



## A new species to genus *Marava* Burr, 1911 (Spongiphoridae: Spongiphorinae) from Pakistan

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### SUMMARY

The earwig belongs to the order Dermaptera. They are small to medium-sized insects, often dark-colored and rather elongated. The modification of the cerci, which produces powerful, terminal, unsegmented, abdominal forceps, is usually stronger and more curved in males than in females. This makes them easily distinguishable in the adult and later juvenile stages. During the present study, specimens were collected in two phases: April 2019 to March 2020 and April 2020 to March 2021, from eleven districts of the Sindh province. A total of 373 specimens were captured and identified as belonging to the single genus *Marava* Burr, 1911, with two species: *Marava arachidis* and *Marava sindthesis* (sp. nov.). *Marava sindthesis* (sp. nov.) is reported as a new species in science. In addition to the species description, information about the distribution of the species is provided.

**Keywords:** New species, Genus, *Marava*, Earwig, Distribution

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### INTRODUCTION

A small group of insects called the Dermaptera, popularly known as earwigs, has more than 1900 living species globally (Hopkins et al., 2021). Dermaptera (Earwigs) belong to the polyneopteran order, and possess more than 2000 species across nine families. They have been reported in the subcontinent and other parts of the world (Kamimura et al., 2023). Earwigs are little to medium-sized insects that are often dark-colored and rather elongated. One distinguishing feature of earwigs is the alteration of the cerci, which produces powerful, terminal, unsegmented abdominal forceps. These forceps are usually stronger and more curved in males than in females. This feature makes them easily distinguishable in the adult and later juvenile stages (Battiston et al., 2021; Miles, 2015). When present, the tegmina is extremely short and truncated, and the hind wings are folded at rest into a small package that is towed beneath the tegmina, exposing most of the terga (Chen, 2021; Aboelhadid et al., 2022; Lund et al., 2023).

Mostly nocturnal insects, earwigs are occasionally found near lights. Earwigs typically hide themselves during the day in crevices, under the bark of trees, or under trash on the ground (Orpet et al., 2019; Saito et al., 2020). Along the Atlantic and Pacific coasts, one species, *Anisolabis maritima* (Géné), is frequently collected from

under rocks or driftwood. The female takes care of the eggs until they hatch after being laid in a burrow in the ground (Miller et al., 2011; Miller & Zink, 2012; Griffiths, 2018; Panhwar & Mustafa, 2022; Panhwar et al., 2023; Sarki et al., 2023).

Earwigs consume living tissues from flowers, ripening fruits, and vegetables in addition to feeding as scavengers on decaying organic materials. Occasionally, aphids and other tiny insects are consumed by earwigs (Binns et al., 2022; Quarrell et al., 2021). Most earwigs in cooler environments are herbivorous, while the majority of those in warm temperate and tropical climates are predators. Although predatory species consume a wide range of insects, they appear to favor soft-bodied larvae (Kahl et al., 2021; Kočárek & Wahab, 2021). Recently, a new record of *M. arachidis* has been found and tested as a laboratory-based biocontrol agent against *R. annulatus* in Egypt (Aboelhadid et al., 2022). There are about 45 species in the genus *Marava*, most of which are found in the Neotropical region (Steinmann, 1989). However, the acuminate parameters, elongate virga, accompanied by a guiding structure and a peculiar hook comprised of a pair of distinctively shaped sclerites, and the characteristic shape of the pygidium with two little tubercles on each side suggest that the current earwig is *Marava arachidis* (Kamimura et al., 2016). This hypothesis was also corroborated by the analysis of the DNA barcoding area, which revealed that the sequence differences between the *M. arachidis* samples from Malaysia and Beni-Suef, Egypt, were only 1.55% (10 out of 645 bases examined) (deWaard et al., 2008). The earwigs are of economic importance, but no work has been conducted on earwigs from Sindh, Pakistan. Therefore, the present study aimed to investigate the fauna of the *Marava* genus from Sindh

