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Distribution of the species *Heptatoma pellucens* (Fabricius, 1776) (Diptera: Tabanidae) in Croatia

Rasprostranjenost vrste *Heptatoma pellucens* (Fabricius, 1776) (Diptera: Tabanidae) u Hrvatskoj

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Abstract

The genus *Heptatoma* contains only one species, *Hepatoma pellucens*, distributed almost throughout the whole Palaearctic region. Without the author's and collaborator's (J. Mikuska) previous and current research, this species had been recorded in six localities in Croatia. The author's previous unpublished data recorded the species in localities of Donja Bistra, Popovac, Šenkovec, Vinica and Duzluk. The findings of this species in the localities of Branjina, Karanac, Kotlina, on Bansko Hill in the Croatian part of Baranja during this year represent new locality records alongside unpublished ones. The total number of recorded localities where *Heptatoma pellucens* appears in Croatia has increased to 40. From all collected specimens from previous and current research (242), 29.34% (71) of specimens of this species in Croatia were collected during 2022. In the sample collected in 2022, 97.18% of specimens were collected by liquid oil trap (shiny black trays filled with transparent vegetable oil). The sex ratio of the collected specimens in 2022 showed there were 1.7 times more males than females, unlike in previous research where only one male specimen was recorded.

Keywords: Europe, fauna, horseflies, new locality records, liquid oil trap

Sažetak

Rod *Heptatoma* sadrži samo jednu vrstu, *Hepatoma pellucens*, rasprostranjenu gotovo na čitavom području Palearktika. Bez autorovih i suradnikovih (J. Mikuska) ranijih i sadašnjih istraživanja ova vrsta bila je zabilježena na šest lokaliteta u Hrvatskoj. U autorovim ranijim neobjavljenim podacima ova vrsta zabilježena je na lokalitetima Donja Bistra, Popovac, Šenkovec, Vinica i Duzluk. Nalazi ove vrste na lokalitetima Branjina, Karanac, Kotlina na Banskom brdu u hrvatskom dijelu Baranje tijekom ove godine predstavljaju s neobjavljenim podacima nove nalaze. Ukupan broj zabilježenih lokaliteta na kojima se vrsta *Heptatoma pellucens* pojavljuje u Hrvatskoj je 40. Od svih uzorkovanih jedinki iz ranijih i sadašnjih istraživanja (242), 29.34% (71) jedinka uzorkovana je tijekom 2022. godine. U ovom uzorku skupljenom 2022. godine 97.18% jedinki uzorkovano je uljnom tekućom klopkom (sjajna crna vrećica u obliku posude prelivena biljnim uljem). U skupljenom uzorku 2022. godine uzorkovano je 1.7 puta više mužjaka nego ženki, za razliku od ranijih istraživanja u kojima je samo jedan mužjak bio uzorkovan.

Ključne riječi: Europa, fauna, obadi, novi nalazi, tekuća uljna klopka

Introduction - *Uvod*

Published data on the distribution of horseflies in Croatia are scarce, because only data on distributions of genera with lesser numbers of species were published so far (Krčmar et al. 2008, 2010). Female horseflies are potential vectors of different pathogens such as bacteria, viruses and protozoa (Foil 1989). Therefore, faunistical and ecological research on horseflies is important from the point of view of medical and veterinarian entomology. In Croatia, data on the distribution of horseflies have been published so far only for species from the genera *Atylotus*, *Chrysops*, *Therioplectes*, *Dasyrhamphis*, and *Philipomyia* (Krčmar et al. 2008, 2010). The genus *Heptatoma* Meigen, 1803 is monotypic. The single known species is *Heptatoma pellucens* (Fabricius, 1776) and it is known widely throughout the Palaearctic region including the extreme north (Chvála et al. 1972). This species inhabits various types of biotopes, and it never occurs in large numbers (Chvála et al. 1972). The first data on the presence of *Heptatoma pellucens* in Croatia was recorded by Langhoffer (1918). The next records were published by Moucha (1965), Leclercq (1976), and Majer (1985) (Table 1). After that, there was no information about this species until the beginning of the nineties of the last century, when numerous samplings of horseflies throughout Croatia began (Krčmar and Mikuska 2001; Krčmar et al. 2006; Krčmar et al. 2008) (Table 1). After those, no further information on the distribution of this species was recorded. Some of the potential reasons for the rather small number of records of this species in Croatia are most likely in its morphological similarities to honeybees. Due to these similarities, it might have been unnoticed in various entomological studies (Brauer 1880; Strobl 1898, 1900, 1902; Coe 1958, 1960; Leclerq 1960, 1965, 1968; Moucha 1959; Danielova 1961). As it can be considered a rare species, and it does not appear anywhere in large numbers. The aim of this article is to present an updated distribution of this species in Croatia.

