Research Article

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Description of a new species of aquatic mite, Unionicola triprocessus (Acari: Unionicolidae) collected from Taramsa village and Naqada island, Qena Governorate, Egypt

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Abstract: *Unionicola triprocessus*, a new species of the freshwater mite genus *Unionicola,* is described for the first time from waters of two islands near the Taramsa village and Naqada city, Qena Governorate, Egypt. This species is parasitized on the freshwater mussel, *Caelatura aegyptiaca.* The morphological characters of female and male the present species are in accordance with those of family Unionicolidae and genus *Unionicola.* The specific characters of the present species compared with characters of other published species of the same genus. These characters are summarized as follows: In both sexes, palpal tibia bears three processes (teeth-like pegs), palpal tarsus ends with three clawlets and 22 pairs of genital acetabulae. In female, two pairs of dorsal plates, five pairs of platelets, 10 pairs of dorsal setae, two pairs of pores and four pairs of genital setae. In male, seven dorsal plates, four pairs of platelets, three pairs of glandularia, three pairs of pores, eight pairs of dorsal setae and five pairs of genital setae.
Keywords: Freshwater mussels – aquatic mites - Unionicolidae - *Unionicola* - *triprocessus*

1. Introduction

Freshwater mites of the family Unionicolidae live either in or close to fresh water bodies and are associated with freshwater mussels (Bivalvia: Unionoida) in lakes and streams [1-3]. Many unionicolid mites are parasitic on fresh water bivalves in the family Unionidae and snails in the families Viviparidae and Ampullariidae [4-6]. Also, other species of unionicolid mites are parasitic on sponges [7-9]. The mollusc-associated mites are readily divided into two groups: mantle mites and gill mites [10-13]. On the other hand, [14,15] reported that *Unionicola* species are free-swimming, or associated with bivalves, gastropods or sponges.

The identification, classification and morphology of *Unionicola* species were recorded from different regions all over the world including Europe, South and North America, Asia, Africa, Australia, Russia and India [16-22]. Unfortunately, little attention has been focused on taxonomical and morphological studies of unionicolid water mites in Egypt. Of the few works in these regards from freshwater mussels in River Nile, Sohag, Egypt**.** Among the few studies in this regard: [23-25] described *Unionicola anodontae, U. niloticus* and *U. palpatus* from bivalve *Anodonta rubens***.** Ramadan et al., [26] described *Unionicola aegyptiaca* from bivalve *Caelatura aegyptiaca.*

This study aims to describe and morphologically characterize a new species of genus *Unionicola* collected for the first time from the freshwater mussel, *Caelatura aegyptiaca* which were collected from water sources surrounding two islands near Taramsa Village and Naqada City in the Qena Governorate, Egypt .

2. Materials and methods

The study protocol was approved by the Research Ethics Committee, Faculty of Science, South Valley University (REC-FSCI-SVU), Qena, Egypt, with the Ethics Reference No. 002/07/25. The unionid freshwater mussels *Caelatura aegyptiaca* were collected from two sites through one year from January till December 2024. The first site is a small island near the western bank of the Nile River facing Taramsa village (26°08'41"N 32°42'29"E). The second site is also, a small island near the western bank of the Nile River facing Naqada city is (25°53'41"N 32°43'28"E). To avoid the loss of host-associated mites, the mussel specimens were hand-picked and placed individually in polyethylene bags. To collect adult mites, the mussels and the polyethylene bags were carefully examined under a dissecting microscope in the lab. Each mussel sample was opened, and the soft parts were examined. The adult stages were found in the mantle cavity and between the gills. Then the collected mites were counted and preserved in 70% alcohol and some of them were uploaded for photography and drawing. Specimens were prepared according to [27].

For Scanning Electron Microscope (SEM) study, few specimens of adult mites were washed in buffer solution and then fixed in a mixture of 3 volumes of 4% glutaraldehyde and one volume of 1% osmium tetroxide for 4 hours. They were dehydrated in graded series of ethanol, critical point dried, gold

coated, and viewed under a JEOL 5300 Scanning Electron microscope at an operating voltage ranged from 10-30 V.

The holotype mite specimens is preserved in Zoology Department, Faculty of Science, Qena University.

2.1 Identification

The collected water mite species identified according to the keys of [3, 14, 15, 21, 23-26, 28-33]. The present mussel host identified according to key of [34,35]. All measurements of the present mite are given in µm.

The Holotype and Paratype specimens of the present mite deposited in Zoology Department, Faculty of Science, Qena University.

