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NOTES ON *NEOSEIULUS PASPALIVORUS* (DE LEON) AND *PROPRIOSEIOPSIS MESSOR* (WAINSTEIN) (ACARI: PHYTOSEIIDAE) COLLECTED IN IRAN

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ABSTRACT — *Neoseiulus paspalivorus* is a new record for Iranian mite fauna. It is re-described and illustrated. Some setal lengths of *Proprioseiopsis messor* collected in Iran show deviations from those of the holotype and re-descriptions from the other countries. This species is re-described and illustrated based on the material collected in Iran.

KEYWORDS — Iran; *Neoseiulus paspalivorus*; Phytoseiidae; re-description; *Proprioseiopsis messor*

INTRODUCTION

Members of the family Phytoseiidae are important predaceous mites feeding on phytophagous mites and small insects (Gerson *et al.* 2003; McMurtry 1984). Despite studies carried out in other parts of Iran, fauna of phytoseiids in the Fars Province is poorly known. We thus conducted a survey to determine the faunistic composition of phytoseiid species in this province.

This paper aims to re-describe two species. One re-description was carried out for *Neoseiulus paspalivorus* (De Leon) as it is the first record of this species from Iran. The other re-description was carried out for *Proprioseiopsis messor* (Wainstein) to show some morphological differences with the holotype and other re-descriptions.

MATERIALS AND METHODS

Mites were extracted during 5 – 7 days from the field-collected samples using Berlese funnel. The phytoseiid mites were cleared in lactophenol and mounted in Hoyer's medium. Drawings were made with the aid of a camera lucida (drawing tube) attached to an Olympus phase contrast microscope. The setal notations used follow Lindquist and Evans (1965) as adapted by Rowell *et al.* (1978) to phytoseiid mites. All measurements are given in micrometers (μm). The mean of the measurements is given first followed by the range in parentheses. The classification systems follow those of Chant and McMurtry (2003, 2005, 2007). The voucher specimens of the two species presented in this paper were deposited in the Acari collection of Fars Science and Research Branch, Islamic Azad University (Entomology Department) and MITOX.

