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VOLUCELLA ZONARIA PODA 1761 SPECIES AND PHENOMENA WHICH PRESENT THEM: MIMICRY, COMMENSALISM, DETRITOPHAGOUS, PREDATORS, MIGRATION

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INTRODUCTION

The university lecturer in entomology should know more insects, rather than about those with the status of „harmful insects of agricultural crops". This status makes me notice different entomological „news" in nature. In the summer of 2016, it was just this phenomenon: drew attention to a new insect without the status of a "pest of crops". This insect was a new species for the entomofauna of the Republic of Moldova and is called *Volucella zonaria* Poda 1761. From this

new species, the author learned interesting information for himself and told about this curious insect to students who study for agronomists on plant protection at the State Agrarian University from Moldova (SAUM). This insect has become a topic for the article, with which the national entomological heritage will be enriched by a new species and interesting data about it.

MATERIALS AND METHODS

The species *Volucella zonaria* Poda 1761, was recorded on 25.VI.2016 on the central alley of the SAUM campus in the city of Chisinau. The central alley is bordered on both sides by numerous trees, dominating the lime tree species (*Tilia* spp.). Several individuals of imago have been occasionally observed, because they were in a resting position on the lower limbs of lime trees (Fig.1).

On the basis of the three specimens of *V. zonaria* Poda 1761, harvested from linden branches, the species was researched in the laboratory of Entomological Agricultural discipline, from the Department of Plant Protection, Faculty of Horticulture of SAUM. According to the determinants used in the general and agricultural entomology specialty, including the literature of the „Plant Protection" specialty, the name of the species was established and this article was drawn up (Ionescu, 1962).

RESULTS AND DISCUSSIONS

Systematic and scientific name. *V. zonaria* Poda 1761 species, is part of Animalia kingdom, Arthropoda phylum, Hexapoda subphylum, Insecta class, Pterygota subclass, Neoptera infraclass, Diptera order, Brachycera suborder, Muscomorpha infraorder, family Syrphidae, Eristalinae subfamily.

Fig. 1. Imago of *Volucella zonaria* Poda 1761 species under the branch trees in the ASU of Moldova campus, Chisinau, 2016 (photo Asea M. Timuş)

Species *Volucella zonaria* Poda 1761, has been studied by several entomologists from

different countries in Europe (Germany, Italy, UK and Denmark), and some of them called it according to their own conception, so there were 3 synonyms of genus (*Conops, Musca, Syrphus*) and 4 of the species (*bifasciatus, valentina, radicum, fasciata, beckeri*) namely:

- ***Volucella*** *zonaria* in 1761 by Nikolaus **Poda** von Neuhaus (Germany);
- *Conops* ***zonaria*** in 1761 by Nikolaus **Poda** von Neuhaus (Germany);
- *Conops bifasciatus* in 1763 by Giovanni Antonio Scopoli (Italy);
- *Musca valentina* in 1766 by Fritz Muller în Otto Friedrich Müller (Denmark)*;*
- *Syrphus bifasciatus* in 1792 by Georg Wolfgang Franz Panzer (Germany);
- *Volucella radicum* in 1803 by Franz de Paula von Schrank (Germany)*;*
- *V.fasciata* in 1829 by Gottlieb August Wilhelm Herrich-Schäffer (Germany);
- *V.fasciata* in 1901 by George Henry Verrall (UK);
- *V.beckeri in* 1961 by Volkert van der *Goot (Olanda)*;

Priority was given to the entomologist from Germany Nikolaus **Poda** von Neuhaus, who proposed 2 genus names (*Conops* şi *Volucella*) and a single species name (*zonaria*).

Popular name. Species *V.zonaria* Poda 1761" in english „the hornet mimic hoverfly" , in germany „ giant hummelschwebfliege", in russian „bolishaia shmelevidka" etc., but in romanian does not have a popular name, that is why it was called „musca-gărgăun". The inspiration came from the development of the fly *V. zonaria* Poda 1761 in absolute comensalism with *Vespa crabro* L. 1758.

Research of the species in the Republic of Moldova. In the native literature about genus *Volucella* the information is based on the species *V. bombylans* L. 1758. About *V. zonaria* Poda 1761 do not provide any kind of information. In the didactic literature (Romanian and Russian), the same *V. zonaria* Poda 1761 is not described, but not the same *V. bombylans* L. 1758 (Ionescu, 1962; Vasiliev, 1974; Stanek, 1977; Bei-Bienko, 1980; Negrobov, 1983). In this situation, any information about the species is important and useful (Timuş, 2016).

Morphological description. Imago's body size higher than other species from Sirphidae family: from 20 to 22 mm in length. The body has two obvious colors: yellow and black. Each body tag is colored as follows: head with yellow frontal plates; the compounds eyes dark brown color; pedicel antennas is yellow; and ariste (bifurcated) with a few fine pearls are black (Fig. 2). The thorax is dark brown and has a rare cheetotaxia, especially on the sides of the segments. The legs are dark brown to black. The wings have the yellow front and the posterior white-transparent. The second pair of metamorphized wings – halteres – are black (pedunculous) and yellow (the last thickened segments). The abdomen with propode, segments 3 and 5 black, and segments 6, 7 and anal the yellow.

Fig. 2. *Volucella zonaria* (Poda 1761) species – the second pair of wings = halteres (photo by Asea M. Timuş).

