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ISODONTIA MEXICANA, A NEW INVASIVE WASP SPECIES IN THE REPUBLIC OF MOLDOVA FAUNA

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A new invasive wasp species, *Isodontia mexicana* (Hymenoptera) was reared from artificial shelters in 2024 on the territory of the Institute of Genetics, Physiology and Plant Protection, Republic of Moldova. We analyzed the biology, the history of the species' distribution in Europe and the possibility of its use in plant protection. *I. mexicana* species came from Central America to Europe during the Second World War and did not change its ecological niche in the invaded area. The presence of a relatively hairy mesosome and frequent visitation of many flowering plants by *I. mexicana,* likely defines it as a powerful new pollinator. As the population of *I. mexicana* grows, a more likely effect may be that the wasp controls crop pests from the Orthoptera order. In this case, artificial refuges should be used in a manner that maximizes the emergence of healthy adult offspring of *I. mexicana* in agricultural areas.

Keywords: *Isodontia mexicana; The Republic of Moldova; Sphecidae, artificial shelters, invasive species, plant protection, pest control, powerful pollinator.*

ISODONTIA MEXICANA, O NOUĂ SPECIE INVAZIVĂ DE VIESPI ÎN FAUNA REPUBLICII MOLDOVA

O nouă specie de viespi invazive, *Isodontia mexicana* (Hymenoptera: Sphecidae) a fost crescută din adăposturi artificiale în anul 2024 pe teritoriul Institutului de Genetică, Fiziologie și Protecția Plantelor, Republica Moldova. Am analizat biologia, istoria distribuției speciilor în Europa și posibilitatea utilizării acesteia în protecția plantelor. Specia *I. mexicana* a venit din America Centrală în Europa în timpul celui de-al Doilea Război Mondial și nu și-a schimbat nișa ecologică în zona invadată. Prezența unui mezosom relativ păros și vizitarea frecventă a multor plante cu flori de către *I. mexicana* îl definește probabil ca un nou polenizator puternic. Pe măsură ce populația de *I. mexicana* crește, un efect mai probabil ar putea fi acela că viespea controlează dăunătorii culturii din ordinul Ortoptere. În acest caz, refugiile artificiale ar trebui utilizate într-o manieră care să maximizeze apariția descendenților adulți sănătoși ai *I. mexicana* în zonele agricole.

Cuvinte-cheie*: Isodontia mexicana; Republica Moldova; Sphecinae, adaposturi artificiale,, specii invazive, protectia plantelor, combaterea dăunătorilor, polenizator puternic.*

Introduction

Invertebrates are the most species-rich group of organisms. Adequate selection of a method and design of a recording methodology are based on an understanding of the biological characteristics of the taxon and the operating principles of existing methods. It is advisable to distinguish between „active" and „passive" accounting. Traditionally, traps are generally considered more effective than active (primarily manual) collection. For inventory and monitoring studies, we chose a method based on the use of artificial shelters, which combines the methods of „interception" and „attraction" of insects [1].

The method involves attracting Hymenoptera entomophages (tubular filler materials for nests, a corps made of various materials) and intercepting insects (placing artificial shelters in the feeding and breeding areas of entomophages, at their flight altitude). The benefits of different types and features of new biodiversity conservation techniques must be assessed and developed for the successful conservation of insect communities in agroecosystems. Agroecological schemes (AES) were introduced into EU agricultural policy in 1985 and have become the main tool for biodiversity conservation in Europe. The implementation of agri-environment schemes (AES) is a key tool for maintaining biodiversity and ecosystem services in European agricultural landscapes [2].

