Chromosome number of *Puccinellia maritima* (Huds.) Parl. in the British Isles

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**ABSTRACT**

Chromosome counts were made on root-tip cells of *Puccinellia maritima* plants representing a wide range of localities and growth forms. All plants examined had $2n = 56$.

**INTRODUCTION**

The most frequently quoted chromosome number for British *Puccinellia maritima* (Huds.) Parl. is $2n = 63$ (Mills 1967, Newton 1965), which is nonaploid if $x = 7$ for the genus, and consistent with the suggestion (Tutin 1955) that the species usually reproduces vegetatively and may be apomictic. Mills also reported $2n = 56$, which is commonly listed for foreign material (Bernström 1948, Church 1949, Sørensen 1958). Other British counts are $2n = 14, 49, \text{ and } 77$ (Brown-Packer 1961), and from foreign material $2n = 42$ (Church 1949), $c 60$ (Castro & Fontes 1946) and 70 (Wulff 1937, Rodrigues 1953).

The counts made by Mills (1967) and Newton (1965) are listed in Table 1, and suggest the possibility of differences in distribution of the octoploid and nonaploid plants in Britain. Because it also seemed possible that the wide range of phenotypic variation observed in the species might correspond to different cytological races, chromosome counts were made on a large number of plants collected as part of a study of infraspecific variation. Plants were sampled from a wide range of habitats and locations (Table 2), different growth forms being included when found adjacent to one another in the field. Growth form differences, often very large, were usually maintained after a period of collateral cultivation (Table 3).

The object of the work presented here was to relate chromosome number to the growth forms and geographical races of the plant.

**TABLE 1. PREVIOUS LOCALIZED CHROMOSOME COUNTS FOR PUCINELLIA MARITIMA IN THE BRITISH ISLES**

<table>
<thead>
<tr>
<th>Author</th>
<th>Location</th>
<th>No. of plants counted</th>
<th>Chromosome Number $2n$</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. R. Mills</td>
<td>Parkgate, Cheshire, v.c. 58</td>
<td>8</td>
<td>51–62</td>
</tr>
<tr>
<td>A. R. Mills</td>
<td>Silverdale, W. Lancs., v.c. 60</td>
<td>3</td>
<td>51–56</td>
</tr>
<tr>
<td>A. R. Mills</td>
<td>Baldovle, Down, v.c. H38</td>
<td>1</td>
<td>c 56</td>
</tr>
<tr>
<td>A. R. Mills</td>
<td>Rye, E. Sussex, v.c. 14</td>
<td>1</td>
<td>c 60</td>
</tr>
<tr>
<td>A. R. Mills</td>
<td>Tollesbury, N. Essex, v.c. 19</td>
<td>1</td>
<td>c 63</td>
</tr>
<tr>
<td>A. R. Mills</td>
<td>Mudeford, S. Hants., v.c. 11</td>
<td>1</td>
<td>c 63</td>
</tr>
<tr>
<td>L. E. Newton</td>
<td>Canvey Island, S. Essex, v.c. 18</td>
<td>1</td>
<td>c 63</td>
</tr>
<tr>
<td>L. E. Newton</td>
<td>Tollesbury (tall plant), N. Essex, v.c. 19</td>
<td>1</td>
<td>c 63</td>
</tr>
<tr>
<td>L. E. Newton</td>
<td>Tollesbury (dwarf plant), N. Essex, v.c. 19</td>
<td>1</td>
<td>c 63</td>
</tr>
<tr>
<td>L. E. Newton</td>
<td>Yantlet Creek, W. Kent, v.c. 16</td>
<td>1</td>
<td>c 63</td>
</tr>
</tbody>
</table>
Tillers taken from individual plants in the field were grown in plastic pots containing John Innes No. 3 potting compost and a basal layer of moss-peat. Portions of root-tip c 30 mm long were taken from the peat, where they were grit-free, pre-fixed for 3 hours in dilute 8-hydroxyquinoline at 5°C, fixed for 3 hours in 3:1 ethanol/acetic acid, and hydrolyzed for 10 minutes at 60°C in 1 N HCl, followed by staining in Feulgen reagent for 1.5 hours. After staining, the tips were treated in 5°C acetic acid, and temporary mounts were made by ringing coverslips with rubber solution. Whenever possible chromosome counts were taken from replicated root-tips and plants.
CHROMOSOME NUMBER OF *PUCCINELLIA MARITIMA*