Materials and Methods - *Materijali i metode*

In this article, all the available data from the literature were used, as well as published and unpublished data from earlier studies of horseflies fauna throughout Croatia from 1992 to 2017. Unpublished data obtained from recent studies of horseflies fauna on Bansko Hill in the Croatian part of Baranja as well as data in press on Mura river in Međimurje were also included. In both studied areas, horseflies were sampled from May to September 2022 using liquid oil traps, which were made from a shiny black plastic tray (60 cm x 40 cm long) filled with transparent yellow sunflower oil at depth of 0.5 to 1 cm. Black and white linen canopy traps were constructed according to Hribar et al. (1991). A sticky trap (12-L black plastic buckets) was used only in the area of Međimurje. The outside surface of the black bucket was covered with a thin layer of horsefly glue. In both study areas, canopy traps were baited with 1-octen-3-ol as an attractant. Identifications were carried out using the standard keys for Tabanidae (Chvála et al. 1972; Krčmar et al. 2011), while the nomenclature follows the Catalogue of Palaearctic Diptera (Chvála 1988). For each record, the following information is provided: name of localities, sampling date, exact geographical coordinates of localities, UTM grid 10x10km, number of collected specimens, sex, and data source.

Results and Discussion - *Rezultati i rasprava*

Distribution - *Rasprostranjenost*

According to literature data, this species had been recorded in six localities in Croatia. The aAuthor's previous unpublished data recorded the species in localities of Donja Bistra, Popovac, Šenkovec, Vinica and Duzluk. The findings of this species in the localities of Branjina, Karanac, Kotlina on Bansko Hill in the Croatian part of Baranja during this year represent new locality records alongside unpublished ones. The total number of recorded localities where *Heptatoma pellucens* appears in Croatia has increased to 40 (Table 1, Figure 1). Only two locality records were found in the Mediterranean part of Croatia (Langhoffer 1918; Moucha 1965; Leclercq 1976), while 38 recorded localities belonged to the Alpine and Continental parts of the country. The flight period of this species is very long, ranging from May to the beginning of September, or even until the end of September (Chvála et al. 1972). In Croatia, the earliest date of collection of this species was recorded on May 8, and the latest on September 25. Altogether, 242 specimens of *Heptatoma pellucens* were collected in Croatia (Table 1) from which six belong to literature data and the rest (236) belong to published and unpublished data of the author and his collaborator (J. Mikuska). During 2022, in the Croatian part of Baranja 66 specimens (23♀, 43♂) of *Heptatoma pellucens* were recorded, while only 5 specimens (3♀, 2♂) were recorded in Međimurje.In 2022, a total of 71 horsefly specimens were collected, of which 45♂ and 24♀ were collected with liquid oil traps in the localities of Branjina, Karanac, Kotlina, Novakovec, Popovac, and Sveta Marija, while only 2♀ were collected with a canopy trap baited with the attractant 1-octen-3- ol in Križovec and Popovac localities. In the Croatian part of Baranja and Međimurje the species *Heptatoma pellucens* was mainly collected in localities close to water surfaces. Although it inhabits different types of habitats (white willow and black poplar forests alongside river areas, lakes, and ponds, common oak forests, birch forests, wet habitats with reeds, degraded mixed forests), it does not appear anywhere in large numbers. In white willow and black poplar forests alongside rivers of Karašica and Drava (in eight different localities) 55 specimens were collected, alongside lakes and ponds (in seven different localities) 18 were collected, in common oak forests (in 11 different localities) 100 were collected, in birch forests (on six different localities) eight were collected in wet habitats with reeds (on one locality) 54 specimens were collected and in degraded mixed forests (on one locality) one specimen was collected. Collected specimens of *Heptatoma pellucens* in 2022 represent 29.34% of all collected specimens of this species in Croatia. During this century, *Heptatoma pellucens* was recorded for the first time in the territory of neighbouring Serbia (Krčmar 2011) and Bosnia and Herzegovina (Mikuska et al. 2008). Due to its appearance and great similarity to honey bees, it most likely remained undetected in earlier studies in these countries, which leaves opportunities for more research and new entomologists to work with this interesting insect.

