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The Neuroptera - Suborder Planipennia of Wisconsin Part 1 - Introduction and Chrysopidae

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THE NEUROPTERA – SUBORDER PLANIPENNIA OF WISCONSIN[1] PART I–INTRODUCTION AND CHRYSOPIDAE

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INTRODUCTION

No one to date has published on the Neuroptera of Wisconsin. The only comprehensive report dealing with the group in a neighboring state is the one by Parfin (1952) for Minnesota. I have collected Neuroptera in Wisconsin in a desultory manner from 1922 to 1957 and from then to the present date methodically and much more extensively. I have worked in all 72 countries of the state, some in only a few places but in a number of counties spaced throughout the state, in many places and at many times. With more collecting other species may be found or the distribution of the known species extended but I feel that publication at this time is warranted.

I have examined the collections at the Milwaukee Public Museum, the University of Wisconsin at Madison and several smaller collections in the state. My inquiries concerning Wisconsin specimens in collections outside the state have yielded very meager results.

In my collecting I have kept every neuropteran specimen no matter how damaged it might be and no matter how many duplicates I had. I did this to more accurately get a comparison of the relative abundance of the species and a more accurate figure of the proportion of males and females and of the type of habitat where different species are found.

METHODS

The two commonest methods of collecting insects, sweeping herbaceous vegetation, bushes and the lower branches of trees and attracting them by light were used throughout this work.

The type of habitats swept for specimens included native coniferous forests and woods, pine plantations, native broad-leaved forests and woods, forest and wood edges, apple and cherry orchards, cultivated fields, hay fields, marshes, bogs, swamps, river and stream banks, lake and pond margins, sand dunes, oak openings, wet prairies, dry hill and bluff prairies, limestone and sandstone bluffs, quartsite and granite outcroppings, roadsides and railroad right of ways, and city yards and gardens.

The type of lights used were gasoline lantern, acetylene cap light, auto head lights, 100 and 150 watt incandescent lights, 15 watt BL and BLB blacklight and 400 watt mercury vapor lamp.

Few records are available which show the number and per cent of Neuroptera specimens caught by light as compared to the total catch of all insects. Making such counts is extremely tedious and time consuming and this may account for the scarcity of records.

Shackleford (1960) in reporting on a light trap catch in Oklahoma lists the major orders and families collected but does not mention Neuroptera.

Table 1 shows that Neuroptera constitute a very small part of the total insect catch when light is used. It is to be noted that my count for Neuroptera is considerably higher than those of Frost (1957) and Pfrimmer (1955). This may be due to the different localities but more likely it is due to two other reasons.

First, I have used lights many times and have been able to note various trends. I have observed that the hours from dusk to midnight are the best hours for catching Neuro-

[1]This project was supported in part by the Research Committee of the University of Wisconsin on funds from the Wisconsin Alumni Research Foundation.

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Table 1. Number and per cent of Neuroptera caught by light trap.

Reference	No. of insects caught	No. of Neuroptera caught	Neuroptera % of total catch
Frost, 1957	188,135	158	0.084
Pfrimmer, 1955	160,396	4	0.0025
Throne	13,591	69	0.51

ptera. Also I have noted that warm, moonless, relatively calm but dewless nights are best. Therefore when I use lights I carefully select the time that experience has proven to be the most profitable for my purpose. Secondly, I am interested in one group only and thus can more easily pick out the Neuroptera from all others, even the small Hemerobiids and the minute Coniopterygidae which might easily be overlooked by a person not particularly interested in them.

My data given in Table 1 were obtained by collecting during 17.5 hours selected over a period June 11 to July 1, 1961, using a 100 watt incandescent light in a funnel trap, in a small backyard containing grass, flowers and several trees and bushes in Shorewood, Milwaukee County, Wisconsin.

I have not run controlled experiments to determine the efficiency of various types of light but from my observations over many hours of collecting I have come to the conclusion that there is very little difference in the efficiency of the various main types of light source for collecting Neuroptera.

CHRYSOPIDAE Hagen

Three genera are found in Wisconsin; *Meleoma, Chrysopa* and *Eremochrysa.* Bickley and MacLeod (1956:182) have an excellent key for separating these genera.

Genus MELEOMA Fitch

Representatives of this genus are found most abundantly in southwestern United States and Mexico. There are only two species of *Meleoma* in northeastern United States, both of which occur in Wisconsin. In the state they appear to be confined to the northern portion except along Lake Michigan, where, as with a number of northern Wisconsin plants and insects, the range extends sourthward.

Dr. Catherine A. Tauber's (1969) monograph on *Meleoma* is the best and most recent paper on the genus. Keys for the separation of the 22 species found in North America are given on pages 7 to 13.

Table 2. Collecting data of 63 specimens of two species of *Meleoma* collected in Wisconsin.

