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THREE AULACIGASTRID SPECIES COLLECTED BY A TRAP BAITED WITH BEEF LIVER. A FAMILY FOR FORENSIC ENTOMOLOGY? (DIPTERA: AULACIGASTRIDAE)

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Abstract: In 2013 the European Association for Forensic Entomology suggested that the associated laboratories, as part of a project called "First Colonizers" should collect, by means of a bait trap, the first forensic insect species arriving at a food resource. The goal of this joint experiment was to identify them and compile all the information required, making it available to the institutions involved. One of the regular members, the Forensic Entomology Laboratory of the General Commissariat of Scientific Police (Madrid) participated in it since the very beginning. One of the dipterous families collected by this lab was the Aulacigastridae. In this paper we show the results and conclusions obtained for this family. The specimens, collected in the Madrid administrative region (Spain) with an aerial forensic trap, consists of three species: *Aulacigaster falcata* Papp, *A. leucopeza* (Meigen) and *A. neoleucopeza* Mathis & Freidberg. *A. falcata* Papp is recorded from the Iberian Peninsula for the first time.
Key words: Diptera, Aulacigastridae, *Aulacigaster* spp., forensic entomology, first record, Iberian Peninsula.

Tres especies de aulacigásridos recolectadas mediante una trampa cebada con hígado de ternera. ¿Una familia para la entomología forense? (Diptera: Aulacigastridae)
Resumen: En el año 2013, la Asociación Europea para la Entomología Forense propuso a sus laboratorios miembros el proyecto titulado "Primeros Colonizadores", consistente en la recogida, mediante una trampa aérea, forense y cebada, de los insectos de interés forense que acuden al recurso trófico en primer lugar. El objetivo del experimento era identificarlos y recopilar los datos pertinentes, quedando toda la información obtenida a disposición de las instituciones participantes. Uno de los miembros de la asociación, el laboratorio de Entomología Forense de la Comisaría General de Policía Científica, sito en Madrid, participó desde el inicio de la experimentación. Una de las familias de dípteros capturadas fue Aulacigastridae. En el presente artículo, mostramos los resultados y las conclusiones obtenidos de esta familia. El material, recolectado en la Comunidad Autónoma de Madrid (España) con una trampa forense aérea, consiste en tres especies: *Aulacigaster falcata* Papp, *A. leucopeza* (Meigen) y *A. neoleucopeza* Mathis & Freidberg. *A. falcata* Papp se cita por primera vez de la Península Ibérica.
Palabras clave: Diptera, Aulacigastridae, *Aulacigaster* spp., entomología forense, primera cita, Península Ibérica.

Introduction

Forensic Entomology is a discipline which helps us to answer some questions raised by a judicial or police investigation. Through the study of insects collected at crime scene, on and around the corpse and during the autopsy performance, these hexapods, considered as forensic indicators to estimate the minimum time elapsed since death, can give us some clues to solve a crime. Sometimes, the Judicial Authority calls for the analysis of this type of evidence to estimate the minimum period of insect activity (PIA) on a corpse. In order to obtain accurate results, it is crucial, among other factors, to have a wide knowledge of the regional fauna of the geographical place where the dead body was found. In this sense, the European Association for Forensic Entomology (EAFE), Institution created in 2002, promoted since its foundation, the development of minimum standards and recommendations in Forensic Entomology (Amendt *et al.,* 2007), encouraging the lab members to take part in joined research projects and share the results.

Material and methods

The project entitled "First colonizers" which is not over yet, began in 2013. It is a wide in scope trapping experiment. Teams all over Europe, some of them are still collecting insects, used a forensic and standardized trap. Following the instructions given by the EAFE, the experiments were carried out during 3 days each month, throughout the year. In our case, we took part in it throughout twenty months. The Board of the EAFE designed and standardized the baited trap. It was used 150 g of beef liver to tempt the insects into the device. Only one trap was used. The trap, aerial, was located in a branch tree and was placed from August 2013 until April 2015 in Madrid Administrative region (Spain) (40º27'55.0" N, 03º38'35.6" E). It allowed us to capture a large amount of insects attracted by the decomposing bait in every trial. The specimens were collected by the specialists of the Forensic Entomology Laboratory belonging to the General Commissariat of Scientific Police within the Spanish National Police Force (Madrid).

Temperature data were recorded every hour during the periods of time of each experiment, using two data loggers, model Escort iLog (EI-IN-D-32-L). One of them left in the branch of the tree and the other on the soil. The evidence was photographed, labelled and preserved.

Results

As it could be expected, many families of Diptera (and other insects) came to the trap during the experiment. One of them has been the Aulacigastridae (= Aulacigasteridae).

The Aulacigastridae is a small family of acalyptrate flies. It includes small flies (1.5-5 mm), predominantly dark brown to black. This family has a worldwide distribution as it has been recorded from the Afrotropical, Holarctic, Neotropical and Oriental regions. It includes only two genera (*Aulacigaster* Macquart, 1835 and *Curiosimusca* Rung, Mathis & Papp, 2005) with a total of 55 species. The genus *Curiosimusca* includes 3 described species and it is only known from the Oriental region.

