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THE APHID FAUNA (Hemiptera: Aphidoidea) OF WATERMELONS

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In this paper the fauna of aphids appearing on watermelons in the area of the Neretva valley is presented. Not only do they feed on the plants, but aphids can transmit virus diseases. The natural spread of aphid transmitted cucurbit viruses is often accomplished by *Acyrthosiphon pisum* (Harris), *Aphis craccivora* Koch, *Aphis gossypii* Glover and *Myzus persicae* (Sulzer). Aphid-transmitted viruses in cucurbits have been poorly investigated in Croatia, although *Cucumber mosaic cucumovirus* (CMV) sporadically occurs on cucurbits. The aim of this study was to investigate and identify aphid species in a watermelon field. The field experiment with watermelons [*Citrullus lanatus* (Thunb.) Matsum & Nakai] was conducted during 2004 and 2005 at Opuzen (43°00'N, 17°34'E, 3 m elevation), located in the Mediterranean area of Croatia. Opuzen is situated in the delta of the river Neretva River, the most important watermelon-growing area in Croatia. Aphid sampling was carried out using yellow water traps (70x70x12 cm). Traps were installed at the date of transplanting and observed daily in order to determine initial aphid flight prior to the first sampling. Insect samples were collected once a week. The collected material was inspected and aphids were separated out using a stereomicroscope (Zeiss, Stemi 2000). Aphid specimens were preserved in plastic vials containing 70 % ethanol until identification according to taxonomy keys. The dominance was calculated by the Balogh formula. The results (predominant, dominant, subdominant, recedent, subrecedent) are presented according to Tischler and Heydeman. During the study of the aphid population, 70 species in 48 genera were detected, with 63 species in 42 genera being identified in 2004 and 44 species in 31 genera in 2005. All species referred to the Aphididae. The overall seasonal percentage composition showed that *Toxoptera aurantii* (Boyer de Fonscolombe) (34 % in 2004 and 23 % in 2005) and *A. gossypii* (15 % in 2004 and 24 % in 2005) were consistently predominant in both years.

Aphids, watermelon, yellow water trap, Croatia

T. GOTLIN ČULJAK, K. ŽANIĆ, S. GORETA BAN, D. BAN, G. DUMIČIĆ i D. GRUBIŠIĆ: Fauna uši (Hemiptera: Aphidoidea) na lubenici. Entomol. Croat. 15. Vol. 1-4: 177-183.

U radu je prikazana fauna lisnih uši lubenice na području doline Neretve. Lisne uši na lubenicama čine izravne štete hranjenjem, a neizravne prenošenjem virusa. Prirodnim širenjem lisnih uši, posebice vrsta *Acyrthosiphon pisum* (Harris), *Aphis craccivora* Koch, *Aphis gossypii* Glover i *Mysus persicae* (Sulzer) prenose se i virusi lubenice. Lisne uši kao prenosioci viroza u Hrvatskoj slabo su istraženi. Cilj ovog rada bio je istražiti i determinirati vrste lisnih uši na lubenici. Poljski pokus na lubenici [*Citrullus lanatus* (Thunb.) Matsum & (Nakai)] proveden je tijekom 2004. i 2005. godine u Opuzenu (N 43° 00', 'E 17° 34', 3 m nadmorske visine) koji se nalazi u mediteranskom području, u delti rijeke Neretve, te je najvažnije uzgojno područje navedene kulture u Hrvatskoj. Istraživanje je provedeno postavljanjem žutih posuda (70x70x12 cm). Uzorci su skupljani jedanput tjedno. Prikupljen materijal je pregledan, a lisne su uši izdvojene pod stereo mikroskopom (Zeiss, STEMI 2000). Uši su čuvane u epruvetama s 70 %-tnim alkoholom te determinirane po ključevima za determinaciju lisnih uši. Dominantnost je izračunata prema formuli Balogh, a uši su svrstane kao dominantne, subdominantne, recedentne i subrecedentne prema Tischler i Heydeman. Tijekom istraživanja determinirano je 70 vrsta koje su sistematizirane u 48 rodova. Tijekom 2004. ukupno je determinirano 63 vrste u 42 roda, a tijekom 2005.godine 44 vrste svrstane u 31 rod. Analiza sastava lisnih uši u obje godine istraživanja upućuju na to da su vrste *Toxoptera aurantii* (Boyer de Fonscolombe) (34 % u 2004. i 23 % u 2005.) i *A. gossypii* (15 % u 2004.i 24 % u 2005.) dominantne vrste u lubenici.