Species	No. & % of Males	No. & % of Females	No. & % of total caught by light	No. & % of total caught by sweeping
signoretti	8 25%	24 75%	24 75%	8 25%
emuncta	11 38%	20 65%	27 87%	4 13%
Total for both species	19 30%	44 70%	51 81%	12 19%

Fig. 1. The counties of the State of Wisconsin

Table 2 shows that only 19% of the specimens collected were caught by sweeping. This is an indication that the genus in Wisconsin is largely tree inhabiting and not easily reached with a net. Females constituted 70% of the total catch. It is interesting to note that of the 675 specimens of *signoretti* and *emuncta* examined by Tauber, collected in many areas of the United States, Canada and Mexico, 71% were females.

signoretti Fitch. (Fig. 2). July 1 to September 2. This species was described by Fitch (1856:82) from a specimen collected in July near the summit of Mount Antonio, Vermont. It has since been collected, as reported by Tauber (1969) in five provinces of Canada from Quebec and Nova Scotia to British Columbia and in the United States from 15 of the northeastern states from Maine to Wisconsin and south to Virginia and Illinois. Bickley and MacLeod (1956) record it from Minnesota and Tennessee.

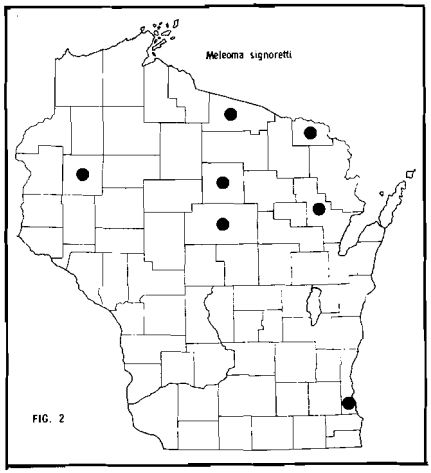


FIG. 2

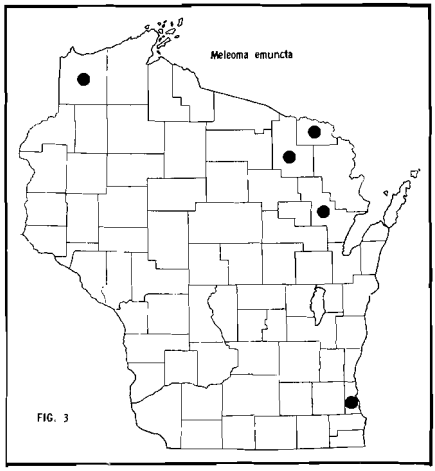


FIG. 3

The Wisconsin specimen recorded by Tauber was collected in Polk County. I have 32 specimens collected in seven counties as indicated in Fig. 2 and three specimens from the Upper Peninsula of Michigan. The male of this species, with its prominent "horn", is a most striking insect when viewed with a dissecting microscope.

emuncta (Fitch). (Fig. 3). July 8 to August 30. This species was described by Fitch (1856) p. 88 as *Chrysopa emuncta.* It is the most widely distributed species of *Meleoma,* recorded by Tauber (1969) from seven provinces of Canada from Quebec and Newfoundland to British Columbia, in the northeastern states from Maine to Wisconsin and southward in the Appalachians to North Carolina, and in the west from Washington to Arizona and Mexico. I have 31 specimens collected in five counties of Wisconsin, two specimens from the Upper and one from the Lower Peninsula of Michigan.

Genus CHRYSOPA Leach

This is by far the best represented genus of the Chrysopidae in Wisconsin. The relationship of the species within the genus is not clear. Smith (1932) breaks the genus into five sections, Bram and Bickley (1963:4) into three groups based on male terminalia, and Dr. Ellis MacLeod (personal communication) speaks of seven groups based on male terminalia, larvae and other characters. Four of the seven groups are represented by Wisconsin species. According to MacLeod's grouping the Wisconsin specimens are as follows:

Perla Group: *nigricornis, oculata, chi, quadripunctata, incompleta* and an undetermined species near *oculata.*

Carnea Group: *carnea, harrisii, rufilabris* and *downesi* if it is found to occur in Wisconsin.

Lineaticornis Group: *lineaticornis.*

Perfecta Group: Undetermined species near *perfecta.*

When Dr. Phillip Adams completes his revision of *Chrysopa* the matter of group or sub-generic relationship will, hopefully, be settled.

It is a rare coincident that the known recognized species of *Chrysopa* in Wisconsin are exactly those found in Maryland and that the key of Bram and Bickley (1963:4) for the *Chrysopa* of Maryland is equally applicable for the Wisconsin species.

Data for specimens of Chrysopa collected in Wisconsin are given in Table 3.

Table 3. Collecting data for 5352 specimens of nine species of *Chrysopa* collected in Wisconsin.

