontire, VIII-1-62, Goeden (OSDA). Jefferson Co., Horseshoe Lk., VII-26-29, Scullen (OSU). Klamath Co., Crater Lk. Park, VIII-4-30, Scullen (OSU); Kirk, VIII-19-51, Roth (OSU); Klamath Falls, VIII-1-54 Schuh (CAS). Lake Co., Summer Lk., VII-21-44, Mote (OSU), VII-24-47, VI-30-48, VII-24-49, VIII-16-49, VIII-3-50, VI-20-51, VIII-19-51, Roth (OSU). Lane Co., H.J. Andrews Expt. F., Blue Rv., VI-21-72, Nagel (OSU). Union Co., Jordan Cr., VII-(29-31)-76, VIII-(29-31)-76, VII-24-VIII-3-77, Davis (WSU); Ladd Cyn., VII-(6-12)-75, VI-(13-16)-76, VII-(29-31)-76, VIII-(8-11)-76, VIII-(22-25)-76, VI-29-VII-2-77, VII-(7-9)-77, VII-(24-26)-77, Davis (WSU); L. Lick Cr., VIII-(3-9)-75, VII-(25-28)-76, VIII-29-IX-8-76, VI-(26-28)-77, VII-(21-23)-77, Davis (WSU); Whiskey Cr., VII-(6-12)-75, VII-27-VIII-2-75, VII-(15-31)-76, VIII-(18-21)-76, Davis (WSU). Wallowa Co., Aneriod Lk. Tr., VII-24-29, Scullen (OSU), VII-1-41, M. R. Rieder (CAS).

Extralimital: California; Olancho, V-25, 57, Wilcox (OSU). Idaho; Stanley Lk., VII-7-47, Duspiva (OSU).

Discussion.--A. incisuralis exhibits a wide range of variation in body color to the extent that it is sometimes difficult to match two specimens. This variation was noticed by Osten Sacken (1877), Hine (1904), Philip (1936, 1941), Stone (1938) and Burger (1974). The main problems that needs a solution is the status of incisuralis, most likely a

complex, rather than a single species. Stone (1938) and Burger (1974) have emphasized the need for investigations of the behavior of adults with respect ecological factors and investigation of the immature stages need to be conducted. This is a good topic of study.

In the light of the foregoing discussion the above description may not fit some of the specimens, partially or totally. The reader is therefore alerted to treat this species with caution. The distribution of A. incisuralis in Oregon is mainly around water sources east of the Cascades. The adults occur from mid June to early September.

Webb and Wells (1924) and Cameron (1926) have reared and described the immature stages.

Rowe and Knowlton (1935) described A. utahensis (as Tabanus utahensis) as a new species. Stone (1938) considered it a synonym of A. insuetus (= A. incisuralis). Philip (1941) considered A. utahensis as a subspecies and later (1965) as a variety of A. incisuralis.

A. incisuralis var. utahensis is separated from the nominal form by the entirely yellow antenna, lack of a stump vein and the smaller size. But these characters are exhibited by a small number (five) of the specimens that were examined. The limited number of specimens is not enough to make a decision on the taxonomic status of A.i. var. utahensis especially since the group shows such a wide range of variation. The characters mentioned above are quite adequate to distinguish this variety.

Specimens of A.i. var. utahensis were examined from the following localities in Oregon:

Harney Co., Hot Lk., 5 mi N.E. Fields, VII-12-68, Lattin (OSU).  
Lake Co., Summer Lk., VII-22-44, Gjullin (OSU); VIII-16-49, VIII-10-66,

Roth (OSU).

Type of *utahensis*: United States National Museum, Washington, D.C.,  
No. 51331.

Type locality: Dolomite, Utah, 11 Aug. 1933.

Distribution.--Utah to Oregon.

*Atylotus tinguareus* (Philip)  
(Map 12)

*Tabanus insuetus* subsp. *tinguareus* Philip, 1936, Can. Ent.  
68:159 (New Synon.), 1941, Can. Ent. 73:105; 1947, Amer. Midland Nat.  
37(2):288 (Cat.).

*Atylotus insuetus* Stone, 1938, U.S.D.A. Misc. Publ. No. 305:20  
(Synon.).

*Atylotus tinguareus*, Philip, 1960, Ann. Ent. Soc. Amer. 53:366  
(Rev.); 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:331 (Cat.); Cole,  
1969, Flies West. N. Amer., p. 166; Nowierski and Gittins, 1976, Univ.  
Ida., Agr. Expt. Sta., Res. Bull. No. 96:15 (Syst.).

Diagnosis.--Size medium, body with various coloration. Eyes metallic  
red to yellow; frons with parallel sides; vertex with long hair,  
postorbital with bristles; antenna predominantly yellow to orange,  
annuli black; palpi creamy. Thorax black;  $R_4$  of wings with stump vein;  
coxae and femora black. Abdomen black to gray, with sublateral yellow  
spots on segments I and II.



Description.--

Female: Length 12 mm.

Head: Eyes metallic red to yellow, with diagonal streak; frons with parallel sides, pollinose grayish yellow; vertex with black long hair, postorbital region with diagnostic tall bristles; ocellar tubercle flat, pollinose; median and basal callus small, black; subcallus pollinose yellow. Clypeus and genae covered with grayish yellow pollen that obscure the black background, with gray to gray yellow hair. First two antennal segments (scape and pedicel) yellow, with black hair; basal portion of flagellum orange, excised, with acute dorsal angle; anelli black. Palpi creamy white, with black hair, second segment swollen.

Thorax: Entirely black, with golden hair; wings hyaline, with costal yellow band,  $R_4$  with stump vein, coxae black, mid and hind femora either entirely black or black mixed with yellow; fore femur yellowish orange with black patches, fore tarsus and parts of mid and hind tarsi black; tibiae and metatarsi yellow.

Abdomen: Black, with golden hair, most specimens with sublateral orange spots on tergites I and II; pile of pleurae golden yellow.

Male: Eyes densely pilose, second palpal segment short, stout with long hair; postorbital bristles present. Otherwise as in female.

Type: California Academy of Science, San Francisco, California,  
No. 12925.

Type locality: Libby, Montana.

Distribution.--Alaska to California.

Material Examined

Oregon: Baker Co., Anthony Lk., VIII-8-67, Goeden (OSDA). Clackamas Co., nr. L. Crater Lk. VIII-2-70, Westcott (OSDA); Still Cr. Meadow, VII-19-78, Mahmoud (OSU); Swim, VII-21-38, Schuh (OSU). Deschutes Co., L. Lava Lk., VIII-10-77, Mahmoud (OSU); 3 Cr. Meadow 15 mi. S. Sisters, VII-23-77, Mahmoud (OSU). Harney Co., 9 mi. S. Burns, VII-13-53, Scullen (OSU). Silver Cr., VII-1906 (OSU). Jackson Co., Mt. Ashland, VII-20-62, F & U Beer (OSU). Jefferson Co., Horse-shoe Lk., VII-26-29, Scullen (OSU). Klamath Co., Crater Lk. Park, VIII-1922, Lovett (OSU); Klamath Falls, VI-18-50, Schuh (OSU); 1 mi. S. Four Mile Lk., VIII-4-70, Penrose-Westcott (OSDA); Winema Forest, VII-28-77, Mahmoud (OSU). Lake Co., Deep Cr., 13 mi. S.E. Lakeview, VII-8-76, Jewett (OSU); Summer Lk., VI-30-48, VI-19/27-51, Roth (OSU). Lane Co., Frog Camp to Lava Bed, VIII-16-41, Ferguson (OSU); Mck. Pass, VIII-16-49, Roth (OSU). Linn Co., Santiam Pass, VIII-17-41, Ferguson (OSU). Marion Co., Brietenbush Lk., IX-13-64, Goeden (OSDA). Union Co., 5 mi. W.N.W. Anthony Lk., VIII-8-67, Goeden (OSDA).

Extralimital: California; Fresno Co., Shaver Lk., VII-25-67, Hoy (OSU). Utah; Bryce Canyon, VII-12-48, Duspiva (OSU). Washington, Red Mt., VII-22-26, Gray (OSU).

Discussion.--This species was originally described by Philip (1936) as a subspecies of A. incisuralis. In 1960, he upgraded its status to full species on the basis of yellow, black or mixed upright bristles across the vertex, a character that incisuralis does not have. I agree

with Philip and can add that most of the specimens with the above character have darker mid and hind femora than incisuralis; the pile of pleura in tingaureus is golden while it is white in incisuralis. The distribution of this species in Oregon is sympatric with that of incisuralis. The seasonal occurrence of the adults range from mid June to mid September.

#### Genus Hybomitra Enderlein

Hybomitra Enderlein, 1922, Mitt. Zoo. Mus. Berlin 10:347; 11:253; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:36 (Synon.); Philip, 1941, Can. Ent. 73:7-11 (Synon.); 1942, Proc. New Eng. Zoo. Club 21:56; Fairchild, 1942, Ann. Ent. Soc. Amer. 35:451 (Subgenus); Philip, 1947, Amer. Midland Nat. 37(2):291 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):6; Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:337 (Cat.); Teskey, 1969, Mem. Ent. Soc. Can. No. 63:92 (Immat.); Pechuman, 1972, Cornell Univ. Agr. Expt. Sta., Search 2(5):23; 1973, Ins. Virg. No. 6, Res. Div. Bull. 81:59; Burger, 1974, Proc. Ent. Soc. Wash. 76(4):433; Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:20 (Syst.).

Type-species, H. solox Enderlein, 1922c = rhombica (Osten Sacken).

Dasyommia Enderlein, 1922c:346. Type-species, Tabanus cinctus Fabricius.

Tylostypia Enderlein, 1922c:347. Type-species, Tabanus astux, Erichson.

Sziladynus Enderlein, 1925b:181. Type-species, Tabanus aterrimus Meigen.

Theriopectes of authors, not Zeller.

Diagnosis.--

Female: Size medium to large, body color black and orange to entirely black. Eyes separated, distinctly pilose; frons with parallel sides or widen above, usually pollinose with denuded ocellar tubecle, median and basal callus; subcallus pollinose or denuded; antennae seven-segmented, base of flagellum usually excised, with dorsal angle, color of antennae varies from entirely black to black and orange; palpi of various coloration, second segment slender or swollen basally. Thorax mostly black, with longitudinal gray stripes; notopleura mostly pale; wings hyaline, coastal cell mostly fumose, stump vein present or absent, legs vary in coloration but mostly black and yellow/orange, hind tibia without apical spur. Abdomen black or black and orange/yellow.

Male: Eyes contiguous, with denser pile than female; palpi reduced, second segment usually egg-shaped, with long hair. Size and other features usually resemble female.

Discussion.--Hybomitra is the largest and most widely distributed genus of Tabanidae in Oregon, both in numbers and density. Twenty species are known from the state. Some species, like californica fulvilateralis and sonomensis, exhibit a wide range of variation that makes the determination of the status of some specimens difficult. This problem leads to the anticipation that these species, and perhaps some others, form a complex. This needs to be investigated before a conclusive answer can be given. Some specific areas of investigation

will be discussed later.

Most species of Hybomitra inhabit higher elevations, where they are usually exist in high densities. The males are less frequently encountered in collections, apparently because they are not blood feeders, and thus are less attracted to man or his traps. Males of a few species are not yet known.

The immature stages of the majority of species from Oregon are not known, mainly because they are difficult to rear and the breeding habits of some species are not known. Some species breed on moss on the edges of rocks and along rivers and stream banks.

The species of Hybomitra are separated from those of Tabanus by the pilose eyes and/or the denuded ocellar tubercle in the former.

Hybomitra and Tabanus are collectively known as horse flies. They constitute the major pests on livestock, chiefly in eastern Oregon.

Key to the Females  
of Hybomitra From Oregon

- 1 - Subcallus pollinose . . . . . 2
  - Subcallus at least partially denuded, shining . . . . . 14
- 2 - Antennae entirely pale, yellowish-orange . . . . epistates (O.S.)
  - Antennae at least partially dark, usually black . . . . . 3
- 3 - Antennal segments almost entirely black, at
  - most with some reddish-orange areas toward
  - base of segment 3 . . . . . 4
  - Antennal segments with some pale, yellowish-
  - orange to orange coloration, especially on
  - segments one, two, and base of three . . . . . 10

- 4 - Notopleura plae, reddish-orange,  
 contrasting with color of mesonotum . . . . . 8  
 Notopleura dark, concolorous with mesonotum . . . . . 5
- 5 - Abdominal tergites two, three, and part of 4 with  
 considerable orange coloration on anterolateral  
 and lateral surfaces . . . . . 6  
 Abdominal segments mostly lacking orange coloration . . . . . 7
- 6 - Ocellar tubercle denuded, frucation without  
 spot . . . . . astutus (O.S.)  
 Ocellar tubercle pollinose, frucation of  
 wing with brown spot . . . . . atrobasis (McD.)
- 7 - Abdomen entirely dark, black . . . . . lanifera (McD.)  
 Abdomen with some white fringe along posterior  
 margins of tergites, dorsal angle of third  
 antennal segment rounded . . . . . sequax (Will.)
- 8 - Abdomen mostly dull black with two to three  
 rows of white spots, face with white hair,  
 length 15-17 mm . . . . . hirtula (Bigot)  
 Abdominal segments two, three, and four with  
 considerable orange coloration on anterolateral  
 and lateral surfaces;  $R_4$  usually lacking stump  
 vein, third antennal segment without or with  
 very shallow excision, antenna mostly black . . . . . 9
- 9 - Hair on abdominal sterna predominantly  
 golden yellow . . . . . sonomensis (O.S.)  
 Hair on abdoinal sternum<sup>a</sup> predominantly  
 black . . . . . phaenops (O.S.)

- 10 - Notopleura pale, reddish-orange, contrasting  
 with dark mesonotum . . . . . 11  
 Notopleura concolorous with mesonotum, ocellar  
 tubercle pollinose; wing furcation with brown  
 spot, . . . . . atrobasis
- 11 - Fore tibia predominantly yellow-orange,  
 smaller species, length 11-13 mm . . . . . opaca (Coquill.)  
 Fore tibia predominantly dark, length more  
 than 13 mm . . . . . 12
- 12 - Fringe of hind tibia predominantly golden,  
 frons about five times as high as width at  
 base . . . . . californica (Mart.)  
 Frons not more than four times as high as  
 width at base, second palpal segment creamy white . . . . . 13
- 13 - Second palpal segment slender . . . . . zygota (Philip)  
 Second palpal segment swollen basally . . . fulvilateralis (Macq.)
- 14 - Notopleura pale, reddish-orange, pollinose,  
 contrasting with darker mesonotum . . . . . 18  
 Notopleura concolorous with darker mesonotum . . . . . 15
- 15 - Body entirely black, with entirely black  
 hair, furcation of wing with dark spot . . . . . procyon (O.S.)  
 Body at least with white hair . . . . . 16
- 16 - Abdomen predominantly black, with or without  
 small lateral pale spot on segment two, and  
 with white hair . . . . . 17  
 Abdominal segments two and three predominantly  
 orange . . . . . rupestris (McD.)

- 17 - Abdomen dull black, with white triangles . . . . . rhombica (O.S.)  
 Abdomen shiny black, with or without  
 triangles . . . . . osburni (Hine)
- 18 - Antennae pale except for annuli of third segment . . . . . 19  
 Antennae mostly dark, black . . . . . 20
- 19 - Basal portion of antennal segment three wide,  
 with acute dorsal angle; femora mostly dark, fore  
 tibia predominantly black . . . . . captonis (Mart.)  
 Basal portion of antennal segment three narrow,  
 with obtuse dorsal angle; femora generally pale  
 on one-half or more of surface, fore tibia  
 predominantly pale, body dull yellow . . . . . aasa Philip.
- 20 -  $R_4$  with stump vein; larger species, length  
 15 mm or larger; mesonotum and abdomen generally  
 pollinose . . . . . tetrica (Mart.)  
 $R_4$  lacking stump vein; smaller species, length  
 12-15 mm; abdomen not as pollinose and usually  
 with some orange areas on segments two and  
 three . . . . . melanorhina (Bigot)

Hybomitra aasa Philip  
 (Map 13)

Hybomitra aasa Philip, 1954, Ann. Ent. Soc. Amer. 47(1):28-30  
 (Orig. Descrip.); 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:337  
 (Cat.); Lane, 1976, J. Med. Ent. 12(6):684 (Immat.).

Tabanus (Hybomitra) aasa, Cole, 1969, Flies West. N. Amer., p. 167.



Diagnosis.--Size medium, body reddish orange and black, frons pollinose grayish yellow; ocellar tubercle denuded, median and basal callus black; subcallus denuded, reddish brown; antenna orange, with black on third segment; palpi creamy yellow. Thorax black, with longitudinal gray stripes; notopleura pale; wings hyaline; legs predominantly orange. Abdomen reddish orange, tergites with median black spots.

Description.--

Female: Length 12-15 mm.

Head: Frons pollinose grayish yellow, widened above; ocellar tubercle denuded red to dark brown; median callus black, tapering at both ends; connected to basal callus which is globose, dark brown to black, merging with subcallus, the latter denuded reddish brown, with pollinose creamy margins. Clypeus and genae pollinose gray, with creamy yellow hair, portion of upper genae yellowish. First, second and base of third antennal segment bright orange, first two with black hair, balance of flagellum black, with excision and acute dorsal angle. Palpi creamy yellow, first segment with long creamy hair, second with black hair.

Thorax: Black; mesnotum with longitudinal gray stripes and gray pollen; notopleura and mesopleura orange, with black hair; venter with dense whitish hair; wings hyaline, coastal with orange patch; legs yellowish orange except base of femora black, fore coxae pollinose gray, with dense white hair; tarsi darken by dense black hair, fringe on hind tibia black.

Abdomen: Tergites I-V orange, with median black spots and black hair, VI and VII black, with orange margins. Venter orange, sternites I and II with small median black spots, VI and VII predominantly black with orange posterior margin.

Male: Not seen from Oregon.

Type: California Academy of Science, San Francisco, California, No. 12875.

Type locality: Fish Lake, Jackson Co., Oregon, 19 July 1943.

Distribution.--British Columbia to California.

#### Material Examined

Oregon: Baker Co., L. Goose Cr., 38 mi. S.E. Union, VII-(1-3)-76, Davis (WSU). Klamath Co., Klamath Marsh, VI-25-39, Aitkin (CAS, UCB); Pelican Butte, U. Klamath, VII-8-60, Schuh (OSU); U. Klamath, VI-8-56, Vertrees (CAS, UCB); Winema N.F., VII-28-77, Mahmoud (OSU); Mares Egg Spr., VI-26-74, Fisher (SOSC). Union Co., Jordan Cr., VII-(4-31)-76, Davis (WSU); Ladd Cyn., VII-(6-19)-75, Davis (WSU), VI-(13-16)-76, VII-(4-31)-76, VIII-(22-25)-76, Davis (WSU); VI-29-77, Davis (WSU); Whiskey Cr., VII-(6-12)-75, VII-(4-17)-76, Davis (WSU).

Discussion.--The bright yellow orange color of fore legs and abdomen will separate this species from H. captonis, which is generally larger and more robust, and with a larger third antennal segment.

H. aasa was collected from southcentral and northeastern Oregon at higher elevations. It might exist in other parts of the state, but

has not been collected.

Hybomitra astuta (Osten Sacken)  
(Map 13)

Tabanus astutus Osten Sacken, 1876, Mem. Boston Soc. Nat. Hist. 2:471 (Orig. Descrip.); Philip, 1936, Can. Ent. 68:153; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:146 (Rev.); Changnon and Fournier, 1943, Nat. Can. 70:80.

Theriopectes astutus, Osten Sacken, 1878, Smithsn. Misc. Collect. No. 270:56.

Hybomitra astuta, Philip, 1947, Amer. Midland Nat. 37:292 (Cat.); 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:338 (Cat.).

Tabanus (Hybomitra) astuta, Cole, 1969, Flies West. N. Amer., p. 167.

Tabanus inscitus Walker, 1848, List, I, p. 172.

Tabanus comes Walker, 1849, List, IV, p. 1152 (Change of Name); Philip, 1936, Can. Ent. 68:156; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:163.

Hybomitra comes, Philip, 1941, Can. Ent. 73:149.

Diagnosis.--Size medium, body black with pale spots. Frons with parallel sides; median and basal callus black; antennae predominantly black; palpi yellow. Thorax black, legs black and orange; wings hyaline. Abdomen black with orange spots.

Description.--

Female: Length 14-15 mm.

Head: Frons white pollinose, with black hairs, sides parallel; ocellar tubercle brown; median callus slender, merges with basal callus, black; basal callus shiny, dark brown, with median ridge; subcallus pollinose white. Clypeus and genae pollinose white, with white and black hair. Antennae black except base of flagellum and apex of fifth annulus pale, scape and pedicel with gray pollen and black hair; flagellum excised, with acute dorsal angle. Palpi slender, light yellow, with black hair.

Thorax: Black; dorsum with faint longitudinal gray stripes; notopleura concolorous with mesonotum; pleura with tufts of black and white hair; wings hyaline, coastal cell with yellow patch, veins dark brown. Venter with grayish white pollen and white hair; legs black and orange, the latter on basal third of fore tibiae, mid and hind tibiae except distal end, joints; fringe on hind tibia black.

Abdomen: Tergite I black, with orange sublateral spots, II-IV orange with median black spot, V-VII black, with orange lateral margins; posterior margins of all segments with three rows of gray spots. The median spots sometimes extend anteriorly in a triangular shape especially on the second tergite. Sternites concolorous with corresponding tergites. Pile of pleurae black with creamy hair on margins.

Male: Not seen from Oregon.

Type: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, No. 4029.

Type locality: White Mountain, New Hampshire, 16 August 1874.

Distribution.--British Columbia to Labrador and New Hampshire, S. to Oregon.

# Material Examined

Oregon: Lane Co., McKenzie Pass, VIII-16-49, Roth (OSU). Linn Co., Marion Forks, VII-15-65, Christenson (OSU).

Discussion.--A rare species, only three specimens reported from Oregon, all from the Cascade Mountains.

The small shiny ocellar tubercle, the black color of the first two antennal segments and the lack of spot on the wing furcation separates this species from H. atrobasis.

The immature stages are not yet known.

Hybomitra atrobasis (McDunnough)  
(map 13)

Tabanus atrobasis McDunnough, 1921, Can. Ent. 53:144 (Orig. Descrip.); Philip, 1937, Can. Ent. 69:35; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:159 (Rev.).

Hybomitra atrobasis, Philip, 1947, Amer. Midland Nat. 37(2):292 (Cat.); 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:338 (Cat.); Nowierski and Gittins, 1976. Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:21 (Syst.).

Tabanus (Hybomitra) atrobasis, Cole, 1969, Flies West. N. Amer. p. 167.

Diagnosis.--Size medium to large, body black and brown. Frons pollinose; ocellar tubercle pollinose; median and basal callus black; antennae pale basally, black distally; palpi yellow. Thorax black,

with longitudinal gray stripes; notopleura black; wings hyaline, furcation with brown spot; legs black and brown. Abdomen black and brown orange.

Description.--

Female: Length 14-17 mm.

Head: Frons widened above, pollinose grayish yellow; ocellar tubercle large, triangular, pollinose or faintly denuded, brown; median callus spindle shape, black; basal callus black, sometimes connected to median callus; subcallus pollinose gray to yellowish gray. Clypeus and genae pollinose gray with grayish yellow hair. First, second and base of third antennal segment orange with black hair; first segment sometimes partially black; balance of third segment black, excision shallow, dorsal angle obtuse. Palpi yellowish, first segment with long white hair, second segment stout, with black hair.

Thorax: Black; mesonotum with longitudinal gray stripes; notopleura concolorous with mesonotum, with black hair; wings hyaline, furcation with brown spot. Venter with dense white hair; coxae and femora, tarsi and distal half of fore tibiae dark brown to black, balance yellowish orange, with black hair; fringe of hind tibiae black.

Abdomen: Tergite I black, with postero-lateral margin orange, II-IV black medially, orange on sides, with black hair, V-VII black, with pale lateral margins; all with three rows of gray spots on posterior margins. Sternites I-IV orange, V-VII black; pile of pleurae creamy, with some black.

Male: Eye with denser pile than female; palpi reduced; antennae with long hair, flagellum slender. Size and other characters same as in female.

Type: Canadian National Collection, Ottawa, Canada.

Type locality: Mount Lehman, British Columbia, Canada.

Distribution.--British Columbia to Oregon and Wyoming.

