

Chromosome Cytology, Reproductive Behavior, and Ecology
of the Insect Family Chrysopidae
Ellis G. MacLeod
Department of Entomology
University of Illinois
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It had been originally intended to study both the chromosome cytology and the reproductive behavior of several of the poorly known, montane species of the insect family Chrysopidae at the Station during the summer of 1969. The first of these undertakings worked out rather well, but several unanticipated problems arose in connection with the study of the reproductive behavior which made the immediate results of this portion of the study somewhat less satisfactory. In addition to these areas of investigation, a successful effort was made to secure, through rearings, larval-adult associations and such items of ecological information as the habitat distributions of the different species and, through a microscopic study of gut contents, of their food specificities. Living representatives of all species encountered were shipped to my laboratory at the University of Illinois and additional, experimental studies of these species are now in progress.

SUMMARY OF RESULTS

Cytology - A total of six species, representing the genera Chrysopa (4 species), Chrysopiella (1 species), and Eremochrysa (1 species) were secured and analyzed cytologically. The species, with their karyotypes and sex-determining system, are summarized in Table I.

TABLE I - Chromosome Cytology of Species Studied

Species	Karyotype	Sex Determination
<u>Chrysopa oculata</u>	2n = 12 (10R + 2J)*	X:Y (X > Y)
<u>C. pleuralis</u>	2n = 12 (10R + 2J)	X:Y (X > Y)
<u>C. excepta</u>	2n = 12 (12R)	X:Y (X = Y)
<u>C. coloradensis</u>	2n = 10 (8R + 2V)	X:Y (X = Y)
<u>Chrysopiella</u> n. sp.	2n = 12 (12R)	X:Y (X > Y)
<u>Eremochrysa punctinervis</u>	2n = 12 (12R)	X:Y (X = Y)

*The abbreviations used for chromosome shapes are: R = Chromosome rod-shaped (acrokinetic) at anaphase, with a near-terminal kinetochore;
J = Chromosome J-shaped at anaphase, with a subterminal kinetochore;
V = Chromosome V-shaped at anaphase (metakinetic) with a median kinetochore.

By itself this information is of slight intrinsic worth, however, the light that is shed on several evolutionary problems within the family is considerable. Specifically, the pair of species C. excepta - C. coloradensis has been suspected of being simply a case of simple geographic variation, with populations in the Rocky Mt., Wind River, and Teton ranges having the "coloradensis" characteristics, while populations at lower elevations in the sagebrush areas show the "excepta" characters. This view seemed reasonable since the apparent morphological differences between these two forms appeared slight. Quite obviously the differences in the number and kinetochore position of the chromosomes in this pair of species is quite profound and indicates that in spite of their superficial similarities they are not only most certainly separate species but that they are probably not even very closely related.

A similar suspicion has been entertained about the pair C. oculata - C. pleuralis and here their identical karyotypes provide no insight into their taxonomic status. In the course of the work during the summer, however, it was found that both species occurred sympatrically in the sage flats of Jackson Hole without the presence of intermediates and that the larvae of the two forms are quite different in appearance. Subsequent work this fall has shown that these two species fail to mate with each other under laboratory conditions, whereas intraspecific pairs mate and produce fertile offspring with ease under the same conditions. Thus, it is very likely that two well-isolated species are presented here. Under these circumstances the identity of their karyotypes is of even more interest since they both differ from several close relatives, found in other portions of the United States, which have 12 acrokinetic chromosomes. Since in addition to their other similarities both C. oculata and C. pleuralis have a pair of J-shaped chromosomes, the presumption is very strong that they share a common ancestry and that one of the early steps in the evolution of the present two species was probably a structural reorganization of one pair of chromosomes in their common ancestor.

It is likely that similar insights will eventually be possible in the genera Chrysopiella and Eremochrysa. At the present time too few species of these groups are known cytologically for any comparisons to be meaningful. The chromosome data pertaining to these six species will be integrated with information pertaining to 35 additional species which have been recently studied to provide an overview of the basic pattern of chromosomal evolution which has occurred in this family of insects.

Reproductive behavior - The reproductive behavior of chrysopids can be studied only by using virgin males and females, since when females are once mated they will remate only after a very long period of time. As most field-collected females have already mated, it is necessary to rear virgin adults in the lab. Ordinarily this is no problem and 2-3 weeks is usually sufficient time to produce the adults for observation; however, it was found that the nighttime temperatures in the laboratory rooms of the Station were so low that development was greatly slowed down. The installation of a space heater in the lab building in August did lessen this problem, but by that time insufficient time remained in which to

carry out this aspect of the study at Jackson Hole. In addition, it was found that one of the species, Chrysopiella n. sp., spontaneously entered a state of suspended development (diapause, somewhat analogous to mammalian hibernation) at the end of its larval stage, so that it would not have been possible to study the courtship of this species even if the lab temperatures had been higher. Although this rearing program did not immediately succeed in providing adults for study, it did make available the associations between larvae and adults which are a necessary first step in order to identify field-collected larvae and, ultimately, to learn the ecological associations of the larval stages.

As noted above, all of the species encountered this past summer have been successfully colonized in my laboratory and with one of my graduate students their reproductive behavior is now under study.

Ecological studies - Observations made in connection with searches for adults indicate, in a preliminary way, the likely ecological situations with which the different species are associated. Thus of the species listed in Table I, all are apparently confined to the lower elevation communities of Jackson Hole proper as none were encountered elsewhere. In addition, all but Chrysopa pleuralis and C. oculata were taken only on the glacial outwash communities in association with either Artemisia or Chrysothamnus. C. pleuralis was encountered on a number of small shrubs along the side of the smaller streams and in open glades in wooded areas. C. oculata was encountered in both of these situations.

Dissection of these field-collected adults and study of their gut contents revealed additional ecological specializations. Thus the four species of Chrysopa under study were obviously predaceous, feeding on a number of species of aphids. In contrast, the species of Chrysopiella and Eremochrysa had only masses of pollen in their digestive tracts. The whole question of the food requirements and specificities of adult chrysopids is very poorly understood and even these limited observations are of considerable value.

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