Species	No. & % of Males	No. & % of Females	No. & % of total caught by light	No. & % of total caught by sweeping
nigricornis	93 74%	33 26%	98 78%	28 22%
oculata	920 42%	1273 58%	702 32%	1491 68%
chi	10 37%	17 63%	17 63%	10 37%
quadripunctata	41 51%	39 49%	55 69%	25 31%
incompleta	17 46%	20 54%	0 0%	37 100%
carnea	1267 56%	1004 44%	1429 63%	842 37%
harrisii	61 43%	82 57%	40 28%	103 72%
rufilabris	223 51%	213 49%	293 67%	143 33%
lineaticornis	17 44%	22 56%	16 41%	23 59%
Total for all species	2649 49.5%	2703 50.5%	2650 49.5%	2702 50.5%

nigricornis Burmeister. (Fig. 4). May 27 to October 4. This green lace-wing is widely distributed in the United States. It extends from Maine (Procter, 1927), Massachusetts (Banks, 1903a) and North Carolina (Brimley, 1938) to at least as far west as New Mexico (Banks, 1904), Arizona (Banks, 1903b) and Utah (Knowlton, 1946) and is found in Canada (Smith, 1932). I have collected it in 13 Wisconsin counties and it undoubtedly occurs throughout the state in favorable habitats. It is mainly a tree inhabiting species.

Typically the antennae are black, at least the basal fourth. Rather recently it has been determined that the antennae of certain specimens are not dark. These have in the past been called *erythrocephala* Banks (1898) and *majuscula* Banks (1906) and have now been reduced to synonymy with *nigricornis* by Bram and Bickley (1963).

oculata Say. (Fig. 5). May 9 to October 16. This species is widely distributed. Hagen (1861) reports it from Nova Scotia, Hudson's Bay, Georgia, Louisiana, Washington and other places. Bickley and MacLeod (1956) say it occurs throughout the Nearctic Region. It and *carnea* are the two most abundant species in Wisconsin. I have specimens from all but seven of the 72 counties in the state.

Specimens of this species have been described under numerous specific and varietal names. Observations and investigations by Bickley (1952), Smith (1922) and Ellis MacLeod (personal communication) show conclusively that these numerous names are not valid and should all be reduced to synonymy.

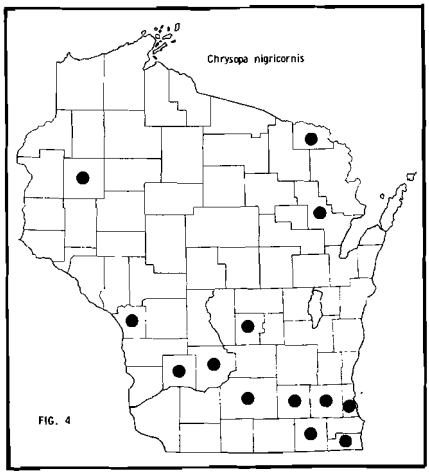


FIG. 4

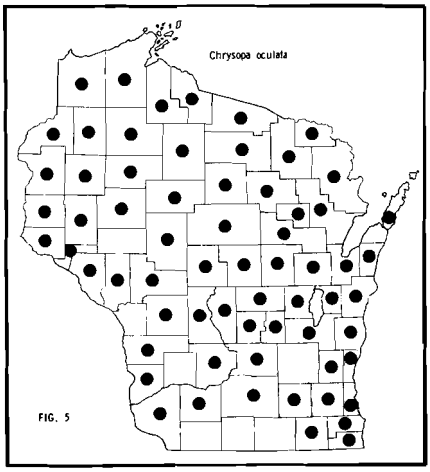


FIG. 5

C. oculata is an open field, roadside and garden inhabiting species and is the one most frequently seen. The adult seasonal distribution, (Fig. 6), is typical of those species overwintering as larvae or prepupa.

chi Fitch. (Fig. 7). June 12 to August 16. This is apparently a northern species. Procter (1927) reports it from Maine, Parfin (1952) from Minnesota, and Bickley and Mac Leod (1956) list it from New Hampshire, New Jersey, Washington, D. C., New York and in Canada from New Brunswick to British Columbia. The species appears to extend southward in the mountains for they also report it from Virginia, Tennessee and California. Banks (1904) records one specimen from New Mexico saying ". . . one specimen from Pecos, June 19th; agrees with eastern specimens throughout."

I have collected *chi* in nine counties but it apparently is not found in southern Wisconsin. *C. chi* appears to be the rarest named species in the state. I have collected only 27 specimens. This species and *lineaticornis* are the two having the shortest period of adult yearly activity in Wisconsin (Fig. 9).

quadripunctata Burmeister. (Fig. 8). May 31 to September 24. Most of the records of *quadripunctata* that I have been able to locate are of specimens collected east of the Rocky Mountains but Knowlton (1946) reports it from Utah and Bickley and Mac Leod (1956) from Vancouver Island. I have 80 Wisconsin specimens from 12 counties. It is primarily a tree and shrub inhabiting species.

