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Factors Influencing the Population of the Onion Thrips on Onion

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The onion thrips (*Thrips tabaci* Lindeman) has been known for a long time as a pest of onion. The damage hinders the development of the onion, causing the plant to end its development earlier than usual, so there may be a decrease in crop yield, too. Control of the onion crop against the onion thrips is the basis of its protection. The chemical protection is difficult owing to the hidden lifestyle of the pest and the wax cover on the leaf of the onion. The natural enemies of the onion thrips can reduce the population only to a small degree. One of the efficient and environmentally friendly protection methods could be the production of thrips resistant onion varieties. The thrips susceptibility of onion varieties (dry onion, leek, green bunch onion and chive) produced in Hungary is unknown. Our aim was to investigate the thrips susceptibility of commercially produced onion varieties and to work out the methods of a large-scale investigation.

Keywords: Onion, thrips, varieties, susceptibility, population dynamics.

Onions are a major crop in Hungary grown on a relatively large surface area (5–6000 ha). One of the most important pests of onion is the onion thrips (*Thrips tabaci* Lindeman). *Thrips tabaci* is a highly polyphagous species but its favourite host plant is still the onion. High populations of onion thrips can damage the leaves of onions *(Allium cepa)* in the field resulting in reduced crop yields (Edelson et al., 1989). Control of the onion crop against the onion thrips is the basis of its protection. Satisfactory chemical control is difficult to achieve for several reasons: a large number of thrips are always hiding between the inner leaves of the onion plant, the pupal stage is spent in the soil, the species is very prolific, the generations overlap, and other host plants are numerous (Jones et al., 1934). The natural enemies of the onion thrips can reduce the population only to a small degree. A more effective and environmentally friendlier protection method is needed in onion production. We were looking for different possibilities to reduce the damage caused by the onion thrips without using more pesticides. Alternatives can be the production method, thrips tolerant cultivars, and different planting times. We also tried to determine the main source of infestation.

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Materials and Methods

Population dynamics and planting methods

Field experiments were made in the 1970s in Soroksár, Hungary, to observe the population dynamics of the onion thrips in onion. There were experimental plots of onion grown directly from seed and also from onion sets. The population dynamics of the onion thrips was observed by blue water trap and by checking of onion plants. Onion sets (before planting) and weeds surrounding the onion field were also checked for thrips. Water traps were emptied every week and the collected specimens were kept in 75% alcohol until identification. The checking of onion plants was done every week by counting the number of thrips on 100 plants per plots.

Susceptibility of varieties

At the beginning of 2002, thrips susceptibility of six commercial onion varieties (Braunschweigi, Stuttgarti, Makói, Makói CR, Makói Fehér, Nemesített Makói) was investigated under greenhouse conditions. 100 plants per varieties were planted in a greenhouse where thrips were already present. After one month all developmental stages were collected from plants and later counted. Observations were also done under field conditions in the following two summers in Tordas, at the Plant Variety Testing Station of the National Institute for Agricultural Quality Control.

Results

Population dynamics and planting methods

Regular observations were made during five years to record the population dynamics of the onion thrips. Every year, the onion sets were checked for thrips before planting. We found that 20–40% of the onion sets were infected with thrips larvae or adult. After the emergence of onion plants we have already found thrips on them but the water traps have not caught any specimens although immigration to the field could have been possible (Pénzes, 1980) *(Figs 1, 2).*

Weeds surrounding the onion field were also inspected for thrips but only a few specimens were found on dandelion *(Taraxacum officinale).* So we may conclude that onion sets are very important as a source of infection.

Blue water traps caught thrips from the end of May when the adults of the first generation were on the wing.

The number of adults caught by both methods suddenly increased in mid-June. There was a decrease in the number of thrips caught in July but the results of the two catching methods were different. At this time the onion plants were ripening, no more new leaves appeared, so the quality of the food source has changed. Thrips left the unsuitable food source and were searching for new ones. Blue water traps captured more thrips

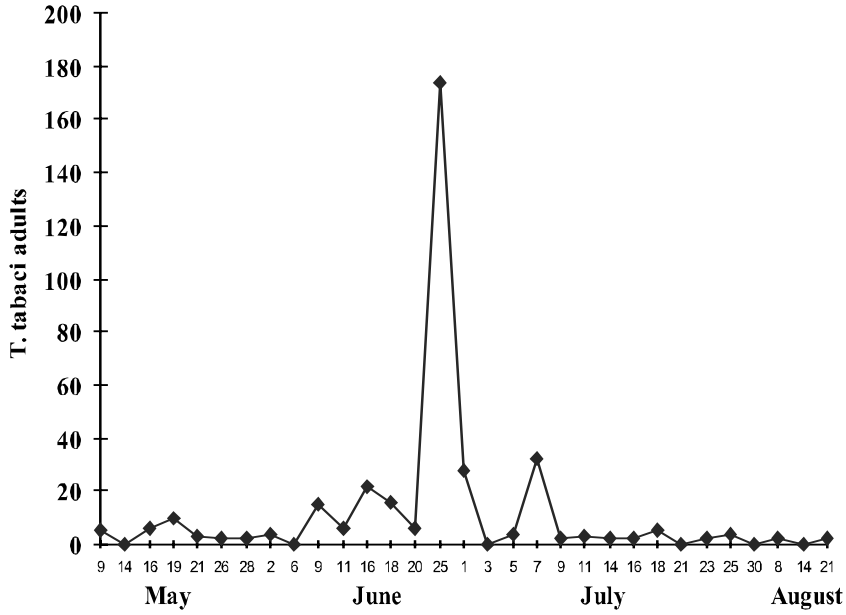

Fig. 1. Thrips adults collected in onion crop using blue watertrap (Soroksár, 1975)

