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И ПРИКЛАДНЫЕ АСПЕКТЫ  
НАУЧНЫХ ИССЛЕДОВАНИЙ  
И ОБРАЗОВАНИЯ  
В ОБЛАСТИ ЗООЛОГИИ БЕСПОЗВОНОЧНЫХ**

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Сравнение таксономической структуры фауны грибных комаров лиственничников Тувы показывает наибольшее сходство с фауной грибных комаров темнохвойной тайги Кузнецкого Алатау.

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## **SPECIES SPECIFICITY OF HETEROCHROMATIN BLOCK DISTRIBUTION AND rDNA LOCALIZATION IN MITOTIC CHROMOSOMES OF MOSQUITOES SPECIES *AEDES EXCRUCIANS*, *AE. BEHNINGI* AND *AE. PUNCTOR***

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**Abstract.** A karyotypic analysis of three mosquito species *Aedes excrucians*, *Ae. behningi* and *Ae. punctor* (Diptera: Culicidae). Differences in the lengths of chromosomes, the distribution of C- and DAPI blocks of heterochromatin, and the localization of rDNA genes on chromosomes were revealed. *Aedes excrucians* has the

largest chromosome length among the three species represented. *Ae. punctor* differs in the localization of rDNA on the second chromosome, while in *Aedes excrucians* and *Ae. behningi*, rDNA genes are located on chromosome 1. All three species have different C-banding and species-specific localization of heterochromatin DAPI blocks. Consequently, chromosome analysis can serve as an additional mechanism for species identification of mosquitoes of the genus *Aedes*.

**Keywords.** *Aedes*, karyotypic analysis, rDNA.

**ВИДОВАЯ СПЕЦИФИКА РАСПРЕДЕЛЕНИЯ  
ГЕТЕРОХРОМАТИНОВОГО БЛОКА И ЛОКАЛИЗАЦИИ  
рДНК В МИТОТИЧЕСКИХ ХРОМОСОМАХ КОМАРОВ  
ВИДОВ *AEDES EXCRUCIANS*, *AE. BEHNINGI*  
И *AE. PUNCTOR***

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**Аннотация.** Проведен кариотипический анализ трех видов комаров *Aedes excrucians*, *Ae. behningi* and *Ae. punctor* (Diptera: Culicidae). Выявлены различия в длинах хромосом, распределении С- и DAPI блоков гетерохроматина и локализации генов рДНК на хромосомах. Так, *Aedes excrucians* имеет наибольшую длину хромосом среди трех представленных видов. *Ae. punctor* отличается локализацией рДНК во второй хромосоме, в то время как у *Aedes excrucians* и *Ae. behningi* гены рДНК расположены в хромосоме 1. А также, все три вида имеют различный С-бэндинг и видоспецифичную локализацию гетерохроматиновых DAPI блоков. Следовательно, хромосомный анализ может служить дополнительным механизмом видовой идентификации комаров рода *Aedes*.

**Ключевые слова.** *Aedes*, кариотипический анализ, рДНК.

Mosquitos from genus *Aedes* are carriers of human diseases. It was found 21 species from the genus *Aedes* in Tomsk region (south of Western Siberia, Russia) [1] widely abundant in other countries as well. There are many invasive species in different countries in the world [2, 3, 4, 5]. Thus, precise species identification of this genus is very important. However, morphological analysis and molecular data are not enough for precise identification of some species from genus *Aedes*.

Karyotype analysis was performed for three species *Aedes excrucians*, *Ae. behningi* and *Ae. punctor* (Diptera: Culicidae) using the mitotic

chromosomes of imaginal discs. C-banding, DAPI staining, measuring of lengths of the chromosomes and rDNA localization have detected species-specific features in the examined species. The diploid mitotic chromosome set in the imaginal discs of these species is  $2n = 6$ . The lengths of the chromosomes are shown in a histogram (Fig. 1).

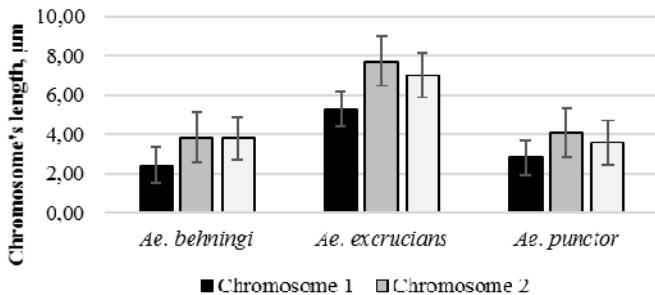


Figure 1. Mean lengths of each chromosome of six *Aedes* mosquito species (*Ae. behningi*, *Ae. excrucians*, *Ae. punctor*)

