Autecology of *Puccinellia distans* (Jacq.) Parl. in saline and alkaline habitats North Gorgan Region

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Abstract

In this study type of soil, forage production, phenology, platability, chemical composition, seed germination, Plant composition and Importance value, were investigated in three distinct locations: sea shore area, Gomishan and Sangar tapeh. *Puccinellia distans* is a perennial grass which grows in the north region of Gorgan, with saline and alkaline soil, high water table and heavy texture and slow drainage of soil. It is an obligate halophytic plant which is well adapted to 321 mm rainfall and has well regeneration.

Growing initiation is from the early autumn and seed ripening is occurred in the last spring, the spikelet may remain until end of autumn. Chemical compositions show that the percentage of protein during vegetative growth is 14-to-16 and in the stage of seed ripening is at least 3.6 to 4.4%.

The *platable* of *Puccinellia distans* compared with associated species is higher and is at first class.

It can be reproduced with seed and also root division and spread rapidly with seed, propagation is obviously occurred by protection of its habitats. Seeds germinate in temperature between 20 to 25 °C up to 50%.

Forage production in Sea shore area, Gomishan and Sangar tapeh are respectively 187, 691, 800 kg/ha, and plant composition percentage were 53.4, 48.8 and 40.3. Important value in sea shore area was 74.7, Gomishan 73 and Sangar tapeh 43.8 according to 300 of base.

Key words: Autecology, *Puccinellia distans*, Saline and alkaline soils, Gorgan

Introduction

Saline and alkaline rangelands of Golestan province are one of the important ranching region but they have been located in a condition which cannot provide needed forage. Therefore the above rangelands are being more poor and palatable species are expose to deterioration, *Puccinellia distans* is one of the above mentioned species. The main aim of this study is knowing the Autecology of *Puccinellia distans* in saline and alkaline habitats north Gorgan region.


*Puccinellia distans* is a perennial grass of the Poaceae Family and Pooidae sub family. In most of world known also as; Reflexed poa; Reflexed meadow – grass; Alkali grass; Reflexed salt meadow grass; Reflexed Saltmarsh grass and Fults grass (Hitchcock A.S,1950,Cusick 1982, Hirota 1991,Binh 1989, Hubbard 1954). *Puccinellia distans* is an Euro-siberian species covering Middle and North Europe, the European part of Soviet Union and Caucasus and Siberia (Latowski and zukowski 1984).also its widespread in the N. America, N.w.Africa ,Turky ,China , Japan , Afghanistan and Iran (Davis 1985 , Hubbard 1954,Tzvelve 1984 , Hitchcock 1950). *Puccinellia distans* distribution in Iran is Gorgan, Khorasan, Azarbayjan, Kerman and Systan & Bluchestan.
Puccinellia has small seeds borne in a relatively rigid open panicle. Shoots can grow up to 70 cm high in a well fertilised stand but may be only 10 cm high on poor plants. Puccinellia is most suitable for the agricultural areas with 375 mm or more annual rainfall. Good stands have been grown with lower rainfall but establishment is more risky. The plants brown off in December and remain dormant over summer. They shoot vigorously after the opening rains of autumn. Heading occurs from about September onwards and the seed is generally ripe by December. Seed is not shed readily and harvesting may be delayed until late summer with little loss of seed (Negus 1982).

F.A.O (1970) Has been reported that *Puccinellia distans* is one of the suitable species in saline and alkaline soils of the steppe zone with 200-230 mm rainfall. Negus (1982) Has been states that Crude protein contents of *Puccinellia distans* is 4 per cent and digestibilities of about 50 per cent, also this species introduced one of the platable plants. (F.A.O, 1970 – Shidaei & Namati 1978- Rangland plant code of Iran, 1993)

F.A.O (1970) Has been reported that in Kamala bad & Walad abad with fancing and to control stock grazing, the dressed propagation *Puccinellia distans*, also Cusick (1982) Has been states that *Puccinellia distans* is a halophytic grass rapidly spreading in Ohio.

Negus (without date) Has been stated that stock must be kept off the pasture for the first 20 months to enable the young Puccinellia plants to develop a good root system and crown. It grazing occurs during the first summer many Puccinellia plants are pulled out of the ground by sheep and the pasture is severely thinned.

**Materials and Methods**

This investigation was carried out in Gomishan and Aghgala rangeland which is located in the northwestern Golestan province and eastern coast of the caspian sea. The extent of the rangelands in this area is 100,000 hectares with the moderate semi-arid climate and average rainfall 321 mm.

