Western Coneflower—A Noxious Species?1

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Highlight
In laboratory tests, dilute foliar extracts of western coneflower (Rudbeckia occidentalis Nutt.) inhibit germination and seedling growth of seeded grasses as do those of some supposedly innocuous species. Under natural conditions on aspen range, measurements of plants of mountain brome growing in close association with coneflower gave doubtful evidence of suppressed growth. Large doses of dried aerial parts of coneflower force-fed to sheep produced no evidence of toxicity or other distress. We found no evidence of coneflower posing any special threat on mountain range, except as a relatively unpalatable increaser species.

Mountain range forbs are considered to be undesirable or noxious when they (1) are relatively unpalatable increaser species; (2) are poisonous to grazing animals; or (3) act to suppress establishment or growth of desirable species through competition. Competition may be direct for light and soil nutrients or indirect by production and liberation of substances toxic to associated species. Western coneflower (Rudbeckia occidentalis Nutt.) is an unpalatable increaser species (USDA Forest Service, 1937). Because of toxic substances in its foliage or roots, this plant has been suspected of poisoning livestock (Pam-mel, 1911) and of inhibiting germination of other species (Carnahan and Hull, 1962).

Our examination of possible toxic effects in coneflower included: (1) A laboratory study of the effects of foliar extract of coneflower on germination and seedling growth of two commonly seeded grasses—Nordan crested wheatgrass and Manchur smooth brome; (2) a field study of the effects of coneflower on the growth of mountain brome (Bromus carinatus Hook. and Arn.) growing in close association with coneflower; and (3) an animal toxicity study in which sheep were force-fed high doses of the dried aerial parts of coneflower.

Field studies and collections of plants in the fruiting state for laboratory and sheep toxicity studies were made on an aspen range site on the Cache National Forest in northern Utah. Laboratory methods for the evaluation of inhibitory substances in foliar extracts generally followed those of Carnahan and Hull (1962). The statistical significance of certain differences at the 5% level was determined by variance analysis and multiple range tests.

The minimum concentration of a filtered extract of the air-dry leaf powder that significantly inhibited germination and coleoptile and root growth of the test grasses was equivalent to 12.5 mg/ml of the unextracted leaf powder. A dialysate of the extract nearly eliminated the inhibitions. Removal of compounds adsorbable on activated charcoal eliminated the inhibition of coleoptile growth only. Paper chromatographic fractionation of the extract obtained by using either distilled water or 40% aqueous methanol as a developing solvent showed inhibitory activity at all Rf values, but greatest within the 0.8-1.0 range. However, extracts of leaves of mountain brome, supposedly an innocuous species, in the same dilutions showed the same inhibitory effects on the test grasses as did coneflower extract.

These results indicate that under laboratory conditions inhibitory effects can be found in the extracts of many species, as has been reported in the literature (Bonner, 1950; Borner, 1960). Osmotic activity and/or inhibitory products of the micro-organisms that proliferate in the unsterilized extract during the test period could account for at least part of the activity. However, some species, such as coneflower, might produce a secondary inhibition due to a particular fraction of its foliar extract that may be of questionable effectiveness in the field.

To test for possible inhibitory effects of coneflower on the growth of mountain brome during midsummer, measurements were made of 60 plants—20 were growing alone; 20 were growing in close association (within clusters of stems) with coneflower; and the remainder were growing in close association with a codominant forb, groundsel (Senecio serra Hook.). For the 60 plants, determinations were made of stem number per bunch, stem height, length of main roots, and shoot-root ratios (Table 1). Only the results for stem number support the hypothesis that coneflower inhibits the growth of mountain brome.

Table 1. Average growth characteristics of mountain brome growing alone, in close association with coneflower, or in close association with groundsel.

