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Chromosomes of *Aphidius ervi* HALIDAY, 1834

(Hymenoptera: Braconidae)

With 5 figures and 2 tables

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Summary

Chromosome numbers of n=5 and 2n=10 were found in a few laboratory strains of *Aphidius ervi* HALIDAY, 1834 from Germany. However, several females having 2n=12 were detected in one of the populations studied. These females are likely to represent a thelytokous strain originating from an initially arrhenotokous one. The karyotype with 2n=12 has a characteristic additional pair of fully heterochromatic acrocentric chromosomes.

Zusammenfassung

Die Chromosomenanalyse einiger Laborlinien von *Aphidius ervi* HALIDAY, 1834 aus Deutschland ergab n=5 und 2n=10. Allerdings wurden bei einigen weiblichen Tieren einer Population Chromosomensätze mit 2n=12 gefunden. Diese Tiere repräsentieren wahrscheinlich eine thelytoke Linie, die aus einer ursprünglich arrhenotoken Population hervorging. Der Karyotyp mit 2n=12 enthält ein zusätzliches charakteristisches Paar vollständig heterochromatischer akrozentrischer Chromosomen.

Резюме

В нескольких лабораторных линиях наездника *Aphidius ervi* HALIDAY, 1834 из Германии обнаружено n=5 и 2n=10, однако в одной из популяций найдены самки, имеющие 2n=12. Эти самки, очевидно, составляют телитокическую линию, возникшую внутри исходной арренотокической популяции. Кариотип с 2n=12 содержит характерную дополнительную пару полностью гетерохроматиновых акроцентрических хромосом.

Keywords

Chromosomes, *Aphidius ervi*, Hymenoptera: Braconidae

Introduction

Chromosomes of about twenty species of the braconid subfamily Aphidiinae including a few members of the genus *Aphidius* NEES, 1819 have been studied up to now (GOKHMAN & QUICKE, 1995; QUICKE & BELSHAW, 1999; GOKHMAN, 2000). For *Aphidius ervi*

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HALIDAY, 1834 a haploid number n=5 has been found (QUICKE & BELSHAW, 1999). However, our analysis of laboratory strains of *A. ervi* from Germany revealed several chromosome numbers including 2n=12 (GOKHMAN, 2002). Results of this study are given below.

Material and methods

Laboratory cultures of *A. ervi* used were maintained in 1998-2001 at the University of Bayreuth, Germany, on *Acyrtosiphon pisum* HARRIS, 1776 (Homoptera, Aphididae) and originated from insects collected in natural populations at Seybothenreuth (10 km E Bayreuth). Air-dried chromosome preparations were made from prepupae of parasitic wasps according to the routine procedure described by IMAI et al. (1988). Differential chromosome staining (C-banding) was performed using the method developed by SUMNER (1972) and modified by GOKHMAN (1997). For chromosome measurements diploid metaphase plates were scanned directly from the preparations using an optic microscope fitted with a TV camera connected to a personal computer equipped with the image analysis program ImageExpert, version 1.0. Scanned images were measured using Adobe Photoshop, version 4.3.

Abbreviations used: M- metacentric, SM- submetacentric, A- acrocentric, NFn- haploid arm number, NF- diploid arm number.

Results

Among the studied individuals of *A. ervi*, n=5 (4M+1SM); NFn=10 and 2n=10 (8M+2SM); NF=20 have been found in most males and females respectively (Tab. 1). These karyotypes include three comparatively large metacentrics followed by a smaller submetacentric and another metacentric chromosome (Tab. 2, Figs 1, 2). However, three females examined in 1998 showed 2n=12 (8M+2SM+2A); NF= 22 (Tab. 1). In addition to the chromosomes characteristic of most individuals with 2n=10, females with 2n=12 appeared to have a pair of small acrocentrics (Tab. 2, Fig. 3). Nevertheless, a thorough study of available adult specimens from different strains revealed no morphological differences between them. C-banding demonstrated that most chromosomes contained only small heterochromatic segments, except for the pair of acrocentrics in the karyotype with 2n=12. These chromosomes were fully heterochromatic and usually occupied a peripheral position within the dividing nucleus (Figs 4, 5).