### Material Examined

Oregon: Baker Co., Big Cr., VI-28-VII-16-71, Davis (WSU); Cougar Cr., VII-(12-14)-76, Davis (WSU); L. Goose Cr., 38 mi. S.E. Union, VII-(7-16)-77, Davis (WSU); Velvet Cr., 28 mi. S.E. Union, VII-(5-12)-75, VII-(7-16)-77, Davis (WSU). Benton Co., Mary's Peak, VII-1923, Chamberlin (OSU), VII-12-31, Larson (OSU), VII-12-31, Schuh (CAS), VII-12-56, Capizzi (OSDA), VII-20-60, Hasbrouck (OSU), VII-25-62, Fisher (CAS), VII-18-68, Oman (OSU), VII-15-69, Rose & McLay (OSU), VIII-1-75, Mathis (OSU), VII-(14-27)-76, VIII-4-77, VII-(6-24)-78, VIII-1-78, Mahmoud (OSU), VII-16-76, Siebert (OSU); 8 mi. W. Alsea, VII-2-77, VII-3-78, Mahmoud (OSU); 15 mi. S.W. Alsea, Lobster Vall., VIII-10-76, VI-29-77, VIII-2-77, Mahmoud (OSU). Curry Co., Big Meadows, VII-18-65, Goeden (OSDA). Deschutes Co., Redmond, VII-1-40, Larson (OSDA). Douglas Co., Sulphur Spr., VII-30-57 (OSU). Grant Co., John Day, VII-22-48, Roth (OSU). Harney Co., Malheur Field Sta., VII-30-77, Gruber (OSU). Hood River Co., Hood River, VI-22-17, Childs (OSU). Jackson Co., Talent X-4-68, Couch (SOSC). Lake Co., Summer Lk., VII-28-77, Mahmoud (OSU). Lane Co., H.J. Andrews Expt. Forest,

VI-(26-28)-72, Nagel (OSU), VI-29-77, Eulensen (OSU); 2-5 mi. E. Blue Rv., VII-25-74, Westcott, (OSDA). Lincoln Co., 10 mi. N.W. Nashville, VII-(12-21)-62, Lewis (OSU). Linn Co., Cascadia, Will. N.F., VII-7-77, Mahmoud (OSU); Crabtree Basin, VI-30-71, Darling (OSU); 6 mi. S.E. Gates, VII-3-71, Westcott (OSDA); Monument Pk., VI-16-60, Lattin (OSU), VII-16-60, Hasbrouck (OSU), VII-3-71, Westcott (OSDA), VII-12-74, Mathis (OSU); Tombstone Pass, Hwy. 20, VII-30-77, Razafimahatratra (OSU); Marion Forks, VII-15-65, Christenson (OSU). Marion Co., Breitenbush Lk., VII-10-64, Goeden (OSDA). Multnomah Co., 7 mi. S.E. Corbett, Trapper Cr., VIII-11-64 (OSU). Polk Co., Black Rock, 10 mi. S.W. Dallas, VII-20-60, Allen (OSU). Tillamook Co., E. Cr., Blaine, VII-1971, Johnson (OSU). Umatilla Co., Tollgate, VII-7-64, Schuh-Lattin-Anderson (OSU). Union Co., Jordan Cr., VII-(6-31)-75, VIII-2-75, VII-(4031)-76, VIII-(8-31)-76, VI-29-VIII-3-77, Davis (WSU); L. Lick Cr., VI-29-VII-5-75, VI-27-VII-28-76, VI-28-VII-23-77, Davis (WSU); U. Lick Cr., VII-6-VIII-9-75, VI-27-VII-28-76, VI-28-VIII-9-77, Davis (WSU); Ladd Cyn., VI-29-VIII-16-75, VI-13-IX-4-76, VI-22-VIII-12-77, Davis (WSU); Whiskey Cr., VII-6-VIII-16-75, VI-27-IX-4-76, VI-22-VIII-3-77, Davis (WSU). Wallowa Co., 17 mi. S. Lostine, VII-21-70, Oman (OSU). Washington Co., Dixie, VII-4-07 (OSU).

Extralimital: Washington, Mt. Rainier, VII-23-39, Crumb (OSU); Stablex, VII-20-28, Gray (OSU).

Discussion.--H. atrobasis is one of the most abundant tabanids in Oregon. It usually exists in large numbers, especially at the higher elevations of the Cascade Range, the Coast Range, and northeastern parts of Oregon. It is one of the species that was collected



abundantly in a malaise trap from Mary's Peak and some localities in Baker and Union Counties. It is also common around water.

Its taxonomic characters were discussed under H. astuta but it should be added that the pollinose ocellar tubercle is not a typical character of Hybomitra. This is an example of the inconsistency in the basic characters used to separate Hybomitra from Tabanus. However, H. atrobasis has pilose eyes and so it was placed in Hybomitra. Possibly it could be an intermediate form.

The adult season of activity is from late June to late September. The immature stages are not yet known.

Hybomitra californica (Marten)  
(Map 14)

Tabanus californicus Marten, 1882, Can. Ent. 14:210 (Orig. Descrip.); McDounnough, 1921, Can. Ent. 53:141; Philip, 1935, Can. Ent. 67:95; 1937, 69:37; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:129 (Rev.).

Hybomitra californica, Philip, 1947, Amer. Midland Nat. 37(2):292 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):15 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:338 (Cat.); Lane, 1976, J. Med. Ent. 12(6):684 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:21 (Syst.).

Tabanus (Hybomitra) californicus, Cole, Flies West. N. Amer., p. 167.

Diagnosis.--Size large, robust; body brown and black. Frons widened above; ocellar tubercle shiny red to brown; median callus black; basal callus brown; subcallus pollinose; antennae predominantly bright

orange, annuli black; palpi yellow. Thorax black; notopleura pale; legs black and orange, hind tibiae with golden fringe; wings hyaline. Abdomen predominantly brown yellow, with black spots.

Description.--

Female: Length 16-20 mm, robust.

Head: Frons pollinose gray to grayish yellow, sides widened above; ocellar tubercle small, shiny red, surrounded by shiny brown area and black hair; median callus slender, black; basal callus reddish brown; subcallus pollinose yellowish; clypeus and genae pollinose, concolorous with subcallus, with creamy golden hair. First two segments and most of basal portion of third antennal segment, bright orange, balance black, scape and pedicel with black hair, excision deep, acute angle prominent. Palpi yellow, with black hair, second segment stout.

Thorax: Black; mesonotum with longitudinal gray stripes, golden and black hair; notopleura orange, with black hair; wings hyaline, coastal cell fumose yellow. Venter with dense creamy hair; legs yellowish orange, with black on fore leg except apex of femor and basal half of tibia, basal half of mid and hind femor, tarsi with dense black hair, black areas with black hair, pale areas with mixture of golden and black hair; fringe on hind tibiae predominantly golden.

Abdomen: Tergite I black, with orange sides, II-IV yellow brown, with median black spot, pale area with black hair, V-VII black, posterior margin with golden fringe; sternites I-IV yellowish brown, V-VII black, with yellow hair, pile of pleura yellow.

Male: Not seen from Oregon.

Type: According to Philip (1947, 292) the type has been destroyed.

Type locality: California.

Distribution.--British Columbia to Oregon and Idaho.

### Material Examined

Oregon: Baker Co., Cougar Cr., 37 mi. S.E. Union, VII-25-VIII-31-76, Davis (WSU); Benton Co., Corvallis, VIII-9-59, Dilica (OSU), VII-29-62 (OSU), IX-2-63 (UCD), VIII-7-64, Lewis (OSU); Mary's Peak, VII-12-31, Schuh (CAS), VII-12-58, Capizzi (OSDA), VII-29-62 (OSU), VII-25-62, Fisher (CAS), VIII-31-62, Goeden (OSDA), VII-12-VIII-15-63, Rotary trap (OSU), VII-15-69, Oman (OSU), VI-20-70, VII-13-74, Westcott (OSDA), VIII-1-75, Mathis (OSU), VII-(22-27)-76, IX-2-76, VIII-8-77, VIII-(1-10)-78, Mahmoud (OSU); McDonald Forest, IX-10-70, Westcott (OSDA); 9 mi. W. Philomath, IX-1-49, Roth (OSU); 15 mi. S.W. Alsea, Lobster Vall., VIII-10-76, Mahmoud (OSU). Clackamas Co., Swim, VIII-28-28, Gray (OSU). Deschutes Co., Sisters, VII-20-09, Bridwell (OSU); Soda Rv., VIII-10-77, Mahmoud (OSU). Douglas Co., Diamond Lk., Hoffman (OSU). Jefferson Co., Olallie Lk., VIII-23-31 (CAS), VIII-5-41 (OSU). Klamath Co., Crater Lk. Park, VIII-4-30, Scullen (OSU); Mares Egg Spr., VI-26-74, Lynch (SOSC), VII-2-75, Rigby (SOSC). Lake Co., Summer Lk., VI-27-51, Roth (OSU). Lane Co., H.J. Andrews Expt. Fors., VI-28-72, VII-(13-26)-72, Nagel (OSU), VII-27-76, Frost (OSU); Frog Camp to Lava Bed, VIII-16-41, Ferguson (OSU). Lincoln Co., Boyer, VIII-13-34, MLH (PSU); 10 mi. N. Hwy. 34, IX-16-71, Lattin (OSU);

10 mi. N.W. Nashville, VIII-11-64, Lewis (OSU). Linn Co., Fern View, on Hwy. 20, VIII-12-56, Jerath (OSU); Harrisburg, VIII-4-64 (OSU); Monument Pk., VII-16-69, Goeden (OSDA); Santiam Pass, Lost Prairie, IX-3-49 (OSU). Multnomah Co., Cotton, VI-1933, E.S. Roth (CAS). Polk Co., Black Rock, 10 mi. S.W. Dallas, VII-8-60, VIII-18-60, Allen (OSU). Union Co., Jordan Cr., 28 mi. S.S.W. La Grande, VIII-(18-28)-76, Davis (WSU); Ladd Cyn., VII-(29-31)-76, VIII-18-IX-4-76, Davis (WSU); Whiskey Cr., VII-(29-31)-76, VIII-(18-31)-76, Davis (WSU). Washington Co., Forest Grove, IX-24-38, Crumb Jr. (OSU).

Extralimital: Washington; Electron, VII-24-34, Crumb (OSU); Mt. Rainier, VII-27-32, VIII-11-36, Crumb (OSU). Canada, B.C.: Vancouver Is., IX-(5-10)-60, Lattin (OSU).

Discussion.--H. californica is a common species in Oregon, mainly at higher elevations especially in the Coastal Range and Cascade Mountains. It is readily attracted to a malaise trap. Although it is distinguished by the golden fringe on hind tibia, some forms are not quite consistent with the typical species. It is most likely that californica is a species complex with various forms, but needs to be investigated.

It is curious that the male has not been collected in spite of the fairly high numbers of specimens collected from Oregon. The immature stages are not yet known.

Some of the specimens collected resembled californica, but had a black fringe on the hind tibia. Dr. Pechuman examined these and concluded that they are either members of an undescribed species, or variants of a species or hybrids of californica and other Hybomitra

species like captonis or fulvilatralis. Further investigations should solve this problem.

Hybomitra captonis (Marten)  
(Figures 2, 5, Map 15)

Tabanus captonis Marten, 1882, Can. Ent. 14:211 (Orig. Descrip.); Hine, 1904, Ohio Nat. 5:235 (Rev.); Cole and Lovett, 1921, Proc. Calif. Acad. Sci. 11(15):233; McDunnough, 1921, Can. Ent. 53:141; Philip, 1935, Can. Ent. 67:95; 1937, 69:37, 94; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:139 (Rev.).

Hybomitra captonis, Philip, 1947, Amer. Midland Nat. 37(2):293 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):15 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:338 (Cat.); 1966, Ann. Ent. Soc. Amer. 59(3):520 (Synon.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:22 (Syst.).

Tabanus (Hybomitra) captonis, Cole, 1969, Flies West. N. Amer., p. 167.

Tabanus recendens Walker, 1854, List, V, Sup. 1, p. 201.

Tabanus comastes Williston, 1887, Trans. Kans. Acad. Sci. 10:137.

Diagnosis.--Size medium to large, body orange and black. Frons widened above; ocellar tubercle large, shiny reddish brown; median callus dull black; basal callus black to brown, subcallus denuded reddish brown to black; antennae predominantly bright orange, annuli black; palpi creamy. Thorax black; notopleura orange; wings hyaline; legs orange and black. Abdomen orange and black.

Description.--

Female: Length 14-17 mm.

Head: Frons widened above, pollinose grayish yellow, with black hair; ocellar tubercle large, shiny dark brown to black; median callus dull black; basal callus shiny black to dark brown merges with the shiny reddish brown subcallus. Clypeus and genae pollinose grayish yellow, with creamy hair. First two antennal segments orange with gray pollen and black hair, basal portion of third segment either entirely or predominantly reddish orange, balance black, excision prominent, dorsal angle acute. Palpi creamy yellow with black hair.

Thorax: Black, mesonotum with faint longitudinal gray stripes; notopleura orange, with black hair; wings hyaline, costal cell fumose yellow. Venter with dense creamy hair; fore legs black except base of tibiae orange, mid and hind legs orange except base of femora and apices of tarsi, black area with black hair, orange areas with golden hair; hind tibiae with black fringe.

Abdomen: Tergites I-IV orange to brown with median black spot. V-VII black, with orange lateral margins; all tergites with gray posterior margin, II and III sometimes with gray median triangle; sternites I, VI and VII black, II-V bright orange.

Male: Eyes with denser pile than female; frontal triangle with silvery white pollen; palpi reduced; abdomen with denser hair. Size and other characters as in female.

Type: According to Philip (1947, 293) the type has been destroyed.

Type locality: California.

Distribution.--Yukon Territory, to California and Colorado.

Material Examined

Oregon: Baker Co., Big Lk., 26 mi. S.E. Union, VII-(25-28)-76, VI-29 to VIII-20-77, Davis (WSU); Cougar Cr., 37 mi. S.E. Union, VIII-(22-25)-76; Davis (WSU); Fish Lk., Wallowa Mts., VII-30-71, Penrose (OSDA); L. Goose Cr., 38 mi. S.E. Union, VIII-(12-25)-76, VI-21-77, Davis (WSU); U. Goose Cr., 34 mi. S.E. Union, VII-(6-12)-75, VII-(18-20)-76, VIII-(22-25)-76, VII-(7-29)-77, VIII-(2-20)-77, Davis (WSU); Velvet Cr., 28 mi. S.E. Union, VII-(6-27)-75, VII-7 to VIII-9-77 Davis (WSU). Benton Co., Corvallis, VII-31-38, Mowry (OSU), VI-4-49 (UCB); 8 mi. W. Alsea, VIII-2-77, Mahmoud (OSU); 15 mi. S.W. Alsea, VI-5-76, Lattin (OSU), VIII-10-76, Mahmoud (OSU); Mary's Peak, VII-8-14, Gentner (OSU), VI-1920 (OSU), VIII-9-53, Koontz (OSU), VII-12-56, VII-12-58, Capizzi (OSDA, WSU), VII-12-58, VII-5-63, Lattin (OSU), VII-11-58, Scullen (OSU), VII-20-60, Hasbrouck (OSU), VII-(11-15)-63, VIII-(9-15)-63, Rotary Trap (OSU), VII-15-69, Rose and McClay (OSU), VI-20-70, Westcott (OSDA), VII-12-72, VII-21-74, VIII-15-75, Mathis (OSU), VII-(18-21)-76, B and M Gavin (OSU), VII-16-76, Siebert (OSU), VII-(22-27)-76, VIII-(4-8)-77, VII-3 to VIII-24-78, Mahmoud (OSU). Clackamas Co., Below Timberline, Mt. Hood, VI-22-58, Jewett Jr. (OSU); nr. Little Crater Lk., VIII-2-70, Westcott (OSDA); U. Clackamas Rv., VII-25-73, Johnson (OSU). Deschutes Co., Elk Lk., VII-5-58, Jewett Jr. (OSU); Mck. Pass, VIII-10-49, VIII-3-56, Roth (OSU). Douglas Co., Drain, VIII-1-53, Hopkins (OSU); Glendale, VIII-1-35 (CAS). Jackson Co.,

16 mi. N.E. Ashland, VII-26-62, Reiling (SOSC). Jefferson Co., Horseshoe Lk., VII-25-09, Bridwell (UCB). Klamath Co., Big Marsh Cr., VI-20-59, Lewis (OSU); Crater Lk. Park, 1929, Hibbard (OSU), VIII-7-63, Schuh, Hansen and Miller (WSU); Klamath Marsh, VI-25-39 (UCB, UCD). Lake Co., Summer Lk., VII-24-49, Roth (OSU). Lane Co., H.J. Andrews Expt. For., VII-(13-27)-72, Nagel (OSU), VII-27-76, Frost (OSU), VI-29-77, Eulensen and Searles (OSU); Frog Camp, Lava Bed, VIII-16-41 (CAS); Oakridge, VII-17-59 (CAS); Sunrise Shelter, VIII-1-59, Lattin (OSU). Lincoln Co., 10 mi. N.W. Nashville, VIII-8-63, VIII-11-64, Lewis (OSU); 5 mi. S. Burnt Woods, VII-9-68 (OSU); Logsdon (reared) emerged III-12-62 Lewis (OSU); 10 mi. S. Toldeo, Drift Cr., VI-20-58, Lattin (OSU). Linn Co., Big Lk., Alpine Meadow, VII-31-66, Goeden (OSDA); Crabtree Basin, VI-30-71, Darling (OSU); Marion Lk., VIII-11-64, Baker (OSU); Monument Pk., VIII-2-53, Ritcher (OSU), VI-20-58, VI-16-60, Lattin (OSU), VII-16-60, Scullen (OSU), VII-16-60, Hasbrouck (OSU), VII-5-70, Westcott (OSDA), VII-12-72, Mathis (OSU); Marion Forks, VII-15-65, Christenson (OSU); Scar Mt., VI-21-58, Smith (OSU); Tombstone Prairie, IX-5-63, Goeden (OSDA). Marion Co., Brietenbush, VII-5-58, Jewett Jr. (OSU); Mt. Jefferson, VII-20-07, Bridwell (OSU). Multnomah Co., Larch Mt., VII-18-40 (CAS). Polk Co., Black Rock, 10 mi. S. Dallas, VII-(5-18)-60, Allen (OSU). Tillamook Co., nr. Van Duzer Park, VII-18-70, Westcott (OSDA); Wilson, VIII-6-46, Rheer (OSU). Union Co., Jordan Cr., 28 mi. S.S.W. La Grande, VII-(13-15)-75, VII-15 to VIII-31-76, VII-19 to VIII-12-77, Davis (WSU); Ladd Cyn., 14 mi. S. La Grande, VII-(6-12)-75, VI-(13-16)-76, VII-(4-31)-76, VIII-(8-31)-76, VI-(22-29)-77, VII-19 to VIII-3-77, Davis (WSU); L. Lick Cr., 26 mi. S.E. Union, VIII-(3-16)-75, VIII-(29-31)-76, VI-28-77, VII-7-77,



VIII-(2-20)-77, Davis (WSU); U. Lick Cr., 28 mi. S.E. Union, VII-27 to VIII-2-75, VII-(29-31)-76, VIII-(22-25)-76, VI-28-77, VIII-(7-23)-77, VIII-(2-29)-77, Davis (WSU); Whiskey Cr., VII-(6-19)-75, VII-(4-31)-76, VIII-8 to IX-4-76, VII-8 to VIII-3-77, Davis (WSU). Wallowa Co., 17 mi. S. Lostine, VII-21-70, Oman (OSU); Joseph (OSU); 15 mi. E. Joseph, VII-7-66, Goeden (OSDA). Wasco Co., Mt. Hood, Alpine Campground, VIII-2-70, Westcott (OSDA).

Extralimital: Washington: Mt. Rainier, VIII-5-35, Baker (OSU), VIII-9-35, Wilcox (OSU), VIII-11-36 Crumb (OSU).

Discussion.--H. captonis is the most abundant Hybomitra in Oregon. It constituted about half of the Tabanidae collected from Mary's Peak during July and August of 1976 to 1978. It is characterized by the shiny black subcallus which is quite a stable character that separates it from most of the similar Hybomitra species. The black fore leg separates it from H. aasa. There is some speculation (Pechuman 1979, personal communication) that H. captonis may be one of the parents of some of the unknown Hybomitra species collected from Mary's Peak that are thought to be hybrids. The other parent could be H. californica or fulvilateralis. This matter has to be verified through further investigations.

H. captonis is common at higher elevations in the Coast Range, the Cascade Range and the northeastern parts of Oregon. It shares the habitat with H. atrobasis, H. californica, and H. sequax, all of which are readily attracted to malaise traps.

The adults are active from mid June to end of August. The immature stages are not known. In spite of many trials made in this

laboratory to rear Hybomitra larvae picked from Mary's Peak, the larvae did not pupate.

Hybomitra epistates (Osten Sacken)  
(Map 14)

Tabanus epistates Osten Sacken, 1878, Mem. Boston Soc. Nat. Hist. II (Sup.):555; Malloch, 1917, Bull. Ill. Lab. Nat. Hist. 12:360; McDunnough, 1921, Can. Ent. 53:360; Philip, 1931, Minn. Agr. Expt. Sta., Tech. Bull. No. 80:33 (Biosyst.); 1937, Can. Ent. 69:39; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:136 (Rev.).

Tabanus epistatus Hine, 1903, Ohio State Acad. Sci. Sp. Pap. 5:50; 1904, Ohio Nat. 5:236 (Lapsus).

Theriopectes epistates Osten Sacken, 1878, Smithsn. Misc. Coll. No. 270:56.

Hybomitra epistates, Philip, 1947, Amer. Midland Nat. 37(2):293 (Cat.); 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:338 (Cat.); Teskey, 1969, Mem. Ent. Soc. Can. No. 63:99 (Immat.); Pechuman, 1972, Cornell, Univ., Agr. Expt. Sta., Search 2(5):26 (Biosyst.); Noweirski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:22 (Syst.).

Tabanus californicus Hine, 1904, Ohio Nat. 5:236 (Not Martin 1882, Can. Ent. 14:210).

Diagnosis.--Size medium, body black and orange. Frons widened above; ocellar tubercle brown red; medium callus slender, black; basal callus subquadrate, black; antennae entirely pale; palpi creamy yellow. Thorax black; notopleura pale; wings hyaline; legs orange and black.

## Description.--

Female: Length 13-15 mm.

Head: Frons widened above, pollinose yellowish gray, with black hair; ocellar tubercle shiny brown red, surrounded by black hair; median callus spindle shaped black; basal callus subquadrate, black; subcallus pollinose, silver white; clypeus and genae concolorous with subcallus, with white hair. First two antennal segments yellowish orange, with white pollen and black hair; third segment bright orange, annuli tinged with black; excision deep, dorsal angle acute. First palpal segment dark, with long white hair; second segment stout, creamy yellow with black and small white hairs.

Thorax: Black; mesonotum with faint or no gray stripes, gray pollen and black hair; notopleura orange, with dense black hair; wings hyaline, coastal cell fumose, yellow, veins orange. Venter with dense white hair; legs orange with black fore leg except basal half of tibia, coxae, mid and hind femora, all with black hair; hind tibia with black fringe.

Abdomen: Tergites I-IV orange, with median black spot, V-VII black, with orange lateral margins; all with gray posterior margins and black hair. Sternites I-V orange, I with sublateral black spots; VI and VII black, with orange posterior margins; all with golden hair; pile of pleurie golden.

Male: Not seen from Oregon.

Type: Cotype, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts No. 4026 (Stone, 1938).

Type locality: Fort Simpson, Hudson Bay Territory, Canada.

Distribution.--Alaska to Nova Scotia, south to Oregon, Colorado and New Jersey.

#### Material Examined

Oregon: Baker Co., Cougar Cr., 37 mi. S.E. Union, VIII-9-77, Davis (WSU); L. Goose Cr., VIII-9-77, Davis (WSU). Benton Co., Corvallis (UCB). Harney Co., Fish Lk., Steens Mt., VII-7-53, Scullen (CAS). Klamath Co., Cherry, VI-28-37, Bolinger-Jewett (OSU, CAS); Crater Lk., VII-(16-19)-22, Van Dyke (CAS); Klamath Marsh, VI-25-39, Aitkin (CAS); Lake of the Woods, VII-11-40, Scullen (OSU). Union Co., Jordan Cr., 28 S.S.W. La Grande, VIII-(21-23)-77, Davis (WSU); L. Lick Cr., 26 mi. S.E. Union, VII-23-77, Davis (WSU); Whiskey Cr., VII-(6-12)-75, Davis (WSU). Washington Co., Reedville, VIII-29-56, James (WSU).

Extralimital: Montana; Ravalli Co., VII-23-32, Philip (OSU). Canada; Manitoba, V-19-20 (OSU).

Discussion.--H. epistates is very widely distributed in North America, especially in Canada and the northern United States. In Oregon, it occurs in limited numbers. The immature stages were reared and described by Philip (1931), and Teskey (1969). The latter collected the larvae from wet moss in open unshaded areas. The adult is characterized by the entirely pale antenna.

The adults occur from late June to late August.

Hybomitra frontalis (Walker)

Tabanus frontalis Walker, 1848, List I, p. 172 (Orig. Descrip.); Curran, 1927, Can. Ent. 59:82; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:161 (Rev.).

Hybomitra frontalis, McAlpine, 1961, Can. Ent. 93:894-924 (Biosyst.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:339 (Cat.); Teskey, 1969, Mem. Ent. Soc. Can. No. 63:101 (Immat.); Pechuman, 1972, Cornell Univ., Agr. Expt. Sta., Search 2(5):26-27 (Biosyst.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:22-23 (Syst.).

Hybomitra septentrionalis frontalis, Philip, 1947, Amer. Midland Nat. 37(2):298 (Cat.).

Tabanus incisus Walker, 1850, Ins. Saund. 1:26.

Description and Discussion.--One specimen is in the collection of Washington State University, Pullman, Washington, collected from Corvallis in June, 1899 and identified as Tabanus frontalis by Philip in 1949. I examined the specimen; the third antennal segment is broken, the first segment black and the second pale. I compared it with two specimens of frontalis from Michigan and a third from Idaho. It does not resemble any of these in the head shape or in the abdominal coloration. It does not fit the description given in the literature for frontalis (Stone 1938).

McAlpine (1961) published an excellent paper on the frontalis complex in which he provided distribution maps in North America and

illustrations of its body parts.

Based on my examination of the above specimen and the distribution maps of McAlpine (1961), as well as the distribution of frontalis in Philip (1965), it is most likely that frontalis does not exist in western Oregon and that the specimen mentioned above from Corvallis is Hybomitra sonomensis. But since frontalis has been reported from Idaho (Nowierski and Gittins 1976) it might well occur in the eastern part of the state. I am therefore presenting the above information so that future investigators would be aware of it.