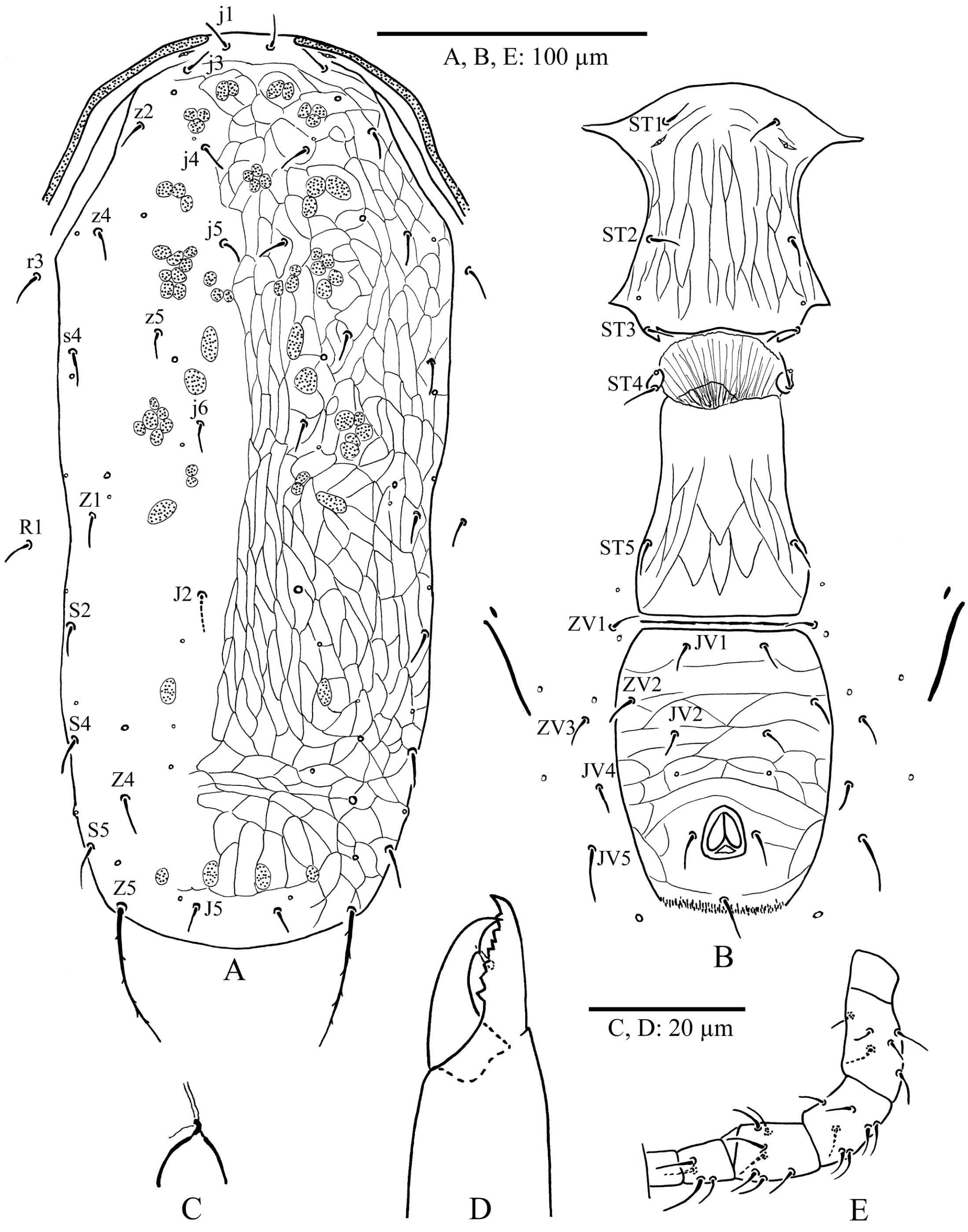

FIGURE 1: *Neoseiulus paspalivorus* (De Leon) (Female): A – Idiosoma, dorsal view; B – Idiosoma, ventral view; C – Spermatheca; D – Chelicera; E – Leg IV.

Results

Neoseiulus paspalivorus (De Leon) (Figure 1, A-E)

Typhlodromus paspalivorus De Leon, 1957: 143.

Female — One specimen measured.

Idiosomal setal pattern — 10A:9B/JV-3:ZV.

Dorsal idiosoma (Figure 1A) — Dorsal shield 348 long and 155 wide at j_6 level, strongly reticulated; with a slight waist at level of seta R_1 and with a shoulder at level of seta r_3; dorsal setae smooth, except for Z_5, serrate; lengths: j_1 11, j_3 11, j_4 9, j_5 9, j_6 9, J_2 (missing), J_5 9, z_2 10, z_4 10, z_5 8, Z_1 10, Z_4 15, Z_5 52, s_4 11, S_2 11, S_4 13, S_5 16; setae r_3 12 and R_1 10 on lateral integument.

Peritreme — Extending to the level of setae j_1 (Figure 1A).

Ventral idiosoma (Figure 1B) — Sternal shield moderately reticulated 91 long and 63 wide at level of setae ST_2; sternal setae short, $ST_{1\text{-}3}$ 9 – 10, ST_4 12, ST_4 on metasternal shields; genital shield lightly reticulated, width 65 at widest point, ST_5 13; 2 pairs of metapodal shields, primary narrow and 40 long and accessory 8 long; ventrianal shield subquadrate, with light reticulation, length 108, width at level of setae ZV_2 85 and width at level of paranal setae 73; with 3 pairs of short preanal setae JV_1 9, JV_2 9, ZV_2 9; 4 pairs of setae surrounding ventrianal shield on integument, JV_4 10, JV_5 21, ZV_1 9, ZV_3 8; ventrianal shield with a pair of small round pores posteromesad to JV_2, distance between these pores 35 almost equal to distance between JV_2-JV_2 insertions. Spermatheca — Calyx cup-shaped 6 long and 7 wide; atrium c-shaped. (Figure 1C).

Chelicera — Fixed digit 20 long with 7 teeth and a pilus dentilis; movable digit 24 long with 1 tooth (Figure 1D).

