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## CONTRIBUTION TO THE KNOWLEDGE OF CLEARWING MOTHS (INSECTA, LEPIDOPTERA, SESIIDAE) IN CROATIA

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New species members and updated check list of Croatian Sesiid fauna is given in the paper. Data was gathered by a thorough review of published literature on this insect group and especially by taxonomical analysis of collections at the Croatian Natural History Museum in Zagreb and Entomological Department at the Municipal Museum of Varaždin. In this paper we have made a check-list of clearwing moths registered in Croatian fauna, their zoogeographical characteristics and distribution for species not so well known for Croatia.

**Key words:** Sesiidae, Croatia, fauna, distribution.

**Kučinić, M., B. Hrašovec, A. Bregović & F. Perović: Prilog poznavanju staklokrilki (Insecta, Lepidoptera, Sesiidae) u Hrvatskoj, Nat. Croat., Vol. 6., No. 2., 275–284, 1997, Zagreb**

Pregledom entomoloških zbirki Gradskega muzeja u Varaždinu i Hrvatskoga prirodoslovnog muzeja u Zagrebu, te na temelju literaturnih podataka dan je prilog poznavanju fauni staklokrilki Hrvatske. Prikazan je popis vrsta, njihove zoogeografske značajke i rasprostranjenost vrsta koje su manje poznate za Hrvatsku.

**Ključne riječi:** Sesiidae, Hrvatska, fauna, rasprostranjenost.

### INTRODUCTION

By their morphological, ecological and ethological characteristics, clearwing moths (Sesiidae) constitute a very specific lepidopterous family. During their larval stage they mainly inhabit the inside of roots, stems or branches of various host plants, reaching

the pupal stage in one to three years. Most of the species can be collected daily by careful observation of their host plants, by laboratory rearings in their feeding habitats and by selective catching with sexual pheromones. Clearwing moths research in Croatia, together with other lepidopterological research, started in 19<sup>th</sup> century and has continued with fluctuating intensity ever since (ABAFI-AINGER et al. 1896, ABAFI-AINGER 1910, BARTOL et al. 1964, BURGERMAISTER, 1964; KOVAČEVIĆ & FRANJEVIĆ-OŠTRC, 1978; MLADINOV, 1961; SCHWINGENSCHUB & WAGNER, 1925–1927; STAUDER, 1932–33,...). In those researches clearwings were only partially investigated, and we suspect that larger part of naturally occurring species in those habitats was not recorded. This is of no surprise, having in mind the specific field collecting methods and larval rearings which have to be laboured if one wants to obtain adult moths. Often used light trapping gives no satisfactory results. The richest faunistic data can be found in ABAFI-AINGER et al. (1896), MANN (1869), ABAFI-AINGER (1910), STAUDER (1932–33) and KRANJČEV (1985). The latter thoroughly studied Podravina area where he recorded 23 species (nearly 45% for complete group in Croatian fauna). *Synanthedon croaticus*, described by KRANJČEV (1978) is actually a synonym for *Synanthedon melliniforme* Laspeyres, 1801 (ŠPATENKA et al. 1993). Following review of the clearwing fauna emerged as a result of a fifteen year research period, during which the Croatian Natural History Museum (CNHM) curators among other species collected clearwings, and in greater extent of the nonpublished data from CNHM collections and some collections from the Entomological Department of the Municipal Museum of Varaždin (MMV), regarding the latest comprehensive work on European Sesiidae (LAŠTUVKA & LAŠTUVKA, 1995).

## MATERIALS AND METHODS

Several collections were examined during the research: the Central Collection, the Igalffy collection, the Lorković collection, the Vozilići collection (all at CNHM, Zagreb) and the Košćec collection from the Municipal Museum of Varaždin (MMV). Nearly 200 clearwing specimens were examined. The material was collected on following locations: Kamenica, Ravna Gora, Trnovec, Varaždin (all **Hrvatsko zagorje** region); Peščenica (**Turopolje** region); Bosiljevo (**Kordun** region); Zagreb, and Plješevica Mt (**central Croatia**); Babrovača (**Velebit Mt**, 900 m a.s.l.); Vozilići (**Istra** region); Caska, Dubrave (island of Pag – **Dalmatia** region) (Fig. 1). Species determination was obtained according to FORSTER & WOHLFAHRT (1971), LAŠTUVKA & LAŠTUVKA (1995), SKINNER (1986), SPULLER, (1910). For several species, morphological analysis of genitalia was accomplished regarding LAŠTUVKA & LAŠTUVKA (1995). The number of species in fauna of Italy, Austria, Hungary, Germany, Greece, Spain, France, Sweden was given according to LAŠTUVKA & LAŠTUVKA (1995) and LAŠTUVKA & ŠPATENKA (1996), and for Slovenia according to CARNELUTTI (1992) and LAŠTUVKA & LAŠTUVKA (1995).