3- RESULTS

***Unionicola triprocessus* sp. nov.**

3.1 Diagnosis of adult forms

The adult females and males of this species have oval-shaped bodies. Both sexes possess raptorial-shaped palps, each consisting of five curved segments. The palpal tibia has three processes (teeth-like pegs), each process bears on tubercle with a short simple seta. Palpal tarsus terminates with three clawlets. The genitalia of the adult two forms characterized with two genital plates. Each plate bears twenty-two acetabulae. Each ventral genital flap of female carries three simple setae. The ventral surface of the adult two forms has two groups of coxal epimerae on each side; each group consists of two epimerae.

3.2 Description of female: (Fig. 1A-E; Pls 1A-H, 2A-C)

Holotype - one female, island at the western bank of the River Nile facing Taramsa village (26°08'41"N 32°42'29"E).

Paratypes – 4 females, two islands at the western bank of the River Nile facing Taramsa village (26°08'41"N 32°42'29"E) and Naqada city (25°53'41"N 32°43'28"E) Qena Governorate.

The body of alive specimen is oval-shaped brown in color about 1257 µm and 701 µm in length and width respectively. Rostral shield is triangular in shape and extended dorsally anterior to the idiosoma without setation. Each pedipalp consists of five segments. Trochanter segment (P-1) is the smallest in size without setae. Femur segment (P-2) is the longest one and wider than the remaining palpal segments and carries two pairs of simple setae. Genu segment (P-3) is slightly trapezoidal in shape and bears two simple setae. Palpal tibia (P-4) is elongated and carries two tiny simple setae and three lateral processes. Each process carries a simple seta on tubercles. Palpal tarsus (P-5) is rectangular in shape and carries eight simple setae different in size and terminates with three various sized clawlets. The cheliceral base is rectangular in shape and bears two long movable digits. Each digit is differentiated into dimarginally serrated basal part, while its terminal part is saw-like in shape.

The dorsal surface has Y-shape sense organ, two pairs of plates, five pairs of platlets, ten pairs of simple setae and two pairs of pores. The first pair of plates is located in the center of the body on either side of Y-shape. Each central plate is rectangular in shape and decorated with Bright spots. The second pair of plates is smaller than the first one and carries a pair of eyes on each one. The platelets are arranging as follows: two pairs in the region of eyes, one pair lateral to the first pair of plates, two pairs in the opisthosomal region. The simple setae are scattered on the dorsal surface, while the pores, one pair behind the eye plates and the other one lateral to the first pair of plates

The ventral view of the female consists of four coxal epimerae (I-IV) on each side of the body, three pairs of glandularia and a pair of pores around the genital area. Coxal epimera (I) is rectangular in shape with posterior projection extended to coxal epimera (III) and carries five short simple setae. Coxal epimera (II) is oval in shape and bears three simple setae. Coxal epimera (III) is separated from coxal epimera (IV) by incomplete suture and carries four simple setae, while coxal epimera (IV) is the largest one and bears six simple setae. The last two coxal epimerae decorated with Bright spots. The first pair of glandularia lie between the epimerae (II) and (III), the second one behind epimerae IV and the third one around the genital area.

The genital opening is an elongated and guarded by one pair of genital plates. Each genital plate is D-shaped and carries twenty-two genital acetabulae and four simple setae (two on anterior margin and two on posterior one). Each plate has two flaps (one dorsal and one ventral). The dorsal flap is elongated and terminated with long simple seta, while the ventral flap has D-shaped and carries three simple setae. The anus is circular in shape and surrounded with rounded striation,

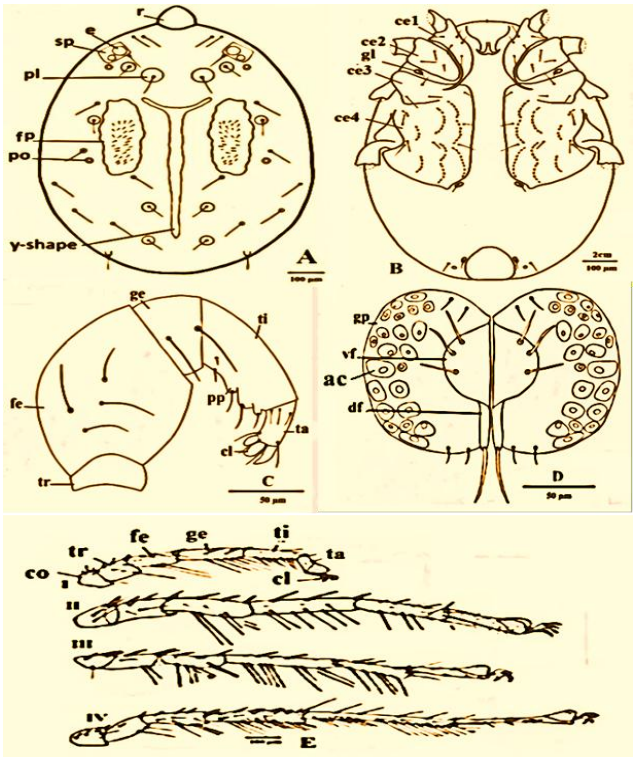

Fig.1. Camera lucida drawing of female ***Unionicola triprocessus*** showing A, dorsal view; B, ventral view; C, palp; D, genital area; E, legs.