Hybomitra fulvilateralis (Macquart)  
(Map 15)

Tabanus fulvilateralis Macquart, 1838, Mem. Soc. Roy. des Sci., de l'Agr. et des Arts, Lille 1838:137 (Orig. Descrip.).

Hybomitra fulvilateralis, Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:339 (Cat.); Burger, 1974, Proc. Ent. Soc. Wash. 76(4):-436; Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:23 (Syst.).

Tabanus haemaphora Marten, 1882, Can. Ent. 14:210.

Tabanus haemophorus Aldrich, 1905, Smithsn. Misc. Coll. 46, No. 1444, p. 666 (Lapsus.).

Tabanus haemaphorus, McDunnough, 1921, Can. Ent. 53:141; Philip, 1935, Can. Ent. 67:95; 1937, 69:39, 94; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:137 (Rev.).

Tabanus haematophora Knowlton and Thatcher, 1934, Proc. Utah Acad. Sci. 11:293 (Lapsus.).

Hybomitra haemaphora, Philip, 1947, Amer. Midland Nat. 37(2):294

(Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):15 (Tax.).

Diagnosis.--Size large, body orange and black. Frons not quite parallel, broader than H. californica; ocellar tubercle shiny red; median callus black; basal callus dark brown to black; antennae orange basally, black distally; palpi creamy. Thorax black; notopleura orange; wings hyaline; legs orange and black. Abdomen predominantly orange, with black spots and dorsal median gray triangles.

Description.--

Female: Length 14-19 mm.

Head: Frons broader and shorter than in H. californica, width at vertex about one-half length, pollinose grayish yellow, slightly widened above; ocellar tubercle shiny red to brown; surrounded by black hair; median callus black; basal callus dark brown to black, touching eyes; subcallus pollinose, gray yellow, clypeus and genae pollinose, concolorous with subcallus, upper genae with black hair, lower genae and clypeus with creamy hair. First two antennal segments and base of third orange, the formers with gray pollen and black hair, excised portion and annuli black, excision shallow, dorsal angle obtuse. Palpi creamy with black hair, second segment stout basally.

Thorax: Black; mesonotum with longitudinal gray stripes and black hair; notopleura and parts of mesopleura orange, with black hair and tufts of creamy hair around the latter; wings hyaline, coastal cell fumose yellow. Venter with dense creamy hair; legs orange with black

front leg except base of tibia, coxae and mid and hind femora, with black hair; fringe on hind tibia predominantly black.

Abdomen: Tergites I-IV yellowish orange, with black median spot, sometimes with gray median triangle on the black spot, V-VII black, with orange lateral margins; sternites I-V orange, I with two lateral and one median black spot, VI-VII black; posterior margins of all segments gray; pile of pleurae mixture of creamy yellow and black hair.

Male: Not seen from Oregon.

Type: According to Philip (1947, 294) the type is destroyed.

Type locality: California.

Distribution.--British Columbia to Manitoba, south to California and New Mexico.

#### Material Examined

Oregon: Baker Co., Big Cr., VI-(15-21)-75, VI-23-VII-3-76, VI-28-77, Davis (OSU); Cougar Cr., VI-(12-21)-77, VII-20-77, Davis (WSU); L. Goose Cr., VII-29-VIII-5-75, VI-(17-30)-76, VI-(21-28)-77, Davis (WSU); U. Goose Cr., VI-22-VII-12-75, VI-(27-30)-76, VI-21-77, VII-31-VIII-3-77, Davis (WSU); Velvet Cr., VI-29-VII-12-75, VI-(27-30)-76, VI-5-VII-7-77, Davis (WSU); Pine Cr., 12 mi. W. Baker, VII-13-67, Goeden (OSDA). Benton Co., Corvallis, Hays (OSU); McDonald Forest, Oak Cr., VI-30-71, Steyskal (OSU). Clackamas Co., nr. Little Crater Lk., VIII-2-70, Westcott (OSDA); Mt. Hood, VI-22-25, Van Dyke (CAS). Columbia Co., Scappoose, VI-25037, Rieder (OSU). Deschutes Co.,



Redmond, VII-1-40, Larson (OSDA). Douglas Co., Diamond Lk., VIII-5-55, Jewett Jr. (CAS); Idleyld Park, Umpqua Forest, VII-20-64 (UCD); 6 mi. E. Elkton, Meh1 Cr., V-27-69, Vertrees (WSU). Harney Co., Steens Mts., VI-25-22, Chamberlin (OSU). Jackson Co., Bessif Cr., VI-25-69 (UCB); Crowfoot Rd., VI-2-51 (UCD); Prospect, VI-20-24, Fox (CAS). Klamath Co., Cherry Cr., VI-28-37, Bolinger-Jewett (CAS); Crescent Lk., VIII-10-35, Ferguson (OSU), VII-3-52 (UCD); Fort Klamath, VII-8-31, Derflinger (OSU); Crater Lk. (Sphagum Bog), VIII-7-63, Schuh-Gray (WSU); Klamath Marsh, VI-25-39, Aitkin (CAS, UCB, UCD); Malone Sprs., VI-22-74, Barnell (OSU); Mt. McLaughlin, VII-19-30, Scullen (CAS). Lake Co., 14 mi. S. Lakeview, VII-12-60, Pitman (OSU). Lane Co., 10 mi. N.E. Oakridge, VI-30-59, Kettumen (CAS). Linn Co., S. Santiam, VIII-5-39, Smith (CAS). Union Co., Jordan Cr., VII-6 to VIII-2-75, VI-23 to VIII-28-76, VI-5 to VIII-3-77, Davis (WSU); Ladd Cyn., VI-22 to VII-19-75, VI-13 to IX-4-76, VI-5 to VIII-3-77, Davis (WSU); L. Lick Cr., VI-15 to VII-12-75, VI-21 to VII-23-77, Davis (WSU); U. Lick Cr., VI-27 to VII-12-75, VI-21 to VII-16-77, Davis (WSU); Whiskey Cr., VII-6 to VIII-2-75, VI-23 to VIII-31-76, VI-22 to VII-25-77, Davis (WSU). Wallowa Co., 19 mi. N. Enterprise, VI-27-60, Lattin (OSU).

Extralimital: Montana; Ravalli Co., VIII-12-43, Philip (OSU).

Canada, British Columbia, Fernie, VI-11-34, Leech (OSU); Vernon, VII-1930, Gillespie (OSU).

Discussion.--This is one of the difficult species of Hybomitra. It exhibits some variation that creates difficulties in separating it from other species, such as H. californica and H. zygota. The obvious

characters of H. fulvilateralis are the broad frons and the creamy palpi, but zygota also possesses these characters. Philip (1937, 1943) separated the two species by the slender yellow second palpal segment and absence of clouds from zygota wings. But these are characters which are not constant in a series of specimens that I examined that had been identified by Philip as zygota (in California Academy of Science Collection). I suspect that the two "species" are in fact only one variable species. This idea is enhanced by a series of specimens from Mary's Peak that I could not determine. Dr. Pechuman kindly examined them and thought that they could either be variants of californica or hybrids of californica and with fulvilateralis as the other parent. These are just speculations that need to be verified by further investigations.

Hybomitra hirtula (Bigot)  
(Map 16)

Theriopectes hirtulus Bigot, 1892, Mem. Soc. Zoo. de France 5:641 (Orig. Descrip.).

Tabanus hirtulus, Hadwen, 1914, Proc. Brit. Columbia Ent. Soc. 4:48; Cameron, 1926, Bull. Ent. Res. 17:27 (Bionom.); Rowe and Knowlton, 1936, Can. Ent. 67:242; Philip, 1936, Can. Ent. 68:155 (male); Stone, 1938, U.S.D.A. Misc. Publ. No. 305:159 (Rev.).

Hybomitra tetrica hirtula, Philip, 1941, Can. Ent. 73:151 (Synon.); 1947, Amer. Midland Nat. 37(2):299 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):17 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:341 (Cat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:29 (Syst.).

Tabanus frenchii Hine, 1904, Ohio Nat. 5:237 (Rev.).

Tabanus opacus Hine, 1904, Ohio Nat. 5:240; Cole and Lovett, 1921, Proc. Calif. Acad. Sci. 11(15):234.

Description.--Essentially identical with H. tetrica except that the subcallus is pollinose white.

Male: Not seen from Oregon.

Type: British Museum (Natural History), London, England.

Type locality: Washington.

Distribution: British Columbia to California and S. Dakota.

#### Material Examined

Oregon: Baker Co., Anthony Lk., VII-12-53, Roth-Beer (OSU); Big Cr., VI-29-VII-5-75, VI-27-76, VII-(11-28)-76, VI-28-77, VII-7/16/28-77, Davis (WSU); Cougar Cr., VI-(27-30)-76, VII-(25-28)-76, VIII-(12-14)-76, VI-21/28-77, VII-7/16/23-77, VIII-2-77, Davis (WSU); L. Goose Cr., VI-29-VII-5-75, VII-(6-12)-75, VIII-(4-7)-76, VI-21/28-77, VII-7/16-77, Davis (WSU); U. Goose Cr., VI-29-VII-5/75, VII-(6-12)-75, VII-(18-20)-76, VIII-(4-7)-76, VII-7/28-77, Davis (WSU); Velvet Cr., VI-29-VII-5-75, VII-(6-26)-75, VI-27-VII-3-76, VII-(11-20)-76, VIII-(29-31)-76, Davis (WSU); Whitman N.F., VII-12-14, Chamberlin (CAS, OSU). Benton Co., Corvallis, V-1930, Hays (OSU). Coos Co., Fairview, 5 mi. N.E. Coquille, VII-20/22-59, Rogers (OSU). Crook Co., 23 mi. E. Prineville, VII-29-76, Lattin (OSU). Deschutes Co., 3 Cr. Meadow, 15 mi. S. Sisters, VII-12-77, Mahmoud (OSU). Klamath Co.,

Crater Lk., VII-16-22, VII-9-38, VII-6-59 Huntzinger (CAS, OSU); Fort Klamath, VII-17-56, Hoffman (OSU); Klamath Falls, VI-27-39 (OSU). Linn Co., Marion Forks, VII-15-65, Christenson (OSU). Morrow Co., Boardman, VII-5-62 (OSU). Union Co., Jordan Cr., VII-(6-12)-75, VII-4-VIII-11-76, VIII-(29-31)-76, VII-8-VIII-3-77, Davis (WSU); Ladd Cyn., VI-(6-19)-75, VI-13-IX-4-76, VI-22/29-77, VII-8-77, VII-19-VIII-3-77, Davis (WSU); L. Lick Cr., VI-29-VII-12-75, VII-(25-31)-76, VIII-(22-31)-76, VII-(7-28)-77, Davis (WSU); U. Lick Cr., VI-29-VII-12-75, VII-20-VIII-2-75, VII-(11-14)-76, VI-21/28-77, VII-(7-23)-77, VIII-2-77, Davis (WSU); Whiskey Cr., VII-(6-12)-75, VI-27-IX-4-76, VII-8-77, VII-25/28-77, VIII-12-77, Davis (WSU). Wallowa Co., 17 mi. S. Lostine, VII-21-70, Oman (OSU); Lost Lk., VIII-5-61, Rieder (OSU); Minam N.F., VI-19-18, Chamberlin (OSU).

Idaho: Mt. Borah, Dickey, VII-2-47, Duspiva (OSU).

Discussion.--Bigot (1892) described hirtulus as a full species, but Philip (1941) downgraded it to a subspecies of tetrica on the basis the only character that separated them is variable. I examined many specimens of both species and found that the subcallus is consistently pollinose in hirtula and denuded in tetrica. The former species is more abundant and wider range of distribution than the latter, but they are sympatric in distribution. Based on these findings it is the writer's opinion that hirtula should be given a full species status.

The immature stages of hirtula were reared and described by Cameron (1926) from Canada. He collected the adults while biting horses and cattle.

The adults are on the wing from late June to late August.

Hybomitra lanifera (McDunnough)  
(Map 16)

Tabanus lanifera McDunnough, 1922, Can. Ent. 54:239 (Orig. Descrip.); Philip, 1936, Can. Ent. 68:153; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:151 (Rev.).

Hybomitra lanifera, Philip, 1947, Amer. Midland Nat. 37(2):295 (Cat.); 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:339 (Cat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:23 (Syst.).

Diagnosis.--Size medium, body entirely black. Sides of frons parallel, ocellar tubercle brown to orange; median callus black; basal callus brown, subcallus pollinose; antennae dark brown basally, black apically, palpi pale to dark. Thorax entirely black; wings hyaline, legs brown to black. Abdomen, black.

Description.--

Female: Length 12-13 mm.

Head: Frons pollinose grayish orange, with black hair, sides parallel; ocellar tubercle brown; median callus dull black; basal callus shiny black, sometimes connected to median callus; subcallus pollinose gray to silver. Clypeus and genae white, with black and creamy hair. Antennae black, first two segments sometimes tinged with brown, with black hair; excision on flagellum very shallow, dorsal angle not well differentiated. Palpi slender, first segment black, with long black and creamy hair, second segment dark creamy to orange, with black hair.

Thorax: Entirely black, with black hair; dorsum sometimes with faint longitudinal gray stripes; prescutal lobe partially pale; wings hyaline, coastal cell fumose yellow; legs dark brown, with black hair, tibiae lighter than rest of legs, sometimes dark reddish.

Abdomen: Shiny black, with dense black hair and two to three rows of white hair tufts on dorsum; sublateral of second tergite sometimes pale.

Male: Not seen from Oregon.

Type: Canadian National Collection, Ottawa, Canada, No. 511.

Type locality: Banff, Alberta, Canada.

Distribution: Alaska to Alberta, south to Oregon and Colorado.

#### Material Examined

Oregon: Wallowa Co., Aneroid Lk., Blue Mt., VII-24-29, Scullen (OSU).

Washington: Mt. Rainier, VIII-(7-9)-35, Wilcox (OSU).

Discussion.--The shiny black color, and lack of white pile on all segments, plus the small size, separates this species from H. sequax. The pollinose subcallus separates it from its closest relative, H. procyon.

Only two specimens so far have been collected from Oregon (Wallowa Co.), but it exists in Washington State and Idaho. This might suggest that it is confined to the northeastern and possibly other northern parts of the state.

Hybomitra melanorhina (Bigot)  
(Map 16)

Theriopectes melanorhina Bigot, 1892, Mem. Soc. Zoo. de France 5:642 (Orig. Descrip.).

Tabanus melanorhinus, Philip, 1936, Can. Ent. 68:155; 1937, 69:49; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:156 (Rev.).

Hybomitra melanorhina, Philip, 1941, Can. Ent. 73:150 (Synon.); 1947, Amer. Midland Nat. 37(2):296 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):15 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:339 (Cat.); Lane, 1976, J. Med. Ent. 12(6):684 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:25 (Syst.).

Tabanus rhombicus (form 3), Osten Sacken, 1877, West. Dipt., p. 218.

Diagnosis.--Size medium, body black. Frons widened above; ocellar tubercle orange to brown; median callus black; basal callus shiny brown to black, concolorous with the shiny subcallus; antennae black, base of flagellum pale. Thorax black; notopleura orange; wings hyaline; legs yellowish orange and black. Abdomen black, with sublateral reddish orange spots.

Description.--

Female: Length 12-15 mm.

Head: Frons slightly widened above, pollinose white, with black hair; ocellar tubercle brown to orange; median callus dull black; basal callus shiny dark brown to black, merging and concolorous with the shiny subcallus. Clypeus and genae whitish gray, with black hair. Antennae

black, base of flagellum and sometimes pedicel yellowish, scape and pedicel with gray pollen and black hair; excision shallow, dorsal angle obtuse. Palpi creamy, basal segment with long white hair, second segment swollen basally with black and fine white hair.

Thorax: Black; mesonotum with longitudinal gray stripes; notopleura orange, with black hair; wings hyaline, coastal cell fumose yellow. Venter with dense white hair, legs yellowish orange with black fore leg except basal half of tibia, mid and hind coxae and femora, with black hair.

Abdomen: Dorsum black; tergites II and III with sublateral orange to red spots; all tergites with three rows of gray spots and gray posterior margin; tergites IV-VII with orange lateral margins. Sternites I-IV orange with one median and two lateral black spots, V-VII black, all with gray posterior margins and white hair; pile of pleurie white.

Male: Not seen from Oregon.

Type: British Museum (Natural History), London, England.

Type locality: Washington.

Distribution: British Columbia to Montana, south to California.

#### Material Examined

Oregon: Baker Co., Big Cr., VI-29 to VIII-16-75, VII-1 to IX-8-76, VI-21 to VIII-9-77, Davis (WSU); Cougar Cr., VI-27 to VIII-31-76, VI-21 to VIII-9-77, Davis (WSU); L. Goose Cr., VI-29 to VII-26-75, VIII-(4-7)-76, VI-21 to VII-23-77, Davis (WSU); U. Goose Cr.,



VI-29 to VII-12-75, VI-27 to IX-8-76, VI-21 to VIII-20-77, Davis (WSU); Whitman N.F., VII-11-14, Chamberlin (OSU). Clackamas Co., Mt. Hood, S. Side 7000 ft., VII-30-36, Scullen (OSU); nr. L. Crater Lk., VIII-2-70, Westcott (OSDA); Swim, VII-25-37, Van Dyke (CAS). Deschutes Co., Sparks Lk., VII-19-77, Mahmoud (OSU). Douglas Co., Diamond Lk., VII-23-53, Jewett Jr. (OSU). Hood River Co., Hood River Meadow, 35 mi. S. H.R., VII-28-65, Goeden (OSDA). Jackson Co., Ashland, VII-5-58, Boyer, VII-12-63 Alsing (SOSC). Josephine Co., 2 mi. S.E. O'Brien, VI-26-50, Black-Davis (OSDA). Klamath Co., Deming Cr., 11 mi. N.E. Bly, VIII-12-56, Schuh (CAS); 10 mi. E. Beaver Marsh, VII-24-56, Goeden (OSDA); Klamath Falls, VII-3-54, Russell-Schuh, VII-17-56, Hoffman (CAS); Mare Egg Sprs., VI-26-74, Thompson (SOSC); U. Klamath W.L. Ref., VI-26-74, Swisher (SOSC); Winema N.F., VII-28-77, Mahmoud (OSU). Lake Co., 14 mi. S. Lakeview, VII-12-60, Pitman (OSU); Deep Cr., 13 mi. S.E. Lakeview, VII-8-73, Jewett Jr. (OSU); Summer Lk., VII-28-77, Mahmoud (OSU). Linn Co., Lost Prairie, S. Santiam Hwy., VIII-3-48 (OSU); Cascadia, Will. N.F., VII-7-77, Mahmoud (OSU); Marion Forks, VII-15-65, Christenson (OSU); Big Meadow, VII-18-65, Goeden (OSDA). Marion Co., Breitenbush, VII-21-54, Jewett Jr. (OSU). Umatilla Co., 1 mi. S. Ukiah-Dale St. Pk., VI-23-77, Westcott-Brown (OSDA) (OSU). Union Co., 5 mi. W.N.W. Anthony Lk., VIII-8-67, Goeden (OSDA); Jordan Cr., VII-4 to VIII-21-76, VII-8-77, VIII-3-77, Davis (WSU); Ladd Cyn., VII-6 to VIII-16-75, VI-13 to IX-4-76, VI-22 to VIII-3-77, Davis (WSU); L. Lick Cr., VI-29 to VIII-16-75, VII-1 to IX-8-76, VI-28 to VIII-20-77, Davis (WSU); U. Lick Cr., VI-29 to VIII-16-75, VI-27 to VII-28-76, IX-(5-8)-76, VII-7 to VIII-20-77, Davis (WSU); Whiskey Cr., VII-(6-12)-75, VIII-(10-16)-75, VII-(4-31)-76, VII-8-77, Davis (WSU). Wallowa Co., 15 mi.

E. Joseph, VII-7-66, Goeden (OSDA); Wallowa, VII-22-29, Scullen, V-23-33, Philip (CAS); Wallowa Mts., VII-6-22 (CAS).

Extralimital: Montana; Adrolli Co., Comas Cr., VII-23-32, Philip (OSU). Washington; Red Mt., VII-22-28, Gray (OSU).

Discussion.--H. melanorhina is similar to H. tetrica, but the former is smaller in size, with a shorter and broader frons, basal callus ovoid,  $R_4$  of wing lacks a stump vein; and the hind metatarsi are pale. Tabanus stonei also superficially resembles melanorhina but may be separated by generic differences.

Its distribution in Oregon is along the Cascade Mountains and the mountains of northeastern Oregon. But the number of specimens is small in the collections, perhaps the reason that no specimens were located from the Coastal Range. The adults are active from mid June to late August with occasional specimens taken in September. The immature stages are not yet known.

Hybomitra opaca (Coquillett)  
(Map 18)

Tabanus opacus Coquillett, 1904, In Baker, Inv. Pac. 1:21 (Orig. Descrip.); Hine, 1904, Ohio Nat. 5:240 (Rev.); Cole and Lovett, 1921, Proc. Calif. Acad. Sci. 11(15):234; Philip, 1936, Can. Ent. 68:154; 1937, 69:50; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:160 (Rev.).

Hybomitra opaca, Philip, 1947, Amer. Midland Nat. 37(2):296 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):15 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:340 (Cat.); Burger, 1974, Proc. Ent. Soc. Wash. 76(4):440 (Syst.); Nowierski and Gittins, 1976,

Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:25 (Syst.).

**Diagnosis.**--Size relatively small, body orange and black. Frons widened above; ocellar tubercle orange to brown; median and basal callus black to dark brown; antennae orange basally, black apically; palpi white. Thorax black, with longitudinal gray stripes; notopleura orange; wings hyaline; legs with black coxae and femora, remainder orange. Abdomen orange, with black spots.

**Description.**--

Female: Length 11-13 mm.

Head: Frons pollinose gray, with black hair, slightly widened above; ocellar tubercle dull orange to brown; median callus considerably large, black; basal callus shiny dark brown, touching eyes; subcallus pollinose gray; clypeus and genae pollinose concolorous with subcallus, with black and white hair. First two antennal segments and extreme base of third, orange, clothed with gray pollen and black hair on former two, balance of flagellum black, with considerable excision and acute dorsal angle. Palpi white, first segment with white hair, second swollen basally, with black hair.

Thorax: Black; mesonotum with longitudinal gray stripes; humeral callus, notopleura and margin of prescutal lobe orange, with black hair; wing hyaline, veins orange. Venter with dense white hair; coxae and femora black to dark brown, tibiae and tarsi yellowish orange; with black hair, fringe on hind tibia predominantly black.

Abdomen: Tergite I predominantly black with sublateral orange spots; II-IV orange, with median black spots, and black hair sublaterally, V black, with sublateral orange spots; VI and VII black, with orange lateral margins; all tergites with three rows of gray spots on posterior lateral margin. Venter orange except sternites VI and VII black, with creamy hair.

Male: Not seen from Oregon.

Type: U.S. National Museum, Washington, D.C., No. 7319.

Type locality: Ormsby Co., Nevada.

Distribution: Alberta and Saskatchewan to California and Colorado.

#### Material Examined

Oregon: Benton Co., Mary's Peak, VII-24-76, Mahmoud (OSU). Harney Co., Frenchglen, VII-12-47, Ellertson (OSU). Malheur Co., Jordan Valley, VII-10-53, Lauderdale (OSU).

Montana: Bozeman.

Discussion.--H. opaca is relatively rare in Oregon and has scattered distribution. The small size and predominantly orange fore tibiae separates opaca from other similar Hybomitra species. McAlpine (1961) discussed the similarity between this species and H. frontalis. He concluded that opaca is a morph of the frontalis complex, but it is apparent that his idea has not been widely accepted since opaca is still considered to be a full species (Philip 1965).

H. opaca occurs in the western half of North America. The few

adult specimens seen by the writer were collected during July. The immature stages are not yet known.

Hybomitra phaenops (Osten Sacken)  
(Map 1/)

Tabanus phaenops Osten Sacken, 1877, West. Dipt., p. 217 (Orig. Descrip.); Hine, 1904, Ohio Nat. 5:241 (Rev.); Cole and Lovett, 1921, Proc. Calif. Acad. Sci. 11(15):234; McDunnough, 1921, Can. Ent. 53:143; Webb and Wells, 1924, U.S.D.A. Bull. No. 1218:20 (Biosyst.); Cameron, 1926, Bull. Ent. Res. 17:33 (Bionom.); Rowe and Knowlton, 1935, Can. Ent. 67:243.

Tabanus phaenops, Surcouf, 1921, Gen. Ins. Fasc. 175:79 (Lapsus.).

Theriopectes phaenops, Osten Sacken, 1878, Smithsn. Misc. Coll. No. 270:57.

Tabanus sonomensis var. phaenops, Stone, 1938, U.S.D.A. Misc. Publ. No. 305:134 (Synon.).

Hybomitra sonomensis var. phaenops, Philip, 1947, Amer. Midland Nat. 37(2):298 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):17 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:340 (Cat.); Burger, 1974, Proc. Ent. Soc. Wash. 76(4):441 (Syst.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:28 (Syst.).

Description.--H. phaenops resembles H. sonomensis but the former has entirely black antennae; its palpi are sometimes black, with shiny golden hair; hair on the venter is predominantly black; hair on lower genae mostly black; abdominal sternites predominantly black.

Male: Not seen from Oregon.

Type: Cotype, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, No. 14521 (Philip 1947).

Type locality: Webber Lake, California.

Distribution: British Columbia to California and Wyoming.