The larvae of certain Chrysopids are called "trash-carriers" from their habit of depositing a rather compact pad of aphid skins, plant hairs and other "trash" upon their backs. For details see Smith (1926).

The only true trash-carrier in Wisconsin is *lineaticornis.* However, *quadripunctata* might be termed a partial trash-carrier for, although it does not form a compact pad, it does cover its back loosely with material. It has been claimed that this habit developed as a protection against parasites and predators and this may be true but it seems a little strange that most, if not all, trash-carriers are comparatively rare whereas some of the non-trash-carriers are exceedingly common. At least to the human eye, a mass of aphid skins moving across a leaf or along the bark of a tree, is most conspicuous.

On August 25, 1966 I collected such a larva while sweeping *Quercus.* At 4:45 PM I gave the larva a rose aphid. It seized it with both mandibles, pierced it and starting sucking. As the aphid shrunk in size the larva continued to suck with one mandible and used the other to help move the aphid about so the sucking mandible could get into all the minute cavities of the aphid body. At 4:50 PM it completed sucking and

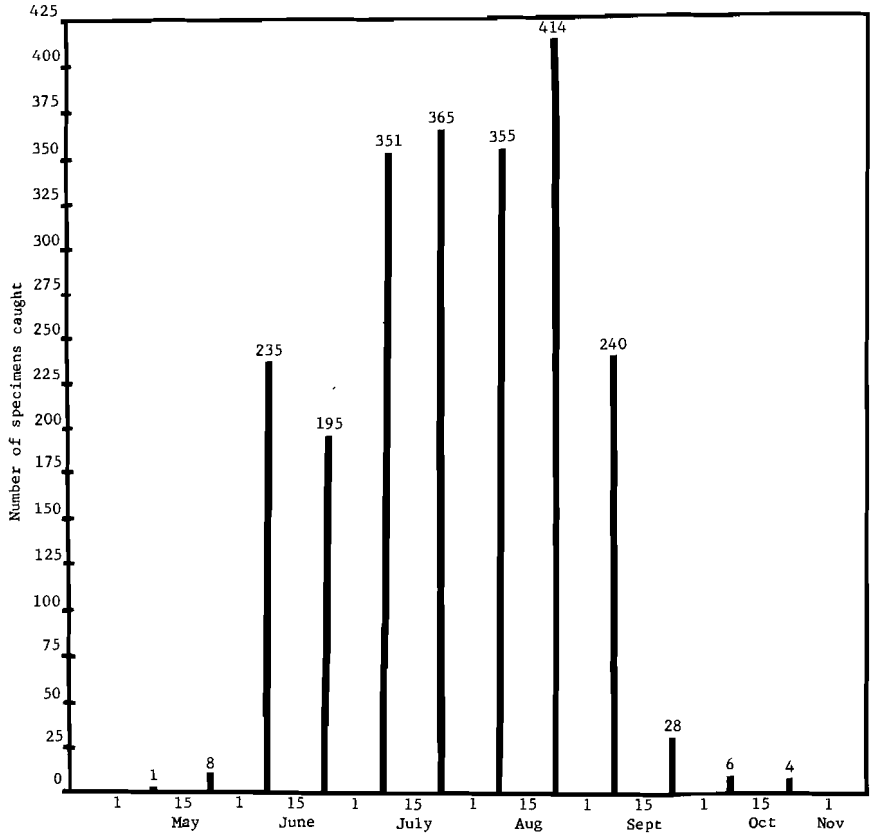
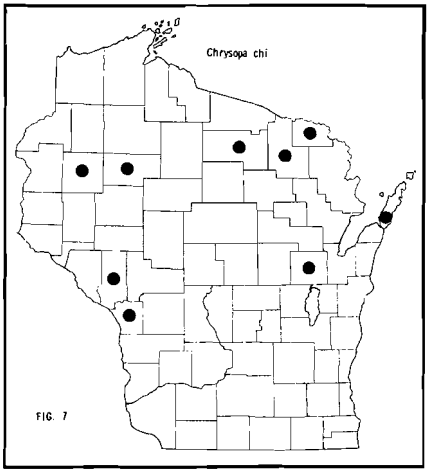
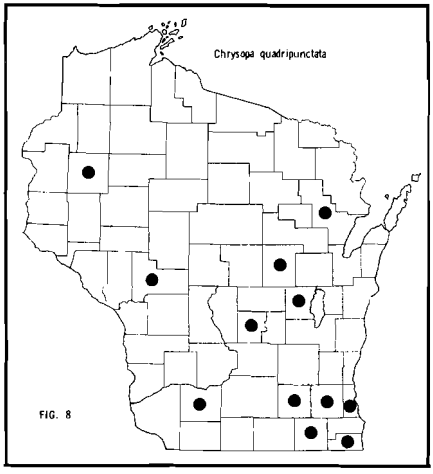


Fig. 6. Seasonal distribution of adult *Chrysopa oculata* Say. Based on 2202 specimens.