## RESULTS AND DISCUSSION

The review of the above mentioned collections and of during the last 15 years personally collected material resulted with the list of 20 clearwing species of the Croatian fauna (Tab. 1). A list of Croatian clearwings is updated and expanded with new species and new geographical distribution data.

**Table 1.** A review of clearwing moths from examined collections, recently collected material.

***Sesia apiformis* (Clerck, 1759)**

Bosiljevo, (date?), leg. Kozulić; Peščenica 18.VI.1974. leg. F. Perović, Trnovec VI. 1950. leg. I. Igalffy (Central coll. CNHM); Varaždin 2.VII.1928., 20.VI.1929., 30.VI.1929., 17.VII.1930., 4.VIII.1936. (coll. Košćec, MMV); Zagreb (Cvjetno naselje) 26.VI.1978. (coll. Lorković, CNHM);

***Paranthrene tabaniformis* (Rottemburg, 1775).**

Bosiljevo, (date?), leg. Kozulić (Central coll. CNHM); Varaždin 4.VIII.1925., 17.VII.1929., 25.VII.1930. (coll. Košćec, MMV);

***Synanthedon spheciformis* ([Denis & Schiffermüller], 1775)**

Trnovec V.1914. leg. I. Igalffy (Central coll. CNHM);

***Synanthedon stomoxiformis* (Hübner, 1790)**

Trnovec 30.VI.1948., VII.1950. leg. I. Igalffy (Central coll. CNHM); Kamenica 2.VII.1932. (coll. Košćec, MMV);

***Synanthedon culiciformis* (Linnaeus, 1758)**

Varaždin 2.V.1947. (coll. Košćec, MMV);

***Synanthedon formicaeformis* (Esper, 1783)**

Varaždin 4.VII.1928. (coll. Košćec, MMV);

***Synanthedon myopaeformis* (Borkhausen, 1789)**

Zagreb 9.VII.1932., 10.VII.1932. leg. Valjavec, Caska (Pag island) 23.VI.1962. leg. Mladinov, 26.VI. 1962. leg. K. Igalffy (Central coll. CNHM); Kamenica 18.VII.1929., 2.VIII.1936. (coll. Košćec, MMV);

***Synanthedon vespiformis* (Linnaeus, 1761)**

Bosiljevo, (date?), leg. Kozulić (Central coll. CNHM); Kamenica 18.VII.1929., 17.VII.1933., Varaždin 29.VI.1928., 3.VII.1928., 10.VII.1928., 25.VII.1930., 28.VI.1937., 13.VII.1950. (coll. Košćec, MMV);

***Synanthedon conopiformis* (Esper, 1782)**

Varaždin 25.VII.1925. (coll. Košćec, MMV);

***Synanthedon tipuliformis* (Clerck, 1759)**

Plješivica Mt (location?) 14.VII.1927., Zagreb 11.VII.1929. leg. Valjavec (Central coll. CNHM); Varaždin 5.VII.1929. (coll. Košćec, MMV);

***Synanthedon cephiformis* (Ochsenheimer, 1808)**

Trnovec VII.1939. leg. I. Igalffy (Central coll. CNHM); Kamenica 12.VII.1929. (coll. Košćec, MMV);

***Bembecia ichneumoniformis* ([Denis & Schiffermüller], 1775)**

Kamenica 16.VII.1929., 22.VII.1929., 28.VII.1933., 19.VII.1934., Ravna Gora 18.VII.1928., Varaždin 8.VIII.1929. (coll. Košćec, MMV);

***Bembecia megillaeformis* (Hübner, [1813])**

Kamenica 17.VII.1929., 23.VII.1929., 2.VIII.1934. (coll. Košćec, MMV);

***Bembecia uroceriformis* (Treitschke, 1834)**

Caska (Pag island) 8.VII.1960. leg. L. Mladinov, VII.1960. leg. I. Igalffy (Central coll. CNHM);