Traps - *Lovke*

Specimens collected by liquid oil traps (69) make up 28.51% from all of the collected specimens of this species in Croatia so far. During studies done in 2022, 1.7 times more males than females were trapped, while in previous studies only one male specimen of *Heptatoma pellucens* was recorded (Krčmar and Mikuska 2001). In previous studies, mainly female specimens were collected which were mostly attracted to olfactory cues the traps provided with different attractants (Krčmar and Mikuska 2001), unlike males which were mostly attracted to horizontally polarized light (Horváth et al. 2008). A similar ratio of males to females (1.8) was observed in the species *Tabanus shannonellus* in a study con-

ducted on the island of Badija in the Korčula archipelago when a liquid oil trap was first used for sampling of horseflies in Croatia (Krčmar 2013). The enhanced effectiveness of liquid oil traps in collecting male and female specimens of *Heptatoma pellucens* could be explained by their positive polarotaxis. Recently, Horváth et al. (2008) found that many horsefly species prefer horizontally polarizing black oil surfaces. This was however not known for *Heptatoma pellucens* prior to this study (Horváth et al. 2008). Furthermore, Egri et al. (2012) proved that shiny black oil traps are very successful in collecting both sexes of water-seeking horseflies. Females and males are attracted to horizontally polarized light, if such light stimulates the ventral side of their compound eyes (Száz et al. 2022).

Table 1 Historical and new records of *Heptatoma pellucens* in Croatia
Tablica 1. Povijesni i novi nalazi vrste *Heptatoma pellucens* u Hrvatskoj.