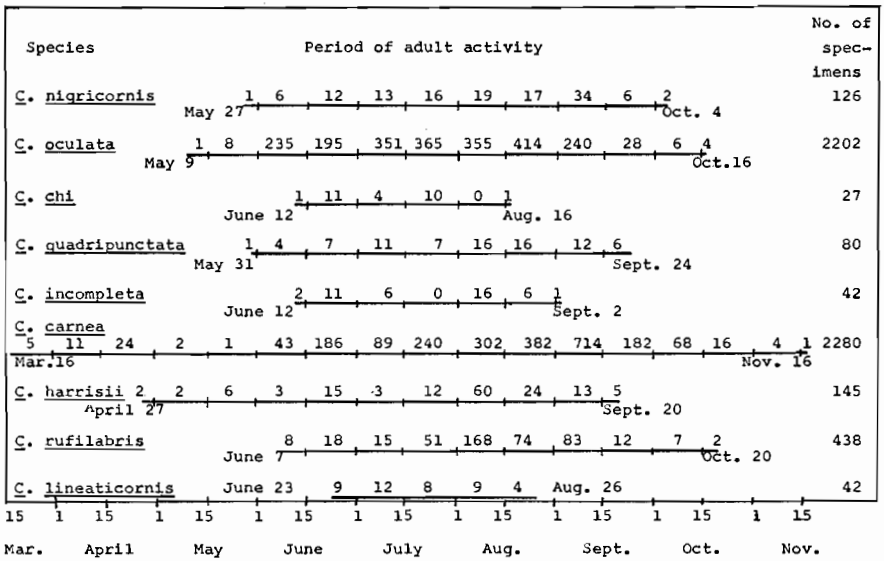


Fig. 9. Period of adult activity of Wisconsin Chrysopids and their relative abundance as indicated by collecting data.

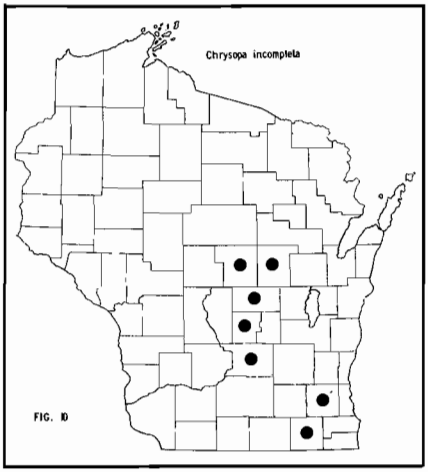
took the empty skin in its mandibles, bent head and thorax up and back and deposited the skin on its back. At 5:05 PM it took another aphid and finished sucking at 5:13 PM. It raised the anterior part of the body up and back as before but this time it also raised the posterior part of the abdomen in order to aid in properly placing the skin.

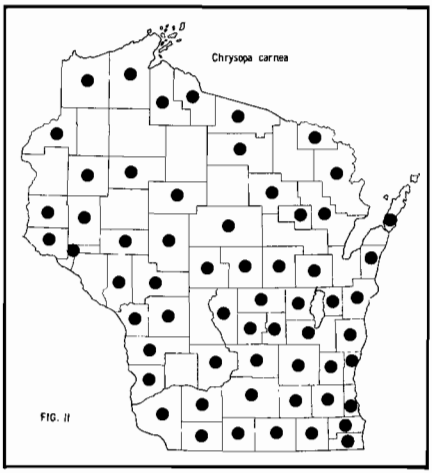
The next morning when I examined it, it was in a corner of a vial between the glass and a rose leaflet and it had taken all the aphid skins off its back and was probing each in turn, apparently trying to extract any juice it had passed up the day before. Could this packet of skins be a reserve cache of food in case a live supply is not found? Or could it serve as a protection against evaporation?

incompleta Banks. (Fig. 10). June 12 to September 2. Bram and Bickley (1963) record this species from Massachusetts, New Jersey, Maryland, Virginia, North Carolina and Georgia. I am indebted to Dr. Phillip A. Adams, California State College at Fullerton for making the determinations of my first specimens collected and of extending the range to include South Carolina and Florida (personal communication).

