Odonatologica 11(4): 323-329 . *December 1, 1982*

CYTOLOGICAL NOTES ON FIVE DRAGONFLY SPECIES FROM URUGUAY

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Received April 1, 1982/Accepted April 12, 1982

Notes on karyotype morphology are given and micrographs are provided of the following 5 spp. from Uruguay, South America, 3 of which (asterisked) have not been previously examined cytologically: Coenagrionidae: *Ischnura fluviatilis* Sel. (n ♂ = 14, *m*?); Libellulidae: *Perithemis mooma* Kirby (n ♂ = 13, *m*), *Erythrodiplax atroterminata* Ris* (2n ♀ = 26), *E. chromoptera* Borror* (n ♂ = 11, *m*), and *E. nigricans* (Ramb.)* (n ♂ = 13, *m*).

INTRODUCTION

Since the karyological studies on neotropical dragonflies carried out by CUMMING (1964), a series of reports have enriched the cytotaxonomic data of neotropical Odonata of nearly 200 taxa (CRUDEN, 1968; KIAUTA, 1970, 1972a, 1972c, 1979b; KIAUTA & BOYES, 1972; KIAUTA & VAN BRINK, 1978; FERREIRA et al., 1979).

The present paper describes the cytological characteristics of five species from Uruguay, viz.*Ischnura fluviatilis* Sel. (Coenagrionidae) and, *Perithemis mooma* Kirby, *Erythrodiplax atroterminata* Ris, *E. chromoptera* Borror and *E. nigricans* (Ramb.) (all Libellulidae). Save for a brief preliminary note (GOÑI & DE ABENANTE, 1981), the *Erythrodiplax* species are new to cytology.

MATERIAL AND METHODS

The specimens were identified by the second author; they are deposited in the collection of the Departamento de Artrópodos, Facultad de Humanidades y Ciencias, Montevideo, Uruguay.

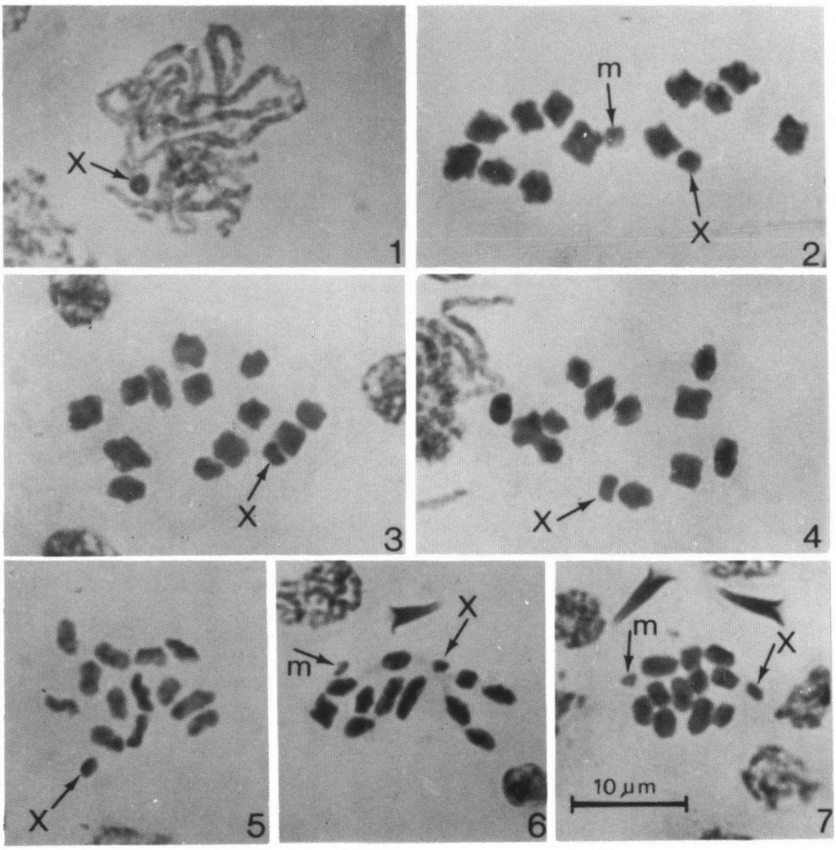
The gonads were fixed in the field in alcohol-acetic acid (3:1). The cytological preparations were made by lacto-acetic-orcein squash technique, after softening the material in 60% acetic acid.

DESCRIPTIONS AND DISCUSSIONS OF THE KARYOTYPES

ISCHNURA FLUVIATILIS SELYS, 1876
Figures 1-5

Material.— 3♂, Uruguay, Cancela, 82 km E of the City of Salto, March 21, 1981;— 3♂ Cuareim River, Artigas, March 22, 1981.

