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SHORT COMMUNICATION

OCCURRENCE OF LOCALIZED CENTROMERES IN LEPIDOPTERA CHROMOSOMES*

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ABSTRACT

Chromosome numbers in twenty-three adult males of *Heliconius erato* (Lepidoptera; Nymphalidae) belonging to three populations from Rio Grande do Sul and one from Rio Grande do Norte were all $2n = 42$. Analysis of spermatogonial meiotic and mitotic metaphases revealed the presence of localized centromeres, confirming two previous reports for other species and showing that, in contrast to what is generally accepted, Lepidoptera chromosomes are not always holocentric.

INTRODUCTION

The Lepidoptera are an important taxonomic group, with more than 200 thousand species, some of them already studied cytologically. Several

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authors have reported on the extremely reduced size and spherical shape of the chromosomes of these insects, providing evidence for their holocentric nature (Barry *et al.*, 1967; Bauer, 1967; Suomalainen, 1969; Murakami and Imai, 1974; White, 1978). The chromosome numbers of Lepidoptera vary from $n = 7$ to $n = 220$, $n = 31$ being the most frequent and characteristic of the Nymphalidae family. However, *Heliconius erato* (Nymphalidae), according to previous reports, has $n = 21$ (Suomalainen, 1969; De Lesse, 1970a,b; De Lesse and Brown, 1971; White, 1973). According to Mohanty and Nayak (1980), there seems to be a trend towards evolution of lower chromosome numbers in some Lepidoptera groups. No detailed report about the morphology of *H. erato* chromosomes, however, is known to us.

The present study describes the chromosome number of four different *Heliconius erato* populations and the presence of localized centromeres in the chromosomes of this species.

MATERIAL AND METHODS

Information about the twenty-three individuals from the four different populations is given in Table I.

The testes of adult males were pre-treated with hypotonic solution for 15 minutes, fixed in 3:1 methanol-acetic acid for at least 24 hours, squashed and stained with 65% acetic-lactic orcein.

Chromosome number and morphology were analyzed from meiotic and mitotic spermatogonial metaphases.

RESULTS AND DISCUSSION

Results are shown in Table I. All the individuals examined had $n = 21$ ($2n = 42$), confirming previous reports (Suomalainen, 1969; De Lesse, 1970a,b; De Lesse and Brown, 1971; White, 1973). No difference in chromosome number was detected among the populations.

Meiotic pairing was regular, with 21 bivalents at metaphase I. As shown in Figure 1, localized centromeres are clearly seen in some meiotic configurations (Figure 1A) and in mitotic metaphases (Figure 1B). These results show that *Heliconius erato* chromosomes are not holocentric and that the centromere position varies among different chromosomes. Our data do not agree with most references in the literature, reporting holocentric and very small isodiametric chromosomes in Lepidoptera (Barry *et al.*, 1967; Bauer, 1967; Suomalainen, 1969; Murakami and Imai, 1974; White, 1978).

Table I - List of the individuals analyzed with their respective chromosome number.

Place of origin	Individual number	Date of collection	Number of cells studied		Chromosome number (n)
			meiosis	mitosis	
Guaíba, RS	GUA - 50	Aug. 25, 1982	3	5	21
	GUA - 213	Aug. 25, 1982	2	2	21
	GUA - 214	Aug. 25, 1982	6	1	21
	GUA - 216	Aug. 25, 1982	5	1	21
	GUA - 220	Aug. 25, 1982	3	1	21
	GUA - 223	Aug. 25, 1982	5	3	21
	GUA - 226	Aug. 25, 1982	7	1	21
Porto Alegre, RS	IPH - 8	July 27, 1982	2	1	21
	IPH - 9	July 27, 1982	2	-	21
	IPH - 11	July 27, 1982	3	2	21
	IPH - 13	July 27, 1982	3	2	21
	IPH - 15	Aug. 31, 1982	6	4	21
	IPH - 17	Aug. 31, 1982	9	2	21
	IPH - 18	Aug. 31, 1982	5	5	21
	IPH - 19	Aug. 31, 1982	4	5	21
	IPH - 20	Aug. 31, 1982	4	3	21
Tenente Portela, RS	TUR - 3	Oct. 5, 1982	11	-	21
	TUR - 4	Oct. 5, 1982	8	2	21
	TUR - 7	Oct. 5, 1982	8	2	21
	TUR - 8	Oct. 5, 1982	5	2	21
	TUR - 9	Oct. 5, 1982	8	1	21
Natal, RN	NA - 2	July 25, 1982	1	6	21
	NA - 4	July 25, 1982	4	1	21

