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IDENTIFICATION AND DESCRIPTION OF THE INVASIVE SPECIES *Isodontia mexicana*

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IDENTIFICAREA ȘI DESCRIEREA SPECIEI INVAZIVĂ *ISODONTIA MEXICANA*

Rezumat. Din adăposturile artificiale, în anul 2024, pe teritoriul Institutului de Genetică, Fiziologie și Protecție a Plantelor, a fost obținută, identificată și descrisă pentru fauna din Republica Moldova o nouă specie invazivă de viespi (Sphecidae) - *Isodontia mexicana*. Viespile au fost găsite în biotopul cel mai apropiat de centura forestieră dintre cele 3 opțiuni, în zone umbrite. Astfel, implementarea schemelor de agromediu (AES) care conțin o combinație de adaposturi artificiale cu eterogenitatea peisajului este un factor important în creșterea abundenței viespilor vizuitoare, care sunt capabile să ofere servicii ecosistemice de mare valoare economică (polenizare și combatere a dăunătorilor).

Cuvinte cheie: *Isodontia mexicana*; Republica Moldova; Sphecidae, adaposturi artificiale, specii invazive, polenizator, controlul daunatorilor.

Summary. From artificial shelters in 2024, on the territory of the Institute of Genetics, Physiology and Plant Protection, a new for the Republic of Moldova fauna, invasive species of digging wasps (Sphecidae) — *Isodontia mexicana* — was obtained, identified and described. The wasps were found in the closest to the forest belt biotope of the 3 variants, in shaded areas. Thus, the introduction of agro-ecological schemes (AES) containing a combination of artificial shelters with landscape heterogeneity is an important factor in increasing the abundance of digging wasps, which are able to provide ecosystem services of high economic value (pollination and pest control).

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

Introduction

Solitary wasps provide pest control services, regulate arthropod populations, and support pollination of flowering plants. Appropriate management of agrolandscape resources can help conserve biodiversity. Landscape heterogeneity is an important factor that increases the abundance and species diversity of digger wasps, as forest belts and nectar crops provide floral resources, arthropod prey and nesting opportunities [1].

The advantages of different types and features of new biodiversity conservation methods should be assessed and developed for the successful conservation of insect communities in agroecosystems. An adequate choice of method and the design of accounting methodology are based on an understanding of the biological characteristics of the taxon and the operating principles of existing methods. To conduct inventory and monitoring research, we chose a method based on the use of artificial shelters, which combines the methods of “interception” and “attraction” of insects [2]. The method involves attracting entomophages of the Hymenoptera order (tubular nest filling materials, a corps made of natural materials) and intercepting insects (placing artificial shelters in the entomophagy’s feeding and breeding areas, at the height of their flight).

In the artificial shelters that we used to attract Hymenoptera entomophages to breed and develop their offspring, in 2024 a new for the Republic of Moldova invasive wasp species was discovered - *Isodontia mexicana* de Saussure, 1867, which was accidentally imported to Europe from North America.

The aim of the research was to use artificial shelters for monitoring and attracting entomophagous Hymenoptera for reproduction and offspring development.

Materials and methods

Research location: laboratory and field conditions of the Institute of Genetics, Physiology and Plant Protection, MSU, Republic of Moldova.

The object of our research *I. mexicana*, was reared from artificial shelters in 2024. The species has been well studied both in America and Europe. The species nests in natural cavities, such as hollows in the branches and stems of common reeds, and provides its offspring with medium-sized paralyzed prey belonging to a wide range of Orthoptera order species. The partitions of the nest are made of dried blades of grass, which gave the wasp its popular name: "grass-carrying wasp" [3].

The research was carried out in several stages during the vegetation period. We used two types of filler material: hollow tubes (15 cm long) made of reed (20 pcs.) and plastic (20 pcs.). Four variants of the artificial shelter corps were examined: 1) white cardboard; 2) dark cardboard; 3) transparent plastic; 4) dark plastic. The experiment was conducted in three replicates. In April, artificial shelters were placed in various biotopes (according to the schemes), fixed at a certain height (1,5 m) above the ground, on supports. The biotopes of fruit orchards (apple, pear) were chosen as a food source (pollen, nectar) for the wasp imago. The *Miscanthus sinensis* field provided the wasps with a natural supply of tubular stems for nest placement.