Regarding to genus *Aulacigaster*, there are 5 species recorded from the Palaearctic region, 4 of them are known to occur in Europe (*A. falcata* Papp, 1998, *A. leucopeza* (Meigen, 1830), *A. neoleucopeza* Mathis & Freidberg, 1994 and *A. pappi* Kassebeer, 2001).

In the present experiment a total of 31 specimens of *Aulacigaster* have been collected. The material has been reviewed or identified by the first author. 3 species have been found, which are preserved in alcohol (70º) in the Forensic Entomology Laboratory of the General Commissariat of Scientific Police (Madrid), 2 specimens of *A. falcata* are deposited in the private collection of the first author.

***Aulacigaster falcata* Papp, 1998**

MATERIAL COLLECTED: 6.12.2013 1 female, 9.1.2014 1 male, 1.4.2014 1 male 1 female, 3.4.2014 1 female and 7.5.2014 2 males 2 females.

This species is only known from Europe in Croatia, Germany, Greece, Hungary, Italy, Madeira (Portugal) and Switzerland. Therefore, it is now recorded from the Iberian Peninsula for the first time.

***Aulacigaster* leucopeza (Meigen, 1830)**

MATERIAL COLLECTED: 3.12.2013 1 female, 4.12.2013 1 female, 6.12.2013 2 females, 8.1.2014 2 males, 10.1.2014 1 female, 7.3.2014 1 female, 6.5.2014 1 male 2 females, 7.5.2014 3 males 2 females and 3.3.2015 2 females.

This species is widespread distributed in Europe, including Spain, and it has been also recorded from the East Palaearctic.

***Aulacigaster neoleucopeza* Mathis & Freidberg, 1994**

MATERIAL COLLECTED: 9.1.2014 1 female, 1.4.2014 1 female, 6.5.2014 1 female and 7.5.2014 1 female.

This species has a Nearctic distribution, although it has been recently recorded from the Iberian Peninsula in Andorra (Carles-Tolrá y Pujade-Villar, 2003) and Spain (Córdoba province) (Carles-Tolrá, 2006). Thus, we extend now its peninsular distribution to the center in Madrid.

Remarks

According to the bibliography (Bächli *et al*., 1999; Brown *et al*., 2010; Marshall, 2012; Mathis & Freidberg, 1994; McAlpine, 1987; Papp, 1997; Papp & Darvas, 1998; Rung *et al*., 2005) this family is "frequently found on tree-trunk sap fluxes", "attracted to weeping wounds and sap fluxes of deciduous trees", "associated with slime fluxes of deciduous trees", among other phrases. As deciduous trees we may record elms, asps, poplars, oaks, hornbeams, etc. Consequently, the components of this family are commonly called "sap flies". As far is known, the females deposit their eggs in moist decaying sap, where the larvae develop as microbial grazers, breathing through a long, tail-like respiratory tube and long, thin spiracular lobes on the thorax.

Nevertheless, Carles-Tolrá *et al*. (1993) collected many specimens of *A. leucopeza* by vinegar traps, whereas Bächli *et al.* (1999) collected a lot of the three species by using beer/wine traps; very often up to three species were included, so this kind of traps are, therefore, not selective but very effective. Likewise, Carles-Tolrá & Pagola-Carte (2013) and Carles-Tolrá & Verdugo Páez (2009) used wine/beer traps, but in these cases only *A. leucopeza* was caught. On the other hand, a small number only was found using fruit baits for collecting drosophilids (Bächli *et al*., 1999). Finally, Carles-Tolrá & Lencina (2010a, 2010b) and Carles-Tolrá & Verdugo Páez (2010) collected quite specimens of *A. leucopeza* by flight interception traps.

Conclusions

On the one hand, *Aulacigaster* has always been linked to sap flow trees. Moreover, it has been collected in large quantities with wine/beer traps, fruit traps (much lesser amount) and even with flight interception traps. Therefore, these new captures with liver are truly amazing and interesting. Clearly, this represents a significant improvement of the nutritional and biological knowledge of *Aulacigaster* to expand it to beef liver.

In the 20 months (60 days total) that lasted the experiment, 31 *Aulacigaster* specimens were collected, which were concentrated in the months of April and May. Nevertheless, it is highlighted that *A. falcata* specimens were also detected and collected at average temperatures below 10 ºC, that could be critical for other insects of forensic interest, very common in Forensic Entomology.

Unfortunately, the very low numbers caught on as long a period of time leads us to the conclusion that this family of Diptera, or rather, the genus *Aulacigaster* does not seem to be a good candidate to join the Forensic Entomology, at least for now. Although, it could be interesting to study deeper its biological cycle and the duration of the stages of development to different regimes of constant temperature.

As this is an European megaproject performed simultaneously by several teams of Forensic Entomology, it could be interesting to carry out more comprehensive research lasting several years. Once, all the data were entered in a database, perhaps we would be able to draw definite and undoubted conclusions about *Aulacigaster* and its relationship to the liver.

Therefore, answering the question concerning the title of this work, the answer with the obtained results is, so far, negative.

In order to finish, just to tell that thanks to this experiment the species *A. falcata* is first recorded in Spain within the Iberian Peninsula and *A. neoleucopeza* in Madrid Administrative region (Spain).

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