Assessment of the Auchenorrhyncha Fauna of Winter Oilseed Rape Stands in Connection with the Disease Caused by Aster Yellows Phytoplasma

Őszi káposztarepce állományok kabócafaunájának felmérése az őszirózsa sárgulás fitoplazma okozta betegséggel összefüggésben

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Abstract: The highly polyphagous aster yellows phytoplasma can infect winter oilseed rape as well. In Hungary, the first detection of the aster yellows phytoplasma in oilseed rape was reported in 2020. Leafhoppers are mentioned as the primary vectors of the pathogen, but only a few experiments have proven their transmission ability in Europe. In recent years, we aimed to survey the Auchenorrhyncha fauna of winter oilseed rape. Yellow sticky traps were primarily used to monitor insect populations, but sweep netting was also carried out. *Zyginidia* and *Empoasca* genera were the most abundant, but specimens of potentially aster yellows phytoplasma vectors such as *Macrosteles* and *Psammotettix* genera were also caught.

Keywords: *winter oilseed rape; leafhoppers; aster yellows phytoplasma*

Összefoglalás: A rendkívül polifág őszirózsa sárgulás fitoplazma képes az őszi káposztarepcét is megbetegíteni. Hazánkban először Zala vármegyéből származó repcenövényekből mutatták ki 2020-ban. A kórokozó terjesztésében a kabócák szerepét szokták kiemelni, habár Európában még kevés az ezt bizonyító tanulmány. Az utóbbi években végzett rovargyűjtéseink célja az őszi káposztarepce állományok kabócafaunájának felmérése volt. Sárga ragacslapos csapdázás mellett, kiegészítő módszerként, fűhálót is alkalmaztunk. Nagyobb egyedszámban a *Zyginidia* és *Empoasca* genus egyedeit fogtuk, de találtunk irodalmi adatok alapján potenciális őszirózsa sárgulás fitoplazma vektorként számon tartott *Macrosteles* és *Psammotettix* nembe tartozó kabócákat is.

Kulcsszavak: *őszi káposztarepce; kabócák; őszirózsa sárgulás fitoplazma*

1. Introduction

A new plant disease of oilseed rape was first discovered in Poland and the Czech Republic around the year 2000. The symptoms (floral virescence, phyllody, reduced leaves, malformation of siliques) visible in May and June indicated phytoplasma infection. Ten years later, after a more severe infection spreading large areas in Poland, Zwolińska and co-workers (2011), using molecular methods, confirmed the presence of aster yellows phytoplasma (AYP) in the diseased rape plants. Plants showing symptoms of possible phytoplasma infection could be found sporadically in smaller patches in Hungarian oilseed rape fields in the last two decades. In the spring of 2020, oilseed rape plants with characteristic phytoplasma symptoms could be observed in more significant numbers in several fields in Zala County. Varga and co-workers (2020) detected aster yellows phytoplasma in the diseased plants. Several Auchenorrhyncha species can transmit AYP. In North America, 24 AYP vector leafhopper species are known (Stillson and Szendrey, 2020), but our knowledge about insect vectors is limited in Europe. The European species of the genus Macrosteles are the most examined. AYP was detected in several leafhopper species, but successful transmission experiments with oilseed rape are unknown. This study aimed to investigate the Auchenorrhyncha fauna of oilseed rape and to identify potential AYP vectors.

2. Materials and Methods

Leafhoppers were collected for four years (2020-2023) from oilseed rape fields near the town of Zalaegerszeg. As a primary method, 10x16 cm yellow sticky traps of Csalomon® were used. Trapping started with the emergence of oilseed rape plants and ended at the beginning of the flowering. Two yellow sticky traps (yellow on both sides) were used in every field and changed bi-weekly. Sweep netting was an auxiliary method carried out (always with 100 net strokes) when the developmental stage of the crop made it possible. The collected insects were stored in a refrigerator (-20 °C) till identification. Insects were identified using Ossiannilsson's (1978-1983) work and other sources (Holzinger et al., 2003; Biedermann and Niedringhaus, 2004) with more recent keys of Central European species by morphological analysis with stereo microscopy.

