GOOGLE STREET VIEW AS A TOOL FOR FAUNISTIC RESEARCH: CASE OF *BRIGITTEA CIVICA* AND ITS OCCURRENCE IN MORAVIA AND SILESIA (CZECH REPUBLIC)

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Abstract: This study focuses on mapping the occurrence of the *Brigittea civica* spider (Lucas 1850) in Moravia and Silesia using Google Street View. With this spider we can meet exclusively on the walls of human dwellings within the Czech Republic, where it creates characteristic circular webs, allowing it to be monitored using a computer with internet connection. The method of observation using Google Street View has not yet been applied to any species of spider. In this case, therefore, this is the first published study, where the presence of a particular spider species was monitored through this application. In total, the observations were done in 128 of faunistic squares. The presence of *B. civica* was recorded in 47 faunistic squares in total, with 45 new cases in the given square, and in two cases an earlier finding was confirmed. Based on the findings, we can say that *B. civica* is much wider in our country than we thought.

Key Words: Brigittea civica, species expansion, Google Street View, Araneae, synantropic species

INTRODUCTION

It is relatively difficult to assign most of spiders to certain species in the wild but also in the urban environment from a distance. However, *B. civica* is one of the few exceptions. This spider is exclusively synanthropic in central Europe (Billaudelle 1957). *B. civica* is easily recognizable according to a typical circular webs on the walls of buildings (Samu et al. 2002). A very common phenomenon is ten or even more spiders per $1m^2$. The whole cobweb colonies are also not the exception (Krumpálová 2001). The effect on the size of the cobweb has, in particular, the surface of the wall. On smooth walls, the cobweb size is usually larger and can range up to 100 cm^2 in some cases (Billaudelle 1957). The size of the cobwebs is usually about 5 cm (Kostanjšek and Celestina 2008). The spider itself then reaches a size of 2.5–3 mm in males, females are slightly larger with 3–3.5 mm (Kostanjšek and Celestina 2008). Besides the size, there is another important determining feature of a gray ass with a black drawing (Billaudelle 1957).

So far, all published findings from human dwelling environments have been made only by direct on-site observations, for example (Van Keer et al. 2010, Marusik et al. 2011, Dandria et al. 2005, Havlová 2008). There has not yet been published a single article dealing with mapping this spider using Google Street View, although in this case, thanks to the unmistakable shape and density of cobwebs, it is directly available. Google Street View is one of the geographic information services that can be used to explore the places that we are currently interested in. The advantage of this system is that the images in this application are equipped with precise geographic coordinates and they are digitally interconnected with each other and with a map base. Then you just need choose the place you want to see on the map that is linked to Google Street View. If it is scanned, a tour is displayed. This is the same as when we take a closer look on the map (Tomíšek 2012). However, this application is not entirely unknown in biological mapping. For example, Olea and Mateo-Tomás (2013) using Google Street View mapped the habitats of two cliff-nesting vultures (the griffon vulture and the globally endangered Egyptian vulture)

in northwestern Spain. With help of this application, Deus et al. (2015) studied the spread of invasive plants in Portugal where similar mapping is carried out by car.

MATERIAL AND METHODS

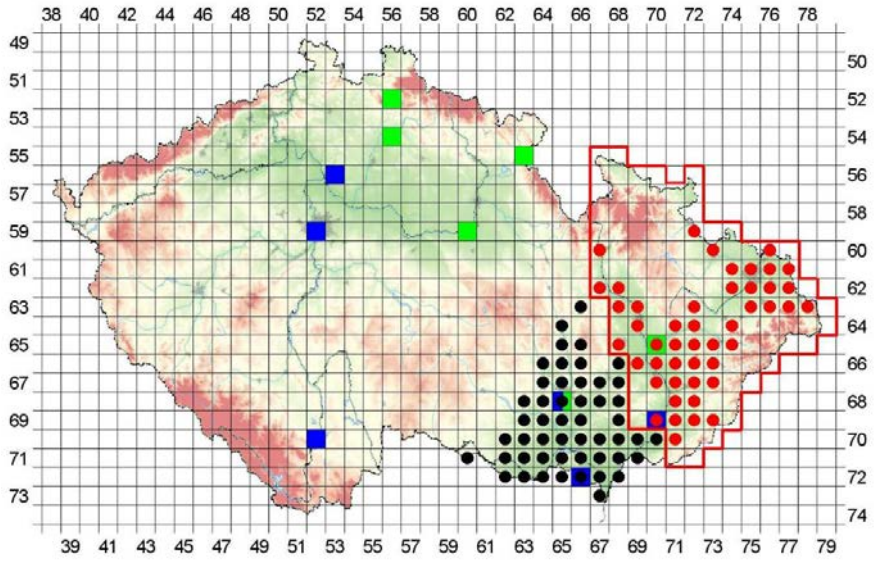
The area of southeastern, central, eastern and northern Moravia as well as Silesia were chosen as a model territory for mapping the occurrence of *B. civica* in our territory using Google Street View.