***Synasphacia triannuliformis* (Freyer, 1845)**

Varaždin 31.VII.1925., 2.VIII.1925., 23.VII.1928., 18.VII.1930., 21.VII.1930. (coll. Košćec, MMV);

***Synasphacia muscaeformis* (Esper, 1783)**

Caska (Pag island) 21.VI.1960., 28.VI.1960., 4.VII.1960., 29.VI.1962. leg. M. Mladinov, 5.VII.1960, leg. Magerle, Dubrave (Pag island) VII.1962. leg. K. Igalffy, Zagreb 6.VII.1929., 17.VII.1929., VII.1929. leg. Valjavec (Central coll. CNHM);

***Chamaesphacia chalciformis* (Esper [1804])**

Babrovača (Velebit Mt, 900 m a.s.l.) 2.VII.1995. leg. F. Perović (Central coll. CNHM); Vozilići 10.VII.1976. leg. F. Perović (coll. Vozilići, CNHM);

***Chamaesphacia hungarica* (Tomala, 1901)**

Kamenica 27.VII.1929., Varaždin 27.VII.1925., 1.VIII.1925., 3.VIII.1925., 21.VII.1927., 26.VI.1928. (coll. Košćec, MMV);

***Chamaesphacia empiformis* (Esper, 1783)**

Kamenica 19.VII.1929., 21.VII.1929., 22.VII.1929., 23.VII.1929., 29.VII.1929., 29.VII.1931., Ravna Gora 14.VII.1928., 3.VIII.1931., Varaždin 25.VII.1925., 30.VII.1925., 28.VII.1927., 1.VIII.1927., 30.VI.1928., 24.VII.1928., 26.VII.1928., 31.VII.1928., 6.VII.1929., 9.VII.1935, 14.VII.1935. (coll. Košćec, MMV);

***Chamaesphacia astatiformis* (Herrich-Schäffer, 1846)**

Dubrave (Pag island) VII.1962., leg. K. Igalffy (Central coll. CNHM);

After inspecting all the available material in previously mentioned collections and reviewing domestic and foreign relevant literature (ABAFI-AINGER et al, 1896; ABAFI-AINGER 1910; BARTOL et al., 1964; BURGERMAISTER, 1964; KOVAČEVIĆ & FRANJEVIĆ-OŠTRC, 1978; KRANJČEV, 1985; LAŠTUVKA & LAŠTUVKA, 1995; MLADINOV, 1961; SCHWINGENSCHUB & WAGNER, 1925–1927) we made a check list of clearwing moths registered in Croatian fauna (Tab. 1).

**Table 2.** Check list of clearwing moths registered in Croatian fauna, with their zoogeographical characteristics:

1. *Tinthia tineiformis* (Esper, 1789); Holomediterranean
2. *Tinthia brosiiformis* (Hübner [1813]); E Mediterranean-Asiatic
3. *Pennisetia hylaeiformis* (Laspeyers, 1801); Euroasiatic
4. *Sesia apiformis* (Clerk, 1759); Palearctic
5. *Sesia melanocephala* Dalman, 1816; Eurasiatic
6. *Paranthrene tabaniformis* (Rottemburg, 1775); Holarctic
7. *Paranthrene insolitus* (Le Cerf, 1914); W Palearctic
8. *Paranthrene diaphana* (Dalla Torre & Strand, 1925); Balkan peninsula-Anatolia?
9. *Synanthedon mesiaeformis* (Herrich-Schäffer, 1846); W Palearctic
10. *Synanthedon spheciformis* ([Denis & Schiffermüller], 1775); Eurasiatic
11. *Synanthedon stomoxiformis* (Hübner, 1790); W Palearctic
12. *Synanthedon culciformis* (Linnaeus, 1758); Holarctic

