EFFECT OF SALINITY ON SEED STRUCTURE OF CHICK PEA
(CICER ARIETINUM) CV. C-235
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ABSTRACT

The present investigation was carried out on chick pea (Cicer arietinum) cv. C-235 to study the effect of different levels of salinity (C, 40, 60, 80 mg L⁻¹) on the seed structure. The width of seed coat decreased with salinity and the most affected level was of 60 and 80 mg L⁻¹. The other affected part of the seed was the storing tissue i.e. cotyledon which showed a considerable reduction under the stress conditions.

Salinity is most serious environmental problem that poses serious threat to productivity of crop plants. It is one of the major limiting factors to the productivity of field crop. In India, a large area (about 12 million hectares) both in arid and semi-arid region is affected by salinity which ultimately reduced the crop productivity (Aggarwal et al., 1982). Green legumes are the major source of proteins for large section of population in this country, contributing nearly 10 per cent of the total consumption by human beings and live stock (Jalil and Tahir, 1973). An important factor limiting the green legumes is the saline soil. The structural and functional aspects of reproductive structures which have direct relevance to Agricultural productivity also have known to be affected by salinity. Therefore, Chick pea (Cicer arietinum L.) variety C-235 an important leguminous crop has been selected for the present study.

The present investigations were carried out on Chick pea (Cicer arietinum L.) variety C-235 at CCS, Haryana Agricultural University, Hisar during the year 1994. Surface sterilized seeds were inoculated with rhizobial strain ( cv. 181 ) specific to chick pea. Four sets of plants were raised in sand in a pot culture house and supplies with N - free nutrient solution at periodic intervals. The whole investigations were divided into two sets : one set served as a control, while the other three sets were provided with 40, 60, 80 mg L⁻¹ of salt (Na⁺ + Cl⁻) stress respectively. For studying the general anatomy and the effect of different levels of salinity on the anatomical features of seed, the materials were fixed in formalin - Acetic acid - Alcoholic solution (FAA). FAA solution composed of Ethanol - 50 ml + Glacial acetic acid - 5 ml + Formaline - 10 ml + Water - 35 ml.

After fixing the sample for 32 hours the samples were washed and preserved in 70 per cent alcohol till their further use. The preserved materials when used were dehydrated through ethanol-Xylene series and then infiltrated and embedded in paraffin wax (Congealing point 58-60°C). Serial transverse and longitudinal sections were cut at 10-12 μ on microtome (Spencer ‘820’ microtome USA make). Affixing of the paraffin ribbons to the slides were made by using Haupt’s adhesive. The solutions were stained customary with safranin - light green and studied under light microscope at the magnification of 900, (approx.). For studying the seed coat structure, the sampling was done 240 hrs after anthesis.

A Transverse section of seed coat of Cicer arietinum revealed that a layer of radially elongated palisade like cells devoid of intercellular spaces on the outer side. According to literature these cells are usually termed as

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malpighian cells or macroscleroids (because of their shape and thickness of their walls.) The thickness was characteristically unequal throughout and usually the walls consisted of cellulose and cutin. (Malpighian cells get elongated towards the funicle and their size increases 3-folds).

In these cells the cell layer was broader at the base and the outer layer of the upper cell wall of these cells were covered by a thin cuticle. During the development the greater portion of the inner tissue of the outer integument get disintegrated and the outer cell developed at the cost of these cells and these become thick walled termed as testa. The malpighian cells constituting the testa remained uniform in thickness except at the hilum where their size increased to one and half times. The characteristic feature of *Cicer arietinum* is the development of counter palisade i.e. and equivalent layer of palisade developed at the hilum which also attached with the funicle. Just at the center of the counter palisade cells were the vascular strands as evident from the tracheidal elements present in the parenchymatous cells of funicle. Another feature of malpighian cells was, towards the outer side, there was a continuous light area running along the cells i.e. parallel to the surface of seed coat, termed as light line or lines lucida.

Below the testa there was another one or two layers of rectangular cells which constitute the tegmen. Some of these cells were very small and they possessed a few intercellular spaces. At some places the shape of these cells resembles with osteoscleroids. Below the tegmen, the whole of the seed was occupied with embryo, the major part of which was the food storing cotyledons, which was traversed with vascular elements here and there.

Treatment of different levels of salinity adversely affected the seed coat construction. The length of the radially arranged malpighian cells got reduced which ultimately reduced the thickness of testa (Fig. 1, 2).

The reduction in length of these cells were also noticeable towards the hilum region where along with this a reduction in counter

![Fig. 1. T.S. of seed in control x 900 (Approx.)](image-url)
Fig. 2. T.S. of seed in 80 meq L\(^{-1}\) salinity x 900 (Approx.)

Epidermis - E, Palesade cells - Ps, Testa - Tt

Fig. 1, 2. Effect of salinity on structure of seed

Table 1. Effect of chloride salinity on the seed structure of chickpea (Cicer arietinum cv. C-235)

<table>
<thead>
<tr>
<th>Salinity levels (mg L(^{-1}))</th>
<th>Seed coat thickness (μm)</th>
<th>Cotyledon thickness (μm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>260</td>
<td>100</td>
</tr>
<tr>
<td>20</td>
<td>250</td>
<td>90</td>
</tr>
<tr>
<td>40</td>
<td>240</td>
<td>80</td>
</tr>
<tr>
<td>60</td>
<td>220</td>
<td>70</td>
</tr>
<tr>
<td>80</td>
<td>220</td>
<td>50</td>
</tr>
</tbody>
</table>

palisade was also observed. The reduction in thickness was very well prominent at 80 mg L\(^{-1}\). Besides this there was no change caused in the construction of the testa and tegman. The outer affected part of the seed was the storing tissue i.e. cotyledon which also showed a considerable reduction of up to 17% (Table 1).

Seed, the final and the ultimate product is also influenced by various environmental stresses. The histological studies of the seed showed that seed coat construction was the most affected by salt stress. The length of malpighian cells was reduced drastically and so also the food storing tissue i.e. cotyledon which showed a decline in thickness. All these changes indicate a qualitative change in the seed under saline condition. Ram et al. (1984), Dhingra and Sharma (1992) also reported a decline in the quality of seeds under saline condition in terms of seed weight.

CONCLUSIONS

Seed of chickpea is a non-endospermic and constitutes the outer seed coat and inner cotyledons enclosing the embryo axis. A characteristic feature of chick pea is the development of counter palisade i.e. an equivalent layer of palisade developed at the
hilum. As usual the seed coat consists of 2 layers, testa and tegmen. The width of seed coat decreased with salinity and the most affected level was 60 and 80 mg L\(^{-1}\). The other affected part of the seed was the storing tissue which showed a considerable reduction.

REFERENCES