CHROMOSOME NUMBERS, MEIOTIC BEHAVIOR, AND POLLEN VIABILITY OF SPECIES OF VRIESEA AND AECHMEA GENERA (BROMELIACEAE) NATIVE TO RIO GRANDE DO SUL, BRAZIL

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Chromosome number, meiotic behavior, and pollen viability were analyzed in 15 species of two genera, Vriesea and Aechmea, native to Rio Grande do Sul, Brazil. This study is the first cytogenetic analysis of these taxa. The chromosome numbers are all \( n = 25 \), consistent with the proposed base number of \( x = 25 \) for Bromeliaceae. All examined taxa displayed regular bivalent pairing and chromosome segregation at meiosis. Observed meiotic abnormalities include univalents in metaphase I; missing or extra chromosomes and precocious division of centromeres in metaphase II; laggards in telophase I and anaphase II/telophase II. The high pollen viability (>88%) reflects a regular meiosis.

Key words: Aechmea; Bromeliaceae; chromosome numbers; meiotic behavior; pollen viability; Vriesea.

The family Bromeliaceae has a tropical to subtropical distribution with just one species outside the American continent (McWilliams, 1974). The nearly 3000 species are divided into three subfamilies: Pitcairnioideae, Bromelioideae, and Tillandsioideae (Smith and Downs, 1974).

Vriesea, with approximately 250 species, is the second largest genus in subfamily Tillandsioideae. Vriesea is mostly epiphytic, with species distributed from Mexico to southeast Brazil (Smith and Downs, 1977). Twenty species of Vriesea are reported for the Brazilian state of Rio Grande do Sul (Winkler, 1980, 1982; Reitz, 1983; Waechter, 1992).

The genus Aechmea, comprising approximately 220 species, is common in the Amazon region and the Atlantic Forest of eastern Brazil. Aechmea is a large and diverse genus placed in subfamily Bromelioideae (Smith and Downs, 1979), with both epiphytic and terrestrial species. In Rio Grande do Sul state, about 11 species of Aechmea occur (Winkler, 1980, 1982; Reitz, 1983; Waechter, 1992).

Cytogenetic studies on the family Bromeliaceae are few. And only about 10% of the species have reported chromosome numbers. The chromosome numbers for these species are reported for the first time, except for Vriesea psittacina (Brown and Gilmartin, 1989).

MATERIAL AND METHODS

The species analyzed in this study are listed in Table 1. The specimens were either collected in the field and from cultivated material at Fundação Zoobotânica (FZB), Porto Alegre, Rio Grande do Sul. Voucher specimens have been deposited at Alarich Schultz herbarium-HAS (FZB). The plants were cultivated in the greenhouse of the Department of Genetics, Universidade Federal do Rio Grande do Sul. Taxonomic nomenclature follows Reitz (1983).

To obtain PMCs undergoing meiosis, young inflorescences were selected when floral buds were 1.7–2.0 mm long for Vriesea guttata, 0.9–1.6 mm long for all other Vriesea species, and 0.3–0.7 mm long for both Aechmea species. Floral buds were fixed for 24 h in 3:1 ethanol: glacial acetic acid with a drop of saturated aqueous ferric chloride (FeCl₃·6H₂O) at room temperature. After fixation, buds were transferred to 70% alcohol and stored in a freezer at −18°C. Squash preparations were made in a 1% propionic carmine on a microscope slide.

Pollen stainability was used to indicate pollen viability. Flowers at anthesis were collected for this analysis. Floral buds were fixed in 3:1 ethanol: glacial acetic acid for 24 h at room temperature and stored in 70% alcohol in a freezer at −18°C. Squash preparations were stained following Alexander’s method (1980). The stainability was determined using samples of 1500 pollen grains per flower. At least three flowers were analyzed per individual.
<table>
<thead>
<tr>
<th>Species</th>
<th>Number of plants</th>
<th>Chromosome number</th>
<th>Voucher</th>
<th>Localities of collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. carinata Wawra</td>
<td>7</td>
<td>50</td>
<td>HAS 102424</td>
<td>Maquiné</td>
</tr>
<tr>
<td>V. erythrodaecylon (E. Morren) E. Morren ex. Mez</td>
<td>2</td>
<td>50</td>
<td>HAS 102427</td>
<td>Três Cachoeiras</td>
</tr>
<tr>
<td>V. flavmea L.B. Smith</td>
<td>1</td>
<td>50</td>
<td>HAS 102321</td>
<td>Morrinhos do Sul</td>
</tr>
<tr>
<td>V. friiburgensis Mez</td>
<td>4</td>
<td>50</td>
<td>HAS 102411</td>
<td>Itapuí</td>
</tr>
<tr>
<td>V. guttata Linden and André</td>
<td>2</td>
<td>50</td>
<td>HAS 102414</td>
<td>Cambará do Sul</td>
</tr>
<tr>
<td>V. incurvata Gaudchaud</td>
<td>5</td>
<td>50</td>
<td>HAS 102438</td>
<td>Caraá</td>
</tr>
<tr>
<td>V. platynema Gaudchaud</td>
<td>3</td>
<td>50</td>
<td>HAS 102406</td>
<td>Guabiju</td>
</tr>
<tr>
<td>V. platzzmannii E. Morren</td>
<td>1</td>
<td>50</td>
<td>HAS 102404</td>
<td>Capão da Canoa</td>
</tr>
<tr>
<td>V. psittacina (Hooker) Lindley</td>
<td>2</td>
<td>50</td>
<td>HAS 102415</td>
<td>Viamão</td>
</tr>
<tr>
<td>V. procera (Martius ex. Shultes F.) Wittmack</td>
<td>4</td>
<td>—</td>
<td>HAS 102418</td>
<td>Maquiné</td>
</tr>
<tr>
<td>V. philoppo-coburgii Wawra</td>
<td>5</td>
<td>—</td>
<td>HAS 102306</td>
<td>São Francisco de Paula</td>
</tr>
<tr>
<td>V. rodigasiana E. Morren</td>
<td>2</td>
<td>—</td>
<td>HAS 102421</td>
<td>Dom Pedro de Alcântara</td>
</tr>
<tr>
<td>V. reinzi Leme and A. Costa</td>
<td>2</td>
<td>—</td>
<td>HAS 102310</td>
<td>São Francisco de Paula</td>
</tr>
<tr>
<td>Aechmea calyculata (Morren) Baker</td>
<td>4</td>
<td>50</td>
<td>HAS 102467</td>
<td>Santo Antônio da Patrulha</td>
</tr>
<tr>
<td>A. gamosepala Wittmack</td>
<td>2</td>
<td>50</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