Since I live so far from the known range of *incompleta*, one might assume that my specimens collected in Wisconsin were accidental arrivals but there are some disjunct coastal plain species of plants in Wisconsin and perhaps *incompleta* followed the same route into the state as did the plants. Regardless of how they first reached Wisconsin the species is well established, for I have collected 42 specimens in seven counties in nine of the years from 1957 to 1969, inclusive. All of my specimens were collected in pine plantations by sweeping *Pinus strobus* L., *P. resinosa* Ait. and *Quercus* spp. All of these plantations were in very sandy areas.

carnea Stephens. (Fig. 11). March 16 to November 16. This species has for years been known under the names *plorabunda* Fitch (1856) and *californica* Coquillett (1890). Tjeder (1960) determined that our specimens are identical with the old world *carnea,* which is the most widely distributed chrysopid in the world occurring throughout Europe, north and south Africa and as far east as India and Formosa Killington (1937). Now most of North America must be included in its range. *C. carnea* is the most common species collected in Wisconsin. I have specimens from 60





of the 72 countries and it undoubtedly occurs statewide. It can be found in open fields and gardens, along roads and railroads, open woodlands and to some extent in broad-leaved forests.

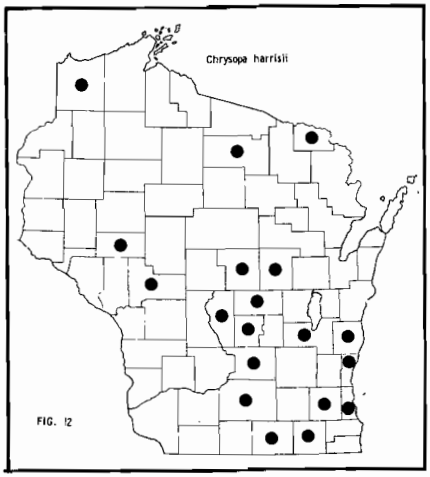
This species overwinters as the adult. This is borne out by the extremely long season of adult activity (Fig. 9) as compared to that of other species in the state. Note that there is a first peak of abundance in the period April 15 to May 1, then a decided dropping off to about June 1 and then an increase to the second peak the first half of September. The peak in April represents the overwintering adults with the generation from eggs starting to appear in June.

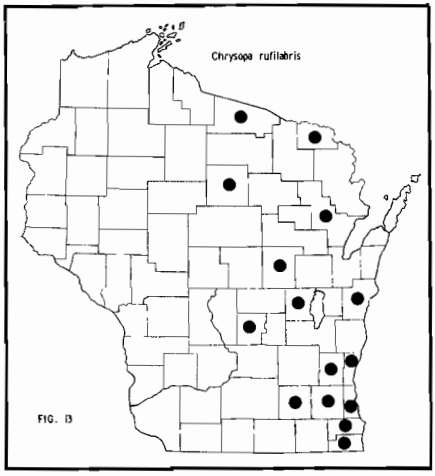
Overwintering adults change color as the days get shorter, becoming pink or pinkish brown. In the spring of the year, when adult diapause is broken with the lengthening day, the green color gradually returns MacLeod (1967), Tauber and Tauber (1969, 1970).

harrisii Fitch. (Fig. 12). April 27 to September 20. This species has been recorded from North Carolina (Brimley, 1938) to Kansas (Smith, 1934), north to Minnesota (Parfin, 1952) and New Hampshire (Banks, 1903a) and many localities in between. Smith (1932) reports it from Ontario to British Columbia and Bickley and MacLeod (1956) record it from Fort Yukon, Alaska. Stroud (1950) records it from White Sands National Monument, New Mexico. This seems an unlikely location for *harrisii* and might upon close examination turn out to be *externa* Hagen which has frequently been confused with *harrisii*.

Chrysopa harrisii seems to be a more northern species found most abundantly on conifers. I have taken the cocoons of this species more commonly than those of any other species. On August 1, 1967 in Waukesha County I collected 28 cocoons in 25 minutes on the needles of *Pinus resinosa* Ait. The yellow or yellowish cocoons are very conspicuous against the dark green needles. I placed each of these cocoons in individual glass vials plugged with cotton. From August 7 to August 14 eight male and eight female *harrisii* emerged. From August 14 to August 26 seven hymenopterous parasites emerged from five cocoons. The remaining cocoons were opened on September 3. Six contained dead *harrisii* larvae and one contained a dead *harrisii* larva and a dead adult hymenopterous parasite. Of the 28 cocoons 16 or approximately 57%, produced living adult *harrisii*.

