

A new species of *Proprioseiopsis* (Mesostigmata, Phytoseiidae), with a dichotomous key to reported species from Egypt

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Original research

ABSTRACT

This paper deals with the description of *Proprioseiopsis salviae* n. sp. (Acari: Mesostigmata: Phytoseiidae) on the basis of adult females and male. The new mite species was collected from the soil underneath some ornamental plants, at Orman Botanical Garden, Giza governorate, Egypt. Mites were extracted using Modified Tullgren funnel and mounted on microscope glass-slides on Hoyer's medium for identification. A key to the identification of Egyptian species of *Proprioseiopsis* is provided.

Keywords predators; systematics; morphology; ornamental plants; biological control

Zoobank <http://zoobank.org/ADD0ECCC-07D3-4017-A519-DD9C0B52F623>

Introduction

Family Phytoseiidae Berlese (Mesostigmata) comprises of about 2,880 described species (Demite *et al.* 2014, 2022). Species in the family are extensively studied because of their potential as biological control agents for several pests (Denmark *et al.* 1999; Gerson *et al.* 2003; McMurtry *et al.* 2013, 2015). The possibility to determine potential phytoseiid species in the pest control programs, it is necessary to determine their diversity.

Genus *Proprioseiopsis* Muma include 165 described species from different habitats (McMurtry *et al.* 2015; Demite *et al.* 2022). Nine species of *Proprioseiopsis* were reported from Egypt including the one herein 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). The objective of the current work is to describe a new species of *Proprioseiopsis* collected at Orman Botanical Garden, Giza governorate, Egypt and give a key to all Egyptian species of genus *Proprioseiopsis*.

Material and methods

Mite samples were collected from soil underneath different ornamental plants at Orman Botanical Garden, Giza governorate, Egypt. The samples were kept in polyethylene bags and transferred to the laboratory for extraction by Modified Tullgren funnel (Krantz and Walter 2009). The collected mites were mounted on microscopic slides using Hoyer's medium and labelled with all required information for later examination. The slides were dried at (40–50°C) for two weeks. Mite specimens were examined using a phase contrast (Olympus, BHA) microscope. Taxonomically important structures were illustrated with the help of a drawing attachment. Illustrations were prepared by using the Adobe Illustrator® program. The

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measurements were taken with a graded eyepiece and given in micrometers (μm), representing the average followed by the respective ranges in parentheses. The values shown as widths of the dorsal shield refer to maximum widths (posterior to the level of setae *s4*). The indicated numbers of teeth on the chelicera do not include the apical hook of the respective digit. Identification was done according to Chant and McMurtry (1994, 2007) for taxonomy of Phytoseiidae concepts. Setal nomenclature follows that of Rowell *et al.* (1978) and Chant and Yoshida-Shaul (1991) for dorsal and ventral surfaces of the idiosoma, respectively. The idiosomal setal pattern follows that of Chant and Yoshida-Shaul (1992). The notation for solenostomes and poroids is based on Athias-Henriot (1975). Coordinates provided were taken at the time the samples were collected. Key to Egyptian species is based on the keys provided by Chant and McMurtry (1994, 2007); Abo-Shnaf and Moraes (2014); and Abo-Shnaf *et al.* (2019).

Results and discussion

Systematics

Subtribe Proprioseiopsina Chant & McMurtry

Proprioseiopsina Chant & McMurtry 2004: 219; 2007: 85.

Genus *Proprioseiopsis* Muma

Proprioseiopsis Muma 1961: 277.

Proprioseiopsis salviae n. sp.

Zoobank: CF38DCFC-FC88-43B6-A7BE-36FBD6BB843F

(Figures 1–2)

Diagnosis — Seta *Z4* longer than *Z5*; seta *S2* > *S4* > *S5*, seta *S4* about 1.4 times as long as *S5*; calyx of spermatheca saccular; genital shield broad, with posterior margin truncate; ventrianal shield longer than wide; genu I without macroseta, genu II with seven setae; fixed cheliceral digit with seven teeth, movable digit with one tooth.

