Changes in antioxidant enzymes during sunflower seed development
Arnaud Lehner, Christophe Bailly, Sandra Rousseau, Françoise Corbineau, Daniel Côme

To cite this version:
Arnaud Lehner, Christophe Bailly, Sandra Rousseau, Françoise Corbineau, Daniel Côme. Changes in antioxidant enzymes during sunflower seed development. Journée de l’UFR de Biologie de l’Université Pierre et Marie Curie, Paris 6, 2001, Paris, France. hal-02081252

HAL Id: hal-02081252
https://normandie-univ.hal.science/hal-02081252
Submitted on 27 Mar 2019
INTRODUCTION

Seed germinability and vigour are closely related to the conditions of seed development and maturation on the mother plant. The development of orthodox seeds is associated with reserve accumulation, which provides the energy source for seedling growth, and with a pronounced desiccation phase, which allows the seeds to enter a dry quiescent state. Desiccation of plant tissues has been shown to be related to production of active oxygen species (AOS), the accumulation of which may generate various cellular damage (Leprincke et al., 1993; Sminnikoff, 1993). Therefore, the ability of seeds to escape oxidative injuries during their programmed desiccation on the mother plant, through AOS scavenging, might be related to their subsequent germinability. The aims of this work were (i) to study the changes in the antioxidant enzymes superoxide dismutase (SOD), catalase (CAT) and glutathione reductase (GR) during sunflower seed development and after artificial drying, and (ii) to investigate whether there was a relationship between acquisition of seed vigour and expression of these enzymes.

RESULTS

SEED DEVELOPMENT

Seed dry mass accumulated from 24 to 42 days after pollination (Fig. 1). At the end of reserve accumulation, so called physiological maturity, thousand seed weight (TSW) was ca 55 g and moisture content was around 30 % fresh weight (FW). Seed water content regularly decreased from 63 % FW at 24 DAP to 10 % FW at 56 DAP, thus showing no marked desiccation phase.

Table 1: Germination ability and seed vigour of dried seeds collected at various stages of their development. MTG, mean time to germinate. T50, duration of controlled deterioration which reduced seed germination by 50 %.

<table>
<thead>
<tr>
<th>DAP</th>
<th>Normal seedlings (%)</th>
<th>MTG at 15°C (h)</th>
<th>T50 (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>89.7</td>
<td>80</td>
<td>122.4</td>
</tr>
<tr>
<td>34</td>
<td>97.7</td>
<td>64</td>
<td>132.0</td>
</tr>
<tr>
<td>42</td>
<td>95.3</td>
<td>57</td>
<td>144.0</td>
</tr>
<tr>
<td>50</td>
<td>90.7</td>
<td>47</td>
<td>156.0</td>
</tr>
</tbody>
</table>

Figure 1: Changes in moisture content (●) and in thousand seed weight (TSW, ▲) of sunflower seeds during their development.

ELABORATION OF SEED GERMINABILITY

Dry seeds were able to germinate, and then to tolerate desiccation, as soon as 24 DAP, i.e. when they were still immature (Table I). Germination percentages increased during seed development, and seeds reached physiological maturity. Further decrease of percentages of normal seedlings was related to fungus contamination. Seed vigour, as assessed by germination rate at 15°C and tolerance to controlled deterioration, improved during seed development and after physiological maturity (Table I). Indeed, MTG decreased and duration of controlled deterioration necessary to reduce seed germination by 50 % (T50) increased during development.

CHANGES IN ENZYME ACTIVITIES DURING SEED DEVELOPMENT

GR activity did not evolve significantly during seed development on the mother plant and was very similar in fresh and dry seeds (Fig. 2A). SOD activity displayed the same profile of activity and therefore did not show any significant change during seed development (data not shown).

CONCLUSION

The results obtained give new insights on acquisition of germinability and on changes in antioxidant enzymes during sunflower seed development:

- Desiccation tolerance is acquired very early in the seed developmental program (at least when drying is mild).
- Seed vigour increases after physiological maturity.
- Although SOD and GR are active, they do not appear to be involved in acquisition of desiccation tolerance or elaboration of seed vigour.
- Catalase is associated with seed desiccation through a transcriptional regulation of its expression. CAT activity is correlated with the onset of physiological maturity but probably not with seed germinability.

REFERENCES