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APHID FAUNA (HEMIPTERA: APHIDOIDEA) IN CROATIA

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Aphids (Aphidoidea) are among the most important pests of agricultural crops. This investigation into the aphid in the period of 1996-1998 was conducted using two methods: the yellow water trap (YWT) and Rothamsted suction trap (RST) methods, and was carried out in Zagreb. Through faunistic research 83 species of aphids were identified, out of which 13 were completely new for the aphid fauna in Croatia. In the yellow water trap (YWT) method a total of 64 species were identified, 6 species of these being identified only in the YWT. With the Rothamsted suction trap method (RST) a total of 77 species were identified, 19 of them being identified only with RST. In the YWT method 2 eudominant, 2 dominant, 4 subdominant, 4 recent and 52 subrecent aphid species were recorded. In the RST, 2 eudominant, 2 dominant, 3 subdominant, 6 recent and 62 subrecent aphid species were recorded. According to frequency in YWT *Drephanosiphum platanoidis* Schrank is a euconstant species. All other aphid species in YWT and in RST are accidental.

Aphids, yellow water trap (YWT), Rothamsted suction trap (RST)

T. GOTLIN ČULJAK, J. IGRC BARČIĆ, R. BAŽOK, D. GRUBIŠIĆ, Fauna lisnih uši (Hemiptera: Aphidoidea) u Hrvatskoj, Zavod za poljoprivrednu zoologiju, Agronomski fakultet Sveučilišta u Zagrebu, Svetošimunska cesta 25, 10000 Zagreb, tgotlin@agr.hr – Entomol. Croat. 2005, Vol. 9. Num 1-2: 57 - 69

Lisne uši jedna su od najvažnijih grupa štetnika na poljoprivrednim kulturama. Istraživanja lisnih uši provedena su uporabom žute posude i usisne postaje smještene u Zagrebu. Tijekom istraživanja faune lisnih uši determinirane su 83 vrste lisnih uši, od kojih je 13 novoutvrđenih vrsta u fauni Republike Hrvatske. Uporabom žute posude determinirane su 64 vrste, od kojih 6 vrsta nije nađeno u uzorcima usisne postaje. Uporabom usisne postaje determinirano je 77 vrsta, od kojih 19 vrsta nije nađeno u uzorcima žute posude. Uporabom žute posude zabilježene su 2 eudominantne, 2 dominantne,

4 subdominantne, 4 recentne i 52 subrecentne vrste lisnih uši. Uporabom usisne postaje zabilježene su 2 eudominantne, 2 dominantne, 3 subdominantne, 6 recentnih i 62 subrecentne vrste lisnih uši. Prema stupnju frekvencije samo je vrsta *Drepanosiphum platanoidis* Schrank eukonstantna vrsta u uzorcima žute posude, dok su sve ostale vrste lisnih uši, determinirane pomoću obje metode, slučajne ili akcidentalne.

Lisne uši, žuta posuda, usisna postaja

Introduction

Aphids (Aphidoidea) are one of the most important pests of agricultural crops. There are around 4500 species in the world (Eastop and Blackman, 2001). There are not many data or papers on the fauna of aphids in Croatia. Through faunistic research Gotlin Čuljak (2001) has identified 83 species of aphids, of which 13 were completely new for the aphid fauna in Croatia.

Methodology

Over a period of three years (1996–1998) the aphid phauna in Croatia was monitored by use of the Rothamsted suction trap (RST) and yellow water trap (YWT) methods, (70 x 70 x 70 cm) carried out in Zagreb (Maksimir).

Dominance was calculated by the BALOGH formula:

$$D_1 = \frac{a_1}{\Sigma a_i} \times 100$$

a_1 = number of identified species of aphids;
Σa_i = total number of aphids.

The results (eudominant, dominant, subdominant, recent, subrecent) were classified according to Tischler and Heydeman.

The frequency was calculated by the BALOGH formula:

$$Ca_1 = \frac{Ua_1}{\Sigma U_i} \times 100$$

Ua_1 = number of samples with identified species of aphids
ΣU_i = total number of samples

The results (accidental, accessory, constant, euconstant) were classified according to Tischler.

