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CHROMOSOME STUDY IN MALES OF NEARCTIC SPECIES OF *GERRIS* FABRICIUS AND *LIMNOPORUS* STÅL (HEMIPTERA: HETEROPTERA: GERRIDAE)

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Abstract.—Chromosome study of males of some Nearctic species of Gerridae of the genera *Gerris* and *Limnoporus* reveals that contrary to what has been reported for Palearctic species, the mechanism of sex determination varies among subgroups. Consistently absent are m chromosomes, and kinetochore activity is restricted to the terminal ends of chromosomes during meiosis.

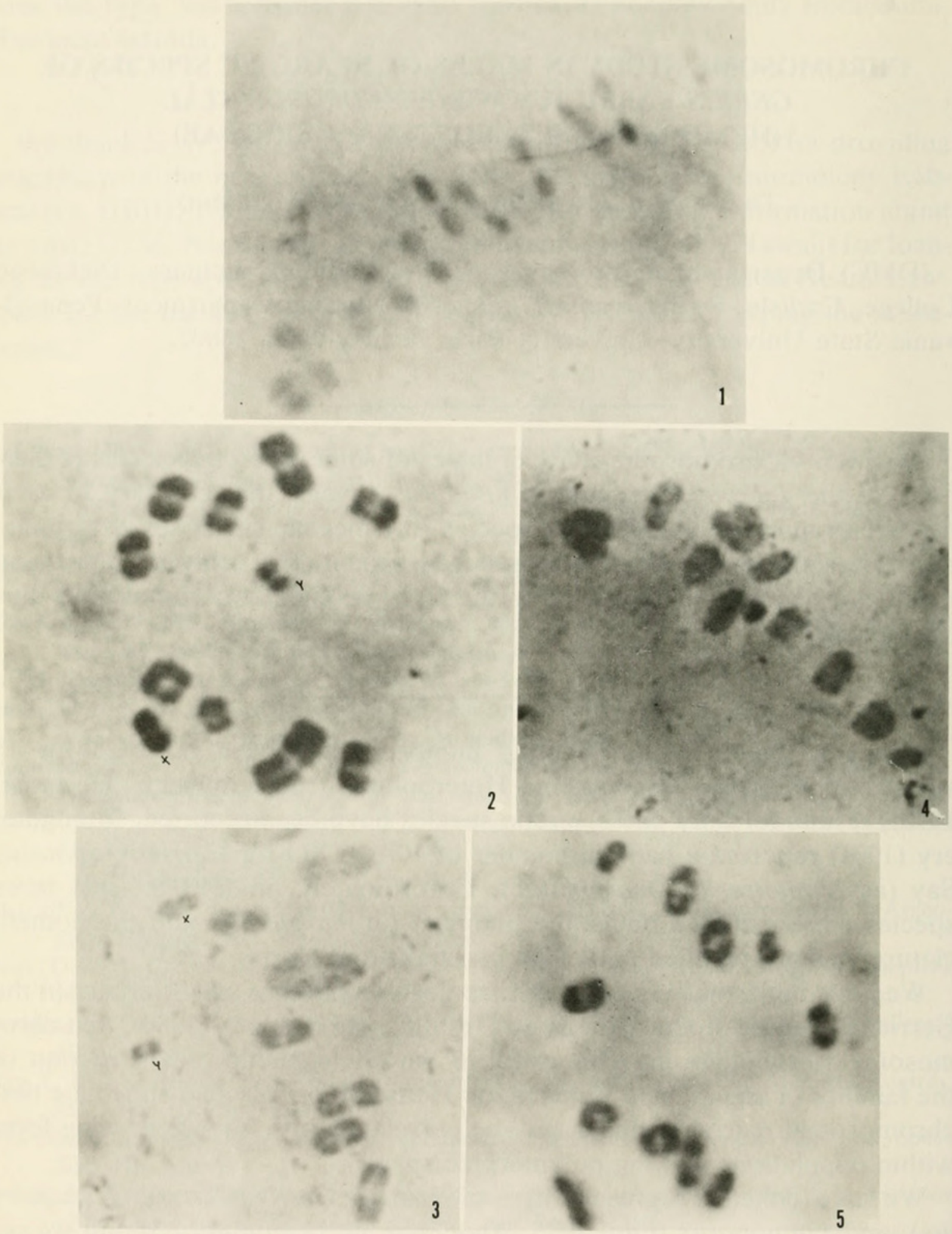
Although diploid and/or haploid numbers have been reported for 15 species of Gerridae (Hemiptera: Heteroptera) (see summary, Ueshima, 1979), results for only one Nearctic species have been reported. Montgomery (1901) reported a haploid number of 10A + XO for *Gerris marginatus* Say (as *Limnotrechus marginatus*). Unfortunately, in 1901 at least three species were included under the binomen *G. marginatus* and the nomenclature was not clarified until 1934 by Drake and Harris.