Female (Five specimens measured, Figs. 1 a–e)

Dorsum (Fig. 1a) – Dorsal shield with few lateral striae anteriorad *z4*, smooth elsewhere, where muscle marks are more evident; 370 (352–397) long and 287 (265–311) wide; with 16 pairs of setae and two pairs of sub-lateral setae (*r3* and *R1*), fifteen pairs of poroids and six pairs of solenostomes (*gd1*, *gd2*, *gd4*, *gd5*, *gd6*, *gd9*). Length of dorsal setae: *j1* 36 (34–39), *j3* 66 (62–69), *j4* 11 (9–13), *j5* 9 (8–10), *j6* 17 (16–20), *J5* 10 (9–10), *z2* 50 (47–55), *z4* 30 (26–33), *z5* 9 (8–10), *Z1* 20 (18–22), *Z4* 88 (86–92), *Z5* 69 (68–70), *s4* 85 (83–87), *S2* 25 (23–29), *S4* 23 (22–25), *S5* 16 (14–19), *r3* 28 (23–33), *R1* 21 (18–23). All setae smooth, except *Z4* and *Z5*, slightly serrated. Peritreme extending anteriorly to level of *j1*.

Venter (Fig. 1b) – Presternal area slightly striate. Sternal shield reticulate anterolaterally; smooth elsewhere, posterior margin slightly concave; with three pairs of setae (*ST1*–*ST3*) and two pairs of poroids (*iv1* and *iv2*). Setae *ST4* and poroid (*iv3*) situated on rounded metasternal platelets. Distances *ST1*–*ST1* 50 (47–51), *ST2*–*ST2* 76 (73–82), *ST3*–*ST3* 87 (85–90), *ST4*–*ST4* 84 (81–87), *ST1*–*ST3* 60 (58–64). Genital shield smooth with three pairs of muscle marks; distance *ST5*–*ST5* 97 (92–100). Ventrianal shield subpentagonal, reticulate; 119 (114–125) long, 116 (111–124) wide at *ZV2* level and 111 (107–118) wide at anus level; with three pairs of pre-anal setae (*JV1*, *JV2*, and *ZV2*) and one pair of pre-anal round pores (*gv3*) posteromesad *JV2*. Seta *JV5* 71 (68–74). Ventral setae smooth. Two pairs of punctate metapodal plates present. With four transversely elongate punctate platelets between genital and ventrianal shields. Unsclerotized cuticle laterad and posteriorad ventrianal shield with four pairs of distinguishable poroids.