At metaphase I there are 14 elements (Figs 2-4). The X, and a bivalent nearly equal in size, are the smallest of the complement. The latter only exhibits *m*--chromosome behavior in some nuclei (Fig. 2). At pachytene, a small positively heteropycnotic element represents the X-chromosome (Fig. 1) which can easily be distinguished from the autosomes at metaphase II (Fig. 5).



Figs 1-7. Male germ cell chromosomes of *Ischnura fluviatilis* Selys (Figs 1-5), and *Perithemis mooma* Kirby (Figs 6-7): (1) *I. fluviatilis*, pachytene, —(2-4) metaphase I;—(6) *P. mooma*, prometaphase I,—(7) metaphase I.

Among the twelve n=14 *Ischnura* species so far cytologically examined (for review cf. KIAUTA, 1972 b; 1980) the presence of the *m*-chromosome has only been described in *I. ramburi* (Sel.) (KIAUTA & VAN BRINK, 1978), *I. pumilio* (Charp.) (KIAUTA, 1979 a), and in some populations of *I. senegalensis* (Ramb.) (KIAUTA & KIAUTA, 1980). KIAUTA & KIAUTA (1980) have argued that the occurrence and variation of the relative size of the *m*-chromosome in *I. senegalensis* represents an adaptive feature in this species. No *m*-bivalent has been reported in *I. fluviatilis* by CUMMING (1964) in material from Bolivia. In the three Uruguayan specimens examined here, there is no strong evidence for the presence of an *m*-chromosome in *I. fluviatilis*. Consequently, until further evidence will become available, we prefer to indicate it as "*m* (?)".

PERITHEMIS MOOMA KIRBY, 1889

Figures 6-7

Material. — 2♂, Uruguay, Cancela, 82 km E of the City of Salto, March 21, 1981.

n ♂=13. The primary spermatocyte shows 13 elements of gradually decreasing magnitude, save for the minute *m*-bivalent and the X, which is the second smallest of the set at metaphase I (Figs 6-7). The karyotype is identical to that recorded by CUMMING (1964) from Bolivia, and by FERREIRA et al. (1979) from São Paulo, Brazil.

ERYTHRODIPLAX ATROTERMINATA RIS, 1911

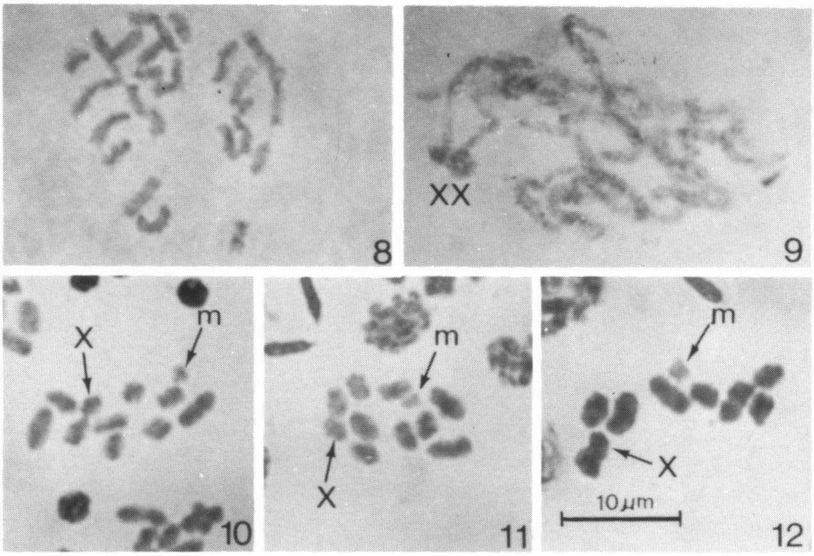
Figures 8-9

Material. — 1♀, Uruguay, Cancela, 82 km E of the City of Salto, March 21, 1981.

2 n ♀= 26. At oogonial metaphase the chromosomes are of gradually decreasing magnitude (Fig. 8). In the few oogonial methaphases examined, neither the X-pair nor the *m*-pair could be discerned.

A positively heteropycnotic sex-bivalent, attached to two chromosomes, was observed in some pachytene figures (Fig. 9). As apparent from this figure, the X is of medium size. This uncommon allocyclic behavior of the sex chromosome at early oogenesis stages was previously reported in *E. media* Borror (KIAUTA & BOYES, 1972), and in the coenagrionid *Enallagma cyathigerum* (Charp.) and in the corduliid, *Cordulia aenea* (L.) (KIAUTA, 1969).