According to the literature we present some aspects about the other three stages of the species *V. zonaria* Poda 1761: egg, larvae and pupae. The egg is about 1 mm and yellow color; larva apod, acephate, light brown, with rudiments of the mouthpiece similar to „cornicles"; the

pupae of type coarctate, 35-40 mm long and shiny chestnut color (Ionescu, 1962; Bei-Bienko, 1980).

Biology. Species *V. zonaria* Poda 1761 develops a generation a year and sows in the pupae stage in the soil (Fig. 3). The adult flies early spring, or the end of March in early April. Imago feeds on pollen and nectar of flowers, especially on plants *Buddleja davidii, Cirsium, Carduus* etc. The female lays its egg-laying in the nests of wild bees, bumble bees and wasps, but prefer those of *Vespa crabro* L. 1758.

Months and decades																					Hibernation
IV			V			VI			VII			VIII			IX			X			
I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	
(0)	(0)																				
		+	+	+	+	+	+	+	+												
		polleno- and nectarphage																			
								o	O	o	o										
								wasp's nest													
									I	I	I	I	I	I	I	I					
									detritophagus and predator												
												o	o	o	o	o	o	o	(0)	(0)	(0)
												the soil around the nests									
Legend: 0 – pupae; (0) – hibernation pupae; + – imago; o – egg; I – larvae.																					

Fig. 3. Phenological table of the *V. zonaria* Poda 1761 species (orig.)

Mimicry. To penetrate into the wasps nest and lay eggs, and at maturity can leave the nest without being detected by the host-sacrifice, evolutionally, the fly has adapted through 2 options: (i) **primary** - the morphologically changed aspect, which is similar to the wasp-hosts, a phenomenon called mimicry (Fig. 4); (ii) **secondary –** the production of odorous substances to calm the wasp-hosts. The mimicry to the species *V. zonaria* Poda 1761, is thus presented: large dimensions (20-22 mm), color (especially yellow abdomen and black stripes), the shape of the head and thorax looking dorsal, the front wings and their stretching along the body in rest, which perfectly mimics the species *Vespa crabro* L. 1758. It is different by aristate and short antennas, large dipterer eyes, the second pair of wings modified in halteres.

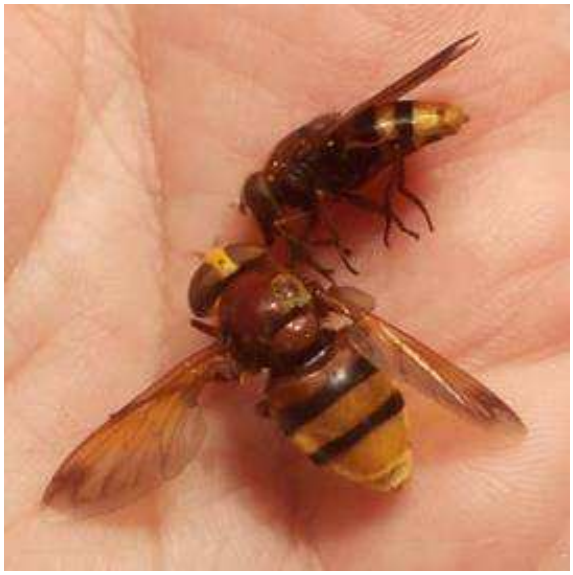

Fig. 4. *Volucella zonaria* Poda 1761 **s**pecies – looking wasp flies = mimicry (photo by Asea M. Timuş).

Commensalism. In the imago stage, *V. zonaria* Poda 1761 species, has the property of producing, by means of special glands, odorous substances that emit a pheromone. This pheromone acts as a sedative on the wasp-host adults, after which the wasps become gentle and continue their specific activity. The moment foreigners appear, in that case, respectively imagos of *V.zonaria* Poda 1761, tho wasp-hosts get the „indifferent" aspect of the appearance of the „stranger" in their nest; the presence of the „alien" for a longer duration; the activity of the „stranger" in the nest or when he places his egg in the wasp nest. After laying the eggs by the *V.zonaria* Poda 1761, she leaves the nest of the wasp without the wasp-host to attack the fly imago or the foreign egg left in her nest. The new larva appeared feed on all the remains of the nest, thus obtaining the status of detritivores or detritophages species.

Detritophagous. In the larval stage, *V. zonaria* Poda 1761 species, feeds with decomposing organic material from the hayenoptera's nest: dead wasps, other rotting matter**.**

Predation. In the larval stage, *V. zonaria* Poda 1761 species, can consume, including diseased larvae and pupae, or with abnormal development of hymenopterans-host, and is also characterized as a predator.

Migration. European literature mentions that *V.zonaria* Poda 1761 species is a migratory species. In the imago stage, they migrate from the hot zones of the continent to the coldest or the north. The phenomenon of migration has been investigated by English entomologists (Falk & Steven, 1983). English entomologists mention that the species is anthropoid, being more and more registered in urban parks, especially in private gardens with decorative vegetation. The same phenomenon can also be mentioned about *Vespa crabro* L. 1758, including in the Republic of Moldova, but this species will be discussed in another article.

In the result of our investigation of *V. zonaria* Poda 1761 species can be concluded the following: in 2016 the fly was registered on plants of the genus *Tilia* from SAUM campus. The hornet mimic hoverfly develops one generation per year, overwinters in the pupal stage in soil in wasps nest. The fly adults feed with pollen and nectar; the larvae consume decaying organic matter, they are also predators. The mimicry was developed to access to the nests hosts and victims (food). The *V. zonaria* Poda 1761 can be considered as an indicator of environmental change in Moldova cities.

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