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Proprioseiopsis zaheri n. sp. (Acari: Phytoseiidae) from Egypt with a key to the *Proprioseiopsis* species reported from the country

Ahmad Said Sanad[a], Reham Abo-Shnaf[a]

[a] Vegetable and Aromatic Plant Mites Department, Plant Protection Research Institute, Agricultural Research Centre, 12611 Dokii, Giza, Egypt.

Original research

ABSTRACT

Proprioseiopsis zaheri **n. sp.** is described based on adult females collected from giant reed plant, *Arundo donax*, at Monufia governorate, Egypt. A key to the *Proprioseiopsis* species found in Egypt is also provided.

Keywords taxonomy; Proprioseiopsina; predators; giant reed plant
Zoobank http://zoobank.org/98208AB1-DC84-46EF-9923-F43901574944

Introduction

Arundo donax L. (Poaceae), known as giant reed, is native to the Mediterranean region and has been cultivated throughout the world for a long time, to make mats, roofs, for erosion control and as an ornamental (Neal 1965; Wagner *et al.* 1999). In Egypt, this plant is commonly found and can be identified in ancient temple drawings (Neal 1965). It has been mentioned to act as a banker plant for many species of predacious mites (Metwally *et al.* 2013).

Phytoseiidae is a mite family of plant inhabiting predators cited as biological control agents of several agricultural arthropod pests (Gerson *et al.* 2003; McMurtry *et al.* 2013, 2015). Some species of this family have been extensively used as biological control agents of these pests (Sanad and Hassan 2019; Elhalawany *et al.* 2019, 2021; Lopez 2023).

Proprioseiopsis Muma is a phytoseiid genus that contains about 168 valid species worldwide (Demite *et al.* 2014, 2023). Ten species of this genus have been reported from Egypt to date, including the new species here described (Nasr and Abou-Awad 1985; Zaher 1986; El-Halawany and Abdel-Samad 1990; Basha and Yousef 2000; Abo-Shnaf and Moraes 2014; Abo-Shnaf *et al.* 2019; Abo-Shnaf and Zaki 2022). Some *Proprioseiopsis* species have been studied to assess their possible role as bio-control agents, e.g., *Proprioseiopsis asetus* (Chant), *P. rotundus* (Muma), *P. messor* (Wainstein), *P. cabonus* (Schicha & Elshafie), and *P. badryi* (El-Borolossy) (Abou-setta *et al.* 1997; Fouly 1997; Abou-Awad *et al.* 1998; El-Hady 2005; Momen *et al.* 2011; Abdel-Khalek and Momen 2022).

The objective of the present study is to describe a new *Proprioseiopsis* species based on adult females and provide an updated identification key to the species of this genus recorded from Egypt.

Material and methods

Leaf samples of *A. donax* were collected at Al Khatatbah, Monufia governorate, Egypt, and transported to a laboratory for examination under a dissecting microscope. The phytoseiids

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Corresponding author
Reham Abo-Shnaf:
riamaboshnaf@yahoo.com

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found were mounted on microscopic slides in Hoyer's medium and examined under a phase contrast (Olympus, BHA) microscope. Taxonomically important structures were illustrated with the help of a drawing tube attached to the microscope, and measured with a graded eyepiece. Measurements are given in micrometers, representing the average followed, in parentheses, by the respective ranges. The values shown as widths of the dorsal shield refer to maximum width (immediately posterior to the level of setae *s4*). The indicated numbers of teeth on the cheliceral digits do not include the respective apical hook. Mite identification at the generic level was based on Chant and McMurtry (2007). Setal nomenclature follows Rowell *et al.* (1978) and Chant and Yoshida-Shaul (1991) respectively for the dorsal and the ventral surfaces of the idiosoma. Idiosomal setal pattern follows Chant and Yoshida-Shaul (1992). The notation of solenostomes and poroids follows that of Athias-Henriot (1975). Coordinates provided are approximate, as these were not taken at the time the samples were collected. All mite specimens were collected by the senior author of this work.

Results and discussion

Systematics

Tribe Amblyseiini Muma

Subtribe Proprioseiopsina Chant & McMurtry, 2004: 219, 2007: 85

Proprioseiopsis Muma, 1961: 277; Chant and McMurtry 2005: 9, 2007: 87.
sandersi group, Chant, 1959: 102.
belizensis species group, Chant & McMurtry, 2005: 13.
belizensis species subgroup, Chant & McMurtry, 2005: 13.