Locality *Lokalitet*	Date of samplings *Datum uzorkovanja*	Coordinates *Koordinate*	UTM *UTM*	Number of collected specimens and sex *Broj ulovljenih primjeraka i spol*	Data Source *Izvor podataka*
Zagreb	17.05.1890.	45° 56' 39'' N 15° 39' 44'' E	WL 77	1♀	Langhoffer 1918; Moucha 1965; Majer 1985
Krapina	-	46° 09' 38'' N 15° 52' 21'' E	WM 61	-	Baranov 1945
Orehovica	26.06.1926.	45° 20' 03'' N 14° 27' 19'' E	VL 51	1♀	Langhoffer 1918; Moucha 1965
Livade	14.08.1975.	45° 21' 46'' N 13° 48' 46'' E	VL 02	2♀	Leclercq 1976
Trnovec	21.07.1982.	46° 17' 35'' N 16° 23' 49'' E	WM 61	1♀	Majer 1985
Draganić	2.05.2021.	45° 36' 07'' N 15° 35' 55'' E	WL 44	1♀	https://www.inaturalist.org/taxa/547151-Heptatoma-pellucens
Josipovac	18.07.1992.	45° 34' 55'' N 18° 35' 01'' E	CR 15	3♀	Krčmar and Mikuska 2001
Josipovac	19.07.1992.	45° 34' 55'' N 18° 35' 01'' E	CR 15	1♀	Krčmar and Mikuska 2001
Josipovac	20.07.1992.	45° 34' 55'' N 18° 35' 01'' E	CR 15	1♀	Krčmar and Mikuska 2001
Josipovac	23.07.1992.	45° 34' 55'' N 18° 35' 01'' E	CR 15	2♀	Krčmar and Mikuska 2001
Josipovac	25.07.1992.	45° 34' 55'' N 18° 35' 01'' E	CR 15	5♀	Krčmar and Mikuska 2001
Josipovac	1.08.1992.	45° 34' 55'' N 18° 35' 01'' E	CR 15	1♀	Krčmar and Mikuska 2001
Petrijevci	8.07.1993.	45° 36' 51'' N 18° 32' 12'' E	CR 05	3♀	Krčmar and Mikuska 2001
Petrijevci	9.07.1993.	45° 36' 51'' N 18° 32' 12'' E	CR 05	5♀	Krčmar and Mikuska 2001
Petrijevci	10.07.1993.	45° 36' 51'' N 18° 32' 12'' E	CR 05	3♀	Krčmar and Mikuska 2001
Petrijevci	25.07.1993.	45° 36' 51'' N 18° 32' 12'' E	CR 05	1♀	Krčmar and Mikuska 2001
Petrijevci	9.09.1993.	45° 36' 51'' N 18° 32' 12'' E	CR 05	3♀	Krčmar and Mikuska 2001
Osijek	21.09.1993.	45° 33' 18'' N 18° 41' 44'' E	CR 24	1♀	Krčmar and Mikuska 2001
Petrijevci	25.09.1993.	45° 36' 51'' N 18° 32' 12'' E	CR 05	1♀	Krčmar and Mikuska 2001
Petrijevci	18.05.1994.	45° 36' 51'' N 18° 32' 12'' E	CR 05	1♀	Krčmar and Mikuska 2001