However, Bigger (1976) detected clear primary constrictions in mitotic chromosomes using colchicine and G-banding techniques. Rishi and Rishi (1979) observed localized centromeres and morphological differentiation in *Trabala vishnu* chromosomes, also using colchicine.

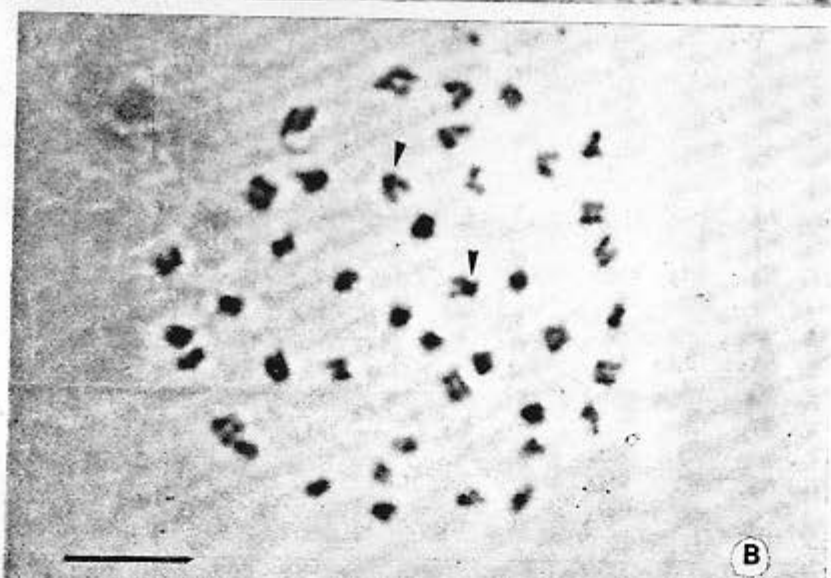
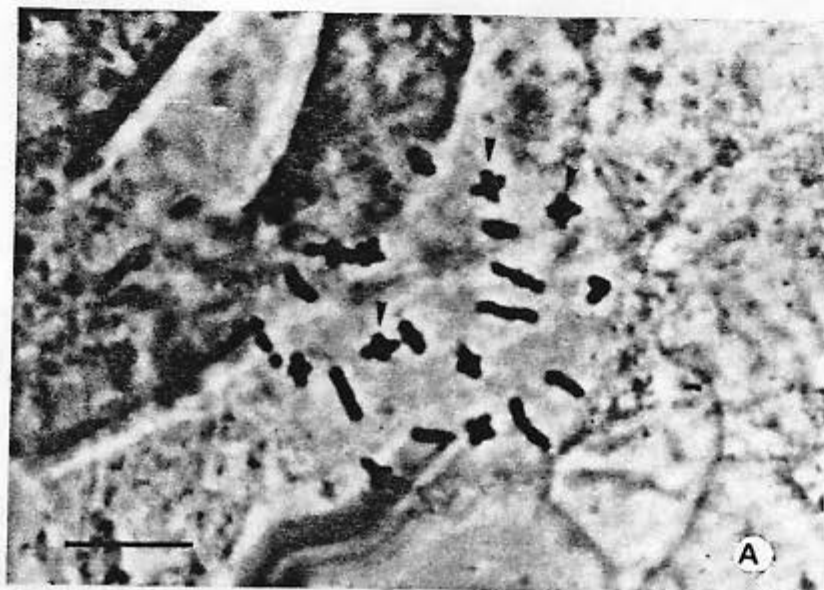


Figure 1 - A, Meiotic metaphase I, $n = 21$; arrows point to clearly localized centromeres; B, Mitotic metaphase, $2n = 42$; most of the chromatids have already separated but some of the chromosomes still show a clear attachment of the chromatids to a localized centromere (arrows). Scale equal to $10 \mu\text{m}$.