After dismantling the artificial shelter, the reed stems with a grass plug typical for this species were placed in a special cage for laboratory breeding insects. We were able to record the first specimens of *I. mexicana* when imagoes were reared from nests located in tubular reed stems. Various identification keys were used to determine the taxonomic affiliation of the species. The taxonomic characteristics of the Sphecidae family were determined using several identification guides [4, 5, 6]. The species identification was made using standard keys for European *Isodontia* and numerous photographs available on the Internet [7]. The studied material is stored in the collection.

Results and discussions

The *I. mexicana* species was photographed, recorded and identified.

Characteristics of Sphecidae family. The 1-st segment of the hind tarsus with a notch at the base, is not very widened or densely hairy (not adapted to pollen transfer); the hairs covering the body are simple; large spur of hind knees on inner side in dense hairs. The pronotum at the back is in the form of a straight, truncated ridge, bearing humeral tubercles on the sides, not reaching the bases of the wings; eyes of normal shape. Nests consist of one or more cells, arranged in the ground or in wood. The larvae's food includes paralyzed insects and is usually stored for future use; some species regularly provide food to the larvae throughout the entire development period. Most representatives of the family are useful in extermination of various pests [5, 6, 7].

Characteristics of the *Isodontia* Patton, 1880 genus. The first recurrent vein enters the second submarginal cell, the second recurrent vein enters the third submarginal cell; the body is completely black (Fig. 1a).

Characteristics of the *Isodontia mexicana* species: abdomen entirely black; dorsal propodeal area finely punctate, but with at most only a trace of transverse striation; the petiole is strongly curved in profile, the same length or longer than tibia one (Fig. 1b); the abdomen is without stripes of light hairs; the clypeus and the lower part of the frons are covered with long, erect hairs of black color (Fig. 1c); the anterior edge of the female clypeus has a small, deep median notch, bordered on each side by a tooth; the wings are smoky, darker along the apical edge; the antennae of the male do not have clearly defined placodes [7].

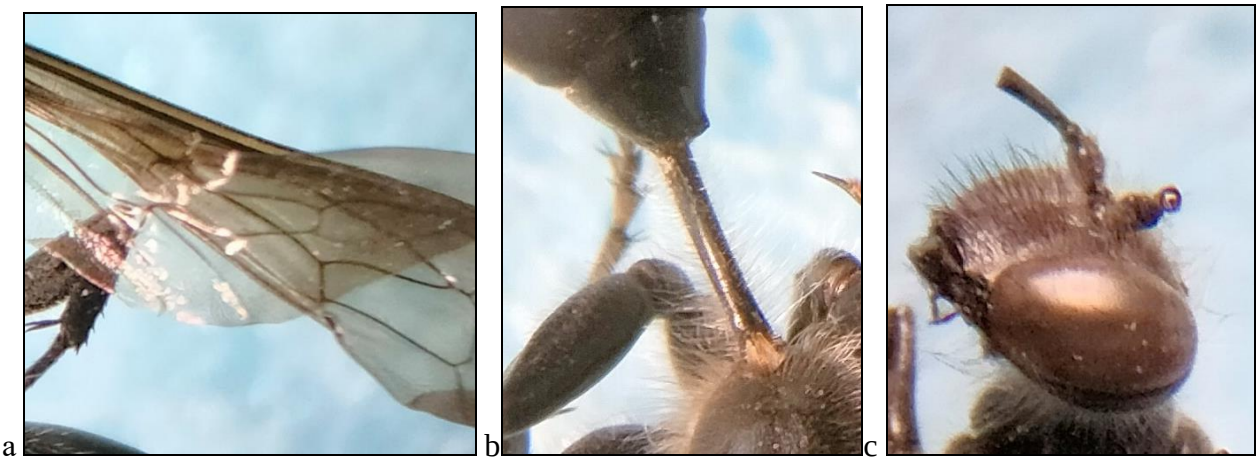


Figure 1. *Isodontia mexicana*: a) right wing, front; b) curved petiole; c) head from the side (photo by the author)

Thus, the taxonomic affiliation of the new species of wasp is as follows: 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.

***I. mexicana* life cycle**

After emerging from the natal nest, females mate with males and begin nest construction. These wasps create and supply individual brood cells with partitions of grass blades (fig. 2a), where numerous larvae feed and develop. The female stings the victim in order to immobilize it; she then clutches the paralyzed prey beneath her and carries it back to the nest. Once the nest is stocked with sufficient prey, she lays an egg. The egg is laid in a protected environment (hollow branches or plant stems). It is small, oval and usually attached to the substrate inside the nest (fig. 2b).