Smith (1922:1322) in discussing the emergence of the pupa from the cocoon mentions the circular opening in the cocoon and the lid. He raises the question as to whether the larva builds the lid in while spinning the cocoon, the pupal mandibles cut the lid or whether it is torn open by pressure exerted by the pupa. To throw some





light on this question I quote directly from my notes written at the time I opened the cocoons from which nothing had emerged. "I picked the cocoons open with two sharp, thin dissecting needles. In all cases a circular lid easily separated from the cocoon as though a living pupa had emerged. This suggests that it is the larva which is primarily responsible for the ease with which the lid comes off."

rufilabris Burmeister. (Fig. 13). June 7 to October 20. This is a widely distributed species found throughout the United States. It has been recorded from Canada (Bickley and MacLeod, 1956) and from Mexico (Banks, 1901). It is the third most abundant species in Wisconsin. Because of its abundance in the state and its widespread distribution in North America its distribution in Wisconsin is difficult to understand. I have no records of any specimen from the western part of the state. Parfin (1952) records *rufilabris* from only one county in Minnesota. I have collected it in a wide variety of habitats.

On August 14, 1964 I placed a larva of *rufilabris* on a leaf of *Ribes sativum* Syme on which were numerous small green aphids. It immediately caught an aphid in its mandibles and started sucking. I watched it continuously from 12:00 noon until 1:20 PM under a 15 power dissecting scope. In this 80 minute period it caught and completely drained 21 aphids. The average time required to drain an aphid was two minutes, the least one minute and the most slightly over four minutes. Of the 80 minutes, 42 were spent in eating and 38 in resting or searching for aphids. It was apparent that the larva found the aphids by the sense of touch or smell not sight.

On July 22, 1966, having no aphids immediately available, I killed a spider by squeezing the cephalothorax with forceps and put in front of the nearly full grown larva of *rufilabris*. The spider was twice the bulk of the larva which immediately pierced the spider's abdomen. It started to suck the juices at 5:16 PM and by 7:30 PM the spider was greatly shrunken and the larva had finished feeding and had withdrawn its mandibles. Two daya later I put another spider of comparable size with the same *rufilabris* larva at 10:25 AM. It fed continuously until 10:50 AM and then withdrew its mandibles and rested.

This larva fed no more and at 9:00 AM of July 25th started spinning a cocoon which it finished by the next morning. On August 5, 1966 about 8:00 AM the adult emerged.

Frequently, when no other food was available, I have fed *Chrysopa* larvae the larvae of the Goldenrod Ball Gall with success.

lineaticornis Fitch. (Fig. 14). June 23 to August 26. Bickley and MacLeod (1956) record this species from Quebec, New York, Maryland, Virginia, North Carolina, Tennessee

and Michigan and Banks (1903a) records it from Massachusetts and New Hampshire. I have collected six specimens from Edmonson County, Kentucky, two from Baxter County, Arkansas, and 42 from Wisconsin. The latter two states show a westward extension of the former reported range.

C. lineaticornis is largely a tree inhabiting species. It has the shortest period of adult activity of any species of green lace-wing in Wisconsin. It is the only true trash-carrying chrysopid in the state.

Bram and Bickley (1963) have considered *columbiana* Banks as a synonym of *lineaticornis.*

UNDESCRIBED SPECIES OF CHRYSOPA

I am indebeted to Dr. Ellis G. MacLeod for determining that a puzzling specimen of mine belongs to an undescribed species. In a letter dated April 1, 1968 he says, "Specimen #1374B is a female of an undescribed species closely related to *C. oculata.* Both Phil Adams and myself have seen this species from several areas in the east of the U.S. and from as far west as Utah. Your specimen is the first Wisconsin record of which I am aware. This is a particularly interesting little species since it is actually quite common in some localities and has been completely overlooked by all of the workers on the Neuroptera up to now. Although closely similar to *C. oculata* it is consistently different in having large *dark brownish* spots on the clypeus, which are always lacking in *C. oculata* (although, of course, the lateral margins of the clypeus are margined in *C. oculata*). The chromosomes of the new species also differ from those of *C. oculata,* as do the larval stages which I reared a few years ago."

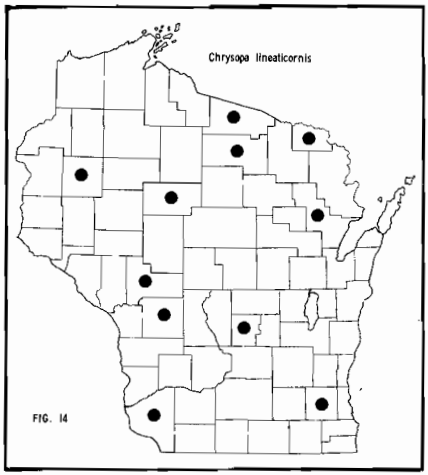
Another series of puzzling specimens that I sent to Dr. MacLeod he determined as specimens of either an undescribed species or of an exotic introduced into the United States. He found it in 1962 in Maryland and later from a number of places in the eastern states. He is investigating the status of this species, which is near *C. perfecta* Banks. I am sure that Dr. MacLeod or Dr. Adams or both in collaboration will soon publish on the status of these species which are new to Wisconsin and to the United States.

