

Species Composition of Thysanoptera in White Cabbage Heads

J. FAIL and B. PÉNZES

Department of Entomology, Faculty of Horticultural Science,
Budapest University of Economic Sciences and Public Administration,
H-1118 Budapest, Ménesi út 44, Hungary, e-mail: fail@omega.kee.hu

In 2000–2002 thrips species were collected from mature white cabbage head leaves in Hungary. The total number of the sampled specimens was 4226. Out of the 3374 identified adults *Thrips tabaci* was predominant (91.3%). *Frankliniella tenuicornis* was found in significant number (6.9%) with rather extraordinary appearance in 2000 (15.1%) but in the other years its frequency was lower (0.5%, 1.9% respectively). The rest of the adults (1.8%) were: *Frankliniella intonsa*, *Aeolothrips intermedius*, *Thrips angusticeps*, *Thrips atratus*, *Haplothrips aculeatus*, *Limothrips denticornis*, *Anaphothrips obscurus*, *Chirothrips manicatus* and *Scolothrips longicornis*. The 852 second instar larvae were also identified. 96.4% was *Thrips tabaci*, 2.7% *Thrips angusticeps* and 0.8% *Anaphothrips obscurus*. In spite of the fact that in 2000 15.1% of the adults on cabbage was *Frankliniella tenuicornis*, not a single larva was found. Therefore we concluded that in Hungary it is only the thelytokous populations of *Thrips tabaci* that are of high importance as thrips pest of white cabbage.

Keywords: *Brassica oleracea* convar. *capitata* provar. *capitata*, white cabbage, thrips species, Thysanoptera.

Although there had been early reports of the onion thrips (*Thrips tabaci* Lindeman) feeding on white cabbage (*Brassica oleracea* L. convar. *capitata* provar. *capitata* Duch.) outdoors (Wolfenbarger and Hibbs, 1958), indoors (Pénzes, 1980) and in storage (Fox and Delbridge, 1977) the species had not been considered as an important cabbage pest until the 1980s. Since then *Thrips tabaci* has been recognized as a serious threat to white cabbage production in the USA (Shelton et al., 1983), in Hungary (Kristóf and Péntzes, 1984), in Germany (Giessmann, 1988), in Austria (Kahrer, 1992), in France (Herold and Stengel, 1993) and in England (Ellis et al., 1994).

Few studies have been carried out to determine whether it is only the onion thrips that damages white cabbage or there are other species living in cabbage fields. In 1981–1982 North and Shelton (1986a) collected 15 thrips species by means of sticky traps placed 0.25 m above the crop canopy of several cabbage fields in New York State, USA. The species collected were: *Limothrips denticornis* (Haliday), *Chirothrips manicatus* Haliday, *Thrips tabaci* Lindeman, *Frankliniella tritici* (Fitch), *Anaphothrips obscurus* (Müller), *Frankliniella tenuicornis* (Uzel), *Aeolothrips fasciatus* (Linnaeus), *Thrips trehernei* Priesner, *Sericothrips variabilis* (Beach), *Sericothrips interruptus* Hood, *Thrips nigropilosus* Uzel, *Thrips atratus* (Haliday), *Thrips dispar* (Haliday), *Taeniothrips betulae* (Crawford) and *Limothrips cerealium* (Haliday). The majority of the collected thrips belonged to six species: *Limothrips denticornis*, *Chirothrips manicatus*, *Frankliniella tritici*, *Anaphothrips*

obscurus, *Frankliniella tenuicornis* and *Thrips tabaci*. In all sites and in both years the onion thrips became abundant from the beginning of September onwards. Between November 1982 and February 1983 adults of *Thrips tabaci* and *Anaphothrips obscurus* with larvae of the Thripini were found in samples (taken from the top 2 cm of the soil in which vegetation was growing) from cabbage fields (North and Shelton, 1986b).

