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The first Persian boxer mantid: a new species of *Holaptilon* Beier, 1964 from Haftad-gholeh Protected Area, Iran (Mantodea, Mantidae)

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Abstract

In order to identify the fauna of Mantodea in Iran, some specimens were collected by different collecting methods. A recent entomological survey in Markazi province has produced two conspecific male and female specimens of an undescribed species. The specimens were collected from highlands of Haftad-gholeh Protected Area, in June of 2017. The species is closest morphologically to *Holaptilon pusillulum* Beier, 1964. Therefore, a new species as the first Persian boxer mantid is described, *Holaptilon brevipugilis* **sp. n.**, along with the ootheca. Habitus images, measurement data, a key to species, and locality data are presented.

Key words: Persian mantid, new species, Iran, Mantidae, *Holaptilon*

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Introduction

The order Mantodea is a diverse group of carnivorous insects known as praying mantises. This group is comprised of approximately 2500 described species (Ehrmann, 2002). Mantidae is the largest family and consists of almost 50% of the total mantises described so far (Patel & Singh 2016). Iran is a vast country, that has a continental type of climate. A few studies on the mantis fauna of Iran have been carried out by Sakenin *et al*., (2011), Morshedi Aghbolagh *et al*., (2012), Mofidi-Neyestanak (2015) and Samin *et al*., (2016). Over the past two years, we have assembled a sizable collection of mantises from different habitats of Iran. During a preliminary survey of insects in Haftad-gholeh Protected Area (HPA) in Markazi province, a single male and a single female of an unknown species of praying mantis were collected. Both of specimens were found on the ground. The collecting site was in a high altitude location within HPA (~1800 m) in mountain ecosystem. The specimens exhibit the diagnostic character of the family Mantidae (*sensu* Ehrmann 2002). Those genera with an overall gross morphology that is markedly distinct from the undescribed specimens were excluded in our generic-level comparisons (*e.g.* very small-sized and wingless mantises). After a thorough examination, we determined specimens to be representative of an undescribed species belonging to the monotypic genus *Holaptilon* Beier, 1964. Although distinct from the only other species in the genus, *H.pusillulum* Beier, 1964, our new species shares a number of similarities justifying its inclusion within the genus. *Holaptilon* is classified within the tribe Amelini with 28 other genera (Patel & Singh 2016). This mysterious genus was firstly described over a half-century ago, but there is no considerable information about it. We now describe the new species using male and female specimens as well as characterize the ootheca.

Materials and methods

Region sampled

Haftad-gholeh Protected Area is the largest protected mountainous area in Markazi province, covering about 97,400 hectares (240,680 acres) of pristine habitat. The area resides in the central part of Iran between three major cities, Arak, Mahallat and Khomein. HPA has been known as an important habitat to a large number of vulnerable vertebrate species. The average annual temperature of HPA is 13.9 degrees Celsius. July normally ranks as the warmest month, with an average temperature of 27.1 degrees Celsius. February is typically the coldest month, with an average temperature of 0 degrees Celsius. The spring and autumn are short-period seasons. The winter lasts from four to six months, this long-period season has 65 to 120 freezing days. On average, January is the most humid. On average, August is the least humid month. The annual average humidity is 46%. The area elevation ranges from 1728–2993 meters and it receives rain in excess of 340 mm per year (Islamic Republic of Iran Meteorological Organization 2015).

Collection and preparation

Descriptive conventions and character systems

The species treatment within this study provides a brief diagnosis, and verbal character descriptions stemming from the anterior surface of the head, the dorsal surface of the thorax, the prothoracic leg, and the abdomen. The verbal descriptions are provided for the male and female as well as the ootheca. Foreleg spine nomenclature follows Wieland (2013) where diagrams of arrangements can be viewed.

Measurements. Eighteen measurements were obtained using a SaIran ZSM-1001 stereo-microscope. All measurements are presented in millimeters.

