Investigations of Sterility in Amphidiploid Raphanobrassica

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Populations of the amphidiploid hybrid Raphanobrassica (2n = 4x = 36, rrcc) was produced at Svalöv in 1969 from crosses between autotetraploid fodder radish, Raphanus sativus L. (4x = 36, rrrr) and autotetraploid marrowstem kale, Brassica oleracea var. aceptrala L. (4x = 36, cccc). Raphanobrassica has potentials to become an interesting annual fodder crop if sterility can be overcome and if economic seed production can be made possible. Yield, quality and dry matter content of this fodder crop are as good as or better than fodder rape and marrowstem kale. During the last three years, our investigations have been concentrated on fertility problems. The following results have been obtained:

1. Causes to sterility on the female side

Embryo-sac formation

The main cause of sterility is a disturbance of a more general nature in the interplay between the two parent genomes. As a result of this, the material exibits a high frequency of unfertilized and/or degenerated embryo-sacs. Aposporic embryo-sacs are found in most plants.

Repeated selections during 6 generations have improved seed fertility from 0.1 to 2.3 seeds per pollinated flower (= 13%). Seed fertility of 40% is necessary for an economic seed production.

2. Causes to sterility on the male side

Disturbances at meiosis

Meiosis was studied in one F_2 and one F_7 population. Univalents at M I, laggards and bridges at A I and A II are frequent, resulting in anueploid gametes and plants. These disturbances are supposed to be caused by insufficient meiotic timing between the parental genomes.

There are no indications that repeated selection resulting in improved seed fertility has any influence on the rate of disturbances at meiosis.

Meiosis appears to be only slightly influenced by external factors, while seed fertility is considerable influenced.

Pollen-tube germination

Male fertility has been calculated by using the conventional method, i.e. to stain pollen in cotton blue and to count the number of well stained grains. In order to check the reliability of these fertility data, several experiments were made to estimate the percentage of pollen grains capable of growing on mature stigma. This was done with fluorescence technique.

All results point in the same direction; a high correlation between stainability and germination of pollen grains. Thus, in most lines, male fertility and pollen tube germination have increased gradually, as a result of intense selection. In several cases we have observed that two pollen-tubes develop from one single grain. Why this happen we don´t know yet.

Conclusions

The main cause to sterility is abnormal development of embryo-sacs resulting in low seed production. Disturbances at meiosis and reductions in male fertility occur, but are of less importance.

Literature

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