Lisne uši, lubenica, žuta posuda, Hrvatska

Introduction

A number of aphid species have been recorded as Cucurbitaceae crop feeders. Alate aphids land on crops soon after planting. In addition to feeding on plants, some aphids transmit virus diseases. The natural spread of aphid-transmitted cucurbit viruses is often accomplished by *Acyrthosiphon pisum* (Harris), *Aphis cracivora* Koch, *Aphis gossypii* Glover and *Mysus persicae* (Sulzer) (Eastop, 1977; Katis et al., 2006). Aphid fauna in watermelons have been poorly investigated in Croatia. Aphid fauna sporadically occurs on cucurbits but it has not been documented to date. The aim of this study was to investigate and identify aphid species in a watermelon field.

Material and Methods

Experimental site:

A field experiment with watermelons [*Citrullus lanatus* (Thunb.) Matsum & Nakai], cv. Fantasy (Known-You Seed Co., Ltd., Taiwan) was conducted during 2004 and 2005 at Opuzen (43°00'N, 17°34'E, 3 m elevation) located in the Mediterranean area of Croatia. Opuzen is situated in the delta of the river Neretva River, which represents the most important watermelon-growing area in Croatia. The average annual rainfall in Opuzen is 1232 mm and the mean annual air temperature is 15.7 °C.

Aphid sampling:

Aphid sampling was carried out using Moericke yellow water traps (YWT) which were placed in the middle of field in 2004 and in 2005. A total of 12 traps were used in 2004 and 15 traps in 2005. Traps were installed at the date of transplanting and observed. Samples were collected once a week. The material collected was inspected and aphids were separated out using a stereomicroscope (Zeiss, Stemi 2000). Aphid specimens were preserved in plastic vials containing 70 % ethanol until identification.

Species identification and their abundance:

Winged adult aphids were identified and counted according to taxonomy keys (Blackman & Eastop, 1994; 2000; Taylor, 1980). The number of individual species per trap was recorded. The dominance was calculated by the Balogh formula:

$$D_1 = \frac{a_1}{\sum_{i=1}^{n} a_i} 100\%$$

a_1 = number of determined species of aphid

$\sum_{i=1}^{n} a_i$ = total number of aphids

The results (eudominant, dominant, subdominant, recedent, subrecedent) are presented according to Tischler (Tischler, 1949).

Results and Discussion

In 2004 we collected 7,653 aphid individuals while in 2005 we collected 25,393 individuals. In total, 70 aphid species were identified from the traps in a watermelon field at Opuzen, situated in the delta of the Neretva River. The aphids are as follows: *Acyrtosiphon gossypii* Mordvilko; *Acyrtosiphon pisum* (Harris); *Anoecia corni* Fabricius; *Aploneura lentisci* (Passerini); *Aphis acetose* L.; *Aphis craccivora* Koch; *Aphis fabae* Scopoli; *Aphis gossypii* Glover; *Aphis nerii* Boyer de Fonscolombe; *Aphis spiraecola* Patch; *Atheroides* sp.; *Aulacorthum solani* (Kaltenbach); *Brachycaudus cardui* (L.); *Brachycaudus helichrysi* (Kaltenbach); *Brevicoryne brassicae* (L.); *Calipterinella calliptera* (Hartig); *Capitophorus elaegni* (del Guercio); *Capitophorus horni* Börner; *Capitophorus similis* van der Goot; *Cavariella aegopodii* (Scopoli); *Cavariella theobaldi* (Gillette and Bragg); *Chaitophorus leucomelas* Koch; *Chaitophorus populeti* (Panzer); *Chaitophorus tremulae* Koch; *Coloradoa tanacetina* (Walker); *Cryptomyzus ribis* (L.); *Uroleucon ambrosiae* (Thomas); *Uroleucon tussilaginis* (Walker); *Drepanosiphum platanoidis* (Schrank); *Dysaphis plantaginea* (Passerini); *Elatobium abietinum* (Walker); *Eriosoma ulmi* (L.); *Eucallipterus tiliae* (L.); *Forda marginata* Koch; *Geoica setulosa* (Passerini); *Hayhurstia atriplicis* (L.); *Hyadaphis phoeniculi* Passerini; *Hyalopterus pruni* (Geoffroy); *Hyperomyzus lactucae* (L.) *;Hyperomyzus lampsanae* Börner; *Hyperomyzus pallidum* Hille Ris Lambers; *Hyperomyzus picridis* (Börner and Blunck); *Macrosiphum euphorbiae* (Thomas); *Macrosiphum rosae* (L.); *Masonaphis* sp.; *Megoura viciae* Buckton; *Metopolophium dirhodum* (Walker); *Microlophium evansi* (Theobald); *Myzus ornatus* Laing; *Myzus ascalanicus* Doncaster; *Nasonovia ribisnigri* (Mosley); *Nearctaphis* sp.; *Pemphigus* sp.; *Periphyllus californiensis* Shinji; *Phorodon humuli* (Schrank); *Phylaphis fagi* (L.); *Rhopalosiphum padi* (L.); *Sitobium avenae (*Fabricius); *Sitobium fragariae* (Walker);*Subsaltusaphis* sp.; *Tetraneura* sp.; *Therioaphis luteola* (Börner); *Therioaphis trifolii* (Monell); *Thripsaphis thripsoides* Hille Ris Lambers;*Thuleaphis rumexicolens* (Patch); *Tinocallis platani* Kaltenbach; *Toxoptera aurantii* (Boyer de Fonscolombe); *Tuberculatus moerickei* Hille Ris Lambers and not intetified species.

