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Phytoseiidae of Vietnam (Acari: Mesostigmata) with description of a new species

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Original research

ABSTRACT

Vietnam is a large country of Southeast Asia and a globally recognized hotspot of biodiversity. Until recently, only limited surveys had been carried out on the resident Phytoseiidae fauna and presence of 12 species had been documented, with 11 belonging to the sub-family Amblyseiinae and 1 to the sub-family Typhlodrominae. Here, we present results from 2017 field surveys and add a total of 8 new country records, one of which a newly-described species. At least 5 species *(i.e.*, *Neoseiulus longispinosus*, *Paraphytoseius cracentis*, *P. orientalis*, *Amblyseius cinctus* and *A. herbicolus*) are well-known biological control agents (BCA), while two species (*Euseius ovaloides* and *Gynaeseius liturivorus*) carries ample potential as BCA agents but necessitates further study. In addition to the intrinsic value of phytoseiid mite biodiversity in tropical environments, demonstration of the natural occurrence of efficient BCAs in Southeast Asian countries such as Vietnam is of great agricultural and commercial interest.

Keywords survey; collection; taxonomy; systematics; Vietnam
Zoobank http://zoobank.org/9062B6C5-A8EF-4DB4-B5DA-30ACCA8B1D4A

Introduction

The Phytoseiidae family is widespread all over the world and consists of about 2,500 valid species dispatched in three sub-families and 94 genera (Demite *et al.* 2014, 2020). Several species in the family are important natural enemies of phytophagous mites, insect eggs and small (or immature) insects in natural habitats, arable field crops and protected crops globally (McMurtry and Croft 1997; McMurtry *et al.* 2013). Despite the extensive faunistic surveys carried out for more than 70 years worldwide, the fauna of certain countries and ecosystems remains little explored (Tixier and Kreiter, 2009; Kreiter *et al.* 2020a). Consequently, it is important to conduct surveys in these poorly-investigated areas and gain more information on resident biodiversity, especially in hotspots of biodiversity. Furthermore, in-country surveys of Phytoseiidae can signal local presence of known biological control agents (BCA) and introduce new potential BCAs, especially in the context of international and country regulations including the Nagoya Protocol on Access and Benefit Sharing (Mason *et al.* 2018).

Most areas of Southeast Asia constitute globally-important hotspots of biodiversity (Myers, 1988). These geographical entities are of immediate importance to biodiversity conservation, regularly hold high endemism and have been subject to considerable loss of natural habitats

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in recent years (Myers *et al.* 2000). The characterization of the phytoseiid mite diversity in these areas is thus directly contributing to this general topic of conservation. Though Vietnam is a large area in Southeast Asia, scant information exists on the resident phytoseiid mite fauna restricted to only five species listed in the world Phytoseiidae database (Demite *et al.* 2020) [*Amblyseius matinikus* Schicha & Corpuz-Raros, *Graminaseius polisensis* (Schicha & Corpuz-Raros), *Neoseiulus longispinosus* (Evans), *Paraphytoseius orientalis* (Narayanan, Kaur & Ghai), and *Scapulaseius asiaticus* (Evans)], based on only one paper (Nguyen *et al.* 2016) concerning a survey in one city of Vietnam, *i.e.*, Ho Chi Minh City.

Actually, 12 species are known from Vietnam, the previous five and 7 additional species: *Amblyseius tamatavensis* Blommers, *Proprioseiulus dahonagnas* (Schicha & Corpuz-Raros) and an undetermined *Typhlodromus* sp., *Paraphytoseius cracentis* (Corpuz & Rimando), *Amblyseius largoensis* (Muma), *Neoseiulus californicus* (McGregor) and *Proprioseiopsis lenis* (Corpuz & Rimando) (Nguyen & De Clercq, 2018; Nguyen & Dao, 2019; Nguyen *et al.* 2019a; Nguyen *et al.* 2019b).

This paper constitutes the sixth contribution to Vietnam's Phytoseiidae Fauna and reports results of an additional field surveys realised in 2017.

Material and Methods

The survey took place in Yen Bai province, a mountain province located at the northwest part of northern-central Vietnam.

Plant-inhabiting mites were collected in several cultivated plots planted with *Manihot esculenta* and on surrounding wild plants in two villages of Vietnam (Vinh Kien village: 21.74°N, 105.08°E, Yen Binh district, Yen Bai province and Mau Dong village: 21.91°N, 104.64°E, Van Yen district, Yen Bai province).

Mites were directly collected on leaves with a fine brush.

Collected mite specimens were then transferred with a fine brush into small plastic vials containing 70° ethanol. Next, mites were mounted on slides using Hoyer's medium and all identified using a phase contrast and Differencial Interference contrast microscope (DMLB, Leica Microsystèmes SAS, Nanterre, France). Characters of specimens were measured using a graduate eyepiece (Leica, see above). Chant and McMurtry's (1994, 2007) concepts of the taxonomy of the family Phytoseiidae and the world catalogue database of Demite *et al.* (2014, 2020) were used to identify mite species. In this paper, the setal nomenclature system adopted was that of Lindquist & Evans (1965) and Lindquist (1994), as adapted by Rowell *et al.* (1978) for the dorsum and by Chant & Yoshida-Shaul (1991) for the venter. The idiosomal setal pattern follows Chant & Yoshida-Shaul (1992). The notation for solenostomes and poroids is based on Athias-Henriot (1975). Numbers of teeth on the fixed and movable cheliceral digits do not include the respective apical tooth. Setae not referred to in the Results section should be considered as absent. All measurements are given in micrometers (µm) in the text and figures and presented as the mean in bold followed by the range in parenthesis. All collected individuals were measured if no precision is given. New measurements added with existing literature records are marked in bold in the tables.

Specimens are deposited in the mite collections of Montpellier SupAgro conserved in UMR CBGP INRA/IRD/CIRAD/SupAgro. All specimens were identified, except for few single males which were not taken into account. The following abbreviations are used in this paper for morphological characters: dsl = dorsal shield length just under *j1* to just below *J5*; dsw = dorsal shield width at the level of *s4*; Per. ext.: peritreme extension; *gd* = solenostome; *Z4* ser., *Z5* ser. = *Z4*, *Z5* serrated (if *Z4* and *Z5* without ser. = not serrated); Metastern. sh. = presence or absence of metasternal shield; lisl = Largest inguinal sigilla (= "metapodal plate") length; lisw = Largest inguinal sigilla (= "metapodal plate") width; sisl = smallest inguinal sigilla (= "metapodal plate") length; gensl = genital shield length; gensw post. cor. = genital shield width posteriorly; vsl = ventrianal shield length; vsw *ZV2* & vsw anus = ventrianal shield width at

ZV2 level and at paranal setae level; Dist. solen. vas = distance between solenostomes on the ventrianal shield; scl = total spermatheca length (calyx + neck or cervix + atrium); scw = calyx width; FD = fixed digit; Fdl = fixed digit length; MD = movable digit; Mdl = movable digit length; No teeth Fd = number of teeth on the fixed digit; No teeth Md = number of teeth on the movable digit; Shaft = length of the shaft of spermatodactyl; BCA = Biological control agents; FCI = French Caribbean Islands; VCW: various countries in the world; im. = immature. The following abbreviations are used in this paper for institution: CBGP = Centre de Biologie pour la Gestion des Populations; CIRAD = Centre International de Recherche Agronomique pour le Développement; INRA = Institut National de la Recherche Agronomique; IRD = Institut de Recherche pour le Développement; MSA = Montpellier SupAgro, France; UMR = Unité Mixte de Recherche.

Results and Discussion

A total of 14 species were found: 11 belonging to Amblyseiinae and to genera *Amblyseius*, *Euseius*, *Graminaseius*, *Gynaeseius*, *Neoseiulus*, *Paraphytoseius* and *Scapulaseius*; Three species are belonging to Phytoseiinae and to genus *Phytoseius*. No species of the sub-family Typhlodrominae has been found.

Thirteen species had been previously described among which 8 are new records for Vietnam, while 1 species is new to science. All results concerning the 14 species are given hereunder.

Subfamily Amblyseiinae Muma

Amblyseiinae Muma, 1961: 273.

Genus *Neoseiulus* Hughes

Neoseiulus Hughes, 1948: 141.

Neoseiulus longispinosus (Evans)

Typhlodromus longispinosus Evans 1952: 413; Evans 1953: 465; Womersley 1954: 177; Ehara 1958: 55.
Typhlodromus (*Amblyseius*) *longispinosus*, Chant 1959: 74.
Amblyseius longispinosus, Corpuz & Rimando 1966: 129; Schicha 1975: 103.
Neoseiulus longispinosus, Moraes *et al.* 1986: 85; 2000: 245; Chant & McMurtry 2003a: 37; Moraes *et al.* 2004a: 129; Chant & McMurtry 2007: 29.

Specimens examined: Muoi in P4 plot (aasl 66 m, lat. 21°54'41" N, long. 104°38'7" E), 1 ♀ on *Styrax tonkinensis* (Styracaceae), 12/V/2017; in P8 plot (aasl 66 m, lat. 21°54'46" N, long. 104°38'9" E), 1 im. on *Bambusodae* sp. (Poaceae), 17/V/2017; in P1 plot (aasl 66 m, lat. 21°54' N, long. 104°38' E), 1 ♀ an in plot SP5 plot (aasl 66 m, lat. 21°54' N, long. 104°38' E), 3 ♀♀, on *Manihot esculenta* (Euphorbiaceae), 17/V/2017; in P11 plot (aasl 66 m, lat. 21°54'30" N, long. 104°38'14" E), 1 im. on *Mallotus canii* (Euphorbiaceae), and 1 ♀ on *Passiflora foetida* (Passifloraceae), 31/V/2017.

Remarks: this species is distributed in many countries of the world, mainly in tropical areas (Moraes *et al.* 2000; Mailloux *et al.* 2010; Kreiter *et al.* 2013, 2018 a, c; Demite *et al.* 2020). It was rarely encountered before in surveys made in Guadeloupe, Martinique and La Réunion but was recently more captured when screening low vegetation constituting companion plants in citrus orchards (Mailloux *et al.* 2010; Kreiter *et al.* 2013, 2018c; Le Bellec *et al.*, unpub. data). This species appears to be more common on grasses of the lower vegetation with populations of tetranychid mites. *Neoseiulus longispinosus,* a type II phytoseiid predatory mite like *N. californicus* (McMurtry *et al.* 2013), is increasingly being considered for the control of *Eutetranychus*, *Oligonychus*, and *Tetranychus* spider mites in Asia (Nusartlert *et*

Table 1 Character measurements of adult females of *Neoseiulus longispinosus* collected in this study and those reported in previous studies (localities followed by the number of specimens measured).

Characters	Vietnam	La Réunion	Comoros	Holotype Indonesia	Sri Lanka	Taiwan	Thailand
	6, this study	18	1	1	3	?	3
Dsl	**321** (305 – 350)	320 (278 – 348)	380	332	321 (313 – 338)	-	330 (315 – 340)
Dsw at *s4 level*	**170** (130 – 213)	183 (150 – 205)	192	173	187 (175 – 208)	-	186 (178 – 195)
j1	**19** (15 – 23)	18 (15 – 20)	20	14	18 (17 – 19)	17	19 (18 – 21)
j3	**57** (50 – 65)	62 (53 – 73)	69	51	62 (61 – 64)	58	61 (56 – 68)
j4	**57** (53 – 60)	55 (48 – 60)	70	49	58 (56 – 60)	59	58 (54 – 62)
j5	**65** (63 – 70)	66 (58 – 73)	78	59	70 (69 – 71)	-	69 (65 – 72)
j6	**69** (65 – 73)	73 (65 – 83)	78	64	70 (68 – 72)	-	71 (68 – 73)
J2	**76** (73 – 78)	74 (68 – 83)	88	66	77 (75 – 79)	-	74 (68 – 81)
J5	**8**	8 (6 – 10)	10	10	8	-	9 (7 – 12)
r3	**61** (55 – 65)	59 (48 – 78)	75	54	55 (55 – 56)	-	61 (50 – 67)
R1	**56** (55 – 58)	61 (54 – 80)	70	58	60 (59 – 62)	-	63 (55 – 70)
s4	**81** (73 – 83)	82 (70 – 88)	-	75	82 (80 – 83)	72	81 (76 – 85)
S2	**73** (63 – 80)	75 (68 – 85)	88	67	73 (70 – 79)	70	73 (68 – 80)
S4	**61** (55 – 68)	56 (43 – 68)	63	49	59 (57 – 62)	58	61 (56 – 68)
S5	**18** (15 – 20)	17 (15 – 18)	18	15	21 (19 – 23)	17	20 (18 – 25)
z2	**64** (60 – 73)	67 (56 – 75)	75	58	69 (68 – 70)	62	66 (62 – 70)
z4	**69** (63 – 75)	73 (65 – 80)	78	58	73 (73 – 75)	65	71 (68 – 75)
z5	**31** (28 – 33)	27 (23 – 33)	38	-	32 (32 – 38)	-	31 (25 – 36)
Z1	**74** (68 – 78)	75 (65 – 85)	83	67	77 (76 – 78)	-	75 (71 – 78)
Z4	**70** (60 – 73)	70 (63 – 75)	78	68	72 (71 – 73)	65	71 (65 – 76)
Z5	**76** (63 – 80)	81 (73 – 88)	85	72	80 (80 – 81)	70	78 (72 – 81)
st1-st1	**48** (45 – 48)	47 (43 – 50)	48	-	-	-	-
st2-st2	**57** (55 – 60)	58 (55 – 60)	55	-	53 (50 – 55)	-	59 (57 – 60)
st3-st3	**70** (63 – 73)	71 (68 – 78)	60	77	-	-	-
st1-st3	**54** (53 – 55)	57 (55 – 60)	73	62	55 (53 – 56)	-	63 (57 – 85)
st4-st4	**69** (60 – 75)	71 (63 – 83)	85	-	-	-	-
Gensl	**116** (103 – 125)	-	-	-	-	-	-
st5-st5	**56** (50 – 60)	54 (50 – 58)	58	-	53 (51 – 54)	-	61 (55 – 64)
Gensw post.corn.	**75** (70 – 80)	-	-	-	-	-	-
Lisl	**29** (25 – 33)	25 (20 – 30)	23	-	-	-	-
Lisw	**2**	3 (3 – 6)	3	-	-	-	-
Sisl	**14** (13 – 18)	12 (10 – 18)	18	-	-	-	-
Vsl	**110** (95 – 125)	114 (93 – 125)	125	97	106 (103 – 111)	-	123 (120 – 125)
Vsw *ZV2*	**91** (75 – 100)	86 (80 – 95)	90	87	91 (89 – 93)	-	97 (95 – 100)
Vsw anus	**77** (75 – 78)	69 (67 – 73)	78	-	75 (73 – 77)	-	-
JV5	**59** (50 – 68)	62 (55 – 70)	73	-	-	-	-
StIV	**74** (70 – 75)	79 (75 – 83)	75	80 – 87	68 (68 – 70)	74	74 (72 – 77)
Scl	**22** (18 – 23)	24 (13 – 35)	25	30	21 (20 – 21)	17	19 (17 – 22)
Scw	**5** (5 – 6)	4 (3 – 10)	5	4	-	-	-
Fdl	**23** (20 – 25)	24 (19 – 28)	23	-	22 (21 – 22)	-	23 (22 – 25)
No teeth Fd	-	6	-	-	5	-	-
Mdl	**25**	24 (23 – 30)	23	-	25 (23 – 25)	-	26 (25 – 27)
No teeth Md	-	2	-	-	2	-	-

