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Karyotypes of three Psocoptera (Insecta) species from Madeira Island, Portugal

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Abstract. The male karyotype and testis structure of *Atlantopsocus adustus* (Hagen, 1865), *Trichopsocus clarus* (Banks, 1908) and *Trichopsocus brincki* Badonnel, 1963 from Madeira have been studied for the first time. All species display 2n = 17 (16A + X). In prophase cells of *A. adustus* and *T. brincki* a single nucleolus attached to one of the autosomal bivalents has been revealed. *A. adustus* has testes with three seminal follicles each, while the testes of *T. clarus* and *T. brincki* consist of one seminal follicle. The data on the two last species represent the first karyological data for the family Trichopsocidae.

Key words: Psocoptera, Madeira Island, karyotype, testes, endemic species.

Introduction

The fauna of Madeira comprises 40 Psocoptera species, including 6 endemics (Lien-hard, 1998). We have studied for the first time the karyotypes and number of seminal follicles in *Atlantopsocus adustus* (Hagen, 1865) (fam. Psocidae), a Macaronesian endemic distributed in Madeira, the Azores and Canary Islands, and in two representatives of the family Trichopsocidae: *Trichopsocus clarus* (Banks, 1908), which has a worldwide distribution and is widespread in coastal regions, and *T. brincki* Badonnel, 1963, endemic to Madeira (Lienhard, Smithers, 2002). The data on the last two species represent the first karyological data for the family Trichopsocidae.

Material and methods

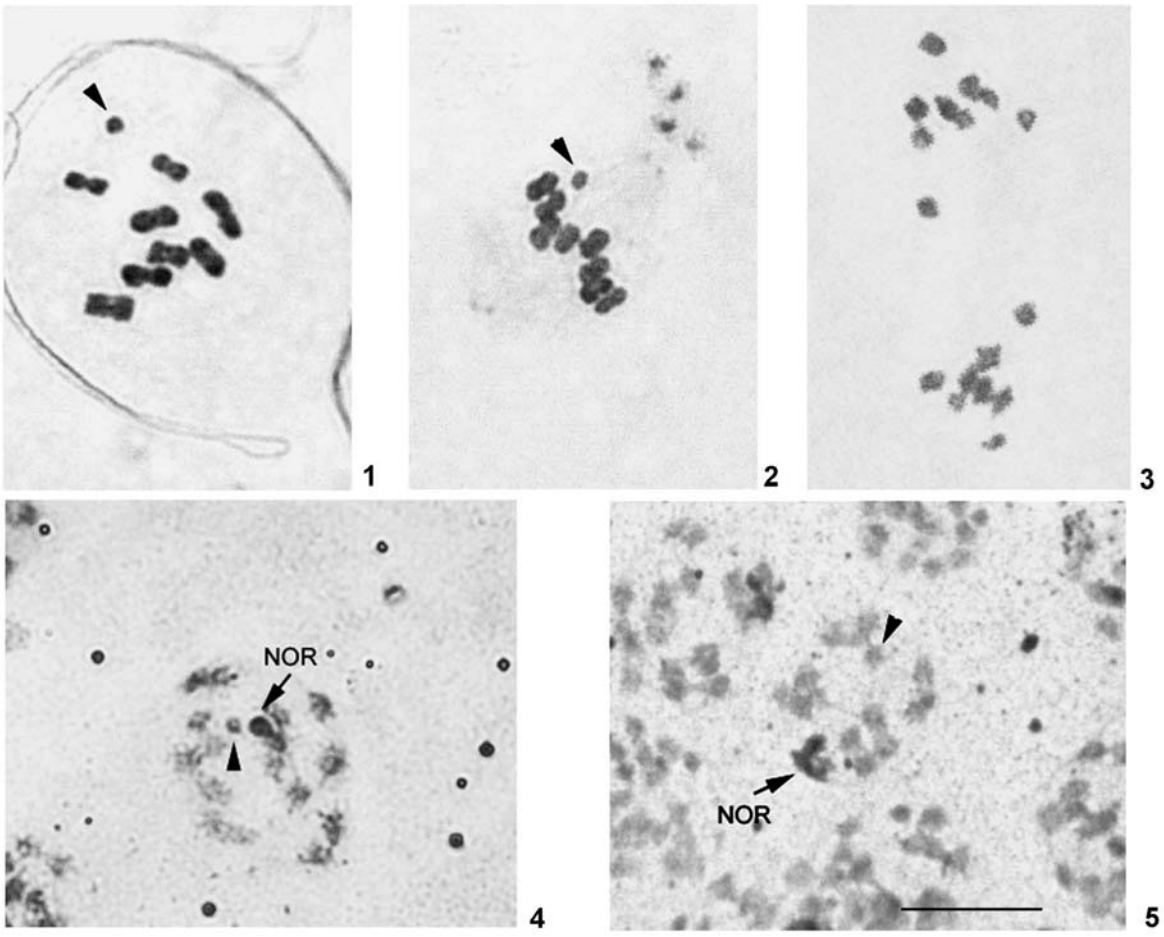
The following material, collected by E. Nunes, has been used for analysis:

A. adustus, Madeira: 1 male, Pico da Silva, Camacha, 18.VI.2005 on *Pinus pinaster*; 1 male, Ribeiro Serrão, Camacha 17.VI. 2005 on *Castanea sativa*; 1 male, Cabeço da Meia Serra 15.X.2005 on *Erica platycodon* subsp. *madericola*

T. clarus, Madeira: 2 males, Abrigo do Pastor, Camacha 13.X.2005 on *Quercus robur*.

T. brincki, Madeira: 13 males, Cabeço da Meia Serra, Camacha 15.X.2005 on *Erica platycodon* subsp. *madericola*.

Specimens were fixed in alcohol/acetic acid mixture (3 parts of 96% ethanol: 1 part of glacial acetic acid) and kept in refrigerator at +4°C. Testes were dissected out of the abdomens and squashed on slides in a drop of 45% acetic acid. The preparations were made permanent by a dry ice technique (Conger, Fairchild, 1953). After the cover slips were removed, slides were dehydrated in fresh 3 : 1, air-dried and stained by Feulgen-Giemsa procedure as described previously (Golub,



Figs 1-5. 1 - Metaphase I in *Atlantopsocus adustus* (Hagen, 1865). **2 -** Metaphase I in *Trichopsocus brincki* Badonnel, 1963. **3 -** Anaphase I in *Trichopsocus clarus* (Banks, 1908). **4 -**Ag-stained prophase of *Atlantopsocus adustus* (Hagen, 1865). **5 -** Ag-stained prophase of *Trichopsocus brincki* Badonnel, 1963. X-chromosome is indicated by arrow-head. NOR – nucleolar organizing region. Bar = 10 μm.

2004) and by AgNOR-technique as described by Howell and Black (1980).

Results

Karyotype

Meiotic metaphases I (MI) of *A. adustus* (Fig. 1) and *T. brincki* (Fig. 2) include eight autosomal bivalents and a univalent X-chromosome. In both species the autosomal bivalents gradually decrease in size, while X-chromosome is close in size to a half of one of the middle-sized bivalents, and in the majority of cells is situated on one side of the bivalents, at the periphery of the metaphase plate.

In *T. clarus*, only meiotic anaphases I (AI) were available for analysis, and chromosomal plates with 8 and 9 univalents, respectively, have been observed (Fig. 3).

Thus, for every species, the formula of male diploid karyotype has been determined as 2n = 17 (16A + X).

After $AgNO_3$-staining, a single nucleolus at-

tached to one of the autosomal bivalents was revealed in every prophase cell of *A. adustus* and *T. brincki* (Figs 4, 5).

Reproductive system

A. adustus is characterised by testes each with three relatively small seminal follicles arranged consecutively at the vas deferens. Both *T. clarus* and *T. brincki* display testes each with one relatively large seminal follicle.

Discussion

All three studied species belong to the most advanced psocopteran suborder Psocomorpha and share karyotype with 2n = 17 (16A + X) in males. The variability of psocomorphan karyotypes has been observed recently (Golub, 2004). The great bulk of karyologically studied species of the suborder (about 85 %) has the same chromosome number, 2n = 17, which is considered as a modal and ancestral for Psocomorpha.

The pattern of nucleolus attachment has been so far studied in four psocid species (Golub et al., 2004; Golub, Cucerová, 2008, in press). A single nucleolus is revealed in meiotic prophases in every species. However the location of NOR varies: in *Psococerastis gibbosa* (Sulzer, 1776) (Psocidae) and *Dorypteryx domestica* (Smithers, 1958) (Psyllopsocidae) the nucleolus is attached to one of the autosomal bivalents, which is coincident with data on *A. adustus* (Psocidae) and *T. brincki* (Trichopsocidae) from the present study. On the other hand, in *Amphipsocus japonicus* (Enderlein, 1906) (Amphipsocidae) and *Blasta conspurcata* (Rambur, 1842) (Psocidae) attachment of the nucleolus to the sex chromosomes is characteristic.

The studied species differ in the number of seminal follicles per testis – three in *A. adustus* and one in *T. clarus* and *T. brincki*. Both numbers have been reported for Psocomorpha, while 3 is the prevailing one (Wong, Thornton, 1968; Golub, 2003). *A. adustus* is the first representative of the genus *Atlantopsocus* studied in this respect. The species belongs to the largest psocopteran family Psocidae. All studied representatives of this family possess testes with 3 follicles (for a review see Golub, 2003).

T. clarus and *T. brincki* display a similar testi structure to *Trichopsocus dalii* (McLachlan, 1867), the only previously studied species of the family Trichopsocidae (Ribaga, 1901).

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