For identifying aphid species, the following keys were used: Rupais (1961), Taylor (1980), Stroyan (1984), Blackman and Eastop (1984, 1994, 2000), Dubnik (1991), notes by Igrc Barčić and the collection of permanent samples by Leclant.

Results

The investigations lasted 3 years, from 1996-1998. Over this period in the YWT 11,934 and in RST 16,259 aphids were caught. A total of 28,193 specimens were caught and identified. The first catch in the YWT was as follows: 1996- April 29th; 1997- April 11th and 1998- March 13th. The first catch in RST was as follows: 1996- April 25th; 1997- April 14th; 1998- April 12th. The last catch in YWT was recorded as follows: 1996. November 21st; 1997, November 18th; 1998, November 17th. The last catch in RST was recorded in: 1996, November 15th; 1997, November 20th; 1998, November 8th.

The results of the total aphid catch in the YWT are shown in table 1. The results of the total aphid catch in RST are shown in table 2. The results of the dominance are presented in figures 1 and 2. The results for frequency are presented in figures 3 and 4.

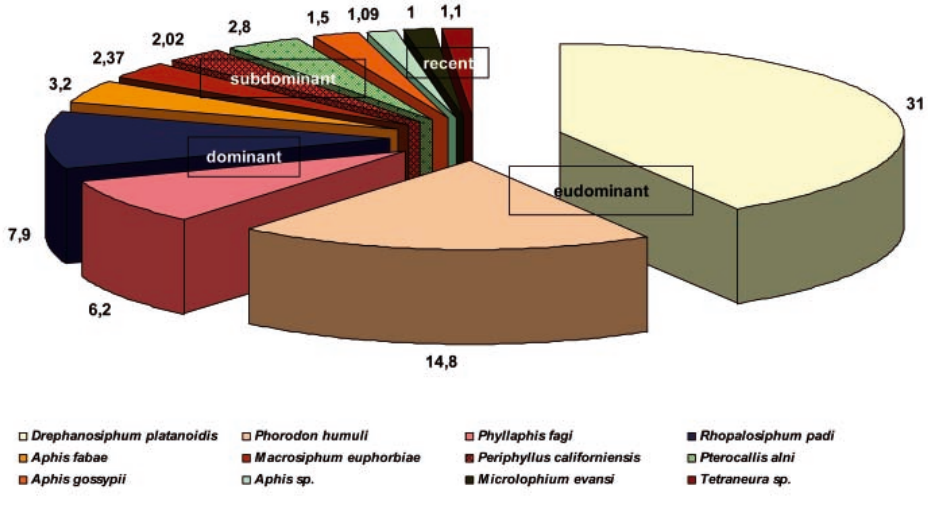

Figure 1. The dominance of the aphid species in yellow water trap

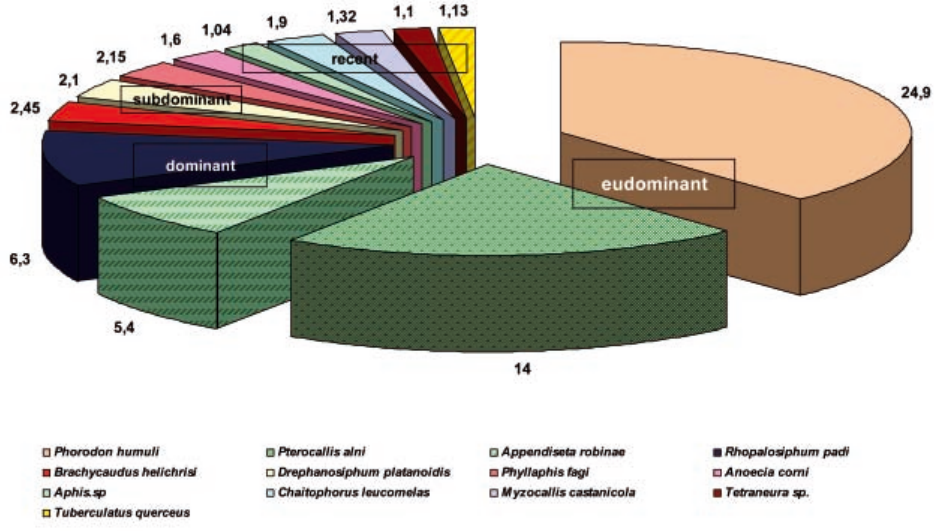