In order to study the autecology of *Puccinellia distans* three habitats by the names of sea shore area, Gomishan and Sangar-tapeh have been considered. In these habitats forage production measured by clipping and weighting method and 1 square meter quadrat were used (Hossaini, 1995) and also important value (IV) calculated with formula: IV = Rc + Rd + Rf (Relative cover, density and frequency) (Shidaei & Namati 1978).

Soil analysis were done by following methods in laboratory: texture by hydrometry, electrical conductivity in saturation extract with electrical conductivity meter, acidity by pH meter and cation exchange capacity by ammonium acetate. Chemical analysis were done according to A.O.A.C * methods. Investigation on preference value is conducted by feeding minutes method in phenology stage of heads out. In this method, the grazing time by sheep has been considered by using the cronometer in complete block design method.

**Results**

*Soil*. The results of the soil analysis in three habitats of *Puccinellia distans* have been shown in table 1. and water table of sea shore area shown in figure 2.

*Vegetation*. Forage production of this species in sea shore area, Gomishan and sangar-tapeh are respectively 187, 691 and 800 kg ha⁻¹ and plant composition
percentage were 53.4, 48.8 and 40.3. Important value in sea shore area was 74.7, Gomishan 73 and sangar-tapeh 43.8 according to 300 of base (Table 2).

**Phenology.** Growing initiation of *Puccinellia distans* after autumn rainfalls is occurred, flowering stage is the early June and seed ripening is occurred in the last spring and the early summer, the spiklet may remain until end of autumn.

**Platability.** The result of platability show that this species in compared with associated spicies such as, *Halocnemum strobilaceum*, *Aeluropus spp*, *Frankenia hirsuta*, *Salsola spp* and annual grass & forb have higher consumption and is at first class (Table 3 & 4).

**Chemical composition of** *Puccinellia distans* show that the percentage of crude protein during vegetation is 14.35 to 16.5 and in the stage of seed ripening is at least 3.6 to 4.4 % (figure 1).

**Seed** of *Puccinellia distans* is very small, so that the number of 1000 grain weight were 0.133 gr. It’s seed germinate in temperature between 20 to 25 °C up to 50 %. It can be reproduced with seed and also root division and spread rapidly with seed, propagation is obviously occurred by protection of it’s habitats.

This species was well regeneration after enclosure and reduced stocking rate. Forage yield was increased from 800 to 2500 kg/ha and canopy cover from 22 to 90 %.

* Association of official agricultural chemists (1965)

**Discussion**

In basis of done investigation and after present study and other studies *Puccinellia distans* is one of halophyte grass is growing in sea shore and saline & alkaline areas. Due to heavy texture of soil in these areas, is observed that water table is high and drainage is very low so that in duration of growth *Puccinellia distans* was placed at water logging condition.

F.A.O studies is showed that this species can be grow with low rainfall (200mm) during growth season and Negus (1982) has showed the best growth for this plant is occurred in 375 mm rainfall or more. In this study *Puccinellia distans* has well growth and regeneration with 321 mm rain fall during growth season.

Chemical composition show that the percentage of protein during seed ripening is 3.6 to 4.4 % that is accordant with Negus (1982) results.

*Puccinellia distans* in Shidaei & Namati (1978) book, Range plant code of Iran (1993) and F.A.O (1970) results is one of high platability plants (class I). In this study in ranking this plant was at first class in campared with associated species as *Parapholis incurve*, *Zingeria trichopoda*, *Plantago coronopus* ....and *Aeluropus lagopoides* (Table 4).

Reduced stoking rate, exclusion on regeneration and forage yield increasing are effective (Cusick, 1982 – F.A.O, 1970 – Negus, 1982) so that in this study in areas that excluser forage yield was increased from 800 to 2500 kg/ha and canopy cover from 22 to 90%.

The results obtained from this study show that this species all well distributed and adapted in north Gorgan saline and alkaline rangeland and can be used in reclamation and regeneration of rangeland in this conditions. At present, this species is being used in range management projects in Gomishan and has a many effects on the range condition and forage production.
Referens

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Table 1 : Results of the soil analysis in Puccinellia distans habitats