The delta is a reclaimed marshy valley, characterized by a high level of biodiversity. Consequently, the composition of aphid species recorded on watermelon plants, reflected the adjacent landscape which has a rich variety of cultivated and wild plant species.

Table 1 The dominance of aphids in 2004 (%)

Aphid species	YWT 1	YWT 2	YWT 3	YWT 4	YWT 5	YWT 6	YWT 7	YWT 8	YWT 9	YWT 10	YWT 11	YWT 12	Dominance	Results
Acyrtosiphum pisum	5.6	7.6	5.9	6.7	3.7	2.7	6.8	9.0	4.2	7.4	10.3	5.4	6.3	Dominant
Aphis citricola	0.0	0.6	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.06	Subrecedent
Aphis craccivora	1.7	4.8	2.4	5.8	6.2	1.4	3.1	2.2	7.2	6.8	2.9	1.6	3.84	Subdominant
Aphis fabae	4.5	5.3	3.6	4.9	5.4	1.0	4.5	2.7	4.8	5.5	6.6	3.2	4.33	Subdominant
Aphis gossypii	13.2	15.4	10.5	18.1	12.5	14.0	13.7	3.4	13.0	16.3	12.1	11.3	12.8	Eudominant
Aphis sp.	0.4	13.3	11.1	15.1	1.2	4.4	10.2	0.0	4.8	1.6	7.9	5.9	6.33	Dominant
Aphis spiraceola	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.06	Subrecedent
Aulacorthum solani	2.2	4.1	5.5	4.3	1.7	4.8	3.2	2.2	4.3	3.1	4.0	3.2	3.55	Subdominant
Brachycaudus cardui	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	Subrecedent
Brachycaudus helichrysi	0.9	0.7	0.3	0.9	0.9	0.3	0.3	0.2	1.3	1.1	0.9	1.3	0.76	Subrecedent
Brachycaudus sp.	0.2	0.3	0.9	0.2	0.5	0.3	1.9	0.7	1.6	0.4	0.7	0.0	0.64	Subrecedent
Brevicoryne brassicae	1.5	1.3	0.9	0.7	0.9	1.0	2.4	0.9	1.4	1.5	0.9	0.3	1.14	Recedent
Capitophorus horni	0.0	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.05	Subrecedent
Capitophorus similis	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.2	0.0	0.06	Subrecedent
Cavariella aegopodii	0.0	0.1	0.0	0.2	0.1	0.3	0.3	0.0	0.5	0.2	0.4	0.0	0.18	Subrecedent
Cryptomyzus ribis	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.06	Subrecedent
Disaphis plantaginea	0.2	0.1	0.0	0.7	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.3	0.13	Subrecedent
Hayhurstia atriplius	0.0	0.0	0.1	0.4	0.4	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.08	Subrecedent
Hyadaphis phoeniculi	0.0	0.0	0.3	0.0	0.3	0.0	1.5	0.4	1.6	0.9	1.1	0.8	0.58	Subrecedent
Hyalopterus pruni	3.5	3.7	2.7	7.5	6.9	4.4	6.0	4.5	6.9	3.6	6.8	3.8	5.03	Dominant
Hyperomysus lactucae	7.1	4.7	0.8	3.4	3.8	5.1	3.9	5.2	2.9	5.6	5.1	3.5	4.26	Sudominant
Hyperomysus lampsanae	0.0	0.1	0.1	0.0	3.3	1.0	0.0	0.0	0.0	0.0	0.2	0.0	0.39	Subrecedent
Macrosiphum euphorbiae	1.3	1.6	1.1	0.6	2.3	0.3	1.1	1.8	1.9	1.2	2.4	2.1	1.48	Recedent
Macrosiphum rosae	0.4	0.7	0.3	0.4	0.5	0.0	0.2	0.2	0.1	0.1	0.0	0.5	0.28	Subrecedent
Metopolophium dirhodum	0.6	0.1	0.0	0.2	0.4	0.7	0.5	0.2	0.0	0.3	0.6	0.5	0.34	Subrecedent
Mysus persicae	2.8	2.1	1.1	1.5	0.9	0.3	2.1	1.8	2.2	1.8	2.2	2.7	1.79	Recedent
Nasonovia ribisnigri	0.2	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.04	Subrecedent
Phorodon humuli	0.0	0.4	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.08	Subrecedent
Rophalosyphum padi	1.7	1.3	0.7	0.4	0.8	0.0	1.5	0.2	1.3	0.4	0.4	0.5	0.77	Subrecedent
Tetraneura sp.	0.4	0.1	0.1	0.0	0.1	0.0	0.3	0.0	0.2	0.3	0.4	0.3	0.18	Subrecedent
Therioaphis trifolii	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.05	Subrecedent
Thuleaphis rumexiodeus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.03	Subrecedent
Toxoptera auranti	34.6	21.8	38.9	18.1	39.3	45.4	21.0	52.4	30.4	30.1	22.6	35.1	32.48	Eudominant