Figure 2. The dominance of the aphid species in Rothamsted suction trap

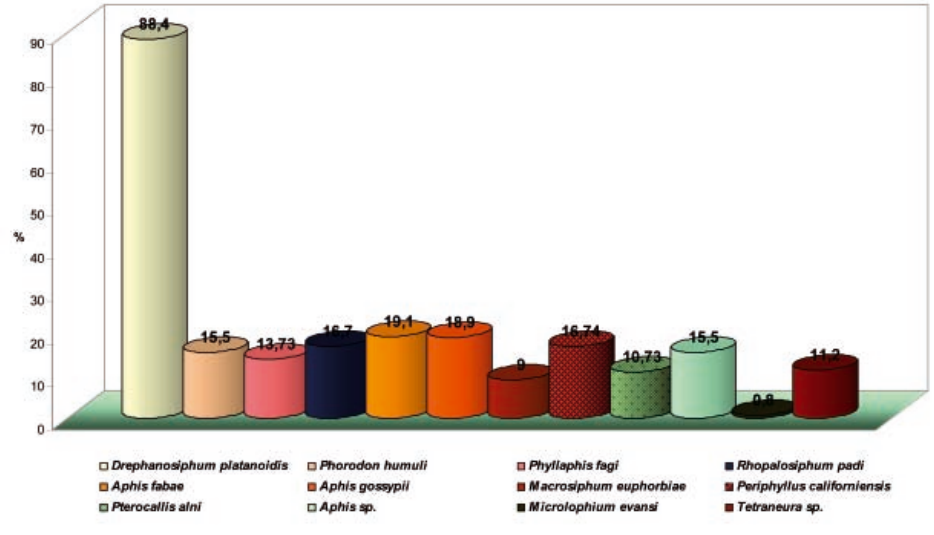

Figure 3. The frequency of the aphid species in Yellow water trap

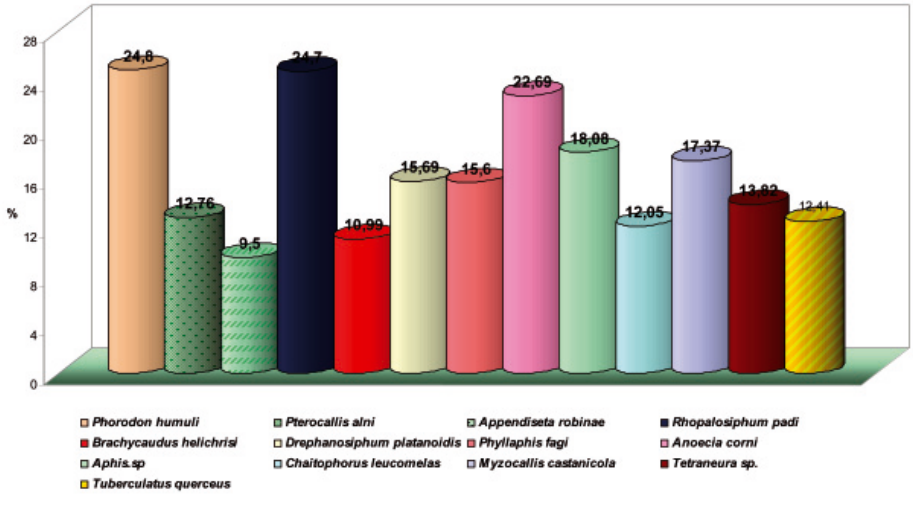

Figure 4. The frequency of the aphid species in Rothamsted suction trap

Discussion

During faunistic research (1996–1998), a total of 83 aphid species were identified, 13 species of which had not previously been recorded in Croatia (Gotlin Čuljak, 2001; Gotlin Čuljak et al. 2002). In the YWT, a total of 64 species were identified, 6 species of which were identified only in the YWT. These are the following species: *Aphis pomi, Drepanosiphum aceris, Drepanosiphum acerinum, Drepanosiphum dixoni, Hyperomyzus lampsanae* and *Protrama* sp. With the RST method, a total of 77 species were identified, 19 species of which were identified only in RST. These are the following species: *Adelges sp., Callipterinella tuberculata, Callipterinella* sp., *Capithophorus* sp., *Chromaphis juglandicola, Eulachnus* sp., *Forda marginata, Hormaphis betulae, Macrosiphoniella* sp., *Myzocallis corylli, Ovatus* sp., *Rhopalosiphum maidis, Rhopalosiphum insertum, Sitobion fragariae, Thelaxes dryophila, Therioaphis luteola, Trama* sp., *Tinocallis platani* and *Uroleucon compositae.*