#### Material Examined

Oregon: Benton Co., Mary's Peak, VII-12-58, Capizzi (OSDA), VIII-1-78, Mahmoud (OSU). Grant Co., 7 mi. S.S.W. Prairie City, VI-28-62, Goeden (OSDA). Harney Co., Burns, VII-19-55, Ritcher (OSU), VII-8-62, Goeden (OSDA), 5 mi. S. Burns, VII-13-27, Scullen (OSU), VII-15-57, Lattin (OSU); 12 mi. S. Burns, VII-22-76, Lightfoot (OSU); 35 mi. S.E. Burns, VI-15-62, Goeden (OSDA); Fish Lk., Steens Mt. , VII-3-47, Ellertson (OSU), VII-15-53, VII-14-61, Roth-Beer (OSU), VII-16-57, Lattin (OSU), VIII-7-64 (OSU); Frenchglen, VII-8-27, Scullen (OSU), VII-12-35, Jewett (OSU), VII-12-47, Ellertson (OSU); Harney Lk., VII-15-27, Scullen (OSU); Malheur Field Sta., VII-(23-30)-77, Gruber (OSU); P. Ranch, VI-23-22, Chamberlin (OSU); Warner Valley, VII-25-51, Roth (OSU); Steens Mt. , W. Side, VII-12-27, Scullen (OSU). Klamath Co., Dairy, IX-4-62, Schuh (WSU); E. Beaver Marsh, VII-24-56, Goeden (OSDA); Fort Klamath, VII-11-27, Scullen (OSU), VII-8-31, Derfinger (OSU); K Kirk, VII-19-51, Roth (OSU); Klamath Falls, VI-(13-16)-58, VI-22-58, Schuh (OSU, WSU); Klamath Marsh, VI-14-63, Larson (OSDA); L. Klamath Lk., VI-21-58, VII-28-58, Schuh (OSU), Malin, VIII-9-22, Lovett (OSU); Rainbow Cr., 4 mi. S. Lk. of Woods, VI-22-55, Vertrees (OSU);

U. Klamath Lk., 3 Mile Cr., VIII-4-63, Schuh (WSU); U. Klamath Marsh, VI-8-20, Rockwood (OSU), VII-13-48, Every (OSU), VII-25-58, Schuh (OSU); 22 mi. S. Schumilt, VIII-3-66, Goeden (OSDA); Winema N.F., VII-28-77, Mahmoud (OSU). Lake Co., Abert Lk., IX-10-64, Schuh-Peters (WSU); Adel, VII-16-32, IX-3-58, Schuh (OSU); Ana Spr. Res., VIII-3-66, Goeden (OSDA); Lakeview, VI-19-45, Scullen (OSU), Rest Lk., VIII-25-44, Scullen (OSU); 20 mi. W. Silver Lk., VII-25-56, Goeden (OSDA); Summer, VII-20-44, Mote (OSU), VII-22-44, VIII-27-44, Gjullin (OSU), VIII-8-47, VI-30-48, VII-24-49, Roth (OSU), VIII-16-49 (UCD), VIII-21-51, VIII-10-66, Roth (OSU), VIII-12-69, Goeden (OSDA), VII-28-77, Mahmoud (OSU); Sycan Marsh, VII-29-77, Cobb (OSU). Lane Co., Sunset Lk., IX-6-62, Vertrees-Schuh (WSU). Malheur Co., Jordan Valley, VII-10-53, Landerdale (OSU). Umatilla Co., Wildhorse Cr., Alvord Basin, V-28-60, Jewett (OSU). Union Co., Jordan Cr., VII-(6-19)-75, VII-(4-31)-76, VI-29-VII-19-77, VIII-3-77, Davis (WSU); Ladd Cyn., VI-29-VII-19-75, VI-(13-30)-76, VII-(4-31)-76, Davis (WSU); Whiskey Cr., VI-(27-30)-76, VII-(15-31)-76, Davis (WSU).

Discussion.--Osten Sacken (1877) described H. phaenops as a species but Stone (1938) downgraded it as a variety of H. sonomensis on the basis of its close similarity to the latter species. The close similarity is a general trend among most Hybomitra and the means of separating them is discussed under H. sonomensis. The differences between phaenops and sonomensis cited in the description above are, in the writer's opinion, adequate and consistent if compared to other Hybomitra species. Thus, I consider phaenops to be a full species.

H. phaenops occurs mainly around water, especially the lakes of

central-eastern and southern parts of Oregon. The adults are active from early June to mid September.

Webb and Wells (1924) reared and described the immature stages. They provided information on life cycle and bionomics of the species.

Hybomitra procyon (Osten Sacken)  
(Map 17)

Tabanus procyon Osten Sacken, 1877, West. Dipt., p. 127 (Orig. Descrip.); Hine, 1904, Ohio Nat. 5:241 (Rev.); Cole and Lovett, 1921, Proc. Calif. Acad. Sci. 11(15):234; Philip, 1936, Can. Ent. 68:153; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:127 (Rev.).

Theriopectes procyon, Osten Sacken, 1878, Smithsn. Coll. No. 270:57.

Hybomitra procyon, Philip, 1947, Amer. Midland Nat. 37(2):297 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):16 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:340 (Cat.); Lane, 1976, J. Med. Ent. 12(6):684 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:26 (Syst.).

Tabanus (Hybomitra) procyon, Cole, 1969, Flies West. N. Amer., p. 168.

Diagnosis.--Size small to medium; body entirely black. Sides of frons parallel; ocellar tubercle brown or black, median callus black; basal callus shiny black; subcallus relatively large, shiny black; genae shiny black, concolorous with subcallus; antenna slender, black; palpus black. Thorax black; wings hyaline, with black spots; legs entirely black. Abdomen entirely shiny black; body hair entirely black.



Description.--

Female: Length 10-14 mm.

Head: Frons pollinose grayish black, with black hair, sides parallel; ocellar tubercle shiny brown, red or black; median and basal callus black; subcallus large, shiny black merging with basal callus and the concolorous shiny genae; clypeus dull black, with gray pollen and black hair extending to genae. Antennae slender, without excision, entirely black. Palpus entirely black, with black hair.

Thorax: Entirely black, with black hair, dorsum with faint gray longitudinal stripes; wings hyaline with black spot on frucation; and cross veins, coastal cell and part of subcoastal fumose black; legs entirely black with black hair.

Abdomen: Entirely shiny black.

Male: Eyes with dense pile; genae enlarged, with dense pile; palpi reduced, stout. Size and color as in female.

Type: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, No. 14519.

Type locality: Sonoma Co., California.

Distribution: British Columbia to California and Wyoming.

Material Examined

Oregon: Baker Co., Big Cr., VI-29 to VI-5-75, VI-27 to VII-20-76, V-20 to VI-22-77, Davis (WSU); Cougar Cr., VI-5-77, Davis (WSU);

Halfway, V-13-59, Jewett (OSU); U. Goose Cr., VI-(27-30)-76, VI-(12-14)-77, Davis (WSU); Velvet Cr., VI-22 to VII-5-75, VI-(17-30)-76, VI-(5-8)-77, Davis (WSU). Benton Co., Alsea, VI-4-22, Lovett (OSU); Corvallis, V-29-15, Howe, VI-12-36, Rieder, IV-13-39, Mowry, IV-24-65, Hoyer (OSU), 2 mi. S.W. Corvallis, V-1-56, Lattin (OSU), 5 mi. N.W. Corvallis, IV-22-62, Smith (OSU); McDonald Forest, VIII-27-77, Ellenson (OSU). Clatsop Co., Saddle Mt., V-20-79, Schwartz (OSU). Deschutes Co., Spring Cr., IV-20-52, Roth (OSU). Douglas Co., Little Rv. Rd., V-17-47, Genter (OSU). Hood River Co., Dee, VI-17-17 (UCB). Josephine Co., Grant Pass, V-18-63, Gordon (SOSC). Lake Co., Lakeview, IV-5-59, James (WSU); Warner Mt., VI-19-23, Chamberlin (OSU). Lane Co., Andrews Expt. For., VI-19-72, Nagel (OSU), IV-25-79, Cooper (OSU). Linn Co., Cascadia, V-24-47, Roth, V-19-35, Jewett (OSU). Marion Co., Brietenbush Spr., VI-27-41, Rieder (OSU), Detroit, IV-11-39 (CAS). Umatilla Co., 10 mi. W. Longdon Lk., VI-4-64, Goeden (OSDA). Union Co., Jordan Cr., VI-22 to VII-12-75, VI-(5-22)-77, Davis (WSU); Ladd Cyn., VII-(6-12)-75, VI-(23-26)-76, Davis (WSU); L. Lick Cr., VI-29 to VII-12-75, VI-(5-8)-77, Davis (WSU); U. Lick Cr., VI-29 to VII-5-75, Davis (WSU); Whiskey Cr., VI-22 to VII-12-75, VI-23 to VII-24-76, VI-(5-22)-77, Davis (WSU). Washington Co., Forest Grove, IV-26-25, F.G. (OSU).

Washington: Electron, V-7-35, Wilcox (OSU).

Discussion.--H. procyon is characterized by the entirely shiny black body, with entirely black pubescence. Its size is relatively small in comparison with most Oregon Hybomitra. Its closest relative in Oregon is H. lanifera, but the latter has a pollinose subcallus and some white pile on the abdomen. H. procyon emerges early in the season, as

early as April and remains on the wing until early July. A few specimens were collected in August. It is not very common in collection and is mostly found at lower and moderately higher elevations. Its distribution in Oregon is mainly west of the Cascade Range and in the northeastern parts of the state.

The immature stages are not yet known.

Hybomitra rhombica (Osten Sacken)  
(Map 18)

Tabanus rhombicus Osten Sacken, 1876, Mem. Boston Soc. Nat. Hist. 2:472 (Orig. Descrip.); 1877, West. Dipt., p. 218; Hine, 1904, Ohio Nat. 5:242 (Rev.); Cole and Lovett, 1921, Proc. Calif. Acad. Sci. 11(15):234; Cameron, 1926, Bull. Ent. Res. 17:36 (Bionom.); Rowe and Knowlton, 1935, Can. Ent. 67:243; Philip, 1936, Can. Ent. 68:152; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:153 (Synon.).

Theriopectes rhombicus, Osten Sacken, 1878, Smithsn. Misc. Coll. No. 270:57.

Hybomitra rhombica, Philip, 1947, Amer. Midland Nat. 37(2):297 (Cat.); Middlekauff, 1950; Bull. Calif. Ins. Surv. 1(1):16 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:340 (Cat.); Burger, 1974, Proc. Ent. Soc. Wash. 76(4):441 (Syst.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:27 (Syst.).

Tabanus (Hybomitra) rhombicus, Cole, 1969, Flies West. N. Amer., p. 168.

Tabanus centron Morten, 1882, Can. Ent. 14:211; Hine, 1904, Ohio Nat. 5:235; Cole and Lovett, 1921, Proc. Calif. Acad. Sci. 11(15):234; Philip, 1935, Can. Ent. 67:94 (Synon.).

Tabanus osburni Hine, 1904, Ohio Nat. 5:241 (Orig. Descrip.); Philip, 1931, Minn. Expt. Sta. Tech. Bull. No. 80:114 (Biosyst.); Rowe and Knowlton, 1935, Can. Ent. 67:243; Philip, 1936, Can. Ent. 68:153 (Synon.); Stone, 1938, U.S.D.A. Misc. Publ. No. 305:153 (Synon.).

Hybomitra rhombica osburni, Philip, 1941, Can. Ent. 73:150; 1947, Amer. Midland Nat. 37(2):297 (Cat.).

Hybomitra rhombica var. osburni, Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:340 (Cat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:27 (Syst.).

Hybomitra solox Enderlein, 1925, Mitt. Zoo. Mus. Berlin 11:364.

Diagnosis.--Size medium, body black. Frons widened above; ocellar tubercle large brownish orange; median callus long, black; basal callus dark brown to black; subcallus denuded, dark brown to black; antenna orange basally, black distally; palpus creamy yellow. Thorax black; notopleura concolorous with mesonotum; wing hyaline; legs orange and black. Abdomen black, with white hair.

Description.--

Female: Length 12-16 mm.

Head: Frons pollinose white, with black hair, widened above; ocellar tubercle large, brown to orange; median callus slender, black; basal callus shiny black to dark brown, touching eyes; subcallus shiny black to dark brown. Clypeus and genae pollinose white, with white hair. First two antennal segments and base of third reddish orange to black, former two with black hair, balance of third segment black, excision very shallow or wanting, dorsal angle rounded. Palpus creamy yellow,

first segment sometimes dark, with long white hair, second segment with white hair at swollen basal half and black hair apically.

Thorax: Entirely black. Mesonotum with longitudinal gray stripes and black hair; notopleura concolorous with mesonotum; wings hyaline, with brown band along posterior end of  $R_1$  and light spot on furcation coastal cell fumose yellow. Legs black, with orange on basal half of fore tibia mid and hind tibia and metatarsus, clothed with dense black hair; mixed with white on femora.

Abdomen: Black, tergite II with reddish orange sublateral spot, all tergites, with three rows of white triangles of hair which are partially or totally rubbed away on some segments, posterior margins of all segments gray; venter with white hair; pile of pleurae white.

Male: Not seen from Oregon.

Type: Cotype, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, No. 4030 (After Stone 1938).

Type locality: Colorado mountains.

Distribution: British Columbia to Arizona, Colorado and Minnesota.

#### Material Examined

Oregon: Baker Co., Anthony-Dutch Flat Trail, VIII-8-29, Scullen (OSU), Whitman N.F. VII-1924, Chamberlin (CAS, OSU, UCB). Deschutes Co., 3 Cr. Meadow, 15 mi. S. Sisters, VII-23-77, VIII-10-77, Mahmoud (OSU). Harney Co., Fish Lk., Steens Mt., VII-19-69, Jewett (OSU). Hood River Co., Mt. Hood, V-19-25, Fox (CAS). Jackson Co., Ashland Mt.,

VII-22-66 (CAS); Silver Cr. Basin, VII-18-67, Goeden (OSDA). Jefferson Co., Horse Lk., VII-25-09, Bridwell (OSU); Suttle Lk., VIII-7-35, Scullen (OSU). Klamath Co., Crater Lk., VII-(16-17)-22, Van Dyke (CAS), 1929, Hibbard (OSU), VII-6-37, E. Roth (CAS); Gearheart Mt., VIII-5-66, Goeden (OSDA). Lake Co., Horse Mt., VII-31-09, Bridwell (CAS, OSU); 14 mi. S. Lakeview, VII-12-60, Pitman (OSU); Summer Lk., VII-24-50, Roth (OSU). Lane Co., H.J. Andrews Expt. For., VII-13-72, Nagel (OSU); Mck. Pass, VIII-16-49, VIII-3-50, Roth (OSU). Wallowa Co., 9 mi. E. Imnaha, VII-30-41, Rieder (OSU); Hat Point, VII-(20-21)-60, Rogers (OSU); Lostine, VII-21-70, Oman (OSU); Wallowa Lk., VII-27-29, Scullen (OSU), VIII-2-41, Rieder (OSU).

Extralimital: California; Fresno Co., Huntington Lk., VIII-1-67, Hoy (OSU). Montana; Lake Co., 2 to 5 mi. S. Swan Lk., VIII-9-72, Mathis (OSU). Utah; Mirror Lk., VII-19-48, Duspiva (OSU). Washington; Mt. Rainier, VIII-8-32, Baker (OSU), VII-11-36, Crumb (OSU).

Discussion.--H. rhombica is very similar to H. osburni (Hine).

The relationship between the two will be considered below in detail.

In Oregon, H. rhombica occurs in the Cascade Range and in the northeastern region of the state. It had been collected in small numbers. The adults have a short seasonal occurrence during July and the first half of August.

Cameron (1926) gave some description for male pupa, but the larval stage is not yet known.

Hine (1904) described osburni as a species and separated it from rhombica by the lack of red spots on abdominal tergite II. Philip

(1941) treated osburni as a subspecies of rhombica, then in 1965 he downgraded it to varietal status. He separated it from the typical taxon by the shiny body, the faint abdominal triangle and the lack of abdominal red spots. I examined many specimens, labelled osburni from Oregon and some neighboring states and found that none of the above characters, used by Philip, were consistent. Some of the shiny bodied specimens do have red spots and/or abdominal triangle while some of the dull bodied rhombica lack the red spots and/or the abdominal triangle. I also noticed that some of the specimens from both dull and shiny bodied have a mixture of black and white hair on the first palpal segment while some others have only black hair.

The above observations reflect some variation in this species. However, this variation is not as great as in other groups such as Atylotus incisuralis, which is treated as one species in spite of the variation. The characters that were used by Philip for the differentiation of the two species are neither consistent nor adequate to separate them. Moreover, the distribution of the two "species" Oregon and Idaho (Nowierski and Gittins 1976) is sympatric.

Based on the above argument I think that osburni should be considered as a synonym of rhombica.

Type: According to Philip (1947, p. 297), cotypes of unstated numbers are in Ohio State University, Columbus, Ohio; Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, Canadian National Collection, Ottawa and Philip's Collection (now incorporated into the collections of California Academy of Science, San Francisco).

Type localities: Philip (1947) reported the above cotypes from Alberta, British Columbia, Alaska, Montana and Washington.

Distribution: Alaska to Oregon and Minnesota.

Material Examined (According to Label)

Oregon: Baker Co., Anthony-Dutchflat Trail, VIII-6-29, Scullen (OSU, CAS); Big Cr., VII-(6-12)-75, VIII-(10-16)-75, VII-7 to VIII-2-77, Davis (WSU); Cougar Cr., VI-28-VII-7-77, Davis (WSU); L. Goose Cr., VI-29-VII-26-75, VI-21-VII-23-77, Davis (WSU); U. Goose Cr., VI-29-VII-12-75, VII-(25-28)-76, Davis (WSU); Velvet Cr., VI-29-VIII-9-75, VII-(11-28)-76, VI-28-VIII-2-77, Davis (WSU); Whitman N.F., VII-1914, Chamberlin, (OSU, UCB); Pine Cr., 12 mi. W. Baker, VII-13-67, Goeden, VII-25-68, Goeden-Westcott (OSDA). Benton Co., Corvallis, Campus, V-1927, Storm (OSU). Grant Co., Dixie Mt., VIII-12-29, Scullen (OSU); John Day, VII-22-48, Roth (OSU); Bull Prairie For. Camp, 40 mi. S. Heppner, VII-10-64, Schuh-Lattin (OSU). Harney Co., N. Fish Lk., Steens Mt., VII-19-69, Jewett Jr. (OSU). Hood River Co., Hood River, IX-24-17, Childs (OSU, UCB); Lost Lk., VIII-5-41, Rieder (OSU). Jackson Co., Mt. Ashland, VII-14-43, Scullen (CAS, OSU). Lake Co., Summer Lk., VII-24-50, Roth (OSU); 14 mi. S. Lakeview, VII-12-60, Pitman (OSU); Horse Mt. Flats, VII-31-09, Bridwell (CAS). Linn Co., Marion Forks, VII-15-65, Christenson (OSU); Summit Prairie, VII-23-39, Gray-Schuh (CAS). Marion Co., Salem, VII-10-52, Goeden (OSDA). Union Co., Grand Ronde Rv., VII-18-65 (UCB); Jordan Cr., VI-29-VIII-2-75, VII-4-VIII-31-76, VII-8-VIII-12-77, Davis (WSU); Ladd Cyn., VII-(6-19)-75, VI-13-IX-4-76, VI-29-VIII-12-77, Davis (WSU); L. Lick Cr.,



VI-29-VII-5-75, VI-22-VII-23-77, Davis (WSU); U. Lick Cr., VI-29-VII-5-75, VII-(11-28)-76, VI-28-VII-23-77, Davis (WSU); Whiskey Cr., VII-6-VIII-2-75, VI-27-IX-4-76, VI-29-VIII-3-77, Davis (WSU). Wallowa Co., E. Eagle Cr., VII-9-34, Lare (OSU); 17 mi. S. Lostine, VII-21-60, Oman (OSU); Hatpoint, VII-(20-21)-60, Rogers (OSU); Lick Cr., Wallowa N.F., VIII-12-37, Bolinger-Jewett (OSU); Wallowa Lk., VII-27-29, Scullen, VIII-2-41, Rieder (OSU); VII-14-47, Davis-Black, VII-25-65, Goeden (OSDA), VIII-14-64, James (WSU), 9 mi. E. Imnaha, VII-30-41, Rieder (OSU); Wallowa Mts., VII-24-54, Adel Kamal (WSU).

Extralimital: Idaho; Schafer Butte, 40 mi. W. Nampa (No Date), Hasbrouck (OSU). Washington; Eunice Lk., VIII-16-31, Eide (OSU); Mt. Rainier, VII-27-32, VIII-26-35, Baker (OSU).

Hybomitra rupestris (McDunnough)  
(Map 19)

Tabanus rupestris McDunnough, 1921, Can. Ent. 53:143 (Orig. Descrip.); Philip, 1936, Can. Ent. 68:50.

Hybomitra rupestris, Philip, 1947, Amer. Midland Nat. 37(2):297; 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:340 (Cat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:27 (Tax.).

Tabanus rhombicus var. rupestris, Stone, 1938, U.S.D.A. Misc. Publ. No. 305:154 (Synon.).

Tabanus (Hybomitra) rupestris, Cole, 1969, Flies West. N. Amer., p. 168.

Diagnosis.--Size medium; body orange and black. Frons slightly widened above; ocellar tubercle large, brown to orange; median callus tapering above, black; basal callus shiny dark brown to black;

subcallus denuded dark brown to black; scape, pedicel of antenna orange, flagellum reddish at base, balance black; palpus yellow. Thorax black, notopleura black; wings hyaline; legs black and orange. Abdomen orange, with black spots.

Description.--

Female: Length 12-15 mm.

Head: Frons slightly widened above, pollinose white; ocellar tubercle large, brown to orange; median callus black, tapering above, connected to ocellar tubercle; basal callus shiny, brown to black, touching eyes; subcallus denuded brown to black. Clypeus and genae pollinose white, with white mixed with black hair on genae. Scape and pedicel of antennae orange, with black hair; base of flagellum reddish orange, balance black, excision shallow, dorsal angle elevated, acute. First palpal segment dark, with long white hair, second segment yellow, with white hair on swollen basal half, black hair on attenuated apical half.

Thorax: Black, with longitudinal gray stripes dorsally, dense white hair ventrally; notopleura black, concolorous with mesonotum; wings hyaline, with spots on furcation and cross veins; posterior end of  $R_1$  with brown band, coastal cell fumose yellow; coxae, femora, apex of fore tibia and fore tarsus black, remainder of leg parts orange, with black hair, femora with white hair.

Abdomen: Tergite I black, with sublateral orange spots, II-IV yellowish orange, with median black spot, V-VII black, with orange lateral margins, all with median white hair triangle (rubbed out in

some specimens) and gray posterior margin. Sternites I-IV yellowish orange. I with lateral black spots; V-VII black; pile of pleurae golden.

Male: Eyes with denser pile than female; frontal triangle with white pollen; scape of flagellum slightly swollen; palpi reduced, with long hair. Size and other characters in female.

Type: Canadian National Museum, Ottawa, Canada, No. 209.

Type locality: Gallatin County, Montana.

Distribution: British Columbia to Oregon and S. Dakota.

#### Material Examined

Oregon: Baker Co., U. Goose Cr., VIII-20-77, Davis (WSU); Velvet Cr., VIII-20-77, Davis (WSU). Benton Co., Mary's Peak, VII-27-76, Mahmoud (OSU). Clackamas Co., Nr. Govt. Camp, VII-20-37, Van Dyke (CAS). Crook Co., Ochoco Mts., Hwy. 26, VII-31-65, Jewett Jr. (OSU). Grant Co., John Day, VII-21-48 (OSU); Sheep Mt. Rd. (5000 ft.), VII-19-36, Scullen (OSU). Harney Co., 4 mi. W. Fish Lk., Steens Mt. , VII-15-53, Roth-Beer (OSU). Lake Co., 14 m. S. Lakeview, VII-12-60, Pitman (OSU). Lincoln Co., 10 mi. N.W. Nashville, VII-21-59, VII-13-62, Lewis (OSU), Waldport, VII-14-38, Van Dyke (CAS). Umatilla Co., Ukiah, V-24-58, Every (OSU). Union Co., Grand Ronde Rv., VII-18-65 (UCB); Jordan Cr., VII-20-VIII-16-75, VII-15-VIII-31-76, VII-19-VIII-12-77, Davis (WSU); Ladd Cyn., VIII-(10-16)-75, VI-13-IX-4-76, VII-19-VIII-23-77, Davis (WSU); L. Lick Cr., VII-23-77, Davis (WSU); Medical Sprs., VIII-3-30, Jellison (OSU); Whiskey Cr.,

VII-27-VIII-16-75, VII-15-IX-4-76, VII-8-VIII-23-77, Davis (WSU).

Wallowa Co., Hot Point, VII-2-69, Goeden (OSDA); Lick Cr. Rs., Wallowa N.F. (4000 ft.), VIII-16-37, Jewett-Bolinger (OSU).

Utah: Johnson Resv., nr. Fish Lk., VII-15-48, Duspiva (OSU).

Discussion.--Stone (1935) treated H. rupestris as a variety of H. rhombica on the basis of the close similarity of the head and thorax of both species; Philip (1947) treated H. rupestris as a full species. The consistency in abdominal color plus the distribution of H. rupestris are good reasons to justify its position as a full species.

Its distribution in Oregon is mainly in the northeastern region and in the Coastal Range. Apparently it has a wider range of distribution in the western part of the state, but due to the relatively small frequency it has not been collected very much. The adults are active from early July to mid August.