Legs — Leg IV (Figure 1E) with only one short macroseta on basitarsus, pointed apically, StIV 16 long; other legs without macrosetae; genua and tibiae I-II-III-IV with 10-8-7-7 and 10-7-7-6 or 7 setae, respectively (left and right tibiae with 6 and 7 setae, respectively).

Specimen examined — One female, June 2010, soil under a palm tree, Bandarabbas, Iran, collector: Fariba Kamyab.

Remarks — Members of the species group *paspalivorus* are mainly characterized by having the dorsal shield strongly reticulate and narrow, usually with a shoulder at the level of r_3 and by having ventral setae very short (Chant and McMurtry 2003). One more character that should be considered for this species group is the reticulation on genital shield. Chant and McMurtry (2003) listed 14 nominal species in the *paspalivorus* species group suggesting *N. baraki* (Athias-Henriot 1966) and *N. benjamini* (Schicha 1981) as possible synonyms of *N. paspalivorus*. Zannou *et al.* (2006) treated *N. baraki* and *N. benjamini* as valid species and separated *N. benjamini* from the other closely related species by having seta ST_4 off metasternal shield. This character was possibly taken from the original description of Schicha (1981) without examining the type material. In re-describing *N. benjamini*, Ueckermann and Loots (1988) by examining the holotype female and Lofego *et al.* (2009) by re-describing Brazilian specimens, depicted seta ST_4 on metasternal shield. Beard (2001) briefly re-described *N. benjamini* collected from pineapple in Queensland without mentioning the metasternal shield. One of her two deposited slides in Queensland Museum clearly shows that ST_4 is inserted on the metasternal shield (Pers. Comm. of Owen Seeman with F. Faraji). The position of ST4 could not be confirmed based on the holotype specimen because of the poor condition of the specimen (Pers. Comm. of Danuta Knihinicki with F. Faraji). Therefore, we are questioning the validity of this character to distinguish *N. benjamini* from the other species. In *N. baraki* the number of teeth on the movable digit of chelicerae is not consistent. Zannou *et al.* (2006) mentioned one tooth while Athias-Henriot (1966) mentioned two. Lofego *et al.* (2009) showed a similar variability in *N. benjamini* for the number of cheliceral teeth on both digits. Examination of more specimens is necessary to clear this up in *N. baraki*. For *N. paspalivorus*, De Leon (1957) pointed out 4 to 6 teeth on the fixed digit of chelicerae. The Iranian specimen shows 7 teeth, which was also men-