Table 1. The results of aphid catch in the yellow water trap (YWT)

THE APHID SPECIES	YEAR	THE TOTAL NUMBER OF APHIDS
1. *Acyrtosiphum pisum* Harris, 1776	1997, 1998	24
2. *Amphorophora rubi* Kltb., 1843	1997, 1998	26
3. *Anoecia corni* Fabricius, 1775	1996,1997, 1998	72
4. *Aphis craccivora* Koch, 1854	1996, 1997, 1998	36
5. *Aphis fabae* Scopoli, 1863	1996, 1997, 1998	382
6. *Aphis gosypii* Glover, 1877	1996,1997,1998	172
7. *Aphis pomi* de Geer, 1773	1996,1997	5
8. *Aphis sambuci* Linnaeus, 1758	1996,1997	10
9. *Aphis sp. Linnaeus*, 1758	1996,1997,1998	130
10. *Appendiseta robiniae* Gillete, 1907	1996,1997,1998	12
11. *Aulacorthum solani* Kltb., 1843	1997,1998	36
12. *Brachycaudus helichrysi* Kltb.,1843	1996,1997, 1998	11
13. *Brevicoryne brassicae* Linnaeus, 1758	1996, 1997,1998	24
14. *Calliperinela minutissima* Stroyan, 1953*	1996,1997,1998	6
15. *Calliperinela calliptera* Hartig, 1841*	1996,1997	2
16. *Callaphis juglandis* Goeze, 1778	1996,1997	4
17. *Capitophorus horni* Börner, 1931	1996, 1997	6
18. *Cavariella aegopodii* Scopoli, 1763	1997, 1998	48
19. *Cavariella pastinacae* Linnaeus, 1758	1997	2
20. *Cavariella theobaldi* G&B, 1918	1996,1997,1998	24
(*Cavariella* sp.)	1997	2
21. *Chaitophorus leucomelas* Koch, 1854	1997	2
22. *Chaitophorus populeti* Panzer, 1804*	1997	2
23. *Chaitophorus* sp. Koch, 1854	1996, 1997	60
24. *Cinara* sp. Curtis, 1835	1997	2
25. *Cryptomyzus ribis* Linnaeus, 1758	1996, 1997	10
26. *Dactynotus* sp.	1997	2
27. *Drepanosiphum platanoideas* Schrank, 1801	1996, 1997, 1998	3700
28. *Drepanosiphum aceris* Koch, 1855*	1996	2