From June to the end of October 1993, Herold and Stengel (1994) collected 11 species of thrips in cabbage fields in France by using water traps. The vast majority of the collected adults belonged to seven species: *Thrips tabaci* Lindeman, *Thrips angusticeps* Uzel, *Thrips physapus* Linneaus, *Aeolothrips intermedius* Bagnall, *Limothrips denticornis* (Haliday), *Limothrips cerealium* (Haliday) and *Frankliniella intonsa* (Trybom). In June *Thrips angusticeps* was the most abundant species but disappeared in July. From July onwards *Thrips tabaci* became dominant and from the beginning of September it was almost the only species found in the water traps. *Thrips tabaci* adults were first identified from plant samples in the middle of July, when cabbage reached the cupping stage. Out of all collected adults, 62% were *Thrips tabaci*, 9% *Thrips angusticeps*, 8% *Thrips physapus* and 21% *Aeolothrips intermedius*.

In 1993–1995 Legutowska (1997) identified 10 thrips species in samples obtained from white cabbage heads at several sites in Poland. The species were: *Thrips tabaci* Lindeman, *Limothrips denticornis* (Haliday), *Frankliniella intonsa* (Trybom), *Thrips fuscipennis* Haliday, *Frankliniella tenuicornis* (Uzel), *Thrips major* Uzel, *Thrips flavus* Schrank, *Thrips atratus* (Haliday), *Thrips nigropilosus* Uzel and *Aeolothrips intermedius* Bagnall. *Thrips tabaci* was predominant, representing 90.6% of adults. The remaining specimens primarily belonged to *Limothrips denticornis*, *Frankliniella intonsa*, *Thrips fuscipennis* and *Frankliniella tenuicornis* (2.4%, 2%, 2.2% and 1.6% respectively). The other species occurred sporadically. The collected larvae were also identified: 98.8% were *Thrips tabaci*, 0.8% *Frankliniella tenuicornis* and 0.4% *Thrips fuscipennis*.

Since little is known about the thrips species other than *Thrips tabaci* occurring on cabbage in Hungary, studies were carried out to establish the Thysanoptera species composition of cabbage fields.

Materials and Methods

In 2000–2002 thrips were repeatedly collected on cabbage fields at 5 locations in Hungary (Table 1). The specimens were taken only from mature heads after the outer head leaves had been peeled off. Varieties showing the greatest damage at a time were screened for thrips. The average sample consisted of some 80 specimens, although at the end of the year extremely low figures occurred (Table 1). Adults, larvae and pupae were removed with a fine brush that had been moistened with the collecting preservative and immediately placed into small tubes containing 70% ethanol. Thrips were kept in the tubes at room temperature until mounted in Berlese medium. Identification was based on the keys given by Jenser (1982), Moritz et al. (2001) and the larval key obtained from Steve Nakahara.