Table 2. The dominance of aphids in 2005 (%)

Aphid species	YWT 1	YWT 2	YWT 3	YWT 4	YWT 5	YWT 6	YWT 7	YWT 8	YWT 9	YWT 10	YWT 11	YWT 12	YWT 13	YWT 14	YWT 15	Dominance	Results
Acyrtosiphum gossypii	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.74	0.1	Subrecedent
Acyrtosiphum pisum	0.00	0.78	1.00	0.26	1.48	1.02	2.09	0.41	0.63	1.43	1.48	0.95	1.51	1.22	1.65	1.06	Recedent
Aphis craccivora	2.60	1.55	3.79	4.23	5.42	3.83	3.13	6.10	2.51	4.30	3.94	4.75	3.02	5.37	6.43	4.06	Subdominant
Aphis fabae	5.21	4.26	2.20	3.17	0.99	1.79	3.66	4.07	1.57	4.66	3.94	3.80	5.44	5.12	5.88	3.72	Subdominant
Aphis gossypii	34.71	32.36	19.76	17.72	25.12	29.85	25.33	21.34	14.11	18.28	26.85	11.08	25.98	22.93	18.38	22.92	Eudominant
Aphis sp.	4.34	5.04	3.39	10.05	3.94	5.87	8.62	4.27	5.64	4.66	8.87	8.23	2.72	5.12	3.68	5.63	Dominant
Aphis spiraceola	0.00	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	Subrecedent
Aulacorthum solani	0.87	0.97	0.40	0.53	0.25	0.51	0.52	0.20	0.31	1.43	0.74	0.63	1.51	0.73	1.29	0.73	Subrecedent
Brachycaudus helichrysi	1.08	0.58	0.40	0.26	0.99	0.51	0.26	0.41	0.16	1.43	0.74	0.32	0.00	0.24	0.55	0.53	Subrecedent
Brachycaudus sp.	0.43	1.55	0.80	0.53	0.99	0.26	0.78	0.81	0.31	0.72	0.74	0.63	2.11	0.73	0.37	0.78	Subrecedent
Brevicoryne brassicae	8.89	7.56	5.19	8.73	6.65	6.63	4.70	7.32	4.39	7.17	3.20	7.59	7.25	4.39	3.49	6.21	Dominant
Cavariella aegopodii	0.00	0.00	0.00	0.00	0.49	0.00	0.26	0.20	0.00	0.00	0.25	0.32	0.30	0.00	0.37	0.15	Subrecedent
Cavariella sp.	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.07	Subrecedent
Dactinotus ambrosiae	0.00	0.00	0.00	0.26	0.25	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.05	Subrecedent
Dactinotus tussilaginis	1.08	0.78	1.20	0.79	0.00	0.77	0.52	0.81	0.47	1.08	0.00	1.27	0.60	1.46	1.65	0.83	Subrecedent
Dactinotus sp.	0.87	0.78	1.00	1.32	0.74	0.26	0.78	0.20	0.78	0.72	0.74	0.95	0.91	0.49	0.37	0.73	Subrecedent
Dysaphis plantaginea	0.22	0.00	0.00	0.79	0.25	0.00	0.52	0.00	0.31	0.36	0.00	0.00	0.00	0.00	0.00	0.18	Subrecedent
Forda marginata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.01	Subrecedent
Hyadaphis phoeniculi	0.00	0.00	0.20	1.06	1.23	0.26	1.31	0.20	0.31	2.15	1.23	1.27	1.51	1.22	0.55	0.83	Subrecedent
Hyalopterus pruni	0.43	0.78	0.80	1.32	0.49	0.51	1.57	1.02	0.94	0.72	1.23	1.58	0.00	0.73	0.00	0.81	Subrecedent
Hyperomysus lactucae	7.16	6.40	5.39	10.32	10.10	9.44	12.01	11.38	17.71	8.96	11.33	8.86	13.90	11.95	12.13	10.47	Eudominant
