CHROMOSOMES OF TWO PARASITIC WASPS OF THE FAMILY ENCYRTIDAE (HYMENOPTERA: CHALCIDOIDEA)

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Key words: chromosomes, parasitic wasps, Encyrtidae

Abstract: Karyotypes of two Encyrtidae species are studied for the first time. A karyotype with $2n = 22$ was found in *Anagyrus orbitalis* and $n = 9$ is reported for *Mira mucora*. Published data on the chromosome number of another *Anagyrus* species (*Anagyrus lopezi*) are discussed.

INTRODUCTION

Encyrtidae is one of the largest families in the superfamily Chalcidoidea and comprise about 3735 recognized species in 460 genera (Noyes, 2003). Most species are parasitoids of scale insects (Coccoidea) and various Encyrtidae species are successfully used in biological control programs of these pests (Guerrieri & Noyes, 2000). Despite the large number of species and their importance, only few species were investigated cytogenetically. Karyological data are known for seven species in three genera: four species of *Copidosoma*, two species of *Ageniaspis* and one species of *Anagyrus* (Gokhman & Quicke, 1995; Andrade-Souza *et al.,* 2002; Gokhman 2004a; Guerrieri & Noyes, 2005). Published data on chromosome number of *Copidosoma* species are somewhat conflicting and this was recently discussed by Guerrieri & Noyes (2005).

Encyrtidae have a haploid chromosomes number ranging from 8 to 11, and this do not agree with the frequently supposed close relationship between this family and Eupelmidae what have $n = 5$ (Gokhman & Quicke, 1995). In order to provide additional information on the karyotype of members of Encyrtidae, two species from the subfamily Tetracneminae were investigated: *Anagyrus orbitalis* (Ruschka, 1923) and *Mira mucora* Shellenberg, 1803.

MATERIAL AND METHOD

Adult females used in this study were collected in Romania in the Botanical Garden of Iaşi using a sweep net (*Mira mucora*) or obtained from mealy bugs (Pseudococcidae) on grasses collected at Agigea Maritime Dunes Natural Reserve (*Anagyrus orbitalis*). Air dried preparations were obtained from the ovaries of adult females as suggested by Gokhman & Quicke (1995) using the technique of Imai *et al.* (1988). Chromosomes were paired using the position of the centromere and chromosome size. The species were identified by the author; voucher specimens are preserved in author’s collection at “Al. I. Cuza” University of Iaşi.

RESULTS AND DISCUSSIONS

Family **Encyrtidae** Walker

Subfamily **Tetracneminae** Howard

Anagyrus orbitalis (Ruschka, 1923). $2n = 22$ (2SM + 6ST + 14A), NF = 30. The karyotype of this species consists of 11 pair of chromosomes that gradually decrease in length. All chromosomes in the karyotype excepting chromosome 9 belong to two categories: subtelocentric and acrocentric. Chromosome 9 is submetacentric; chromosomes 1, 6, and 8 are subtelocentric, while chromosomes 2, 3, 4, 5, 7, 10 and 11 are acrocentric (Figure 1a, b).

Mira mucora Shellenberg, 1803. $n = 9$. Only meiotic chromosomes were observed in this species. Nine open bivalents of similar size are observed, each of them with a single terminal chiasma (Figure 1c).

The only published data on the karyotype of a Tetracneminae species are those of van Dijken (1991) who reports 10 chromosomes for the male and 20 chromosomes for the female of *Anagyrus lopezi* (De Santis, 1964). These data were derived from a study on the primary sex ratio and chromosome preparations were made from embryonated eggs using an acetic orceine squash method (not very suitable to determine exact chromosome morphology). In the photographs of metaphasic plates provided by van Dijken (1991) it is possible to count 11 chromosomes in the male mitotic plate ($n = 11$). In the female mitotic plate 21 chromosomes are clearly counted, but