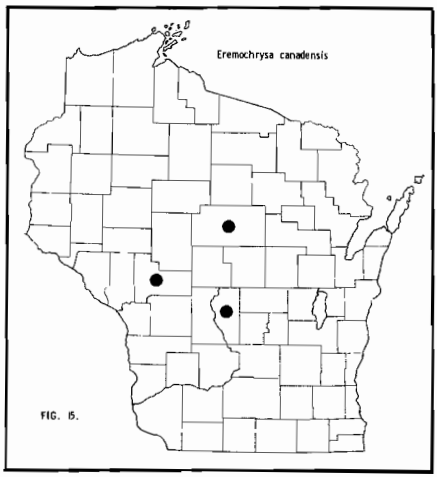
The collection data for my specimen of the undescribed species near *C. oculata* Say are as follows: #1374B female, collected 6-VII-1966 in T16N,R10E,S6 Marquette County, Wisconsin. It was caught while sweeping *Pinus strobus* and *P. resinosa* in a pine plantation in a sandy area.

The collection data for my specimens of the undescribed species near *C. perfecta* Banks are as follows: #429 male, collected 8-VII-1957 in Adams County, Wisconsin; Roche a Cri Roadside Park while sweeping *Quercus* sp. at the base of a moist sandstone bluff. #699 female, collected 28-VII-1958 in Iowa County, Wisconsin; Tower Hill State Park while sweeping vegetation in a hardwoods edge habitat. #1070L female, collected 23-VIII-1959 in T16N,R10E,S6 Marquette Co., Wisconsin; in 100 watt light trap in open vegetated area in a sandy *Pinus strobus, P. resinosa* plantation. #1448E female, collected 23-VI-1967 in Waukasha Co., Wisconsin; Eagle while sweeping *Quercus* spp. and *Pinus* spp. in a sandy pine plantation. #1457B female, collected 12-VII-1967 in Waukesha Co., Wisconsin; North Prairie while sweeping *Quercus* spp. and *Juniperus virginiana* L. All of the above specimens were collected by A. L. Throne.

HYPOTHETICAL SPECIES

I have never found *Chrysopa downesi* Smith in Wisconsin but I strongly suspect that it occurs in the northern part of the state. It is a species very close to *carnea.* The two species are very difficult to tell apart in pinned specimens; even the male terminalia are of little help. Live specimens are more easily recognized because of the intense dark green coloration of *downesi* as contrasted to the much lighter green of *carnea. C. downesi* appears to be always associated with coniferous trees, whereas *carnea* seldom is. Overwintering *carnea* change color as preciously mentioned but *downesi* never change color.





Genus **EREMOCHRYSA** Banks

Most of the species of this genus are found in southwestern United States. It is the rarest genus of Chrysopidae in Wisconsin, there being but one species and that seldom found. The best keys for separating the species of *Eremochrysa* are those in Banks (1950:52-53, 59-60).

canadensis Banks. (Fig. 15). July 8 to July 26. The type locality for this species is Go Home Bay, Lake Huron, Ontario (Banks, 1911). It has also been recorded from Maine, New Hampshire and Massachusetts (Bickley and MacLeod 1956). I find no other localities listed for this species. No specimen of this genus has ever been recorded from Wisconsin so this report extends the known range considerably to the west. I have taken 23 specimens of *canadensis* from three counties and consider this species rare enough to give the collecting data.

Adams County, Roche a Cri Roadside Park about one-half mile north of Friendship on State Highway 13. On July 8, 1957 I caught four males and thirteen females. All were at rest in the shade on a bare, vertical, moist sandstone bluff. Some were caught with forceps and others with a net after they flew when disturbed. Twelve were captured about 3:30 PM and five about 7:30 PM. About 8:00 AM, July 9, 1957, I took three more males and one female at the same place.

Marathon County, Rib Hill State Park near Wausau. During the evening of July 9, 1957 I caught one female at the summit of Rib Hill on the bare quartsite outcrop. It was attracted by the light of a gasoline lantern.

Jackson County, Castle Mounds Roadside Park just south of Black River Falls. During the evening of July 26, 1957 one female was attracted to a gasoline lantern at the base of a bare sandstone bluff.

I have collected at the latter two locales several times and at Roche a Cri many times since 1957 looking for *canadensis* without finding another specimen. I suspect the species may still be found in the state but to get rare specimens one must collect at the right spot at the right time and often the right spot and time are very restricted in extent.

Banks (1950) on pages 60 and 64 suggests the similarity of *E. canadensis* and *E. hageni* Banks. On page 66 he lists as *candensis* the specimen which Procter caught in Maine and called *hageni* (Procter, 1927). Also Dr. Ellis G. MacLeod suggested to me (personal communication) that *canadensis* appears to be a synonym of *hageni.* Perhaps on further study this will prove to be true.

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