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CHROMOSOME NUMBERS OF SPIDER MITES FROM BAMBOO

BY W. HELLE ¹ and K. TAKAHASHI ²

ABSTRACT: The chromosome numbers have been assessed for 5 bisexual tetranychid species infesting bamboo in Japan. A haploid number of n = 2 occurs in the species Aponychus corpusae and Yezonychus sapporensis, a number of n = 3 in Panonychus akitanus and Schizotetranychus recki, and a number of n = 6 in Schizotetranychus celarius. The taxonomic significance of the karyotype information is discussed.

RÉSUMÉ : Nombre chromosomique de quelques araignées rouges du bambou (Acariens : Tetranychidae).
L'étude porte sur la détermination du nombre de chromosomes de 5 espèces de tétranyques comportant des mâles et des femelles, et vivant sur Bambou au Japon. Le nombre haploïde est n = 2 pour Aponychus corpusae et Yezonychus sapporensis, n = 3 pour Panonychus akitanus et Schizotetranychus recki, et n = 6 pour Schizotetranychus celarius. La discussion porte sur la valeur taxonomique de ces informations cytogénétiques.

INTRODUCTION

More than 50 tetranychid species have been reported to occur in Japan, infesting a variety of plant species (EHARA and SHINKAJI, 1975). So far, no karyotype studies have been reported dealing with the Japanese spider mite species. This paper presents a study of the mitotic chromosome numbers of five species collected from sasa bamboo.

MATERIAL AND METHODS

Using the aceto-orcein staining method, squash preparations were made of embryonic tissues taken from eggs by the technique outlined by HELLE et al., 1980. All species were collected from Sasa senanensis Franch & Sav. in Sapporo, and reared under laboratory conditions in plexiglass cells on the same hostplant, following the rearing method described by HELLE & OVERMEER, 1985. All species examined are known to be bisexual.

RESULTS AND DISCUSSION

In all egg samples, a haploid and a diploid chromosome number was found to occur, as is expected for species with a haplo-diploid sex-determination. The data are presented in table 1. Selected photomicrographs from the squash preparations are given in figs 1-8.

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FIGS 1-8: Photomicrographs of mitotic stages in egg squashes. Magnification 2800 x.

1. — Yezonychus sapporensis = 2 ; 2. — Y. sapporensis 2n = 4 ; 3. — Schizotetranychus recki n = 3 ; 4. — S. recki 2n = 6 ; 5. — Aponychus corpusae n = 2 ; 6. — A. corpusae 2n = 4 ; 7. — Schizotetranychus celarius n = 6 ; 8. — S. celarius 2n = 12.

TABLE 1. — Chromosome numbers of species collected from sasa bamboo at Sapporo, Japan. The number of eggs examined is presented in parenthesis.

<table>
<thead>
<tr>
<th>Species</th>
<th>2n</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aponychus corpusae Rimando</td>
<td>4(6)</td>
<td>2(6)</td>
</tr>
<tr>
<td>Panonychus akitanus Ebara</td>
<td>6(1)</td>
<td>3(1)</td>
</tr>
<tr>
<td>Yezonychus sapporensis Ebara</td>
<td>4(2)</td>
<td>2(2)</td>
</tr>
<tr>
<td>Schizotetranychus recki Ebara</td>
<td>6(7)</td>
<td>3(5)</td>
</tr>
<tr>
<td>Schizotetranychus celarius (Banks)</td>
<td>12(3)</td>
<td>6(3)</td>
</tr>
</tbody>
</table>

Aponychus belongs to the tribe Eurytetranychini. All species karyotyped from this genus were collected from grasses. A. grandidieri (Gut.) is living on reed (Phragmites) in Madagascar, and has 2n = 4 and n = 2 (GUTIERREZ et al., 1970). An undescribed Aponychus was found to occur on the same host at Roodeplaatdam (personal communication, Dr. M. K. P. MEYER, 1980) and appeared to have 2n = 4 and n = 2 chromosomes (BOLLAND & HELLE, unpublished). The numbers of 2n = 4 and n = 2 of A. corpusae from bamboo are in agreement with the numbers found in the other species. It would certainly be interesting to examine the chromosome number of Aponychus firmianae Ma & Yuan, since this species is not found on grasses, but on deciduous trees (SAITO, 1985).