Hybomitra sequax (Williston)  
(Map 19)

Tabanus sequax Williston, 1887, Trans. Kans. Acad. Sci. 10:137 (Orig. Descrip.); Hine, 1904, Ohio Nat. 5:243 (Synon.); Rowe and Knowlton, 1935, Can. Ent. 67:244; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:128 (Rev.); Philip, 1941, Can. Ent. 73:147 (Male Descrip.); 1947, Amer. Midland Nat. 37(2):315 (Cat.).

Hybomitra sequax, Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:340 (Cat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:27 (Syst.).

Tabanus (Hybomitra) sequax, Cole, 1969, Flies West. N. Amer., p. 169.

Theriopectes leucophorous Bigot, 1892, Mem. Soc. Zool. de France  
5:640.

Tabanus fuscipalpis Bigot, 1892, Mem. Soc. Zool. de France  
5:640.

Tabanus sexfasciatus Hine, 1923, Can. Ent. 55:144.

Tabanus sonomensis Osten Sacken, 1877, West. Dipt., p. 216.

Diagnosis.--Size large; body black. Sides of frons parallel; ocellar tubercle black; median and basal callus merge, forming spear head extending to ocellar tubercle; subcallus pollinose; antenna entirely black; palpus yellowish black. Thorax, including legs, black, with white hair, wing hyaline. Abdomen black, with white spots of hair.

Description.--

Female: Length 15-19 mm.

Head: Frons pollinose yellowish gray, sides parallel; ocellar tubercle large, touching eyes, black, with black hair; median and basal callus merge forming a spear shape that extends to the ocellar tubercle; both black; subcallus pollinose yellowish gray. Clypeus and genae white to gray, with white and black hair, upper genae tinged with yellow. Antenna entirely black, excision deep, dorsal angle rounded. Palpi slender, yellowish black, first segment with white hair, second with black hair.

Thorax: Black; mesonotum with faint gray longitudinal stripes; scutellum and prescutal lobe with white pile; venter with dense tufts of white hair; wings hyaline, cross veins with brown spots, cell  $R_1$

fumose brown; legs entirely black except bases of tibiae pale with white hair.

Abdomen: Black; tergites with three rows of white hair on posterior margins, median row triangular; posterior margins of all segments gray, with white and black hair.

Male: Not seen from Oregon.

Type: University of Kansas, Lawrence, Kansas.

Type locality: Mt. Hood, Oregon.

Distribution: British Columbia to Oregon, Utah and Montana.

#### Material Examined

Oregon: Benton Co., Mary's Peak, VII-11-58, Scullen (OSU), VII-12-58, Capizzi (OSDA), VII-12-60, Lattin (OSU), VII-15-63, VIII-5/27-63, Rotary Trap (OSU), VII-15-69, Rose-McClay (OSU), VIII-1-75, Mathis (OSU), VII-16-76, Siebert (OSU), VII-18-76, B and M Gavin (OSU), VII-(14-27)-76, VIII-4-77, VII-24-78, VIII-(1-8)-78, Mahmoud (OSU). Clackamas Co., Timberline, Mt. Hood, VII-28-37, (CAS). Clatsop Co., Saddle Mt., VII-16-69, Goeden (OSDA). Deschutes Co., Soda Rd., VIII-10-77, Mahmoud (OSU). Hood River Co., H.R., VIII-2-17, Childs (OSU), VII-20-31 (OSU); H.R. Meadows, 35 mi. S. Hood R., VII-28-65, VIII-6-76, Goeden (OSDA). Jackson Co., Mt. Ashland, VII-13-58, Goeden (OSDA), VII-26-66 (UCB). Jefferson Co., Vic Emigrant Res., VII-10-77, Jewett Jr. (OSU). Klamath Co., Crater Lk., VII-10-22, Van Dyke (CAS), VIII-1927, Lovett (OSU), VII-25-30, Scullen (OSU), VII-3-68, Goeden-Westcott

(OSDA). Lane Co., Andrews Expt. For., VII-27-76, Frost (OSU); Oakridge, VII-15-59 (CAS). Linn Co., Monument Pk., VII-16-60, Hasbrouck (OSU), VII-16-60, Jewett Jr. (OSU), VII-16-60, VII-16-65, VII-17-69, VIII-2-69, Goeden (OSDA), Mt. Jefferson, VIII-1914, Lovett (OSU); Marion Forks, VII-15-65, Chirstenson (OSU). Marion Co., Gates Summit, VI-16-60, Lattin (OSU), VII-16-60, Scullen (OSU); Sheep Camp, N. Santiam, VIII-1-50 (OSU). Multnomah Co., Larch Mt., VII-18-40, Gray-Schuh (CAS).

Washington: Hurricane Rdg., Olympic Nat. For., VII-26-52, Roth (OSU); Mt. Rainier, III-11-36, Crumb (OSU).

Discussion.--H. sequax is the largest of the black bodied Oregon Hybomitra. It is distinguished by the entirely black antenna with a characteristically rounded dorsal angle. The body is clothed with white hair. It is one of the most common tabanids at the higher elevations in western Oregon. Although it has been collected in large numbers in malaise traps at Mary's Peak, not a single specimen was reported from northeastern Oregon where an extensive malaise trap collection was conducted. This suggests the fact that it does not occur east of the Cascades. The adult is usually active from early July through mid to late August. The immature stages are not yet known.

Hybomitra sonomensis (Osten Sacken)  
(Map 20)

Tabanus sonomensis Osten Sacken, 1877, West. Dipt., p. 216 (Orig. Descrip.); Hine, 1904, Ohio Nat. 5:244 (Rev.); Cole and Lovett, 1921, Proc. Calif. Acad. Sci. 11:234; McDunnough, 1921, Can. Ent. 53:143; Philip, 1937, Can. Ent. 69:51 (Male, Synon.); Stone, 1938, U.S.D.A. Misc. Publ. No. 305:133 (Synon.).

Tabanus sonemensis Rowe and Knowlton, 1935, Can. Ent. 67:244  
(Lapsus.).

Hybomitra sonemensis, Philip, 1947, Amer. Midland Nat. 37(2):298  
(Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):16 (Tax.);  
Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:340 (Cat.);  
Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull.  
No. 96:28 (Syst.).

Tabanus (Hybomitra) sonemensis, Cole, 1969, Flies West. N. Amer.,  
p. 169.

Theriopteles oculifer Bigot, 1892, Mem. Soc. Zoo. de France,  
5:641.

Diagnosis.--Size medium, body black and red orange. Frons slightly  
widened above; ocellar tubercle triangular, red to brown; median callus  
black; basal callus subquadrate, dark brown; subcallus pollinose,  
antennae predominantly black. Thorax black, notopleura pale; wings  
hyaline; legs black and orange. Abdomen reddish orange, with black  
spots.

Description.--

Female: Length 12-15 mm.

Head: Frons pollinose gray, with black hair, sides parallel; sometimes  
very slightly widened above; ocellar tubercle triangular, red to brown;  
median callus elongated, black; basal callus subquadrate, touching eyes,  
black to dark brown; subcallus pollinose gray; clypeus and genae pollinose  
concolorous with subcallus, with yellowish and some black hair. First  
antennal segment black, sometimes tinged with red and gray pollen,



with black hair; second and extreme base of third segment reddish, with gray pollen, the former with black hair, balance black; excision shallow, dorsal angle obtuse. First palpal segment creamy, tinged with black, with long white and some black hair, second segment creamy, with black and golden hair, sometimes swollen basally.

Thorax: Black; mesonotum with faint gray longitudinal stripes; notopleura orange, with black hair; prescutal lobe partially orange; wings hyaline, coastal cell fumose yellow, veins orange, stump vein on  $R_4$  present or absent. Venter with golden hair; fore leg basal half of tibia, median and hind coxae and femora dark brown to black, with golden hair, balance of legs orange, with golden and black hair; fringe on hind tibia black.

Abdomen: Tergites I-IV reddish orange to orange, with median black spot that enlarged on tergite I, V-VII black, with orange lateral margins, black areas with black hair, orange areas with golden hair. Sternites II-IV orange, II sometimes with median black spot, I and V-VII black, all with golden hair; posterior margins of all segments gray. Pile of pleura golden.

Male: Eyes with two zones of different facets, denser pile than in female; second palpal segment ovoid shape, abdomen tapering. Size and other characters same as in female.

Type: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, No. 14520.

Type locality: Sonoma Co., California.

Distribution: Alaska to California and Colorado.

Material Examined

Oregon: Baker Co., Melhorus Mill, nr. Halfway, VI-17-22, Chamberlin (CAS); Whitney, VI-1914, Chamberlin (CAS). Benton Co., Alsea, VII-17-41, Schuh-Gray (CAS, OSU); 15 mi. S.W. Alsea, VI-5-76, Lattin, VIII-10-76, VI-29-77, IX-17-77, Mahmoud (OSU); Corvallis, V-1928 (UCB), V-14-56, Suthern, 5-21-56, Johnson (OSU); Mary's Peak, VI-12-31, Schuh, VII-12-31, Larsen (CAS); VII-12-63, Rotary Trap (OSU), VII-16-76, Siebert (OSU); VII-(24-27)-76, VII-(6-24)-78, VIII-1-78, Mahmoud (OSU); 8 mi. W. Alsea, VIII-2-77, Mahmoud (OSU); Wood Cr., 5 mi. W. Philomath, VII-6-41, Rieder (CAS). Clackamas Co., Clackamas Lk., VIII-5-41, Schuh (CAS). Deschutes Co., Elk Lk., VIII-8-35, Ferguson (CAS); Bend, VII-10-19 (UCB); Little Lava Lk., VII-19-77, VIII-10-77, Mahmoud (OSU); Mck. Pass, VIII-16-49, VII-24-64, Roth (OSU); Sparks Lk., VII-19-77, Mahmoud (OSU). Douglas Co., Diamond Lk., VII-(13-17)-57, Jewett (CAS); Drain, VII-12-53, Hopkins (OSU); 5 mi. S. Scottsburg, VI-30-68, Westcott (OSDA); 12 mi. S.E. Reedsport, VII-28-64, Vertrees (CAS); Roseburg, VII-15-15, Thompson (CAS). Grant Co., Onion Cr., VII-18-36, Rieder (CAS); Seneca, VII-1951, Isaacson (CAS); Prairie City, VI-10-55, Schuh (CAS). Harney Co., Above Fish Lk., (8500 ft.), VII-20-37, Jewett (OSU), VII-13-35, VII-9-47, Ellertson (CAS); Alvord Desert, VI-30-78, Siebert (OSU); Blitzen Valley, VII-14-36, Jewett (OSU); Frenchglen, VII-12-47, Ellertson (OSU), VII-(8-12)-35 Jewett (CAS-OSU); Harney L. Sand Dunes, VIII-5-77, Cobb (OSU); 12 mi. S. Burns, VII-22-76, Lightfoot (OSU); Manns Lk., VI-(18-19)-51, Malkin (CAS); Narrows, VI-21-58, Ravin (UCB); Squaw Butte, VII-30-56,

Gresbrink (OSU); Steens Mts., VI-20-22, Van Dyke (CAS, OSU); Three Mile Ranch, (4500 ft.), VII-18-47, Jewett (OSU); Malheur Expt. Sta., VII-23-77, Cobb, VII-30-77, Gruber (OSU); Warner Valley, VII-25059, Roth (OSU). Klamath Co., Crater Lk., VII-9-32, Davis (CAS); Dairy, VII-16-57, Schuh (CAS); Fremont N.F., VI-18-22, Van Dyke (CAS); Eagle Ridge, VI-11-24, Fox (CAS); Kirk, VII-19-51, Roth (OSU); Klamath Falls, VII-20-46, VIII-6-46, VI-19-47, VIII-18-47, VII-16-49, VII-11-54, VI-16-55, VII-13-55, VI-21-56, Schuh (CAS, WSU); Klamath Lk., VII-5032, Davis (OSU); Klamath Marsh, VII-8-40, VI-9-49, Scullen (CAS); Fort Klamath, VIII-17-56, Hoffman (OSU); L. Klamath Lk., VIII-2-57, VII-22-55, Schuh (OSU); Upr. Klamath Lk., VII-3-48, Every (OSU); Summit Lk., VIII-16-48, Roth (OSU); Williamson Ranch, VI-1953, Schuh (CAS); Winema N.F., VII-28-77, Mahmoud (OSU); Wood Rv. Valley, VII-19-22, Van Dyke (CAS). Lake Co., Abert Lk., VI-18-34, Jones (CAS, OSU), VII-2-35, Schuh (CAS); Adel, VII-16-32, Stage (OSU); Hart Mt., VII-31-32, Frewing (CAS); 14 mi. S. Lakeview, VII-12-60, Pitman (OSU); Jacobs Cabin, 6600 ft., VII-16-37, Jewett (OSU); Summer Lk., VI-16-38, Schuh-Gray (OSU); VIII-27-44, Gjullin (OSU); VII-20-44, Mote (CAS); VIII-8-47, VI-30-48, VII-24-49, VIII-6-49, Roth (OSU). Lane Co., H.J. Andrews Expt. For., VII-27-72, Nagel (OSU); Frog Camp to Lava Bed, VIII-16-41, Ferguson (CAS); Scott Lk. (Reared) emerged, VIII-4-50, Lewis (OSU). Lincoln Co., 5 mi. S. Burnt Woods, VII-9-68 (OSU); 10 mi. N.W. Nashville, VII-2-59, VII-(12-20)-62, Lewis (OSU); 15 mi. N.E. Toledo, VI-18-58, Bunt (OSU); 10 mi. S. Toledo, Drift Cr., VI-20-58, Lattin (OSU); Tidewater, VII-1-34, Schuh (CAS, OSU); Waldport, VII-9-25, Davis (OSU); VII-14-38 (CAS). Marion Co., Brietenbush Lk., VIII-5-41, Schuh-Gray (CAS), IX-15-64, Goeden (OSDA); Miami, VIII-11-19, Reeher

(OSU); Olallie Lk., VIII-5-41, Schuh-Gray (CAS). Tillamook Co., Devils Lk. Fork, VII-17-27, F.G. (OSU); E. Cr., Blaine, VII-7-71, Johnson (OSU); Neskowin, VI-10-40, Ellsworth, (CAS, OSU); Oceanside, VII-(14-21)-51, James (CAS); Sand Lk., VII-23-66, Goeden (OSDA); Wilson, VII-6-16, Reeher (OSU); Brown Place, Wilson Rv., VII-4-25, F.G. Wallowa Co., Enterprise, VI-23-34 (CAS).

Idaho: Ponds Lodge, VI-30-47, Duspiva (OSU).

Discussion: H. sonomensis is one of the difficult Hybomitra species, with many variations in the shape and the color of the palpus as well as the color of hair clothing it. Variations also occur in the color of the abdominal sternum. This last character is used to separate this species from H. phaenops in which the abdominal hair is black while in H. sonomensis it is predominantly golden. Further discussion on taxonomic relationship between these two species has been considered under H. phaenops (p. 170).

H. sonomensis is very common in Oregon with a very wide distribution. It is usually taken in large numbers around lakes and other water sources. The adults have a long season of activity from mid June to mid September.

I examined one specimen in the collection of Washington State University, Pullman, Washington, collected from Corvallis and labelled as I. frontalis, but I found that it was closer to H. sonomensis than the other species. For more discussion on this specimen, refer to H. frontalis above.

The immature stages are not yet known. The knowledge of these stages is important since they might throw some light on the nature of

variation in this species.

Hybomitra tetrica (Marten)  
(Map 21)

Theriopectes tetrica Marten, 1883, Can. Ent. 15:111 (Orig. Descrip.).

Tabanus tetricus, Philip, 1935, Can. Ent. 67:93 (Synon.); 1937, 69:94, 1937, Pan. Pacif. Ent. 13:64 (Synon.).

Hybomitra tetrica, Philip, 1941, Can. Ent. 73:151; 1947, Amer. Midland Nat. 37(2):299 (Cat.). Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):17 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:341 (Cat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:28 (Syst.).

Tabanus rhombicus Osten Sacken, 1876, Mem. Boston Soc. Nat. Hist. 2:472 (Partim).

Tabanus centror Knowlton and Thatcher, 1934, Proc. Utah Acad. Sci., 11:293 (Lapsus.).

Tabanus centron Rowe and Knowlton, 1935, Can. Ent. 67:241 (Not Marten, 1882).

Diagnosis.--Size medium to large; body black. Frons widened above; ocellar tubercle orange; median callus rod-shaped, black; basal callus dark brown to black; square; subcallus denuded, concolorous with basal callus; antennae predominantly black. Thorax black, venter with dense white hair, wings hyaline,  $R_4$  with stump vein; legs black and orange. Abdomen black, with considerable red ventrally and three rows of gray spots dorsally.

Description.--

Female: Length 15-17 mm.

Head: Frons pollinose white to gray, with black hair, sides almost parallel; ocellar tubercle dull orange, sometimes pollinose; median callus rod-shaped, black, merge with basal callus, the latter square shape, shiny black to dark brown, touching eyes; subcallus denuded black, with lower sides and antennal groove pollinose white. Clypeus and genae pollinose white, with white hair. First antennal segment black or reddish tinged with black, with gray pollen and black hair; second and base of third segment reddish, with gray pollen, pedicel with black hair; balance black, excision very shallow, dorsal angle mostly obtuse. Palpus white, first segment with long white hair, second segment swollen basally, with black and some fine white hair.

Thorax: Black; mesonotum with longitudinal gray stripes; notopleura orange; wings hyaline, with brown band at coastal region,  $R_4$  with stump vein. Venter with dense white hair; legs black, with orange mid tibia and basal two-thirds of fore tibia, coxae with white hair rest with mixture of white and black hair, tarsi with yellow bristles, hind tibia with black fringe.

Abdomen: Dorsum black, with three rows of white spots, median row sometimes not well defined; tergites II and III with or without sub-lateral red spots. Sternites I-IV, sometimes V, reddish orange, with or without irregular black areas, gray pollen and white hair; posterior margins of all segments gray with white hair. Pile of pleurae white.

Male: Not seen from Oregon.

Type: According to Philip (1947, 299) the type is destroyed.

Type locality: Montana.

Distribution: British Columbia to Ontario, south to California and New Mexico.

#### Material Examined

Oregon: Baker Co., Anthony Lk., VII-12-53, Roth-Beer (OSU); Big Cr., VI-29-VIII-16-75, VI-27-VIII-14-76, VI-(21-28)-77, VII-(16-23)-77, Davis (WSU); Cougar Cr., VI-(27-30)-76, VII-(25-28)-76, VIII-(12-14)-76, VI-21-77, VII-(7-16)-77, Davis (WSU); L. Goose Cr., VII-(20-26)-75, VI-27-VIII-7-76, VI-28-77, VII-(7-16)-77, VIII-2-77, Davis (WSU); U. Goose Cr., VI-22-VII-5-75, VI-27-VIII-7-76, VI-28-77, VII-7/23-77, Davis (WSU); 25 mi. N. Halfway, VII-28-61, Goeden (OSDA); Pine Cr., 12 mi. W. Baker, VII-13-67, Goeden (OSDA); Velvet Cr., VI-29-VII-12-75, VI-27-VII-31-76, VI-28-77, VII-16-VIII-9-77, Davis (WSU). Crook Co., 32 mi. N.E. Prineville, VII-19-67, Goeden (OSDA). Grant Co., Dixie Pass, VII-11-53, Roth-Beer (OSU); VII-20-67, Goeden (OSDA); John Day, Rangeland, VII-13-73, Larson (OSDA). Klamath Co., Crater Lk., VIII-1-30, Scullen (OSU); Dairy, VII-9-47, Davis (OSDA); Fort Klamath, VII-17-56, Hoffman (OSU); Pelican Butte, VII-8-60, Schuh (OSU); Spencer Cr., VII-5-58, Vertrees (OSU). Lake Co., 14 mi. S. Lakeview, VII-12-60, Pitman (OSU); Summer Lk., VI-30-48, VII-24-50, VIII-10-66, Roth (OSU). Union Co., Jordan Cr., VII-(6-12)-75, VII-27-VIII-16-75, VII-4-VIII-31-76, VII-8-VIII-3-77, Davis (WSU); Ladd Cyn., VII-(6-19)-75,

VI-13-IX-4-76, VI-25-VIII-3-77, Davis (WSU); L. Lick Cr., VI-29-VII-12-75, VIII-(3-9)075, VI-23-VII-3-76, VII-25-VIII-31-76, VI-28-VII-16-77, VIII-(2-9)-77, Davis (WSU); U. Lick Cr., VI-29-VII-12-75, VIII-(3-9)-75, VI-27-VII-3-76, VII-(11-14)-76, VIII-(4-7)-76, VI-28-77, VII-7-VIII-2-77, Davis (WSU); Whiskey Cr., VI-29-VII-12-75, VII-27-VIII-2075, VI-27-IX-4-76, VII-8-VIII-3-77, Davis (WSU). Wallowa Co., Aneroid, VIII-1-41, Rieder (OSU); 17 mi. S. Lostine, VII-21-70, Oman (OSU); Wallowa Lk., VIII-14-47, Davis-Black (OSDA), VII-14-48, Jones (OSU); Wallowa Mts. Trail to Wall. Lk., VII-24-65, Goeden (OSDA). Wheeler Co., Pisgah Lookout, Ochoco N.F., VII-17-71, Westcott (OSDA).

Discussion: H. tetrica shares the body coloration with H. melanorina, both with denuded subcalli, but the former is larger, with a longer and narrower frons; basal callus square, subcallus less shiny,  $R_4$  of wing with stump vein, tarsi entirely black. This species should be readily separated from the Tabanus species that it resembles superficially.

The limited number of specimens in the collection produced a scattered distribution pattern. But in general, the species occurs at high elevations east of the Cascade Mountains including the northeastern parts of Oregon.

The adult is active and on the wing from late June to late August with occasional specimens collected in September.

The immature stages are not yet known.



Hybomitra zygota (Philip)  
(Map 21)

Tabanus zygotus Philip, 1937, Can. Ent. 69:52 (Male, Orig. Descrip.); p. 267 (Correction).

Hybomitra zygota, Philip, 1941, Can. Ent. 73:152 (Redescrip.); 1947, Amer. Midland Nat. 37(2):300 (Cat.); 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:341 (Cat.).

Diagnosis.--Size medium to large, body orange and black. Sides of frons not quite parallel, broad; ocellar tubercle red, median callus black; basal callus touching eyes, dark brown; subcallus pollinose; antennae orange basally black apically; palpus creamy. Thorax black; notopleura orange; wings hyaline; legs black and orange. Abdomen predominantly orange, with black spots.

Description.--

Female: Length 14-16 mm.

Head: Frons; width at vertex about half its length, pollinose grayish yellow, slightly widened above; ocellar tubercle triangular, reddish orange; median callus slender, black, sometimes extending to basal callus and ocellar tubercle through narrow line; basal callus, elevated, round above, lower corners touching eyes, dark brown to red; subcallus, clypeus and genae pollinose white to gray, clypeus and genae with creamy hair, upper genae sometimes with black hair. First two antennal segments either entirely yellowish orange or partially black, with gray pollen and black hair; base of third segment reddish orange, balance black, excision considerable, dorsal angle varies but

mostly acute. Palpi creamy yellow, slender; basal segment sometimes tinted with black, with creamy hair, second segment sickle shaped, with black and little creamy hair.

Thorax: Black; mesonotum with longitudinal gray stripes and black hair; notopleura reddish orange; wings hyaline, coastal cell fumose yellow, furcation with brown spot, veins brownish orange. Venter with dense creamy hair; coxae, femora, apical third of fore tibia, tarsi black to dark red, remainder including joints orange; coxae and femora with mixture of long creamy and short black hair, rest with black hair including fringe on dorsal tibia.

Abdomen: Tergites I-IV orange, with median black spots, second tergite with large median gray triangle superimposed on the black spots; tergites III and IV sometimes with sublateral black spots; V-VII black, with orange lateral margins; all tergites with median gray spot on posterior margin. Sternites I-V yellowish orange, with golden hair, I and II with median black spot, VI and VII black, with black hair. Pleurites I and II black; pile of pleurae predominantly golden.

Male: According to Philip, it has denser whitish eye pile; eyes with large and small facets; frontal triangle flattened, grayish pollinose; antennae predominantly black; first palpal segment black, second much slender than in female. Thorax without longitudinal lines. Abdominal tergites with more black and less pale color than the female.

Type: California Academy of Science, San Francisco, California,  
No. 4509.

Type locality: Crater Lake, Oregon.

Distribution: British Columbia to Oregon.

Material Examined

Oregon: Clackamas Co., Swim, VII-12-38, Gray-Schuh (CAS). Deschutes Co., L. Lava Lk., VII-19-77, Mahmoud (OSU). Douglas Co., Diamond Lk., Hoffman (OSU). Klamath Co., Big Marsh Cr., VI-14-51, Hoffman (OSU); Crater Lk., VII-16-22, Van Dyke (CAS, OSDA), VII-6-32, Ross (CAS), VI-27-57, Huntzinger (CAS), VI-26-58, Huntzinger (OSU); Miller Lk., VII-14-51, Hoffman (OSU). Lake Co., VI-27-51, Roth (OSU). Lane Co., H.J. Andrews Expt. For., VI-28-72, Nagel (OSU), VII-27-76, Frost (OSU). Linn Co., Cascadia, William. N.F., VII-7-77, Mahmoud (OSU); Marion Forks, VII-15-65, Christenson (OSU).

