**Introduction**

Flourenia cernua is being used as a shrub model to study the role of terpenes in intake by browsing ruminants at the Jornada Experimental Range.

**Materials and Methods**

40 turpentine plants (n = 20 different plants per study) were selected randomly in a heavily infested area on the Jornada Experimental Range during active summer growth (late August).

Each plant was divided into 4 quadrants (northeast, southeast, southwest, and northwest).

Experiment 1: all leaves were removed from 2 leaders (current year's growth) from 8 positions (outer canopy, subcanopy, and basal) in all 4 quadrants and placed on dry ice and stored at -10°C.

Experiment 2: 10 leaders (current year's growth) from each quadrant (outer canopy only) were removed and the 3 leaf age categories were formed (immature, moderate, and mature) by separating leaders into thirds and removing leaves.

5 leaves from each sample were extracted in duplicate for 5 min at room temperature in 5 ml of ethanol containing 5 mg/ml of 2-caren (internal standard).

Leaf surface terpenes were analyzed by gas chromatography-mass spectrometry to determine identity and concentration (Telles et al., 1997) with Kovats indices and mass spectral libraries (Adams, 1995).

Total volatile concentration was estimated from cumulative concentrations of all compounds within a leaf category.

Data were transformed to natural logarithms and subjected to univariate analysis of variance (SAS Inst. Inc., Cary, NC) with a completely randomized design to compare mean concentrations among quadrant and leaf position (Exp. 1) and leaf age (Exp. 2) for each compound. Means were separated using Tukey's honestly significant difference.

Because quadratic effects were minimal, data were pooled over quadrant and reanalyzed without quadrant in the model.

**Table 1:** Effect of leaf type on leaf terpenes in turpentine

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Exp. 1</th>
<th>Exp. 2</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turpene</td>
<td>208</td>
<td>6.9 ± 0.7</td>
<td>4.6 ± 0.8</td>
</tr>
<tr>
<td>-carvone</td>
<td>111</td>
<td>24.3 ± 4.7</td>
<td>24.1 ± 3.1</td>
</tr>
<tr>
<td>-selinene</td>
<td>1127</td>
<td>630 ± 122</td>
<td>630 ± 122</td>
</tr>
<tr>
<td>-ocimenene</td>
<td>200</td>
<td>0.7 ± 0.1</td>
<td>0.7 ± 0.1</td>
</tr>
<tr>
<td>-caryophyllene</td>
<td>111</td>
<td>5.2 ± 1.3</td>
<td>5.2 ± 1.3</td>
</tr>
<tr>
<td>-farnesene</td>
<td>200</td>
<td>4.5 ± 0.4</td>
<td>4.5 ± 0.4</td>
</tr>
<tr>
<td>-aromadendrene</td>
<td>2127</td>
<td>1250 ± 235</td>
<td>1250 ± 235</td>
</tr>
</tbody>
</table>

**Table 2:** Effect of leaf age on leaf terpenes in turpentine

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Exp. 1</th>
<th>Exp. 2</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>-caryophyllene</td>
<td>0.7 ± 0.1</td>
<td>0.7 ± 0.1</td>
<td>0.7 ± 0.1</td>
</tr>
<tr>
<td>-aromadendrene</td>
<td>1250 ± 235</td>
<td>1250 ± 235</td>
<td>1250 ± 235</td>
</tr>
</tbody>
</table>

**Results and Discussion**

93 volatile compounds (including 15 unknowns) were present on the leaf surface of F. cernua (Tables 1 and 2).

7 compounds (including 3 unknowns) in Exp. 1 and 9 in Exp. 2 differed (P < 0.05) among quadrants, but no consistent effect of quadrat was observed in either study.

31 compounds differed (P < 0.05) among leaf positions (Table 2), but outer canopy and subcanopy leaves did not differ for any compound.

Basal leaves contained greater concentrations of 10 compounds than outer canopy and subcanopy leaves, and less than the other 2 positions for 10 compounds.

30 compounds differed for leaf age (Table 2): immature leaves contained greater concentrations than mature leaves for all 30 compounds and greater than the mature age category for 26 compounds (P < 0.05).

Total concentration did not differ among leaf positions but differed for leaf age (greater in immature than mature leaves; P < 0.05) (Tables 1 and 2).

Compounds that differed in Exp. 1 were represented about equally by mono- and sesquiterpenes, whereas compounds affected by leaf age were predominantly sesquiterpenes (only 3 were monoterpenes).

In summary, both leaf position and age affect terpene concentrations and sampling variability in F. cernua.

**Literature Cited**