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POLLEN FEEDING OF *CHEILOSIA ALBIPILA* MEIGEN, 1838 (DIPTERA: SYRPHIDAE)

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This paper presents an examination of the pollen feeding behavior of adults of *Cheilosia albipila* Meigen, 1838 on the Fruška gora mountain in Serbia (Yugoslavia). The qualitative and quantitative analysis of pollen collected from insects' gut content has been done. The results showed that the pollen of *Salix* spp. was the most abundant among the pollen of 26 plant taxa collected from *C. albipila* gut.

The flower catkins of *Salix* species have distinct stamens and high productivity of pollen and present the strongest attractant in the area of Karlovac-Petrovaradin marsh during the flight period when determine the spatial distribution of the specimens of *C. albipila*.

KEY WORDS: hoverflies, *Cheilosia albipila*, pollen, gut content

INTRODUCTION

Cheilosia albipila Meigen, 1838 is distributed in Fennoscandinavia south of the Pyrenees; in Ireland and eastwards through much over the northern and central Europe into European parts of Russia and in central Siberia and Siberia (SPEIGHT, 1998). On the Balkan Peninsula, populations of this species were found in Slovenia, Croatia, Bosnia and Herzegovina, Montenegro, Serbia, Macedonia, Bulgaria and Greece (VUJIĆ, 1996).

The adults of *C. albipila* appear from March to July on the Balkan Peninsula. The earliest record was noted on 6 March in the village Stari Ledinci, located at the altitude of 200m on the mountain Fruška gora. The latest record is from the 9 July in the canyon Sušica, located at the altitude of 1100m on the mountain Durmitor. *C. albipila* seems to prefer environments and habitats in the vicinity of rivers, streams, lakes and marshes connected with the *Saliceto-Populetum* s. l., oak

and beech woods.

Biology of *C. albipila* is rather known: larvae and larval development were described and figured by ROTHERAY (1988), adults were registered on many plant species during the flight period, the presence of pollen of 30 taxa was established on integument of samples collected on the Balkan Peninsula (RADIŠIĆ *et al*., 1998).

In order to improve and augment the data on the biology and pollen-feeding behavior of adults of *C. albipila*, the qualitative and quantitative composition of pollen collected from the integument of adults was determined (RADIŠIĆ *et al*., 1998).

The aim of present study was to get new information about adult feeding biology of *C. albipila*.

MATERIALS AND METHODS

The investigated area presents a wide swampy area, located on the Danube, at the foot of the Fruška Gora mountain, Serbia. Forest vegetation, presented by the association of the *Saliceto-Populetum* s.l., is under a strong anthropogenic influence. The fen meadow vegetation and vegetation of stagnant and slow-flowing waters are also present here.

Specimens of analyzed species were collected in the Karlovac-Petrovaradin marsh during the flight period. The following data pertains to the specimens examined in this study: 03. 23. 1991, 6 males; 03. 26. 1991., 6 males; 04. 05. 1991., 12 males, 2 females; 04. 15. 1991., 2 females; 04. 30.1991., 1 female; 05. 10. 1991., 1 female; leg. Radišić Predrag.

Insects were captured by an entomological net and preserved in separate vials. Pollen from the integument was collected using vacuum method of RADIŠIĆ *et al*. (1992), and the permanent preparations of pollen were made in glycerin-gelatin.

In analysis of gut content, specimens from which pollen was collected by vacuum method of RADIŠIĆ *et al*. (1992) were used. Firstly, specimens were softened in exicator and then their legs were removed. The bodies were boiled in 20% KOH for 30 minutes. After the dissection, gut content was isolated and centrifuged, twice for ten minutes on 3000 r. p. m. Supernatant was removed, and residue was filtrated on cellulose Nitrate Membrane Filters (1,20 μm). Permanent preparations were made in glycerin-gelatin with fuchsin.

Pollen and other plant material, found at the same localities, were also collected.

Pollen was analyzed from 30 specimens (24 males and 6 females) of species *C. albipila.* Pollinogical material was determined at least to subfamily by using keys and atlases (ERDTMAN, 1952; MOOR AND WEBB, 1978) and deductively by means of the collected herbarium material.