Discussion.--H. zygota is a difficult species taxonomically. It is most probable that it represents a member of a species complex that includes H. fulvilateralis (Macq.) and possibly others. It exhibits variation in the color of the antennae and the palpi and sometimes the legs. Philip has discussed these variations in 1937 and 1943. He separated zygota from fulvilateralis by the slender yellow second palpal segment and the lack of wing clouds in zygota, but these characters are not consistent. It is possible that there is some intermediate form or, as indicated above, that the two species are members of a species complex. This is an area where further investigations are required.

Most of the specimens of zygota from Oregon (including the type) were collected from Crater Lake.

The immature stages are not yet known.

Genus Tabanus Linnaeus

Tabanus Linnaeus, 1758, Systema Naturae, ed. 10:601; Osten Sacken, 1875, Mem. Boston Soc. Nat. Hist. 2:421; 1878, 2 (Sup.):555; Williston, 1886, Trans. Kans. Acad. Sci. 10:135; Hine, 1903, Ohio State Acad. Sci. Spe. Pap. 5:46; 1904, Ohio Nat. 5:231; 1906, Ohio Nat. 7:19; 1907, La. Agr. Expt. Sta. Bull. 93:37; McDunnough, 1921, Can. Ent. 53:139; Schwardt and Hall, 1930, Ark. Agr. Expt. Sta. Bull. No. 256:15; Philip, 1931, Minn. Expt. Sta. Tech. Bull. No. 80:13, 96; 1936, Can. Ent. 68:148; 69:35; Schwardt, 1936, Ark. Agr. Expt. Sta. Bull. No. 332:27; Stone, 1938, U.S.D.A. Misc. Publ. No. 305, 171 pp. (Monograph, Rev.); Philip, 1941, Can. Ent. 73:11; 1947, Amer. Midland Nat. 37(2):300 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):7; Jones and Anthony, 1964, U.S.D.A., Tech. Bull. No. 1295:85; Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:332 (Cat.); Teskey, 1969, Mem. Ent. Soc. Can. No. 63:58 (Immat.); Pechuman, 1972, Cornell Univ. Agr. Expt. Sta., Search 2(5):28; 1973, Ins. Virg. No. 6, Res. Div. Bull. 81:63; Burger, 1974, Proc. Ent. Soc. Wash. 76(1):15; Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:15.

Type-species, Tabanus bovinus Linnaeus (Latreille, 1810:443, in Philip 1947).

Neotabanus Lutz, 1909:30. Type-species, Tabanus trilineatus Latreille (Bequaert, 1924:29, in Philip 1947).

Taeniotabanus Krober, 1931:68. Type-species, Tabanus dorsiger Wiedeman.

### Diagnosis.--

Female.--Size varies from small to large, majority of species have black body but a few species have pale coloration. Eyes separated, bare; sides of frons parallel or widened above, pollinose; ocellar tubercle mostly pollinose; median and basal callus present, subcallus mostly pollinose; antennae seven-segmented, varies in color, flagellum excised, with dorsal angle; palpi varies in shape and color. Thorax black, wings hyaline or fumose, stump vein present or absent; legs black to black and orange, hind tibia without apical spur. Abdomen varies from black to black and yellow to orange.

Male: Eyes contiguous, with two facets; palpi reduced, with or without long hair; face depressed. Size same or smaller than female; other features as in female.

Discussion.--Until three decades ago both Tabanus and Hybomitra were considered one genus, Tabanus Linnaeus (Philip 1941). Tabanus is believed to be older than the other groups of Tabanidae (Oldroyd 1964). It has a wide range of distribution throughout the world. The Tabanini is the most widely distributed tribe among the Tabanidae (Mackerras 1954). The species of Tabanus are mostly large in size and are the cause of most destruction and blood loss among livestock. They are known to feed on many types of mammals (Oldroyd 1964). The larvae of Tabanus are less aquatic than those of Chrysops, and occur on wet substrates or in damp soil. They are usually larger in size than Chrysops and are carnivorous and sometimes cannibalistic.

Most Nearctic species of Tabanus occur in eastern North America. There are nine species of Tabanus in Oregon, most of them have a wide distribution in other parts of North America. One species, T. fratellus, was placed by Philip 1947 in the Palaearctic subgenus Glaucops Szilady, but in this study it is placed in the subgenus Tabanus. Most of Oregon species occur in relatively low densities and show scattered distribution.

The species of Tabanus are better known than any other tabanid group. Many publications have been produced on the genus. Most of these publications, like that of Stone 1938, were published before Hybomitra was separated as a distinct genus.

Hybomitra is separated from Tabanus by their denuded ocellar tubercle and presence of hair on the eyes. But some species of Hybomitra, e.g., sonomensis, have bare eyes. It is also true that some Tabanus, e.g., T. stonei, have denuded ocellar tubercle. Some species of Tabanus, e.g., T. laticeps and T. stonei, are very similar to some species of Hybomitra, e.g., H. melanorhina.

Key to the Females  
of Tabanus of Oregon

- 1 - Abdomen entirely black . . . . . 2
  - Abdomen multicolorous . . . . . 3
- 2 - Mesonotum entirely black or dark brown,
  - with black hair . . . . . aegrotus Osten Sacken
  - Mesonotum covered with white hair . . . . . punctifer Osten Sacken
- 3 - Abdomen black, at least the first abdominal
  - tergite with a tiny white triangle,
  - large species, length 16 mm or more . . . . . kesseli Philip

- Abdomen with more white or pale color than  
above, smaller species, length less than 15 mm . . . . . 4
- 4 - Antennae entirely yellow; scutellum at least  
partially orange; abdominal tergites with  
median white stripes . . . . . similis Macquart  
Antennae at least partially black . . . . . 5
- 5 -  $R_4$  with stump vein at furcation; abdominal  
tergites with three rows of gray spots,  
flagellum black . . . . . tetroposis Bigot  
 $R_4$  without stump vein . . . . . 6
- 6 - Notopleura black; abdominal tergites black,  
with three rows of white spots; small species  
8-10 mm long . . . . . fratellus Williston  
Notopleura pale; abdominal tergites with some  
orange . . . . . 7
- 7 - Basal portion of flagellum and apical  
annulus orange; furcation and cross vein of  
discal cell and cell  $M_1$  with brown spots . . . . . monoensis Hine  
Color of antennae not as above; furcation  
without spot . . . . . 8
- 8 - Ocellar tubercle pollinose; abdominal  
tergites with three rows of gray spots . . . . . stonei Philip  
Ocellar tubercle denuded, touching eyes,  
tapered below . . . . . laticeps Hine

Tabanus aegrotus Osten Sacken  
(Map 22)

Tabanus aegrotus Osten Sacken, 1877, U.S. Geol. Geog. Surv. Terr. Bull. 3:219-220 (Orig. Descrip.); Williston, 1887, Kans. Acad. Sci. Trans. 10:139; Hine, 1904, Ohio Nat. 5(2):234 (Rev.); Cole and Lovett, 1921, Proc. Calif. Acad. Sci. Ser. 4, 11(15):223; Rowe and Knowlton, 1935, Can. Ent., 67:240-241; Philip, 1936, Bull. Brooklyn Ent. Soc. 31:190; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:90 (Rev.); Philip, 1947, Amer. Midland Nat., 37(2):301 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv., 1(1):17 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:332 (Cat.); Lane, 1975, Ann. Ent. Soc. Amer., 68(5):816 (Immat.), 1976, J. Med. Ent. 12(6):684-690; Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:16 (Syst.).

Diagnosis.--Large, robust; body entirely black; wings subhyaline with brown clouds, hair on body black to dark brown; sides of frons parallel, median and basal callus merge, black to dark brown; subcallus pollinose; antennae and palpi entirely black.

Description.--

Female: Length 20-25 mm.

Head: Sides of frons parallel, median callus black, slender, extending back to ocellar region, merging with basal callus, basal callus black; subcallus pollinose brown, with black background.

Clypeus and genae black to dark brown with dark brown hair. Antennae entirely black, flagellum excised with acute dorsal angle. Palpi black with metallic brown hair.



Thorax: Entirely black to dark brown with dark brown and black hair; legs black with black and dark brown hair; wings subhyaline, with yellow brown cloud anteriorly, coastal cell entirely fumose.

Abdomen: Black, concolorous with thorax.

Male: With same size and body coloration as female. In the only one male specimen I have seen from Oregon, the antennae, the face and parts of the legs are yellowish brown. The second palpal segment is short and stout, with long hair.

Type: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, No. 14522.

Type locality: Napa County, California.

Distribution: British Columbia to Montana and California.

#### Material Examined

Oregon: Baker Co., L. Beecher Cr., Wallowa Mts., VII-3-71, Penrose-Westcott (OSDA); Big Cr., VIII-(10-16)-75, VII-(25-28)-76, VII-(13-16)-77, VIII-(7-20)-77, Davis (WSU); Cougar Cr., VIII-(22-25)-76, VII-23-77, VIII-20-77, Davis (WSU). Benton Co., Corvallis (OSU); Mary's Peak, VII-12-31, Schuh (CAS), VIII-10-71, Lattin (OSU), VII-13-78, VIII-1-78, Mahmoud (OSU). Curry Co., Red Mt. Prairie, Siskiyou N.F., VII-5-69, Westcott (OSDA). Douglas Co., Diamond Lk., VII-(12-17)-57, Jewett Jr. (OSU); Glendale, VIII-1-35, Kohls (CAS). Harney Co., Frenchglen, VII-12-47, Ellertson (OSU); Harney Lk., X-23-61, Goeden (OSDA); Pike Cr., Steens Mt., VI-23-47, Ellertson (OSU).

Hood River Co., Alpine Meadow, VI-19-65, Goeden (USDA-Salem).  
 Jefferson Co., Sheep Camp, N. Santiam, VIII-1-50 (OSU); Santiam Pass  
 Top, VII-22-51 (OSU). Lake Co., 14 mi. S. Lakeview, VII-12-60, Pitman  
 (OSU). Lane Co., H.J. Andrews Expt. F., Mt. Carpenter, VII-20/29-77,  
 VIII-2-77, Eulensen-Searles (OSU); Mck. Brid., 1906, Kennison (OSU);  
 Mck. Pass, VII-3-50, Roth (OSU); Oakridge, VI-29-34, Gjullin (OSU).  
 Linn Co., Cascadia, VII-7-77, Mahmoud (OSU); Fish Lk., VIII-6-41,  
 Jones (OSU); 5 mi. S.E. Gates, VII-5-70, Westcott (OSDA); Marion Forks,  
 VII-15-65, Christenson (OSU); Monument Pk., VII-16-60, Lattin (OSU),  
 VII-16-60, Jewett, Jr. (OSU), VII-21-74, Mathis (OSU); Santiam Pass,  
 VII-22-51 (OSU); Tombstone Prairie, VII-19-77, Lattin (OSU). Marion  
 Co., Elk Lk., VIII-5-58, Jewett Jr. (OSU); Lake Leone, VII-5-34,  
 Scullen (CAS). Polk Co., Black Rock, 10 mi. S.W. Dallas, VII-15-60,  
 Allen (OSU). Tillamook Co., Blaine, VII-14-75, Johnson (OSU). Union  
 Co., Jordan Cr., VIII-(10-16)-75, VII-15-VIII-31-76, VII-24-VIII-13-77,  
 Davis (WSU); Ladd Cyn., VIII-(10-16)-75, VI-(13-16)-76, VII-(29-31)-76,  
 VIII-(18-21)-76, VII-24-VIII-3-77, Davis (WSU); L. Lick Cr., VII-(6-  
 26)-75, VIII-(24-31)-75, VII-(25-28)-76, VIII-(29-31)-76, VII-(21-23)-  
 77, Davis (WSU); U. Lick Cr., VIII-(24-31)-75, VII-(13-16)-77, VII-31-  
 VIII-20-77, Davis (WSU); Whiskey Cr., VII-(6-12)-75, VII-(29-31)-76,  
 VIII-(29-31)-76, VII-(27-30)-77, Davis (WSU).

Extralimital: California; Fresno Co., Shaver Lk., VII-19-68, Hoy (OSU);  
 Madera Co., Poison Meadows, VIII-12-67, Sagadoe (OSU). Washington;  
 St. Helens, VII-22-56, Johnson (OSU).

Discussion.--I. aegrotus is one of the largest species of tabanids in  
 Oregon. It is characterized by the entirely black to dark brown body

color. Sometimes it might be confused with I. kesseli, especially if specimens of the latter are not well preserved. It may be separated from I. kesseli by the lack of any white hair on any part of the body and by the larger median callus which is lean in I. kesseli.

This species is generally found at higher elevations, but sometimes it is found in lower elevations. Its frequency in the collections from Oregon is relatively low. Its distribution in Oregon is mainly in the Cascade Mountains, the Coastal Range, and the northeastern and southeastern parts of the state.

Adults are active from late June to late August. One specimen in the collection of OSDA, Salem, was collected near the end of October.

Lane (1975) described the immature stages of this species from California. He collected the larvae from sand and gravel along creek borders.

Tabanus fratellus Williston  
(Map 22)

Tabanus fratellus Williston, 1887, Trans. Kans. Acad. Sci. 10:140 (Orig. Descrip.); Hine, 1904, Ohio Nat. 5:237 (Synon.); Philip, 1936, Bull. Brooklyn Ent. Soc. 31:192; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:76 (Rev.).

Glaucops fratellus, Philip, 1947, Amer. Midland Nat. 37(2):287 (Cat.).

Tabanus (Glaucops) fratellus, Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:337 (Cat.); 1966, Ann. Ent. Soc. Amer. 59(3):521; Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:19 (Syst.).

Diachlorous haematoptides Bigot, 1892, Mem. Soc. Zoo. de France

5:22.

Diagnosis.--Size small, body black. Antennal annuli three to four, compact. Side of frons almost parallel, pale; median and basal callus denuded black; subcallus pollinose. Antennae predominantly pale.

Thorax with slender gray longitudinal stripes; wings with brown band at posterior end of subcosta; legs predominantly dark. Abdomen with three rows of gray spots.

Description.--

Female: Length 10 mm.

Head: Frons whitish gray, with black hair, sides more or less parallel; vertex with black shiny zone; median and basal callus subequal, black; basal callus shiny, subquadrate; subcallus pollinose concolorous with frons. Clypeus and genae white with white hair. Antennae orange with gray pollen; scape and parts of pedicel sometimes dark; basal segment of flagellum about two times the length of annuli, annuli compact, their number varies from three to four, distal two sometimes not well differentiated. Palpi slender, white, with black hair.

Thorax: Mesonotum black, with slender and faint gray longitudinal stripes and dense gray hair; scutellum black; wings hyaline; posterior end of subcosta with brown band. Venter black, with gray pollen and dense white hair; coxae, femora, distal end of fore tibia and all tarsi black, with white and black hair, balance of legs yellow.

Abdomen: Black, with posterior margins of segments white, tergites with three rows of white spots, tergites I and II sometimes entirely black; sterna with gray pollen and white hair.

Male: Head very large in proportion to the body; eyes metallic gold, with two zones of large and small facets; palpi reduced, shaggy; face depressed; coxae and femora brown. Remainder of characters as in female.

Type: According to Stone (1938), one female cotype is in the collection of the University of Kansas, Lawrence, Kansas. Stone designated this cotype as the lectotype.

Type locality: Washington Territory.

Distribution: Alaska to Oregon and Montana.

#### Material Examined

Oregon: Benton Co., Corvallis, 1906, Buchanan (OSU); 8 mi. S. Alsea, VIII-2-77, Mahmoud (OSU). Clackamas Co., Clackamas Rv., VII-25-73, Johnson (OSU). Clatsop Co., Omate, VII-23-58, Jewett Jr. (OSU). Deschutes Co., L. Lava Lk., VIII-10-77, Mahmoud (OSU). Lane Co., H.J. Andrews Expt. For., VI-28-72, Nagel (OSU); Lucky Boy Camp, Blue Rv., VIII-5-35, Scullen (OSU); McKenzie Pass, VIII-16-49, Roth (OSU). Linn Co., Cascadia, VIII-12-24, Scullen (OSU).

Alaska: Douglas Island, VII-4-58 (CAS).

Discussion.--Williston (1887) described fratellus in the genus Tabanus. Philip (1947) placed it in the genus Glaucops on the basis of the

triannulate antenna. He then downgraded Glaucops to subgeneric level in 1965. I examined many specimens from Oregon and noticed that while some specimens have triannulate antennae, other specimens from the same population have four annuli. Teskey (1979, personal correspondence) has observed the same thing. He also found that while fratellus has the basicosta haired, the type of Glaucops; G. hirsutus, has a bare basicosta. Furthermore, he found close similarity between the larva of fratellus and that of T. sparus. He is convinced that fratellus should not be included in the subgenus Glaucops.

In the light of the above, it is now obvious that fratellus should not be considered in the subgenus Glaucops. Therefore, it is my belief that fratellus should be placed in the subgenus Tabanus.

Tabanus kesseli Philip  
(Map 23)

Tabanus kesseli Philip, 1950b, Ann. Ent. Soc. Amer., 43:117 (Orig. Descrip.); Middlekauff, 1950, Bull. Calif. Ins. Surv., 1(1):20 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:334 (Cat.); Lane, 1976, J. Med. Ent. 12(6):684 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:16 (Syst.).

Diagnosis.--Size large, body entirely black except for small white triangles on abdominal tergites; wings with brown tinge basally and at costa; furcation with brown spot. Sides of frons not quite parallel, median callus linear; subcallus pollinose; antennae and palpi entirely black.

Description.--

Female: Length 17-20 mm.

Head: Frons slightly widened above, pollinose dusty brown, with black hair; median callus, linear, black, long; basal callus black, subquadrate; subcallus pollinose dusty brown, with black background; clypeus and genae concolorous with subcallus. Antennae entirely black, flagellum with excision and acute dorsal angle (less acute than in aegrotus). Palpi tapering distally, black, with appressed black hair.

Thorax: Entirely black, tinged with brown (some specimens with predominantly brown body), unbanded; legs entirely black except for a pale area on base of fore tibia, hind tarsus with golden bristles; wings with brownish tinge basally, coastal cell lightly infuscated.

Abdomen: With the exception of small white triangles of hair on the posterior median parts of the tergites, body entirely black to dark brown with black hair. The white triangles can easily be rubbed off.

Male: Eyes with a zone of large metallic brown facets, surrounded by an area of smaller facets; palpi very much reduced with dense long hair. Face depressed. Remainder of characters as in female.

Type: Holotype and allotype in California Academy of Science, San Francisco, California, No. 12926.

Type locality: West Forks, Ravalli Co., Montana.

Distribution: British Columbia to California and Wisconsin.

Material Examined

Oregon: Baker Co., Big Cr., VIII-(10-16)-75, VII-(25-28)-76, VI-29-VII-2-77, VII-21-VIII-20-77, Davis (WSU); Cougar Cr., VIII-(12-14)-76, VIII-(22-25)-76, VI-28-77, VIII-2/9/20-77, Davis (WSU); L. Goose Cr., VI-29-VII-5-75, VIII-(3-9)-75, VII-(7-9)-77, VIII-(7-20)-77, Davis (WSU); U. Goose Cr., VII-27-VIII-2-75, VIII-(4-14)-76, VII-31-VIII-3-77, VIII-(13-16)-77, Davis (WSU); Velvet Cr., VIII-(24-31)-75, VII-(13-30)-77, VIII-(7-20)-77, Davis (WSU). Benton Co., Camp Adair, VII-20-56, Goulding (OSU); Corvallis, VII-29-25, Gillespie (OSU), VII-30-31 (OSU), VIII-9-47, Hobbs (OSU), VII-26-77, Oman (OSU); Mary's Peak, VII-12-31, Larson (OSU), VII-15-63, Rotary Trap (OSU). Coos Co., Fairview, V-23-59, Jewett Jr. (OSU). Douglas Co., Glendale, V-1-35, Kolhs, (CAS). Hood River Co., Cascade Locks, VII-14-68, Brown (OSDA). Jackson Co., Applegate, VIII-20-76, Lightfoot (OSU); Gold Hill, VII-9-47 (UCD); Mt. Ashland, VII-8-51 (UCD); Tallman Cr., Ashland, VIII-11-44, Scullen (OSU). Josephine Co., Grants Pass, VII-10-68, Goeden (OSDA); Grave Cr., VI-29-25, Scullen (OSU). Lane Co., H.J. Andrews Expt. F., Blue Rv., VI-28-72, VII-2/11-73, VIII-2-73, Nagel-Daterman (OSU); Oakridge, VI-29-34, Gjullin (OSU). Lincoln Co., Boyer, VII-19-38, JCD (PSU); 10 mi. N.W. Nashville, VII-12-62, Lewis (OSU). Polk Co., Black Rock, 10 mi. S. Dallas, VII-5-60, Allen (OSU). Union Co., Jordan Cr., VII-(15-17)-76, VII-(29-31)-76, VIII-(18-25)-76, Davis (WSU); Ladd Cyn., VII-(29-31)-76, IX-(1-4)-76, VII-31-VIII-3-77, Davis (WSU); L. Lick Cr., VIII-(10-16)-75, VIII-22-IX-8-76, VII-13-VIII-3-77, Davis (WSU); U. Lick Cr., VIII-(10-16)-75, VII-(25-28)-76, VII-(13-16)-77, VII-27-VIII-29-77, Davis (WSU). Yamhill Co., Peavine Ridge, nr.



McMinnville, VI-22-55, Fender (PSU).

Discussion.--In 1950, Philip separated this species from its close relatives by the characters discussed under T. aegrotus. The relatively small number of specimens in the collections from Oregon could be the reason for its scattered distribution. It occurs mainly west of the Cascade Range and in the northeastern parts of the state. Seasonal occurrence of the adults is from early May to about mid August. The immature stages are not yet known.

Tabanus laticeps Hine  
(Map 23)

Tabanus laticeps Hine, 1904, Ohio Nat. 5(2):239 (Orig. Descrip.); Cole and Lovett, 1921, Proc. Calif. Acad. Sci., Ser. 4, 1(15):233; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:62 (Rev.); Philip, 1947, Amer. Midland Nat. 37(2):309 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):17 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:334 (Cat.).

Diagnosis.--Size medium, body with black with pale spots. Ocellar tubercle large, shiny red; basal callus shiny red to brown, merges with median callus; subcallus pollinose. Antennae pale basally, annuli black. Palpi creamy, swollen basally, tapering distally. Thorax black, notopleura pale; femora black; tibiae pale. Abdominal tergites black with three rows of pale spots.

Description.--

Female: Length 13-14 mm.

Head: Frons yellowish gray, with parallel sides; ocellar tubercle very large, shiny reddish brown; median callus oval, black; basal callus shiny reddish brown, connected to median callus; subcallus yellowish tan with gray pollen. Clypeus and genae white with white hair, upper parts of genae concolorous with subcallus. Antenna; scape and pedicel yellow, with black hair; extreme base of flagellum reddish, balance black. Palpi creamy white, with white and black hair, swollen basally, slender distally, tapering to apex.

Thorax: Mesonotum black; gray longitudinal stripes not distinct in all specimens; notopleura and humeral callus pale yellow, with black hair; wings hyaline. Venter dark, with dense creamy white hair; coxae and femora black; tibiae and metatarsi yellowish orange with dense black hair, mixed with some white hair on tibiae; rest of tarsal segments black.

Abdomen: Dorsum predominantly black, tergites I - IV with large reddish sublateral spots, tergites V-VII with irregular pale spots; posterior margins of tergites with three rows of gray spots and white hair. Sternites I-III pale with three rows of black spots; rest of sternites black with gray posterior margins.

Male: Not seen from Oregon.

Type: Cotype, Ohio State University, Columbus, Ohio. A male and a female in U.S. National Museum, Washington, D.C., are probably part of the original series (Stone 1938).

Type locality: California, Washington.

Distribution: British Columbia to California.

Material Examined

Oregon: Baker Co., Big Cr., VI-29-VIII-5-75, VI-28-77, VII-7-77, VIII-2-77, Davis (WSU); Cougar Cr., VI-28-77, VII-7/16-77, Davis (WSU); L. Goose Cr., VII-(6-26)-75, VI-(19-22)-77, VII-(7-9)-77, Davis (WSU); U. Goose Cr., VI-29-VIII-5-75, VI-28-77, Davis (WSU). Benton Co., Mary's Peak, VII-12-31 (OSU). Coos Co., Coos Bay, VIII-15068, Goeden (OSDA); Fairview, VII-20/22-59, Rogers (OSU). Tillamook Co., Blaine, E. Cr., VII-7-71, Johnson (OSU); Devil's Lk. Fork, Wilson Rv., VII-17-27, F.G. (OSU). Union Co., L. Lick Cr., VI-29-VIII-16-75, VI-28-77, VII-(7-16)-77, VII-2-77, Davis (WSU); U. Lick Cr., VII-(11-14)-76, Davis (WSU).

Discussion.--I. laticeps closely resembles H. melanorhina in body size and color but the latter has shiny denuded subcallus and dense pile on eyes. I. stonei also has same size and body similar to I. laticeps but the latter has a large shiny ocellar tubercle.

I. laticeps is rather rare, only four specimens were found in OSU collection and one in OSDA collection in Salem. In three years of extensive malaise collecting in the northeastern parts of Oregon, only 37 specimens were collected (collection of Washington State University, Pullman, Washington).

The adults are active from mid June to mid August. The immature stages are not yet known.

Tabanus monoensis Hine  
(Map 24)

Tabanus monoensis Hine, 1924 in Webb and Wells, U.S.D.A. Bull. No. 1218:29-31 (Orig. Descrip.); Stone, 1938, U.S.D.A. Misc. Publ. No. 305:81 (Rev.); Philip, 1947, Amer. Midland Nat. 37(2):310 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):18 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:334; Lane, 1975, Ann. Ent. Soc. Amer. 68(5):817-818; 1976, J. Med. Ent. 12(6):683-690 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:17-18 (Syst.).