Each leg has six segments and carries groups of swimming hairs, short quill- like setae, club- like setae, didentated-like setae, serrated setae and coalesced minute hairs, each leg terminates with a pair of hook-like claws which are forked distally. Each leg tarsus has a socket-like pit or fossa on its terminal area in which the claws could be retracted during rest. Leg I in both sexes is the shortest of all and followed by III then II and IV (Figs 1E, 2E; Pl. 3D-H)

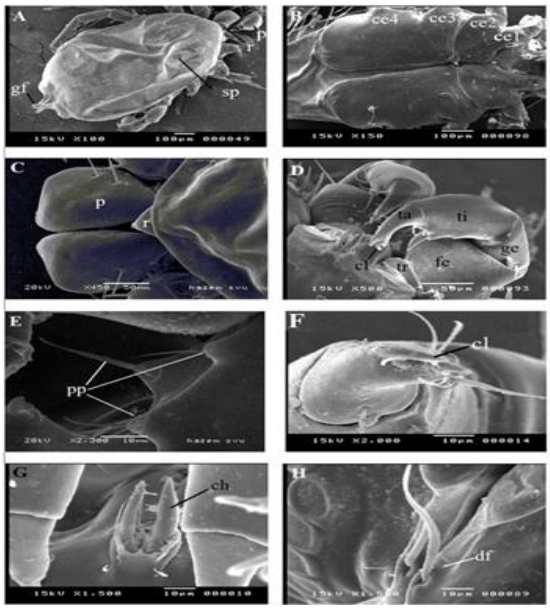

Plate 1: Scanning electron micrographs of adult female of *Unionicola triprocessus* showing: A, Dorsal view; B, Ventral view; C, Rostrum; D, gnathosoma; E, Palpal processes; F, Palpal tarsus; G, Chelicerae; H, dorsal flaps of genitalia.

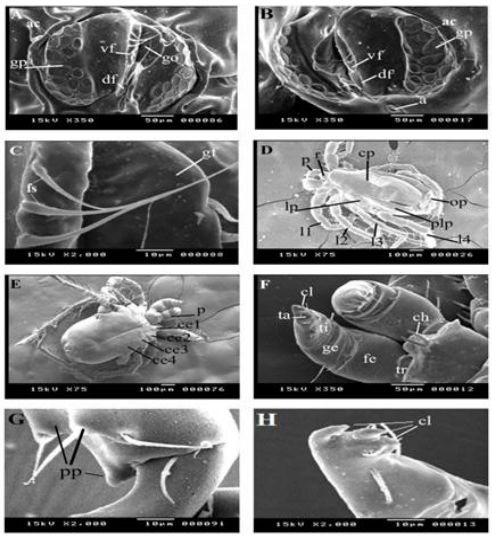

Plate 2: Scanning electron micrographs of adults female and male of *Unionicola triprocessus* showing: A; Genital area of female ; B, dorso-ventral view of female genital area showing genital acetabulae, genital opening and anus ; C, ventral flaps of female genitalia; D, dorsal view of male; E, ventral view of male; F, gnathosoma of male; G, Palpal processes of male; H, Palpal tarsus of male