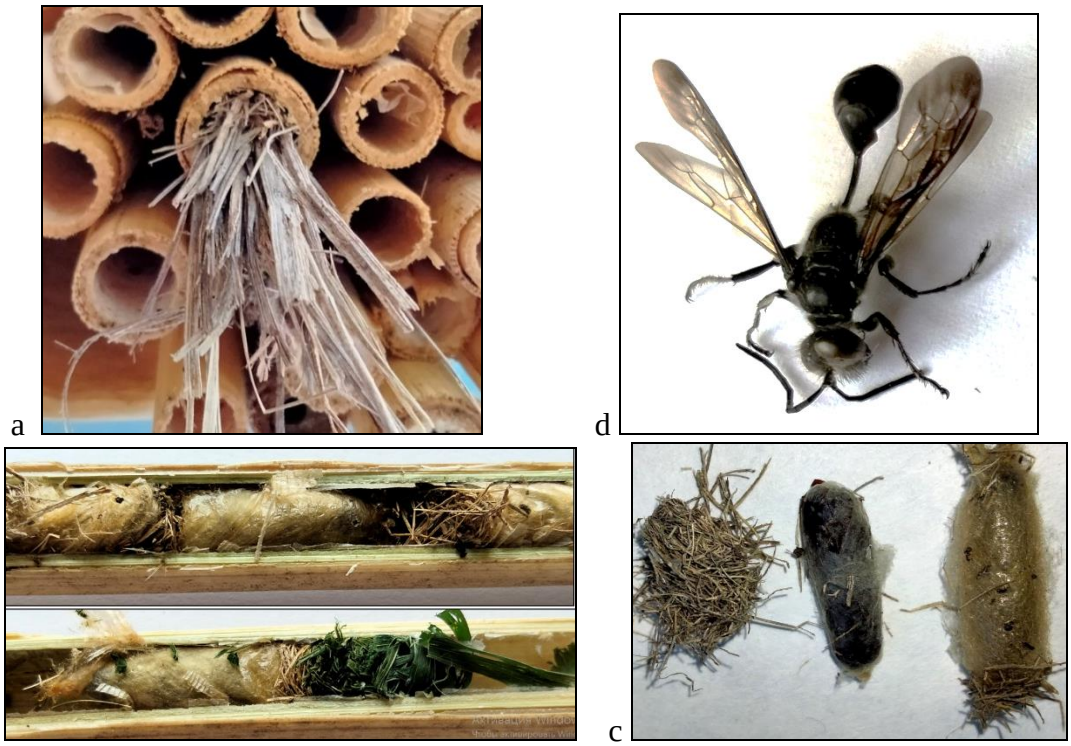


Figure 2. Life cycle of *I. mexicana* inside artificial shelters: a) grass plugs in the nest; b) nests in reed stems with grass partitions between cells; c) cocoon, grass septum and pupa; d) *I. mexicana* imago hatched from pupae (photo by the author)

The larvae appear worm-like after hatching, with a soft, elongated body. It has no wings and its head is distinguished by chewing parts for food consumption (the imago provides it with paralyzed prey (Orthoptera)). The stage primarily focuses on growth, molting repeatedly to increase its size. The larvae consume the hidden prey over the next 4-7 days. When the food supply is exhausted, each larva spins a cocoon. In the form of a pupa, the wasp undergoes significant changes in a protective cocoon. This stage is motionless and outwardly appears incapacitated, although internal development occurs rapidly. The imago, emerging from the pupa, displays wings and functional reproductive organs. The exoskeleton hardens, and the body acquires a characteristic coloration. 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* is a pollinator, showing very clear preferences for plants of the Lamiacea, Asteraceae, Fabaceae and Apiaceae families.

Assessment of the *I. mexicana* ecological niche

The invasive species of predatory solitary wasp *I. mexicana*, introduced beyond its native range probably 70-80 years ago, is now found exclusively in the Northern Hemisphere. The invasion range of *I. mexicana* is limited to Europe, where the wasp is found in many countries, especially France and Italy, but also in Switzerland, Austria, Germany and Serbia. The easternmost point of distribution in Europe is in Ukraine and Crimea, the northernmost in southern England, the southernmost in central Italy and the westernmost in northern Spain. *I. mexicana* has not changed its ecological niche in the territory of invasion. 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 *I. mexicana* wasp is forests and forest-steppes, urban and suburban areas, agricultural and cultivated areas, meadows and steppes. Scientists have made a forecast that *I. mexicana* could spread further across Europe and Asia, reach new, unoccupied continents in the Southern Hemisphere, and survive there [8]. The discovery of *I. mexicana* in the Republic of Moldova confirms this forecast and complements the map compiled in 2018 (fig. 3).