These discordant data clearly show that more detailed studies on Lepidoptera chromosomes, especially designed to determine their holocentric or non-holocentric nature, are needed.

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RESUMO

O número cromossômico de vinte e três machos adultos de *Heliconius erato* (Lepidoptera; Nymphalidae), pertencentes a três populações do Rio Grande do Sul e uma do Rio Grande do Norte, foi sempre $2n = 42$. O exame das metáfases meióticas e mitóticas espermatozoniais revelou a presença de centrômeros localizados, confirmando duas observações anteriores em outras espécies e mostrando que, ao contrário do geralmente aceito, nem sempre os cromossomos de Lepidoptera são holocêntricos.

REFERENCES

- Barry, B.D., Guthrie, W.D. and Dollinger, E.J. (1967). Evidence of a diffuse centromere in the European cornborer, *Ostrinia nubilalis* (Lepidoptera; Pyralidae). *Ann. Entomol. Soc. Am.* 60: 487-488.
- Bauer, H. (1967). Die Kinetische Organisation der Lepidopteren Chromosomen. *Chromosoma* 22: 101-125.
- Bigger, T.R.L. (1976). Karyotypes of three species of Lepidoptera including an investigation of B-chromosomes in *Pieris*. *Cytologia* 41: 261-282.
- De Lesse, H. (1970a). Les nombres de chromosomes chez les lépidoptères rhopalocères en Amérique Centrale et Colombie. *Ann. Soc. Ent. France* 6: 347-358.
- De Lesse, H. (1970b). Formules chromosomiques de quelques lépidoptères rhopalocères de Guyane. *Ann. Soc. Ent. France* 6: 849-855.
- De Lesse, H. and Brown Jr., K.S. (1971). Formules chromosomiques de lépidoptères rhopalocères du Brésil. *Bull. Soc. Ent. France* 76: 131-137.
- Mohanty, P.K. and Nayak, B. (1980). Karyology of three Indian lasiocampid moths (Lepidoptera). *J. Res. Lepid.* 19: 227-229.

- Murakami, A. and Imai, H.T. (1974). Cytological evidence for holocentric chromosomes of the silkworms *Bombyx mori* and *B. mandarina* (Bombycidae; Lepidoptera). *Chromosoma* 47:167-178.
- Rishi, S. and Rishi, K.K. (1979). Chromosomal analysis of *Trabala vishnu* (Lasiocampidae) with clear indication of localized centromeres. *Cytobios* 24:33-42.
- Suomalainen, E. (1969). Chromosome evolution in Lepidoptera. *Chromosomes Today* 2:132-138.
- White, M.J.D. (1973). *Animal Cytology and Evolution*. Cambridge University Press, Cambridge.
- White, M.J.D. (1978). *Modes of Speciation*. W.H. Freeman & Co., San Francisco.

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BRIEF COMMUNICATION

EXCLUSIVENESS OF LOCALIZED CENTROMERES IN LEPIDOPTERA CHROMOSOMES

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SHYAM LAL, JAMES C. MCNEIL, and JOHN MCNEIL, JR.

ABSTRACT

Chromosome studies in twenty-one species of butterflies and eleven species of moths belonging to seven suborders from the suborder of the order have been undertaken. These were all to test the validity of the hypothesis that all chromosomes of lepidopteran insects are holocentric. The results of these studies indicate that the hypothesis is incorrect. The studies indicate that the chromosomes of lepidopteran insects are not holocentric. The studies indicate that the chromosomes of lepidopteran insects are not holocentric.

INTRODUCTION

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