Sunger	1.06.1994.	45° 21' 39'' N 14° 44' 15'' E	VL 81	1♀	Krčmar et al. 2008
Petrijevci	18.06.1994.	45° 36' 51'' N 18° 32' 12'' E	CR 05	2♀	Krčmar and Mikuska 2001
Petrijevci	16.07.1994.	45° 36' 51'' N 18° 32' 12'' E	CR 05	7♀	Krčmar and Mikuska 2001
Petrijevci	23.07.1994.	45° 36' 51'' N 18° 32' 12'' E	CR 05	1♀	Krčmar and Mikuska 2001
Borovik	5.08.1994.	45° 23' 02'' N 18° 11' 55'' E	BR 72	1♂	Krčmar and Mikuska 2001
Donja Bistra	31.08.1994.	45° 54' 35'' N 15° 49' 25'' E	WL 68	1♀	Krčmar collection
Bokšić Lug	2.07.1994.	45° 37' 11'' N 18° 03' 40'' E	YL 35	1♀	Krčmar and Mikuska 2001
Petrijevci	26.05.1995.	45° 36' 51'' N 18° 32' 12'' E	CR 05	3♀	Krčmar and Mikuska 2001
Petrijevci	2.07.1995.	45° 36' 51'' N 18° 32' 12'' E	CR 05	5♀	Krčmar and Mikuska 2001
Borovik	3.07.1995.	45° 23' 02'' N 18° 11' 55'' E	BR 72	1♀	Krčmar and Mikuska 2001
Šenkovec	9.07.1995.	46° 24' 08'' N 16° 24' 57'' E	XM 04	1♀	Krčmar collection
Musić	23.08.1995.	45° 18' 44'' N 18° 06' 15'' E	BR 72	1♀	Krčmar and Mikuska 2001
Normanci	8.05.1996.	45° 33' 21'' N 18° 21' 44'' E	BR 94	1♀	Krčmar and Mikuska 2001
Normanci	11.05.1996.	45° 33' 21'' N 18° 21' 44'' E	BR 94	10♀	Krčmar and Mikuska 2001
Zoljan	21.05.1996.	45° 28' 34'' N 18° 03' 39'' E	BR 63	1♀	Krčmar and Mikuska 2001
Vinica	31.05.1996.	46° 20' 22'' N 16° 09' 14'' E	WM 93	2♀	Krčmar collection
Babina Greda	21.06.1996.	45° 06' 54'' N 18° 33' 07'' E	CQ 09	1♀	Krčmar and Mikuska 2001
Lokve	29.06.1996.	45° 21' 30'' N 14° 45' 03'' E	VL 82	1♀	Krčmar et al. 2008
Spačva	4.07.1996.	45° 10' 06'' N 18° 51' 06'' E	CQ 39	1♀	Krčmar and Mikuska 2001
Babina Greda	5.07.1996.	45° 06' 54'' N 18° 33' 07'' E	CQ 09	1♀	Krčmar and Mikuska 2001
Normanci	6.05.1997.	45° 33' 21'' N 18° 21' 44'' E	BR 94	11♀	Krčmar and Mikuska 2001
Normanci	10.05.1997.	45° 33' 21'' N 18° 21' 44'' E	BR 94	11♀	Krčmar and Mikuska 2001
Koška	10.05.1997.	45° 32' 44'' N 18° 16' 59'' E	BR 84	4♀	Krčmar and Mikuska 2001
Zoljan	10.05.1997.	45° 28' 34'' N 18° 03' 39'' E	BR 63	6♀	Krčmar and Mikuska 2001
Borovik	12.05.1997.	45° 23' 02'' N 18° 11' 55'' E	BR 72	1♀	Krčmar and Mikuska 2001
Kutjevo	17.05.1997.	45° 25' 33'' N 17° 53' 00'' E	YL 23	14♀	Krčmar and Mikuska 2001
Pušine	17.05.1997.	45° 35' 50'' N 17° 41' 09'' E	YL 14	13♀	Krčmar and Mikuska 2001
Koška	17.05.1997.	45° 32' 44'' N 18° 16' 59'' E	BR 84	11♀	Krčmar and Mikuska 2001
Vrpolje	20.05.1997.	45° 12' 37'' N 18° 24' 19'' E	BR 90	2♀	Krčmar and Mikuska 2001
Babina Greda	20.05.1997.	45° 06' 54'' N 18° 33' 07'' E	CQ 09	4♀	Krčmar and Mikuska 2001