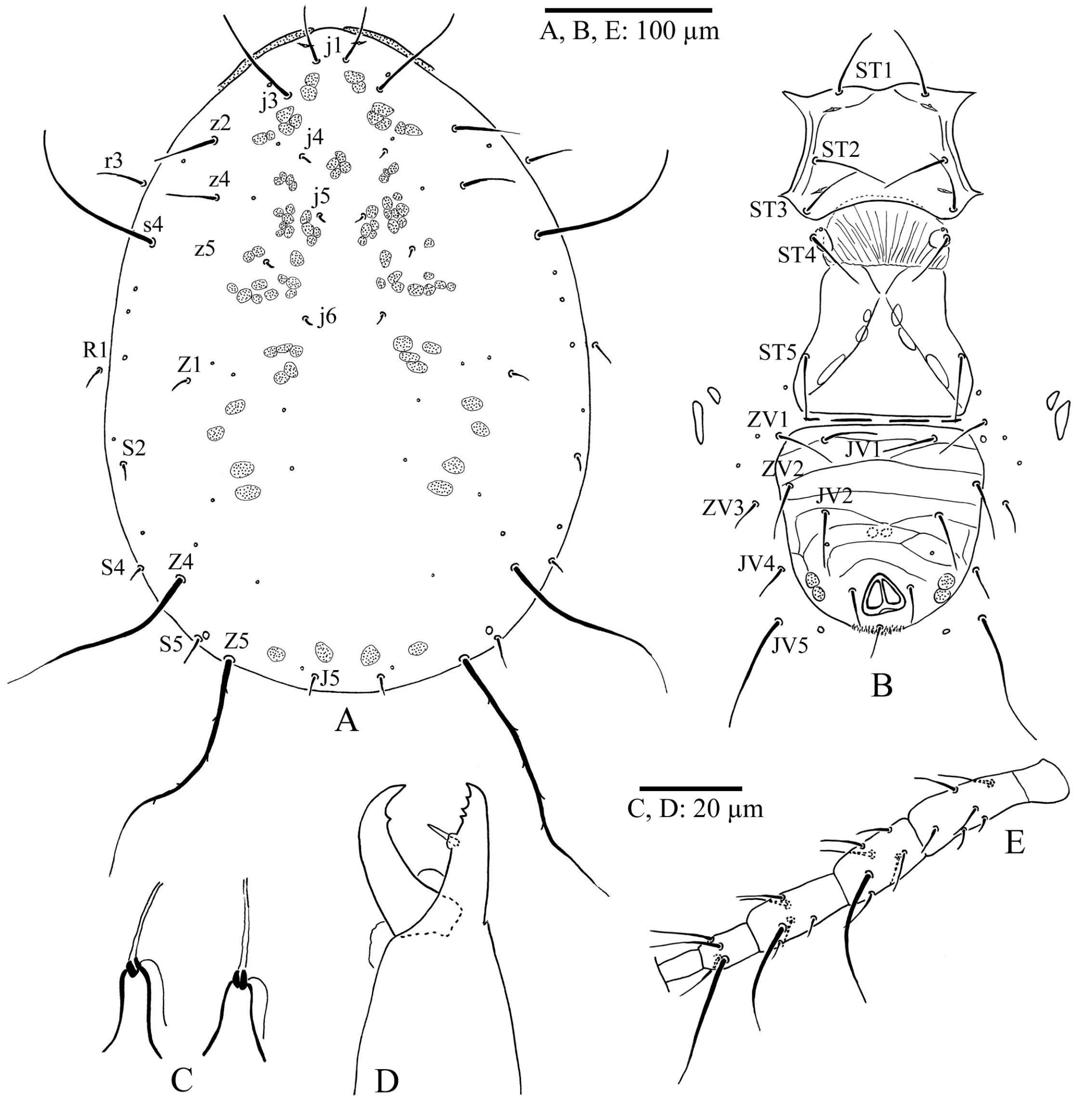

FIGURE 2: *Proprioseiopsis messor* (Wainstein) (Female): A – Idiosoma, dorsal view; B – Idiosoma, ventral view; C – Spermathecae; D – Chelicera; E – Leg IV.

tioned by Palevsky *et al.* (2009). Recently, Sourassou *et al.* (2011) examined three populations (Brazil, Benin and Ghana) of the species morphologically identified as *N. paspalivorus*. Despite morphological similarity, inter-population crosses showed reproductive isolation between the three populations indicating that the tested specimens are distinct biological entities. The single collected specimen from Iran resembles the original description of *N. paspalivorus* in all respects. The Iranian specimen does not show any significant morphometric differences from those of the three populations provided by Sourassou *et al.* (2011).

***Proprioseiopsis messor* (Wainstein) (Figure 2, A-E)**

Typhlodromus messor Wainstein, 1960: 668.
Amblyseius (*Amblyseius*) *apheles* Van der Merwe, 1968: 121 (synonymy according to Ueckermann and Loots, 1988).

Amblyseius lindquisti Schuster and Pritchard, 1963: 246 (synonymy according to Abbasova, 1972).

Female — 10 specimens measured.

Idiosomal setal pattern — 10A:8E/JV-3:ZV.

Dorsal idiosoma (Figure 2A) — Dorsal shield 407 (390 – 430) long and 278 (255 – 290) wide at j_6 level, smooth (a faint network of reticulation is visible at posterior half of dorsal shield in some specimens); dorsal setae smooth, except for Z_4 and Z_5, serrate (in some specimens Z_4 smooth); lengths: j_1 36 (34 – 38), j_3 65 (61 – 70), j_4 5, j_5 6 (5 – 6), j_6 7 (6 – 8), J_5 11 (10 – 11), z_2 35 (32 – 40), z_4 27 (21 – 33), z_5 6 (5 – 6), Z_1 9 (8 – 10), Z_4 122 (113 – 128), Z_5 167 (143 – 190), s_4 99 (92 – 105), S_2 11 (10 – 12), S_4 9 (8 – 12), S_5 18 (15 – 23); setae r_3 26 (25 – 28) and R_1 14 (14 – 15) on lateral integument.