Sources of measurements – La Réunion: Kreiter *et al.* 2020 accepted; Grande Comore Island of Comoros Archipelago: Kreiter *et al.* (2018b) (a mistake remains in the paper, 1 single female measured instead of 8 as indicated); Holotype Indonesia: Schicha (1975); Sri Lanka: Moraes *et al.* (2004b); Taiwan: Tseng (1983); Thailand: Oliveira *et al.* (2012); - : not provided.

al. 2011). Its behaviour, feeding, development, prey consumption, cannibalism and intra-guild predation have been extensively studied by several authors (see for example Luong *et al.* 2017), with the ultimate aim to enhance its use for biological control. *Neoseiulus longispinosus* is a well-known BCA sold in several countries and commercially-available for management of spider mites. Under controlled laboratory conditions, *N. longispinosus* exhibits potential as a BCA against the citrus red spider mite *P. citri* (Huyen *et al.,* 2017).

This species was already known from Vietnam and reported as a local BCA in earlier survey work (Nguyen *et al.* 2016) though no measurements were given. Measurements of female specimens collected during this study are given in table 1 and compared with measurements obtained from specimens collected in other countries of Asia and Islands of the Indian Ocean. Measurements match with most of the previous measurements, especially with those obtained on specimens from La Réunion Island. The setal lengths of the present females are longer than those obtained from the holotype, which are in the lower part of the range of data obtained for each seta (probably measurements were obtained from a very small size female).

Genus *Paraphytoseius* Swirski & Shechter

Paraphytoseius Swirski & Shechter 1961: 113; Moraes *et al.* 1986: 104.
Chant & McMurtry 2003b: 216; Moraes *et al.* 2004a: 160; Chant & McMurtry 2007: 49.
Amblyseius (*Paraphytoseius*), Ueckermann & Loots 1987: 221.
Amblyseius (*Ptenoseius*), Pritchard & Baker 1962: 295.
Proprioseius (*Paraphytoseius*), Karg 1983: 302.
Ptenoseius, Schuster & Pritchard 1963: 198.

Paraphytoseius cracentis (Corpuz & Rimando)

Ptenoseius cracentis Corpuz & Rimando 1966: 115.
Amblyseius (*Paraphytoseius*) *multidentatus,* misidentification (*S5* illustrated in figures): Ehara & Bhandhufalck 1977: 79 as mentioned in Ehara *et al.* 2000: 114.
Paraphytoseius cracentis, Moraes *et al.* 1986: 104; Chant & McMurtry 2003b: 220; Moraes *et al.* 2004a: 160; Chant & McMurtry 2007: 53.

Specimens examined: Muoi, in P3 plot (aasl 66 m, lat. 21°54’40” N, long. 104°38’13” E), 1 ♀ + 1 ♂ on *Chromolaena odorata* (Asteraceae) and 1 ♀ on *Rubus alceifolius* (Rosaceae), 11/V/2017; in P5 plot (aasl 66 m, lat. 21°54’56” N, long. 104°38’22” E), 3 ♀♀ + 1 ♂ + 1im. on *C. odorata* (Asteraceae), 1 ♀ + 1 ♂ on *Ficus hispida* (Moraceae) and 1 ♀ + 1 ♂ on *Artemisa vulgaris* (Asteraceae), 13/V/2017; in P6 plot (aasl 66 m, lat. 21°54’55” N, long. 104°38’22” E), 1 ♀ on *Ficus hispida* (Moraceae) and 1 ♀ on *Curculigo orchioides* (Hypoxidaceae), 15/V/2017; in P7 plot (aasl 66 m, lat. 21°54’51” N, long. 104°38’22” E), 1 ♀ on *F. hispida* (Moraceae) and 2 ♀ + 2 ♂ on *Urena lobata* (Malvaceae), 16/V/2017; in P8 plot (aasl 66 m, lat. 21°54’46” N, long. 104°38’9” E), 2 ♀♀ on *C. odorata* (Asteraceae) and 1 ♀ on *R. alceifolius* (Rosaceae), 16/V/2017; in plot PM1 plot (aasl 66 m, lat. 21°54’ N, long. 104°38’ E), 2 ♀♀ on an unknown host plant, 17/V/2017; in P9 plot (aasl 66 m, lat. 21°54’46” N, long. 104°38’18” E), 1 ♀ on *U. lobata* (Malvaceae) and 6 ♀♀ + 1 ♂ on *C. odorata* (Asteraceae), 18/V/2017; in P10 plot (aasl 66 m, lat. 21°54’46” N, long. 104°38’12” E), 2 ♀♀ + 1 ♂ on *C. odorata* (Asteraceae), 18/V/2017; in P11 plot (aasl 66 m, lat. 21°54’30” N, long. 104°38’14” E), 4 ♀♀ + 1 ♂ on *F. hispida* (Moraceae), 1 ♂ + 1 im. on *Bidens pilosa* (Asteraceae), 4 ♀♀ + 1 ♂ on *C. odorata* (Asteraceae), 1 ♂ on *R. alceifolius* (Rosaceae) and 2 ♀♀ + 1 ♂ on an unknown host plant, 31/V/2017; in P15 plot (aasl 66 m, lat. 21°54’56” N, long. 104°38’46” E), 2 ♀♀ on *F. hispida* (Moraceae), 6 ♀♀ + 2 ♂♂ on *U. lobata* (Malvaceae) and 1 ♀ on *Ch. odorata* (Asteraceae), 03/VI/2019; in P4 plot (aasl 66 m, lat. 21°54’41” N, long. 104°38’7” E), 1 ♀ on *Xanthium strumarium* (Asteraceae), 18/VII/2017; in P5 plot (aasl 66 m, lat. 21°54’56” N, long. 104°38’22” E), 1 ♀ on *U. lobata* (Malvaceae), 19/VII/2017; in P6 plot (aasl 66 m, lat. 21°54’55” N, long. 104°38’22” E), 3 ♀♀ on *X. strumarium* (Asteraceae), 20/VII/2017; in P16

plot (aasl 66 m, lat. 21°54'56" N, long. 104°38'46" E), 1 ♂ on *Ch. odorata* (Asteraceae) and 1 ♀ on *U. lobata* (Malvaceae), 22/VII/2017; in P10 plot (aasl 66 m, lat. 21°54'46" N, long. 104°38'12" E), 1 ♀ + 1 ♂ on *Tephrosia candida* (Fabaceae) and 1 ♀ on *Morus alba* (Moraceae), 25/VII/2017; in P14 plot (aasl 66 m, lat. 21°54'56" N, long. 104°38'46" E), 1 ♀ on *X. strumarium* (Asteraceae), 27/VII/2017; in P12 plot (aasl 66 m, lat. 21°54'51" N, long. 104°38'45" E), 2 ♀♀ + 1 ♂ on *U. lobata* (Malvaceae), 29/VII/2017.

Remarks: the predatory mite *P. cracentis* is a natural enemy of thrips found on vegetables such as green bean, cucumber, green squash, eggplant, and pepper in the Red River Delta in Vietnam. *Paraphytoseius cracentis* is feeding on *Frankliniella occidentalis* Pergande (Thysanoptera: Thripidae) and *Carpoglyphus lactis* (L.) (Acari: Acaridae) (Nguyen and De Clercq 2018, paper in which this species was mentioned for the first time for Vietnam. The intrinsic rate of natural increase of *P. cracentis* fed on *C. lactis* (0.215 female/ female/ day) was however significantly higher than that of mites fed on thrips (0.189). Nguyen and De Clercq (2018) conclude that *P. cracentis* can sustain and increase its population when fed on

Table 2 Character measurements of adult females and males of *Paraphytoseius cracentis* collected in this study and those reported in previous studies (localities followed by the number of specimens measured).

	♀						♂				
Characters	**Vietnam** (12)	**Japan**	**Papua New Guinea**	**Philippines**	**Taiwan**	**Thailand**	**Vietnam** (12)	**Philippines**	**Taiwan**	**Thailand 1**	**Thailand 2**
	12, this study	(3 for Dsl & Dsw, 7-8 for other characters)	2	2	?	10	12, this study	1	?	5	3
Dsl	**293** (273 – 303)	281 (3)	268	266 – 281	264 (251 – 279)	292 (265 – 310)	**238** (223 – 268)	220	216 (214 – 219)	320	243 (235 – 255)
Dsw at *s4* level	**145** (130 – 166)	155 (3)	146	100 – 103	95 (92 – 96)	158 (150 – 168)	**116** (103 – 125)	95	86 (85 – 87)	160	143 (140 – 147)
j1	**34** (30 – 35)	35 (35 – 37)	33	32 – 38	33 (32 – 34)	33 (33 – 39)	**25** (23 – 28)	24	25 (24 – 26)	25	26 (24 – 27)
j3	**87** (83 – 93)	87 (85 – 89)	90	84 – 91	92 (87 – 99)	92 (82 – 98)	**61** (58 – 68)	68	66 (63 – 70)	59	59 (58 – 60)
j4	**5** (5 – 6)	4 (4 – 5)	4	4 – 5	Minute	5 (4 – 6)	**4** (3 – 5)	2 – 4	-	4	5
j5	**5**	4	5	4	Minute	5 (4 – 6)	**5** (4 – 5)	2 – 4	-	5	5
j6	**6** (5 – 7)	6 (6 – 7)	6	6	minute	7 (5 – 9)	**7** (5 – 8)	2 – 4	-	6	6 (6 – 7)
J5	**5**	4 (4 – 5)	5	2	minute	5 (4 – 6)	**4** (3 – 5)	2 – 4	-	4	3
r3	**45** (43 – 48)	46 (45 – 47)	37	40 – 42	47 (42 – 53)	48 (44 – 50)	**28** (25 – 30)	24	31 (28 – 33)	27	30 (27 – 33)
R1	**30** (28 – 33)	34 (33 – 35)	23	26 – 33	30 (27 – 36)	32 (28 – 38)	**16** (13 – 20)	12	16 (15 – 17)	14	15 (15 – 16)
s4	**120** (113 – 128)	123 (121 – 124)	117	115 – 127	125 (120 – 132)	128 (119 – 134)	**84** (78 – 88)	88	89 (80 – 97)	81	88 (85 – 89)
S5	**14** (11 – 18)	13 (13 – 14)	14	8 – 13	minute	14 (11 – 17)	**8** (6 – 12)	8	-	6	7 (6 – 7
z2	**10** (9 – 11)	10 (9 – 10)	10	8 – 12	minute	10 (8 – 13)	**10** (8 – 11)	8	-	9	10 (10 – 11)
z4	**9** (8 – 10)	9	10	8 – 12	minute	9 (8 – 12)	**9** (8 – 10)	8	-	8	10 (9 – 11)
z5	**5**	5	4	4	minute	5 (4 – 5)	**3** (3 – 4)	2 – 4	-	5	5
Z1	**8** (6 – 8)	7	9	7 – 8	minute	7 (6 – 9)	**7** (5 – 8)	8	-	6	6 (6 – 7)
Z4	**75** (70 – 80)	77 (75 – 78)	71	74 – 82	77 (70 – 83)	80 (75 – 85)	**48** (43 – 53)	54	49 (48 – 49)	47	52 (50 – 53)
Z5	**100** (90 – 110)	106 (104 – 107)	95	91 – 121	110 (99 – 119)	102 (92 – 105)	**54** (50 – 58)	65	55 (48 – 61)	52	59 (55 – 62)
st1-st1	**69** (63 – 75)	-	-	-	-	-	**56** (53 – 60)	-	-	-	-
st2-st2	**68** (65 – 70)	-	-	84 – 85	57 (64 – 69)	73 (71 – 76)	**60** (55 – 63)	-	-	-	-
st3-st3	**79** (75 – 80)	-	-	-	-	-	**68** (63 – 70)	-	69 (68 – 70)	-	-
st1-st3 ♀ / *st1-st5* ♂	**67** (63 – 70)	-	-	70 – 74	78 (74 – 84)	70 (65 – 75)	**115** (110 – 133)	-	115 (113 – 117)	-	-
st4-st4	**86** (78 – 90)	-	-	-	-	-	**59** (55 – 63)	-	-	-	-
gensl	**112** (100 – 123)	-	-	-	-	-			Not applicable		
st5-st5	**83** (80 – 85)	-	-	84	86 (78 – 90)	89 (84 – 92)	**50** (45 – 63)	-	-	-	-
gensw post. corn.	**91** (85 – 95)	-	-	-	-	-					
Lisl	**37** (33 – 43)	-	-	24	31 (24 – 36)	-			Not applicable		
Lisw	**1**	-	-	-	-	-					
Vsl	**92** (75 – 103)	-	-	94 – 96	97 (95 – 105)	112 (104 – 120)	**91** (83 – 100)	86	95 (89 – 101)	-	102 (101 – 102)
Vsw *ZV2*	**62** (55 – 70)	-	-	58	58 (51 – 64)	66 (53 – 74)	**111** (100 – 128)	129	110 (109 – 112)	-	124 (120 – 126)
Vsw anus	**51** (48 – 55)	-	-	-	-	-	**64** (60 – 70)	-	-	-	-
JV5	**74** (60 – 85)	69 (67 – 70)	-	68 – 77	75 (71 – 84)	-	**20** (15 – 25)	-	20 (18 – 20)	21	-
SgeII	**13** (11 – 15)	-	-	10 – 13	-	14 (12 – 16)	**13** (10 – 15)	-	-	-	12
Erected setae femur IV	**12** (10 – 13)	16 (15 – 16)	-	-	-	-	**8** (7 – 9)	-	-	-	-
SgeIV	**30** (28 – 33)	31 (30 – 32)	22	24 – 28	-	31 (27 – 33)	**21** (18 – 23)	20	-	21	21 (20 – 22)
StiIV	**38** (35 – 40)	41 (40 – 42)	34	38 – 39	-	40 (38 – 42)	**29** (25 – 30)	30	-	29	30
StIV	**46** (43 – 50)	49	38	40 – 41	-	47 (43 – 52)	**36** (33 – 38)	36	-	35	37 (35 – 40)
SttIV	**45** (43 – 49)	44 (42 – 45)	30	43 – 46	-	47 (45 – 58)	**36** (33 – 38)	37	-	36	38 (37 – 40)
Scl	**3** (2 – 4)	-	-	?	-	8 (7 – 10)			Not applicable		
Scw	**10** (9 – 10)	-	-	-	-	-					
Fdl	**31** (30 – 33)	-	-	29	-	28 (26 – 30)	**21** (20 – 23)	-	-	-	19 (18 – 20)
No teeth Fd	**11** (11 – 12)	-	-	12	11	-	**9** (9 – 10)	12	8	-	-
Mdl	**33** (33 – 35)	-	-	33	-	34 (32 – 37)	**22** (20 – 25)	-	-	-	23 (21 – 24)
No teeth Md	**3** (2 – 3)	-	-	3	3	-	**1**	3	1	-	-
Shaft	Not applicable						**15** (13 – 20)	12	-	-	16 (15 – 17)
Toe							**5** (4 – 6)	6	-	-	-