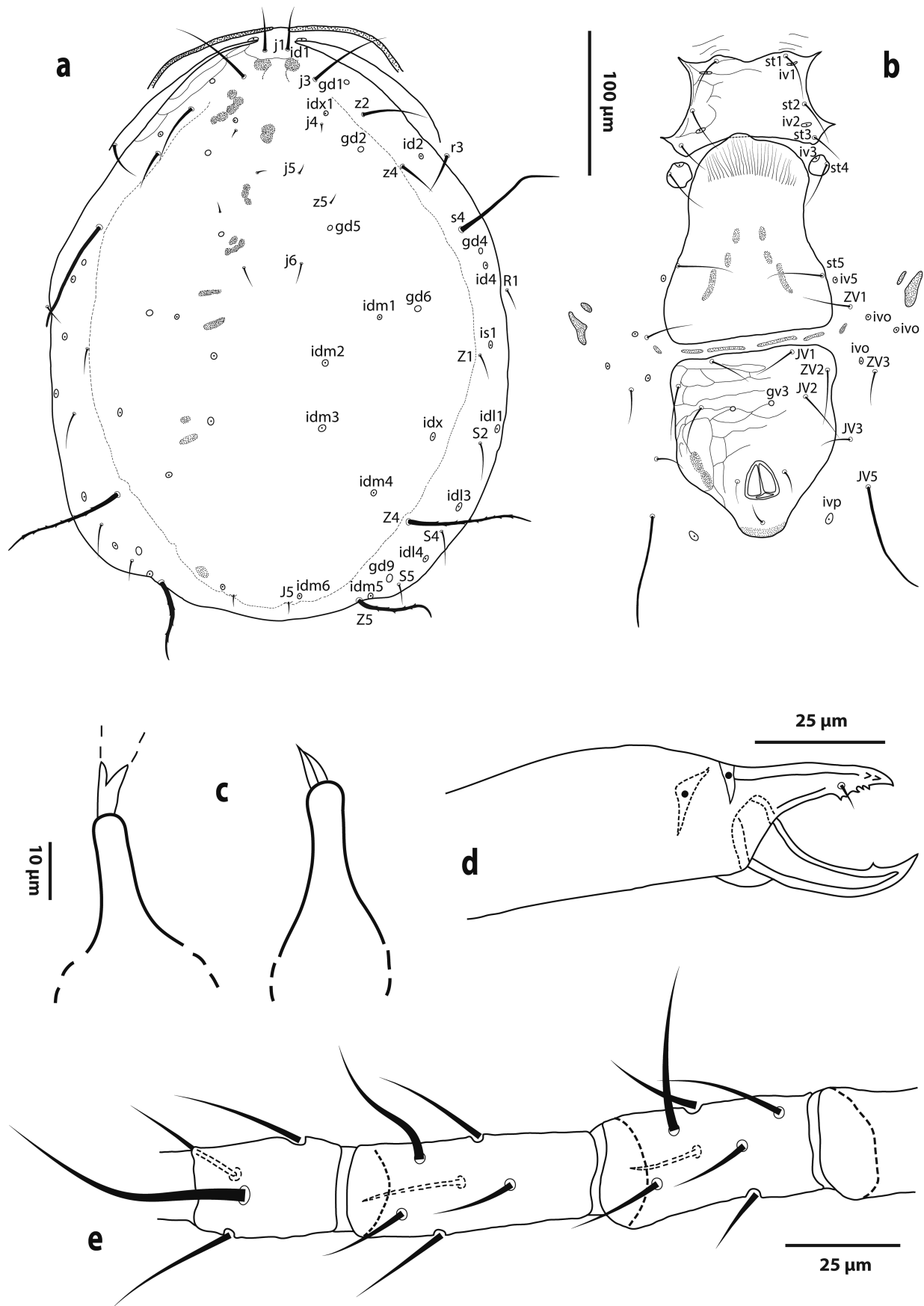


Figure 1 *Proprioseiopsis salviae* n. sp. holotype female. a – Dorsal shield, b – Ventral shields, c – Spermathecae, d – Chelicera, e – Genu, tibia and basitarsus of leg IV.

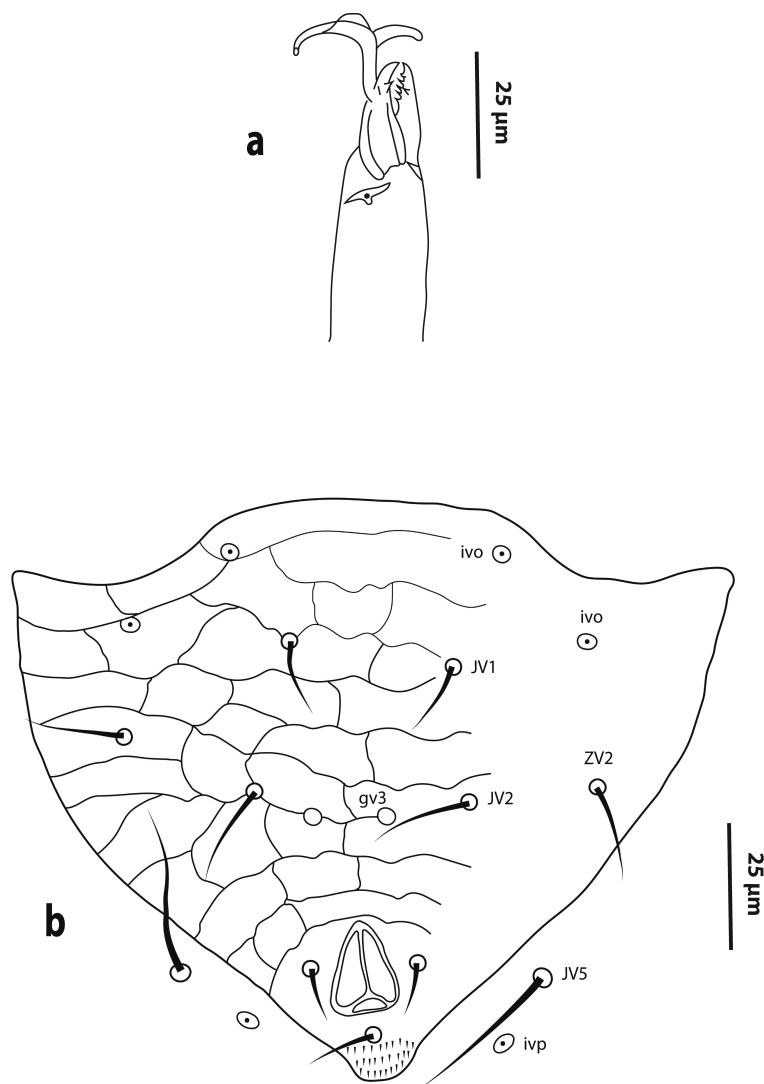


Figure 2 *Proprioseiopsis salviae* n. sp. paratype male. a – Chelicera showing spermatodactyl, b – Ventrianal shield.