Peritreme — Extending anterior to setae j_1 (Figure 2A).

Ventral idiosoma (Figure 2B) — Sternal shield smooth, with a few lateral striae, posterior margin concave, 67 (66 – 69) long and 97 (93 – 100) wide at level of setae ST_2; ST_1 42 (41 – 44), ST_2 40 (38 – 43), ST_3 38 (36 – 40), ST_4 38 (37 – 40), ST_4 on metasternal shields; genital shield smooth, width 106 (103 – 109) at widest point, ST_5 40 (37 – 42); 2 pairs of metapodal shields, primary 26 (24 – 28) and accessory 13 (11 – 16) long; ventrianal shield pentagonal, with reticulation, length 131 (125 – 135), width at widest point 133 (123 – 140) and width at level of paranal setae 99 (95 – 103); with 3 pairs of preanal setae JV_1 32 (31 – 32), JV_2 31 (31 – 32), ZV_2 29 (26 – 32); 4 pairs of setae surrounding ventrianal shield on integument, JV_4 19 (18 – 21), JV_5 86 (81 – 90), ZV_1 29 (27 – 31), ZV_3 15 (14 – 16); ventrianal shield with a pair of small round pores posteromesad to JV_2, distance between these pores 32 (57 – 64) slightly shorter than distance between JV_2-JV_2 insertions.

Spermatheca — Calyx saccular 17 (16 – 19) long; atrium u-shaped inserted at base of the calyx. (Figure 2C).

Chelicera — Fixed digit 31 (29 – 32) long with 3 teeth and a pilus dentilis; movable digit 31 long with 1 tooth (Figure 2D).

Legs — Leg IV (Figure 2E) with three pointed macrosetae, SgeIV 78 (72 – 83), StiIV 65 (58 – 70), StIV 78 (75 – 83); legs I, II and III with one macroseta each, SgeIII 45 (40 – 48), SgeII 33 (31 – 34), SgeI 34 (33 – 34); genua and tibiae I-II-III-IV with 10-8-7-7 and 10-7-7-6 setae, respectively.

Specimens examined — Two females, 28 Aug. 2009, soil from a cotton farm, Larestan, Fars, Iran, collector: Fakhrodin Khdempour; eight females, soil, April-Nov. 2009, Marvdasht, Fras, Iran, collector: Hadi Ostovan.

Remarks — The specimens collected in Fars province of Iran show morphological features simi-

TABLE 1: Comparison of some dorsal setal length of females in different population of *Proprioseiopsis messor* (Wainstein) with those collected in Iran (Fars province)

	j3	z2	z4	Z4	Z5	s4	S5
P. messor (original description)[1]	53	28	14	125	167	95	15
P. messor (Iran)[2]	61 – 70	32 – 40	21 – 33	113 – 128	143 – 190	92 – 105	15 – 23
P. messor (Australia)[3]	42 – 52	25 – 31	11 – 13	114 – 121	164 – 178	83 – 92	13 – 16
P. messor (France)[2]	43 – 55	30 – 40	15 – 23	103 – 133	150 – 190	80 – 95	14 – 16
P. messor (Greece)[4*]	59	35	14	130	197	100	16
P. messor (Israel)[5]	-	30 – 37	9 – 12	120 – 138	166 – 191	91 – 105	-
P. messor (South Africa)[6]	41 – 50	35	17	107 – 123	154 – 183	76 – 88	16 – 19
P. messor (Spain)[7]	47 – 54	28 – 32	12 – 16	118 – 139	168 – 196	90 – 103	13 – 18
P. messor (Ukraine)[8]	50	28	12	160 – 170	165 – 225	125	12
= *P. apheles* original description[9]	54 – 56	40 – 45	20 – 22	130 – 140	193 – 200	95 – 102	20 – 22
= *P. lindquisti* original description[10]	52	36	14	145	200	100	8
= *P. lindquisti* (Washington state)[11]	60	34	17	132	192	108	17

[1]Wainstein (1960), [2]Present work, [3]Schicha (1983), [4]Papadoulis and Emmanouel (1991), [5]Swirski *et al.* (1998), [6]Moraes *et al.* (2007), [7]Ferragut *et al.* (2010), [8]Livshitz and Kuznetsov (1972), [9]Van der Merwe (1968), [10]Schuster and Pritchard (1963), [11]Congdon (2002). *Calculated from the figure.