Sources of measurements – For ♀♀: Japan: Ehara et al. (2000); Papua New Guinea: McMurtry & Moraes (1985); Philippines: Schicha & Corpuz-Raros (1985); Taiwan: Ho & Lo (1989); Thailand: Oliveira et al. (2012). For ♂♂: Philippines: Schicha & Corpuz-Raros (1985); Taiwan: Ho & Lo (1989); Thailand 1: (misidentified as *Paraphytoseius multidentatu* s, setae *S5* overlooked as mentioned by Ehara et al. 2000) Ehara & Bhandhufalck (1977); Thailand 2: Oliveira et al. (2012). - : not provided.

F. occidentalis, and that *C. lactis* can be used for mass-rearing of this predatory mite in the perspective to use it in biological control.

This species was already known from Vietnam and reported locally as a BCA from earlier survey work (Nguyen and De Clercq 2018) though no measurements were provided. Measurements are given here in table 2 for females and males and compared with those obtained from specimens collected in other countries of Asia.

All measurements collected during this study match well with most of the previous measurements, especially with measurements of specimens from Thailand.

Paraphytoseius horrifer (Pritchard & Baker)

Amblyseius (*Ptenoseius*) *horrifer* Pritchard & Baker, 1962: 295.
Amblyseius horrifer, Meyer & Rodrigues 1966: 30.
Amblyseius (*Paraphytoseius*) *horrifer*, van der Merwe 1968: 169.
Proprioseius (*Paraphytoseius*) *horrifer*, Karg 1983: 302.
Paraphytoseius horrifer, Moraes *et al.* 1986: 105; Beard 2001: 84; Chant & McMurtry 2003b: 37; Moraes *et al.* 2004a: 152; Chant & McMurtry 2007: 53.

Specimens examined: Muoi, in P11 plot (aasl 66 m, lat. 21°54'30" N, long. 104°38'14" E), 1 ♂ on *Rubus alceifolius* (Rosaceae), 31/V/2017; in P15 plot (aasl 66 m, lat. 21°54'56" N, long. 104°38'46" E), 1 ♀ on *Chromolaena odorata* (Asteraceae), 2/VI/2017 and 1 ♀ on *R. alceifolius* (Rosaceae), 3/VI/2017; Ma, in P1 plot (aasl 66 m, lat. 21°45'53" N, long. 105°1'28" E), 1 ♂ on *Xanthium stumarium* (Asteraceae) and 1 ♀ on *Blumea eberhardtii* (Asteraceae), 14/VII/2017.

Remarks: This species is widely distributed in sub-Saharan Africa and Madagascar. The biology of *P. horrifer* remains totally unknown.

This is the first record of this species from Vietnam and from Asia. Measurements are given in the table 3 for females and males and compared with those obtained from specimens collected in other countries of Africa and Indian Ocean. Measurements obtained during this study agree well with most of the previous measurements obtained, especially with measurements of specimens from La Réunion Island.

Paraphytoseius orientalis (Narayanan, Kaur & Ghai)

Typhlodromus (*Amblyseius*) *orientalis* Narayanan, Kaur & Ghai 1960: 394.
Paraphytoseius orientalis, Moraes *et al.* 1986: 105; Chant & McMurtry 2003b: 220; Moraes *et al.* 2004a: 162, Chant & McMurtry 2007: 53.
Amblyseius ipomeai El-Banhawy 1984: 126 (synonymy according to Chant & McMurtry 2003b: 216).
Paraphytoseius narayanani Ehara 1967: 67 (synonymy according to Ehara & Ghai, *in* Ehara 1967: 77).
Paraphytoseius multidentatus Swirski & Shechter 1961: 114 (synonymy according to Matthysse & Denmark 1981).

Specimens examined: Muoi, in P4 plot (aasl 66 m, lat. 21°54'41" N, long. 104°38'7" E), 1 ♀ on *Styrax tonkinensis* (Styracaceae), 12/V/2017; in P6 plot (aasl 66 m, lat. 21°54'55" N, long. 104°38'22" E), 1 ♀ on *Curculigo orchioides* (Hypoxidaceae), 15/V/2017; in P4 plot (aasl 66 m, lat. 21°54'41" N, long. 104°38'7" E), 1 ♀ on *Xanthium stumarium* (Asteraceae), 18/VII/2017; in P6 plot (aasl 66 m, lat. 21°54'55" N, long. 104°38'22" E), 1 ♀ on *X. stumarium* (Asteraceae), 20/VII/2017.

Remarks: This species is widely distributed in tropical and subtropical areas in South America, Africa and Asia. It and other members of the genus belong to the large polyphagous generalist group, type III (McMurtry & Croft 1997; McMurtry *et al.* 2013). Navasero and Navasero (2016) have studied the life history of *P. orientalis* on the broad mite, *Polyphagotarsonemus latus* (Banks), as prey. The authors reported high predation rates on *P. latus* eggs, suggesting its potential use against this pest.

This species has been collected before in Vietnam by Nguyen *et al.* (2016). Exact indications of locations were provided in this paper but without providing measurements of collected specimens. Measurements from this study are provided in the table 4 and compared with those obtained from specimens collected in other countries of Asia and Indian Ocean. Measurements obtained with this study agree well with most obtained from female specimens

Table 3 Character measurements of adult females and males of *Paraphytoseius horrifer* collected in this study and those reported in previous studies (localities followed by the number of specimens measured).

	♀						♂		
Characters	**Vietnam**	**Africa**	**Holotype Zaire**	**La Réunion**	**Senegal**	**South Africa**	**Vietnam**	**La Réunion**	**South Africa**
	2, this study	4	1	12	2	2	2, this study	1	2
Dsl	**300 – 308**	300 (294 – 310)	298	295 (265 – 330)	300 – 304	318 – 339	**225 – 253**	250	260
Dsw at *s4* level	**170 – 175**	158 (149 – 166)	166	153 (128 – 175)	163 – 170	165 – 176	**113**	110	140
j1	**35**	38 (37 – 40)	38	33 (25 – 40)	35 – 38	39 – 42	**23 – 25**	15	
j3	**90**	85 (80 – 88)	84	86 (78 – 100)	83 – 85	-	**58 – 60**	58	59
j4	**5**	3	3	5 (3 – 5)	3 – 5	-	**3**	4	-
j5	**5**	3	3	5 (3 – 5)	3 – 5	5	**5**	4	-
j6	**5**	7 (6 – 8)	6	8 (5 – 10)	5 – 6	9	**8**	7	-
J5	**5**	4 (3 – 5)	3	5 (3 – 8)	3 – 5	5	**3**	3	-
r3	**49 – 50**	43 (10 – 45)	45	48 (45 – 58)	43 – 45	52	**25**	30	33
R1	**33 – 35**	31 (27 – 41)	28	38 (30 – 45)	30 – 32	36	**14**	18	22
s4	**125**	131 (122 – 139)	138	126 (110 – 148)	118 – 125	136 – 141	**83**	80	103
z2	**10 – 13**	11 (10 – 12)	11	12 (9 – 13)	8 – 10	14	**10**	10	-
z4	**9 – 10**	8 (6 – 11)	6	11 (9 – 13)	8 – 10	9	**10**	10	-
z5	**5**	5 (4 – 5)	5	5 (3 – 8)	3 – 5	5	**3**	5	-
Z1	**6 – 8**	7 (6 – 8)	5	7 (5 – 8)	7 – 9	5	**5**	7	-
Z4	**75**	80 (77 – 84)	84	80 (70 – 88)	73 – 75	85 – 89	**45 – 48**	45	59
Z5	**108**	114 (112 – 118)	116	109 (93 – 133)	95 – 100	122 – 127	**50**	50	75
st1-st1	**63 – 70**	-	-	68 (55 – 73)	-	-	**58**	53	-
st2-st2	**68 – 70**	73 (72 – 74)	69	71 (65 – 80)	68 – 69	78	**58**	55	-
st3-st3	**80**	-	-	79 (73 – 85)	-	-	**68**	63	-
st1-st3 ♀ / *st1-st5* ♂	**70**	66 (64 – 69)	63	68 (58 – 75)	68 – 70	92	**113 – 133**	98	-
st4-st4	**85 – 93**	-	-	88 (75 – 98)	-	-	**58**	55	-
gensl	**125**	-	-	-	-	-		Not applicable	
st5-st5	-	83 (82 – 86)	84	86 (75 – 95)	85 – 88	87	**48**	48	-
gensw	-	-	-	-	-	-			
Lisl	**38**	-	-	30 (25 – 38)	-	-		Not applicable	
Lisw	**2**	-	-	3	-	-			
Sisl	-	-	-	11 (10 – 13)	-	-			
Vsl	-	103 (96 – 110)	115	99 (53 – 118)	113 – 115	117	**95 – 100**	-	122
Vsw *ZV2*	-	68 (62 – 74)	75	59 (53 – 75)	68 – 70	70	**113 – 118**	105	120
Vsw anus	-	62 (59 – 67)	63	61 (55 – 68)	65	-	**65 – 70**	60	-
JV5	**73 – 75**	-	-	77 (70 – 85)	-	-	**15 – 18**	50	28
SgeII	**13 – 15**	12 (11 – 13)	-	15 (13 – 15)	13 – 15	-	-	13	14
SgeIV	**25 – 30**	25 (24 – 27)	24	27 (23 – 45)	28 – 30	28	**20**	18	23
StiIV	**37 – 40**	37 (35 – 40)	34	36 (30 – 43)	32 – 38	47	**25 – 28**	23	34
StIV	**43**	40 (38 – 43)	36	43 (38 – 47)	43 – 45	47	**33**	30	37
SttIV	**45**	41 (39 – 42)	-	45 (43 – 48)	33 – 35	-	**35**	30	-
Scl	**2**	4 (3 – 5)	4	3 (3 – 5)	-	25		Not applicable	
Scw	**8**	12 (9 – 13)	-	10 (9 – 11)	-	10			
Fdl	**28 – 30**	29	-	34 (23 – 50)	-	-	**20 – 23**	20	22
No teeth Fd	**11**	10 – 11	-	11	-	-	**8**	5 ?	8
Mdl	**33**	34 (33 – 34)	-	32 (25 – 38)	-	-	**22 – 23**	20	22
No teeth Md	**3**	2 – 3	-	2	-	-	**1**	1	1
Shaft	Not applicable						**16 – 20**	15	18
Toe							**5**	-	-

Sources of measurements – For ♀♀: Africa (Benin 1♀, Kenya 1♀, Uganda 2♀): Moraes *et al.* (2007); Holotype Zaïre : Moraes *et al.* 1989b; La Réunion: Kreiter *et al.* 2020; Senegal: Kade *et al.* (2011); South Africa: van der Merwe (1968). For ♂♂: La Réunion: Kreiter *et al.* 2020; South Africa: van der Merwe (1968); - : not provided.

Table 4 Character measurements of adult females of *Paraphytoseius orientalis* collected in this study and those reported in previous studies (localities followed by the number of specimens measured).