Table 1

Location and time of sampling and the number of collected individuals

Date	Location	L1	L2	Pupae	Adult	Total	Date	Location	L1	L2	Pupae	Adult	Total
14.06.2000	Tordas	2	9	1	52	64	17.08.2001	Tordas	3	69	10	118	200
14.06.2000	Rábakecöl	0	7	1	11	19	29.08.2001	Szarvas	0	5	1	56	62
19.06.2000	Tordas	0	1	0	54	55	04.09.2001	Szarvas	1	16	0	8	25
27.06.2000	Tordas	1	15	3	87	106	10.09.2001	Tordas	0	4	0	13	17
30.06.2000	Tordas	1	2	0	88	91	14.09.2001	Soroksár	5	20	7	51	83
05.07.2000	Tordas	3	12	1	66	82	25.09.2001	Szarvas	5	40	9	61	115
14.07.2000	Tordas	2	12	3	45	62	09.10.2001	Fertőd	4	24	8	34	70
19.07.2000	Tordas	1	57	10	173	241	11.10.2001	Szarvas	0	11	0	36	47
26.07.2000	Tordas	9	29	15	93	146	13.11.2001	Fertőd	2	2	7	29	40
08.08.2000	Tordas	2	0	1	69	72	14.11.2001	Szarvas	2	21	3	31	57
15.08.2000	Tordas	0	20	6	49	75	06.12.2001	Szarvas	0	0	0	3	3
22.08.2000	Tordas	0	6	7	21	34	03.06.2002	Tordas	0	5	2	9	16
05.09.2000	Tordas	1	7	1	7	16	07.06.2002	Tordas	0	3	1	52	56
21.09.2000	Fertőd	0	5	1	84	90	14.06.2002	Tordas	0	0	0	24	24
05.10.2000	Fertőd	0	0	0	45	45	12.07.2002	Soroksár	2	12	3	63	80
12.10.2000	Fertőd	0	0	0	155	155	31.07.2002	Tordas	0	18	8	69	95
25.10.2000	Fertőd	3	14	4	116	137	15.08.2002	Tordas	0	5	1	34	40
27.10.2000	Szarvas	2	6	2	31	41	22.08.2002	Tordas	4	15	8	73	100
16.11.2000	Fertőd	20	67	10	172	269	27.08.2002	Tordas	2	24	41	63	130
06.06.2001	Tordas	12	47	6	185	250	17.09.2002	Szarvas	0	0	0	59	59
14.06.2001	Tordas	13	39	1	102	155	18.09.2002	Szarvas	0	3	0	16	19
21.06.2001	Tordas	6	8	2	23	39	24.09.2002	Szarvas	0	0	0	7	7
13.07.2001	Tordas	6	26	5	41	78	01.10.2002	Szarvas	0	1	0	107	108
20.07.2001	Tordas	2	36	6	19	63	10.10.2002	Szarvas	1	7	5	49	62
27.07.2001	Tordas	3	33	27	97	160	31.10.2002	Szarvas	1	22	12	22	57
02.08.2001	Soroksár	0	2	1	27	30	20.11.2002	Szarvas	0	0	1	10	11
03.08.2001	Tordas	3	18	5	271	297	05.12.2002	Szarvas	1	7	5	20	33
10.08.2001	Tordas	10	40	1	74	125	Total:	135	852	252	3374	4613	

Results

The total number of identified specimens was 4226, belonging to 11 species (Table 2). *Thrips tabaci* was predominant, representing 91.3% of adults and 96.4% of larvae. Both adults and larvae of this species were all females. *Frankliniella tenuicornis* occurred in significant numbers (6.9%), although the figures varied extensively throughout the years of sampling (15.1%, 0.5%, 1.9%). All other species occurred sporadically. *Thrips tabaci* was dominant throughout all months with the exception of June 2000 (Fig. 1), when most of the collected adults were *Frankliniella tenuicornis*. The same phenomenon did not occur in the other years (Figs 2 and 3). In a few months only *Thrips tabaci* adults were identified: August and November 2000, August, September, November and December 2001, November and December 2002 (Figs 1–3).

Table 2

Thysanoptera species collected from white cabbage heads in Hungary, 2000–2002

Thrips species	2000		2001		2002		2000–2002	
	14.06–16.11.		06.06–06.12.		03.06–05.12.			
	Number	%	Number	%	Number	%	Number	%
Adults								
<i>Thrips tabaci</i> Lindeman	1178	83.1	1249	97.7	653	96.5	3080	91.3
<i>Frankliniella tenuicornis</i> (Uzel)	214	15.1	6	0.5	13	1.9	233	6.9
<i>Frankliniella intonsa</i> (Trybom)	9	0.6	6	0.5	1	0.1	16	0.5
<i>Aeolothrips intermedius</i> Bagnall	4	0.3	6	0.5	6	0.9	16	0.5
<i>Thrips angusticeps</i> Uzel	4	0.3	5	0.4	2	0.3	11	0.3
<i>Thrips atratus</i> (Haliday)	1	0.1	4	0.3	0	0	5	0.1
<i>Haplothrips aculeatus</i> Fabricius	3	0.2	1	0.1	1	0.1	5	0.1
<i>Limothrips denticornis</i> (Haliday)	2	0.1	0	0	1	0.1	3	0.1
<i>Anaphothrips obscurus</i> (Müller)	2	0.1	0	0	0	0	2	0.1
<i>Chirothrips manicatus</i> Haliday	0	0	2	0.2	0	0	2	0.1
<i>Scolothrips longicornis</i> Priesner	1	0.1	0	0	0	0	1	0.0
Total	1418	100	1279	100	677	100	3374	100
Number of species	10		8		7		11	
Larvae								
<i>Thrips tabaci</i> Lindeman	262	97.4	439	95.2	121	99.1	822	96.4
<i>Thrips angusticeps</i> Uzel	2	0.7	20	4.3	1	0.9	23	2.7
<i>Anaphothrips obscurus</i> (Müller)	5	1.9	2	0.4	0	0	7	0.8
Total	269	100	461	100	122	100	852	100
Number of species	3		3		2		3	