According to KIAUTA & BOYES (1972) "a modification in the recombination index of *E. atroterminata*" could be expected. They based this speculation on the study of the cytophylogeny of *Erythrodiplax* in general and on that of the connata section of Borror's group in particular. This is not confirmed here, since the ♀ diploid number of *E. atroterminata* is 26, hence 13 elements could be expected during meiosis; this being the basic chromosome number of the family (KIAUTA, 1969, 1972 b).



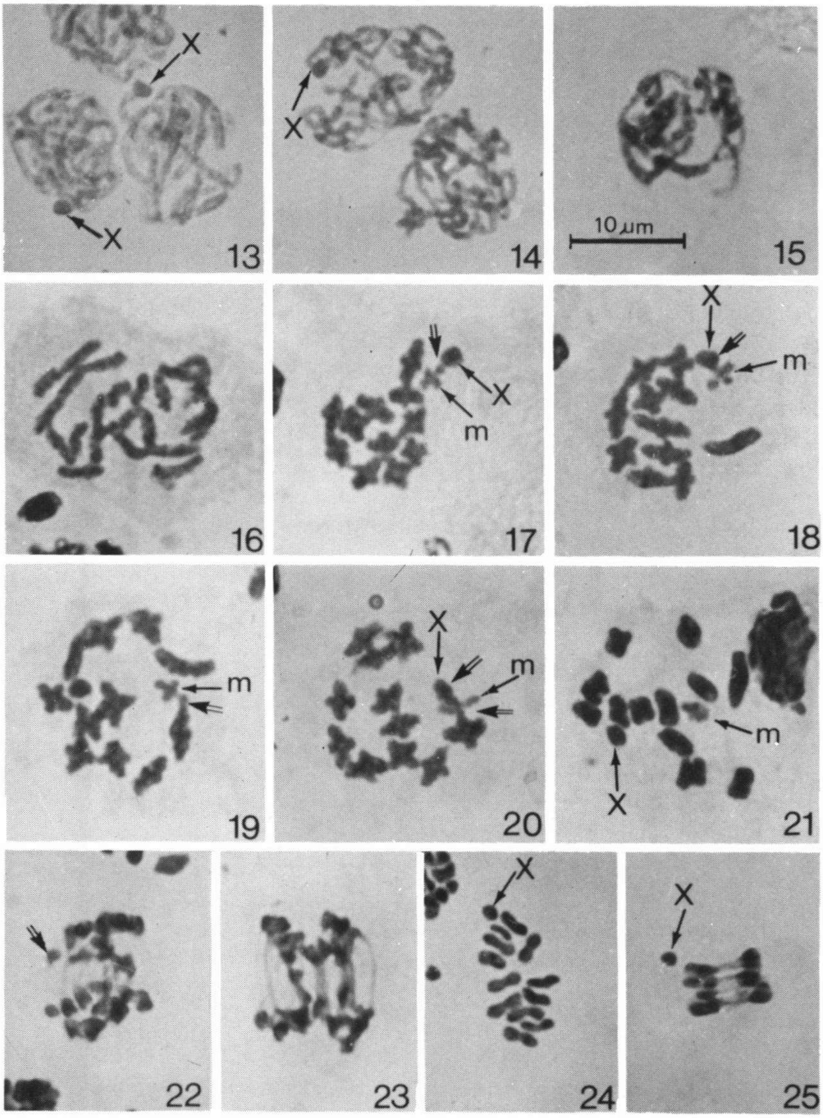
Figs 8-12. (8-9) *Erythrodiplax atroterminata* Ris: (8) oogonial metaphase,—(9) oocyte pachytene with positively heteropycnotic sex-bivalent;—(10-12) Primary spermatocyte complements of *E. chromoptera* Borror: (10-11) prometaphase I;—(12) metaphase I.

ERYTHRODIPLAX CHROMOPTERA BORROR, 1942
Figures 10-12

Material. — 1♂, Uruguay, the City of Artigas, the Cuareim River, March 22, 1981

n ♂= 11. In primary spermatocyte metaphase two bivalents are distinctly larger than the others (Figs 10-12). A medium-sized X element and a smaller *m*-bivalent, nearly half the size of the X, are seen at metaphase I.

This species has not been previously studied cytologically, and it shares with *E. media* Borror the smallest chromosome number of the genus (cf. KIAUTA, 1972 b). In the latter, there are 22 and 11 elements at the spermatogonial and primary spermatocyte metaphase respectively, as has been demonstrated in material from Bolivia (CUMMING, 1964) and from São Paulo, Brazil (KIAUTA & BOYES, 1972; FERREIRA et al., 1979). In view of the two large bivalents at metaphase I, the origin of the reduced chromosome number in *E. chromoptera* is probably due to the fusion of four pairs of the original karyotype.