Research was done on the computer monitor using Google Street View, where you can view panoramic views taken from a height of approximately 2.5 meters every 10 meters of the track (Google 2017). The observation itself took place for 20 days, from 10 July 2017 to 30 July 2017. In order to comply with the uniform methodology, the cobwebs were always observed in the same and unchanging way. Firstly, a faunistic square had been selected, and then all the permanently inhabited villages and towns located in the square were reviewed in this application. The observation was always begun at the center of the settlement, and all the available scattered streets were traversed all the way to the end of these settlements. Observations were made on both sides of the street, left and right at the same time. *B. civica* is easily recognizable according to a typical circular webs on the walls of buildings We did not record the real presence of spider individuals. We assume that the presence of its web means the presence of the species. The detected data was recorded in a pre-prepared form. Drawings of occurrences into particular faunistic squares on maps were done according to Pruner and Mika (1996). For the creation of the map, we used the free applications of BioLib (2017).

RESULTS

A total of 128 faunistic squares were examined using Google Street View. Before this study, *B. civica* was found only in two faunistic squares in this area of interest (Czech Arachnological Society 2017). By observation, the presence of the cobwebs was newly found in another 45 faunistic squares of the area of interest, and in two other faunistic squares the incidence from previous years was confirmed. In total, this spider was newly found in 45 housing units. The survey data were plotted on map.

Figure 1: *Map of occurrence of B. civica with faunistic squares (BioLib 2017)*



Legend: The red line indicates the area of interest on which the observation was done. Red dots are the current Google Street View mapping. Squares with no finds remain without fill. The black dots then represent the occurrence of a spider in the South Moravian Region where mapping was performed by observation directly on the sites (Novotný et al. 2017). Squares with no occurrence recorded remain without padding. Blue square indicates the incidence recorded in the years 1951–2000. Green square indicates the findings from the years 2001–2015 (based on data of the Czech Arachnological Society 2017, Havlová 2008, Macek 2006).

Table 1 Faunistic squares with places of finding

Number faunistic square	City
7071	Hluk
6973	Slavičín
6972	Luhačovice, Bojkovice
6971	Uherský Brod
6970	Uherské Hradiště, Staré Město, Kunovice
6872	Luhačovice
6871	Napajedla
6773	Vizovice
6772	Zlín, Fryšták
6771	Zlín, Otrokovice, Tlumačov
6774	Kopřivnice, Nový Jičín
6472	Hranice
6469	Olomouc
6267	Mohelnice
6369	Olomouc
6268	Litovel, Uničov
6368	Litovel
6770	Kroměříž, Tlumačov
6673	Vsetín
6672	Bystřice pod Hostýnem
6671	Holešov
6670	Hulín, Chropyně, Kroměříž
6669	Kojetín
6574	Rožnov pod Radhoštěm
6573	Valašské Meziříčí
6572	Bystřice pod Hostýnem
6571	Bystřice pod Hostýnem
6570	Přerov
6568	Prostějov
6471	Lipník nad Bečvou
6378	Třinec
6377	Třinec
6376	Frýdek-Místek
6375	Frýdek-Místek
6374	Kopřivnice, Příbor
6372	Odry
6174	Ostrava
6076	Bohumín
6277	Český Těšín
6276	Havířov
6275	Ostrava
6274	Studénka
6177	Karviná
6176	Bohumín
6175	Ostrava, Hlučín

DISCUSSION

The observation in the interest areas of Moravia and Silesia showed that the spider spread not only in this territory, but throughout the Czech Republic, is considerably underestimated. The Czech Arachnological Society (2017) officially reports only 7 faunistic squares in the Czech Republic, of which only two are in the area of interest. To this number Macek (2006) adds one finding from East Bohemia and Havlová (2008) another three faunistic squares from northern Bohemia. However, as it has already been observed from earlier observations directly on sites in the South Moravian region, this spider is very abundant in this region. Newly, 48 faunistic squares have been identified in this area (Novotný et al. 2017).

As it can be seen from Figure 1, altitude plays an important role in spreading. Buchar and Růžička (2002) states that *B. civica* is most commonly found at altitudes of 200–400 m above sea level. This assertion can be accepted. The observation revealed that the optimal altitude for its existence is indeed within this range of values, but it is also abundant in altitudes below 200 m above sea level. On the contrary, at altitudes above 400 m above sea level, we can not practically meet it. This is due to the fact that it is extremely delicate for frost and it does not like also rain and dampness (Billaudelle 1957). On the contrary, it complies with the conditions of the environment where it is warm and dry (Krumpálová 2001). That is why we can only meet with this spider in the lowlands. Up to 400 m above sea level, it penetrates only sporadically and only into larger cities, which can be explained by the effect of the city thermal island. According to Bednář (1985), this is reflected by the fact that we can observe a higher temperature inside the city than in the surrounding undeveloped landscape. This frost-sensitive spider seems to use this and thus it can survive the winter and the unfavorable conditions. An important role in spreading appears to be the presence of major road journeys that lead through cities and villages. Here is a big prerequisite for spreading through automotive and freight transport on the chassis of the means of transport. A similar effect is probably the presence of the railroad near human settlements, which would explain the abundant occurrence of cobwebs in the railway stations, where there is probably the spread of this type by train sets.

CONCLUSION

Mapping using Google Street View, which has never been used to spider sightings, has brought new insights into the spread of the species in the territory of Moravia and Silesia. From the area of interest, only two faunistic squares were recorded before this observation, but it was newly found out of in another 45 faunistic squares. However, it is likely that this extension is far from definitive and the spider will continue to spread to places where its occurrence has not yet been recorded.

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