The two parameters were calculated concerning the pollen:

1. Presence of one type of pollen in relation to the total number of pollen (Parameter 1 on the Table II).

It is defined as a ratio between the total count of pollen grains of one plant taxon and total count of pollen grains of all registered plant taxa. The number of pollen grains for each plant taxon used for this ratio is the pooled data from all specimens examined during this study and presented as percentage in Table I.

2. Frequency of presence of one pollen type (Parameter 2 on the Table II).

This parameter is defined as the percentage of individual adults from the investigated population that have particular type of pollen**.** Four intervals of pollen frequency were established:

- euconstant type, which was present on 81-100% of the population sample;
- constant type, which was present on 61-80% of the population sample;
- accessory type which was present on 41-60% of the population sample;
- accidental type which was present on 0-40% of the population sample.

RESULTS

Examination of the pollen collected from the gut content of 30 individuals of *C. albipila* revealed pollen from 26 plant taxa (Table I).

The analysis of pollen constancy shows the existence of following pollen types: 4 euconstant, 1 constant, 2 accessory and 19 accidental ones (Tables. I and II).

DISCUSSION

Salix species comprise the first group of plant taxa. Specimens of *C. albipila* are caught on the flower catkins of willow according to the literature data (KOR-

Table I
Qualitative and quantitative composition of pollen collected from the gut of *Cheilosia albipila*

Date	No. specimens (m/f)	*Salix* spp.	*Tussilago* sp.	*Corylus* sp.	*Taraxacum* sp.	Cupressaceae	*Carpinus* sp.	*Fraxinus* sp.	*Morus* sp.	*Betula* sp.	*Ulmus* sp.	Rosaceae	Aster type	*Chrysosplenium* sp.
3/23/91	1m	6	5	1	5	1	2	1	3	3	1	2	4	2
3/23/91	2m	465	4	2	0	2	0	0	0	0	0	0	3	0
3/23/91	3m	0	8	0	0	0	0	0	0	3	0	0	1	0
3/23/91	4m	1	6	0	0	0	0	0	0	1	0	0	3	0
3/23/91	5m	2736	18	14	0	1	0	1	0	1	1	0	2	3
3/23/91	6m	237	99	11	0	3	0	0	0	0	0	0	0	1
3/26/91	7m	226	47	13	0	1	0	0	0	0	0	0	0	0
3/26/91	8m	2	6	14	0	2	0	0	0	0	1	0	1	2
3/26/91	9m	13	19	17	0	1	0	0	0	0	0	0	2	0
3/26/91	10m	0	2	9	0	0	0	0	0	0	0	0	0	1
3/26/91	11m	15	0	8	0	1	0	0	0	0	0	0	0	0
3/26/91	12m	107	251	8	3	0	2	0	0	0	0	0	0	0
4/5/91	13m	1664	60	5	0	0	0	0	0	0	0	0	6	0
4/5/91	14m	24	4	51	0	3	0	1	0	0	0	0	0	0
4/5/91	15m	193	8	12	0	1	0	3	0	0	0	0	0	0
4/5/91	16m	2127	17	14	0	2	0	1	0	0	0	0	1	0
4/5/91	17m	13	5	5	0	0	0	0	0	0	0	0	0	0
4/5/91	18m	9	29	10	0	0	0	0	0	1	0	0	0	0
4/5/91	19f	36	17	27	0	1	0	3	0	1	0	0	0	0
4/5/91	20m	50	9	4	1	0	0	0	0	0	0	0	0	0
4/5/91	21m	7	18	5	0	1	0	8	0	0	0	0	0	0
4/5/91	22f	93	0	10	0	4	0	0	0	0	0	2	0	0
4/5/91	23m	10	17	12	0	1	0	1	0	0	0	0	0	0
4/5/91	24m	193	18	11	0	1	0	1	0	0	1	0	0	0
4/5/91	25m	69	32	8	0	0	0	59	0	0	0	0	0	0
4/5/91	26m	18	7	11	1	0	0	38	0	0	0	0	0	0
4/15/91	27f	2472	10	16	0	0	0	5	0	0	0	0	0	0
4/15/91	28f	83	0	0	0	1	0	0	0	0	0	0	0	0
4/30/91	29f	1685	25	7	1	0	0	3	0	0	0	0	0	1
5/10/91	30f	52	13	11	0	0	0	4	0	0	0	830	1	0
		Sum of pollen grains												
		12606	754	316	11	27	4	129	3	10	4	834	24	10
	%	82.10	4.91	2.06	0.07	0.18	0.03	0.84	0.02	0.07	0.03	5.43	0.16	0.07
		Sum of specimens with pollen grains												
		28	27	27	5	17	2	14	1	6	4	3	3	6
	%	93.33	90.00	90.00	16.67	56.67	6.67	46.67	3.33	20.00	13.33	10.00	10.00	20.00