Characters	Vietnam 4, this study	Japan 8 for Dsl & Dsw, 10 for other characters	Hong-Kong 7	La Réunion 5	Madagascar ?	Mauritius 1	Paratype Hong-Kong, 1
Dsl	**288** (280 – 295)	278 (275 – 281) (8)	259 – 305	266 (260 – 283)	280 – 295	290	306
Dsw at *s4* level	**128** (123 – 140)	153 (151 – 155) (8)	-	150 (145 – 150)	155 – 160	-	165
j1	**36** (33 – 37)	36	36 (30 – 38)	31 (28 – 35)	30 – 36	38	36
j3	**78** (75 – 87)	84 (82 – 85)	79 (76 – 81)	83 (81 – 88)	79 – 89	83	81
j4	**4** (3 – 5)	3	4 (3 – 5)	5 (4 – 5)	< 10	5	4
j5	**5** (3 – 5)	3	4 (3 – 5)	5	< 10	-	4
j6	**7** (5 – 8)	6	4 (3 – 5)	8 (5 – 8)	< 10	-	6
J5	**4** (3 – 5)	3 (3 – 4)	4 (3 – 5)	5 (4 – 5)	< 10	-	5
r3	**45** (43 – 50)	48 (47 – 49)	43 (41 – 46)	38 (35 - 40)	36 – 48	55	45
R1	**26** (25 – 28)	26 (25 – 27)	26 (20 – 33)	34 (33 – 35)	23 – 35	33	25
s4	**121** (118 – 125)	121 (118 – 123)	117 (107 – 124)	120 (113 – 123)	118 – 130	125	117
z2	**10** (9 – 10)	8 (7 – 8)	8 (5 – 11)	11 (10 – 15)	< 10	8	9
z4	**9** (7 – 10)	9 (9 – 10)	10 (8 – 13)	10 (5 – 10)	< 10	10	11
z5	**5** (3 – 5)	5	4 (3 – 5)	6 (6 – 8)	< 10	-	3
Z1	**8** (7 – 8)	7	8 (8 – 10)	9 (6 – 9)	< 10	8	8
Z4	**72** (65 – 78)	74 (73 – 75)	74 (69 – 81)	80 (70 – 80)	68 – 80	70	71
Z5	**94** (88 – 100)	100 (99 – 101)	82 (76 – 91)	105 (99 – 107)	96 – 116	93	94
st1-st1	**65** (60 – 68)	-	-	70	-	-	-
st2-st2	**66** (65 – 68)	-	-	68 (65 – 68)	-	-	66
st3-st3	**74** (73 – 75)	-	-	75 (75 – 78)	-	-	-
st1-st3	**62** (60 – 63)	-	-	65 (64 – 65)	-	65	66
st4-st4	**85** (78 – 93)	-	-	85 (85 – 93)	-	-	-
Gensl	**107** (105 – 108)	-					
st5-st5	**84** (80 – 93)	-	-	85	-	-	79
Gensw	**90** (88 – 93)						
Lisl	**30**	-	-	18	-	-	-
Lisw	**3**	-	-	2	-	-	-
Vsl	**96** (88 – 100)	-	93 (84 – 102)	80	102 – 108	113	97
Vsw *ZV2*	**64** (63 – 65)	-	53	65	59 – 63	-	52
Vsw anus	**54** (53 – 55)	-	53 – 55	63		-	55
JV5	**71** (63 – 78)	71 (70 – 72)	69 (64 – 76)	66 (65 – 75)	63 – 82	-	-
SgeI	**9** (8 – 10)	9 (8 – 9)	-	-	-	8	6
SgeII	**13** (10 – 15)	14 (14 – 15)	-	13	Present	13	13
SgeIV	**27** (25 – 29)	28 (27 – 28)	28 (25 – 33)	23 (21 – 28)	22 – 27	30	25
StiIV	**34** (31 – 37)	34 (34 – 35)	35 (33 – 38)	38 (30 – 38)	28 – 38	38	35
StIV	**46** (45 – 48)	49 (48 – 49)	44 (41 – 46)	41 (38 – 42)	38 – 45	45	43
SttIV	**38** (35 – 40)	35 (38 – 39)	33 (30 – 36)	33 (33 – 45)	34 – 42	48	36
Scl	**3**	-		3 (3 – 5)	20	4	-
Scw	**10**	-		10 (8 – 11)	7	6	-
Fdl	**25** (25 – 28)	-	25	27 (27 – 30)	-	25	-
No teeth Fd	**8**	-	7	7 – 8	8	7	-
Mdl	**29** (28 – 30)	-	29 (28 – 30)	35 (31 – 35)	-	28	-
No teeth Md	**3**	-	2	2	3	2	-

Sources of measurements – Japan: (identified as *Paraphytoseius multidentatus* , synonymized by Mathysse & Denmark 1981): Ehara *et al.* (2000); Hong-Kong: Swirski & Shechter (1961); La Réunion: Kreiter *et al.* 2020; Madagascar (identified as *Paraphytoseius multidentatus* , synonymized by Mathysse & Denmark 1981): Blommers (1976); Mauritius: Kreiter *et al.* (2018a); Paratype Hong-Kong: Moraes *et al.* (2007); - : not provided.

collected in other countries, especially with measurements of specimens from Hong Kong and La Réunion Island.

Genus *Scapulaseius* Karg & Oomen-Kalsbeek

Scapulaseius Karg & Oomen-Kalsbeek 1987: 132.
Amblyseius (*Scapulaseius*) Karg & Oomen-Kalsbeek 1987: 132.
newsami group of *Typhlodromus* (*Amblyseius*), Chant 1959: 95.
markwelli species group of *Amblyseius*, Schicha 1987: 2.
japonicus species group of *Amblyseius*, Schicha 1987: 26.
oguroi species group of *Amblyseius*, Wu & Ou 1999: 103.
Scapulaseius, Chant & McMurtry 2005b: 331; 2007: 65.

Scapulaseius asiaticus (Evans)

Typhlodromus asiaticus Evans 1953: 461.
Typhlodromus (*Amblyseius*) *asiaticus*, Chant 1959: 80.
Amblyseius (*Typhlodromopsis*) *asiaticus*, Muma 1961: 289.
Amblyseius (*Amblyseius*) *asiaticus*, Ehara 1966: 20; Ehara & Bhandhufalck, 1977: 58.
Amblyseius asiaticus, Carmona 1968: 280; Gupta, 1975: 32.
Amblyseius (*Neoseiulus*) *asiaticus*, Ehara 2002: 127.
Typhlodromips asiaticus, Moraes *et al.* 2004a: 207.
Scapulaseius asiaticus, Chant & McMurtry 2005b: 335; 2007: 67.
Scapulaseius linearis Corpuz-Raros & Rimando 1966:125 (synonymy according to Schicha & Corpuz-Raros 1992: 60).
Scapulaseius siaki Ehara & Lee 1971: 64 (synonymy according to Ehara & Bhandhufalck 1977: 58).

Specimens examined: Ma, in P1 plot (aasl 63 m, lat. 21°45'53" N, long. 105°1'28" E), 1 ♀ on *Chromolaena odorata* (Asteraceae), 9/V/2017; Muoi, in P7 plot (aasl 66 m, lat. 21°54'51" N, long. 104°38'22" E), 1 ♀ on *Crassocephalum crepidioides* (Asteraceae), 16/V/2017; in P9 plot (aasl 66 m, lat. 21°54'46" N, long. 104°38'18" E), 1 ♀ on an unknown plant support, 18/V/2017; in P11 plot (aasl 66 m, lat. 21°54'30" N, long. 104°38'14" E), 1 im. on *C. odorata* (Asteraceae), 31/V/2017; in P15 plot (aasl 66 m, lat. 21°54'56" N, long. 104°38'46" E), 1 ♀ on *C. odorata* (Asteraceae), 31/V/2017; in P8 plot (aasl 66 m, lat. 21°54'46" N, long. 104°38'9" E), 2 ♀♀ + 1 im. on *Xanthium strumarium* (Asteraceae), 2/VI/2017; in P13 plot (aasl 66 m, lat. 21°54'50" N, long. 104°38'46" E), 1 ♀ on *X. strumarium* (Asteraceae), 29/VII/2017.

Remarks: Species of this genus are supposed to be of type III (McMurtry and Croft 1997; McMurtry *et al.* 2013), i.e. a polyphagous generalist predator. However, the biology of *S. asiaticus* remains totally unknown.

This species was already known from Vietnam from results of a previous survey (Nguyen *et al.* 2016). Exact indications of locations were provided in this paper without providing any morphological data on the collected specimens. Measurements of collected specimens during this study are provided in table 5 and compared with those obtained from specimens collected in other countries of Asia and Indian Ocean. Measurements obtained match with most of previous measurements, especially with measurements of specimens from Thailand.

Scapulaseius okinawanus (Ehara)

Amblyseius (*Amblyseius*) *okinawanus* Ehara 1967: 72; Ehara & Bhandhulfack 1977: 58.
Amblyseius okinawanus, Lo 1970: 56.
Neoseiulus okinawanus, Moraes *et al.* 1986: 91.
Amblyseius (*Neoseiulus*) *okinawanus*, Ehara & Amano 1998: 37; Ehara & Amano 2002: 321.
Amblyseius okinawanus, Jung *et al.* 2003: 189.
Typhlodromips okinawanus, Moraes *et al.* 1986: 137; 2004a: 220.
Scapulaseius okinawanus, Chant & McMurtry 2005b: 335; 2007: 67.

Table 5 Character measurements of adult females of *Scapulaseius asiaticus* collected in this study and those reported in previous studies (localities followed by the number of specimens measured).

Characters	Vietnam	Indonesia	Mauritius	Sri Lanka	Thailand 1	Thailand 2
	7, this study	3	9	1	**?**	8
Dsl	**306** (293 – 313)	300 – 325	311 (304 – 325)	287	330	301 (283 – 318)
Dsw at *s4* level	**179** (170 – 188)	180 – 195	191 (182 – 199)	182	230	200 (181 – 222)
j1	**21** (18 – 23)	16 – 18	22 (20 – 24)	19	20	21 (19 – 23)
j3	**14** (13 – 15)	16 – 18	17 (15 – 20)	13	18	15 (10 – 16)
j4	**8**	8 – 9	5	8	7	8 (7 – 10)
j5	**8** (6 – 8)	8 – 9	5	8	7	8 (6 – 10)
j6	**9** (8 – 10)	8 – 9	8 (7 – 9)	9	8	10 (9 – 12)
J2	**9** (8 – 10)	8 – 9	9 (7 – 9)	9	9	11 (10 – 12)
J5	**8** (8 – 9)	8 – 9	8 (7 – 8)	6	6	8 (7 – 8)
r3	**13** (13 – 15)	16 – 18	15 (13 – 16)	12	14	13 (11 – 15)
R1	**10** (9 – 13)	16 – 18	18 (16 – 19)	14	16	16 (14 – 17)
s4	**18** (16 – 20)	16 – 18	23 (22 – 25)	17	21	21 (18 – 23)
S2	**15** (13 – 18)	16 – 18	18 (15 – 20)	13	15	16 (13 – 18)
S4	**12** (10 – 13)	16 – 18	15 (13 – 17)	12	13	14 (11 – 15)
S5	**13** (10 – 15)	16 – 18	14 (13 – 15)	11	13	14 (12 – 19)
z2	**12** (10 – 15)	-	14 (13 – 14)	11	13	14 (13 – 15)
z4	**13** (10 – 15)	-	11 (10 – 12)	11	11	11 (7 – 13)
z5	**8** (7 – 10)	-	7 (6 – 9)	7	9	9 (8 – 11)
Z1	**10** (7 – 13)	-	9 (8 – 9)	-	11	11 (10 – 12)
Z4	**50** (47 – 55)	44	47 (44 – 52)	45	51	52 (49 – 58)
Z5	**77** (75 – 80)	73	73 (65 – 77)	68	73	74 (70 – 83)
st1-st1	**50** (48 – 50)	-	-	-	-	-
st2-st2	**58** (55 – 60)	-	57 (55 – 60)	52	-	59 (57 – 61)
st3-st3	**61** (55 – 65)	-	-	-	-	-
st1-st3	**53** (50 – 55)	-	53 (52 – 54)	48	-	54 (50 – 58)
st4-st4	**65** (56 – 83)	-	-	-	-	-
Gensl	**101** (90 – 113)	-	-	-	-	-
st5-st5	**59** (55 – 63)	-	61 (55 – 65)	54	-	61 (58 – 64)
Gensw post. corn.	**69** (65 – 80)		71 (60 – 74)	-	-	-
Lisl	**16** (13 – 18)	-	-	-	-	-
Lisw	**3** (2 – 5)	-	-	-	-	-
Sisl	**10**	-	-	-	-	-
Vsl	**102** (95 – 110)	105	99 (95 – 101)	97	-	103 (97 – 110)
Vsw *ZV2*	**82** (78 – 90)	116	81 (77 – 84)	79	-	84 (80 – 87)
Vsw anus	**64** (50 – 73)	-	67 (61 – 74)	65	-	-
JV5	**23** (20 – 25)	-	26 (22 – 28)	-	19	-
SgeI	**16** (15 – 20)	-	18 (16 – 19)	-	-	17 (15 – 20)
SgeII	**12** (10 – 15)	-	12 (10 – 13)	-	-	11 (8 – 13)
SgeIII	**17** (15 – 19)	-	15 (13 – 17)	14	-	17 (15 – 18)
StiIII	**15** (13 – 18)	-	-	15	-	-
SgeIV	**28** (25 – 30)	-	26 (24 – 29)	22	27	27 (24 – 30)
StiIV	**22** (20 – 24)	-	20 (18 – 23)	18	22	22 (18 – 26)
StIV	**50** (48 – 50)	-	49 (44 – 53)	45	50	49 (44 – 52)
Scl	**30** (28 – 35)	-	33 (29 – 34)	27	-	35 (29 – 40)
Scw	**5** (4 – 6)	-	-	-	-	-
Fdl, No teeth	**25** (23 – 28), **9**	-	26 (24 – 27), 9	-	-	22 (21 – 23)
Mdl, No teeth	**25** (23 – 28), **3**	18	27 (25 – 29), 2-3	-	-	25 (23 – 25)

Sources of measurements – Mauritius: Ferragut & Baumann (2019); Sri Lanka: Moraes *et al.* (2004b); Thailand 1: Ehara & Bhandhufalck (1977); Thailand 2: Oliveira *et al.* (2012); - : not provided.