## MATERIALS AND METHODS

### COLLECTION OF THE SPECIES

The earwigs were collected from various localities in the Sindh province, including Hyderabad, Jamshoro, Matiari, Shaheed Benazir Abad, Khairpur Mirs, Dadu, Mirpur Khas, Naushero Feroz, Sanghar, Tharparkar, and Larkana. However, they avoid sunlight, and numerous species were found under stones, in onion cultivated lands, crow shelters, bathrooms, and crawling in shallow galleries and kitchens. An insect hand net was used to pick up the species, and simultaneously, they were chloroformed for a few minutes. The specimens were pinned within 30 minutes, as they were flexible and could easily lose any parts if stretched. The insect pins were inserted using one elytron of the specimen. However, the antennae and legs were left intact to display taxonomic characteristic features of unidentified insects, which were then stored in an insect box. The boxes were labeled with the date, name of collectors, and locality, and naphthalene was kept inside those boxes to avoid insect damage.

### IDENTIFICATION OF SPECIES AND DATA ANALYSIS

The identification of potential species was conducted using a stereomicroscope, following the identification methods and keys suggested by Vickery & Kevan (1983), Steinmann (1989), and Burr (1910). Measurements and diagrams were made in millimeters (mm) using the "Ocular Square Micrometer" method described by Vickery and Kevan (1983). The data was analyzed using the SPSS software.

## RESULTS

### DISTRIBUTION AND OCCURRENCE OF GENUS *Marava* BURR, 1911

The specimen were collected in two phases i.e., April 2019 to March 2020 and April 2020 to March 2021 from eleven Districts (detail is given in materials methods) of Sindh province. The occurrence and distribution of genus *Marava* were mapped that showed highest frequency for *M. arachidis* compared *M. sindhesis* species (figure 1 A and B). The *M. arachidis* was widely distributed in all districts, however, the *M. sindhesis* was found solely in District Matiari of Sindh province (Table 1). Of total 363 *M. arachidis* species, 191 were found in all districts during phase one, the species collections between April 2019 to March 2020 (Figure 2). Nonetheless, 172 species for *M. arachidis* were distributed in all districts of phase two that was searched during April 2020 to March 2021 (Table 1; Figure 3).

On the other hand, the total 10 (ten) species of *M. sindhesis* were found and distributed in only Matiari District. The six specimen were found during 2019 to 2020, whereas, only four (4) species were distributed and collected during April 2020 to March 2021 phase (Figure 2 and 3). The larger number of *M. arachidis* species were dominated in District Sanghar with 27 and 34 specimen in both phases respectively. However, the least number of species for *M. arachidis* were distributed at Matiari with three (03) species during 2019 to 2020 phase and seven (07) species were distributed at Jamshoro District during 2020 to 2021 phase (Figure 2 and 3; Table 1). These results demonstrate that occurrence and distribution of *M. arachidis* were rich compared *M. sindhesis* species.

**Table 1: The distribution of species of genus *Marava* Burr, 1911 in different Districts of Sindh Province.**

Species	A	b	C	d	e	f	G	h	i	J	k	L	Total
Apr 19-Mar 20	Hyderabad												
<i>M. arachidis</i>	---	---	2	2	5	6	1	---	---	---	---	1	17
<i>M. sindhesis</i>	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 20-Mar 21	Hyderabad												
	M	n	O	p	q	r	s	t	u	v	w	x	
<i>M. arachidis</i>	---	---	2	2	3	3	1	---	---	---	---	1	12
<i>M. sindhesis</i>	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 19-Mar 20	Jamshoro												
<i>M. arachidis</i>	---	---	---	3	4	5	---	---	---	---	---	---	12
<i>M. sindhesis</i>	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 20-Mar 21	Jamshoro												
<i>M. arachidis</i>	---	---	1	1	2	2	---	---	---	---	---	1	07
<i>M. sindhesis</i>	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 19-Mar 20	Matiari												
<i>M. arachidis</i>	---	---	---	---	---	3	---	---	---	---	---	---	03
<i>M. sindhesis</i>	---	---	---	---	3	3	---	---	---	---	---	---	06
Apr 20-Mar 21	Matiari												
<i>M. arachidis</i>	---	---	1	1	3	4	---	---	---	---	---	---	09