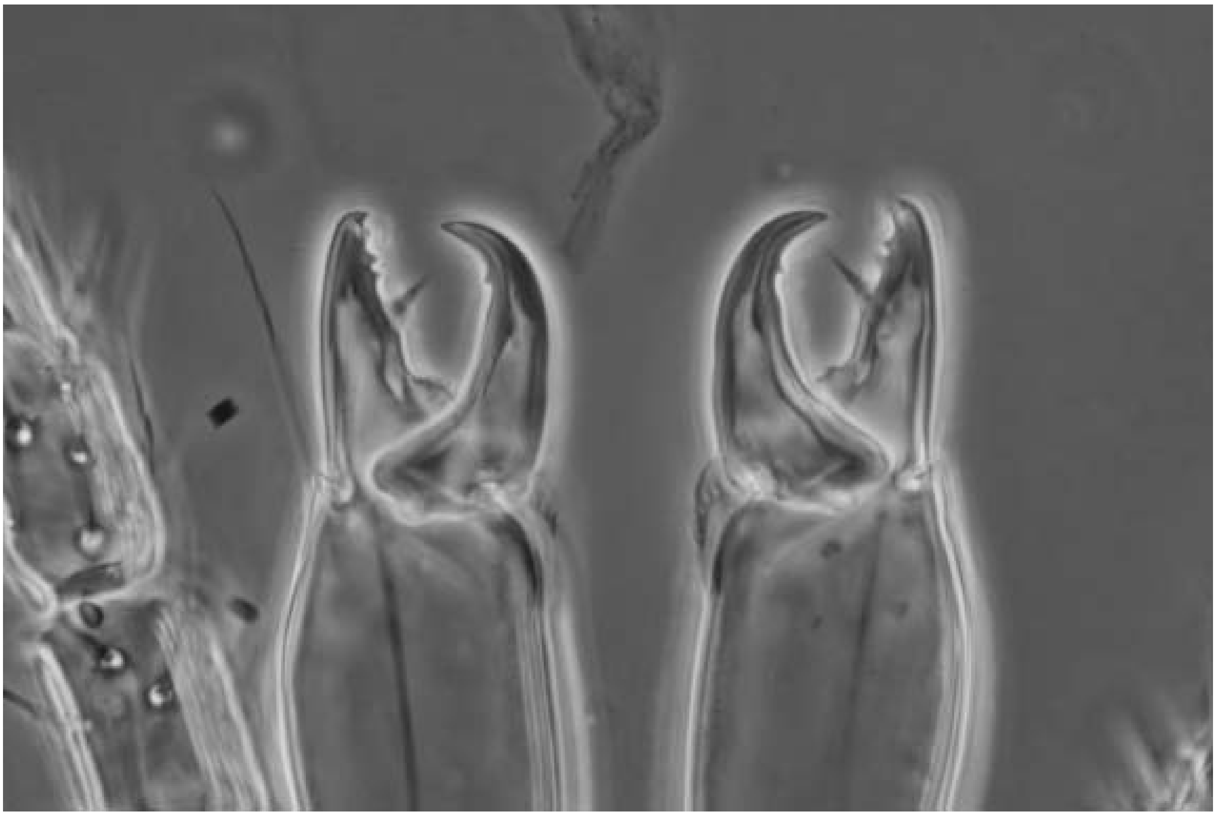

FIGURE 3: Chelicerae of *Proprioseiopsis messor* (Wainstein) (Female) collected in Iran (Fars province).