Hyperomyzus lampsanae	2.17	2.71	2.99	2.91	2.46	1.79	6.27	4.27	5.02	3.94	6.16	4.11	7.55	8.29	6.80	4.46	Subdominant
Hyperomysus pieridis	0.43	0.78	0.80	1.06	2.22	1.53	2.35	2.24	0.63	0.72	2.22	0.63	2.42	2.44	1.84	1.49	Recedent
Macrosiphum euphorbiae	1.52	0.97	1.00	1.06	0.49	1.02	2.87	0.81	1.72	2.51	2.96	0.63	0.30	0.49	0.55	1.26	Recedent
Macrosiphum rosae	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.20	0.16	0.00	0.00	0.00	0.00	0.00	0.18	0.05	Subrecedent
Metopolophium dirhodum	0.22	0.78	0.00	0.00	0.25	0.00	0.00	0.41	0.47	0.36	0.25	0.00	0.00	0.24	0.00	0.21	Subrecedent
Myzus persicae	7.59	6.59	7.98	7.41	5.42	3.57	6.53	4.47	5.49	7.17	6.90	9.81	5.14	4.15	5.15	6.22	Dominant
Phyllaphis fagi	0.00	0.19	0.40	0.79	0.25	0.26	0.26	0.81	1.25	1.08	0.25	1.58	0.30	0.00	0.55	0.53	Subrecedent
Tetraneura sp.	0.22	0.39	0.40	0.53	0.49	0.26	0.26	0.20	0.47	0.00	0.25	0.95	0.60	0.00	0.37	0.36	Subrecedent
Tinocallis platani	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.02	Subrecedent
Therioaphis trifolii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.25	0.95	0.00	0.00	0.00	0.1	Subrecedent
Thuleaphis rumexiodeus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.02	Subrecedent
Toxoptera auranti	19.74	24.22	40.92	24.87	28.82	29.34	15.14	27.64	34.48	25.81	15.27	28.48	15.71	22.68	27.02	25.34	Eudominant

In this study, the dominance of only 33 species was compared in 2004 and 2005 (Table 1 and Table 2).

During research in 2004, 2 eudominant, 3 dominant, 4 subdominant, 3 recedent and 21 subrecedent species of aphids were determined. In 2005, 3 eudominant, 3 dominant, 3 subdominant, 3 recedent and 21 subrecedent species of aphids were determined.

In both years of investigation *A. gossypii, T. auranti* and in 2005 *H. lactucae* were recorded, making up more than 10 % of the total population. These species do direct damage, but also transmit a very dangerous virus to watermelons.

Conclusions

During the study of the aphid population, 70 species in 48 genera were detected, with 63 species in 42 genera being identified in 2004 and 44 species in 31 genera in 2005. All species referred to the Aphididae. The overall seasonal percentage composition showed that *Toxoptera aurantii* (Boyer de Fonscolombe) (32.48 % in 2004 and 25.34 % in 2005) *A. gossypii* (12.8 % in 2004 and 22.92 % in 2005) in both years of investigation and *H. lactucae* in 2005 (10.47 %) were consistently predominant.

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