In the artificial shelters, that we used to attract entomophagous Hymenoptera: Sphecidae to the reproduction and development of offspring in 2024, a new wasp species for the Republic of Moldova, *Isodontia mexicana* de Saussure, 1867, was discovered. The object of our research – *I. mexicana* has been well

studied both in America and in Europe. The species nests in natural cavities, such as hollows of branches and stems of common reed, and adults provide larvae with paralyzed medium-sized prey, belonging to a wide range of the Orthoptera order species (Gryllidae, Tettigoniidae). The partitions of the nest are made of dried blades of grass, which gave the wasp its popular name: „grass-carrying wasp” [3]. The purpose of the research was to use artificial shelters to monitor and attract entomophagous Hymenoptera for reproduction and development of offspring. The method of artificial shelters makes it possible to assess the natural potential of entomophages in agrocenoses and the possibility of their use in plant protection.

Materials and methods

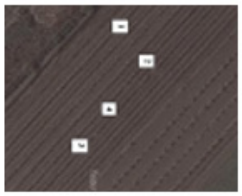
The research was carried out on the territory of laboratory and field conditions of the Institute of Genetics, Physiology and Plant Protection of the Republic of Moldova.

The object of our research was a new invasive wasp species for the Republic of Moldova, *Isodontia mexicana* (Hymenoptera: Sphecidae), reared from artificial shelters in 2024. Taxonomic affiliation of the wasp: class Insecta → subclass Pterygota → infraclass Neoptera → superorder Holometabola → order Hymenoptera → suborder Apocrita → infraorder Aculeata → superfamily Apoidea → family Sphecidae → subfamily Sphecinae → tribe Sphecini → genus *Isodontia* → species *Isodontia mexicana* de Saussure, 1867 = *Sphex apicalis* de Saussure, 1867 = *Sphex apicalis mexicana* de Saussure, 1867.

The research was carried out in several stages during the vegetation period. We used 2 types of filler material: hollow tubes made of reed and plastic. 4 options of corps for artificial shelters were investigated: 1) white cardboard; 2) dark cardboard; 3) transparent plastic; 4) dark plastic. The experiment was carried out in triplicate. In April, artificial shelters were placed in various biotopes (according to the schemes), securing them at a certain height (1,5 m) above the ground, on poles. Biotopes of orchards (apple, pear tree) were chosen as a food source (pollen, nectar) for wasp imagoes. The *Miscanthus sinensis* field provided the wasps with a natural supply of tubular stems for nesting (Fig. 1)

Figure 1. Schemes of location and variants of artificial shelters for entomophages Hymenoptera attraction in different biocenoses during the vegetation period of 2024 (photo by the author).

1. Artificial delta shelters made from white cardboard

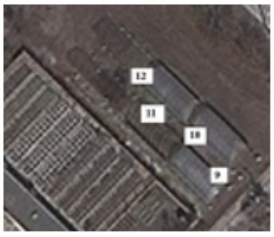


GARDEN (APPLE)

2. Artificial delta shelters made of black cardboard

MISCANTHUS SINENSIS FIELD

3. Artificial cylindrical shelters made of transparent plastic



GARDEN (PEAR)

4. Artificial cylindrical shelters made of dark plastic

Results and discussions

At the end of June, we dismantled the artificial shelters. We counted, photographed and identified the species *I. mexicana,* using a guide for the fauna of northwestern Europe. Currently, three species of the genus *Isodontia Patton*, 1880 are known in Europe. Two native species - *I. paludosa* and *I. splendidula* - and one non-native North American species, *I. mexicana*. Among the Sphecidae fauna of Moldova, *I. mexicana* immediately stands out due to its uniform black coloration.

Species characters of *I. mexicana*: gaster all black; dorsal propodeal area finely punctured and chagrined but with at most only a trace of transverse striation; petiole strongly curved in profile, as long or longer than tibia one; gaster without bands of pale hairs; clypeus and lower frons with the long erect hairs black; anterior clypeal margin of female with a small deep median emargination bounded by a tooth on each side; wings smoky, darker along apical margin; male antenna without clearly defined placoids [5].