**TABLE 3. GROWTH FORM DIFFERENCES BETWEEN TWO CLONES OF *PUCCINELLIA MARITIMA* FROM WELLS, NORFOLK**

<table>
<thead>
<tr>
<th>Accession code</th>
<th>3rd leaf-blade length (cm)</th>
<th>Maximum vegetative tiller height from ground (cm)</th>
<th>No. of tillers (18/4/73 at Norwich)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(13/6/72 in field)</td>
<td>(13/6/73 at Norwich)</td>
<td></td>
</tr>
<tr>
<td>P 348</td>
<td>2.26 (0.129)</td>
<td>2.68 (0.292)</td>
<td>19.5 (2.53)</td>
</tr>
<tr>
<td></td>
<td>3.76 (0.108)</td>
<td>7.42 (0.684)</td>
<td></td>
</tr>
<tr>
<td>P 353</td>
<td>8.38 (0.443)</td>
<td>7.94 (0.534)</td>
<td>11.25 (2.29)</td>
</tr>
<tr>
<td></td>
<td>7.54 (0.389)</td>
<td>14.64 (1.13)</td>
<td></td>
</tr>
</tbody>
</table>


**CHROMOSOME NUMBERS**

*P. maritima* has chromosomes which are relatively long and thin, which makes counting difficult because they are often intermingled with one another in imperfect squashes. In over-spread preparations splitting of chromatids frequently occurred, adding another difficulty to counting. In good cells 56 chromosomes were usually present, but a few cells appeared to contain numbers in the range 53–55, suggesting a degree of somatic aneuploidy. All plants, including representatives of extremes of growth form, had a number at or just below $2n = 56$, the octoploid ($x = 7$) level (Fig. 1). Some other counts ranged from 50 to 64, but in all instances where aberrant counts were investigated repetition on new material of the same plants led to the conclusion that $2n = c 56$.

**Figure 1.** A root-tip cell of *Puccinellia maritima* showing a full complement of chromosomes, $2n = 56$ (accession P 35).
KARYOTYPE

Preparations were insufficiently clear for full karyotype analysis but Fig. 2 summarizes five categories of chromosome size and form. About six pairs of small acrocentric chromosomes are present; the rest are metacentric ranging in size up to twice as long as the acrocentrics. At least two pairs of the largest metacentrics have distinct satellites, and identical chromosomes have been seen in other species of the genus *Puccinellia*. All chromosomes showed bands of more intense staining which matched in several pairs and could be valuable in karyotype analysis.

DISCUSSION AND CONCLUSIONS

Chromosome number was found to be constant in plants of different growth form coming from a wide range of sites, suggesting that it is not a facet of variation in the species in the British Isles. The widespread occurrence of octoploids (2n = 56) with little aneuploidy is consistent with results of our unpublished breeding experiments which show that *P. maritima* is an active out-breeder with a low selfing rate.

The presence in its karyotype of sets of many similar chromosomes supports the idea that the species is a polyploid, but meiosis appears to be regular (Church 1949), and the plants are highly interfertile. Our evidence suggests that British plants are octoploid, but allowing for difficulties with counting it is not possible to rule out the existence of aneuploids. The wide range of morphological variability of the species is likely to be the produce of environmental selection on populations whose gene systems perform normal segregation and recombination, and not the expression of isolated lines maintained after a breakdown of sexuality.

ACKNOWLEDGMENTS

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REFERENCES