Specimens examined: Muoi, in PM1 plot (aasl 66 m, lat. 21°54' N, long. 104°38' E), 2 ♂♂ on an unknown host plant, 17/V/2017; in P9 plot (aasl 66 m, lat. 21°54'46" N, long. 104°38'18" E), 2 ♀♀ on *Crassocephalum crepidioides* (Asteraceae), 17/V/2017; in P15 plot (aasl 66 m, lat. 21°54'56" N, long. 104°38'46" E), 1 ♀ on *Rubus alceifolius* (Rosaceae), 17/V/2017; in P11 plot (aasl 66 m, lat. 21°54'30" N, long. 104°38'14" E), 3 ♀♀ on *Xanthium strumarium* (Asteraceae), 26/VII/2017.

Remarks: The biology of *S. okinawanus* remains totally unknown.

This is the first mention of this species in Vietnam.

Measurements of specimens collected during this study are provided in table 6 for females and males and compared with measurements obtained from specimens collected in other countries of Asia. Measurements obtained agree well with most of those previously obtained, except setae *j6*, *J2*, and *z5*, and macrosetae *SgeI* and *SgeII* in female specimens and shorter setae of the *j-J, S* series and *Z1* of male specimens.

Genus *Amblyseius* Berlese

Amblyseius Berlese, 1914: 143; Garman, 1948: 16; Muma, 1955: 263; Chant, 1957: 528; Kennet, 1958: 474; Muma, 1961: 287; Gonzalez & Schuster, 1962: 8; Pritchard & Baker, 1962: 235; van der Merwe & Ryke, 1963: 89; Corpuz & Rimando, 1966: 116; van der Merwe, 1968: 109; Zack, 1969: 71; Muma and Denmark, 1970: 62; Chant & Hansell, 1971: 703; Denmark & Muma, 1972: 19; Tseng, 1976: 104; Chaudhri *et al.*, 1979: 68; Karg, 1982: 193, Schicha, 1987: 19, Schicha & Corpuz-Raros, 1992: 12; Denmark & Muma, 1989: 4; Chant & McMurtry, 2004a: 188; 2007: 73.
Amblyseius (*Amblyseius*), Karg, 1983: 313.
Amblyseius (*Amblyseialus*), Karg, 1983: 313.
Amblyseius (*Amblyseius*) section *Amblyseius*, Wainstein, 1962: 15.
Amblyseius (*Amblyseius*) section *Italoseius* Wainstein, 1962: 15.

Amblyseius cinctus Corpuz & Rimando

Amblyseius cinctus Corpuz & Rimando 1966: 119.
Amblyseius (*Amblyseius*) *cinctus*, Ehara & Bhandhufalck 1977: 70.
Amblyseius (*Multiseius*) *cinctus,* Denmark & Muma 1989: 103.
Amblyseius cinctus, Moraes *et al.* 1986: 10; 2004a: 20; Chant & McMurtry 2004a: 203; 2007: 78.

Specimens examined: Muoi in P1 plot (aasl 66 m, lat. 21°54' N, long. 104°38' E), 10 ♀ + 1 im. on *Manihot esculenta* (Euphorbiaceae), 17/V/2017; in P5 plot (aasl 66 m, lat. 21°54'56" N, long. 104°38'22" E), 1 ♀ on *Urena lobata* (Malvaceae), 19/VII/2017.

Remarks: This species was described from specimens collected in the Philippines on *Panicum* sp. and *Streblus asper*. Life history of *A. cinctus* has been evaluated on *Polyphagotarsonemus latus* (Banks), an important pest of several cultivated (crop) plants worldwide (Vichitbandha and Chandrapatya 2009) and this species can be considered as a potential BCA of *P. latus*.

This is the first mention of this species in Vietnam.

Measurements of specimens collected during this study are provided in table 7 and compared with measurements obtained from specimens collected in other countries of South-East Asia. Measurements obtained during this study agree well with those obtained from female specimens collected in other countries.

Amblyseius herbicolus (Chant)

Typhlodromus (*Amblyseius*) *herbicolus* Chant 1959: 84.
Amblyseius (*Amblyseius*) *herbicolus*, Muma 1961: 287.
Typhlodromus herbicolus, Hirschmann 1962: 23.

Table 6 Character measurements of adult females and males of *Scapulaseius okinawanus* collected in this study and those reported in previous studies (localities followed by the number of specimens measured).

	♀				♂		
Characters	**Vietnam**	**Japan**	**Korea**	**New Hebrides**	**Vietnam**	**Japan**	**Korea**
	6, this study	9	7	1?	2, this study	3	4
Dsl	**324** (310 – 328)	340	306	314	**243 – 250**	250	-
Dsw at *s4* level	**201** (180 – 210)	190 – 250	205	173	**125 – 128**	180	-
j1	**20** (18 – 22)	21	20	-	**18**	18	18
j3	**15** (13 – 15)	16	16	-	**13 – 14**	19	19
j4	**9** (8 – 10)	10	9	-	**6 – 8**	10	9
j5	**8** (5 – 10)	10	9	-	**6 – 8**	9	9
j6	**8** (8 – 10)	12	12	-	**8**	11	10
J2	**10** (9 – 10)	15	15	-	**8 – 10**	12	11
J5	**9** (8 – 9)	8	9	-	**7 – 8**	8	7
r3	**13** (10 – 15)	14	13	-	**12 – 14**	12	10
R1	**10** (8 – 13)	11	11	-	**11 – 12**	11	10
s4	**20** (19 – 21)	22	20	-	**18 – 19**	19	18
S2	**19** (18 – 20)	17	18	-	**13 – 16**	17	18
S4	**16** (15 – 18)	16	17	-	**13**	17	16
S5	**16** (14 – 18)	15	18	-	**11 – 12**	15	17
z2	**14** (13 – 15)	15	14	-	**13**	14	14
z4	**15** (13 – 16)	16	15	-	**15 – 18**	15	15
z5	**9** (8 – 10)	11	10	-	**6 – 8**	10	9
Z1	**12** (10 – 13)	14	14	-	**5 – 7**	12	12
Z4	**35** (33 – 37)	35	33	-	**30 – 34**	30	27
Z5	**82** (80 – 88)	78	80	-	**53 – 58**	57	56
st1-st1	**49** (48 – 51)	-	-	-	**38 – 43**	-	-
st2-st2	**58** (55 – 63)	-	-	65	**48 – 51**	-	-
st3-st3	**64** (63 – 68)	-	-	-	**47 – 48**	-	-
st1-st3 ♀ / *st1-st5* ♂	**55** (53 – 58)	-	-	55	**93 – 95**	-	-
st4-st4	**70** (60 – 83)	-	-	-	**35 – 36**	-	-
Gensl	**104** (103 – 105)	-	-			Not applicable	
st5-st5	**62** (55 – 68)	-	-	-	**33 – 34**	-	-
Gensw post. corn.	**72** (68 – 75)	-	-				
Lisl	**16** (15 – 18)	-	-	18		Not applicable	
Lisw	**5** (3 – 7)	-	-	-			
Sisl	**10** (8 – 13)	-	-	10			
Vsl	**104** (98 – 108)	-	-	115	**97 – 105**	-	-
Vsw *ZV2*	**88** (83 – 90)	-	-	92	**100 – 115**	-	-
Vsw anus	**79** (78 – 80)	-	-	-	**58 – 68**	-	-
Dist. solen. vas	**24** (23 – 25)	-	-		**18**	20	22
JV5	**29** (25 – 30)	28	28	-	**18**	-	-
SgeI	**10** (9 – 13), knob.	-	-	19 – 20 knob.	**10**	-	-
SgeII	**9** (8 – 9), knob.	-	-	15 – 16 knob.	**13**	-	-
SgeIII	**19** (18 – 20), knob.	-	-	21 – 23 knob.	**10**	-	-
StiIII	**17** (13 – 19)	-	-	18	**23**	20	21
SgeIV	**27** (25 – 30), knob.	29	25	31 knob.	**15**	20	22
StiIV	**24** (20 – 25)	24	25	25	**43**	42	48
StIV	**53** (53 – 54), knob.	54	56	55 knob.			
Scl	**11** (10 – 13)	-	-	8		Not applicable	
Scw	**7** (5 – 8)	-	-	-			
Fdl, No teeth	**25** (23 – 25)	-	-	-	**23**	-	-
No teeth Fd	7	-	-	-	**7**	-	-
Mdl, No teeth	**27** (25 – 28)	-	-	-	**23**	-	-
No teeth Md	3	-	-	-	**1**	-	-
Shaft		Not applicable			**13 – 15**	-	-
Toe					**5**	-	-

Sources of measurements – For ♀♀: Japan: Ehara (1967); Korea: Ryu & Lee (1992); New Hebrides: Schicha (1982). For ♂♂: Japan Ehara (1967); Korea: Ryu & Lee (1992). - : not provided.

Amblyseius herbicolus, Moraes *et al.* 1986: 14; 1989a: 79; Chant & McMurtry 2004: 208; Moraes *et al.* 2004a: 27; Chant & McMurtry 2007: 78.
Amblyseius deleoni Muma & Denmark 1970: 68 (synonymy according to Daneshvar & Denmark 1982; Denmark & Muma 1989).
Amblyseius giganticus Gupta 1981: 33 (synonymy according to Gupta 1986).
Amblyseius impactus Chaudhri 1968: 553 (synonymy according to Daneshvar & Denmark 1982).
Amblyseius (*Amblyseiulus*) *thermophilus* Karg 1991: 12 (synonymy according to El-Banhawy & Knapp 2011).
Typhlodromus (*Amblyseius*) *amitae* Bhattacharyya 1968: 677 (synonymy according to Denmark & Muma 1989).

Specimens examined: Muoi in P8 plot (aasl 66 m, lat. 21°54'46" N, long. 104°38'9" E), 1 ♀ on *Paspalum* sp. (Poaceae), 17/V/2017.

Remarks: *Amblyseius herbicolus* is widespread in all tropical and subtropical regions of the world. It is the second most abundant phytoseiid mite on *Coffea arabica* in Brazil, and is deemed to be an efficient predator of *Brevipalpus phoenicis* (Geijskes), vector of the coffee ring spot virus (Reis *et al.* 2007). *Amblyseius herbicolus* is also found in association with the broad mite, *Polyphagotarsonemus latus* Banks in crops such as chili pepper (*Capsicum annuum*) in Brazil and has good potential for controlling the latter. Rodriguez-Cruz *et al.* (2013) have demonstrated that *A. herbicolus* was able to develop on broad mites, castor bean pollen (*Ricinus communis*) and sunn hemp pollen (*Crotalaria juncea*). Provision of pollen can enhance populations of this predator and increase biological control (Duarte *et al.* 2015),

Table 7 Character measurements of adult females of *Amblyseius cinctus* collected in this study and those reported in previous studies (localities followed by the number of specimens measured).

Characters	Vietnam 11, this study	Philippines 2	Thailand 1 ?	Thailand 2 4
Dsl	**337** (308 – 363)	314	350	326 (312 – 341)
Dsw at *s4* level	**196** (188 – 207)	175	240	223 (218 – 227)
j1	**25** (23 – 30)	24 – 26	25	25 (24 – 25)
j3	**44** (40 – 48)	42 – 44	44	45 (44 – 46)
j4	**5** (4 – 6)	5	5	5 (5 – 6)
j5	**5** (4 – 5)	5	4	4
j6	**5** (5 – 7)	5	5	6 (5 – 7)
J2	**6** (5 – 7)	5	5	6 (6 – 7)
J5	**5** (5 – 7)	8	6	6
r3	**13** (10 – 15)	10	13	13 (13 – 14)
R1	**8** (6 – 8)	9	7	7 (7 – 8)
s4	**73** (63 – 82)	68 – 73	69	70 (68 – 77)
S2	**7** (5 – 8)	6	7	8 (7 – 8)
S4	**5** (5 – 6)	6	7	7 (6 – 7)
S5	**5** (5 – 6)	9	6	6 (5 – 7)
z2	**10** (8 – 13)	7	9	10
z4	**8** (6 – 9)	8	7	7
z5	**5** (4 – 5)	4	4	4
Z1	**6** (5 – 8)	6	6	7 (7 – 8)
Z4	**88** (83 – 95)	72 – 90	86	95 (88 – 106)
Z5	**178** (166 – 188)	200	169	172 (168 – 182)
st1-st1	**59** (55 – 64)	-	-	-
st2-st2	**66** (63 – 68)	60	-	66 (65 – 67)
st3-st3	**74** (70 – 77)	79	-	-
st1-st3	**55** (53 – 58)	-	-	56 (55 – 58)
st4-st4	**76** (68 – 105)	-	-	-

Characters	Vietnam 11, this study	Philippines 2	Thailand 1 ?	Thailand 2 4
Gensl	**114** (105 – 125)	-	-	
st5-st5	**66** (62 – 69)	74	-	68 (66 – 70)
Gensw post. corn.	**77** (70 – 83)	-	-	-
Lisl	**16** (13 – 18)	16	-	-
Lisw	**5** (3 – 6)	-	-	-
Sisl	**9** (7 – 10)	8	-	-
Vsl	**109** (100 – 115)	82	-	114 (110 – 118)
Vsw *ZV2*	**81** (75 – 88)	-	-	80 (78 – 84)
Vsw anus	**73** (63 – 78)	-	-	-
Dist. Solen. pva	**21** (20 – 23)	-	-	
JV5	**59** (55 – 65)	52 – 70	57	-
SgeI	**32** (28 – 35)	33	-	34 (32 – 35)
SgeII	**30** (25 – 33)	32	-	33 (32 – 34)
SgeIII	**42** (38 – 48)	45	-	44 (42 – 46)
StiIII	**30** (28 – 33)	34	-	31 (28 – 32)
SgeIV	**85** (80 – 91)	84 – 90	79	84 (80 – 86)
StiIV	**49** (45 – 55)	36 – 53	47	49 (46 – 54)
StIV	**62** (53 – 65)	56 – 60	60	66 (64 – 67)
Scl	**11** (10 – 15)	12 – 16	-	11 (10 – 11)
Scw	**3** (3 – 4)	3	-	-
Fdl, No teeth	**29** (25 – 33), **9 – 10**	27, 9 – 10	-	-
Mdl, No teeth	**30** (28 – 33), **3 – 4**	31, 3 – 4	-	-

Sources of measurements – Philippines: Corpuz & Rimando (1966) and Schicha & Corpuz-Raros (1992); Thailand 1: Ehara & Bhandhufalck (1977); Thailand 2: Oliveira *et al.* (2012); - : not provided.