lar to those of the holotype and re-described specimens (Congdon 2002; Ferragut *et al.* 2010; Livshitz and Kuznetsov 1972; Moraes *et al.* 2007; Papadoulis and Emmanouel 1991; Schicha 1983; Schuster and Pritchard 1963; Swirski *et al.* 1998; Van der Merwe 1968; Wainstein 1960). However, the dorsal setae j_3 and z_4 have longer lengths compare to those of the other populations of *P. messor* (Table 1). Wainstein (1960) did not mention the details of chelicerae. In the re-descriptions of *P. messor*, there is a mixed report of fixed digit of chelicerae of having either 3 (e.g. Livshitz and Kuznetsov 1972) or 4 teeth (e.g. Moraes *et al.* 2007). The specimens collected in Iran clearly show 3 teeth on fixed digit of chelicerae (Figure 3).

CONCLUSION

Re-describing species based on strains from multiple geographic regions would increase our knowledge of intraspecific variation, thus making descriptions more robust and meaningful, therefore facilitating species identification. Furthermore, diagnostic molecular data increasingly complements morphological characters, providing additional diagnostic power, and is essential where morphology is unenlightening. Less explored areas include biological characteristics and cross-breeding studies, but these also can yield important supporting data. Considered together, these data would enable taxonomists to overcome the difficulty on what characters should be considered as intra- or interspecific variation.

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References

Abbasova E.D. 1972 — Phytoseiid mites (Parasitiformes: Phytoseiidae) of Azerbaijan. Avtoreferat Dissertatsii na Soiskanie Uchenoy Stepeni Kandidata Biologicheskikh Nauk. Akadrmiya Nauk Azerbaydzhanskoy SSR, Institut Zoologii , Baku, Azerbaijan, pp. 34

Athias-Henriot C. 1966 — Contribution à létude des *Amblyseius* paléarctiques (Acariens anactinotriches, Phytoseiidae) — Bull. Sci. Bourgogne, 24: 181-230.

Beard J.J. 2001 — A review of Australian *Neoseiulus* Hughes and *Typhlodromips* De Leon (Acari: Phytoseiidae: Amblyseiinae) — Invert. Taxon., 15: 73-158. doi:10.1071/IT99017

Chant D.A., McMurtry J.A. 2003 — A review of the subfamily Amblyseiinae Muma (Acari: Phytoseiidae). Part I. Neoseiulini new tribe — Internat. J. Acarol., 29: 3-46. doi:10.1080/01647950308684319

Chant D.A., McMurtry J.A. 2005 — A review of the subfamily Amblyseiinae Muma (Acari: Phytoseiidae): Part V. Tribe Amblyseiini, subtribe Proprioseiopsina Chant and McMurtry — Internat. J. Acarol., 31: 3-22. doi:10.1080/01647950508684412

Chant D.A., McMurtry J.A. 2007 — Illustrated keys and diagnoses for the genera and subgenera of the Phytoseiidae of the world (Acari: Mesostigmata). West Bloomfield, MI, USA: Indira Publishing House. pp. 220

Congdon B.D. 2002 — The family Phytoseiidae (Acari) in western Washington State with descriptions of three new species — Internat. J. Acarol., 28(1): 3-27. doi:10.1080/01647950208684275

De Leon D. 1957 — Three new Typhlodromus from southern Florida (Acarina: Phtyoseiidae) — Fla. Entomol., 40: 141-144. doi:10.2307/3492041

Ferragut F., Perez Moreno I., Iraola V., Escudero, A. 2010 — Ácaros depredadores en las plantas cultivadas. Familia Phytoseiidae — Ediciones Agrotecnicas, S. L., pp. 202

Gerson U., Smiley R.L., Ochoa R. 2003 — Mites (Acari) for pest control — Oxford (UK): Blackwell Publishing. pp. 537

Lindquist E.E., Evans G.O. 1965 — Taxonomic concepts in the Ascidae, with a modified setal nomenclature for the idiosoma of the Gamasina (Acarina: Mesostigmata) — Mem. Entomol. Soc. of Canada, 47: 1-64. doi:10.4039/entm9747fv

Livshitz I.Z., Kuznetsov N.N. 1972 — Phytoseiid mites from Crimea (Parasitiformes: Phytoseiidae). In: Pests and diseases of fruit and ornamental plants. Proceedings of The All-Union V. I. Lenin Academy of Agricultural Science, The State Nikita Botanical Gardens, Yalta, Ukraine, 61: 13-64.