Table I
Qualitative and quantitative composition of pollen collected from the gut of *Cheilosia albipila* (continuiti)

No. specimens (m/f)	Lamiaceae	Chenopodiaceae	Rubiaceae	Acer type	*Juglans* sp.	*Myriophyllum* sp.	*Populus* sp.	*Tilia* sp.	*Polygonum* sp.	*Prunus* sp.	*Plantago* sp.	Pinaceae	*Euphorbia* sp.	Undeterminated	Sum of pollen
1m	1	0	1	0	0	0	1	0	0	0	0	0	0	13	52
2m	0	4	0	0	1	2	6	0	0	0	0	0	0	14	503
3m	1	0	0	0	0	0	0	0	0	0	0	0	0	2	15
4m	3	11	0	0	0	0	11	0	0	0	0	0	0	2	38
5m	8	1	0	0	0	0	7	0	0	0	0	0	0	2	2795
6m	0	0	0	1	0	0	6	0	1	0	0	0	0	54	413
7m	1	4	0	1	0	0	3	0	0	1	0	0	0	3	300
8m	0	4	0	0	0	0	5	0	0	2	0	0	0	3	42
9m	1	2	0	5	0	0	3	0	0	1	0	0	0	11	75
10m	0	0	0	0	0	0	4	0	0	0	0	0	0	7	23
11m	0	3	0	0	0	0	4	0	0	0	0	0	0	3	34
12m	0	2	0	0	0	0	4	1	10	0	0	0	0	3	391
13m	0	1	0	0	0	0	3	1	0	0	0	0	0	8	1748
14m	0	1	0	0	0	0	1	0	0	0	0	0	0	5	90
15m	0	1	0	0	0	0	5	0	0	0	0	0	0	3	226
16m	0	4	0	3	1	0	2	1	0	0	0	0	0	13	2186
17m	0	1	0	1	0	0	2	0	0	0	1	0	0	6	34
18m	0	1	0	2	0	0	2	0	0	0	0	0	0	5	59
19f	0	1	0	2	0	0	7	1	0	0	0	0	0	9	105
20m	0	0	0	0	0	0	3	2	0	0	0	0	0	2	71
21m	0	1	0	0	0	0	1	0	0	0	0	0	0	10	51
22f	0	5	0	1	6	0	3	0	0	0	0	3	0	4	131
23m	0	1	0	1	0	0	6	0	0	0	0	0	0	5	54
24m	0	4	0	0	0	0	3	0	0	0	0	0	0	4	236
25m	0	2	0	0	0	0	7	0	0	0	0	0	0	7	184
26m	0	0	0	2	0	0	4	0	0	0	0	0	0	5	86
27f	0	1	0	4	0	0	8	0	0	0	0	0	0	4	2520
28f	0	1	0	0	0	0	2	0	0	0	0	0	0	1	88
29f	0	1	0	1	0	0	9	0	0	0	0	1	0	4	1738
30f	0	0	0	144	0	0	9	0	0	0	0	0	1	2	1067
	Sum of pollen grains														
	15	57	1	168	8	2	131	6	11	4	1	4	1	214	15355
%	0.10	0.37	0.01	1.09	0.05	0.01	0.85	0.04	0.07	0.03	0.01	0.03	0.01	1.39	100
	Sum of specimens with pollen grains														
	6	23	1	12	3	1	29	5	2	3	1	2	1		
%	20.00	76.67	3.33	40.00	10.00	3.33	96.67	16.67	6.67	10.00	3.33	6.67	3.33		

Table II
Correlation between pollen transport and pollen feeding.