Proprioseiopsis zaheri n. sp.

Zoobank: 256848A2-2C36-4471-BAB3-4174CADDA849

Figure 1 (a-e)

Diagnosis

Females of this new species have seta *S2* about twice as long as *Z1*, setae *S4* and *S5* about half as long as *s4*, ratio setae *s4*: *Z1* >3, seta *z4* about 1.7 as long as *z2*, seta *Z4* slightly shorter than *Z5*, and seta *S2* > *S4* > *S5*, all setae smooth, except *Z4* and *Z5*, slightly serrate; peritreme reaching level of *j1*; ventrianal shield subpentagonal, longer than wide; calyx of spermatheca saccular; fixed cheliceral digit with two teeth, movable digit with one tooth; leg IV with three sharp-tipped macrosetae, macrosetae on other legs quite short (genua II and III, and tibia III), chaetotaxy of genua I-IV: 2,2/1, 2/1,2; 2,2/1, 2/0,1; 1,2/1,2/0,1; 1,2/1, 2/0,1.

Female (n = three specimens measured)

Gnathosoma (Fig. 1a) — Corniculi convergent; about 18 (16–21) long, basal width of corniculus 4 (4–5). Fixed cheliceral digit 31 (29–34) long, with two subapical teeth and *pilus dentilis*; movable digit 32 (31–34) long, with one tooth; dorsal and antiaxial lyrifissures distinct.

Dorsum (Fig. 1b) — Dorsal shield oval with a slight constriction at level of *R1*; smooth, except few anterolateral striae, and a pair of patches of scant reticulation mediad *S2*; length of dorsal shield 404 (382–432), width 272 (255–283). Dorsal setal pattern 10A:8E, with 16 pairs of setae on the dorsal shield (*r3* and *R1* off the shield), twelve pairs of poroids (*id1*, *id4*, *idm1-idm3*, *idm5*, *idm6*, *idl1*, *idl3*, *idl4*, *is1*, and *idx*), and seven pairs of solenostomes (*gd1*, *gd2*, *gd4-gd6*, *gd8*, and *gd9*). Length of dorsal setae as follows: *j1* 30 (27–31), *j3* 55 (55–56), *j4* 9, *j5* 10 (9–10), *j6* 15 (13–16), *J5* 13, *z2* 39 (34–43), *z4* 64 (61–68), *z5* 7 (7–8), *Z1* 26 (26–27), *Z4* 80 (73–85), *Z5* 87 (81–94), *s4* 77 (73–82), *S2* 47 (36–53), *S4* 35 (27–40), *S5* 31 (30–33),

