Factors affecting thrips resistance in cabbage

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***Abstract* – In two field experiments in the Netherlands the development of thrips populations and thrips damage in ten cabbage varieties was monitored. Also a number of morphological, physiological en biochemical plant traits were measured. The most important factors leading to a low level of thrips damage were a late development of a compact head, a low dry matter content and a high amount of leaf wax.[1]**

INTRODUCTION

Cabbage is one of the main field crops grown by organic farmers in the Netherlands. When cabbage is cultivated for storage, it is usually harvested around mid-October. This type of cabbage crop may be severely damaged by thrips (*Thrips tabaci*). Thrips damage can already be noticed in August, but the thrips population and the more severe symptoms develop mostly during September and October. Also during cold storage symptoms continue to develop. In conventional cultivation chemical treatments are used to control thrips damage, but as the insects are protected within the developing head this is not always effective. In organic farming of course no chemical protection is available.

The damage caused by thrips is due to the symptoms that develop after feeding, which are small callus growths that will turn brownish after some time. These symptoms necessitate the removal of the outer leaf layers before marketing. The presence of the insects themselves, and the direct yield loss due to feeding are not important.

Among modern cabbage varieties, large differences are known to exist in the susceptibility to thrips damage, although it is not clear whether these differences are due to resistance (affecting the thrips population in the plant) or to tolerance (affecting the development of symptoms upon thrips feeding). Further, not much is known about plant traits affecting the resistance or tolerance to thrips. This research is aimed at elucidating these points.

MATERIAL AND METHODS

Plant material and cultivation

Ten cabbage accessions with varying scores for thrips damage, wax layer, earliness of heading and of maturity were obtained from the Centre of Genetic Resources of the Netherlands (open-pollinated varieties) and from seed companies (F1 hybrids). Seedlings were transplanted to plugs at 2 weeks after sowing and planted in the field at 6 weeks.

All accessions were planted end May 2005, and four accessions were planted also mid-June. The experiment was replicated in two fields, one in Wageningen and one in Zwaagdijk. Both fields were laid out in three blocks, each with one plot per accession/plant date and 45 plants per plot. Cultivation was according to organic farming regulations.

Evaluation of traits, thrips population and damage

At four dates (10 August, 1 September, 22 September and 20 October) three plants per plot were evaluated a.o. for head circumference (cm), leaf thickness (mm), developmental stage, head compactness, and leaf wax (visual grading). Heads were halved longitudinally. One half was peeled, the total number of adult thrips were counted, and the thrips damage (affected leaf area and size of warts) graded visually; the three other halves from each plot were pooled and ground, and analyzed for a.o. Brix and total dry matter.

Statistical analysis

Data were transformed where necessary to obtain uniform residual variances. This involved logarithmic transformation of developmental stage and of thrips damage scores; for other traits no transformation was necessary. Next averages (of transformed values if necessary) were calculated per plot. All further analyses were based on plot means, and carried out in Genstat 8.

RESULTS AND DISCUSSION

Development in time

At the first harvest date, most plants had barely started to form a head. Only a few thrips were found in the entire experiment and no damage was observed. During the next three harvests all heads grew and matured. Although differences in maturity and compactness were evident at the earlier harvests, these tended to disappear at the last harvest. For leaf thickness, Brix and dry matter content no clear trends were observed. Leaf wax was lower at the first harvest than at the next three harvests.

Effect of planting date

Four accessions were sown and planted at two dates. For developmental stage, size en compactness large differences between the two dates were observed during the earlier harvests, which decreased towards the last harvest date. No clear

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effects on leaf wax or leaf thickness were observed, while Brix and dry matter content were slightly lower in heads from the late planting. The number of thrips was considerably smaller, and the damage slightly smaller in the late planting, with exception of the highly resistant cultivar Galaxy which showed no consistent differences between the plant dates.

Location effects

At Wageningen the cabbages grew and matured faster and became larger than at Zwaagdijk. Leaves were thicker and had more wax at Zwaagdijk. There was no difference in compactness. At the final harvest the thrips population and damage were comparable at both locations, but at the third harvest we found less thrips but more damage at Wageningen than at Zwaagdijk.

Genotypic effects

The ten varieties showed a large variation for all traits studied, as was expected from the selection criteria. The varieties Slawdena and Bartolo showed high thrips populations and high damage as expected, while Galaxy showed a resistant / tolerant reaction. Thrips population and damage were highly correlated (R=0.91 and 0.86 in the third and fourth harvest); there were no varieties with a remarkably low damage in relation to the number of thrips.

Correlations between variety traits and thrips

Thrips damage and thrips numbers in the last two harvests were highly correlated. Both were positively correlated with Brix and dry matter content. They were also positively correlated with compactness and developmental stage in the first two harvests. This indicates that a cabbage head with tightly packed leaves early in the season leads to higher thrips populations; presumably because the insects are sheltered against predators. Further, a high amount of leaf surface wax is negatively correlated with thrips damage and numbers, indicating that wax gives some protection against thrips. No relation was found with head size. Contrary to earlier indications, we also found no relation between leaf thickness and thrips population or damage.

WORK IN PROGRESS

In addition to the traits mentioned above we are currently analysing glucosinolate content of all varieties. Further we have made crosses between some varieties with high and low resistance or tolerance to thrips. We will verify the identified relations between variety traits and thrips damage in 2006 using additional plant material, including other varieties as well as cross progenies. Also extra morphological traits will be studied.

CONCLUSIONS

Thrips damage and thrips population size were found to be highly correlated, and no varieties were found with high trips numbers but low damage. This indicates that resistance rather than tolerance is the dominating factor affecting thrips damage.

Important factors that limit thrips damage are the late formation of a compact head, a low dry matter content and a high amount of leaf surface wax.