1.) *Body length* = length of body from central ocelli to posterior tip of abdomen; 2.) *Pronotum length* = from anterior margin to posterior margin; 3.) *Prozone length* = anterior margin of pronotum to center of supra-coxal sulcus; 4.) *Pronotum width* = from lateral margins at the widest point, the supra-coxal bulge; 5.) *Head width* = from lateral margins of the eyes at widest point;

6.) *Head vertex to clypeus* = from the vertex of the head at center to the lower margin of the frons and upper margin of clypeus; 7.) *Frons width* = from lateral margins of frons, inferior to the antennal insertions, at the widest point; 8.) *Frons height* = from upper margin abutting central ocellus to lower margin abutting clypeus; 9.) *Prothoracic femur length* = from proximal margin abutting trochanter to distal margin of genicular lobe; 10.) *Mesothoracic femur length* = from most proximal margin abutting trochanter to the distal side of the terminal spine insertion site; 11.) *Mesothoracic tibia length* = from most proximal groove near joint with the femur to the distal side of the terminal spine insertion site; 12.) *Mesothoracic tarsus length* = from proximal joint to the apex of the ungues curve; 13.) *Metathoracic femur length* = from most proximal margin abutting trochanter to the distal side of the terminal spine insertion site; 14.) *Metathoracic tibia length* = from most proximal groove near joint with the femur to the distal side of the terminal spine insertion site; 15.) *Metathoracic tarsus length* = from proximal joint to the apex of the ungues curve; 16.) *Anteroventral femoral spine count* = all inner marginal ridge spines and two proximal near marginal spines, but excluding the genicular spine; 17.) *Anteroventral tibial spine count* = all inner marginal ridge spines, but excluding the distal terminal spur; 18.) *Posteroventral tibial spine count* = all outer marginal ridge spines, but excluding the distal terminal spur.

Imaging Habitus images were captured with a Canon 7D SLR mark2, macro lens (100mm). Images were processed in Adobe Photoshop CS6 Extended to adjust levels, contrast, exposure, sharpness, and add scale bars. Minor adjustments were made using the stamp tool to correct background aberrations and to remove distracting debris.

Taxonomic placement

Mediterranean and Middle East distributed species classified within Amelinae (sensu Ehrmann 2002; Battiston *et al*. 2010) were compared with the male and female of the undescribed species (*H. brevipugilis* sp. n.) discovered in HPA. In addition, available keys by Giglio-Tos (1927) were used to recover genus level identification. Both methods proved that the new taxon had the greatest affinities with *Holaptilon pusillulum* Beier, and should be included within the monotypic genus *Holaptilon* Beier, 1964.

Many characters easily define *H. pusillulum* and *H. brevipugilis* as congeneric including: the vertex is slightly curved without clear furrow; ocelli very small even in the male; the pronotum is almost oval; forefemora dorsal margin uniquely curved, inner face with colorful pattern; apterism in both sexes; the forefemora with 12 anteroventral spines; the foretibiae with 10 anteroventral spines; and the supra-anal plate transverse; the whole body spotted of brown.

Holaptilon Beier, 1964

Holaptilon has been monotypic until now.

Very small-sized mantis. Head thick and broader than the pronotum. Vertex rounded. Frontal sclerite transverse. Globular eyes. Ocelli very small in both sexes, far apart from each other. Antennae thin, threadlike and lightly ciliated in the male. Pronotum flat, short and compact. Both sexes apterous. Forelegs compact, forecoxae longer than pronotum. Forefemora broad with dorsal edge curved. Mid and hind femora clearly thicker near to the base. Metatarsi of hind legs shorter than the remaining articles taken together. Abdomen slender with weakly carinate segments. Supra-anal plate transverse, triangular and rounded in the tip. Cerci short and projecting the supra-anal plate (Beier 1964).

Key to species

Male forefemora inner face with slight curved white patch on the distal that not creating an apical black spot (Fig. 2A). Male mesonotum and metanotum posterior margin more concave (Fig. 4 A). Male foretibiae with 13 posteroventral spines.....***pusillulum* Beier, 1964**

1'Male forefemora inner face with rounded white patch on the distal that creating an apical black spot (Fig. 2B). Male mesonotum and metanotum posterior margin less concave (Fig. 4B). Male foretibiae with 12 posteroventral spines.....***brevipugilis* sp. n**.