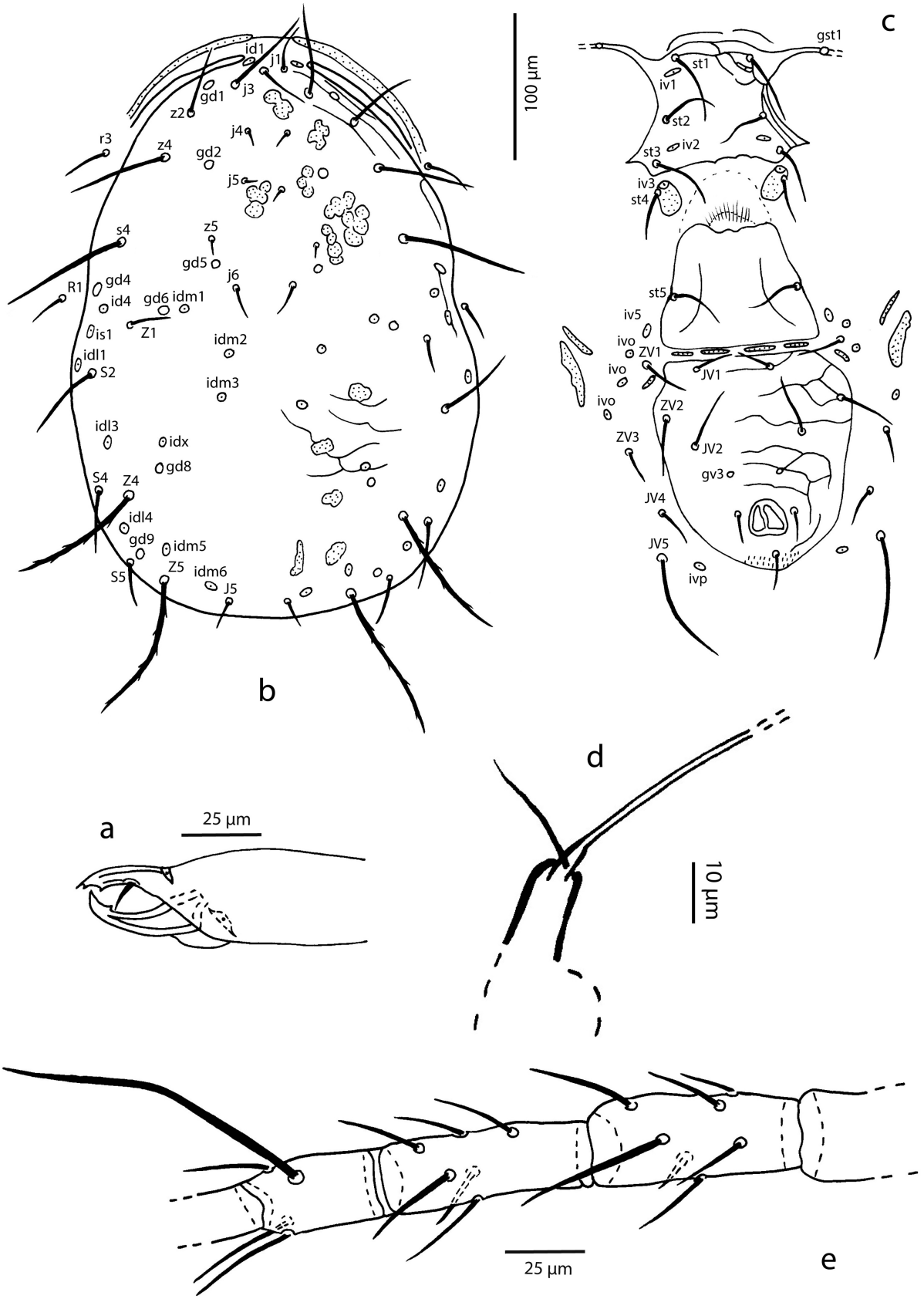


Figure 1 *Proprioseiopsis zaheri* **n. sp**. Holotype female. a – Dorsal shield, b – Ventral shields, c – Spermatheca, d – Chelicera, e – Genu, tibia, and basitarsus of leg IV.

r3 28 (27–29), and *R1* 26 (25–27). All dorsal setae smooth, except *Z4* and *Z5*, slightly serrate. Peritreme extending anteriorly to level of *j1*.

Venter (Fig 1c) — Ventral setal pattern JV-3:ZV. Pre-sternal region slightly striate. Sternal shield slightly reticulate anterolaterally, smooth elsewhere; fused with endopodal plates, with distinct lateral extensions between coxae I-II bearing a solenostome (*gst1*) on each distal end; with three pairs of setae (*st1-st3*) and two pairs of poroids (*iv1* and *iv2*); posterior margin slightly concave, with tiny teeth. Seta *st4* and poroid (*iv3*) on roundish punctate metasternal platelets. Distances *st1-st1* 56 (56–57), *st2-st2* 78 (77–79), *st3-st3* 87 (82–91), *st4-st4* 85 (77–93), *st1-st3* 69 (66–70). Genital shield smooth; distance *st5-st5* 92 (86–96); *iv5* posterolaterad *st5*. Ventrianal shield subpentagonal, reticulate; 148 (146–151) long, width at level of *ZV2* 140 (133–147) and width at level of anus 109 (107–112); bearing three pairs of pre-anal setae (*JV1*, *JV2*, and *ZV2*), the circumanal setae, and a pair of small rounded solenostomes (*gv3*) posteromesad *JV2*. With four transversely elongate punctate platelets between genital and ventrianal shields; with four pairs of setae (*JV4*, *JV5*, *ZV1*, and *ZV3*), a pair of tiny platelets, and four pairs of poroids (*ivo* and *ivp*) on integument surrounding ventrianal shield. Seta *JV5* smooth, much longer than other ventral setae 69 (66–72) long. Two pairs of punctate metapodal plates, anterior plate 17 (16–20) long and 3 wide, posterior plate 29 (27–31) long and 6 (5–7) wide.