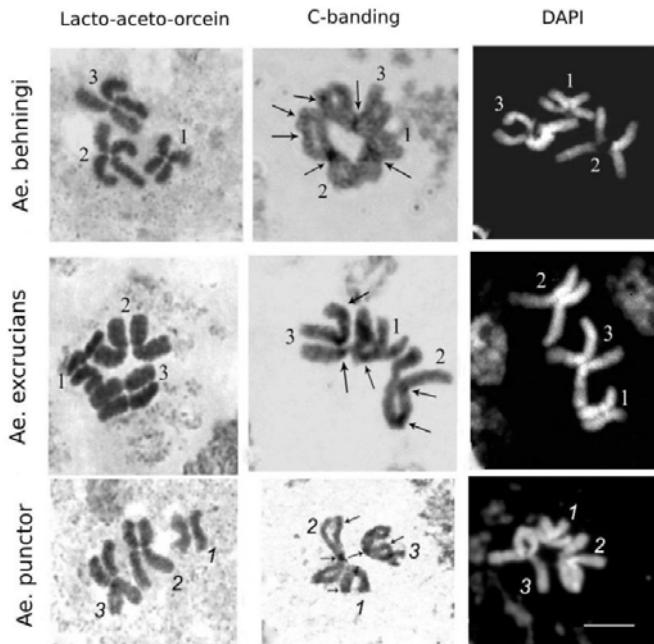


Figure 2. Metaphase chromosomes of imaginal discs of the mosquito species *Ae. behningi*, *Ae. excrucians*, *Ae. punctor*. 1–3, chromosome designations; arrows denote C-bands; scale bar, 5  $\mu\text{m}$

The corresponding histogram (Fig. 1) shows that the mean values of three pairs of metaphase chromosomes are considerably larger in *Ae. excrucians* as compared with other species. Calculation of the relative length and centromere index for the metaphase chromosomes of imaginal discs for *Ae. excrucians*, *Ae. behningi* and *Ae. punctor* has shown that the all three pairs of chromosomes in the examined species are metacentric [6, 7].

Examination of the mitotic chromosomes stained with C- and DAPI stains reveals the specific distribution of heterochromatin patterns in the chromosomes (Fig. 2).

As it known, differential staining for heterochromatin blocks in animal and plant mitotic chromosomes reveals distinct species specificity [8]. The obtained data allowed us to schematize the C-banding and DAPI patterns in mitotic chromosomes (Fig. 3).

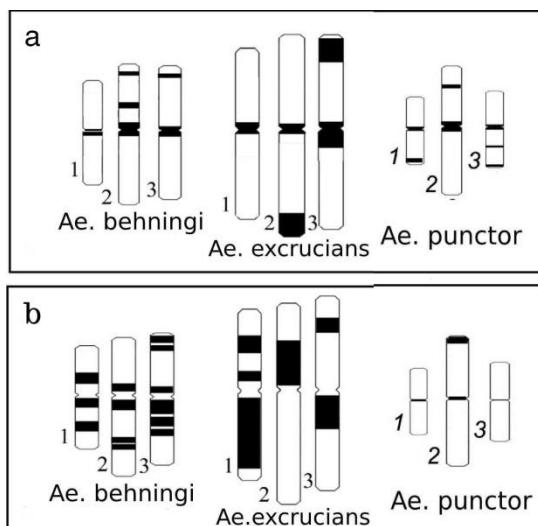


Figure 3. Idiograms of chromosome banding of *Ae. behningi*, *Ae. excrucians*, *Ae. punctor*; (a) C-banding, and (b) DAPI: 1, 2, and 3 denote chromosomes 1, 2, and 3, respectively

The analysis of rDNA locus of *Ae. behningi*, *Ae. excrucians*, *Ae. punctor* is revealed that *Ae. behningi*, *Aedes excrucians* have one locus in chromosome 1 and *Ae. punctor* also has one loci rDNA genes but in chromosome 2 (Fig. 4).

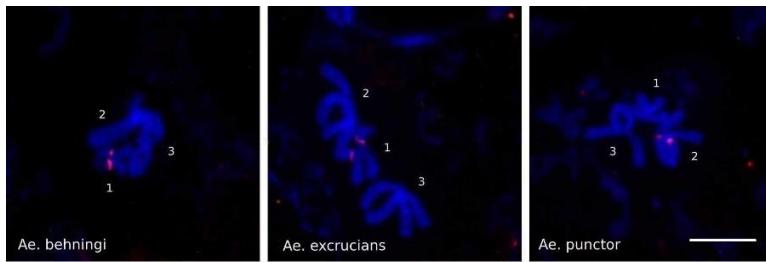


Figure 4. Localization of rDNA in chromosomes of *Ae. behningi*, *Aedes excrucians*, *Ae. punctor*. Scale bar, 5  $\mu$ m.

The performed karyotype analysis of the metaphase chromosomes in imaginal discs of three mosquito species – *Ae. behningi*, *Ae. excrucians* and *Ae. punctor*, – has revealed the differences in chromosome lengths, species-specific distribution of heterochromatin blocks and localization of rDNA genes in chromosomes which can be an additional marker in species-level identification of these species.

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