M. sindthesis	---	---	---	---	1	3	---	---	---	---	---	---	04
Apr 19-Mar 20	Shaheed Benazirabad												
M. arachidis	1	2	2	4	6	---	2	---	---	---	---	1	18
M. sindthesis	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 20-Mar 21	Shaheed Benazirabad												
M. arachidis	---	---	1	2	3	3	---	---	---	---	---	---	9
M. sindthesis	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 19-Mar 20	Khairpur Mirs												
M. arachidis	1	2	1	2	6	5	---	---	---	---	---	1	18
M. sindthesis	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 20-Mar 21	Khairpur Mirs												
M. arachidis	---	---	1	1	3	4	---	---	---	---	---	---	09
M. sindthesis	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 19-Mar 20	Dadu												
M. arachidis	---	1	2	3	5	4	---	---	---	---	---	1	16
M. sindthesis	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 20-Mar 21	Dadu												
M. arachidis	---	1	2	3	3	5	1	1	---	---	---	1	17
M. sindthesis	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 19-Mar 20	Mirpurkhas												
M. arachidis	---	---	2	1	4	6	---	---	---	---	---	1	14
M. sindthesis	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 20-Mar 21	Mirpurkhas												
M. arachidis	---	---	---	1	4	4	---	---	---	---	---	---	09
M. sindthesis	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 19-Mar 20	N/Feroze												
M. arachidis	3	2	1	2	5	7	1	---	---	---	---	2	23
M. sindthesis	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 20-Mar 21	N/Feroze												
M. arachidis	2	1	2	1	6	7	---	---	---	---	---	2	21
M. sindthesis	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 19-Mar 20	Sanghar												
M. arachidis	2	3	3	4	9	6	---	---	---	---	---	---	27
M. sindthesis	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 20-Mar 21	Sanghar												
M. arachidis	2	3	4	2	9	8	2	---	---	---	---	4	34
M. sindthesis	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 19-Mar 20	Tharparkar												
M. arachidis	2	3	1	2	6	5	---	---	---	---	---	2	21
M. sindthesis	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 20-Mar 21	Tharparkar												
M. arachidis	2	2	1	2	5	8	---	---	---	---	---	2	22
M. sindthesis	---	---	---	---	---	---	---	---	---	---	---	---	---
Apr 19-Mar 20	Larkana												
M. arachidis	1	1	1	2	7	8	---	---	---	---	---	2	22
M. sindthesis	---	---	---	---	---	---	---	---	---	---	---	---	---



showing the number of species and y-axis depicts the species i.e., *M. arachidis* and *M. sindhesis*.

## SYSTEMATICS AND TAXONOMY OF GENUS *Marava* BURR, 1911

### *Description of Marva arachidis* (YERSIN, 1839)

The description of *M. arachidis* revealed that the head and antenna is light brown and light golden in color respectively. While its pronotum seems light brownish and black in color. The earwigs are present. The abdomen is segmented into seven (7) sections in dark brown color. Whereas legs and forceps are golden and brown in color respectively. Inside the forceps the cerite shape like structures are present (for description see Figure 3). *Marva arachidis* is a dorsal side and scaled 0.3mm the details for measurements in millimeters (mm) of female specimen are presented in (Table 2).

*Marava arachidis* is a species of little earwig in the family Spongiphoridae and is widely found in Africa, Australia, and the Caribbean. However, we have confirmed the extensive existence of this species in eleven (11) districts of Sindh Province. The habitat of *M. arachidis* is flowers and trees. The material has been examined from eleven districts of the province with dominance in four districts, namely N. Feroze, Larkana, Sanghar, and Tharparkar, in both phases, i.e., April 2019 to March 2020 and April 2020 to March 2021.



**Figure 3: Morphology of *M. arachidis*. The species was collected from Sindh province.**

**Table 2: The morphological description of *M. arachidis* measured in (mm).**

Parameters	Female (n=30)	
	(Mean $\pm$ Sd)	(Range)
Length of head	2.89 $\pm$ 10.58	2.15-03.75
Length of antennae	2.46 $\pm$ 6.97	2.0-3.0
Length of pronotum	3.08 $\pm$ 1.48	2.50-4.0
Length of hind femur	0.35 $\pm$ 0.07	0.2-0.3
Length of hind tibia	2.56 $\pm$ 7.27	2.25-3.0
Length of hind tarsus	0.22 $\pm$ 0.04	0.1-0.2
Length of forceps	31.20 $\pm$ 12.0	2.0-2.75
Total body length	11.2 $\pm$ 05.99	9.0- 14.0