Table 8 Character measurements of adult females of *Amblyseius herbicolus* collected in this study and those reported in previous studies (localities followed by the number of specimens measured).

Characters	Vietnam	Africa	Grande Comore	Holotype	Kenya	La Réunion	Senegal	Thailand	Turkey
	1, this study	8	2	**Portugal**, 1	46	15	2	1	3
Dsl	**388**	352 (325 – 368)	385 – 428	369	335	359 (343 – 390)	360 – 365	360	313 – 352
Dsw at *s4* level	**182**	256 (240 – 274)	263 – 275	236	190	240 (225 – 265)	250 – 268	194	196 – 221
j1	**38**	37 (34 – 40)	40 – 43	38	32	35 (33 – 38)	35 – 38	37	33 – 38
j3	**43**	49 (38 – 58)	53 – 55	42	37	40 (38 – 45)	38 – 45	38	32 – 39
j4	**8**	6 (5 – 8)	6	9	4 – 6	7 (5 – 8)	6 – 8	6	8 – 9
j5	**5**	4 (3 – 5)	5	7	4 – 6	5 (5 – 5)	4	5	7 – 8
j6	**8**	7 (5 – 8)	5 – 6	11	4 – 6	7 (5 – 8)	8	8	6 – 7
J2	**10**	10 (8 – 11)	8 – 10	12	4 – 6	8 (8 – 10)	8 – 9	9	8 – 9
J5	**10**	8 (6 – 10)	10	9	4 – 6	8 (8 – 10)	8 – 10	7	9 – 10
r3	**13**	14 (11 – 16)	8 – 15	15	10	12 (10 – 13)	10 – 11	13	10 – 16
R1	**10**	9 (8 – 10)	10 – 13	8	10	10 (10 – 13)	9 – 10	9	8 – 9
s4	**105**	113 (98 – 130)	120 – 125	100	92	98 (95 – 108)	123 – 135	95	86 – 96
S2	**8**	12 (8 – 14)	13	11	10	12 (10 – 13)	13 – 15	10	10 – 12
S4	**8**	11 (8 – 13)	13	13	10	11 (8 – 13)	8 – 10	11	9 – 11
S5	**8**	9 (8 – 10)	13	11	10	9 (8 – 10)	8 – 10	9	9 – 10
z2	**10**	11 (8 – 16)	6 – 8	13	6	13 (8 – 18)	8 – 9	13	9 – 12
z4	**10**	8 (8 – 10)	8	9	6	10 (8 – 13)	10 – 11	10	8 – 12
z5	**8**	6 (5 – 6)	5	6	6	5 (5 – 8)	7 – 9	7	6 – 7
Z1	**8**	10 (8 – 13)	8	9	10	12 (10 – 13)	8 – 10	13	9 – 12
Z4	**105**	126 (101 – 152)	133 – 135	110	90	99 (93 – 108)	163 – 172	94	91 – 99
Z5	**288**	281 (251 – 306)	288 – 300	236	232	255 (248 – 273)	310 – 345	270	220 – 251
st1-st1	**65**	-	68	-	-	66 (63 – 68)	-	-	-
st2-st2	**70**	71 (66 – 75)	73 – 75	-	69	73 (65 – 78)	75 – 78	73	70 – 73
st3-st3	**75**	-	63 – 65	-	-	77 (73 – 83)	-	-	-
st1-st3	**65**	65 (58 – 70)	73 – 75	-	62	69 (68 – 73)	63 – 65	67	64 – 69
st4-st4	**75**	-	78 – 83	-	-	76 (73 – 80)	-	-	-
Gensl									
st5-st5	**63**	71 (67 – 75)	70 – 78	-	65	65 (63 – 70)	65 – 70	68	58 – 64
Gensw post. C.									
Lisl	**20**	-	23	-	-	22 (18 – 25)	-	-	-
Lisw	**5**	-	5	-	-	5 (5 – 5)	-	-	-
Sisl	**18**	-	13	-	-	14 (10 – 18)	-	-	-
Vsl	**110**	116 (112 – 118)	120 – 135	-	108	111 (100 – 123)	113 – 115	117	102 – 117
Vsw *ZV2*	**50**	57 (53 – 59)	63	-	48	48 (43 – 58)	65 – 69	56	44 – 48
Vsw anus	**70**	71 (66 – 77)	80	-	69	69 (63 – 78)	75 – 78	70	61 – 69
JV5	**55**	-	80 – 85	-	52	61 (53 – 78)	-	-	51 – 60
SgeI	**55**	42 (35 – 48)	45 – 48	-	-	44 (40 – 48)	43 – 48	50	40 – 48
SgeII	**40**	38 (35 – 42)	38	-	52	37 (33 – 40)	38 – 40	39	34 – 39
SgeIII	**53**	52 (45 – 59)	53 – 58	-	41	44 (35 – 48)	48 – 52	48	41 – 46
StiIII	**43**	41 (34 – 48)	43	-	35	41 (38 – 48)	43 – 45	40	33 – 40
SgeIV	**128**	124 (96 – 158)	135	112	110	118 (110 – 123)	160 – 162	110	98 – 128
StiIV	**Broken**	90 (67 – 109)	100	82	76	88 (83 – 93)	102 – 115	85	75 – 89
StIV	**70**	76 (66 – 86)	80	76	65	72 (65 – 78)	76 – 78	72	63 – 70
Scl	**25**	-	38 – 40	18	28	31 (28 – 33)	33 – 35	25	24 – 32
Scw	**5**	-	2 – 3	-	-	5 (5 – 8)	-	-	-
Fdl, No teeth	**28, 10+1**	31 (30 – 31), 10+1	33, 11 – 12	11 – 12	8	36 (30 – 40), 13	-	34	29 – 36, 12
Mdl, No teeth	**33, 3 – 4**	35 (34 – 35), 3	30	?, 4	?, 3	33 (28 – 35), 4	-	35	31 – 33, 4

Sources of measurements – Africa (Benin 1♀, Burundi 1♀, Democratic Republic of Congo 1♀, Ghana 1♀, Kenya 3♀, Rwanda 1♀): Zannou *et al.* (2007); Grande Comore Island of the Comoros Archipelago: Kreiter *et al.* (2018b); Portugal (holotype): Denmark & Muma (1989); Kenya: El-Banhawy & Knapp (2011); La Réunion: Kreiter *et al* . 2020; Senegal: Kade *et al.* (2011); Thailand: Oliveira *et al.* (2012); Turkey: Akyazi *et al.* (2016); - : not provided.

especially with cattail pollen (*Typha latifolia*), chilli pepper pollen and bee-collected pollen. *Amblyseius herbicolus* was collected recently in Comoros archipelago (Kreiter *et al.* 2018b). This is the first record of that species in Vietnam.

Measurements of the single specimen collected during this study are provided in table 8 and compared with measurements obtained from specimens collected in other countries of Africa, Asia and Indian Ocean. These measurements match with those obtained previously. The dorsal shield width is less important in the single Vietnam specimen than all order widths of the table, probably because the single female was a small one, all other dimensions being quite similar.

Genus *Graminaseius*

Graminaseius Chant & McMurtry 2004a: 215; 2007: 83.

Graminaseius polisensis (Schicha & Corpus-Raros)

Amblyseius polisensis Schicha & Corpuz-Raros 1992: 39; Moraes *et al.* 2004a: 47.
Graminaseius polisensis, Chant & McMurtry 2004a: 219; 2007: 85.

Specimens examined: Muoi in P6 plot (aasl 66 m, lat. 21°54'55" N, long. 104°38'22" E), 1 ♀ + 1 ♂ on *Xanthium strumarium* (Asteraceae), 20/VII/2017.

Remarks: This species was described from several specimens collected on various plants in Philippines.

The biology of *G. polisensis* remains totally unknown and even the life type of this species and of species of *Graminaseius* are unknown.

Table 9 Character measurements of one adult female and one adult male of *Graminaseius polisensis* collected in this study and those reported in previous studies (localities followed by the number of specimens measured).

	♀		♂	
Characters	**Vietnam** 1, this study	**Holotype Philippines**, 1	**Vietnam** 1, this study	**Paratype Philippines**, 1
Dsl	**325**	380	**250**	299
Dsw at *s4* level	**205**	216	**166**	179
j1	**15**	19	**15**	16
j3	**Broken**	32	**23**	25
j4	**10**	14	**10**	12
j5	**10**	14	**10**	12
j6	**Broken**	18	**10**	12
J2	**Broken**	18	**10**	15
J5	**Broken**	10	**8**	8
r3	**15**	16	**Broken**	-
R1	**14**	14	**10**	-
s4	**Broken**	51	**Broken**	37
S2	**Broken**	10	**18**	19
S4	**Broken**	10	**13**	13
S5	**Broken**	10	**13**	13
z2	**15**	19	**13**	16
z4	**13**	19	**13**	16
z5	**8**	11	**Broken**	12
Z1	**15**	19	**10**	12
Z4	**Broken**	62	**Broken**	50
Z5	**58**	57	**35**	39
st1-st1	**48**	-	**43**	-
st2-st2	**63**	82	**53**	82
st3-st3	**70**	-	**55**	-

	♀		♂	
Characters	**Vietnam** 1, this study	**Holotype Philippines**, 1	**Vietnam** 1, this study	**Paratype Philippines**, 1
st1-st3 ♀ / *st1-st5* ♂	**58**	68	**70**	68
st4-st4	**68**	-	**48**	-
st5-st5	**63**	93	**38**	36
Lisl	**20**	29	Not applicable	
Lisw	**3**	-		
Sisl	**10**	14		
Vsl	**110**	-	**105**	126
Vsw *ZV2*	**100**	-	**150**	155
Vsw anus	**83**	-	**68**	-
JV5	**38**	38	**35**	38
SgeIV	**43**	43	**30**	31
StIV	**53**	48	**43**	37
Scl	**27**	27	Not applicable	
Scw	**5**	4		
Fdl	**33**	38	**23**	-
No teeth Fd	-	6	-	-
Mdl	**33**	38	**25**	-
No teeth Md	-	1	-	-
Shaft	Not applicable		**20**	19
Foot			**38**	-

Sources of measurements – For ♀♀: Philippines: Schicha & Corpuz-Raros (1992), probably measurements of the holotype female. For ♂♂: Philippines: Schicha & Corpuz-Raros (1992), probably measurements of the paratype male; - : not provided.

This species was already known from Vietnam from a previous survey (Nguyen *et al.* 2016). Details of locations were provided in this paper though no measurements were provided on the collected specimens. Measurements of specimens collected in this study are provided in table 9 for the single female and the single male and compared with measurements obtained from specimens collected in the Philippines, *i.e.*, country of the original description. Measurements obtained for Vietnamese specimens (both damaged) collected during this study agree well with most obtained from female and male type material from Philippines, most of the setae being shorter in Vietnamese specimens.

Genus *Gynaeseius* Wainstein

Amblyseius (*Kampimodromus*) section *Gynaeseius* Wainstein 1962: 14.
Indoseiulus Ghai & Menon 1969: 347.
Amblyseius (*Indoseiulus*) Ehara 1982: 42.
Indoseiulus, Denmark & Kolodochka 1993: 249; Moraes *et al.* 1986: 59; 2004a: 89.
Macmurtryseius Kolodochka & Denmark 1995: 20.
irregularis group Chant 1959: 70.
Gynaeseius, Chant & McMurtry 2006: 22; 2007: 107.

Gynaeseius liturivorus (Ehara)

Amblyseius (*Indoseiulus*) *liturivorus* Ehara 1982: 43; McMurtry & Moraes 1984: 29; Ehara 1985: 120.
Amblyseius (*Amblyseius*) *liturivorus*, Tseng 1983: 54.
Indoseiulus liturivorus, Moraes *et al.* 1986: 60; Denmark and Kolodochka 1993: 253; Ehara *et al.* 1994: 139; Ehara & Amano 1998: 48; Moraes *et al.*: 2004a: 89.
Amblyseius armellae Schicha and Gutierrez 1985: 175 (synonymy according to Denmark & Kolodochka 1993).

Re-description of the adult female of *Gynaeseius liturivorus* (Ehara)

n = 19 (Figs. 1 a – b, 2 a – c)

Dorsum — (Fig. 1a) Dorsal shield 361 (333 – 375) long and 223 (188 – 250) wide at level of *s4*, smooth, with seven solenostomes (*gd1*, *gd2*, *gd4*, *gd5*, *gd6*, *gd8*, *gd9*), 21 pairs of poroids, 16 pairs of dorsal setae and two pairs of sub-lateral setae off the dorsal shield: *j1* 18 (15 – 20), *j3* 19 (18 – 20), *j4* 14 (12 – 15), *j5* 13 (11 – 15), *j6* 15 (13 – 18), *J2* 18 (15 – 20), *J5* 8 (7 – 8), *z2* 16 (15 – 18), *z4* 18 (15 – 20), *z5* 13 (10 – 15), *Z1* 19 (18 – 20), *Z4* 18 (15 – 20), *Z5* 28 (25 – 30), *s4* 20 (18 – 23), *S2* 19 (15 – 23), *S5* 19 (18 – 20), *r3* 16 (15 – 18), *R1* 19 (17 – 20). All setae minute and smooth.

Peritreme — (Fig. 1a) Extending to a level between *j1* to *j3*, closer to *j3*.