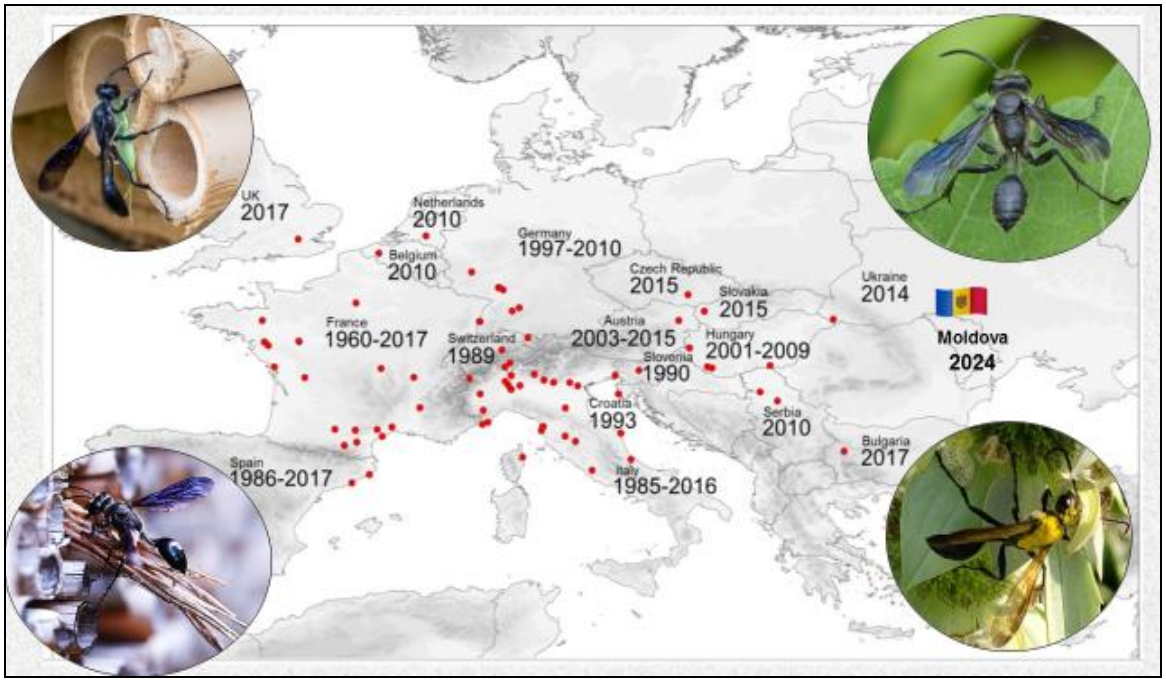


Figure 3. Georeferenced species data for *I. mexicana* in Europe (invasion range). The estimated year of the species arrival is shown based on the year of first detection and the year of last recording for each of the 17 + 1 (Moldova) wasp-infested countries

Conclusions

From artificial shelters in 2024, on the territory of the Institute of Genetics, Physiology and Plant Protection, a new for the Republic of Moldova fauna, invasive species of digger wasps (Sphecidae) — *Isodontia mexicana* — was obtained, identified and described;

The potential for economic use of the species was determined based on its biological characteristics:

a) the presence of a relatively hairy mesosome and frequent visitation of many flowering plants by *I. mexicana* probably defines a new powerful pollinator;
b) in the case of *I. mexicana*, prey taxa (Gryllidae and Tettigoniidae) are usually quite numerous and diverse, while in most of Europe there are relatively few orthopteran-hunting Sphecidae;
c) *I. mexicana* wasps were found in the closest to the shelterbelt biotope of the 3 variants, in shaded areas of apple orchard. Thus, the implementation of agro-ecological schemes (AES) containing a combination of artificial shelters with landscape heterogeneity is an important factor that increases the abundance of digger wasps that are able to provide ecosystem services of high economic value (pollination and pest control). In this case, artificial shelters should be used in a way that maximizes the emergence of healthy adult *I. mexicana* progeny in agricultural areas.

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