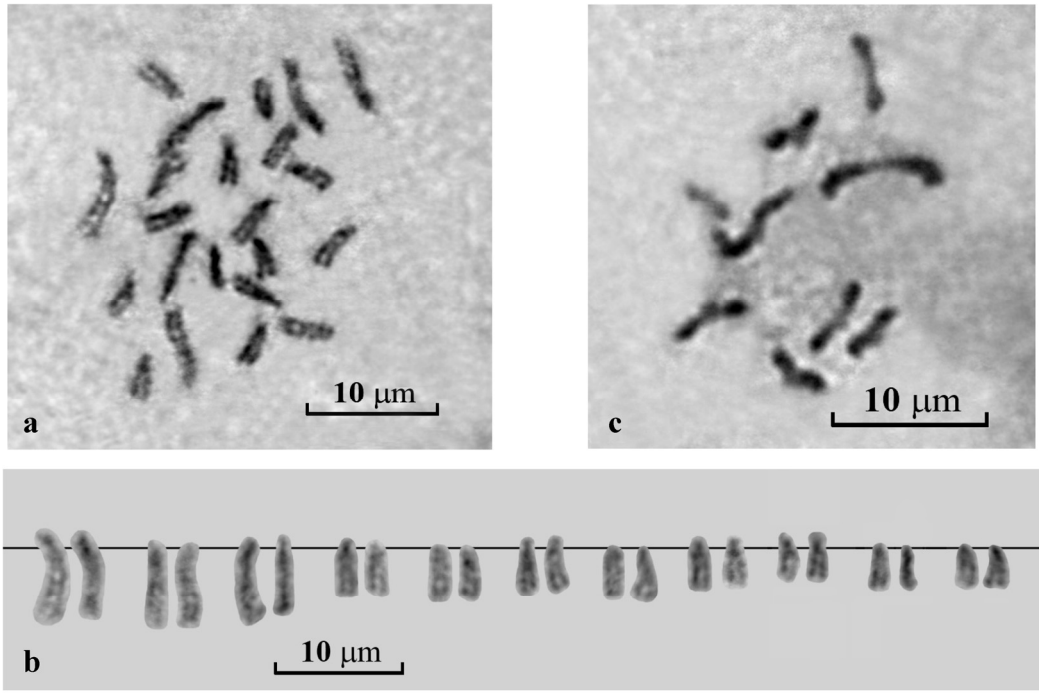

Figure 1. a, b – mitotic metaphasic plate and karyotype in *Anagyrus orbitalis*; c –diakinesis in *Mira mucora*

because many chromosomes are partially overlapping it is safe to assume that there are in fact 22 chromosomes. If it is to count only 20 chromosomes, one large metacentric element cannot be paired. So it is likely that *A. lopezi* has $n = 11$ as *A. orbitalis*, but a new cytogenetical analysis of this species is needed to establish the exact chromosome number.

Available information on the karyotype of Encyrtidae (based on two genera in the subfamily Encyrtinae – *Copidosoma* and *Ageniaspis* and two genera in the subfamily Tetracneminae – *Anagyrus* and *Mira*) show that members of this family have a high chromosome number with $n = 8 – 12$.

The most frequent chromosome numbers in members of Chalcidoidea are $n = 5 – 6$, but higher chromosome numbers ($n = 8 – 12$) were found in Mymaridae, Eurytomidae, some Aphelinidae and Encyrtidae. All investigated members of Platygastroidea have $n = 10$ (Gokhman, 2004b) and high chromosome numbers in Chalcidoidea are interpreted as a plesiomorphic character state by outgroup comparison (Gokhman & Quicke, 1995; Gokhman, 2000). For Mymaridae and Eurytomidae this is a very realistic hypothesis, as Mymaridae are possibly sister group to other Chalcidoidea (Gibson, 1986; Gibson, Heraty & Woolley, 1999) and Eurytomidae are a basal family (Zerova, 1995) of the "pteromalid" lineage, but this character state is more difficult to interpret in Encyrtidae. Encyrtidae could form a clade with Tanaostigmatidae and Eupelmidae or at least with Tanaostigmatidae, Neanastatinae and Calosotinae based at least on possible autapomorphies in mesonotum structure (Gibson, 1989). As Eupelmidae have a small chromosome number with $n = 5$ (Gokhman & Quicke, 1995;

Gokhman, 2002), the karyotype with high chromosome numbers in Encyrtidae could be in fact secondary derived by multiple centric fissions.

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