Venter — (Fig. 1b) All shields smooth. Sternal shield with three pairs of setae and two pairs of lyrifissures; one pair of sternal setae on metasternal shields with a pair of pores; posterior margin with a projection very difficult to see. Distances between *st1*-*st1* 64 (60 – 68), *st2*-*st2* 70 (63 – 78), *st3*-*st3* 81 (75 – 88), *st1*-*st3* 74 (68 – 78), *st4*-*st4* 93 (79 – 106). Genital shield length 130 (115 – 140), width at the level of *st5* 84 (78 – 90), width at the level of the posterior corners 95 (83 – 100). Two pairs of inguinal sigilla of "metapodal shields" 26 (23 – 28) long and 4 (3 – 5) wide for the primary and 14 (13 – 15) long for the secondary shield. Ventrianal shield with three pairs of preanal setae (*JV1*, *JV2*, and *ZV2*), small oblong pre-anal pores. Membrane surrounding ventrianal shield with four pairs of setae (*ZV1*, *ZV3*, *JV4* and *JV5*), and six pairs of round to oblong poroids; ventrianal shield 109 (91 – 135) long, 66 (63 – 70) wide at level of *ZV2*, and 54 (50 – 60) wide at level of anus. One pair of pore distant to 24 (20 – 33). *JV5* 23 (20 – 25) long, smooth.

Chelicera — (Fig. 2a) Chelicerae are visible by the side with digits open. Consequently, they are drawn. Fixed digit 30 (28 – 33) long with 11 teeth; and movable digit 34 (33 – 36) long with 3 small teeth.

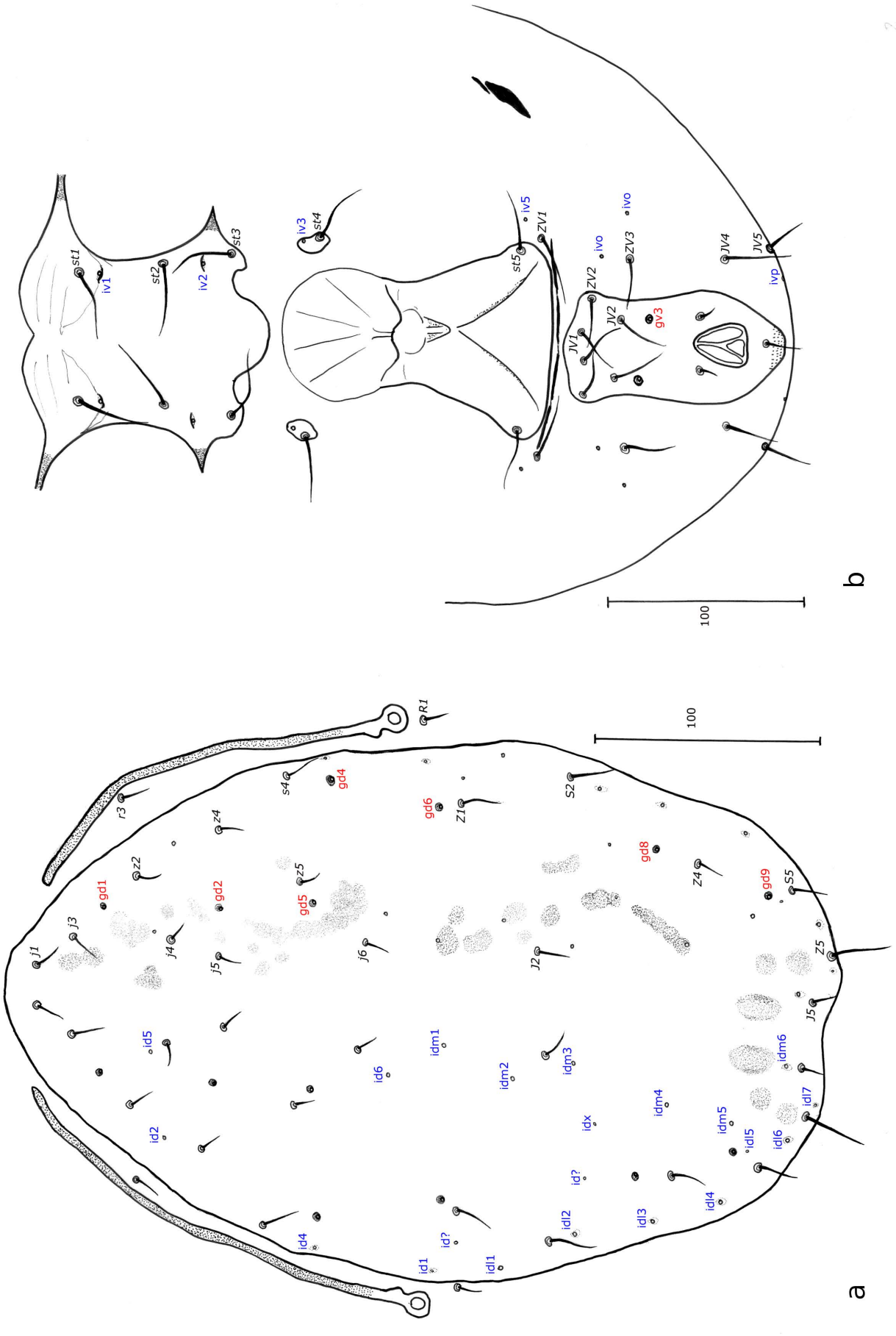


Figure 1 Female of *Gynaeseius liturivorus* (Ehara). a – Dorsal shield and peritreme; b – Ventral shields.

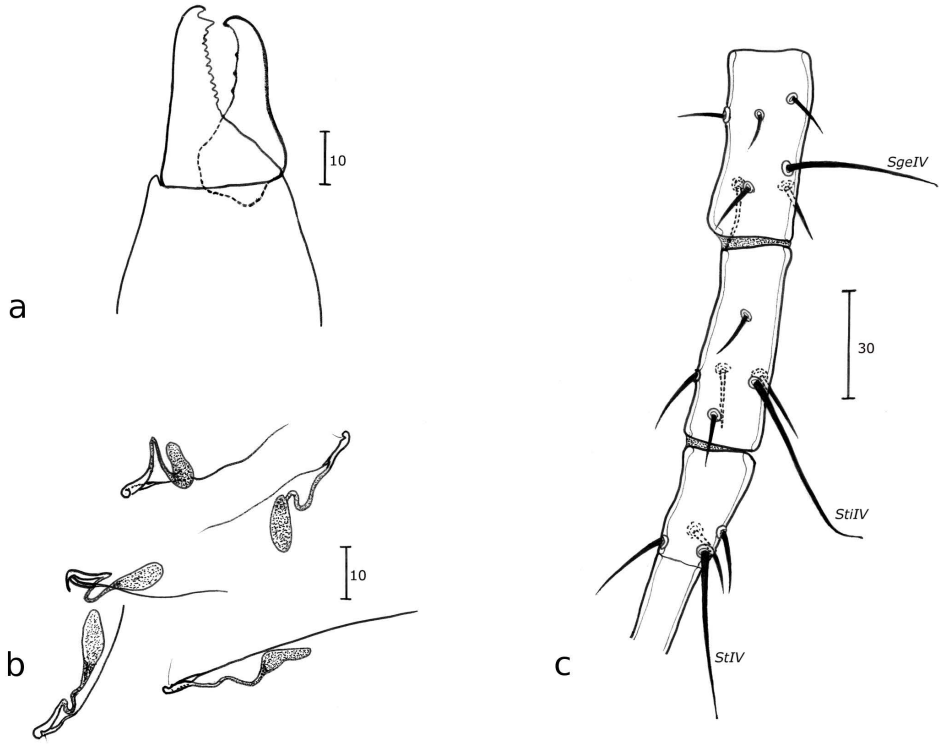


Figure 2 Female of *Gynaeseius liturivorus* (Ehara). a – Insemination apparatus; b – Chelicera; c – Genu; tibia and basitarsus of the leg IV.

Spermatheca — (Fig. 2b) Spermatheca with a long, slender tubular calyx 38 (33 – 47) long and 4 (2 – 7) wide, an atrium slightly swollen bifurcate. Ductus minor and ductus major visible in some specimens.

Legs — (Fig. 2c) Macrosetae on all legs, all pointed except on legs IV with macrosetae slightly bulbous; one on genua of legs I, II and III, and three on genu, tibia and basitarsus of leg IV: *SgeI* 35 (30 – 38), *SgeII* 15 (13 – 20), *SgeIII* 29 (25 – 30), *StiIII* 30 (28 – 35), *SgeIV* 42 (37 – 47), *StiIV* 54 (50 – 55), *StIV* 48 (43 – 53). Genu II and III with 7 setae each, chaetotactic formula of genu II: 2-2/0, 2/0-1; genu III: 1-2/1, 2/0-1. A pair of erected setae on femora IV: 30 (28 – 32).

First description of the deutonymphs of *Gynaeseius liturivorus* (Ehara)

n = 4 (Figs 3 a – b)

Dorsum — (Fig. 3a) Dorsal shield 301 (250 – 338) long and 169 (155 – 188) wide at level of *s4* with no solenostomes and no poroids visible. The dorsal shield bears 14 pairs of dorsal setae and 2 pairs of sub-lateral setae: *j1* 28 (25 – 33), *j3* 31 (28 – 35), *j4* 4 (3 – 6), *j5* 4 (3 – 6), *j6* 6 (5 – 8), *J2* 9 (8 – 10), *J5* 5 (4 – 5), *z2* 5 (4 – 7), *z4* 6 (5 – 8), *z5* 4 (3 – 6), *Z4* 12 (10 – 13), *Z5* 31 (28 – 35), *s4* 17 (15 – 18), *S2* 9 (7 – 10), *r3* 8 (6 – 8), *R1* 6 (5 – 8). All setae smooth.

Peritreme — (Fig. 3a) Extending to a level between *z4* and *z2*, closer to *z2*.

Venter — All ventral shields very smooth not reticulated with margins not visible and so no drawings possible. Distances between *st1 – st1* 44 (40 – 47), *st2 – st2* 64 (63 – 65), *st3 - st3* 59 (55 – 63), *st1 – st3* 80, *st4 - st4* 53 (50 – 55), *st5 – st5* 49 (47 – 50). Ventrianal shield with three pairs of pre-anal setae, *JV1*, *JV2*, and *ZV2*, and a pair of small oblong pores 21 (20 – 23) apart. Membrane surrounding ventrianal shield with one pair of setae *JV5* smooth; ventrianal shield 94 (90 – 100) long, 54 (53 – 55) wide at anterior corners and 52 (50 – 53) wide at level of *anus*. *JV5* 15 long, smooth.

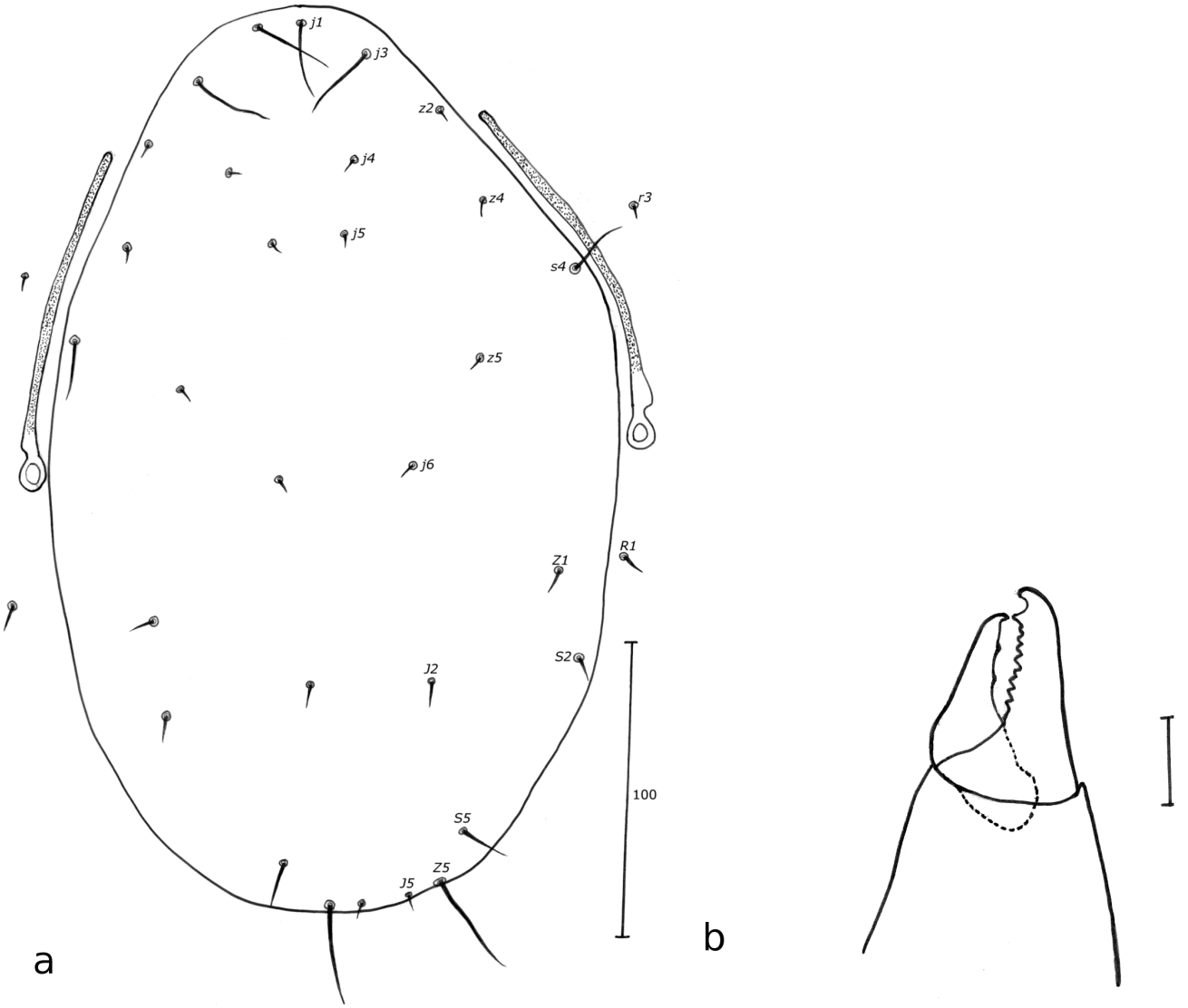


Figure 3 Deutonymph of *Gynaeseius liturivorus* (Ehara). a – Dorsal shield and peritreme; b – Chelicera.