***Description of Marva sindhesis***

Description of *M. sindhesis* as a male holotype unveiled the tumid head probably triangular, distinct coronal suture faint. The antennae are segmented with approximately 25 segments. The first segment is shorter and distant from the antennal basis. The second segment is even shorter. However, the fourth segment is shorter than the third and fifth annulus respectively. The eyes are medium in size and the head is as wide as the pronotum. Notwithstanding, the pronotum is square-like and widened posteriorly with straight lateral margins, although the posterior margin is rounded. The mesonotum is totally covered by the pronoun. The tegmina are well developed and long, with no lateral keels. The posterior margin is straight but seems oblique to the longitudinal body axis, so that the tegmina form a median tip. The legs are short, but the tarsi are simple. The length of the first and third tarsomeres are equal in size. The second tarsomere is one third the size compared to the other two, and the arolium is absent. The abdomen is parallel and the abdominal tergite lacks a carina. The lateral tubercles on the third tergite are weak. The pygidium is broad (for morphological description, see Figure 4). *Marva sindhesis* was a dorsal side and scaled 0.3mm the details for measurements in millimeters (mm) are presented in (Table 3).

The coloration and pigmentation of *M. sindhesis* was analyzed and depicted specimen as dark brown in color having uniformly glabrous surface structure but shiny. Antennae are brown to yellow in color, though abdomen and head are darker than that of thorax, wings are yellow in color and distal third of the femora. The tibia and tarsi are yellowish in color. The pygidium, cerci and abdominal sternites are reddish brown (Figure 4).





**Figure 4: Morphology of *M. sindhesis*. The species was collected from Sindh province.**

Furthermore, the diagnostic characteristics features of *M. sindhesis* revealed that the species may be closely related to *socotrana* Haas 2004 but five 5mm longer in size. The pygidium is broader and ornamented than antenna and is segmented into



25 segments. The *socotrana* is ornamented and antenna has clear and visible thirteen (13) segments. The material of species has been examined and found only in one district Matiari with total 10 specimen in both 2019-20 and 2020-21 phases. The habitat of *M. sindthesis* was garden. As for as the etymology is concerned the name of the species has been allocated after the name of Sindh province. The specimen holotype was deposited and permanently stored in museum of Department of Zoology, University of Sindh, Jamshoro.

**Table 3: The morphological description of *M. sindthesis* measured in (mm).**

Parameters	Male (n=1)
Length of head	1.6
Length of pronotum	1.75
Width of pronotum	2.9
Length of tegminal	2.6
Length of cerci	6.8
length of body	13.2

## DISCUSSION

We collected 373 specimens of Dermaptera (earwigs) that belong to genus *Marava* during filed survey of eleven districts of Sindh province, Pakistan. The 363 specimens belong to *M. arachidis* species and one species with ten specimen that were recorded during 2019 to 2021 as a new record to science. However, the new species identified in this study is *Marava sindthesis*. *Marava arachidis* has already been identified and reported as reproductive biology perspective in Malaysia (Kamimura et al., 2016). *M. arachidis* has also been identified as a new record and was used as laboratory-based biocontrol agent against *Rhipicephalus annulatus* (Aboelhadid et al., 2022). *M. arachidis* the bone-house earwig is cosmopolitan species and was recorded from Australia, Africa, Europe, Caribbean North and South America and Asia (Bannerman and Geverink, 2019). Moreover, there has not any report and/or evidence been found that could manifest the new record for both *M. arachidis* and *M. sindthesis* in Pakistan. Importantly, *Marava sindthesis* is new species that identified in this study and was endemic recorded in only district Mitari, Sindh Province, Pakistan. Whereas *M. arachidis* found in all districts of Sindh province. Whether *M. arachidis* can dwell in other regions (provinces) of Pakistan, the evidence waits for further studies, however, the *M. sindthesis* is totally new record in entomological science.

## CONCLUSION

Present study concludes the finding of two species i-e: *Marava arachidis* and *Marava sindthesis* sp nov. Besides, distributional data of species are provided.

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