All other karyotyped species belong to the tribe Tetranychini.

Yezonychus has a feature in common with Schizotetranychus: the empodium is split into two claw-like structures. However, this does not necessarily reflect a phylogenetic resemblance. A bifid empodium is possibly an adaptation to locomotion on grass leaves, and in that case the resemblance in empodium is a matter of convergent development. An important difference between Yezonychus and Schizotetranychus is found in the number of dorsal setae on the opisthosoma. The karyotypic information gives no arguments for the supposition that there is a close relationship between both genera: Yezonychus has n = 2, and this number is not found as yet in Schizotetranychus.

The numbers 2n = 6 and n = 3 for Panonychus akitanus are the same as found for the other two species examined for this genus, viz. P. ulmi (Koch) and P. citri (McG.). The similarity in chromosome number is in accordance with the close resemblance existing between species within Panonychus.

The chromosome numbers of the two Schizotetranychus species (S. recki with 2n = 6 and
n = 3, and *S. celarius* with the double number : 2n = 12 and n = 6), may be seen as representing two groups, i.e. a group with a haploid number of n = 3, and a group with n = 6 (see table 2). The species *S. recki* and *S. celarius* are closely related, resembling in aedeagus and in ambulacrum, and having a similar dorsal chaetotaxy. However, certain characteristics are different, and may be considered as being more primitive for *S. recki*, and more derived for *S. celarius*.

**Table 2. — Survey of chromosome numbers and references in Schizotetranychus.**

<table>
<thead>
<tr>
<th>Species</th>
<th>Chromosome number</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>S. eremophilus</em> McG</td>
<td>n = 3</td>
<td>HELLE et al., 1981</td>
</tr>
<tr>
<td><em>S. reticulatus</em> P. &amp; B.</td>
<td>n = 3</td>
<td>BOLLAND et al., 1981</td>
</tr>
<tr>
<td><em>S. sacchari</em> Flecht. &amp; B.</td>
<td>n = 3</td>
<td>FLECHTMANN, 1982</td>
</tr>
<tr>
<td><em>S. schizopus</em> (Zacher)</td>
<td>n = 3</td>
<td>HELLE &amp; BOLLAND, 1967</td>
</tr>
<tr>
<td><em>S. recki</em> Ebara</td>
<td>n = 3</td>
<td>present paper</td>
</tr>
<tr>
<td><em>S. australis</em> Gut.</td>
<td>n = 6</td>
<td>HELLE et al., 1970</td>
</tr>
<tr>
<td><em>S. jouveli</em> Gut.</td>
<td>n = 6</td>
<td>HELLE &amp; GUTIERREZ, 1983</td>
</tr>
<tr>
<td><em>S. celarius</em> (Banks)</td>
<td>n = 6</td>
<td>present paper</td>
</tr>
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</table>

The chaetotaxy of tibia I and II, and of tarsus I and II, is more reduced in *S. recki*. The peritremes of both species are different, and those of *S. celarius* possibly represent the more derived state. Both species also differ with regard to the hibernating stage. *S. recki* hibernates with diapausing eggs, but in *S. celarius* it is the adult female which enter into diapause (MORIYAMA and MORI, 1977). Egg diapause may be considered as the more primitive state, and adult diapause as the derived state (cf. GUTIERREZ & HELLE, 1985).

It is to conclude that also with respect to chromosome number, *S. celarius* represents the derived, and *S. recki* the primitive state. A chromosome number of n = 3 is commonly found in the Tetranychini, and occurs in nearly all genera of this tribe (HELLE et al., 1981). A number of n = 6 is rare, and has been found only in *Schizotetranychus* and *Tetranychus*.

The division of the genus *Schizotetranychus* into two groups by karyotype is not clearly supported by morphological differences, neither by other biological characteristics. In both groups species occur from grasses as well as on dicotyledons. More karyotypic information is required for an appropriate discussion on the relationships between the different *Schizotetranychus* species, and the eventual resemblances with species from other genera, like *Eotetranychus*.

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