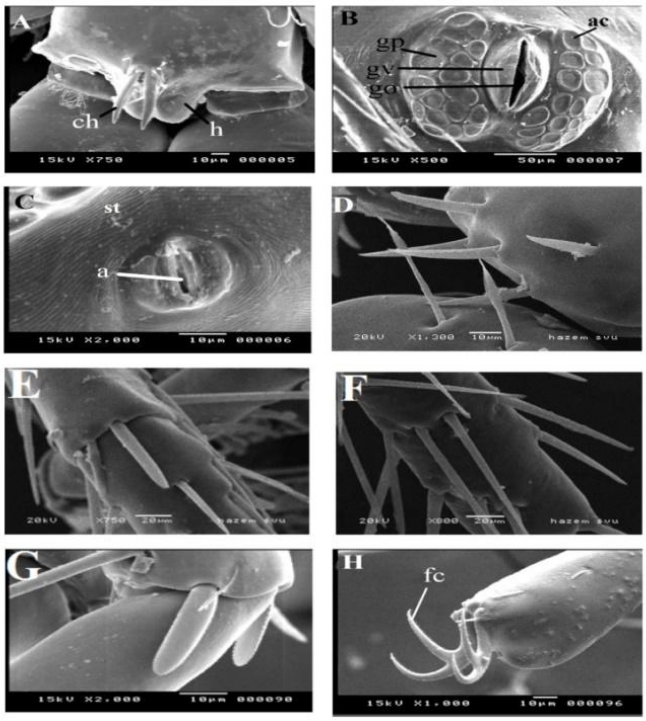

Plate 3: Scanning electron micrographs of the male of *Unionicola triprocessus* showing: A, Chelicerae and hypostome; B, ventral view of genital area showing genital acetabulae, and genital opening; C, anus and its striation; D-G different types of setae on legs (I-IV) for both sexes; H, End of leg I display claws

Description of male (Fig. 2A-E; Pls 2D-H; 3A-C):

Holotype - one male, island at the western bank of the River Nile facing Taramsa village (26°08'41"N 32°42'29"E).

Paratypes – 4 males, two islands at the western bank of the River Nile facing Taramsa village (26°08'41"N 32°42'29"E) and Naqada city (25°53'41"N 32°43'28"E) Qena Governorate.

Male of the present species is similar to the female in case of body shape, color, structure of chelicerae and palps, rostral shield, coxal epimerae, ventral glandularia, anus and legs. The body of male measures about 1000 and 518 µm in length and width, respectively. All palpal segments of male are similar to its female except the simple setae of palpal tarsus (P-5) are seven in number.

The dorsal surface of male characterized by the presence of seven dorsal plates (two central, two laterals, two para-laterals and one opisthosomal), four pairs of platelets, three pairs of glandularia, three pairs of pores and eight pairs of dorsal setae. The first central plate is an inverted U-shaped, located behind the rostral shield and carries two pairs of eyes, a pair of platelets, a pair of glandularia and a pair of pores. The second central plate is the largest one, Pear-like in shape and carries y-shaped sense organ, five pairs of simple setae and two groups of bright spots. The lateral plates are elongated in shape and lack setae. Each para-lateral plate is elongated with narrower anterior top than the posterior one and carries a pair of pores, a pair of glandularia and three platelets. The opisthosomal plate

is rectangular in shape and carries two pairs of simple setae. Each platelet and glandurlaria bear one simple seta, respectively. The dorsal setae are scattered on the dorsal plates.

The male genital opening is an elongated, slit- like structure, guarded by an inverted heart-shaped plates with internal valves. Each genital plate carries twenty-two acetabulae and three tiny simple setae. The genital valves are elongated and carry two pairs of short simple setae.

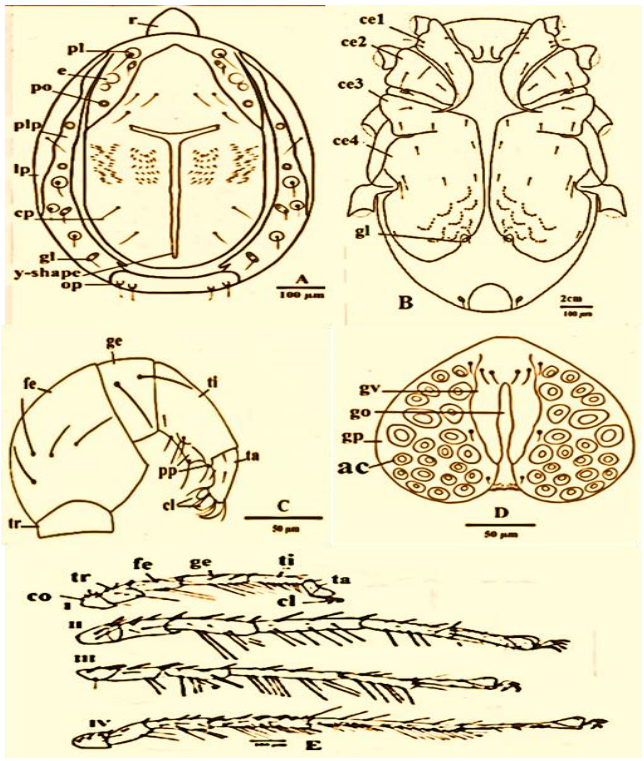

Fig.2. Camera lucida drawing of male ***Unionicola triprocessus*** showing A, dorsal view; B, ventral view; C, palp; D, genital area; E, legs.

