Karyotype of *Latibulus argiolus* (Rossi, 1790) (Hymenoptera: Ichneumonidae)

Кариотип *Latibulus argiolus* (Rossi, 1790) (Hymenoptera: Ichneumonidae)

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ABSTRACT. Karyotype of *Latibulus argiolus* (Rossi, 1790) (Ichneumonidae), a widespread parasitoid of the wasp genus *Polistes* Latreille, 1802 (Vespidae), was studied for the first time using chromosome morphometrics. In this species, n = 9 and 2n = 18 were found. No karyotypic difference between the examined populations of *L. argiolus* from different host species and geographical regions was detected.

Material and methods

Nests of *Polistes nimpha* (Christ, 1791) and *P. galli-cus* (Linnaeus, 1761) used in the present study were respectively collected by A.Y. Kosyakova and A.I. Rusin on *Pinus sylvestris* Linnaeus (Smokhino, Klepikovsky District, Ryazan Province, Russia; 55°08´N; 40°35´E) and *Grindelia squarrosa* (Pursh) (outskirts of Kherson, Kherson Province, Ukraine; 46°40´N; 32°37´E) in August and September 2019. Cocoons containing last-instar larvae of the overwintering second generation of *L. argiolus* were extracted from the nests, kept at 5 to 7 °C for a few weeks, and then kept at room temperature either for obtaining prepupae for the karyotypic analysis or for rearing adult individuals. Reared specimens of *L. argiolus* were identified by the first author using the key provided by Oh et al. [2012].

Chromosome preparations were made from cerebral ganglia and early pupae using a modified version of the technique described by Imai et al. [1988]. Wasps were dissected in 0.5% hypotonic sodium citrate solution containing 0.005% colchicine, and the tissues were incubated in fresh solution for 30 minutes at room temperature. The material was transferred to a pre-cleaned microscope slide using a Pasteur pipette and gently flushed to other subfamilies of the Ichneumonidae [Gokhman, 2009]. We have studied for the first time chromosome sets of two populations of *Latibulus argiolus* (Rossi, 1970), a well-known parasitoid of the wasp genus *Polistes* Latreille, 1802 (Vespidae) [Makino, 1983; Rusina, 2013]. The results of this study are given below.

Introduction

Parasitoid Hymenoptera are one of the most speciose, taxonomically complicated and economically important insect groups, with their estimated number of species in the world fauna far exceeding one million [Quicke, 1997; Bebber et al., 2014; Forbes et al., 2018]. Among parasitic wasps, Ichneumonidae represent the most diverse family that harbors more than 24 thousand described species [Huber, 2017]. The subfamily Cryptinae is the largest group of the Ichneumonidae which includes about 400 genera and 4500 described species [Quicke, 2015]. However, chromosomes of only nine cryptine ichneumonids are examined up to now, as opposed to more than 150 karyotypically studied members of the family that belong...
with Fixative I (glacial acetic acid: absolute ethanol: distilled water 3:3:4). Tissues were disrupted in an additional drop of Fixative I using dissecting needles. Another drop of Fixative II (glacial acetic acid: absolute ethanol 1:1) was then applied to the center of the area and blotted off the edges of the slide. The slide was air dried at room temperature. Preparations were stained with freshly prepared 3% Giemsa solution in 0.05M Sorensen’s phosphate buffer (Na₂HPO₄ + KH₂PO₄, pH 6.8).

Twenty-eight mitotic divisions were studied and photographed using an optic microscope Zeiss Axioskop 40 FL fitted with a digital camera Axioimac 208 color (Carl Zeiss, Germany). To obtain karyograms, the resulting images were handled with image processing programs ZEN version 3.0 (blue edition) and GIMP version 2.10. Chromosomes from the best four haploid metaphase plates were measured using KaryoType software version 2.0 to identify relative lengths (RLs) and centromeric indices (CIs) of chromosomes (Table 1) which were then classified using criteria provided by Levan et al. [1964].

Results and discussion

The haploid karyotype of *L. argiolus* contains nine chromosomes (n = 9) (Fig. 1). Among them, there are three long bi-armed chromosomes, i.e. two metacentrics and a submetacentric, three substantially shorter chromosomes (two acrocentrics and a metacentric/submetacentric), and another three apparently metacentric or submetacentric chromosomes (Table 1). Analogously, the diploid karyotype of this species harbors nine chromosome pairs (2n = 18; image not shown).

*L. argiolus* became the second karyotypically studied member of the tribe Cryptini (= Mesostenini) [Gokhman, 2009]. However, the chromosomal set of another species that belongs to this group, *Mesostenus gracilis* Cresson, 1864 with n = 10, strongly differs from that of *L. argiolus* by having all chromosomes of similar size as well as by the predominance of subtelocentrics and L. argiolus Cresson, 1864 with n = 10, strongly differs from that of species that belongs to this group, parasitoid species into separate taxonomic entities is likely to be adaptive only if it attacks hosts with substantially different life-history strategies [Gokhman, 2018], and this is apparently not true in the case of *L. argiolus*.

**Fig. 1. Karyogram of haploid chromosome set of *L. argiolus*.** Scale bar: 5 µm.

**Table 1. Relative lengths and centromeric indices of chromosomes of *L. argiolus* (mean ± SD).**

| Chromosome no. | RL ± SD       | CI ± SD       |
|----------------|--------------|--------------|
| 1              | 19.75 ± 0.89 | 46.31 ± 2.03 |
| 2              | 15.51 ± 1.10 | 45.48 ± 4.22 |
| 3              | 13.78 ± 0.68 | 31.42 ± 3.78 |
| 4              | 10.49 ± 0.47 | 0            |
| 5              | 9.57 ± 0.63  | 0            |
| 6              | 9.12 ± 0.34  | 38.47 ± 5.34 |
| 7              | 7.97 ± 0.30  | 30.24 ± 6.76 |
| 8              | 7.39 ± 0.35  | 36.00 ± 6.20 |
| 9              | 6.42 ± 1.03  | 32.18 ± 3.54 |

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