***Holaptilon pusillulum* Beier, 1964**

Repository. Paratype male (M3942). Natural History Museum Vienna.

Paratype labels: Pinned. Israel, Jerusalem Yad Vashem, 9 July 1964, det. M. Beier.

Distribution. Israel and Jordan (Abu-dannoun & Katbeh-Bader 2007).

Diagnosis. Head and body sand-colored, spotted of brown. Vertex curved, without clear furrows. Frontal sclerite more than twice as broad as high. The flagellomeres pale in the basal half. Pronotum with oval outline, constricted only near the base, about 1.3 times longer than broad. Metazone barely 1.4 times longer than prozone. Forecoxae anteriorly with some small black teeth. Forefemora very compact, with curved dorsal edge; 12 anteroventral spines; 4 discoidal spines, of which first very short, second and 3rd curved; 4 very short external spines. Femoral brush proximal margin extending beside the anteroventral spine 9. Foretibiae rather compact, with 13 short posteroventral spines and 10 anteroventral spines. Supra-anal plate transverse, triangular, with blunt apex.

Male morphometry: body length 10–12; pronotum length 2.7; metazone length 1.6; pronotum width 2.1; head width 2.1; metathoracic femur length 4; metatarsus of hind leg 1.8.

Female morphometry: body length 14.5; pronotum length 3.1; metazone length 1.8; pronotum width 3.1; head width 3.3; metathoracic femur length 4.3; metatarsus of hind leg 1.8.

***Holaptilon brevipugilis* Kolnegari, sp. n.**

http://zoobank.org/D07CEEB8-B5FB-4FAB-B69A-BD4792B655F0

Repository. Holotype Male (IAUAMKM0135). Allotype Female (IAUAMKM0136). Islamic Azad University of Arak, Markazi, Iran.

Holotype and Allotype labels: Pinned. Iran, Haftad-gholeh Protected Area, 34.1288264, 50.0729371, 1803 m, 9–10 June 2017, Coll: M. Kolnegari.

Natural history. Based on the collecting location on the ground for both the male and the female, we presume that the species utilizes a low vegetation. The male and the female walks rapidly through vegetation and uses her forelegs periodically, pausing and moving them similar to boxing mantises (species of *Hestiasula*).

Diagnosis. The easiest way to distinguish *H. brevipugilis* from *H. pusillulum* is the distinct dark asymmetrical dumbbell-like pattern on the pronotum (Figs 4B–C). In addition, body color is relatively darker in *H. brevipugilis*.

Description. Male. Holotype (Fig. 1A): Male was preserved in 95% ethanol and later pinned, causing some deformation in the head and abdomen. Body length 12.2; pronotum length 2.9; prozone length 1.1; pronotum width 2.3; head width 2.8; head vertex to clypeus 1.6; frons width 1.1; frons height 0.3; prothoracic femur length 3.6; mesothoracic femur length 2.9; mesothoracic tibia length 2; mesothoracic tarsus length 2.6; metathoracic femur length 3.7; metathoracic tibia length 3.2; metathoracic tarsus length 4.2; anteroventral femoral spine count R12/L12; posteroventral femoral spine count R4/L4; anteroventral tibial spine count R10/L10; posteroventral tibial spine count R12/L12.

Head (Fig. 3A): Transverse, eyes globular; the vertex rounded without clear furrows; juxta-ocular protuberances absent. Frontal sulcus faint, but a forming convex surface. Ocelli very small; a carina connecting former ocellar locations connecting all three and forming a U. Frontal sclerite transverse, more than twice as broad as high, dorsal margin slightly sloping on both sides, in the middle with a small raised point between antennae, lower margin with a transverse ridge. Clypeus transverse, the upper margin slightly convex, the lateral margins tapering; surface with a medial carina. Labrum rounded. Antennae length 8 mm, with a mostly pale scape and pedicel, but both with small black marks; a clear black band on top of the scape; the flagellomeres relatively dark in the basal half, transitioning to black on the distal end of the antennae, the setae pale colored. Anterior surface of head relatively pale with dense dark markings; frons, clypeus and labrum taupe with dark splotches of black; vertex taupe with black splotches; area around ocelli black; a black band between gena and postgena; mandibles taupe.