Tab. 1: Numbers of studied individuals of *Aphidius ervi*

Year / Chr. Number	1998	2000	2001
n=5	5	3	1
2n=10	6	2	1
2n=6	3	-	-

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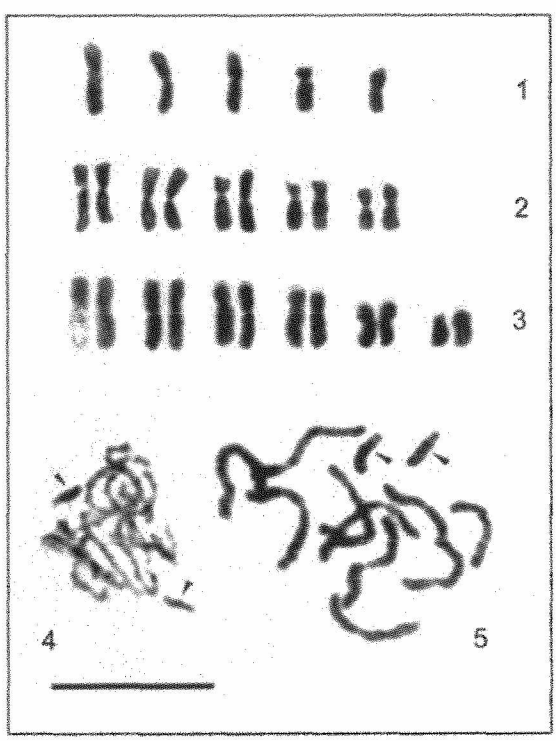
Tab. 2: Chromosomal parameters of diploid karyotypes of *Aphidius ervi*: Relative length (RL), (RL* - last pair of chromosomes excluded) and centromeric index (CI)

Chr. no.	form with 2n=10		form with 2n=12		
	RL	CI	RL*	RL	CI
1	24.08±0.52	45.04±2.27	23.78±0.67	21.52±0.65	46.32±2.65
2	21.79±0.81	47.61±2.12	22.21±0.52	20.11±0.49	47.11±2.66
3	21.60±0.79	41.68±2.56	21.28±1.26	19.26±1.15	42.14±5.00
4	17.31±1.15	30.71±3.04	17.10±0.82	15.48±0.77	29.41±4.53
5	15.22±0.98	46.79±1.82	15.63±0.39	14.15±0.35	45.01±3.27
6	-	-	-	9.48±0.72	0.00±0.00



Figs 1-5. Chromosomes of *Aphidius ervi*. **1** - form with 2n=10, haploid karyogram; **2** - ditto, diploid karyogram; **3** - form with 2n=12, diploid karyogram; **4** - ditto, C-banded prophase; **5** - ditto, prometaphase. Acrocentrics on Figs 4 and 5 are indicated with arrowheads. Scale bar equals 10 μm.

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Discussion

Judging from an increased variation of certain structural characteristics (Tab. 2), diploid karyotypes of *A. ervi* apparently bear some rearrangements (see GOKHMAN, 1998). Nevertheless, the morphometric analysis indicates that these chromosome sets are virtually identical except for the last pair of acrocentric chromosomes in individuals with 2n=12. Some features of these elements (e.g. comparatively small size, positive heteropycnosis and specific behaviour during mitosis) are similar to those characteristic of many B chromosomes found in insects and other animals (WHITE, 1973; WERREN et al., 1988). However, acrocentrics from the karyotype with 2n=12 differ from B chromosomes by the absence of detected numerical variation within individuals. Moreover, neither females with 2n= 11 nor males with n=6 have been found.

Since too few studied specimens showed deviant chromosome numbers (2n=12), the possibility of contamination of the initial culture with a foreign species cannot be fully excluded. However, karyotypes of the Aphidiinae are very diverse in terms of their chromosome numbers and morphology. Specifically, n=3, 5, 6, and 7 has been found in several members of the genus *Aphidius* (GOKHMAN, 2000). It seems extremely unlikely that two separate species which develop on the same host could have very similar chromosome sets. Therefore it is more probable that the wasps having 2n=12 represent a separate thelytokous strain originating from the initial arrhenotokous one with n=5 and 2n=10. This view is further supported by the fact that the origin of „asexual" (= thelytokous) forms has been observed in various members of the Aphidiinae including in the genus *Aphidius* (BELSHAW et al., 1999). If this explanation is true, C-positive acrocentrics in *A. ervi* could bear a specific factor which causes thelytoky in insects with 2n=12.

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