13. *Synanthedon formicaeformis* (Esper, 1783); Eurasiatic
14. *Synanthedon flaviventris* (Staudinger, 1883); Eurasiatic
15. *Synanthedon andrenaeformis* (Laspeyres, 1801); W Palearctic
16. *Synanthedon myopaeformis* (Borkhausen, 1789); W Palearctic
17. *Synanthedon melliniformis* (Laspeyers, 1801); Adriatic-Mediterranean
18. *Synanthedon vespiformis* (Linnaeus, 1761); W Palearctic
19. *Synanthedon conopiformis* (Esper, 1782); W Palearctic
20. *Synanthedon tipuliformis* (Clerck, 1759); Palearctic
21. *Synanthedon spuleri* (Fuchs, 1908); W Palearctic
22. *Synanthedon loranthi* (Králíek, 1966); European
23. *Synanthedon cephiiformis* (Ochsenheimer, 1808); European
24. *Bembecia ichneumoniformis* ([Denis & Schiffermüller], 1775); W Palearctic
25. *Bembecia albanesis* (Rebel, 1918); W Palearctic
26. *Bembecia pavicevici* (Toševski, 1989); Balkan peninsula
27. *Bembecia scopigera* (Scopolii, 1763); W Palearctic
28. *Bembecia megillaeformis* (Hübner, [1813]); W Palearctic
29. *Bembecia himmighoffeni* (Staudinger, 1866); W Mediterranean
30. *Bembecia uroceriformis* (Treitschke, 1834); Holomediterranean
31. *Pyropteron chrysidiformis* (Esper, 1782); Atlantic-Mediterranean
32. *Synasphesia triannuliformis* (Freyer, 1845); E Mediterranean
33. *Synasphesia muscaeformis* (Esper, 1871); European
34. *Synasphesia affinis* (Staudinger, 1856); W Palearctic
35. *Synasphesia leucomelaena* (Zeller, 1847); Holomediterranean
36. *Chamaesphesia aerifrons* (Zeller, 1847); Atlantic-Mediterranean
37. *Chamaesphesia alysoniformis* (Herrich-Schäffer, 1846); E Mediterranean
38. *Chamaesphesia chalciformis* (Esper, [1804]); E Mediterranean-Asiatic
39. *Chamaesphesia schmidtiformis* (Freyer, 1836); E Mediterranean
40. *Chamaesphesia doleriformis* (Herrich-Schäffer, 1846); Adriatic-Mediterranean
41. *Chamaesphesia dumonti* (Le Cerf, 1922); E Mediterranean-Caspian
42. *Chamaesphesia annellata* (Zeller, 1847); E Mediterranean
43. *Chamaesphesia masariformis* (Ochsenheimer, 1808); E Mediterranean-Asiatic
44. *Chamaesphesia bibioniformis* (Esper, 1800); W Palearctic
45. *Chamaesphesia nigrifrons* (Le Cerf, 1911); European ?
46. *Chamaesphesia palustris* (Kautz, 1927); W. Palearctic
47. *Chamaesphesia euceraeformis* (Ochsenheimer, 1816); W Palearctic
48. *Chamaesphesia leucopsiformis* (Esper, 1800); European
49. *Chamaesphesia hungarica* (Tomala, 1901); European
50. *Chamaesphesia empiformis* (Esper, 1783); European
51. *Chamaesphesia tenthrediniformis* ([Denis & Schiffermüller], 1775); European
52. *Chamaesphesia astatiformis* (Herrich-Schäffer, 1846); Caspian-Asiatic

A comparison of the check from LAŠTUVKA & LAŠTUVKA (1995) with our data shows difference in six species not yet recorded for Croatian Sesiid fauna:

- Sesia melanocephala* (Dalman, 1816),
- Synanthedon flaviventris* (Staudinger, 1883),
- Synansphecchia muscaeformis* (Esper, 1783),
- Chamaesphecchia alysoniformis* (Herrich-Schäffer, 1846),
- Chamaesphecchia chalciformis* (Esper, 1804) and
- Chamaesphecchia hungarica* (Tomala, 1901).

