New Chromosome Records for the Superfamily Chalcidoidea (Hymenoptera)

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Summary Karyotypes of five species of parasitic wasps of the superfamily Chalcidoidea, namely: Eurytoma flavimana Boheman (Eurytomidae; 2n=20), Perilampus rushkai Hellén (Perilampidae; 2n=6), Ormyrus graciosus (Foerster) (Ormyridae; 2n=10), Megastigmus pictus (Foerster) (2n=10) and Megastigmus strobilobius Ratzeburg (Torymidae; n=5 and 2n=10) are studied for the first time, including first chromosome records for the family Perilampidae and subfamily Megastigminae (Torymidae). 2n=12 is confirmed in the previously studied Ormyrus sp. Phylogenetic and taxonomic implications of the new chromosomal data are discussed.

Key words Hymenoptera, Chalcidoidea, chromosomes, karyotypes.

The superfamily Chalcidoidea is one of the largest and most diverse groups of parasitic Hymenoptera. Specifically, there are more than 19 thousand described species of this superfamily in the world fauna (Grissell and Schauff 1997). Among various methods used in taxonomic analysis of the Chalcidoidea, chromosomal research begins to play an important role (Gokhman 2002). However, chromosomes of only about 130 chalcid species belonging to 12 families are studied up to now (Gokhman 2003, 2004). Recently I have examined karyotypes of a few species of the Chalcidoidea belonging to groups poorly touched by chromosomal investigation. The results of this work are given below.

Materials and methods

Adult females of parasitic wasps were collected in the Moscow (Botanical Garden, Moscow State University, Moscow, and Ozhigovo, 60 km SW Moscow) and Volgograd regions (the Pichouga River, 30 km NE Volgograd) of Russia in 2001–2004. All species were collected by beating. Chromosome preparations were obtained from ovaries according to the standard technique for studying chromosomes in adult parasitic wasps (Gokhman and Quicke 1995). Cell divisions were studied and photographed using the optic microscope Zeiss Axioskop 40 FL fitted with the digital camera AxioCam MRc. To obtain karyograms, the resulting images were processed with the image analysis program AxioVision version 3.1 and Adobe Photoshop version 6.0. Mitotic chromosomes were classified in four groups (metacentric (M), submetacentric (SM), subtelocentric (ST) and acrocentric (A)) according to the works by Levan et al. (1964) and Imai et al. (1977); meiotic ones—according to the monograph by Darlington (1965). Arm numbers (NF) were also calculated. Parasitic wasps were identified by the author, the identifications were confirmed by Prof. M. D. Zerova (Institute of Zoology, National Academy of Sciences, Kiev, Ukraine). Voucher specimens are deposited in the Zoological Museum, Moscow State University, Moscow, Russia.

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Results

*Family Eurytomidae*

*Eurytoma flavimana* Boheman (Fig. 1). 2n=20 (20M); NF=40. All chromosomes are obviously biarmed. Chromosomes of the first two pairs are substantially larger than the others, and those of the last three pairs are visibly smaller than the remaining ones.

*Family Perilampidae*

*Perilampus rushkai* Hellén (Fig. 2). 2n=6 (4M+2SM); NF=12. As in the previous species, all chromosomes are biarmed. Chromosomes of all pairs can be easily distinguished by their length, and submetacentrics of the last pair—by their centromeric position as well.

*Family Ormyridae*

*Ormyrus gratiosus* (Foerster) (Fig. 3). 2n=10 (10M); NF=20. All chromosomes are biarmed. Since the haploid number of approximately six in *Ormyrus* sp. from the UK was the only previous chromosome record for the family (Gokhman and Quicke 1995), I had to re-examine the corresponding preparation. The re-examination of the whole slide has revealed the only mitotic division with 2n=12 (10M+2SM); NF=24 (Fig. 4). All chromosomes are metacentric except for the fifth pair of submetacentrics. Metacentric chromosomes of the last pair are about twice shorter than the preceding ones.

*Family Torymidae*

*Megastigmus pictus* (Foerster) (Fig. 5). 2n=10 (8M+2SM); NF=20. All chromosomes are apparently biarmed; chromosomes of the first two pairs are obviously longer than the others. It is difficult to determine centromeric position in all chromosomes, but the chromosomal formula analogous to that of the following species can be provisionally applied.

*Megastigmus strobilobius* Ratzeburg (Figs. 6, 7). n=5 and 2n=10 (8M+2SM); NF=20. Mitotic chromosomes of the last three pairs are substantially shorter than the preceding ones. All chromosomes are metacentric except for submetacentrics of the third pair. Five bivalents are found in this species in the diplotene of meiosis. Nearly all of them have two chiasmata, but the third one bears a single chiasma.

Discussion

New information obtained during the present investigation includes first chromosome records...
for the family Perilampidae and the subfamily Megastigmatae (Torymidae). In addition, a new chromosome number was found in the family Ormyridae ($n=5$); the previous record for this family ($n=6$; Gokhman and Quicke 1995) is also confirmed. As for chromosomes of the family Eurytomidae, they were previously studied in detail only in *Eurytoma brunniventris* Ratzeburg (Gokhman 2003); all chromosomes in this species are also biarmed (as in *E. flavimana*) but subtelocentric.

Karyotypes of many other chalcidoids including all species studied in the present paper contain only biarmed chromosomes. Moreover, chromosomes of most species more or less slowly decrease in size within certain karyotypes.

Despite a few exceptions, families of the Chalcidoidea can be arranged in two principal groups according to their chromosome numbers: $n=8–12$ (most frequent $n=9–10$; Mymaridae, Eurytomidae, Encyrtidae and some Aphelinidae) and $n=2–7$ (most frequent $n=5–6$; all other chalcids) (Gokhman 2002, 2003). Members of almost all families studied in this paper (except for the Eurytomidae) belong to the second group. However, $n=3$ found in Perilampidae appears to be one of the lowest numbers among all parasitic wasps (Gokhman 2004). Moreover, species with $n=5$ or 6 prevail in all previously studied low-numbered families of the Chalcidoidea. It is unclear at the moment if Perilampidae are unique in this respect, i.e. if haploid chromosome numbers close to three dominate in this family.

Apart from the phytophagous subfamily Megastigmatae (Torymidae), chromosomes of entomophagous Toryminae and Monodontomerinae were studied previously (Goodpasture 1975, Goodpasture and Grissell 1975). According to our hypothesis (Gokhman 2004), $n=6$ (a combination of five long biarmed chromosomes and a short subtelo- or acrocentric) appears to be initial for the family Torymidae. If this is correct, then karyotypes with $n=5$ found in some members of the family (including Megastigmatae) must be considered as derived.

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**References**