Lacići	7.06.1997.	45° 38' 11'' N 18° 13' 02'' E	BR 85	4♀	Krčmar and Mikuska 2001
Bukovac Sungerski	27.07.1997.	45° 20' 37'' N 14° 46' 42'' E	VL 81	2♀	Krčmar et al. 2008
Sakadaš, Kopački rit	28.07.1999.	45° 36' 30'' N 18° 47' 58'' E	CR 25	1♀	Krčmar and Mikuska 2001
Matić Poljana	21.06.2000.	45° 17' 12'' N 14° 53' 45'' E	VL 81	1♀	Krčmar et al. 2008
Legrad	28.07.2005.	46° 17' 45'' N 16° 51' 19'' E	XM 42	1♀	Krčmar et al. 2006
Ferdinandovac	20.08.2005.	46° 03' 37'' N 17° 11' 25'' E	XM 70	1♀	Krčmar et al. 2006
Zmajevac	2.05.2010.	45° 48' 03'' N 18° 48' 29'' E	CR 37	1♀	Krčmar collection
Popovac	20.08.2010.	45° 48' 22'' N 18° 39' 34'' E	CR 17	1♀	Krčmar collection
Zmajevac	29.05.2016.	45° 48' 03'' N 18° 48' 29'' E	CR 37	1♀	Krčmar et al. 2022
Duzluk	4.07.2017.	45° 30' 55'' N 17° 51' 53'' E	YL 24	1♀	Krčmar collection
Popovac	27.05.2022.	45° 48' 22'' N 18° 39' 34'' E	CR 17	1♀	Krčmar collection
Branjina	18.06.2022.	45° 49' 22'' N 18° 41' 35'' E	CR 17	3♂	Krčmar collection
Popovac	18.06.2022.	45° 48' 22'' N 18° 39' 34'' E	CR 17	1♂	Krčmar collection
Popovac	24.06.2022.	45° 48' 22'' N 18° 39' 34'' E	CR 17	12♂, 2♀	Krčmar collection
Popovac	26.06.2022.	45° 48' 22'' N 18° 39' 34'' E	CR 17	19♂, 3♀	Krčmar collection
Kotlina	29.06.2022.	45° 47' 17'' N 18° 44' 16'' E	CR 27	2♀	Krčmar collection
Branjina	14.07.2022.	45° 49' 22'' N 18° 41' 35'' E	CR 17	1♀	Krčmar collection
Popovac	14.07.2022.	45° 48' 22'' N 18° 39' 34'' E	CR 17	3♀	Krčmar collection
Branjina	17.07.2022.	45° 49' 22'' N 18° 41' 35'' E	CR 17	1♂, 1♀	Krčmar collection
Branjina	21.07.2022	45° 49' 22'' N 18° 41' 35'' E	CR 17	1♂, 1♀	Krčmar collection
Popovac	21.07.2022	45° 48' 22'' N 18° 39' 34'' E	CR 17	1♀	Krčmar collection
Popovac	8.08.2022	45° 48' 22'' N 18° 39' 34'' E	CR 17	1♂, 1♀	Krčmar collection
Branjina	13.08.2022	45° 49' 22'' N 18° 41' 35'' E	CR 17	1♂	Krčmar collection
Popovac	13.08.2022	45° 48' 22'' N 18° 39' 34'' E	CR 17	2♂, 1♀	Krčmar collection
Novakovec	18.08.2022	46° 27' 19'' N 16° 34' 08'' E	XM 14	2♂, 1♀	In press
Sveta Marija	18.08.2022	46° 19' 54'' N 16° 44' 37'' E	XM 33	1♀	In press
Karanac	31.08.2022	45° 45' 37'' N 18° 41' 09'' E	CR 27	1♀	Krčmar collection
Popovac	31.08.2022	45° 48' 22'' N 18° 39' 34'' E	CR 17	2♂, 4♀	Krčmar collection
Branjina	10.09.2022	45° 49' 22'' N 18° 41' 35'' E	CR 17	1♀	Krčmar collection
Križovec	13.09.2022	46° 30' 00'' N 16° 29' 02'' E	XM 15	1♀	In press