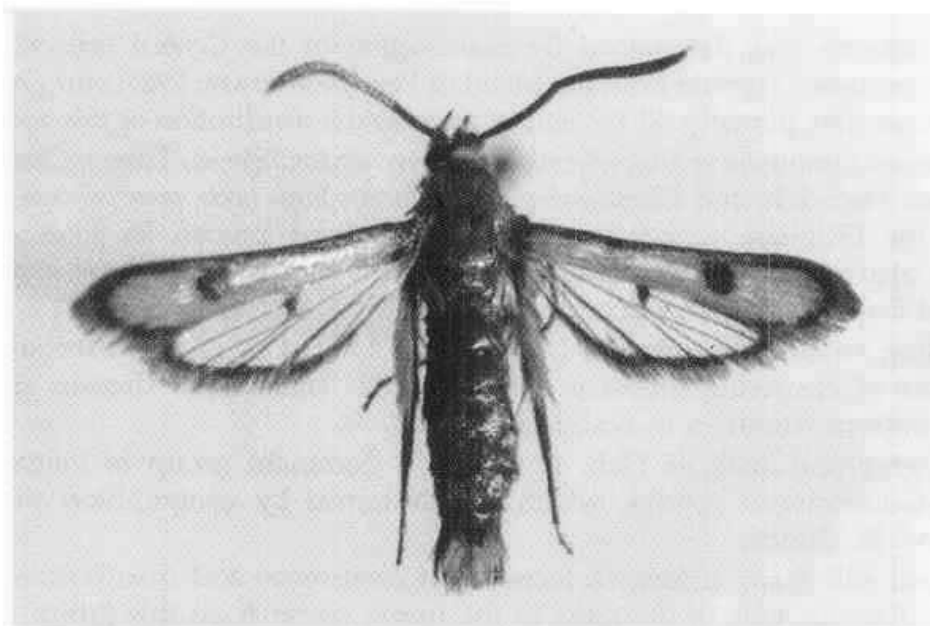


**Fig. 1.** Map of Croatia with localities (1–Kamenica; 2–Ravna Gora; 3–Varaždin; 4–Delekovec; 5–Botovo; 6–Gabajeva Greda; 7–Repaš; 8–Trnovec; 9–Zagreb; 10–Boljara; 11–Spačva; 12–Opeke; 13–Novska; 14–Peščenica; 15–Petrinja; 16–Bosiljevo; 17–Rijeka; 18–Bakar; 19–Babrovača; 20–Caska; 21–Dubrave; 22–Vozilići) and distribution of *Chamaesphecchia chalciformis* Esp., *Chamaesphecchia hungarica* Tom. and *Synansphecchia muscaeformis* Esp.

According to KOVAČEVIĆ & FRANJEVIĆ-OŠTRC (1978) *Sesia melanocephala* is found in Boljara (eastern Croatia) and Petrinja (central Croatia). Same authors recorded *Synanthedon flaviventris* in Opeke (Slavonija region – central Croatia near town Novska, Fig. 1.), Spačva (Slavonija region – eastern Croatia) and Repaš forest basins (Podravina region) (Fig. 1). This findings were not confirmed in our research because of the missing and partly destroyed collections, though distribution areas do not exclude these species for Croatian territory (KOVAČEVIĆ & FRANJEVIĆ-OŠTRC, 1978; LAŠTUVKA & LAŠTUVKA, 1995). Future field research and actual specimen collection should confirm these findings.

KRANJČEV (1985) brings data on *Chamaesphecia alysoniformis* from Repaš, Gabajeva greda and Botovo (Podravina region – NW Croatia) (Fig. 1). He also recorded *C. hungarica* in Đelekovec area (Podravina region). All finding sites for both of the species are located in Podravina. *C. hungarica* was found in Košćec collection, too (collected in the vicinity of Varaždin) (Tab. 1., Fig. 1). Findings of *C. alysoniformis* are especially interesting as they broaden its distribution area more to the west (LAŠTUVKA & LAŠTUVKA, 1995). Preserved specimens are kept in the Kranjčev collection (the Municipal Museum of Koprivnica). Though we did not check these specimens, their taxonomical evaluation from well experienced researcher is not questionable. We consider them as true members of Croatian Sesiid fauna.

*C. chalciformis* (Fig. 2) was recorded in our field researches in Vozilići (Istria) and Babrovača (Velebit Mt) (Fig. 1). At the end of 19<sup>th</sup> century, ABAFI-AINGER et al. (1896) recorded the species for Bakar and Rijeka (Kvarner region) (Fig. 1). Our findings fill up the gap in the distribution (LAŠTUVKA & LAŠTUVKA, 1995) of this species.



**Fig. 2.** *Chamaesphecia chalciformis* – Vozilići 10.VII.1976. (leg. F. Perović)  
(coll. Vozilići, CNHM) (photo B. Hrašovec)

**Table 3.** Number of species registered in fauna of Europe and some in European countries (CARNELUTTI, 1992; LAŠTUVKA & LAŠTUVKA, 1995; LAŠTUVKA & ŠPATENKA, 1996).