In the climatic zone, to which the Republic of Moldova belongs, the wasp *I. mexicana* usually produces one summer generation of offspring in nests and goes into winter as pre-pupae, and then pupates and emerges as adults in the spring. The egg is laid in a protected environment (hollow branches or plant stems). It is small, oval and usually attached to a backing inside the nest. After hatching, the larva looks worm-like with a soft, elongated body. It has no wings, and its head is distinguished by chewing parts for food consumption (the adults supply it with paralyzed prey Orthoptera species). The stage primarily focuses on growth, molting repeatedly to increase its size. As a pupa, the wasp undergoes significant changes in its protective cocoon. The larva's shape gradually changes as its wings and adult body develop. This stage is motionless and outwardly appears incapacitated, although internal development occurs quickly.

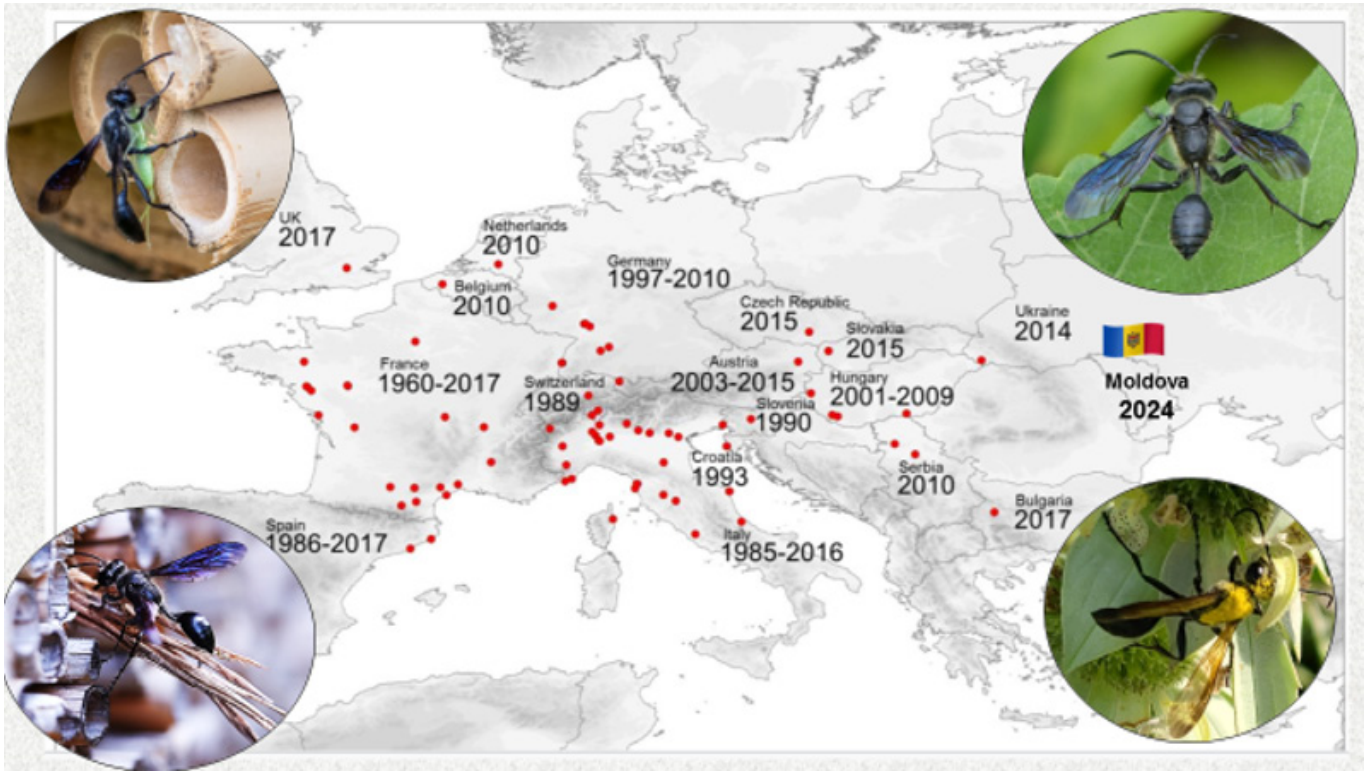
The adult, emerging from the pupa, exhibits wings and functional reproductive organs. The exoskeleton is hardened, and the body acquires a characteristic color. *I. mexicana* pollinators show very clear preferences for plants from the families Lamiácea, Asteraceae, Fabaceae and Apiaceae. Adults are often found in sunny, open areas such as meadows, gardens and fields, where they search for prey and suitable nesting sites. *I. mexicana* can cause toxic reactions with a wide range of severity. However, toxins are usually directed at their prey and predators. They are usually not fatal to humans. Predators dangerous to *I. mexicana* adults are birds, spiders, and mantises [6] (Fig. 2).

