CHROMOSOMAL STUDIES ON SEVEN SPECIES OF APHIDS FROM MANDI REGION OF HIMACHAL PRADESH, INDIA

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SUMMARY

Chromosomes of aphids, *Aphis craccivora* Koch, *A. gossypii* Glover, *A. punicae* Passerini, *Aphis sp.*, *Myzus persicae* (Sulzer), *Schoutedenia emblica* Patel and Kulkarni and *Sitobion takahashii* (Eastop) were studied from different host plants of Mandi district of Himachal Pradesh. The diploid chromosome numbers in these species ranged from 2n = 8 to 18. Karyotypic variations were observed in *M. persicae* with diploid chromosome number of 10 and 12 and in *Schoutedenia emblica* with diploid chromosome number of 12 and 14.

Keywords: Chromosomes, aphids, karyotypic variation.

INTRODUCTION

Of the 4500 species of aphids occurring all over the world, 450 species of aphids are reported to infest crop plants (Blackman & Eastop 2000) and 1758 species of aphids belonging to 270 genera are found feeding on trees (Blackman & Eastop 2006). Of these aphid species, about 20% are known cytologically. There are many aphid species which show karyotypic variations depending upon different host plants, environmental and geographical conditions (Blackman 1971, 1980, Gautam et al. 1993, Yang-Xiaowen & Zhang-Xiao-xi 2000).

Chromosomes of Indian aphids were reported by Sethi & Nagaich (1972) and later by other workers from different regions of India (Devi & Gautam 2012, Dutta & Gautam 1993, Gautam & Dhatwalia 2003, Gautam & Sharma 1990, Khuda-Bukhsh & Kar 1990, Khuda-Bukhsh & Pal 1985, 1986a, b, Kulkarni & Kacker 1980, 1981, Kumari & Gautam 2014). The present study was undertaken to investigate the chromosomes of aphids, *Aphis craccivora, A. gossypii, A. punicae, Aphis sp., Myzus persicae, Schoutedenia emblica* and *Sitobion takahashii* from Mandi district of Himachal Pradesh.

MATERIALS AND METHODS

For chromosomal studies, aphids were collected from various plants of different localities from Mandi district (latitude 31.71°N, 76.93°E and altitude 1044 m above sea level) of Himachal Pradesh. The plant parts were observed for aphid
infestation and aphids were collected from the young shoots and leaves of the plants. Collection was done from May to October, 2014.

Chromosomal preparations were made from young embryos dissected from the parthenogenetic females. Embryos were given pretreatment in 0.7% trisodium citrate solution for 25–30 min and fixed in 1:3 acetic-ethanol solutions for 15–20 min at room temperature. For squashing, the embryos were put on glass slide in a drop of 45% acetic acid for 3–5 min. A cover slip was put on the material and tapped gently with blunt end of forceps to spread the material in a uniform layer. Cover slip was dislodged off the slide with a sudden jerk. Both slides and cover slips were dried and then stained in 2% Giemsa followed by mounting in DPX. For photomicrography, well spread chromosome plates were selected and observed under LEICA DMLS2 microscope. Photography was done with LEICA DFC 320 camera. The actual lengths of chromosomes were measured using ocular micrometer. From the actual lengths of chromosomes, the total complement length (TCL) and relative lengths were calculated. The idiograms were prepared based on relative length data.

For species identification, keys developed by Blackman & Eastop (1984) were used.

**RESULTS AND DISCUSSION**

In the 7 species studied, the chromosome number ranged from 8 to 18. The lowest chromosome number recorded was 8 (2n = 8) in 4 species (*Aphis craccivora, A. gossypii, A. punicae* and *Aphis* sp.) and highest was 18 (2n = 18) in *Sitobion takahashii*. *Myzus persicae* and *Schoutedenia emblica* showed karyotypic variation with 2n = 10, 12 and 2n = 12, 14 respectively.

Out of 7 species, 4 belong to the genus *Aphis*. It is the largest aphid genus containing nearly 500 species (Eastop & Hille Ris Lambers 1976) and seems to be characterized by chromosome number of 2n = 8, although earlier some exceptions have also been reported as in *A. farinose* with 2n = 6 (Baehr 1908 Stevens 1906, 1909) and *A. solanella* and *A. umbrelia* with 2n = 7 (Blackman 1980).

*A. craccivora* are brown coloured aphids and collected from apical shoots and ventral surfaces of leaves of *Punica granatum* (Table 1). The diploid chromosome number in this species was 8 (Figs 1–3) confirming the earlier reports of this species from different host plants such as *Citrus* sp. (Dutta & Gautam 1993), *Cassia fistula* (Kulkarni & Kacker 1979), *Vigna catjang, Lathyrus sativus* (Kurl 1978), *Dolichos biflorus* and *Ageratum conyzoides* (Kurl & Chauhan 1986).

*A. gossypii* are light green to dark green coloured aphids and collected from apical shoots and ventral surfaces of leaves of *Withania somnifera* (Table 1) and has diploid chromosome number of 8 (Figs 4–6). Same chromosome number was reported in this species by other workers from different host plants (Blackman 1986, Devi & Gautam 2012, Dutta & Gautam 1993, Kurl & Chauhan 1986, Robinson & Chen 1969, Samkaria et al. 2010, Stevens 1909).
TABLE 1: Aphid species collected from different host plants and their karyotype analysis.