Pronotum (Fig. 4B): Short, compact, longer than wide, almost oval, rounded off to the anterior margin and passing on to the posterior margin, featuring slight lateral cuticular expansions and a pale medial carina. The margins smooth, but with setae present and sparse black spots. The supra-coxal bulge not distinctly pronounced. The supra-coxal sulcus, well marked, arched, separates the

prozone from the metazone. The prozone slightly bulged. The metazone with slightly concave lateral margins in the posterior half, then widening to the anterior half; two carina oriented anterolateral from medial carina. A dark asymmetrical dumbbell-like pattern on the pronotum.

Mesonotum and metanotum (Fig. 4B): lateral margins almost straight. The mesonotum posterior margin fairly concave, the anterolateral corners visible from the dorsal perspective. The metanotum posterior margin fairly concave.

Forelegs: Femur shape unique with a curved dorsal margin, laterally dotted specially in the dorsal half; spines all tipped blackish; femoral groove to accommodate the tibial spur located near to the base. Dorsal margin narrowing, almost lamellar with a few tubercles each giving rise to a long hair. Outer face of femur pale and darkly blotched; inner face mostly bluish black with large shiny brownish orange patch in the proximal two-thirds of ventral half. 4 discoidal spines, the first and fourth small, the second and third robust. Anteroventral femoral spines short, almost similar length to each other; posteroventral femoral spines all of the same length, spiked between the spines; the posterior and anterior genicular spines small, but robust. Femoral brush proximal margin not extending beside the anteroventral spine 9. Tibia with sparse setae specially along the dorsal margin; inner face mostly pale, but with black band along the ventral margin basal half; outer face pale with black stippling. Posteroventral tibial spines 2–11 of similar length, the proximal spine 1 smaller than the others, the distal spine 12 larger than the others; anteroventral tibial spines gradually increase in length from the most proximal to the most distal spine. Forecoxae mostly smooth with setae interspersed throughout, a few tubercles present along the margins, posterior surface mostly black but distal and posterior margin pale; anterior surface shiny black.

Meso- and Metathoracic Legs: Femora clearly thicker near to the base, with ventral (posterior) carina well developed; dorsal (anterior) carina absent; surface with fairly dense setae; darkly speckled with black markings. Coxae with black markings speckling the surface. Tibia round, covered with setae; mostly pale, with a number of black marks, some appearing as bands. Tarsi short, moderately flattened and pale; the first tarsal segment basally blackened; all tarsal segments have a dark spot on the distal end; mesotarsi and metatarsi with the first segment shorter than the remaining segments combined.

Wings: Apterous.

Abdomen: Slender, with weakly carinate segments. A dark medial band across tergites, pronouncing on the posterior margin of each segments. Supra-anal plate transverse, triangular, rounded in the tip (Fig. 5A).

Female. Allotype (Fig. 1B). Body length 15.9; pronotum length 2.9; prozone length 1; pronotum width 2.6; head width 3; head vertex to clypeus 1.6; frons width 1.2; frons height 0.5; prothoracic femur length 3.1; mesothoracic femur length 2.6; mesothoracic tibia length 1.9; mesothoracic tarsus length 2.2; metathoracic femur length 3.6; metathoracic tibia length 3.7; metathoracic tarsus absent; anteroventral femoral spine count R12/L12; posteroventral femoral spine count R4/L3; anteroventral tibial spine count R9/L10; posteroventral tibial spine count R13/L12.

Head (Fig. 3B): Transverse, eyes globular; the vertex rounded, without clear furrows. The vertex anterior half mostly pale with sparse dark splotches, complete or incomplete black circles around ocelli.; juxta-ocular protuberances absent. Frontal sulcus faint, but a forming convex surface. Ocelli very small; a carina connecting former ocellar locations connecting all three and forming a U. Frontal sclerite transverse, more than twice as broad as high, both upper and lower margins curved downward, in the middle with a small raised point between antennae. Clypeus transverse, the upper margin hardly convex, the lateral margins tapering; surface without a pronounced medial carina. Labrum rounded. Antennae length 5 mm, with a mostly pale scape and pedicel, a clear black band on top of scape; the flagellomeres relatively dark in the basal half, transitioning to obvious black on the distal end of the antennae, the setae pale colored. The frons, clypeus, labrum and mandibles taupe with dark splotches of black; a black band between gena and postgena.