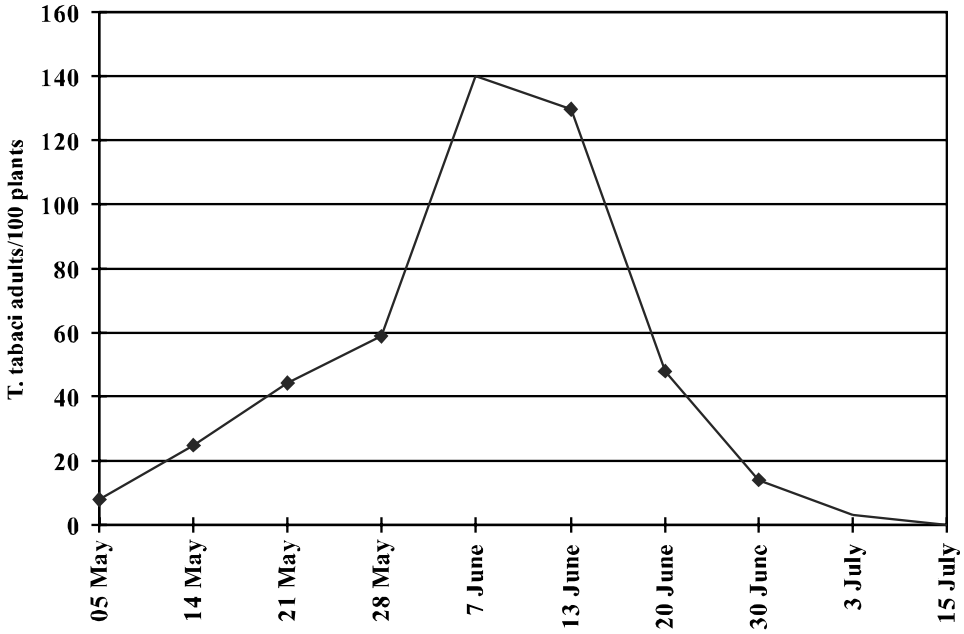

Fig. 2. Thrips adults collected from 100 onion plants (Soroksár, 1975)

because the adults were flying to other plants. We observed them in another onion field, which was direct seeded still having new green leaves at this time beside this field (Pénzes, 1980).

The production method may also be important in the population dynamics. In Hungary we have three main production methods: 1. direct seeded in spring, 2. grown from onion sets, and 3. overwintering (direct seeded). We observed that the thrips population could be different with different production methods. The reason can be the different length of vegetation period favourable to the onion thrips. Harding (1961) observed that economically the thrips population is unimportant until the daily average temperature reaches 14.5 °C. In Hungary this period is from the beginning of May to the middle of September. So the longer is the vegetation period in this period, the higher is the infestation and damage of thrips. The direct seeded method has the longest vegetation period, plants having young leaves for long time, so they are suitable food sources for thrips during the whole vegetation period. Growing from onion sets is less risky because leaf development stops much earlier, so they serve as a food source for a shorter time. But the problem is that onion sets can be infected by thrips, so the young plants may be infected with thrips before thrips occur in nature. The least risky is the overwintering production method, when the best part of the vegetation period is unfavourable for the thrips.

Susceptibility of varieties

Investigation was done in two groups of three varieties because there was a week difference between the planting and infestation of the two groups. After analysing the results statistically we found significant difference between the varieties. In the first group (Braunschweigi, Stuttgarti, Makói) the variety Braunschweigi was significantly more susceptible than the others but there was no notable difference between the other two varieties. In the second group (Makói CR, Makói Fehér, Nemesített Makói) the variety Makói Fehér was significantly more tolerant than the others but there was no notable difference between the other two varieties *(Table 1).*

Table 1

Result of the greenhouse experiment

Species	Number of larvae	Mean	Number of adults	Mean	All stages	Mean
Braunschweigi	11248	112.48 ac*	1357	13.57 b	12605	126.05 ac
Makói Fehér	9355	93.55 ab	1582	15.82 bc	10937	109.37 ab
Makói CR	12107	121.07 c	1793	17.93 c	13900	139.00 c
Makói	8204	82.04 b	988	9.88 a	9192	91.92 b
Nemesített Makói	13024	130.24 c	1818	18.18 c	14842	148.42 c
Stuttgarti	9146	91.46 ab	971	9.71 a	10117	101.17 b

*Tukey–Kramer test. Values denoted by similar letters in a column are not significantly different from each other.

We investigated about 60 onion varieties or future varieties in Tordas under field conditions and observed the same, that there is a significant difference between onion varieties in thrips susceptibility. We also observed another onion species, the Japanese bunch onion *(Allium fistulosum),* which showed less damage than the normal dry onion *(Allium cepa)* under the same circumstances. We observed two, or perhaps three, characters apparently tending to restrict the thrips population – namely, the shape of the leaves, the angle of divergence of the two innermost leaves, and the distance apart of the leaf blades on the sheath column. In most varieties the leaf blades have a flat side; these sides are face to face and, in the young leaves, closely appressed, protecting the larvae against insect enemies and adverse weather conditions. In Japanese bunch onion the leaves are almost circular in cross section reducing protection to the minimum. Another character, probably of some importance, is the greater vertical distance between the leaf blades. Each new leaf extends its sheath farther beyond the one encircling it than in other commonly cultivated varieties. This habit of growth produces an extremely long sheath column. If commercial varieties of onions had these leaf characters, one might secure a more efficient control by spraying or dusting than at present, because practically all of the foliage could be covered (Jones et al., 1934).

Leaf colour and the thickness of wax layer may be other factors in resistance to injury, because temperature in leaf tissues of varieties with lighter green leaves is possibly lower than in those varieties having darker-green foliage. These characters need further investigations.

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