THE APHID SPECIES	YEAR	THE TOTAL NUMBER OF APHIDS
29. *Drepanosiphum acerinum* Walker, 1838*	1997, 1998	4
30. *Drepanosiphum dixoni* H. R. L., 1971*	1996, 1997, 1998	6
31. *Dysaphis plantaginea* Passerini, 1860	1996, 1997, 1998	91
32. *Dysaphis* sp. Börner, 1931	1997, 1998	95
33. *Eriosoma ulmi* Linnaeus, 1758	1997, 1998	4
34. *Eucallipterus tiliae* Linnaeus, 1758	1996, 1997, 1998	36
35. *Hyalopterus pruni* Geoffroy, 1762	1996	2
36. *Hyperomyzus lactucae* Linnaeus, 1758	1996, 1997, 1998	84
37. *Hyperomyzus lampsanae* Börner, 1932*	1996, 1997, 1998	24
38. *Hyperomyzus* sp. Börner, 1932	1996,1997	7
39. *Macrosiphum euphorbiae* Thomas, 1878	1996, 1997, 1998	283
40. *Macrosiphum rosae* Linnaeus, 1758	1997, 1998	60
41. *Macrosiphum gei* Koch, 1855	1996, 1997	12
42. *Megoura viciae* Buckton, 1876	1996, 1997	8
43. *Megourella purpurea* H.R.L., 1949	1997	4
44. *Metopolophium festucae* Theobald, 1917	1996, 1997	2
45. *Metopolophium dirhodum* Walker, 1849	1996	2
46. *Microlophium carnosum* Buckton, 1876	1997, 1998	119
47. *Myzocallis castanicola* Baker, 1917	1996, 1998	3
48. *Myzus cerasi* Fabricius, 1775	1996	6
49. *Myzus persicae* Sultzer, 1776	1996, 1997	6
50. *Protrama* sp. Ktb., 1843	1996, 1997	3
51. *Pemphigus* sp. Hartig, 1839	1997, 1998	6
52. *Periphyllus californiensis* Shinji, 1917*	1996, 1997, 1998	241
53. *Phorodon humuli* Schrank, 1801	1996, 1997, 1998	1766
54. *Phyllaphis fagi* Linnaeus, 1767	1996, 1997, 1998	739
55. *Pterocallis alni* de Geer, 1773	1997, 1998	334
56. *Rhopalosiphum padi* Linnaeus, 1758	1996, 1997	943
57. *Rhopalosiphoninus lathysiphon* Davidson, 1912	1996	2
58. *Rhopalosiphoninus* sp. Baker, 1920	1996,1997	2

THE APHID SPECIES	YEAR	THE TOTAL NUMBER OF APHIDS
59. *Sitobion avenae* Fabricius, 1775	1996	2
60. *Tetraneura* sp.Hartig, 1841	1996,1997, 1998	131
61. *Therioaphis trifolii* Monell, 1882	1996	4
62. *Tuberculatus moerickei* H.L.R. 1974*	1997, 1998	24
63. *Tuberculatus querceus* Kltb., 1843	1997, 1998	2
64. *Uromelan* sp. Mordvilko, 1914	1997, 1998	24
no identificated	1996, 1997, 1998	540
damaged species	1996, 1997, 1998	740
apterae	1996, 1997, 1998	759

* the new registered species of aphids in Croatia

Table 2. The results of aphid catch in the Rothamsted suction trap (RST)

THE APHID SPECIES	YEAR	THE TOTAL NUMBER OF APHIDS
1. *Acyrtosiphum pisum* Harris, 1776	1996, 1997, 1998	114
2. *Adelges* sp. Vallot, 1836	1997, 1998	8
3. *Amphorophora rubi* Kltb., 1843	1996, 1997	33
4. *Anoecia corni* Fabricius, 1775	1996, 1997, 1998	260
5. *Aphis craccivora* Koch, 1854	1996, 1997, 1998	65
6. *Aphis fabae* Scopoli, 1863	1996, 1997, 1998	86
7. *Aphis gosypii* Glover, 1877	1996, 1997, 1998	26
8. *Aphis sambuci* Linnaeus, 1758	1996	5
9. *Aphis* sp. Linnaeus, 1758	1996, 1997, 1998	169
10. *Appendiseta robiniae* Gillete, 1907	1996, 1997, 1998	878
11. *Aulacorthum solani* Gillete, 1907	1996, 1997	3
12. *Brachycaudus helichrysi* Kltb.,1843	1997, 1998	398
13. *Brevicoryne brassicae* Linnaeus, 1758	1996, 1997, 1998	10
14. *Callipterinella tuberculata* von Heyden, 1837	1997	3
15. *Calliperinela minutissima* Stroyan, 1953*	1996, 1997, 1998	130
16. *Calliperinela calliptera* Hartig, 1841*	1996,1997	8