Spermatheca (Fig. 1c) – Calyx of spermatheca saccular, flaring slightly toward vesicle, 23 (21–25) long; atrium forked, with long major duct.

Gnathosoma – Corniculi parallel to each other; about 18 (18–19) long, basal width of corniculus 4 (3–5), distance between tips of corniculi 10 (8–10). Fixed cheliceral digit 32 (31–33) long, with seven teeth; movable digit 30 (28–31) long, with one tooth; dorsal and antiaxial lyrifissures distinct (Fig. 1d).

Legs (Fig. 1e) – Macrosetae present only on leg IV, sharp-tipped: *Sge IV* 48, *Sti IV* 34 (33–35), *St IV* 80 (73–86); chaetotaxy of genu II 2, 2/0, 2/0, 1; genu III 1, 2/1, 2/0, 1.

Male (One specimen measured, Figs. 2 a–b)

Dorsum – Dorsal shield pattern as in adult female, but differs in the number of setae; with 18 pairs of setae (*r3* and *R1* on dorsal shield); 287 long and 224 wide. Length of dorsal setae: *j1* 26, *j3* (broken), *j4* 10, *j5* 9, *j6* 17, *J5* 9, *z2* 51, *z4* 38, *z5* 12, *Z1* 20, *Z4* 68, *Z5* 55, *s4* 59, *S2* 22, *S4* 18, *S5* 16, *r3* 13, *R1* 16. All setae smooth, except *Z4* and *Z5*, slightly serrated. Peritreme extending anteriorly to level between *j1* and *j3*.

Venter – Distances *ST1-ST1* 48, *ST2-ST2* 60, *ST3-ST3* 66, *ST4-ST4* 55, *ST5-ST5* 47, *ST1-ST3* 57, *ST1-ST5* 107. Ventrianal shield subtriangular, reticulate (Fig. 2a); 129 long and 155

Table 1 Differences between *Proprioseiopsis salviae* n. sp. and closer species of the “belizensis species subgroup”.

Species	j3	j6	z2	z4	s4	Z4	Z5	S2	S4	S5	JV5	Sge IV	Sti IV	St IV	Number of teeth on fixed digit	References
<i>P. basis</i>	Not stated	10	40	25	93	106	85	20	Not stated	Not stated	65	35	27	78	3	Karg (1994)
<i>P. belizensis</i>	90–105	5–7	50–52	30–31	102–110	104–112	76–90	10–12	7–13	8–10	48–58	40–41	29–31	55–60	Not stated	Yoshida-Shaul & Chant (1991)
<i>P. mauiensis</i>	42	13	25	19	77	96	92	22	27	24	Not stated	53	45	82	4	Prasad (1968)
<i>P. ovatus</i> (Holotype)	64	12	42	22	88	101	90	17	16	12	Not stated	55	43	96	Multi-dentate	Moraes & McMurtry (1983)
<i>P. ovatus</i>	64 (57–69)	9 (8–10)	39 (32–44)	25 (19–34)	99 (91–106)	108 (88–120)	88 (67–107)	20 (14–26)	14 (9–16)	10 (9–11)	Not stated	58 (46–66)	41 (34–47)	84 (77–91)	5	Moraes et al. (2007)
	80–89	13	38–42	27–35	103–108	100–107	73–88	11	9	9	Not stated	61	36	77	Not stated	Ferragut et al. (2010)
	57–75	8–13	30–53	18–36	91–110	88–122	67–110	14–26	9–18	9–15	75–95	45–66	34–47	73–105	5–7	Kreitera et al. (2020)
<i>P. putrephilus</i>	38 (38–41)	8–10	30 (27–32)	21 (20–23)	65 (62–68)	71 (71–77)	72 (68–80)	9 (8–12)	9 (7–10)	13 (10–15)	50 (48–52)	51 (49–60)	30 (30–35)	44 (42–46)	4–5	Meshkov (1999)
<i>P. rosellus</i>	59	Not stated	z2 = z4	z4 = z2	99	113	90	Not stated	Not stated	Not stated	81	Not stated	Not stated	Not stated	Not stated	Chant (1959)
<i>P. salviae</i> n. sp.	66 (62–69)	17 (16–20)	50 (47–55)	30 (26–33)	85 (83–87)	88 (86–92)	69 (68–70)	25 (23–29)	23 (22–25)	16 (14–19)	71 (68–74)	48	34 (33–35)	80 (73–86)	7	Present Study

wide at anterior corners; with three pairs of pre-anal setae, two pairs of poroids (*ivo*) and a pair of pre-anal pores (*gv3*). Seta *JV5* 35.