A R E A S	1	2	A R E A S	1	2
EUROPE	111	100 %	Germany	34	30,6 %
Croatia	52	46,8 %	Greece	50	45,0 %
Slovenia	23	20,7 %	Spain	51	45,9 %
Italy	55	49,5 %	France	52	49,5 %
Austria	48	43,2 %	Sweden	16	14,4 %
Hungary	41	36,9 %	Great Britain	15	13,5 %

1 – number of species                      2 – per-cent (%) in European fauna

**Table 4.** Zoogeographical characteristics of Sesiid fauna in Croatia.

Zoogeographical characteristics	1	2	Zoogeographical characteristics	1	2
Palaearctic species	1	1,9 %	E Mediterranean-Asiatic species	2	3,8 %
W Palaearctic species	17	32,7 %	E Mediterranean-Caspian species	1	1,9 %
Holarctic species	2	3,8 %	Caspian-Asiatic species	1	1,9 %
Eurasiatic species	5	9,7 %	E Mediterranean species	5	9,7 %
European species	8	15,5 %	W Mediterranean species	1	1,9 %
Holomediterranean species	3	5,8 %	Adriatic-Mediterranean species	2	3,8 %
Atlantic-Mediterranean species	2	3,8 %	Balkan species	1	1,9 %
			Balkan-Anatolia species	1	1,9 %

1 – number of species registered in Croatia, 2 – percent (%) in fauna of Croatia

*S. muscaeformis* was determined by examination of the Central collection at the CNHM. Specimens originate from the island of Pag (MLADINOV, 1965) and Zagreb area (Fig. 1). These data partially fill the empty areas in the distribution of this species, too.

The species *Synansphecchia muscaeformis* Esp. (syn. *phylanthiformis* Lasp.), *Chamaesphecchia alysoniformis* Herr.-Sch. and *Chamaesphecchia chalciformis* Esp. (syn. *prosopiformis* O.) were recorded for Dalmatia region (MANN, 1869) without precise localities. STAUDER (1932/33) also recorded *Synansphecchia muscaeformis* and *Chamaesphecchia alysoniformis* for central Dalmatia without precise localities.

According to our research and LAŠTUVKA & LAŠTUVKA' (1995) distribution lists, the number of clearwing moths in Croatia is 52. This makes Croatia one of the richest European countries in Sesiid fauna (Tab. 3).

Zoogeographical analysis (Tab. 4) reveals a dominant group of Palaearctic and various Mediterranean species, which is determined by geographical position of Croatia and its climate.

There are still many unknown facts about occurrence and distribution of some Sesiids in Croatia. One of the tasks in the future research on this group would be to clear the gaps in our knowledge about their spatial distribution in this region of the world.

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## SAŽETAK

### Prilog poznavanju staklokrilki (Insecta, Lepidoptera, Sesiidae) u Hrvatskoj

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Analizom ilustriranog ključa staklokrilki (Sesiidae) Europe autora LAŠTUVKA & LAŠTUVKA (1995) ustanovili smo da je u tablici koja prikazuje rasprostranjenost vrsta u pojedinim europskim državama prikazana i fauna Hrvatske. U tom prikazu nedostaje šest vrsta koje su u našoj fauni registrirane, bilo kao literaturni podaci ili kao primjerci pohranjeni u našim entomološkim zbirnama (Hrvatski prirodoslovni muzej Zagreb; Entomološki odjel Gradskog muzeja u Varaždinu): *Sesia melanocephala* (Dalman, 1816), *Synanthedon flaviventris* (Staudinger, 1883), *Synansphecchia muscaeformis* (Esper, 1783), *Chamaesphecchia alysoniformis* (Herrich-Schäffer, 1846), *C. chalciformis* (Esper, 1804) i *C. hungarica* (Tomala, 1901). Vrste *Sesia melanocephala* Dal. i *Synanthedon flaviventris* Staud. nisu utvrđene pregledom zbirke profesora Kovačevića, nego se njihova prisutnost u našoj fauni temelji samo na literaturnim podacima (KOVAČEVIĆ & FRANJEVIĆ-OŠTRC, 1978), tako da će ih se u idućim istraživanjima morati potvrditi i ulovom primjeraka.

Izvršena je nadopuna postojećeg popisa (LAŠTUVKA & ŠPATENKA, 1996) vrsta zabilježenih u fauni Hrvatske, koja sada broji 52 vrste (46,8 % europske faune). Osim toga iznesena je i zoogeografska analiza.