Pollen transport (RADIŠIĆ *et al.*, 1998)			Pollen feeding		
Plant taxon	Parameter 1	Parameter 2	Plant taxon	Parameter 1	Parameter 2
Salix spp.	95.31	Euc	*Salix* spp.	82.10	Euc[1]
Rosaceae	0.64	Con	Rosaceae	5.43	Acci[2]
Tussilago sp.	0.024	Acci	*Tussilago* sp.	4.91	Euc
Corylus sp.	0.09	Euc	*Corylus* sp.	2.06	Euc
			Acer type	1.09	Acci
			Populus sp.	0.85	Euc
			Cupressaceae	0.18	Acce[3]
			Aster type	0.16	Acci
			Fraxinus sp.	0.084	Acce
			Chrysosplenium sp.	0.07	Acci
Taraxacum sp.	0.10	Acci	*Taraxacum* sp.	0.07	Acci
			Betula sp.	0.07	Acci
			Polygonum sp.	0.07	Acci
			Juglans sp.	0.05	Acci
Tilia sp.	0.05	Acci	*Tilia* sp.	0.04	Acci
Chenopodiaceae	0.02	Acce	Chenopodiaceae	0.037	Con[4]
			Prunus sp.	0.03	Acci
			Carpinus sp.	0.03	Acci
Ulmus sp.	0.03	Acce	*Ulmus* sp.	0.03	Acci
Vesiculate	0.004	Acci	Pinaceae	0.03	Acci
Morus sp.	0.03	Acci	*Morus* sp.	0.02	Acci
			Lamiaceae	0.01	Acci
Galium sp.	0.001	Acci	Rubiaceae	0.01	Acci
			Myriophyllum sp.	0.01	Acci
			Plantago sp.	0.01	Acci
			Euphorbia sp.	0.01	Acci
Poaceae	0.062	Con			
Carex sp.	0.389	Acce			
Artemisia type	0.054	Acce			
Ranunculaceae	2.928	Acci			
Polypantoporate	0.057	Acci			
Carduus type	0.007	Acci			
Undeterminated	0.046		Undeterminated	1.39	

[1]Euc - Euconstant; [2]Acci - Accidental; [3]Acce - Accesory; [4]Con - Constant

MAN, 1988; TORP, 1994; VUJIĆ AND ŠIMIĆ, 1994; SPEIGHT, 1998) and results from investigation of pollen transport (RADIŠIĆ *et al*.,1998). *Salix* spp. pollen was found on integument of all 30 specimens of *C. albipila* examined, where it contributed 95,31 % of the total pollen count - euconstant type of pollen (RADIŠIĆ *et al*.,1998). Pollen grains of *Salix* spp. from gut content were found on 28 specimens of *C. albipila*, where it contributed 82,10 % of the total pollen count - euconstant type of pollen (Table I). Correlation between pollen from gut content and pollen from integument shows that the flower catkins of *Salix* species have distinct stamens and high productivity of pollen, present the strongest attractant and determine spatial distribution of the specimens of *C. albipila* in the area of Karlovac-Petrovaradin marsh during the flight period.

The second group includes plant taxa within the Asteraceae family. The members of this group are mentioned in the literature data as flowers visited by *C. albipila* : *Petasites albus* (L.) Gaertn. (TORP, 1994), genera *Taraxacum* (SPEIGHT, 1998) and *Tussilago* (KORMAN, 1988; TORP, 1994; SPEIGHT, 1998). There was a small number of *Taraxacum* spp. pollen grains and *Aster* pollen type (includes *Petasistes* and *Tussilago farfara*) on integument of *C. albipila* species (RADIŠIĆ *et al*., 1998). Guts of 90 % examined specimens contained pollen of *T. farfara* - euconstant type with increased number of pollen grains (4.91%) (Tables I and II).

The populations of *C. albipila* species frequently visit the flowers and feed with pollen of *Tussilago*, *Taraxacum* or *Petasites* plants, depending on the presence or dominancy of plant taxa in the environment observed.