4. DISCUSSION

Based on taxonomic keys for families, genera, and species, the current species exhibits diagnostic characters of the family Unionicolidae. These include a skinned body, palpal tibia bearing three teeth-like peg processes, coxal plates usually arranged in two groups, and a life cycle featuring parasitic larval stages (in bivalve gills) followed by free-living adults inhabiting the host's mantle cavity.

This species is further characterized by two widely separated pairs of eyes, both mounted on a shared ocular plate. The palps are raptorial and exhibit a pronounced inward curvature. The chelicerae possess movable digits with finely serrated edges along both margins.

These characters are in accordance with the genus *Unionicola.*

The diagnostic characters of the species:

- **Type host:** freshwater mussel, *Coelatura aegyptiaca.*
- **Distribution of the host:** Two islands at the western bank of the River Nile facing Taramsa village and Naqada city Qena Governorate.
- **Location of the parasite inside the host:** Adult forms in the mantle cavity.

The specific characters of the present species:

I- In both sexes,

1- three processes (teeth-like pegs) of palpal tibia,
2- three clawlets of palpal tarsus,
3- 22 pairs of genital acetabulae**.**

II- In Female,

1- two pairs of dorsal plates.
2- five pairs of platelets.
3- 10 pairs of dorsal setae.
4- two pairs of pores.
5- Three pairs of setae on ventral flaps.
6- Four pairs of genital setae.

III- In male,

1- seven dorsal plates.
2- four pairs of platelets.
3- three pairs of glandularia,
4- eight pairs of dorsal setae.
5- three pairs of pores.
6- five pairs of genital setae.

These diagnostic and specific characters of the present species were compared with those of other species of the same genus [2, 3, 7, 8, 14, 18, 22-26, 30, 36-38]

The present species exhibits specific characters distinguishing it from other published species of genus *Unionicola.* Also, the present species is recorded for the first time in freshwater mussel, *Coelatura aegyptiaca* which is collected from two islands at the western bank of the River Nile facing Taramsa village and Naqada city Qena Governorate.

So, the present species is considered as new one and added to the previously published species.

The nomenclature of the species: This species is named for three processes (teeth-like pegs) on the palpal tibia.

5. Abbreviations

a = anus	fs = flap setae	pl = platelets
ac = acetabulae	ge = genu	Plp = para lateral plate
ce 1- ce 4 = coxal epimerae 1 -4	gf = genital flap	Po=pores
ch=chelicerae	gl = glandularium	pp = palpal processes
cl = clawlets	go = genital opening	r = rostrum
co = coxa	gp = genital plate	sp = second plate
cp = central plate	gv = genital valve	st = striation of anus
df = dorsal flap	h = hypostome	ta = tarsus
e = eyes	l1-l4= legs I-IV	ti = tibia
fc = forked claw	lp = lateral plate	tr = trochantor
fe = femur	op = opisthosomal plate	vf = ventral flap
fp = first plate	p = palp	Y-shape = sense organ

Credit authorship contribution statement:

Conceptualization, Ramadan, Somaia, Hussein, Abdel-Nasser Ahmed, Gaber, Azza, and Mohamed, Al zahraa, methodology, Ramadan, Somaia, Mohamed, Al zahraa; software, Ramadan, Somaia, Hussein, Abdel-Nasser Ahmed, Mohamed, Al zahraa, validation, Ramadan, Somaia, Mohamed, Al zahraa, Hussein, Abdel-Nasser Ahmed, Gaber, Azza, formal analysis, Ramadan, Somaia, Mohamed, Al zahraa, Investigation, Ramadan, Somaia, Hussein, Abdel-Nasser Ahmed, resources, Ramadan, Somaia, Gaber, Azza, Mohamed, Al zahraa, data curation, Ramadan, Somaia, Hussein, Abdel-Nasser Ahmed, writing—original draft preparation, Ramadan, Somaia, Mohamed, Al zahraa, writing—review and editing, Ramadan, Somaia, Hussein, Abdel-Nasser Ahmed, Gaber, Azza, and Mohamed, Al zahraa, visualization, Ramadan, Somaia, Hussein, Abdel-Nasser Ahmed, Gaber, Azza, and Mohamed, Al zahraa, supervision, Ramadan, Somaia, project administration, Ramadan, Somaia. All authors have read and agreed to the published version of the manuscript.

Data availability statement

The data used to support the findings of this study are available from the corresponding author upon request.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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