Spermatheca (Fig. 1d) — Calyx saccular, flaring slightly near vesicle, 12 (10–13) long; atrium distinct, elongate.

Legs (Fig. 1e) — Macrosetae sharp-tipped: *Sge II* 26 (23–29), *Sge III* 27 (23–29), *Sti III* 28 (25–29), *Sge IV* 49 (47–52), *Sti IV* 33 (31–34), *St IV* 94 (90–98); chaetotaxy of genu II 2, 2/1, 2/0, 1; genu III 1, 2/1, 2/0, 1.

Type specimens

Holotype female and two paratype females collected from leaves of *A. donax*, at Al Khatatbah (30°49′13.19″E, 30°21′34.38″N), Monufia governorate, Egypt, in Mar. 2023; all deposited at the mite reference collection of the Egyptian Society of Acarology Museum (ESAM), Zoology and Agricultural Nematology Department, the Faculty of Agriculture, Cairo University, Giza governorate, Egypt.

Etymology

The specific name "*zaheri*" is used in honour of late Professor M.A. Zaher, a pioneer Egyptian acarologist.

Remarks

The new species belongs to the *belizensis* species subgroup (for the saccular spermathecal calyx) of the *belizensis* species group (for lacking macroseta on genu I) of Chant and McMurtry (2005). Within this subgroup, it is most similar to *Proprioseiopsis badryi* (El-Borolossy, in Nasr and Abou-Awad 1985), *P. beatus* (Chaudhri, 1968), *P. campanulus* Karg, 1979, *P. dacus* (Wainstein, 1973), *P. dentatus* Chaudhri, Akbar & Rasool, 1979, and *P. okanagensis* (Chant, 1957). The main differences between *P. zaheri* and those species are shown in Table 1.

In *P. beatus*, the ventrianal shield is triangular; *P. dentatus* has longer *Z1* and *s4* (39 and 83, respectively), and ventrianal shield wider than long; *P. badryi* has most dorsal setae serrate and seta *Z4* longer than *Z5*, *S4* longer and *S5* shorter (50 and 19, respectively), and ventrianal shield subtriangular; *P. campanulus* has seta *z2* half as long and *S2* twice as long (20 and 100, respectively), ventrianal shield subtriangular, and spermatheca saccular with enlarged atrium; *P. dacus* has setae *j1* and *S5* half as long, and *S4* 0.3 as long (16, 15, and 10, respectively); and *P. okanagensis* has setae *S4* and *S5* of similar lengths, both less than half as long as in the new species; additionally, females of *P. okanagensis* has about eight teeth in the fixed cheliceral digit.

Table 1 Differences between *Proprioseiopsis zaheri* **n. sp.** and closest species of the "*belizensis*" species subgroup.

Characters[1]	*P. zaheri* n. sp.	*P. badryi*		*P. beatus*	*P. campanulus*	*P. dacus*	*P. dentatus*	*P. okanagensis*	
DSL	**404**	396	365	367	420–440	365	347	381	-
DSW	**272**	297	237	270	290–320	255	244	234	-
j1	**30**	17	24	26	25	16	29	-	-
j3	**55**	47	54	42	50	47	47	47	52
z2	**39**	40	38	38	20	23	36	33	36
z4	**64**	80	78	62	75	56	62	63	62
Z1	**26**	17	20	29	20	18	39	21	18
Z4	**80**	92	86	75	125	65	68	70	80
Z5	**87**	80	72	78	120	58	75	90	106
s4	**77**	90	87	78	95	74	83	74	82
S2	**47**	60	59	36	100	31	44	40	40
S4	**35**	50	50	31	38	10	36	-	-
S5	**31**	30	19	26	20	15	29	-	-
VASL	**148**	-	132	-	-	-	125	121	182
VASW *ZV2*	**140**	-	133	-	-	-	138	115	126
VASW anus	**109**	-	144	-	-	-	-	-	-
JV5	**69**	60	73	-	-	-	57	50	-
NFD	**2**	2	3	3	9–11	-	4	8	Multidentate
NMD	**1**	1	1	1	2	-	1	1	1
Sge IV	**49**	45	39	36	-	55	36	-	-
Sti IV	**33**	30	29	23	-	47	31	-	-
St IV	**94**	77	74	81	-	85	83	-	-
Spermatheca	Saccular	Bell-shaped	Bell-shaped	Saccular	Saccular with enlarged atrium	Saccular	Saccular	Saccular	Saccular
VAS shape	**Subpentagonal**	Triangular	Subpentagonal	Triangular	Triangular	Pentagonal	Quadrate	Subpentagonal	Subpentagonal
References	**Current study**	Zaher (1986)	Abo-Shnaf & Moraes (2014)	Chaudhri (1968)	Karg (1979)	Wainstein (1973)	Chaudhri et al. (1979)	Chant (1957)	Chant & Hansell (1971)