<table>
<thead>
<tr>
<th>Item</th>
<th>Mountain brome Alone</th>
<th>With coneflower</th>
<th>With groundsel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem number</td>
<td>8.95a</td>
<td>5.50b</td>
<td>4.65b*</td>
</tr>
<tr>
<td>Stem height (cm)</td>
<td>95.30ab</td>
<td>102.45b</td>
<td>87.90b</td>
</tr>
<tr>
<td>Root length (cm)</td>
<td>11.60a</td>
<td>13.10ab</td>
<td>13.85b</td>
</tr>
<tr>
<td>Shoot/root</td>
<td>2.89a</td>
<td>2.50a</td>
<td>3.27a</td>
</tr>
</tbody>
</table>

*Values for any growth characteristic with the same letter in subscript do not differ significantly at the 5% level.

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2 Stationed in Logan, Utah, at Forestry Sciences Laboratory, maintained in cooperation with Utah State University.
that coneflower depresses the growth of brome in the field. However, groundsel had the same effect on brome. For sheep toxicity studies, aerial parts of coneflower (seed heads, stalks, and leaves) were collected from the aspen site and were air dried, ground, mixed, and prepared in feeding units. On the first day, the material was pumped into the rumen of each of three test animals at the rate of one, two-thirds, and one-third pound, respectively. When no symptoms of distress had developed by the following day, the two lower doses were increased to 1½ lb. each, and the feedings were continued for an additional 3 days. Observations and inspections of the animals during and after the 4-day trial showed no evidence of toxicity or distress of any kind.

Under laboratory conditions, coneflower extract in low concentrations can effectively inhibit germination and seedling growth of some seeded grasses, and extracts from species considered to be nontoxic duplicate coneflower’s inhibiting effects on other plants. Carnahan and Hull (1962) found that extracts from three range plants (coneflower, tarweed, knotweed) produced abnormal germination in seeds of intermediate wheatgrass and radish and that even intermediate wheatgrass extract had the same effect on radish germination. During the study reported here, we found that mountain brome extract had an inhibiting influence on crested wheatgrass and smooth brome. If coneflower were exerting a significant inhibitory influence on closely associated mountain brome in the field, the effect should be detectable in growth characteristics other than stem number per clone. Varying soil and light conditions and differing competitive capacities of closely associated species are more likely explanations for particular growth effects in a particular location. Also, if coneflower were significantly toxic to grazing animals, the effect probably would have been apparent from the large doses given in the force-feeding experiment. Therefore, although coneflower is undesirable because of its status as an unpalatable increaser, it does not pose a special threat because of toxic or inhibitory characteristics.

**Literature Cited**


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**Electric Shears for Plot Harvesting**

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**Highlight**

Battery powered electric shears can reduce hand labor required to harvest small forage plots. Extra rechargeable batteries extend capacity to operate shears for several hours. Such shears will clip alfalfa and native range grasses more uniformly than when harvested with conventional hand sickle.

The hand labor required to harvest forage on small plots can be reduced by using battery powered, electric shears. Such shears have been used successfully to harvest alfalfa and native range grass plots. Alfalfa and native range grasses were clipped more uniformly and more easily, than when harvested with a conventional hand sickle. Weeds larger than alfalfa stems were difficult to cut with the shears.

Small rechargeable batteries are contained in the body of the shears; a battery charger is included with each shears. The capacity of the small batteries was not sufficient for long operation. Operating time between battery charges was increased by adding an external battery pack, with no modification of the shears. The battery charger included with the shears can be used to charge the battery pack.

Four rechargeable nickel cadmium 1.25 volt, 0.4 ampere hour battery cells, series connected, will provide sufficient capacity to operate the shears for several hours. A laboratory test of the shears’ performance, with the shears running, but not cutting, gave a running time of about 30 minutes with the internal batteries and about 3 hours with the battery pack.

The male charging connection of the shears will fit the female connection on polarized television power cords. The battery pack is connected to the shears by plugging the battery pack cord into the charging connection on the shears. The battery pack can be housed in a...