Besides *Thrips tabaci*, the larvae of *Thrips angusticeps* and *Anaphothrips obscurus* were identified in some samples (Table 2). *Thrips tabaci* was consistently dominant, the other two species occurring only at the beginning or at the end of the vegetation period. *Thrips angusticeps* were only found in June (in all three years) in one sample. A few larvae of *Anaphothrips obscurus* were identified in June, July and November 2000; each time in a single sample. In 2001 it was found in two samples in June only, whereas in 2002 it did not occur at all (Table 2).

Discussion

The sampling method could have distorted the results in two aspects. Firstly, the adults of larger and dark brown species were most likely overrepresented in the samples, since they – unlike the yellowish species – show quite a contrast on cabbage head leaves, therefore are easier spotted by the naked eye. Secondly, for the same reason larvae were underrepresented.

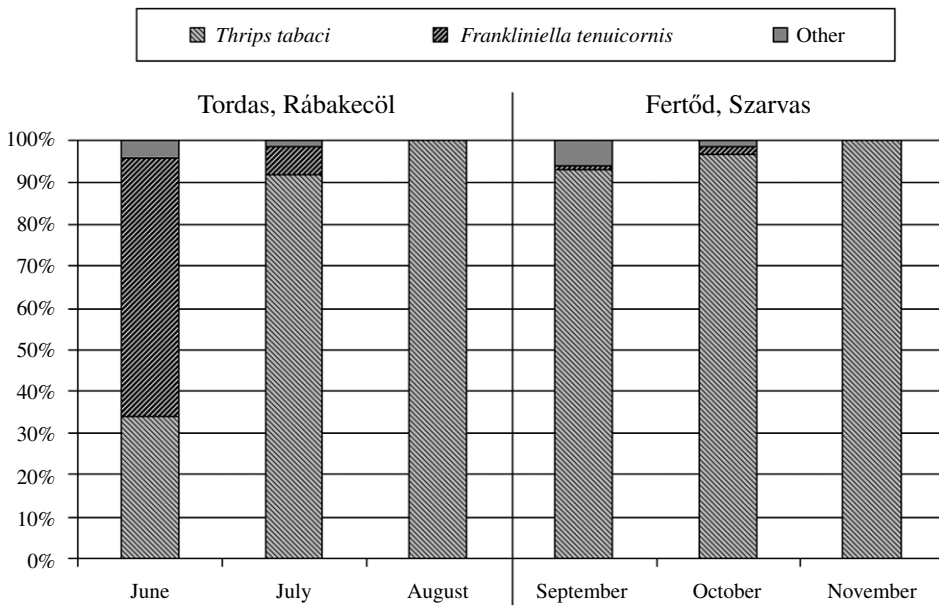


Fig. 1. Relative frequency of the adult thrips in the samples, 2000

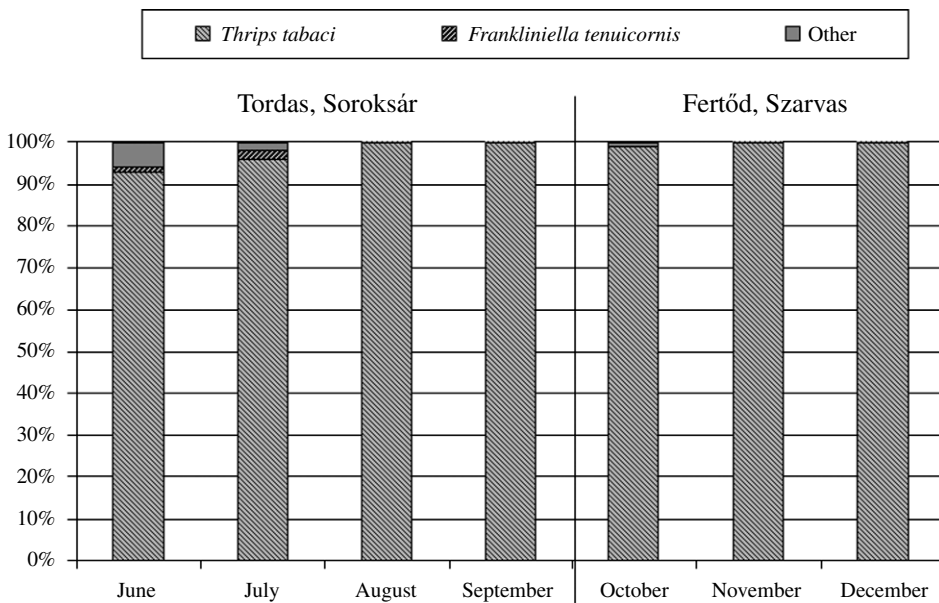


Fig. 2. Relative frequency of the adult thrips in the samples, 2001