3. Results

Based on our data from four years, it can be stated that with the selected methods, true hoppers could be collected chiefly in the autumn (September, October) from oilseed rape. In March and April, when the frosty days of winter ended, no leafhoppers could be collected except a few individuals. Later (May, June), insect sampling became almost impossible when the plants grew taller and the stand became dense. Examining the results of the sampling period of 2020 near Pózva, Auchenorrhyncha specimens belonging to seven different species or genera (identification to species level can be pretty tricky in case of individuals captured by sticky traps) were captured by yellow sticky traps (Table 1). Most of the collected individuals belonged to the genera *Empoasca* and *Macrosteles*. Fewer specimens from fewer species could be collected with sweep netting from the same field during the same sampling period (Table 2). Auchenorrhyncha species captured with sweep netting were identical to those captured with yellow sticky traps, with only one exception. There was a several years old lucerne field right next to the oilseed rape field. When rape was sampled, sweep netting was carried out in lucerne too. Summarised sampling results in lucerne are shown in the last column of Table 2. Comparing the data of the last two columns in Table 2, it can be seen that the species captured in oilseed rape could also be found in lucerne, except for one species. Populations of the common species living in lucerne were present in higher abundance.

Table 1. Number of sampled Auchenorrhyncha specimens on yellow sticky traps in oilseed rape (2020, Pózva)

Species	17.09-28.09	28.09-12.10	12.10-19.10	19.10-03.11	Σ
Macrosteles spp.	8	17	0	2	27
Psammotettix spp.	0	0	0	6	6
Ph. spumarius	3	3	0	2	8
Eupteryx spp.	0	0	0	8	8
Empoasca spp.	0	5	10	32	47
Cixius spp.	2	0	0	1	3
N. fenestratus	0	0	0	1	1

Table 2. Number of Auchenorrhyncha specimens sampled with sweep netting in oilseed rape and (shown in the last column) in neighbouring lucerne field (2020, Pózva)

Species	23.09	30.09	14.10	21.10	03.11	Σ rape	Σ lucerne
Macrosteles spp.	2	1	0	1	0	4	7
Psammotettix spp.	0	1	1	0	2	4	5
Ph. spumarius	1	1	0	0	0	2	8
Eupteryx spp.	0	1	0	0	0	1	0
L. striatella	1	0	0	0	0	1	7

Yellow sticky traps placed in an oilseed rape field near Gősfa in 2021 captured 156 Auchenorrhyncha individuals, which belonged to eight different taxa (Table 3). Like the results of Pózva (Table 1), *Empoasca* specimens were caught in high numbers, but nearly four times as many individuals of *Zyginidia* were captured. True hoppers were collected from another field near Vasboldogasszony in the autumn of 2022 with similar results to Table 3, considering the dominant species (data not shown). Similar results were achieved by another sampling in 2023 near Gősfa (the three most common genera: *Zyginidia, Eupteryx and Empoasca*).

Table 3. Number of sampled Auchenorrhyncha specimens on yellow sticky traps in oilseed rape (2021-2022, Gősfa)

Species	08.09 -24.09	24.09 -08.10	08.10 -25.10	25.10 -09.11	15.02 -28.02	28.02 -16.03	16.03 -28.03	Σ
Macrosteles spp.	5	3	1	0	0	0	0	9
Psammotettix spp.	1	1	2	0	0	0	1	5
Zyginidia spp.	31	55	11	1	0	0	0	98
Empoasca spp.	1	5	15	2	1	0	0	24
Eupteryx spp.	1	5	1	0	0	0	0	7
Arboridia spp.	0	0	1	0	0	0	0	1
Typhlocibinae	4	0	1	0	0	0	0	5
Cicadellidae	0	0	3	4	0	0	0	7

4. Discussion

Based on our multi-year sampling, it can be stated that in oilseed rape, few Auchenorrhyncha species can be found in relatively small numbers compared to the fauna of certain orchards. According to Nickel (2003), there is not any European leafhopper feeding on *Brassica* plants exclusively, so primarily polyphagous or grass specialist species can be found in oilseed rape that migrate into the field from the surrounding, less disturbed vegetation. Our survey also supports this idea because the same species in higher numbers were captured in the lucerne field situated next to the oilseed rape field. (It is worth mentioning here that lucerne had a more diverse leafhopper fauna because five additional species were present besides those captured in both fields.) We know that some of the genera collected during this survey may carry the AYP. Among *Macrosteles* species, *M. laevis* (Zwolińska et al., 2016), *M. sexnotatus* (Schneller et al., 2016) and *M. quadripunctulatus* (Bosco et al., 2007) are reported in the literature as species that can acquire the phytoplasma. In Turkish and Serbian carrot fields, *Psammotettix* species are the most probable vectors of AYP (Drobnjanković et al., 2011; Randa Zelyüt et al., 2022). Italian authors (Galetto et al., 2011) proved that *Empoasca decipiens* can be an experimental vector of AYP. Among the Auchenorrhyncha species caught in the oilseed rape fields of Zala County, some can be potential vectors of AYP, so the information on their possible role in a future phytoplasma epidemic is essential in developing effective control methods.

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