(1) **DSL** = dorsal shield length; DSW = dorsal shield width; **VASL** = ventrianal shield length; **VASW *ZV2*** = ventrianal shield width at *ZV2* level; **VASW anus** = ventrianal shield width at anus level; NFD = number of teeth on fixed cheliceral digit; **NMD** = number of teeth on movable cheliceral digit.

Differently from what was mentioned by Evans (1963) for the phytoseiids, genu II of the new species here described has eight setae (*av* present: 2,2/1, 2/0,1), as also reported for many other *Proprioseiopsis* species.

Key to species of *Proprioseiopsis* reported from Egypt

According to the original description, seta *r3* of *P. sharkiensis* Basha & Yousef, 2000, is inserted on the dorsal shield, as considered in this key. However, there is a chance it is actually in the unsclerotized cuticle, as the margin of the shield is mentioned by the authors of the species to be folded in the holotype. Unfortunately, we could not examine the holotype or additional specimens.

1. Seta *r3* off dorsal shield 2
— Seta *r3* on dorsal shield 9

2. Seta *z2* < *z4* or *z2* > *z4* 3
— Setae *z2* and *z4* subequal in lengt . . . . . *P. ismailiaensis* Abo-Shnaf & Moraes, 2014

3. Seta *z2* > *z4* 4
— Seta *z2* < *z4* 6

4. Seta *Z4* > *Z5* 5
— Seta *Z4* < *Z5* 7

5. Fixed digit of chelicera with seven teeth . . . . . *P. salviae* Abo-Shnaf & Zaki, 2022
— Fixed digit of chelicera with 3–4 teeth . . . . . *P. ovatus* (Garman, 1958)

6. Spermathecal calyx bell-shaped; setae *j3*, *z2*, *z4*, *s4*, *S2*, *S4*, *Z4*, and *Z5* serrate; seta *S4* about 1.7 times as long as *S5* . . . . . *P. badryi* (El-Borolossy, in Nasr and Abou-Awad 1985)
— Spermathecal calyx saccular; only *Z4* and *Z5* slightly serrate; seta *S4* about 1.1 times as long as *S5* . . . . . *P. zaheri* **n. sp.**

7. Fixed cheliceral digit with ten teeth; spermathecal calyx pocular . . . . . *P. aegypticus* Abo-Shnaf, Momen & Lamlom, in Abo-Shnaf *et al.* 2019
— Fixed cheliceral digit with at most three teeth; spermathecal calyx not pocular 8

8. Fixed digit of chelicera with one tooth; calyx of spermatheca saccular (over twice as long as diameter next to vesicle) . . . . . *P. kadii* (El-Halawany & Abdel-Samad, 1990)
— Fixed digit of chelicera with tree teeth; calyx bell-shaped (less than twice as long as diameter next to vesicle) . . . . . *P. messor* (Wainstein, 1960)

9. Seta *Z4* about 1.2 as long as *Z5* . . . . . *P. gizaensis* Abo-Shnaf, Hassan & Lamlom, in Abo-Shnaf *et al.* 2019
— Seta *Z4* about 0.7 as long as *Z5* . . . . . *P. sharkiensis* Basha & Yousef, 2000

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ORCID

Ahmad Said Sanad https://orcid.org/0000-0002-7561-7916
Reham Abo-Shnaf https://orcid.org/0000-0002-4033-9063

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