Figs 13-25. Meiosis of *Erythrodiplax nigricans* (Rambur): (13-14) early pachytene;—(15) late pachytene;—(16) diplotene;—(17-20) diakinesis or early metaphase I (note the *m*-X, *m*-autosome and X-*m*-autosome associations by the arrow);—(21) metaphase I;—(22) anaphase I, the sex element dividing is indicated by an arrow;—(23) early telophase I, where some lagging chromosomes are observed;—(24) metaphase II;—(25) anaphase II.

ERYTHRODIPLAX NIGRICANS (RAMBUR, 1842)
Figures 13-25

Material. — 3♂, Uruguay, Montevideo, Malvin, March, 1981

n ♂= 13. The metaphase-I elements are of gradually decreasing magnitude. The *m*-bivalent is small (but not minute, while the X element is the second smallest chromosome of the complement.

At early pachytene (Figs 13-14), the sex element appears as a positively heteropycnotic body. It is oval-shaped and usually attaches to one of the autosomes. It becomes isopvcnotic at late pachytene (Fig. 15) and diplotene (Fig. 16). In the subsequent stages (Figs 17-25) it is recognizable from autosomes by its shape and precocious segregation.

The *m*-bivalent is negatively heterochromatic at diakinesis (Figs 17-20) and metaphase I (Fig. 21). At diakinesis it usually shows one interstitial chiasma and it associates terminally with the X chromosome (Figs 17-18), with one of the autosomes (Fig. 19), or with both (Fig. 20).

ACKNOWLEDGEMENTS

We wish to thank Lic. DELMIRA AMOEDO and Lic. LORELEY A. DE GAMBARDELLA for help in the fieldcollecting, and Lic. EKATERINA S. DE VAIO for cirtical reading of the manuscript.

REFERENCES

CRUDEN, R.W., 1968. Chromosome numbers of some North American dragonflies (Odonata). *Can.J.Genet.Cytol.* 10(1): 200-214.

CUMMING, R.B., 1964. *Cytogenetic studies in the order Odonata.* PhD thesis, Univ.Texas,Austin. (Univ. Microfilms, Ann Arbor, No. 64-11, 789).

FERREIRA, A., B. KIAUTA & A. ZAHA, 1979. Male chromosome complements of thirty-two Brazilian dragonflies. *Odonatologica* 8(1): 5-22.

GONI, B. & Y.P. DE ABENANTE, 1981. Estudio cromosomico de cinco especies de odonatos del Uruguay. *Res.Com.Jornades Cienc.nat., Montevideo* 2: 47-48.

KIAUTA, B., 1969. Sex chromosomes and sex determining mechanisms in Odonata, with a review of the cytological conditions in the family Gomphidae, and references to the karyotypic evolution in the order. *Genetica* 40(2): 127-157, pls 1-8.

KIAUTA, B., 1970. The chromosome numbers of four neotropic dragonflies from Mexico (Odonata). *Chrom.Inf.Serv., Tokyo* 11: 8-9.

KIAUTA, B., 1972a. The karyotype of the damselfly, Leptagrion macrurum (Burmeister, 1839), and its possible origin, with a note on the cytotaxonomic affinities of the genus (Zygoptera: Coenagrionidae). *Odonatologica* 1(1): 31-35.

KIAUTA, B., 1972b. Synopsis of the main cytotaxonomic data in the order Odonata. *Odonatologica* 1(2): 73-102.

KIAUTA, B., 1972c. Notes on new or little known dragonfly karyotypes. I. The germ cell chromosomes of three Latin American species, Argia funebris (Hagen), Megapodagrion contortum (Selys) (Zygoptera: Coenagrionidae, Megapodagrionidae) and Castoraeschna castor (Brauer) (Anisoptera: Aeshnidae). *Genen Phaenen* 15(1): 23-26.

KIAUTA, B., 1979a. The karyotype of Ischnura pumilio (Charp.) (Zygoptera: Coenagrionidae). *Notul. Odonatol.* 1(3): 47-48.

KIAUTA, B., 1979b. The karyotypes of some Anisoptera from Surinam. *Odonatologica* 8(4): 267-283.

KIAUTA, B. & J.W. BOYES, 1972. Cytology of ten South American Libellulidae, with cytophylogenetic considerations on the genera Orthemis Hagen and Erythrodiplax Brauer (Odonata, Anisoptera). *Genetica* 43(3): 403-421.

KIAUTA, B. & J.M. VAN BRINK, 1978. Male chromosome complements of some Florida dragonflies, United States. *Odonatologica* 7(1): 15-25.

KIAUTA, B. & M.A.J.E. KIAUTA, 1980. On a small collection of dragonfly karyotypes from the Philippines. *Odonatologica* 9(3): 237-245.