*Species analyzed only for pollen stainability.

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TABLE 3. Percentage of pollen stainability in Vriesea species.

<table>
<thead>
<tr>
<th>Species</th>
<th>No. plants analyzed</th>
<th>No. flowers examined</th>
<th>No. pollen grains examined</th>
<th>Percentage of stained grains</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. carinata</td>
<td>7</td>
<td>34</td>
<td>50 548</td>
<td>94.3 (84.3–98.7)</td>
</tr>
<tr>
<td>V. erythroaclyon</td>
<td>7</td>
<td>4</td>
<td>3911</td>
<td>92.2</td>
</tr>
<tr>
<td>V. guttata</td>
<td>1</td>
<td>4</td>
<td>7500</td>
<td>88.1</td>
</tr>
<tr>
<td>V. friburgensis</td>
<td>1</td>
<td>5</td>
<td>26 990</td>
<td>95.8 (88.9–98.5)</td>
</tr>
<tr>
<td>V. incurvata</td>
<td>4</td>
<td>22</td>
<td>41 000</td>
<td>90 (79.9–98.5)</td>
</tr>
<tr>
<td>V. platynema</td>
<td>6</td>
<td>28</td>
<td>40 110</td>
<td>94.1 (87.3–97.7)</td>
</tr>
<tr>
<td>V. prosera</td>
<td>7</td>
<td>26</td>
<td>26 300</td>
<td>93.3 (88.9–98.2)</td>
</tr>
<tr>
<td>V. philoppo-coburgii</td>
<td>5</td>
<td>19</td>
<td>37 101</td>
<td>92.5 (80.5–96.8)</td>
</tr>
<tr>
<td>V. rodigasiana</td>
<td>2</td>
<td>10</td>
<td>15 000</td>
<td>95.4 (94.2–96.6)</td>
</tr>
<tr>
<td>V. retizii</td>
<td>2</td>
<td>10</td>
<td>15 000</td>
<td>98 (97.6–98.4)</td>
</tr>
</tbody>
</table>

* Values are means with minimum and maximum ranges.
Fig. 5. Pollen stainability in Vriesea philippo-coburgii. Viable pollen grains are full (dark) and stain purple, and unviable pollen grains are empty (light) and stain green. Bar = 20 µm.

orient properly between the poles, either not segregating, randomly moving to one or the other poles, or dividing, as in mitosis, into their two chromatids (Swanson et al., 1981).

In Aechmea species a total of 83 D/MI, 106 AI/TI, 29 MII, and 46 AI/III cells were analyzed (Table 2). For A. calyculata, the majority of D/MI cells presented the expected 25 bivalent pairing (Fig. 1). Two or four univalents were observed in D/MI abnormal cells. The similarity among chromosome sizes allowed differentiation of univalents and bivalents. A laggard chromosome was found in 1.2% of AI/TI cells of A. gamosepala, a high frequency (56%) of D/MI cells was observed with irregular pairing (Fig. 2). Unexpectedly, irregularities were not detected in the following phases of meiosis. Our results are similar to those reported for other bromeliad species. Marchant (1967) analyzed meiosis in PMCs of three species of Vriesea and nine species and a hybrid of Aechmea. All but one species presented regular meiosis. Vriesea splendens had an irregular meiosis presenting univalents at first metaphase. This species was not reported as being of hybrid origin.

Pollen viability—The pollen viability was analyzed in 39 plants from 10 species of Vriesea. The pollen viability of the examined species are described in Table 3 and illustrated in Fig. 5.

A high percentage of stained pollen (>88.1%) was regis-

tered for all species. These data also reflect the meiotic regularity. The high pollen viability indicates that irregularities observed at meiosis probably are not significant in terms of species fertility.

LITERATURE CITED