Diagnosis.--Small size, dark. Frons slightly widened above; ocellar tubercle flat with black hair; basal callus shiny black to dark brown; subcallus partially denuded. First two antennal segments and part of annuli dark brown, base of third segment and apex of annuli orange, dorsal angle acute. Palpi white, tapering apically. Thorax dark with gray stripes; wings with brown spot at furcation and  $M_2$  margin; legs predominantly yellow. Abdominal tergites predominantly black; sternites yellow.

Description.--

Female: Length 12-13 mm.

Head: Head broader than thorax. Frons slightly widened above, pollinose whitish yellow with short black hair; ocellar tubercle dark brown, flat, with long black hairs; median callus dull black; basal callus shiny black to dark brown, subquadrate, touching eyes, connected to median callus by a narrow strip; subcallus partially denuded dark

brown, partially covered with yellowish gray pollen. Clypeus white with white hair; genae yellowish gray above, white below. First two antennal segments and first four annuli dark brown to black, with gray pollen and black hair; basal portion of flagellum and apical annulus orange, with white hair. Palpi creamy white, swollen basally, tapering apically, with mixture of black and white hair.

Thorax: Mesonotum black, with longitudinal gray stripes; notopleura orange; wings hyaline, with brown spot at furcation and margin of cell  $M_1$  and  $M_2$ . Venter dark, with white hair; femora dark brown with gray pollen and white hair; basal half of fore tibia light yellow, apical half dark brown concolorous with tarsus; mid and hind tibiae and tarsi yellow brown with black and white hair.

Abdomen: Tergites II-IV with orange on sides, rest of dorsum black, with three rows of white hair on posterior margins of tergites. Venter yellow, with white and black hair; sternites VI and VII darker than the others.

Male: Not seen from Oregon.

Type: United States National Museum, Washington, D.C., No. 24950.

Type locality: Topaz, Mono County, California.

Distribution: Oregon to California and Idaho.

#### Material Examined

Oregon: Baker Co., Big Cr., VIII-20-77, Davis (WSU); Cougar Cr., VII-(25-28)-76, VIII-(22-31)-76, IX-(5-8)-76, VII-(16-23)-77,

VIII-(2-20)-77, Davis (WSU); L. Goose Cr., VIII-(3-9)-75, VII-(13-16)-77, VIII-(18-20)-77, Davis (WSU). Jackson Co., Tallman Cr., Ashland, VIII-11-44 (CAS). Marion Co., Breitenbush Lk., VI-23-40 (CAS). Union Co., Jordan Cr., VI-(19-22)-77, Davis (WSU); L. Lick Cr., VIII-(29-31)-76, Davis (WSU).

Discussion.--This species was described by Webb and Wells (1924) from reared specimens, the larvae of which had been collected by Hine. They gave a comprehensive account of the life cycle, biology, bionomics and behavior of each developmental stage. Lane (1976) found that its larval habitat was mainly in seepages and creek margins. I collected its larvae from moss on rock at Mary's Peak (identified by Dr. Lane), but, thus far, no adult has been collected from Mary's Peak.

The coloration of the antenna is a good character to separate this species from other small sized species of Tabanus.

The number of monoensis collected from Oregon is relatively small. Most of the specimens were collected in malaise traps from the northeastern parts of the state by the Washington State University team.

Tabanus punctifer Osten Sacken  
(Map 25)

Tabanus punctifer Osten Sacken, 1876, Mem. Boston Soc. Nat. Hist. 2, Pt. 4, No. 4:453-454 (Orig. Descrip.); Hine, 1904, Ohio Nat. 5(2):242 (Rev.); Cole and Lovett, 1921, Proc. Calif. Acad. Sci. Ser. 4, 11(15):234; Webb and Wells, 1924, U.S.D.A. Bull. 1218:10-20; Cameron, 1926, Bull. Ent. Res. 17:1-42 (Biono.); Herms, 1927, Pan Pacific Ent. 4:91-92; Philip, 1931, Minn. Agr. Res. Sta. Tech. Bull.

80:1-132 (Biosys.); Rowe and Knowlton, 1935, Can. Ent. 67:243; Stone, 1938, USDA Misc. Publ. No. 305:93-94 (Rev.); Philip, 1947, Amer. Midland Nat. 37(2):313 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):18 (Tax.); Philip, 1965, U.S.D.A., A.R.S.A, Agr. Handb. No. 276:-335 (Cat.); Cole, 1969, Flies West. N. Amer., p. 168; Burger, 1974, Proc. Ent. Soc. Wash. 76(3):253 (Biosys.); Lane, 1975, Ann. Ent. Soc. Amer. 68(5):818 (Immat.); 1976, J. Med. Ent. 12(6):684-690 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:18 (Syst.); Poinar and Lane, 1978, J. Parasit. 64(3):440-444.

Diagnosis.--Large, body predominantly black except for creamy hair on mesonotum. Frons with parallel sides, median callus poorly defined, subcallus pollinose. Antennae and palpi entirely black. Base of fore tibia creamy, remainder of legs and abdomen entirely black; wings subhyaline. Some specimens show variation in body color from black to brown orange.

Description.--

Female: Length 19-23 mm.

Head: Frons pollinose yellowish brown or black, with parallel sides; median callus flat, poorly defined; basal callus shiny, dark brown to black; subcallus dark brown to black with gray pollen. Clypeus and genae dark brown to black, with black hair. Antennae and palpi entirely black (pale in few specimens), excision of flagellum moderate, dorsal angle moderately acute.

Thorax: Mesonotum and scutellum black to brown, entirely covered with

creamy white hair. Venter and legs, except base of fore tibia, entirely black (pale in few specimens), basal third of fore tibia creamy white. Wings subhyaline, with brownish tinge basally and at costa, furcation with dark brown spot.

Abdomen: Entirely black; tinged with brown in a few specimens.

Male: Eyes with large and small facets as in I. kesseli; palpi reduced; face depressed; white hair on mesonotum confined to external margins. Size and other characters as in female.

Type: According to Stone (1938), lectotype is in the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, No. 4044.

Type locality: Utah.

Distribution: British Columbia to Kansas, California and Texas.

#### Material Examined

Oregon: Baker Co., Baker, VIII-20-61, Goeden (OSDA); Big Cr., VII-(25-28)-76, VII-(13-16)-77, Davis (WSU); Cougar Cr., VII-(25-28)-76, VIII-(22-25)-76, VII-28-77, Davis (WSU); L. Goose Cr., VII-(6-12)-75, VII-27-VIII-2075, VII-(13-16)-77, Davis (WSU); Velvet Cr., VIII-(3-9)-75, Davis (WSU). Benton Co., Camp Adair, IX-25-56, Gresbrink (OSU); Corvallis, VII-14-08, Pernot (CAS), VII-3-39, Mowery (OSU), (Reared) emerged III-1-60, L. Lewis (OSU), V-15-60, J. Lewis (OSU), VII-4-65, Eddy (OSU), VII-28-66, LFL (OSU), VIII-12-70, Bliss (OSU), VII-13076, Mooney (OSU); Mary's Peak, 7-1923, Chamberlin (OSU),



VII-15-65, Rotary Trap (OSU). Clackamas Co., Mollala, V-26-46, Ballantyne (OSU). Douglas Co., Diamond Lk., VII-27-65, Eddy (OSU). Grant Co., 20 mi. W. Dayville, VI-26-35, Schuh (OSU); Dixie Pass, VII-20-67, Goeden (OSDA); 7 mi. S.S.W. Prairie City, VII-28-62, Goeden (OSDA). Harney Co., Blitzen Rv., Frenchglen, VII-15-64, Schuh-Lattin (OSU); Frenchglen, VII-3-25, VII-21-43, Scullen (OSU); Hot Spr., 4 mi. N. Andrews, VII-16-57, Goeden (OSDA); P Ranch, VII-23-22, Chamberlin (OSU). Jackson Co., Applegate, VIII-20-76, Lightfoot (OSU); Ashland, VII-3-25, VII-21-43, Scullen (OSU); Copco, VII-1-51 (UCD); Kane Rv., 5 mi. W. Gold Hill, VI-23-37, Bolinger-Jewett (OSU); Medford, VI-22-37, Bolinger-Jewett (OSU); Spr. Mt., VII-24-43, Scullen (OSU); Talent, VII-17-31, Gentner (OSU); Union Cr., IX-(1-15)-50, Malkin (CAS). Josephine Co., Grants Pass, VII-4-23, Chamberlin (OSU); Mt. Sexton, VII-5-25, Scullen (OSU); O'Brien, V-30-52, Roth (OSU); 10 mi. W. Selma, V-31-59, Johnson (OSU). Klamath Co., Bly, VII-23-50, Washbauer (UCB), VI-14-58, Schuh (OSU); Klamath Falls, VI-22-31, Gjullin (OSU); VI-21-58, Vertrees (OSU); 59 mi. E. Klamath Falls, VII-24-30, Scullen (OSU); Rocky Pt., VII-28-41 (UCD). Lake Co., Hart Mt., VII-7-54, Nelson (OSU); Summer Lk., VII-26-30, Scullen (CAS, OSU), VII-27-44, Gjullin (OSU), VIII-8-47, VI-30-48, VIII-16-48, VII-8-51, Roth (OSU). Linn Co., Big Lk., VII-31-66, Goeden (OSDA); Marion Forks, VII-9-65, Christenson (OSU); Peoria Rd., VIII-25-41 (OSU). Malheur Co., 20 mi. N. Jordan Vall., VII-10-53, Lauderdale (OSU); 12 mi. S.W. Nyssa, Owyhee Rv., VIII-7-63, Goeden (OSDA); Ontario, VIII-26-63, Goeden (OSDA); Three Forks, 40 mi. S. Jordan Vall., VIII-12-67, Goeden (OSDA). Marion Co., Salem, VII-5-62, Goeden (OSDA), VII-2-69, Westcott (OSDA). Morrow Co., Boardman, VII-21-61, Osgood (OSU). Polk Co., Dallas,

VII-15-32, Jones (OSU. Umatilla Co., Hermiston, V-1927 (OSU), VII-20-61, VIII-2-61, Goeden (OSDA); Milton-Freewater, VIII-4-60, Ritcher-Koontz (OSU). Union Co., La Grande, VII-1920, Reynolds (OSU); L. Lick Cr., VI-29-VII-5-75, VII-20-VIII-2-75, VII-(19-22)-77, VII-(7-23)-77, Davis (WSU); U. Lick Cr., VI-20-VII-5-75, VIII-(3-9)-75, VI-(26-28)-77, VIII-(7-9)-77, Davis (WSU). Wallowa Co., East Eagle Cr., Wallowa N.F., VII-9-39, Lane (OSU). Washington Co., Blooming, VII-26-38, Schuh-Gray (CAS); Forest Grove, VII-11-38, Shuch-Gray (OSU); North Plains, VI-10-57, Goeden (OSDA). Yamhill Co., McMinnville, VI-28-38 (PSU).

Extralimital: Arizona; Waricopa Co., Phoenix, V-21-61, Scullen (OSU). California; Imper. Co., Laguna Dam, IV-17-47, Wilcox (OSU); Santa Clara Co., X-15-61, Strugess (OSU). Siskiyou Co., Medicine Lk., VIII-1-58, Schuh (OSU); Ventura Co., Foster Park, V-17-42, Toland (OSU); Indio, VI-16-41, Wilcox (OSU); 29 Palms, IX-(2-26)-52, Smith-O'Brien (OSU). Idaho; Hot Sprgs., VI-10-47, Duspvia (OSU). Washington; Tacoma, VII-18-32, Wilcox (OSU); Walla Walla, V-20-26, Stone (OSU).

Discussion.--I. punctifer is one of the largest and most robust tabanid in Oregon. It has a wide distribution in North America. In Oregon, it occurs at low elevations but in relatively low numbers.

It is characterized by the milky white hair on the mesonotum and the white base of the fore tibia. Its life cycle and bionomics was reported by Webb and Wells (1924). They reared the immature stages and described each stage. Burger (1971) and Lane (1976) provided more information on its immature stages. Lane reported that it can breed in all types of aquatic habitats except tree holes. I collected its

larvae from the depth of about six inches in a dry muddy pool at Rock Creek beside the hot spring on Hart Mountain, Lake County, Oregon.

The adults usually are attracted by shiny objects like cars, but they avoid the malaise trap. They are on the wing from mid June to the end of August; but a few specimens were occasionally collected during September.

Tabanus similis Macquart  
(Map 24)

Tabanus similis Macquart, 1850, Soc. des Sci., de l'Agr. et des Arts Lille, Mem. 1849:335 (Orig. Descrip.); Philip, 1959, Trans. Amer. Ent. Soc. 85:208 (Syn.); Roberts and Dicke, 1964, Ann. Ent. Soc. Amer. 57(1):37-39 (Life Hist.); Philip, 1965, U.S.D.A, A.R.S., Agr. Handb. No. 276:336 (Cat.); 1966, Ann. Ent. Soc. Amer. 59(3):521 (Rev.); Teskey, 1969, Mem. Ent. Soc. Canada No. 63:79-80 (Immat.); Lane, 1975, Ann. Ent. Soc. Amer. 68(5):818 (Immat.); 1976, J. Med. Ent. 12(6):683-691 (Immat.); Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:18-19.

Tabanus lineola subsp. scutellaris, Walker, 1850, Ins. Saund., Dipt., 1:27; Stone, 1938, U.S.D.A. Misc. Publ. No. 305:123 (Rev.); Philip, 1942, Psyche 99:28; Chagnon and Fournier, 1943, Nat. Canad. 70:78; Philip, 1947, Amer. Midland Nat. 37(2):309 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):18 (Tax.).

Tabanus lineola of authors (Partim), Osten Sacken, 1876, Mem. Boston Soc. Nat. Hist. 2:448; Hart, 1895, Bull. Ill. Lab. Nat. Hist. 4:235; Hine, 1903, Ohio State Acad. Sci. Spec. Pap. No. 5:51; 1907, Lab. Agr. Expt. Sta. Bull. No. 93:50; Malloch, 1917, Bull. Ill. Lab.

Nat. Hist. 12:359; Philip, 1931, Minn. Agr. Expt. Sta. Bull. No. 80:32, 109, 124, 125 (Biosyst.).

Diagnosis.--Size medium, brownish. Frons widened above, basal callus rectangular, black; subcallus pollinose gray with brownish background; antennae yellow, annuli reddish; palpi creamy white, tapering distally. Thorax black; mesonotum with gray longitudinal stripes; scutellum orange apically; venter pollinose gray, with white hair; legs predominantly yellowish orange. Abdomen yellowish brown; dorsum with black hair and three longitudinal whitish gray stripes.

Description.--

Female: Length 12-13 mm.

Head: Frons widened above, pollinose gray to yellowish gray; median callus slender, black; basal callus rectangular, black; subcallus partially denuded brownish yellow, partially pollinose white. Clypeus and genae white, with white hair. Antennae uniformly yellow except annuli reddish, scape and pedicel with black hair, flagellum with excision and acute dorsal angle. Palpi creamy white, slender apically, with black hair.

Thorax: Mesonotum black with longitudinal gray stripes, posterior half of scutellum orange; notopleura yellow; wings hyaline. Venter pollinose white, with white and dark hair; legs uniformly brown yellow except for tarsus black, with black and some white hair.

Abdomen: Tapering posteriorly; yellowish brown; dorsum with dense black hair and three parallel longitudinal white stripes. Venter with

gray pollen; sternites I and II with black median band.

Male: Eyes with an area of metallic rusty facets surrounded by smaller black ones; palpi reduced. Remainder of characters as in female.

Type: British Museum (Natural History), London, England.

Type locality: Unknown, as Tasmania in error, (Philip 1965).

Distribution: British Columbia to Nova Scotia to California and Georgia.

#### Material Examined

Oregon: Baker Co., Big Cr., VII-27-VIII-2-75, IX-(5-8)-76, VII-16/28-77, VII-29-VIII-2-77, Davis (WSU); Cougar Cr., VI-28-77, VII-7/16-77, Davis (WSU); Durkee, VII-12-67, Goeden (OSDA); L. Goose Cr., VII-(20-26)-75, VII-(18-20)-76, Davis (WSU); U. Goose Cr., VI-29-VIII-16-75, VII-(11-14)-76, VI-21/28-77, VI-7-77, Davis (WSU); Velvet Cr., VIII-(3-9)-75, VI-28-77, Davis (WSU). Benton Co., Corvallis, X-29-62, Willard (OSU). Clackamas Co., Milwaukie, VI-26-70, Johnson (OSU). Grant Co., 7 mi. S.S.W. City Prairie City, VII-28-62, Goeden (OSDA). Hood River Co., Hood Rv., VI-25-17, Cole (CAS). Jackson Co., Ashland, VIII-5-63, Alsing (SOSC); Medford, VII-20-69, Gentner-Goeden (OSDA). Josephine Co., Hugo, V-10-54, Davis (OSDA). Lake Co., Round Lk., VII-9-64, 6 mi. N. Silver Lk., VII-23-57, Miller (OSDH-Portland). Malheur Co., 10 mi. S.W. Ontario, V. Smith Ranch, VIII-7-63, Baker (OSU); 12 mi. S.W. Vale, VII-19-63, Goeden (OSDA). Umatilla Co., Hermiston, VII-20-61, Goeden (OSDA); Ordnance, Rangeland, VI-5-57,

Goeden (OSDA). Union Co., Ladd Cyn., VII-8/25-77, Davis (WSU); L. Lick Cr., VI-29-VII-16-75, VI-(27-30)-76, VII-(25-28)-76, VIII-(29-31)-76, VI-28-77, VII-(7-23)-77, Davis (WSU), U. Lick Cr., VII-(6-26)-75, VIII-(3-16)-75, VII-(11-14)-76, VI-28-77, VII-(7-16)-77, Davis (WSU). Wallowa Co., Lostine, VII-11-67, Goeden (OSDA).

Washington: Naches, VII-5-41, Gjullin (OSU).

Discussion.--This species has long been considered under the subspecies name, I. lineola scutallaris. In 1959, Philip raised it to full species status on the basis of quadratic shape of the basal callus as well as the pale coloration of legs and posterior half of scutellum. Roberts and Dicke (1964) reported that, unlike lineola, the larva of similis does not possess a respiratory spine. Teskey (1969) reported that mature larvae of I. similis differ from those of I. lineola only in color, which is creamy white in the former, and the absence of pubescence between the lateral pubescent projection of the prothorax. He collected the larvae of I. similis from a variety of habitats including the margins of marshes, pools, margins of ponds and flooded meadows. Lane (1976) found that, in California, I. similis mainly bred in seepages and in the margins of ponds.

The majority of adult specimens in Oregon were collected from the northeastern parts of the state in malaise traps by the Washington State University team.

The adults usually occur on the wing from mid May to mid September, but generally are most abundant in July and August.

Tabanus stonei Philip  
(Map 26)

Tabanus stonei Philip, 1941, Can. Ent. 73:144 (Orig. Descrip.); 1947, Amer. Midland Nat. 37(2):315 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):19 (Tax.); Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:336 (Cat.); Cole, 1969, Flies West. N. Amer., p. 169; Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:19 (Syst.).

Diagnosis.--Size medium, gray. Frons widened above, pollinose; ocellar tubercle partially denuded; median and basal callus shiny; subcallus pollinose. Antennae predominantly orange. Thorax dark with gray stripes, legs predominantly dark. Abdomen with reddish gray spot dorsally.

Description.--

Female: Length 13-14 mm.

Head: Frons slightly widened above, pollinose whitish yellow, with black hair; ocellar tubercle partially denuded; median callus occupies about one-third of the width of the frons, shiny black; basal callus ovoid shiny dark brown, connected to median callus; subcallus pollinose white with yellow background. Clypeus and genae white with dense white hair. The first two antennal segments and base of third segment orange, balance of third segment black; excision shallow, dorsal angle obtuse. Palpi with stout basal half, whitish yellow and black hair.

Thorax: Mesonotum with alternate black and gray longitudinal stripes and gray hair; wings hyaline. Venter with dense white hair; legs black except base of fore tibia, mid and tibiae yellow, all with mixture of black and white hair.

Abdomen: Mesonotum with three rows of reddish gray spots, sublateral rows larger and run diagonally, median row forms a straight line across the body. Venter predominantly yellowish orange with gray hair.

Male: Eyes with large and small facets; palpi reduced. Size and other characters as in female.

Type: California Academy of Science, San Francisco, California.

Type locality: 10 mi. E. Three Forks, Jefferson County, Montana, July 9, 1926.

Distribution: British Columbia to Montana, California and Texas.

#### Material Examined

Oregon: Harney Co., nr. Crane, VI-28-22, Chamberlin (OSU); Van Horn Cr., 5 mi. N. Deno Nev., VII-11-68, Oman (OSU). Lake Co., 6 mi. N. Silver Lk., V-I-23-57, Miller (OSDH). Malheur Co., 6 mi. N.W. Ontario, VI-23-66, Goeden (OSDA); Ontario, VIII-19-48, Davis (OSDA); Vale, VII-22-36, Rieder (OSU). Morrow Co., Boardman, VII-5-62 (OSU). Umatilla Co., Hermiston, VII-8-61, Goeden (OSDA); 8 mi. S.E. Hermiston, VII-9-69, Goeden (OSDA). Wasco Co., The Dalles, VII-23-68, Goeden-Smith (OSDA).



Discussion.--T. stonei is relatively rare in Oregon. It has been collected from a few localities in the Cascade Mountains and along the state border with Washington and south border near Nevada. No specimens have been reported from areas west of the Cascades. The species has never been collected in a Malaise trap from Oregon.

T. stonei may be separated from T. laticipes by its pollinose ocellar tubercle. This character, plus the bare eyes, separates it from some Hybomitra species that possess the same body maculation (more discussion on this subject is found under H. melanorinha).

Tabanus tetropsis Bigot  
(Figure 8, Map 26)

Tabanus tetropsis Bigot, 1892, Mem. Soc. Zoo. France 5:681 (Orig. Descrip.); Stone, 1938, U.S.D.A. Misc. Publ. No. 305:167 (Rev.); Philip, 1947, Amer. Midland Nat., 37(2):316 (Cat.); 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:337 (Cat.); Stone, 1972, Ann. Ent. Soc. Amer. 65(3):640; Nowierski and Gittins, 1976, Univ. Ida., Agr. Expt. Sta., Res. Bull. No. 96:18.

Stenotabanus tetropsis, Stone, 1938, U.S.D.A. Misc. Publ. No. 305:167 (Rev.).

Tabanus productus Hine, 1904, Ohio Nat. 5:242; Webb and Wells, 1924, U.S.D.A. Bull. No. 1218:9; Rowe and Knowlton, 1935, Can. Ent. 67:248; Philip, 1947, Amer. Midland Nat. 37(2):312 (Cat.); Middlekauff, 1950, Bull. Calif. Ins. Surv. 1(1):18; Philip, 1965, U.S.D.A., A.R.S., Agr. Handb. No. 276:335 (Cat.).

Stenotabanus productus, Stone, 1938, U.S.D.A. Misc. Publ. No. 276:35 (Rev.); Philip, 1941, Can. Ent. 73:11 (Syn.).

Diagnosis.--Size medium, body gray to black. Wings with stump vein on  $R_4$ . Frons widened above; subcallus pollinose; median callus large and irregular; basal callus shiny. Antennae predominantly black. Thorax with longitudinal gray stripes; tibiae yellow. Abdominal tergites with rows of gray spots.

Description.--

Female: Length 10-13 mm.

Head: Head broader than thorax. Frons widened above, gray, pilose; median callus large, irregular, touching eyes; basal callus shiny black, almost touching eyes; subcallus gray tinged with yellow.

Clypeus and genae white, with white hair. First two antennal segments black with some orange areas and with black hair; third segment black, slender, no excision. Palpi whitish yellow, with mixture of black and white hair, tapering distally.

Thorax: Mesonotum black, with longitudinal gray stripes; notopleura orange; wings hyaline, with characteristic stump vein on  $R_4$ ; legs black except base of fore tibia and most of mid and hind tibiae creamy.

Abdomen: Tergites black, with three rows of longitudinal gray stripes. Venter gray, with black hair.

Male: Eyes with a zone of large yellow facets, surrounded by an area of black small facets, palpi stout. Size and other characters essentially as in female.

Type: A male in the British Museum (Natural History), London, England.

Type locality: Georgia as error (Philip 1965).

Distribution: Oregon to Montana and New Mexico.

Material Examined

Oregon: Harney Co., 8 mi. N. Andrews, Hot Spr., VII-17-57, Lattin (OSU); VII-16-57, Goeden (OSDA); Fields, VI-28-61, Goeden (OSDA); Hot Lk., VII-17-57, Lattin (OSU); Juniper Lk., VIII-4-77, Cobb (OSU); Malheur Field Sta., VII-23-77, Cobb (OSU); Malheur W.L. Ref., Krumbo Res., VII-29-78, Siebert (OSU); Mickey Hot Spr., VII-20-77, Cobb (OSU); Three Mile Ranch, Steens Mt., VII-18-37, Bolinger-Jewett (OSU); 10 mi. S.W. White Horse Ranch, VIII-13-67, Goeden (OSDA); Wagontire, VIII-1-62, Goeden (OSDA). Klamath Co., 7 mi. E. Beatty, VIII-20-70, Goeden (OSDA). Lake Co., Abert Lk., VII-17-32, Stage (OSU); VI-18-34, Jones (OSU); VII-2-35, Schuh (CAS); Adel, VII-20-48, Roth (OSU); Hart Mt., VII-1-33, Frewing (UCB); 5 mi. S. Lakeview, VIII-4-66, Goeden (OSDA); Summer Lk., VII-18-41, VII-22-44, Gjullin (OSU); VIII-25-44, Scullen (CAS, OSU); VII-24-47, VIII-8-47, VII-24-49, VIII-16-49, VI-27-51, VIII-21-51, VIII-10-66, Roth (OSU). Malheur Co., Three Forks, 40 mi. S. Jordan Vall., VIII-12-67, Goeden (OSDA); 15 mi. N.W. Vale, IX-9-62, VIII-28-65, Goeden (OSDA).