THE APHID SPECIES	YEAR	THE TOTAL NUMBER OF APHIDS
17. *Callipterinella* sp. van der Goot, 1913	1996, 1998	13
18. *Callaphis juglandis* Goeze, 1778	1996	3
19. *Capitophorus horni* Börner, 1931	1996, 1997, 1998	122
20. *Capitophorus* sp. van der Goot, 1913	1997	3
21. *Cavariella aegopodii* Scopoli, 1763	1996, 1997, 1998	65
22. *Cavariella pastinacae* Linnaeus, 1758	1997	3
23. *Cavariella theobaldi* G&B, 1918	1997, 1998	49
(*Cavariella* sp.)	1997, 1998	54
24. *Chaitophorus leucomelas* Koch, 1854	1996, 1997, 1998	309
25. *Chaitophorus populeti* Panzer, 1804*	1996,1997	8
26. *Chaitophorus* sp. Koch, 1854	1996, 1998, 1998	114
27. *Cinara* sp. Curtis, 1835	1996,1997	5
28. *Chromaphis juglandicola* Kltb, 1843	1997, 1998	33
29. *Cryptomyzus ribis* Linnaeus, 1758	1996,1997, 1998	16
30. *Dactynotus* sp.	1997, 1998	50
31. *Drepanosiphum platanoidis* Schrank, 1801	1996, 1997, 1998	341
32. *Dysaphis plantaginea* Passerini, 1860	1996, 1997, 1998	114
33. *Dysaphis* sp. Börner, 1931	1997, 1998	55
34. *Eriosoma ulmi* Linnaeus, 1758	1996, 1997	11
35. *Eucallipterus tiliae* Linnaeus, 1758	1996, 1997, 1998	114
36. *Eulachnus* sp. del Guercio, 1909*	1997, 1998	5
37. *Forda marginata* Koch, 1857*	1997, 1998	6
38. *Hormaphis betulae* Mordvilko, 1901*	1996, 1998	6
39. *Hyalopterus pruni* Geoffroy, 1762	1996, 1997, 1998	108
40. *Hyperomyzus lactucae* Linnaeus, 1758	1996, 1997, 1998	16
41. *Hyperomyzus* sp. Börner, 1932	1997	10
42. *Macrosiphoniella* sp. del Guercio, 1911	1997	21
43. *Macrosiphum euphorbiae* Thomas, 1878	1996, 1997, 1998	59
44. *Macrosiphum rosae* Linnaeus, 1758	1996, 1997, 1998	48
45. *Macrosiphum gei* Koch, 1855	1997	5
46. *Megoura viciae* Buckton, 1876	1996, 1997	16

THE APHID SPECIES	YEAR	THE TOTAL NUMBER OF APHIDS
47. *Megourella purpurea* H.R.L., 1949	1997	5
48. *Metopolophium festucae* Theobald, 1917	1997	14
49. *Metopolophium dirhodum* Walker, 1849	1997	21
50. *Microlphium carnosum* Buckton, 1876	1997, 1998	130
51. *Myzocallis corylli* Goetze, 1778	1996, 1998	93
52. *Myzocallis castanicola* Baker, 1917	1996, 1997, 1998	214
53. *Myzus cerasi* Fabricius, 1775	1997, 1998	151
54. *Myzus persicae* Sultzer, 1776	1996, 1997	5
55. *Ovatus* sp. van der Goot, 1913	1997	8
56. *Pemphigus* sp. Hartig, 1839	1996, 1997	33
57. *Periphyllus californiensis* Shinji, 1917*	1996, 1997	33
58. *Phorodon humuli* Schrank, 1801	1996, 1997, 1998	4048
59. *Phyllaphis fagi* Linnaeus, 1767	1996, 1997, 1998	350
60. *Pterocallis alni* de Geer, 1773	1997, 1998	2276
61. *Rhopalosiphum maidis* Fizch, 1856	1997	7
62. *Rhopalosiphum padi* Linnaeus, 1758	1996, 1997, 1998	1024
63. *Rhopalosiphum insertum* Walker, 1849	1997	19
(*Rhopalosiphum* sp.)	1996, 1997	49
64. *Rhopalosiphoninus lathysiphon* Davidson, 1912	1997	3
65. *Sitobion avenae* Fabricius, 1775	1997	48
66. *Sitobion fragariae* Walker, 1846	1996, 1997	8
67. *Sitobion* sp. Mordvilko, 1914	1997	3
68. *Tetraneura* sp. Hartig, 1841	1996, 1997, 1998	179
69. *Thelaxes dryophila* Schrank, 1801	1997, 1998	37
70. *Therioaphis luteola* Börner, 1949	1996, 1997	10
71. *Therioaphis trifolii* Monell, 1882	1996, 1997	13
72. *Trama* sp. von Heyden, 1837	1997	3
73. *Tinocallis platani* Kltb., 1842*	1996	2
74. *Tuberculatus moerickei* H.R.L. 1974*	1996, 1997, 1998	97
75. *Tuberculatus querceus* Kltb., 1843	1996, 1997, 1998	184