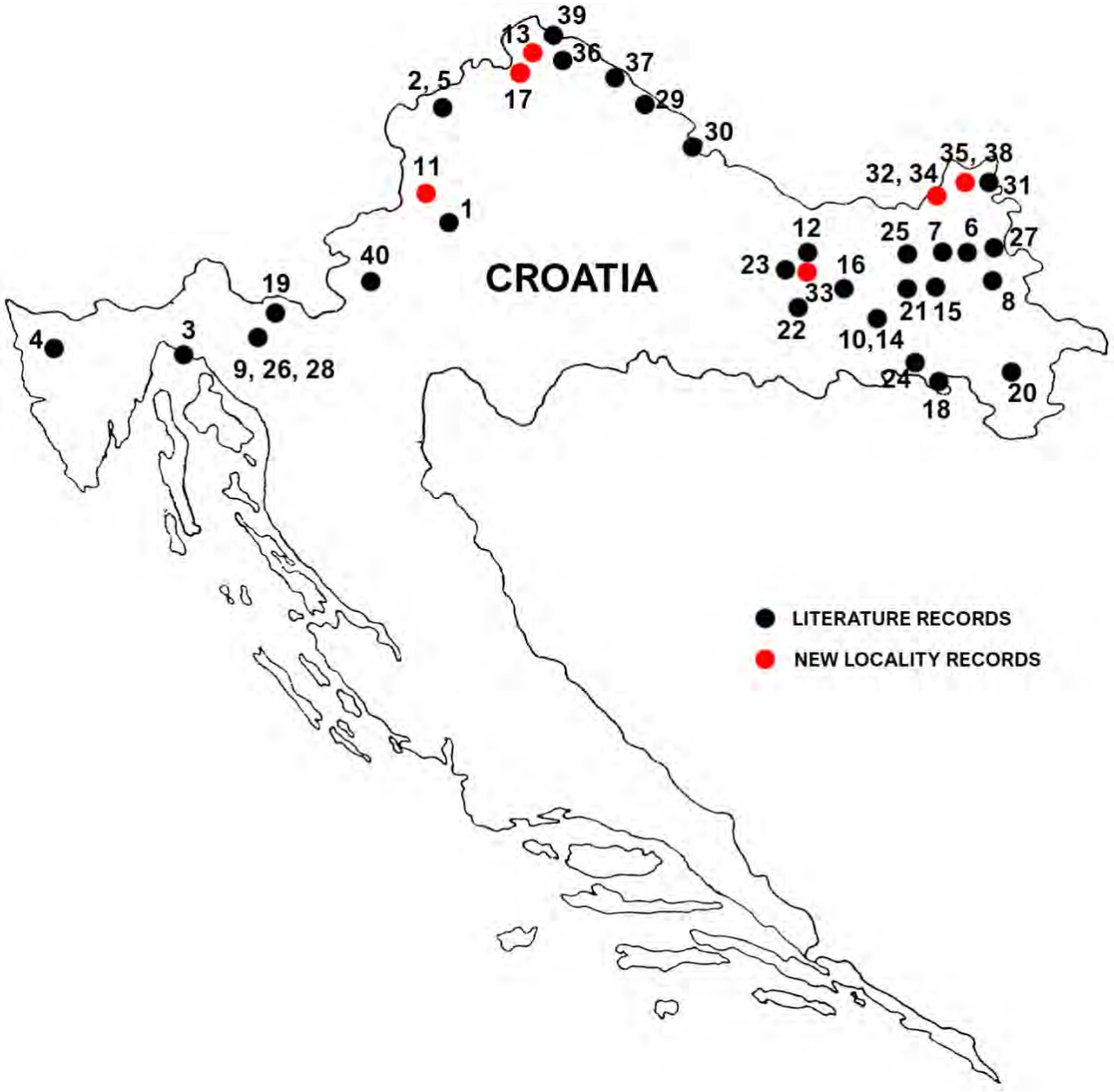

Figure 1 The distribution of *Heptatoma pellucens* in Croatia.

Slika 1. Rasprostranjenost vrste *Heptatoma pellucens* u Hrvatskoj.

Legend: List of localities: 1 Zagreb, 2 Krapina, 3 Orehovica, 4 Livade, 5 Trnovec, 6 Josipovac, 7 Petrijevci, 8 Osijek, 9 Sunger, 10 Borovik, 11 Donja Bistra, 12 Bokšić Lug, 13 Šenkovec, 14 Musić, 15 Normanci, 16 Zoljan, 17 Vinica, 18 Babina Greda, 19 Lokve, 20 Spačva, 21 Koška, 22 Kutjevo, 23 Pušine, 24 Vrpolje, 25 Lacići, 26 Bukovac Sungerski, 27 Sakadaš-Kopački rit, 28 Matić poljana, 29 Legrad, 30 Ferdinandovac, 31 Zmajevac, 32 Popovac, 33 Duzluk, 34 Branjina, 35 Kotlina, 36 Novakovec, 37 Sveta Marija, 38 Karanac, 39 Križovec, 40 Draganić.

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