Pronotum (Fig. 4C): Short, compact, slightly longer than wide, almost oval, rounded off to the anterior margin and passing on to the posterior margin, featuring lateral pronotal expansions and a pale medial carina. The margins smooth, but with setae present and sparse black spots. The supra-coxal sulcus, relatively marked, arched, separates the prozone from the metazone. The prozone almost flat. The metazone with hardly concave lateral margins in the posterior half, then widening to the anterior half. A dark asymmetrical dumbbell-like pattern on the pronotum.

Mesonotum and metanotum (Fig. 4C): lateral margins almost straight. The mesonotum posterior margin slightly concave, the anterolateral corners visible from the dorsal perspective. The metanotum posterior margin almost straight.

Forelegs: Femur with a curved dorsal margin, laterally dotted specially in the dorsal half; spines all tipped blackish; femoral groove to accommodate the tibial spur located near to the base. Dorsal margin narrowing, almost lamellar with a few tubercles each giving rise to a long hair. Outer face of femur pale and darkly blotched; inner face mostly bluish black with large shiny brownish orange patch in the proximal two-thirds of ventral half. 4 discoidal spines, the first and fourth small ,the second and third robust, barely curved. Anteroventral femoral spine (proximal to distal) 2 longest; femoral brush proximal margin not extending beside the anteroventral spine 9; posteroventral femoral spines all of similar length; the posterior and anterior genicular spines small but robust. Tibia with sparse setae specially along the dorsal margin; inner face mostly pale, but with black band along the ventral margin basal half; outer face pale with black stippling. Posteroventral tibial spines 2–12 of similar length, the proximal spine 1 smaller than the others, the distal spine 13 larger than the others; anteroventral tibial spines gradually increase in length from the most proximal to the most distal spine. Trochanter mostly pale but inner face tending to black. Forecoxae mostly smooth with setae interspersed throughout, a few tubercles present along the margins; inner face mostly black, anterior margin pale; large black spot covering most of the outer face.

Meso- and Metathoracic Legs: Femora clearly thicker near to the base, with ventral (posterior) carina well developed; dorsal (anterior) carina absent; surface with numerous small, fine setae; darkly speckled with black markings. Coxae with black markings speckling the surface. Tibia round, covered with setae; mostly pale, with dark bands. Tarsi short with ample setae; mostly pale with the tarsal segments are light proximally and darken toward the distal end; mesotarsi and metatarsi with the first segment shorter than the remaining segments combined.

Wings: Apterous with no visible vestiges.

Abdomen: broad, spindle shaped, the widest being the middle, with weakly carinate segments. Tergites and sternites with numerous small, black spots. Supra-anal plate transverse with almost flat terminus. The ovipositor enlarged, projecting far beyond the distal margin of the supra-anal plate and the cerci. Cerci short, round, with 8 segments, exceeding the supra-anal plate by only a little (Figs 5B–C).

Some morphological differences between *Holaptiolon brevipugilis* sexes: the vertex more convex in the female than the male; the postfrontal sulcus more rounded in the female than the male; the coronal sulcus more pronounced in the female than the male; the frontal sclerite upper and lower margins ridged in the male, rounded in the female, the lateral margins more extended in the male than the female; a black band between gena and postgena more pronounced in the male than the female; the metanotum posterior margin slightly concave in the male but straight in the female.

Ootheca (Fig. 6A–B): *Measurements*. Length 7.9; width 3.6; height 3.4. From the dorsal perspective, the ootheca appears elliptical, with a distinct ventral point on the posterior end where the egg-case laying terminated. The ootheca is convex dorsally from the lateral perspective. The anterior end is smaller than the remainder of the ootheca. Egg chambers can be seen in rows perpendicular to the top and bottom of the egg-case. There is relatively little air space, the egg chambers extending nearly to the perimeter of the ootheca. The ootheca is dark yellow.