We have undertaken a study of chromosome number and structure in the Gerridae because we believe, as do Ueshima and Ashlock (1980), that chromosome morphology may be useful in the phylogenetic reconstruction of the families of aquatic and semiaquatic Heteroptera. We also anticipate that chromosomal rearrangements may be correlated with change in wing form within populations of wing polymorphic species.

We have looked at representatives of Nearctic *Gerris* (*Gerris*), *G.* (*Aquarius*), and *Limnoporus* (until 1975, Andersen, *G.* (*Limnoporus*)) and we report here our results for these groups. We compare the results to those that have been reported for Palearctic species of the same genera and subgenera.

MATERIALS AND METHODS

Gerris (*A.*) *remigis* (Say) was collected at Aguirre Springs, N.M., *G.* (*G.*) *buenoi* Kirkaldy and *L. dissortis* Drake and Harris were collected near



Figs. 1–5. Metaphase I, photographed at ca. 6400×. 1, *Gerris* (*Aquarius*) *remigis*, early metaphase I. 2, *G.* (*Gerris*) *alacris*. 3, *G.* (*G.*) *comatus*. 4, *G.* (*G.*) *buenoi*. 5, *Limnoporus dissortis*.

Minneapolis, Minn., *G.* (*G.*) *alacris* Hussey and *G.* (*G.*) *comatus* Drake and Hottes were collected at Presque Isle State Park, Pa., and *G.* (*G.*) *marginatus* and *G.* (*G.*) *insperatus* Drake and Hottes were collected in Washington, D.C. All species were lab-reared under a 14L:10D photoperiod using techniques that have been described elsewhere (Calabrese, 1974, 1979). Spermatogenic (meiotic) tissue was obtained from males approximately 24 hours after they had molted to the fifth instar. Such males, we discovered, showed the greatest number of metaphase I figures.

Testes were fixed (15 ml glacial acetic acid, 45 ml absolute ethanol, 5 ml acetone) for 2–3 minutes. Each testis was divided and each follicle placed on a slide with a drop of lacto-proprio orcein stain for at least 3–5 minutes. A standard squash was made. Slides were sealed in temporary mounts and scanned for figures at 40×. Numerous preparations were made and scanned for each species. Metaphase I figures were photographed at about 6400× under oil on a Zeiss compound microscope with a Wetzler large format camera attachment.

Results

All results were consistent for the minimum of five representatives examined per species.

Gerris (*Aquarius*) *remigis* (Fig. 1) exhibits a diploid number of 22, and the male is XO.

Four of the *Gerris* species examined exhibit an XY sex determination mechanism in the male and a diploid number of 20 (Figs. 2, 3; *G. insperatus* and *G. marginatus* not shown). However, *G.* (*G.*) *buenoi,* although it exhibits a diploid number of 20, shows an XO sex determination mechanism (Fig. 4).

Limnoporus dissortis exhibits a diploid number of 22 and what appears to be a XO, sex determination mechanism in the male (Fig. 5).

No m chromosomes are visible in any of the species studied (Figs. 1–5; *G. insperatus* and *G. marginatus* not shown). Kinetochores are restricted to the ends of meiotic chromosomes in all species studied (examples, Figs. 1–5).

Discussion

Ueshima (1979) suggested that the Gerridae do not have m chromosomes and that kinetochores are found only at the terminals of chromosomes during meiosis. The results of our studies to date support those suggestions. However, we do not agree with Ueshima (1979) that the XO system is the universal mode of sex determination among the Gerridae. In four of the *Gerris* (*Gerris*) species we studied the male is heterogametic, but it shows an XY system. In one *G.* (*Gerris*) species (*G. buenoi*) and in *G.* (*Aquarius*)

remigis and *Limnoporus dissortis* the mode of sex determination appears to be XO, male heterogametic. It is notable that in a reanalysis of the cytogenetics of *G. (Aquarius) paludum*, a Palearctic species, (Takenouchi and Muramoto, 1968) it has been shown that the sex determination mechanism is XY and not XO as had been reported earlier (Wilke, 1913).

The results of the study to date suggest that there is no consistency within genera and subgenera in terms of sex determination mechanism. Differences in chromosome morphology and the cytogenetic characters discussed herein may prove to be useful characters in a further test of the existing phylogenetic reconstruction for the Gerridae (Calabrese, 1980), when more species are studied (compare Figs. 1–5).

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