Lofego A.C., Demite P.R., Kishimoto R.G., Moraes G.J. de 2009 — Phytoseiid mites on grasses in Brazil (Acari: Phytoseiidae) — Zootaxa, 2240: 41-59.

McMurtry J.A. 1984 — A consideration of the role of predators in the control of acarine pests, pp. 109-121 in D. A. Griffiths, and C.E. Bowman (eds.). Acarology VI, v. 1, Ellis Horwood Ltd., New York.

Moraes G.J. de, Zannou I.D., Ueckermann E.A., Oliveira A.R., Hanna R., Yaninek J.S. 2007 — Species of the subtribes Arrenoseiina and Proprioseiopsina (tribe Amblyseiini) and the tribe Typhlodromipsini (Acari, Phytoseiidae) from sub-Saharan Africa — Zootaxa, 1448: 1-39.

Palevsky E., Gal S., Ueckermann E. 2009 — Phytoseiidae from date palms in Israel with descriptions of two new taxa and a key to the species found on date palms world-wide (Acari: Mesostigmata) — J. Nat. Hist., 43: 1715-1747. doi:10.1080/00222930902969484

Papadoulis G.Th., Emmanouel N.G. 1991b — The genus *Amblyseius* (Acari: Phytoseiidae) in Greece, with the description of a new species — Entomol. Hellenica, 9: 35-62.

Rowell H.J., Chant D.A., Hansell R.I.C. 1978 — The determination of setal homologies and setal patterns on the dorsal shield in the family Phytoseiidae (Acarina: Mesostigmata) — Can. J. Zool., 110: 859-876.

Schicha E. 1981 — A new species of *Amblyseius* (Acari: Phytoseiidae) from Australia compared with ten closely related species from Asia, America and Africa — Internat. J. Acarol., 7: 203-216. doi:10.1080/01647958108683262

Schicha E. 1983 — New species, new records, and redescriptions of phytoseiid mites from Australia, Tahiti, and the African region (Acari: Phytoseiidae) — Internat. J. Entomol., 25(2-3): 103-126.

Schuster R.O., Pritchard A.E. 1963 — Phytoseiid mites of California — Hilgardia, 34: 191- 285.

Sourassou N.F., Hanna R., Zannou I., Moraes G. de, Negloh K., Sabelis M.W. 2011 — Morphological variation and reproductive incompatibility of three coconut-mite-associated populations of predatory mites identified as *Neoseiulus paspalivorus* (Acari: Phytoseiidae) — Exp. Appl. Acarol., 53: 323-338. doi:10.1007/s10493-010-9413-5

Swirski E., Ragusa Di Chiara S., Tsolakis H. 1998 — Keys to the phytoseiid mites (Parasitiformes, Phytoseiidae) of Israel — Phytophaga, Palermo, Italy, 8: 85-154.

Ueckermann E.A., Loots G.C. 1988 — The African species of the subgenera *Anthoseius* De Leon and *Amblyseius*

Berlese (Acari: Phytoseiidae). Entomology Memoir, Department of Agriculture and Water Supply, Republic of South Africa, 73: pp. 168

Van der Merwe G.G. 1968 — A taxonomic study of the family Phytoseiidae (Acari) in South Africa with contributions to the biology of two species — Entomology Memoirs, South Africa Department of Agricultural Technical Services, South Africa, 18: 1-198.

Wainstein B.A. 1960 — New species and subspecies of the genus *Typhlodromus* Scheuten (Parasitiformes, Phytoseiidae) of the USSR fauna — Zool. Zh., 39: 683-690.

Zannou I.D., Moraes G.J. de, Ueckermann E.A., Oliveira A.R., Yaninek J.S., Hanna R. 2007 — Phytoseiid mites of the subtribe Amblyseiina (Acari: Phytoseiidae: Amblyseiini) from sub-Saharan Africa — Zootaxa, 1550: 1-47.

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