There is an orange medial line from the ventral perspective. The method of attachment for this species appears to be smooth vertical surfaces. A single specimen laid its ootheca on the side wall of a container, above the small twig.

Etymology. The word *brevipugilis* is derived from the latin word *brevi* (meaning small) and the latin word *pugilis* (meaning boxer). This name was crafted to reflect the small size and an asymmetrical dumbbell-pattern on the pronotum, additionally the behavior of this mantis, opening and shaking the forelegs like a boxer.

Acknowledgment
We would like to thank Frank Wieland for his opinions. we also would like to thank Susanne Randolf and Harald Bruckner of the Natural History Museum, Vienna, Austria for access to specimen pictures. Thanks to Mandana Hazrati and Reza Babaie-pour for their help in the field.

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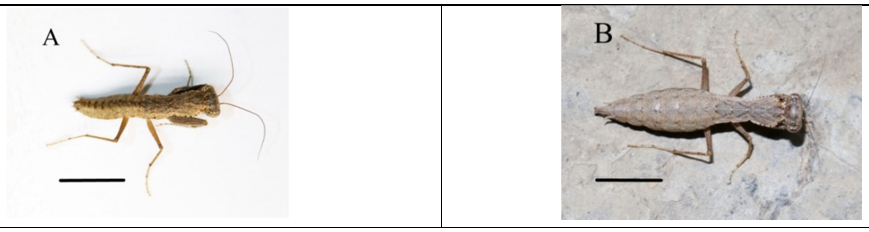

Fig. 1- *Holaptilon brevipugilis* sp. n. live habitus (scale bar: 5 mm). A holotype male (IAUAMKM0135) B Allotype female (IAUAMKM0136)

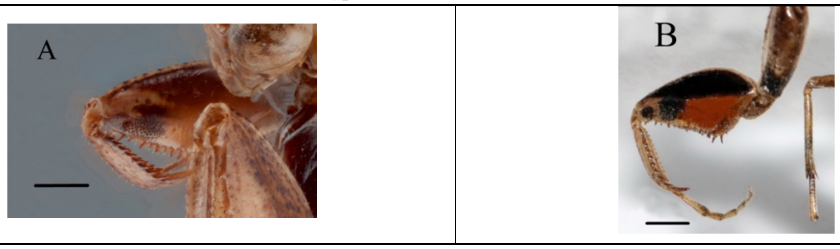

Fig. 2. *Holaptilon* foreleg inner face (scale bar: 1 mm). A *Holaptilon pusillulum* Beier, 1964, B *Holaptilon brevipugilis* sp. n.

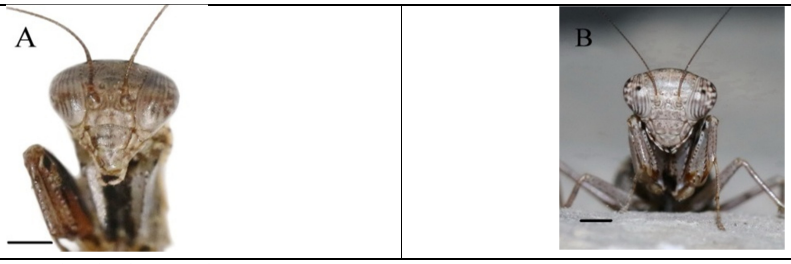

Fig. 3. *Holaptilon brevipugilis* sp. n. head (scale bar: 1 mm). A holotype male, B Allotype female