According to the literature data, the adults of *C. albipila* have been collected at the flowers of the following species of plants: ***Anemone nemorosa*** **L. (**TORP, 1994**),** *Caltha palustris* L. (BRADESCU, 1994, SPEIGHT, 1998), *Ficaria verna* Huds. (TORP, 1994). Although *C. albipila* was often caught at plants of the Ranunculaceae family, pollen of this family was found at only 13.33% on the integument of examined specimens (RADIŠIĆ *et al*., 1998). There was no *Ranunculus* pollen in gut content. The reason for visiting these flowers could be nectar feeding.

There are no references that the specimens of *C. albipila* were captured on flower catkins of *Corylus* spp. and *Populus* sp. Pollen of *Corylus* sp. (Table II) was recognized on integument of this species of hover flies (RADIŠIĆ *et al*., 1998), whereas in gut content pollen of *Corylus* and *Populus* were found. It is registered that early-spring species of hover flies feed with pollen and nectar of anemophilous species of trees and shrubs, as well as with pollen found on the surface of leaves of anemophilous plants.

Pollen transport studies of species: *C. grossa* (Fallen,1817) (RADIŠIĆ *et al*.,1992), *C. griseifacies* Vujić (ŠIMIĆ *et al*., 1994), *C. albipila* (RADIŠIĆ, *et al*., 1998), *C. flavipes* (Panzer,1798) (RADIŠIĆ, *et al*., 1999) and *C. brunnipennis* Becker, 1894 (RADIŠIĆ *et al*., 1999) have always registered pollen of plant species which bloom in earlier season (i.e. Chenopodiaceae). It was also found that the species examined had relatively small number of pollen grains in gut content in constancy 76.67% (Table II) which correlated with HOLLOWAY`s studies (1976). Specimens of *C. albipila* have never been associated with flowers of these plant species, but the existance of pollen on the integument and in the gut content of species examined in this study reveals that adults do come into contact with these plants.

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REFERENCES

BRADESCU, V. 1994. Flower flies (Diptera, Syrphidae) on *Caltha palustris* L. Trav. Mus. Hist. nat. "Grigore Antipa" 34: 13-15.

ERDTMAN, G.E. 1952. *Pollen morphology and plant taxonomy. Angiosperms*. Almqvist and Wiksell, Stockholm, 539 pp.

HOLLOWAY, A.B. 1976. Pollen-feeding in hover-flies (Diptera: Syrphidae). New Zeal. J. Zool. 3: 339-350.

KORMAN, K. 1988. *Schwebliegen Mitteleuropas*. Ecomed-Verl.-Ges., München.

MOOR, P.D. & WEBB, J.A. 1978. *An illustrated Guide to Pollen Analysis*. Hodder and Stoughton, London.

RADIŠIĆ, P., VUJIĆ, A., ŠIMIĆ, S. & RADENKOVIĆ S. 1992. Pollen transport of species *Cheilosia grossa* Fallen, 1817 (Diptera, Syrphidae). Ekologija 27 (2): 41-46.

RADIŠIĆ, P., VUJIĆ, A., ŠIMIĆ, S. & RADENKOVIĆ, S. 1998. Pollen transport of species *Cheilosia albipila* Meigen, 1838 (Diptera,Syrphidae). Acta ent. serb. 3 (1/2): 77-84.

RADIŠIĆ, P., VUJIĆ, A., ŠIMIĆ, S. & RADENKOVIĆ, S. 1999. Pollen transport of species *Cheilosia brunnipennis* Becker, 1894 (Diptera, Syrphidae). Acta ent. serb. 4 (1/2): 75-82.

RADIŠIĆ, P., VUJIĆ, A., ŠIMIĆ, S. & RADENKOVIĆ, S. 1999. Pollen transport of species *Cheilosia flavipes* (Panzer, 1798) (Diptera, Syrphidae). Acta ent. serb. 4 (1/2): 83-91.

ROTHERAY, G.E. 1988 Larval morphology and feeding patterns of four *Cheilosia* species

(Diptera, Syrphydae) associated with *Cirsium palustre* L. Scopoli (Compositae) in Scotland. Jour. of Nat. Hist., 22: 17-25.