Gnathosoma – Corniculi parallel to each other; about 18 long, basal width of corniculus 3, distance between tips of corniculi 14. Fixed cheliceral digit 22 long, with six teeth; movable digit 21 long, with one tooth; dorsal and antiaxial lyrifissures distinct. Shaft of spermatodactyl 18 long with foot about 26 long, T-shaped toe and heel well developed (Fig. 2b).

Legs – Macrosetae sharp-tipped: *Sge IV* 34, *Sti IV* 23, *St IV* 39; chaetotaxy of genua II and III as in adult female.

Type specimens — Holotype female was collected from soil underneath *Salvia splendens* Sellow & Schultes (Lamiaceae), at Orman Botanical Garden (31°12'47.7468"E, 30°1'45.8148"N), Giza governorate, June 20, 2017, one paratype male was collected from soil underneath the same previous substrate and locality, May 23, 2017, one paratype female was collected from soil underneath *Crinum asiaticum* L. (Amaryllidaceae), at the same previous locality, April 04, 2017, one paratype female was collected from soil underneath *Dimorphotheca ecklonis* (De Candolle) (Asteraceae), at the same previous locality, June 05, 2017, one paratype female was collected from soil underneath *Xerochrysum bracteatum* (Ventenat) Tzelev (Asteraceae), at the same previous locality, May 15, 2017; 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. One paratype female was collected from soil underneath *Pelargonium x hortorum* Bailey (Geraniaceae), at the same previous locality, May 23, 2017; deposited at the mite collections of L'institut Agro (Montpellier SupAgro) conserved in UMR CBGP INRAE/IRD/ CIRAD/ SupAgro/ Université de Montpellier, Montpellier, France.

Etymology — The epithet *salviae* refers to “*Salvia*” the genus of the host plant (*Salvia splendens*), from which the holotype female and paratype male were collected.

Remarks — This species belongs to *belizensis* species group as genu I has no macrosetae and to *belizensis* subgroup according to the form of calyx of spermatheca (Chand and McMurtry 2005). The new species closely resembles *Proprioseiopsis basis* Karg, 1994; *P. belizensis* (Yoshida-Shaul & Chant, 1991); *P. mauiensis* (Prasad, 1968); *P. ovatus* (Garman, 1958); *P. putrephilus* Meshkov, 1999 and *P. rosellus* (Chant, 1959). Important differences between these species and the new species are listed in Table (1).

Key to *Proprioseiopsis* species reported from Egypt

Proprioseiopsis kadii is not included in the current key due to impossibility to check its type specimen. This species is also quite similar to *P. messor* and we are not able to separate between them.

1. Seta *Z4* longer than *Z5* 2
— Seta *Z4* shorter than *Z5* 3
2. All dorsal setae smooth; seta *z2* longer than *z4* 6
— All lateral setae serrate except *Z1* and *S5*, smooth; seta *z2* shorter than *z4*
..... *P. badryi* (El-Borolossy)
3. Setae *s4*, *Z4* and *Z5* set on tubercles *P. sharkiensis* Basha & Yousef
— Setae *s4*, *Z4* and *Z5* not set on tubercles 4
4. Seta *z2* longer than *z4* 5
— Seta *z2* about as long as *z4* *P. ismailiaensis* Abo-Shnaf & Moraes
5. Spermatheca bell-shaped *P. messor* (Wainstein)
— Spermatheca poplar *P. aegypticus* Abo-Shnaf, Momen & Lamloom
6. Ratio *z2/z4* about 1.9, setae *j6* and *S4* at most 13 and 18 µm, respectively, seta *r3* off dorsal shield; atrium of spermatheca short, nodular *P. ovatus* (Garman)
— Ratio *z2/z4* less than 1.9, setae *j6* and *S4* more than 13 and 18 µm, respectively, seta *r3* on/off dorsal shield; atrium of spermatheca long, forked 7
7. Seta *S4* about three times as long as *S5*, seta *r3* on dorsal shield
..... *P. gizaensis* Abo-Shnaf, Hassan & Lamloom
— Seta *S4* about 1.4 times as long as *S5*, seta *r3* off dorsal shield *P. salviae* n. sp.

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