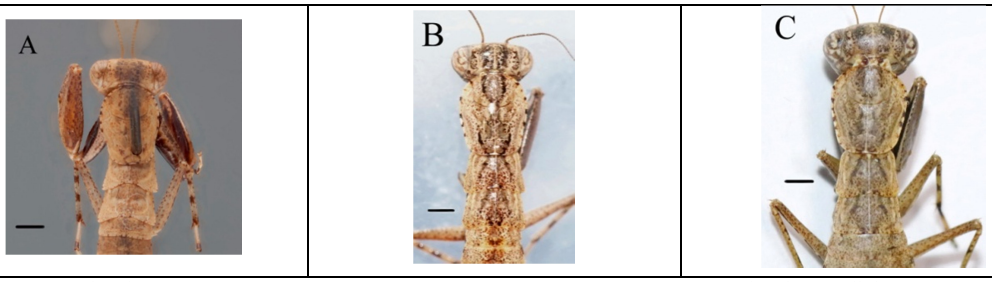

Fig. 4. *Holaptilon* head and thorax from the dorsal perspective (scale bar: 1 mm). A *Holaptilon pusillulum* Beier, 1964 B *Holaptilon brevipugilis* sp. n. holotype male (some changes in its color by the ethanol) C *Holaptilon brevipugilis* sp. n. allotype female

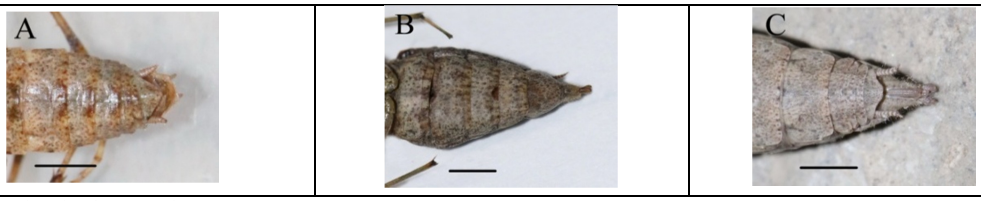

Fig. 5- *Holaptilon brevipugilis* sp. n. abdominal terminal segments (scale bar: 1 mm), A holotype male, from dorsal perspective (some changes in its color by the ethanol), B allotype female, from ventral perspective, C allotype female, from dorsal perspective

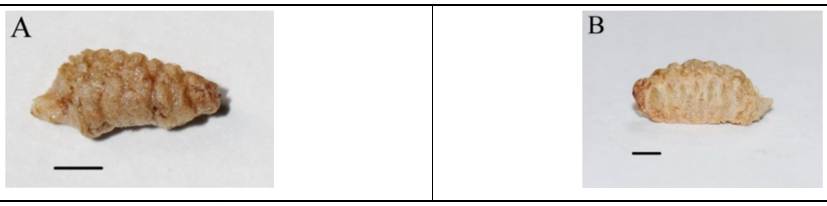

Fig. 6. *Holaptilon brevipugilis* sp. n. ootheca (scale bar: 2 mm). A dorsal, B lateral

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فصلنامه تخصصی تحقیقات حشره‌شناسی
(علمی- پژوهشی)
جلد ۱۰، شماره۲، سال ۱۳۹۷، (۹-۱۷)

توصیف نخستین شیخک مشت‌زن ایرانی، گونه‌ای جدید از جنس *Holaptilon* Beier, 1964 (Mantodea, Mantidae) از منطقه حفاظت شده هفتادقله اراک

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چکیده

به‌منظور مطالعه فون شیخک‌های ایران، به روش‌های مختلف نمونه‌برداری‌هایی صورت گرفت که در نتیجه آن دو فرد نر و ماده از گونه‌ای ناشناخته در خردادماه سال ۱۳۹٦ از منطقه حفاظت شده هفتاد قله استان مرکزی جمع‌آوری گردید. این گونه به‌عنوان نخستین شیخک مشت‌زن ایرانی، متعلق به جنس *Holaptilon* بوده که به دلیل رفتار مشت‌زنی آن‌ها در مواجه با یکدیگر با نام ***Holaptilon brevipugilis* sp. n.** به معنی «مشت‌زن کوچک» نامگذاری گردید. در این مطالعه کلید شناسایی گونه‌های این جنس و توصیف کیسه تخم و همچنین معرفی خصوصیات زیستگاه صورت گرفته است.

واژه‌های کلیدی: شیخک ایرانی، گونه جدید، Mantidae، *Holaptilon*

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