Discussion.--The taxonomic status of this species has been the subject of controversy for some time (see synonymical bibliography above). But this controversy has now been solved by Stone (1972) who found that I. productus Hine is a junior synonym of I. tetropsis Bigot.

I. tetropsis is characterized by a consistent stump vein on  $R_4$ , a character that separates it from all other Oregon species of Tabanus.

Its distribution in Oregon is confined to the southeastern parts of the state, mostly at lower elevations and especially around lakes and marshes where it usually exists at relatively high numbers. The adults are active from mid June to late August and early September.

The immature stages are not yet known.

## CONCLUSIONS

The relatively short period that I spent studying the Tabanidae of Oregon has revealed many problems within the group. Contrary to my earlier belief that the taxonomy of the adult stage was well known, I am now convinced that much remains to be investigated before the status of many Oregon species can be determined.

The limited number of useful morphological characters in Tabanidae adults is a major obstacle that encourages the use of many secondary characters, like color, that are sometimes unstable and subject to fading. This situation has resulted in many new species separated on the basis of color of a single character, e.g., the color of hind tibial fringe in Hybomitra californica. Others are separated by the presence of any easily removable character, e.g., the tiny white abdominal triangle in Tabanus kesseli. Some of the workers tried to solve this problem by introducing varieties to the species of slight variation, but this has resulted in more confusion since some of the varieties, e.g., Hybomitra tetrica var. hirtula, are separated by a character that is more definite and consistent than other characters that separate full species. The criteria for species separation is, therefore, indefinite, and the species status is not clear and subject to personal judgement.

It is apparent that some criteria other than the morphological characters have to be introduced in order to solve these problems. When such criteria are developed, the status of many species, particularly in the genus Hybomitra, will have to be reconsidered. The concept of variety has to be defined before it is used with any group.

The obvious source that may provide more information about the tabanids is to know more about them. The life cycle of many species is not yet known, mainly because the immature stages are not known. The knowledge about the life cycle is important for the study of the bionomics and behavior of each species, which in my opinion, are important criteria that may help in the identification and separation of the species.

Ecological studies of the taxa may also be helpful. Such studies may include the interaction of the populations that inhabit certain geographical regions. The distribution of the species in certain areas and its relation with the overwintering habits of the larvae, i.e., some larvae overwintering in soil covered with snow and possibly in the snow, while others in soil not covered with snow. These are a few examples of ecological studies that could be done.

Chemotaxonomy and internal morphology, including chromosome bands, are other lines of investigation that might be undertaken.

Some of the specific problems in Oregon that need investigation include the variation of body color in Atylotus incisuralis, Hybomitra phaenops, Hybomitra sonomensis, Hybomitra rhombica, Hybomitra californica, Hybomitra fulvilateralis, Hybomitra zygota. The first three species occur in large numbers around Summer Lake, the fourth is abundant in the northeastern parts of Oregon, while the last three occur at higher elevations like Mary's Peak and Crater Lake area. The problem of these species is the uncertainty about whether each of them is a single species with various forms or whether there are more species involved. One problem about the last three species is the existence of some form, on Mary's Peak, that possesses characters of

two more of them, i.e., they have the wide frons of fulvilateralis and zygota and also the yellow palpi and/or the golden hind tibial fringe of californica. It is not known whether these forms are morphs, hybrids, or possibly a new species. This has to be investigated. For the investigation about variation, the paper of McAlpine (1961) on the variation of Hybomitra frontallis would be helpful.

For the biological and ecological studies of a limited number of species, Mary's Peak Campground and Summer Lake are suggested. Each has a good number of tabanid species at high frequencies and they represent different geographical and ecological areas.

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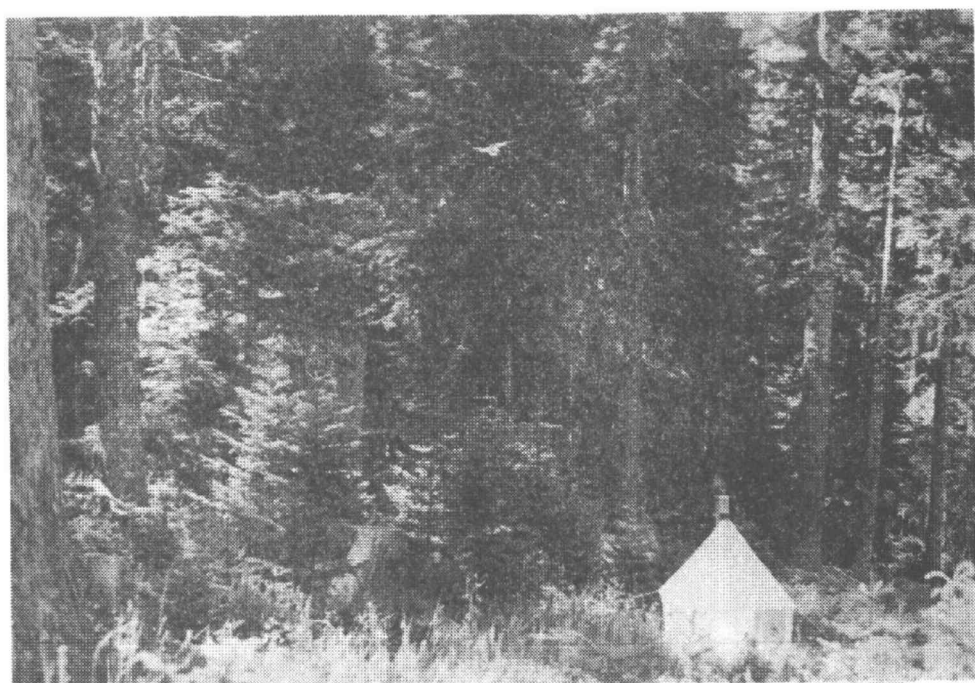
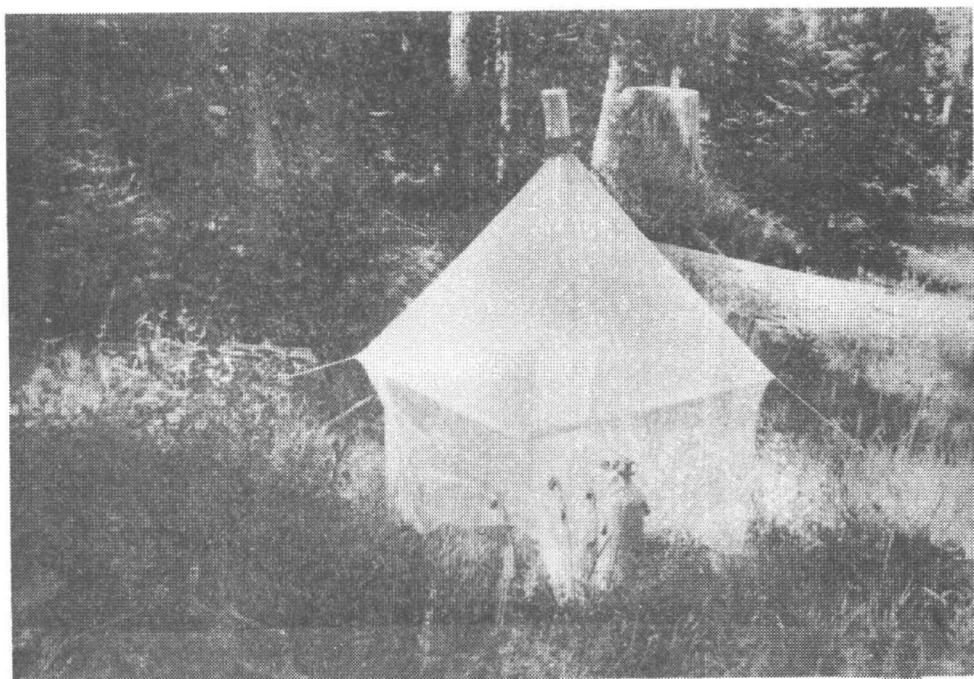
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- Figure 1.
- 1a. Site of adult collection on Mary's Peak Campground area.
  - 1b. A Malaise trap baited with CO<sub>2</sub> on operation.

1<sub>a</sub>1<sub>b</sub>

- Figure 2. Head of Hybomitra captonis (Marten) representing subfamily Tabaninae V, vertex; Ot, Ocellar tubercle; Mc, Median callus; F, frons; E, eye; Bc, Basal callus; Lg, Lower gena; Ug, Upper gena; 1st An S, First Antennal segments; Fc, Frontoclypeus; Pl, Palpus; Ps, Proboscis; Sc, subcallus.
- Figure 3. Head of Chrysops sp. representing subfamily Chrysopsinae Oc, Ocelli.
- Figure 4. Head of Stonemyia tranquella fera (Williston) representing subfamily Pangoniinae; with abnormally long proboscis.

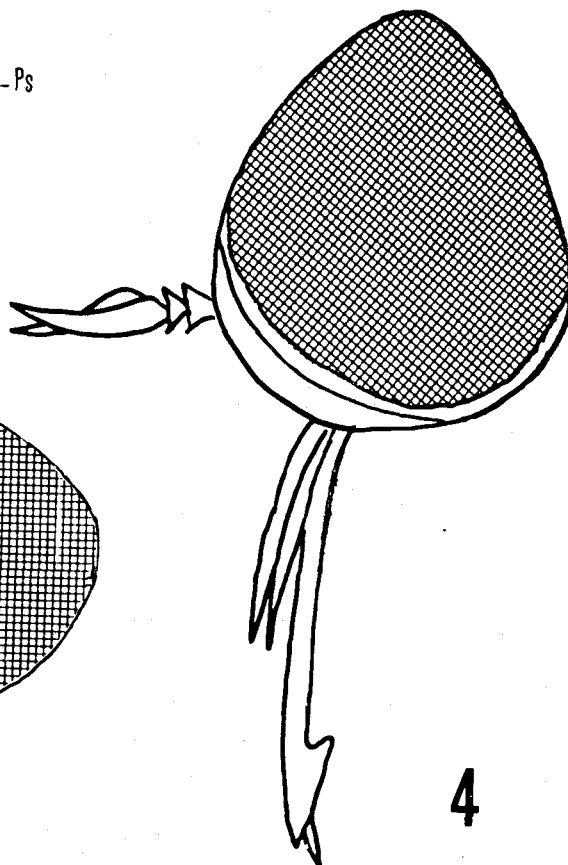
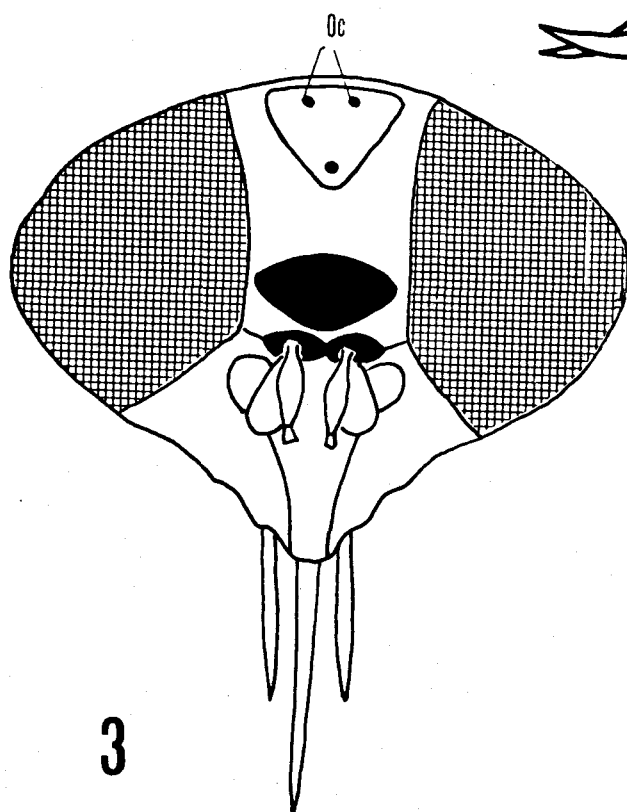
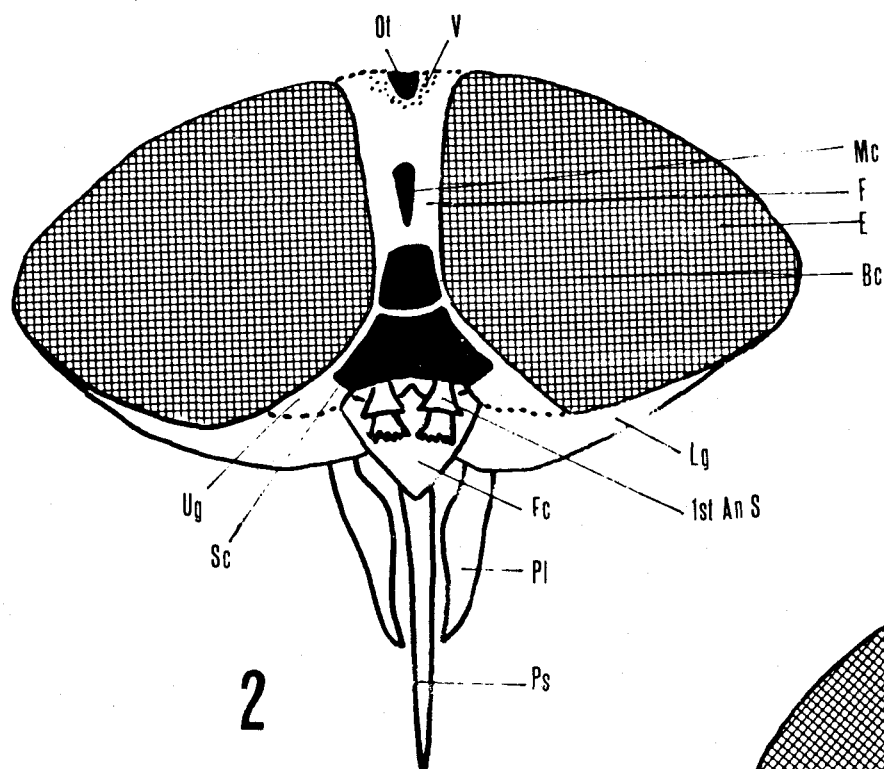


Figure 5. Antenna of Hybomitra captonis (Marten). Sc, Scape; Pl, Pedicel; Fl, Flagellum; An, Annuli.

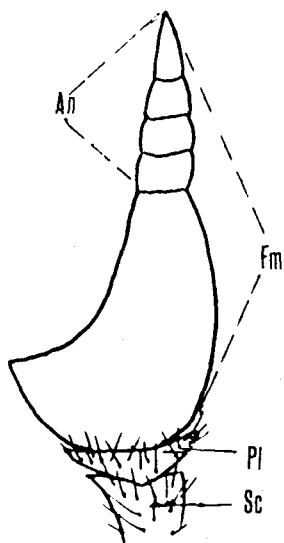
Figure 6. Antenna of Chrysops discalis Williston.

Figure 7. Antenna of Pilimas californicus (Bigot).

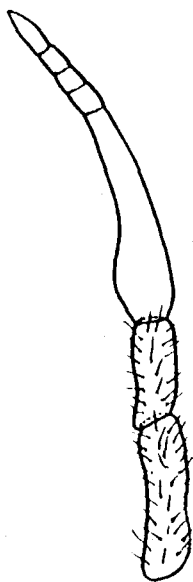
Figure 8. Thorax of Hybomitra captonis (Marten) (dorsal view). Hc, Humeral callus; Npl, Notopleura (=prescutal lobe); Mes, Mesonotum; Scl, Scutellum.

Figure 9. Wing of Tabanus tetropsis, Bigot. C, Costa; Cc, Costal cell; S, Subcosta; Sc, Subcostal cell; R<sub>1</sub>, Radius<sub>1</sub>; R<sub>2</sub> + R<sub>3</sub>, Radius<sub>2+3</sub>; Sv, Stump vein; R<sub>4</sub>, Radius<sub>4</sub>; R<sub>5</sub>, Radius<sub>5</sub>; M<sub>1</sub>, Media<sub>1</sub>; M<sub>2</sub>, Media<sub>2</sub>; M<sub>3</sub>, Media<sub>3</sub>; Cu<sub>1</sub>, Cubital<sub>1</sub>; Cu+2ndA, Cubitus+2nd Anal; CR<sub>1</sub>, Cell R<sub>1</sub>; CR<sub>3</sub>, CR<sub>4</sub>, Cell R<sub>4</sub>; CR<sub>5</sub>, Cell R<sub>5</sub>; Dc, Discal cell; 2R, Radial cell; 2M, Medial cell; 1A, 1st Anal cell; 2A, 2nd Anal cell; CuC, Cubital cell; CM<sub>1</sub>, Cell M<sub>1</sub>; CM<sub>2</sub>, Cell M<sub>2</sub>; CM<sub>3</sub>, Cell M<sub>3</sub>.

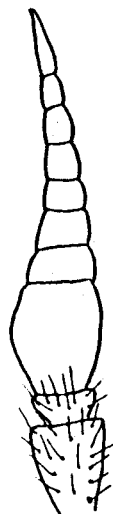
Figure 10. Wing of Chrysops proclivis Osten Sacken. As, Apical spot; Ht, Hyaline triangle; Cb, Cross band.



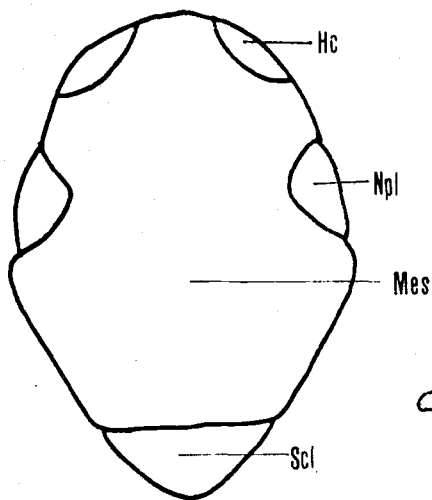
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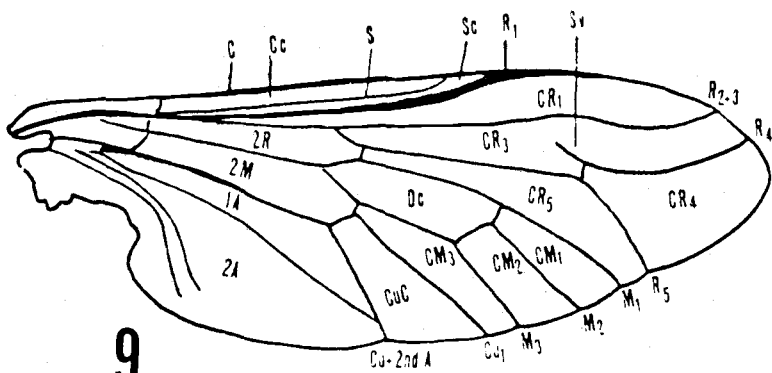
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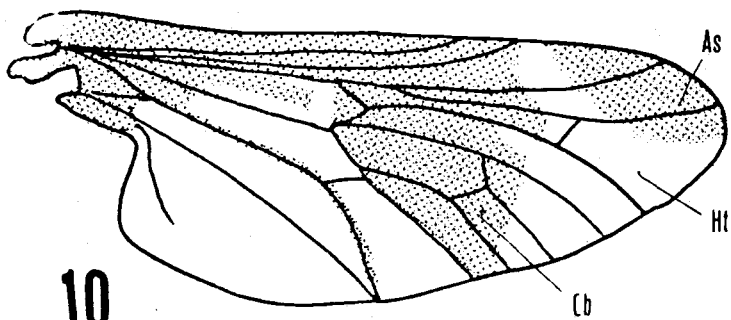
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Figures 11-24. Wings of Chrysops species of Oregon.

11. C. aestuans van der Wulp
12. C. asbestos Philip
13. C. bishoppi Brennan
14. C. coloradensis Bigot
15. C. discalis Williston
16. C. excitans Walker
17. C. furcatus Walker
18. C. mitis Osten Sacken
19. C. noctifer Osten Sacken
20. C. noctifer pertinax Williston
21. C. proclivis Osten Sacken
22. C. proclivis var. atricornis Bigot
23. C. surdus Osten Sacken
24. C. wileyae Philip

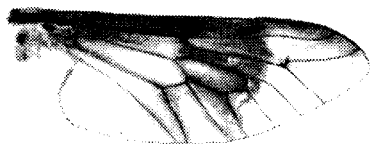
Figure 25. Wing of Silvius notatus (Bigot)



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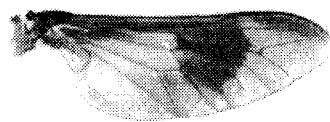
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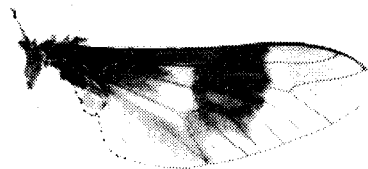
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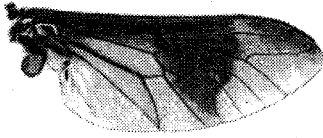




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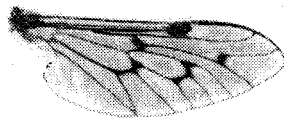
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Figure 26. Seasonal occurrence of adults.

SPECIES	APR	MAY	JUN	JUL	AUG	SEP	OCT
<u>Apatolestes</u>							
<u>comastes</u> var. <u>willistoni</u>				████████			
<u>Pilimas</u>							
<u>californicus</u>				████████	████████		
<u>californicus</u> var. <u>beameri</u>							
<u>Stonemyia</u>							
<u>tranquilla</u> <u>fera</u>				████████	████████		
<u>Silvius</u>							
<u>gigantulus</u>				████████	████████	████████	
<u>notatus</u>			████████	████████	████████		
<u>Chrysops</u>							
<u>aestuans</u>				████████			
<u>asbestos</u>				████████	████████		
<u>bishoppi</u>				████████	████████		
<u>coloradensis</u>				████████	████████	████████	
<u>discalis</u>				████████	████████	████████	
<u>excitans</u>				████████	████████	████████	
<u>furcatus</u>					████████		
<u>mitis</u>				████████	████████		
<u>noctifer</u> <u>pertinax</u>				████████	████████	████████	
<u>proclivis</u>				████████	████████		
<u>proclivis</u> var. <u>atricornis</u>				████████	████████	████████	
<u>surdus</u>				████████	████████	████████	
<u>wileyae</u>				████████	████████		
<u>Atylotus</u>							
<u>incisuralis</u>				████████	████████	████████	
<u>incisuralis</u> var. <u>utahensis</u>					████████		
<u>tingaureus</u>				████████	████████	████████	

SPECIES	APR	MAY	JUN	JUL	AUG	SEP	OCT
<u>Hybomitra</u>							
<u>aasa</u>							
<u>astuta</u>							
<u>atrobasis</u>							
<u>californica</u>							
<u>captonis</u>							
<u>epistates</u>							
<u>fulvilateralis</u>							
<u>hirtula</u>							
<u>lanifera</u>							
<u>melanorhina</u>							
<u>opaca</u>							
<u>phaenops</u>							
<u>procyon</u>							
<u>rhombica</u>							
<u>rhombica</u> var. <u>osburni</u>							
<u>rupestris</u>							
<u>sequax</u>							
<u>sonomensis</u>							
<u>tetrica</u>							
<u>zygota</u>							
<u>Tabanus</u>							
<u>aegrotus</u>							
<u>fratellus</u>							
<u>kesseli</u>							
<u>laticeps</u>							
<u>monoensis</u>							
<u>punctifer</u>							
<u>similis</u>							
<u>stonei</u>							
<u>tetropsis</u>							

## Maps 1-26. Distribution of tabanids in Oregon.

1. Apatolestes albipilosus ■ , A. comastes var. fulvipes ▲ ,  
A. comastes var. willistoni ●
2. Pilimas californicus ● , P. californicus var. beameri ■
3. Stonemyia tranquilla fera ●
4. Silvius gigantulus ● , S. notatus ▲ , S. philipi ■
5. Chrysops aestuans ● , C. asbestos ▲
6. C. bishoppi ● , C. coloradensis ■
7. C. discalis ● , C. excitans ■
8. C. furcatus ■ , C. mitis ●
9. C. noctifer pertinax ●
10. C. proclivis ● , C. proclivis var. atricornis ▲
11. C. surdus ● , C. wileyae ▲
12. Atylotus incisuralis ● , A. incisuralis var. utahensis ▲  
A. tingaureus ■
13. Hybomitra aasa ■ , H. astuta ▲ , H. atrobasis ●
14. H. californica ● , H. epistates ▲
15. H. captonis ● , H. fulvilateralis ▲
16. H. hirtula ▲ , H. lanifera ■ , H. melanorhina ●
17. H. phaenops ● , H. procyon ▲
18. H. opaca ■ , H. rhombica ● , H. rhombica var. osburni ▲
19. H. rupestris ▲ , H. sequax ●
20. H. sonomensis ●
21. H. tetrica ● , H. zygota ▲
22. Tabanus aegrotus ● , T. fratellus ▲
23. T. kesseli ● , T. laticeps ▲
24. T. monoensis ▲ , T. similis ●
25. T. punctifer ●
26. T. stonei ▲ , T. tetropsis ●

