EFFECTS OF SILIQUE POSITION ON SEED GLUCOSINOLATE CONTENT STUDIED IN DOUBLED HAPLOID RAPESEED

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INTRODUCTION

The decrease in seed glucosinolate content is one of the most important goals in rapeseed breeding today. For this purpose a method was developed that is applied in breeding programs nowadays using microspore culture to generate doubled haploid genotypes of winter rapeseed, Brassica napus (Lichter, 1982).
The determination of glucosinolate (gsl) content is often carried out in isolated secondary shoots. However, it is known from earlier studies that the silique position on the different secondary shoots has a distinct effect on the glucosinolate content. Therefore, a clarification of this fact is of major interest for plant breeding, especially since it is possible now to determine the gsl-content on large numbers of completely homozygous genotypes, i.e. doubled haploids (dh-lines).
In the present investigation the effects of silique position on the total gsl-content as well as the proportion of different individual glucosinolates (gsls) was analyzed by HPLC in seeds from the main and secondary branches of dh-lines, respectively.
Also, the influence of parchment bag isolation as compared to open flowering was studied, since selection is often carried out on the basis of results of seed material after isolation.

MATERIALS AND METHODS

For the present experiments 34 dh-lines were analyzed by HPLC according to Demes (1989). With this method the different individual gsls, total gsl-content as well as the total alkenyle- and indole-gsls were determined.
The examinations were carried out with dh-lines from Semundo Company, Rellingen. This material was tested at the breeding stations Teendorf (location 1) and Grundschwalheim (location 2), in order to determine the environmental influence, additionally. Seed samples were simultaneously taken from the main branch as well as from the third and fifth secondary branches, respectively.
The effect of silique position on the gsl-content was statistically evaluated by analysis of variance and the effect of isolation by oneway analysis.

RESULTS AND DISCUSSION

In fig. 1 the mean values of total gsl-content for the two locations as affected by silique position are summarized. This illustration shows the clear decrease of total gsl-content with the order of branches. Highest gsl-contents in drymatter were found in the main branches (25.79 umol/g drymatter at Teendorf and 23.45 umol/g at Grundschwalheim), while the lowest contents were observed in the fifth secondary branch; i.e. 23.07 umol/g dm and 21.03 umol/g dm, respectively.

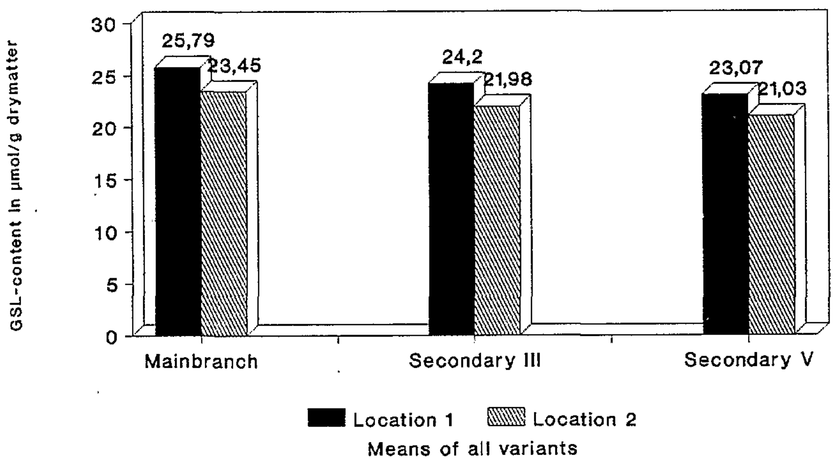

Fig. 1. Total gsl-contents (µmol/g dm) at locations 1 and 2

The reduction of the alkenyle- and the indole-gsls according to silique position was also pronounced, mainly at Teendorf. The statistical evaluation shows that alkenyle- and indole-gsls both affect the total gsl-content, but the importance of alkenyles is always stronger.

Similar effects could also be found for different individual glucosinolates. Pod position as a source of variation was highly significant (P=0.1%) for progoitrin and gluconapin, but only at location 1 (Fig. 2). At location 2 only progoitrin and 4-hydroxy-glucobrassicanapin showed the described effect. Therefore, the influence of location on single gsl-content was not confirmed for all varieties studied.

As shown in fig. 3 isolation of flowers causes significant reductions of gsl-content. The statistical analysis revealed significance for this effect with regard to total and alkenyle gsl-content, but not for the indole glucosinolates. Also the amounts of progoitrin, napoleiferin, gluconapin, glucobrassicanapin, nasturtiin and methoxybrassicin were clearly reduced under isolation bags.

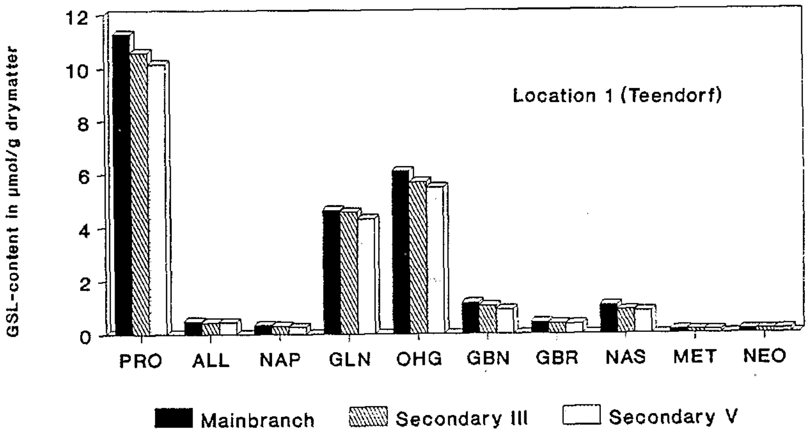

Fig. 2. Content of individual glucosinolates (μmol/g dm) in different branches

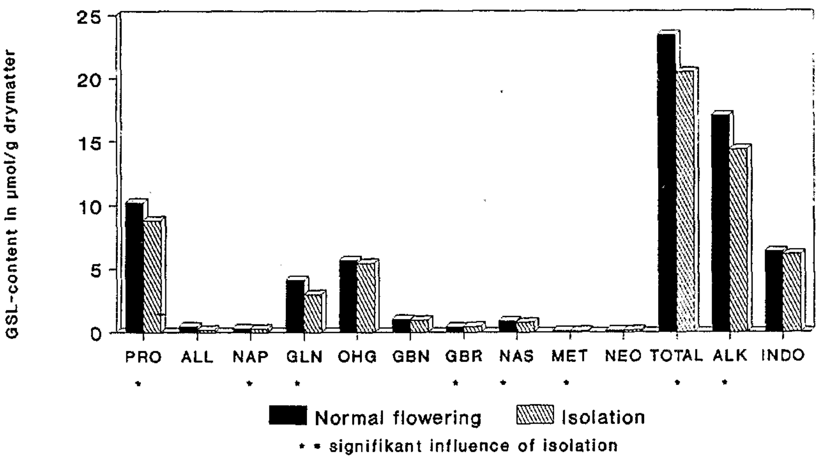

Fig. 3. Content of individual glucosinolates (μmol/g dm) in seeds obtained by open pollination (normal flowering) and artificial self-pollination (bag-isolation)

The accordance of these results with those of Kondra and Downey (1970) is probably due to the fact, that the same order of branches were investigated in both studies. On the contrary, Brune et al. (1987) also analysed gsl-contents of branches of different order and did not detect significant differences. These deviating results observed may be affected by different maturity and supply with assimilates.

As a consequence of these findings, it is recommended that selection for glucosinolate content should be carried out with seeds derived from main branches, only.

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