<table>
<thead>
<tr>
<th>Habitats</th>
<th>Depth Cm</th>
<th>pH</th>
<th>ECe (dsm⁻¹)</th>
<th>CEC (meq/100gr)</th>
<th>Texture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>Depth 0-30</td>
<td>Depth 30-60</td>
<td>0-30 %</td>
<td>30-60 %</td>
<td>Type</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------</td>
<td>-------------</td>
<td>---------</td>
<td>---------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Gomishan</td>
<td>8</td>
<td>8.4</td>
<td>40</td>
<td>36</td>
<td>Silty clay loam</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Silty clay loam - Silty loam</td>
</tr>
<tr>
<td>Sangar-tapeh</td>
<td>8.3</td>
<td>7.9</td>
<td>52</td>
<td>54</td>
<td>Silty loam</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Silty clay loam</td>
</tr>
<tr>
<td>Sea shore area</td>
<td>7.7</td>
<td>7.7</td>
<td>39</td>
<td>38</td>
<td>Clay loam</td>
</tr>
<tr>
<td></td>
<td>7.7</td>
<td>7.7</td>
<td>37</td>
<td>37</td>
<td>Silty clay</td>
</tr>
</tbody>
</table>

**Figure 1: Changes of amount of crude protein in different phenological stage.**
Table 2. Results of plants importance value in *Puccinellia distans* habitats.

<table>
<thead>
<tr>
<th>Species</th>
<th>Sea shore area</th>
<th>Gomishan</th>
<th>Sangar tapeh</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Puccinellia distans</em></td>
<td>21.4</td>
<td>15.5</td>
<td>17.8</td>
</tr>
<tr>
<td><em>Halocnemum strobilaceum</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Halostachys belangeriana</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Salicornia europaea</em></td>
<td>43.1</td>
<td>22.2</td>
<td>65.2</td>
</tr>
<tr>
<td><em>Salsola turcomanica</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Ptrosimonia brachiata</em></td>
<td>5.5</td>
<td>11.1</td>
<td>5.2</td>
</tr>
<tr>
<td><em>Zingeria trichopoda</em></td>
<td>2.9</td>
<td>12.2</td>
<td>2.2</td>
</tr>
<tr>
<td><em>Parapholis incurva</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Plantago coronopus</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Lophochloa phleoides</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Lolium rigidum</em></td>
<td>2.9</td>
<td>12.2</td>
<td>2.2</td>
</tr>
<tr>
<td><em>Hordeum glaucum</em></td>
<td>3.3</td>
<td>13.3</td>
<td>3</td>
</tr>
<tr>
<td><em>Aeluropus lagopoides</em></td>
<td>0.58</td>
<td>4.4</td>
<td>1.5</td>
</tr>
<tr>
<td><em>Aeluropus littoralis</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Polypogon monspeliensis</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Frankenia hirsuta</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Taraxacum neveski</em></td>
<td>0.29</td>
<td>2.4</td>
<td>0.7</td>
</tr>
<tr>
<td><em>Veronica persica</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

1.V=Importance value  R.C= Relative cover  R.F= Relative frequency 
1.D= Importance density
Figure 2. Habitat of Sea shore area in east of Caspian sea (winter)

Figure 3. Platability comparison of *Puccinellia distans* as compared with association species by feeding minutes method in Gomishan habitat.
Table 3. Analysis variance of *Puccinellia distans* compared with associated species.

* P< 0.05 , ** P< 0.01

<table>
<thead>
<tr>
<th>variable</th>
<th>df</th>
<th>ss</th>
<th>variance</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>8</td>
<td>769.6</td>
<td>96.20</td>
<td>88.329</td>
<td>**</td>
</tr>
<tr>
<td>Days</td>
<td>3</td>
<td>1.21</td>
<td>0.40</td>
<td>0.37</td>
<td>n.s.</td>
</tr>
<tr>
<td>Error</td>
<td>24</td>
<td>26.13</td>
<td>1.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>796.95</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Mean comparison of utilization durations by L.S.D* test.

<table>
<thead>
<tr>
<th>Species</th>
<th>Mean of utilization durations (minute)</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Puccinellia distans</em></td>
<td>12.88</td>
<td>I</td>
</tr>
<tr>
<td>Parapholis /Zingeria/Plantago</td>
<td>10.15</td>
<td>II</td>
</tr>
<tr>
<td><em>Lolium/Hordeum</em></td>
<td>1.525</td>
<td>III</td>
</tr>
<tr>
<td>Taraxacum sp</td>
<td>0.800</td>
<td>III</td>
</tr>
<tr>
<td>Halostachys belangeriana</td>
<td>0.625</td>
<td>III</td>
</tr>
<tr>
<td>Frankenia hirsuta</td>
<td>0.300</td>
<td>III</td>
</tr>
<tr>
<td>Polypogon monspeliensis</td>
<td>0.275</td>
<td>III</td>
</tr>
<tr>
<td>Halocnemum strobilaceum</td>
<td>0.200</td>
<td>III</td>
</tr>
<tr>
<td>Aeluropus lagopoides</td>
<td>0.075</td>
<td>III</td>
</tr>
</tbody>
</table>

* L.S.D = Least significant difference