THE APHID SPECIES	YEAR	THE TOTAL NUMBER OF APHIDS
76. *Uromelan* sp. Mordvilko, 1914	1997	16
77. *Uroleucon compositae* Theobald, 1915	1997	5
no identificated	1996,1997,1998	894
damaged species	1996,1997,1998	2032
apterae	1996,1997,1998	267

* the new registered species of aphids in Croatia

Aphids were most investigated in the former Yugoslavia by Tanasijević and Eastop (1963, 1968), recording 115 species of aphids. Within that number, 18 species were recorded for Croatia. Igrc Barčić (1999, 2002) described 73 species of aphids, mainly on cultivated plants. Igrc and Maceljski (1988) described about 50 species of aphids on the potato. In the all existing and reviewed references about aphid fauna in Croatia, 186 aphid species have been recorded (Kovačević, 1956, 1961; Ciglar, 1998; Ciglar and Barić, 1999; Dinarina, 1994; Igrc, 1990; Igrc et al., 1993.). Including the 13 newly found, species the list of aphid species in Croatia includes 199 species altogether (Gotlin Čuljak, 2001; Gotlin Čuljak and Igrc Barčić, 2002).

The number of 199 aphid species identified is still far lower than that estimated by Leclant (according to Dinarina, 1994), who considered that there are some 700-800 aphid species living in Croatia, drawing attention to the need for further research into this group of insects.

In the YWT method, 2 eudominant (*Drepanosiphum platanoidis* and *Phorodon humuli*), 2 dominant (*Phyllaphis fagi* and *Rhopalosiphum padi*), 4 subdominant (*Aphis fabae, Macrosiphum euphorbiae, Periphyllus californiensis* and *Pterocallis almi*), 4 recent (*Macrosiphum euphorbiae, Aphis* sp*., Microlophium evansi* and *Tetraneura sp.*) and 52 subrecent aphid species were recorded (Figure 1). In the RST method, 2 eudominant (*Phorodon humuli* and *Pterocallis alni* are), 2 dominant (*Appendiseta robinae* and *Rhopalosiphum padi*), 3 subdominant (*Brachycaudus helichrisi, Drephanosiphum platanoidis* and *Phyllaphis fagi*), 6 recent (*Anoecia corni, Aphis* sp*., Caithophorus leucomelas, Myzocallis castanicola, Tuberculatus querceus* and *Tetraneura* sp.) and 62 subrecent aphid species were recorded (Figure 2).

According to frequency in YWT (Figure 3), *Drephanosiphum platanoidis* is a euconstant species. All other aphid species found in the YWT and in RST (Figure 3 and 4) are accidental.

Conclusions

- During faunistic research (1996 – 1998), 83 species of aphids were identified, 13 species of which had not previously been recorded
- In the YWT 64 species were recorded and in the RST 77 species;
- The revised list of aphid species for Croatia comprises 199 species;
- In the YWT *Drephanosiphum platanoidis* and *Phorodon humuli* were eudominant, *Phyllaphis fagi* and *Rhopalosiphum padi* dominant, *Aphis fabae, Macrosiphum euphorbiae, Periphyllus californiensis* and *Pterocallis almi* subdominant and *Macrosiphum euphorbiae, Aphis* sp.*, Microlophium evansi* and *Tetraneura* sp.were recent species.
- In the RST, *Phorodon humuli* and *Pterocallis alni* were eudominant, *Appendiseta robinae* and *Rhopalosiphum padi* dominant, *Brachycaudus helichrisi, Drephanosiphum platanoidis* and *Phyllaphis fagi* subdominant and *Anoecia corni, Aphis* sp.*, Caithophorus leucomelas, Myzocallis castanicola* and *Tetraneura* sp. were recent species.
- Only one species, *Drepanosiphum platanoidis*, was a euconstant species in the YWT method. All other aphid species, established by both monitoring methods, were accidental.

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