<table>
<thead>
<tr>
<th>Species</th>
<th>2n</th>
<th>Host Plant</th>
<th>Actual length (µm) ±S.E.</th>
<th>Relative length ±S.E.</th>
<th>Total complement length (µm) ±S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Shortest</td>
<td>Longest</td>
<td>Shortest</td>
</tr>
<tr>
<td>Aphis craccivora</td>
<td>8</td>
<td>Punica granatum</td>
<td>1.04 ±0.10</td>
<td>2.54 ±0.12</td>
<td>7.36 ±0.44</td>
</tr>
<tr>
<td>A. gossypii</td>
<td>8</td>
<td>Withania somnifera</td>
<td>1.09 ±0.07</td>
<td>2.66 ±0.07</td>
<td>7.43 ±0.38</td>
</tr>
<tr>
<td>A. punicæ</td>
<td>8</td>
<td>P. granatum</td>
<td>1.33 ±0.08</td>
<td>2.84 ±0.17</td>
<td>8.18 ±0.30</td>
</tr>
<tr>
<td>Aphis sp.</td>
<td>8</td>
<td>Solanum betaceum</td>
<td>1.78 ±0.11</td>
<td>2.74 ±0.14</td>
<td>9.94 ±0.37</td>
</tr>
<tr>
<td>Myzus persicae</td>
<td>10</td>
<td>S. betaceum</td>
<td>1.02 ±0.04</td>
<td>2.80 ±0.06</td>
<td>5.52 ±0.17</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>S. betaceum</td>
<td>0.84 ±0.04</td>
<td>2.82 ±0.08</td>
<td>3.94 ±0.13</td>
</tr>
<tr>
<td>Schoutedenia emblica</td>
<td>12</td>
<td>Phyllanthus emblica</td>
<td>1.32 ±0.07</td>
<td>3.18 ±0.20</td>
<td>5.31 ±0.22</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>P. emblica</td>
<td>1.25 ±0.05</td>
<td>3.27 ±0.09</td>
<td>4.34 ±0.19</td>
</tr>
<tr>
<td>Sitobion takahashii</td>
<td>18</td>
<td>P. emblica</td>
<td>0.58 ±0.04</td>
<td>2.63 ±0.07</td>
<td>2.37 ±0.19</td>
</tr>
</tbody>
</table>

*Aphis puniceae* are yellowish green aphids and collected from the ventral surfaces of leaves and the apical shoots of *Punica granatum* (Table 1). The diploid chromosome number of 8 (Figs 7–9) observed in the present study confirmed the earlier reports of Dutta & Gautam (1993) in aphids of this species from *P. granatum* and Gautam & Dhatwalia (2003) in aphids from *Pyrus* sp.

Aphids of *Aphis* sp. are dark green and collected from apical shoots and ventral surfaces of leaves of *Solanum betaceum* (Table 1) and diploid chromosome number in this species was found to be 8 (Figs 10,11). The idiogram showed gradual decrease in length of the chromosomes (Fig. 12).

The genus *Myzus* comprises of about 55 species and these are mostly polyphagous aphids. *M. persicae* aphids were orange green to yellowish green and were collected from apical shoots, flowers and ventral surfaces of leaves of *Solanum betaceum* (Table 1). These show karyotypic variation with 2n = 10 and 12 (Figs 13, 14, 16, 17). The idiograms showed gradual decrease in length of chromosomes (Figs 15, 18). The diploid chromosome number 12 in *M. persicae* has been reported earlier by Dutta & Gautam (1993) from *Datura*, by Jangral et al. (2014) from *Raphanus sativus* and by Samkaria et al. (2010) from *Capsicum*.

The karyotype variation in *M. persicae* with 2n = 10 and 12 confirmed earlier report of Kurl (1985) who reported 2n = 10, 11, 12 and 13 in this species. Blackman (1971, 1980) reported 2n = 11,
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12, 13 and 14; Rivi et al. (2012) reported 2n = 12, 13 and 14; Sethi & Nagaich (1972) reported 2n = 11, 12, 13 and Yang-Xiaowen & Zhang-Xiao-xi (2000) reported 2n = 11 and 12 in *M. persicae* from different host plants.

The genus *Schoutedenia* belongs to subfamily Greenideinae. The aphid *S. emblica* are light yellowish green and cannot be easily detected on host plant *Phyllanthus emblica* (Table 1) as they colonize at the bases of leaflets which were of the same colour as that of aphid. *S. emblica* shows karyotype variation with 2n = 12 and 14 (Figs 19, 20, 22, 23). The idiogram of aphid with 2n = 12 showed first pair of longest chromosomes and other 5 pairs of gradually decreasing chromosomes (Fig. 21). The idiogram of aphids with 2n = 14 showed first pair of longest chromosome, second medium sized pair and other 5 gradually decreasing pairs of chromosomes (Fig. 24). Hales (1989) studied meiosis in *S. lutea*.

The genus *Sitobion* comprises of about 75 species. Of these, about 30 species were collected from Asia (Blackman & Eastop 1984). *S. takahashii* was light green with black siphunculi and antennae. These aphids were collected from bases of leaflets from apical parts of *P. emblica* along with *Schoutedenia emblica* (Table 1). Diploid chromosome number reported in *Sitobion takahashii* was 18 (Figs 25, 26). The idiogram showed one pair of longest chromosome and 8 pairs of gradually decreasing chromosomes (Fig. 27). Chromosomes of different species of *Sitobion* have been studied earlier. In these species diploid chromosome numbers, 11, 12, 16, 18 and 20 have been reported (Blackman 1980, Chen & Zhang 1985a, b, Dutta & Gautam 1993, Hales et al. 1990, Kumari & Gautam 2014, Robinson & Chen 1969).

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