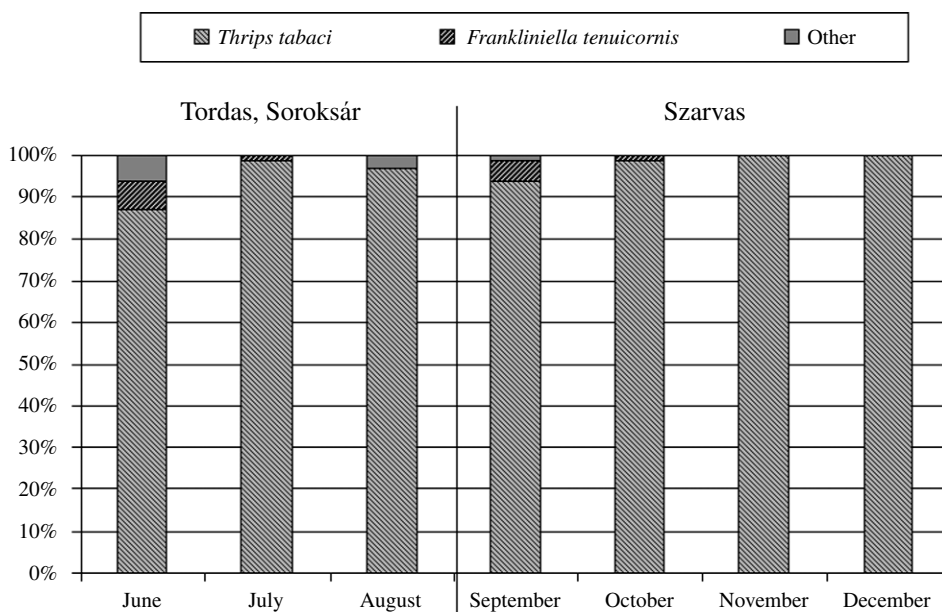


Fig. 3. Relative frequency of the adult thrips in the samples, 2002

Regardless of this, our study revealed that in the whole vegetation period *Thrips tabaci* is by far the dominant thrips species on white cabbage in Hungary. The year 2000, when relatively large proportion of the adults was identified as *Frankliniella tenuicornis*, was rather extraordinary. In that year we observed massive populations of this species on several crops (chives, leek, onion and corn). In the same year, the species was reported damaging corn to an unusual extent (Jenser et al., 2001). In spite of the fact that in 2000 15.1% of the adults on cabbage was *Frankliniella tenuicornis*, not a single larva was found. It seems that out of the 11 identified species, only *Thrips tabaci*, *Thrips angusticeps* and *Anaphothrips obscurus* lay eggs in cabbage heads.

In Hungary it is only the thelytokous populations of *Thrips tabaci* that are of high importance as thrips pest of white cabbage. Its predominance on a given cabbage field seems to be increasing, often reaching as much as 100%.

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