SPEIGHT, M.C.D. 1998. Species accounts of European Syrphidae (Diptera): the Atlantic zone species (revised), Vol. 7 Syrph. the Net publications, Dublin, 190 pp.

SSYMANK, A. & GILBERT F. 1993. Anemophilous pollen in the diet of Syrphid flies with special reference to the leaf feeding strategy occurring in Xylotini (Diptera, Syrphidae). Dtsch. ent. Z., N.F. 40 (2): 245-258.

ŠIMIĆ, S., RADIŠIĆ, P. & VUJIĆ A. 1994. Some zoogeografical and ecological characteristics of species *Cheilosia griseifacies* Vujić, (Diptera, Syrphidae). Bios 2: 257-262.

TORP, E. 1994. *Danmarks Svirefluer*. Danmarks Dyreliv Bind 6. Apollo Books, Stenstrup.

VUJIĆ, A. 1996. *Genus* Cheilosia *Meigen and related genera (Diptera: Syrphidae) on the Balkan peninsula*. Monographs, Matica srpska, Novi Sad.

VUJIĆ, A. & ŠIMIĆ, S. 1994. *Syrphidae (Insecta, Syrphidae) Vršac Hills*. Monographs of Vršac Hills, Matica srpska, Novi Sad.

ИСХРАНА ПОЛЕНОМ ВРСТЕ *CHEILOSIA ALBIPILA* MEIGEN, 1838 (DIPTERA: SYRPHIDAE)

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Извод

Врста *Cheilosia albpila* Meigen, 1838 је распрострањена у Европи и Сибиру (Палеарктичка врста). На Балканском полуострву констатована је у Словенији, Хрватској, Босни и Херцеговини, Црној Гори, Србији, Македонији, Бугарској и Грчкој. (Вујић**,** 1996).

Анализиран је квалитативни и квантитативни састав полена издвојен из садржаја црева врсте *C. albipila.* Примерци су сакупљани у Петроварадинско – Карловачком риту (Фрушка гора) током целог периода активности адултних облика. Утврђен је полен 26 биљних таксона (Табела I).

Полен врбе (*Salix* spp.) је заступљен у цревном садржају код 93.33% примерака (еуконстантни тип полена) (Табела I и II). Резултати испитивања транспорта полена (Радишић *и сар.*, 1998) су указали, а резултати испитивања исхране поленом потврђују да су цветне ресе врбе најачи атрактант и да одређују просторну дистрибуцију адултних облика врсте *C. albipila* на подручју Петроварадинско – Карловачког рита.

У досадашњим истраживањима је констатовано да јединке врсте C. albipila често посећују цветове биљака из фамилије Asteraceae (KORMAN, 1988; TORP, 1994; SPEIGHT, 1998). На интегументу испитиваних јединки заступљена су поленова зрна *Aster* типа (коме припадају и врсте рода *Petasistes* и врста *Tussilago farfara*). Анализа цревног садржаја потврђује значај биљака из ове фамилије јер је код 90% испитиваних примерака врсте *C. albipila* у цревном садржају констатован полен *T. farfara* – еуконстантни тип (Табела I и II).

Поређењем досадашњих истраживања, подаци везани за биљне врсте на чијим су цветовима налажени примерци врсте *C. albipila* и подаци анализе полена на интегументу сирфида, са резултатима анализе цревног садржаја добија се увид у биологију – понашање испитиваних врста сирфида али се истовремено постављају и нови проблеми. Наводимо два примера који захтевају додатна истраживања:

- примерци испитиване врсте су према подацима из литературе констатовани на цветовима биљака фамилије Ranunculaceae (TORP, 1994; BRADESCU,1994; SPEIGHT, 1998). Радишић *и сар*. (1998)**.** су утврдили овај тип полена на интегументу анализираних јединки али у цревном садржају није констатован полен ових биљака.

- анализа полена из садржаја црева је указала да 90 % јединки садржи полен леске (*Corylus*) а 96.67 % јединки полен тополе (*Populus*). Полен леске је констатован и на интегументу (Радишић *и сар.,* 1998) међутим нико од истраживача до сада није хватао адултне примерке на цветним ресама врбе и тополе (Табела I и II).

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