Figure 2. Use of artificial shelters for reproduction and development of *I. mexicana* wasps offspring: nesting station; exposed nests in reed stems; nest cells with cocoons, pupae and adults of *I. mexicana* reared from pupae (photo by the author).

In the experiments, we conducted in 2024, all wasp nests were found in the agrocenosis of an apple orchard, next to the forest belt. The nests were located in cardboard delta-shaped artificial shelters of white and black color (in equal proportions), in reed stems with a diameter of 0,7-0,9 cm. Plastic tubes and traps with a plastic corps did not contain wasp nests. Tubular stems, sealed with a characteristic grass plug, were placed in special containers for rearing adults. In this way, nests, pupae and adults of *I. mexicana* were obtained, photographed and placed in the collection.

According to the history of the *I. mexicana* species expansion, it came from Central America to Europe (Italy) during the Second World War. The species *I. mexicana* did not change its ecological niche in the invaded area. The wasp has shown a clear tendency to occupy areas with moderate temperatures in winter, little rainfall during the driest period of the year, and low altitudes. The habitat of the wasp *I. mexicana* is forests and forest-steppes, urban and suburban areas, agricultural and cultivated areas, meadows and steppes (Europe, Ukraine, Crimea). Scientists predict that *I. mexicana* may spread further across Europe and Asia, reaching new, not yet occupied continents in the Southern Hemisphere and surviving on them [6]. The discovery of *I. mexicana* on the Republic of Moldova territory confirms this prediction and complements the map, compiled in 2018 (Fig. 3).

Figure 3. Georeferenced species data for *I. mexicana* in Europe (invasion range). The estimated year of the species arrival is shown based on the year of first detection and the year of last recording for each of the 17 + 1 (Moldova) wasp-infested countries.



Conclusions

For the first time, a new invasive species of digging wasps is reported for the fauna of the Republic of Moldova - *Isodontia mexicana* (de Saussure, 1867), identified in 2024. The wasp settled only in artificial shelters (corps and tubes) made from natural materials. The biological characteristics of the species and the possibility of its use in plant protection are analyzed:

a) wasps of the *I. mexicana* species were found in the biotope closest to the forest belt of the 3 options. Proximity to forest is a major factor favoring the spread of insects, as forest plantations provide food, nesting sites and shelter. We emphasize the need for long-term monitoring of insects and the increasing focus of future AES agri-environment schemes on the provision of nesting habitats for the effective conservation and expansion of *I. mexicana*;

b) the presence of a relatively hairy mesosome and frequent visits to many flowering plants by *I. mexicana* probably defines a new powerful pollinator;

c) in the case of *I. mexicana*, the prey taxa (Gryllidae and Tettigoniidae) are usually quite numerous and diverse, while in most of Europe there are relatively few Sphecidae that prey on Orthoptera. As *I. mexicana* populations increase, a more likely effect may be that the wasp controls order Orthoptera crop pests. In connection with the spread of locusts in the southern regions of the Republic of Moldova in 2024, there is a need for a detailed study of the species and the possibility of attracting the entomophage to the agrocenoses of the Republic to control pests from the Orthoptera order. In this case, artificial refuges should be used in a manner that maximizes the emergence of healthy adult offspring of *I. mexicana* in agricultural areas.

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