Chelicera — (Fig. 3b) Fixed digit 23 (22 – 25) long, with 9 strong teeth and movable digit 25 (23 – 28) long, with 2 small teeth.

Legs — Legs and macrosetae like in females but with different dimensions: *SgeI* 33 (28 – 35), *SgeII* 30 (28 – 35), *SgeIII* 33 (30 – 35), *StiIII* 34 (30 – 35), *SgeIV* 49 (48 – 50), *StiIV* 51 (45 – 55), and *StIV* 54 (53 – 55). Chaetotactic formula of genu II and III similar to that of females.

Specimens examined — Muoi in all experimental plots (aasl 66 m, lat. 21°54' N, long. 104°38' E), 19 ♀♀ + 4 deutonymphs on *Manihot esculenta* (Euphorbiaceae), 20/VII/2017.

Voucher specimens — 19 ♀♀ + 4 deutonymphs in 2 different slides deposited in CBGP, in Montpellier SupAgro Acarology collection, France.

Remarks — This species was found on *Manihot esculenta* in Vietnam. It is a type-III predator and is considered of interest for thrips control on grape infested with *Scirtothrips dorsalis* Hood (Shibao *et al.* 2004) and on various plants with *Frankliniella occidentalis* (Pergande) and *Thrips palmi* Karny (Mochizuki 2009). *Gynaeseius liturivorus* fed on the larvae of these thrips species. Females consumed an average of 7.4 - 19.4 first-stadium larvae of these

Table 10 Character measurements of adult females of *Gynaeseius liturivorus* collected in this study and those reported in previous studies (localities followed by the number of specimens measured).

Characters	Vietnam	Indonesia	Japan	Papua-New Guinea	Philippines	Taiwan	Thailand
	19, this study	10	17	?	2	3	2
Dsl	**361** (333 – 375)	347 (341 – 353)	342	353	313	323 (317 – 326)	368 (362 – 375)
Dsw at *s4* level	**223** (188 – 250)	235 (231 – 239)	236	194	187	219 (211 – 226)	239 (237 – 242)
j1	**18** (15 – 20)	25 (25 – 26)	15 (15 – 16)	27	14 – 20	17	16 (16 – 17)
j3	**19** (18 – 20)	20 (19 – 21)	19 (18 – 20)	24	14 – 20	19	18 (17 – 19)
j4	**14** (12 – 15)	17 (16 – 17)	13 (13 – 14)	17 – 19	14 – 20	12	17 (16 – 18)
j5	**13** (11 – 15)	18 (18 – 19)	14 (13 – 15)	17 – 19	14 – 20	11	15 (15 – 16)
j6	**15** (13 – 18)	17 (16 – 18)	15 (14 – 15)	17 – 19	14 – 20	12	13
J2	**18** (15 – 20)	19 (18 19)	16 (16 – 17)	17 – 19	14 – 20	14	15
J5	**8** (7 – 8)	9	7 (6 – 7)	8	14 – 20	12	9 (8 – 10)
r3	**16** (15 – 18)	19 (18 20)	15 (15 – 16)	21	14 – 20	-	12 (12 – 13)
R1	**19** (17 – 20)	20 (19 – 20)	18 (16 – 18)	-	14 – 20	-	17 (17 – 18)
s4	**20** (18 – 23)	22 (21 – 22)	20 (20 – 21)	23	14 – 20	17	16
S2	**19** (15 – 23)	23 (22 – 23)	21 (21 – 22)	23	14 – 20	16	20 (20 – 21)
S5	**19** (18 – 20)	23 (22 – 23)	18 (18 – 19)	24	14 – 20	17	19 (18 – 20)
z2	**16** (15 – 18)	19 (19 – 20)	16 (15 – 16)	20	14 – 20	12	16 (16 – 17)
z4	**18** (15 – 20)	20 (19 – 20)	16 (16 – 17)	19	14 – 20	16	18 (17 – 19)
z5	**13** (10 – 15)	18 (17 – 18)	15 (14 – 15)	17	14 – 20	11	14 (13 – 16)
Z1	**19** (18 – 20)	22 (22 – 23)	19 (18 – 20)	25	14 – 20	16	20
Z4	**18** (15 – 20)	20 (19 – 20)	17	23	14 – 20	11	19 (18 – 20)
Z5	**28** (25 – 30)	30 (29 – 31)	23 (23 – 24)	31	27	24	30
st1-st1	**64** (60 – 68)	-	-	-	-	-	-
st2-st2	**70** (63 – 78)	-	-	-	-	-	69 (69 – 70)
st3-st3	**81** (75 – 88)	-	-	81	-	-	-
st1-st3	**74** (68 – 78)	-	-	72	-	-	69 (68 – 70)
st4-st4	**93** (79 – 106)	-	-	-	-	-	-
Gensl	**130** (115 – 140	-	-	-	-	-	-
st5-st5	**84** (78 – 90)	-	-	-	-	-	84 (81 – 92)
Gensw post.cor.	**95** (83 – 100)	-	-	97	-	77	-
Lisl	**26** (23 – 28)	-	-	-	-	-	-
Lisw	**4** (3 – 5)	-	-	-	-	-	-
Sisl	**14** (13 – 15)	-	-	-	-	-	-
Vsl	**109** (91 – 135)	-	-	-	-	91	105
Vsw *ZV2*	**66** (63 – 70)	-	-	-	-	65	70
Vsw anus	**54** (50 – 60)	-	-	-	-	-	65
Dist. solen. vas	**24** (20 – 33)	-	-	-	-	-	-
JV5	**23** (20 – 25)	-	24 (23 – 24)	-	-	-	-
SgeI	**35** (30 – 38)	-	-	-	-	-	35
SgeII	**15** (13 – 20)	-	-	-	-	-	14
SgeIII	**29** (25 – 30)	-	-	-	24	-	30
StiIII	**30** (28 – 35)	-	-	-	27	-	35
SgeIV	**42** (37 – 47)	-	34 (33 – 34)	37	34	34	37
StiIV	**54** (50 – 55)	-	46 (45 – 46)	48	41	43	50 (49 – 52)
StIV	**48** (43 – 53)	-	45 (45 – 46)	42	37	43	48 (47 – 50)
Scl	**38** (33 – 47)	-	-	28	-	-	25
Scw	**4** (2 – 7)	-	-	-	-	-	-
Fdl	**30** (28 – 33)	-	-	-	-	-	-
No teeth Fd	**11**	-	-	12 – 13	12	11	-
Mdl	**34** (33 – 36)	-	-	-		-	-
No teeth Md	**3**	3	3	1 – 2	3	2	-

Sources of measurements – Indonesia: Ehara (2005) (but identified under the name *Indoseiulus armellae* , synonymized by Denmark & Kolodochka, 1993); Japan: Ehara (1982); Papua New Guinea: Schicha & Gutierrez (1985) (but identified under the name *Indoseiulus armellae* , synonymized by Denmark & Kolodochka, 1993); Philippines: Corpuz-Raros (2005); Taiwan: Tseng (1983); Thailand: Moraes *et al.* (2004b); - : not provided.

thrips within the first 24 hrs and laid an average number of 1.6 - 6.8 eggs within 24-48 hrs. These data suggest that *G. liturivorus* would be a promising BCA against thrips (Mochizuki 2009).

All measurements obtained on female specimens collected during this study (Table 10) agree well with measurements obtained from female specimens collected in other countries, especially with type specimens from Japan and Thailand. Specimens of Taiwan have shorter setae while specimens of Indonesia and Papua New Guinea have longer setae.

It is interesting to notice that in deutonymph specimens some setae are longer than those of female specimens, especially *j1*, *j3*, *Z5*, *SgeII*, *SgeIV*, *StIV,* shorter peritremes and chelicerae and a lower number of teeth than female specimens on both digits of chelicerae.

Genus *Euseius* Wainstein

Amblyseius (*Amblyseius*) section *Euseius*, Wainstein, 1962: 15; *Euseius* De Leon, 1967: 86.

Euseius ovaloides (Blommers)

Amblyseius (*Amblyseius*) *ovaloides* Blommers 1974: 147.
Euseius ovaloides Moraes *et al.* 1986: 51; 2004b: 78; Chant & McMurtry 2005a: 215; 2007: 121.

Specimens examined: Muoi in P6 plot (aasl 66 m, lat. 21°54'55" N, long. 104°38'22" E), 1 ♀ + 1 ♂ (in too bad state for doing measurements) on *Vernicia montana* (Euphorbiaceae), 20/VII/2017.

Table 11 Character measurements of adult females of *Euseius ovaloides* collected in this study and those reported in previous studies (localities followed by the number of specimens measured).

Characters	Vietnam (1)	Guadeloupe	La Réunion	Madagascar
	1, this study	4	2	1?
Dsl	**343**	351 (341 – 360)	324 – 340	335
Dsw at *s4* level	**235**	243 (236 – 253)	227 – 258	200
j1	**33**	32 (31 – 33)	28 – 34	27 – 30
j3	**10**	9 (8 – 9)	9	8
j4	**5**	6	6	5
j5	**5**	6 (5 – 6)	6	5
j6	**7**	7 (6 – 7)	-	6
J2	**7**	8 (8 – 9)	6 – 9	7
J5	**5**	6	6	5
r3	**10**	10 (9 – 11)	9	8
R1	**8**	6 (6 – 7	8 – 9	8
s4	**12**	11 (11 – 12)	13	9 – 12
S2	**10**	7 (6 – 8)	8 – 9	8
S4	**11**	8 (7 – 8)	8 – 9	8
S5	**10**	6 (6 – 7)	6 – 8	7
z2	**10**	8 (7 – 9)	8 – 9	7
z4	**8**	8 (7 – 9)	8 – 9	8
z5	**5**	6	6	7
Z1	**8**	7 (6 – 8)	8 – 9	8
Z4	**9**	7 (6 – 8)	6 – 9	8
Z5	**48**	53 (52 – 54)	50 – 54	44 – 48
st1-st1	**58**	-	-	-
st2-st2	**53**	68 (66 – 68)	61 – 63	-
st3-st3	**75**	-	-	-
st1-st3	**75**	58 (56 – 61)	50	-
st4-st4	**95**	-	-	-

Characters	Vietnam (1)	Guadeloupe	La Réunion	Madagascar
	1, this study	4	2	1?
Gensl	**123**			
st5-st5	**70**	79 (76 – 82)	63 – 69	-
Gensw post.cor.	**105**			
Lisl	**23**	-	-	-
Lisw	**5**	-	-	-
Sisl	**13**	-	-	-
Vsl	**100**	98 (93 – 105)	98 – 104	100
Vsw *ZV2*	**40**	44 (42 – 47)	44 – 50	-
Vsw anus	**63**	74 (71 – 78)	71 – 74	72
JV5	**25**	-	-	22
SgeI	**19**	14 (12 – 16)	-	-
SgeII	**15**	15 (12 – 17)	-	-
SgeIII	**25**	26 (25 – 27)	22 – 28	25
StiIII	**23**	16 (14 – 19)	19 – 22	20
SgeIV	**35**	40 (37 – 42)	38 – 39	36 – 40
StiIV	**33**	36 (34 – 38)	35	29 – 34
StIV	**55**	62 (59 – 66)	47 – 60	52 – 57
Scl	**14**	14 (14 – 15)	9 – 13	11
Scw	**2**	-	-	1
Fdl	**23**	29 (27 – 31)	25	28
No teeth Fd	-	-	2	1
Mdl	**23**	30 (27 – 32)	25	26
No teeth Md	-	-	1	1

Sources of measurements – Guadeloupe: Moraes *et al.* (2000); La Réunion: Moraes *et al.* (2012); Madagascar: Blommers (1976); - : not provided.

Remarks: All measurements obtained on the single female specimen collected during this study agree well with measurements obtained from female specimens collected in other countries.

Euseius ovaloides was described by Blommers (1974) from specimens collected on *Citrus hystrix* and *Persea americana* in Madagascar. Like all *Euseius* species, this species belongs to the type IV (polliniphagous generalist predators) of McMurtry and Croft (1997) and McMurtry *et al.* (2013). The species has been occasionally recorded from Madagascar (Blommers, 1974), Papua-New Guinea (Schicha and Gutierrez 1985), Seychelles (Schicha, 1987), Reunion Island, (Quilici *et al.*, 1997, 2000), Guadeloupe, Martinique and Marie-Galante (Moraes *et al.*, 2000; Kreiter *et al.*, 2006) on various plants, though its biology remains unknown. It is suspected to be a poor predator of tetranychid mites (Gutierrez and Etienne, 1986) but can be considered as a potentially good predator of thrips and of whiteflies. This is one of the more common species on La Réunion Island.

This is the first mention of that species in Vietnam.

Measurements of the single female specimen collected during this study are provided in table 11 and compared with measurements obtained from specimens collected in other countries of Indian Ocean and the Caribbean.

Subfamily Phytoseiinae Berlese

Phytoseiini Berlese 1913: 3; Phytoseiinae, Vitzthum 1941: 768.

Genus *Phytoseius* Ribaga

Phytoseius Ribaga, 1904: 177.

Phytoseius coheni Swirski & Shechter

Phytoseius (*Dubininellus*) *macropilis coheni* Swirski & Shechter 1961: 104.
Phytoseius (*Phytoseius*) *macropilis coheni*, Ehara 1966: 26.
Phytoseius (*Dubininellus*) *coheni*, Swirski & Golan 1967: 226; Wu 1997: 153.
Phytoseius (*Phytoseius*) *coheni*, Moraes *et al.* 1986: 219.
Phytoseius coheni, Moraes *et al.* 2004a: 235; Chant & McMurtry 2007: 129.
Phytoseius hawaiiensis Prasad 1968: 1460 (synonymy according to Denmark & Evans 2011: 301).
Phytoseius huangi Ehara 1970: 62 (synonymy according to Ehara 2002: 40).
Phytoseius jianfengensis Chen, Chu & Zhou 1980: 15 (synonymy according to Wu 1997: 153).

Specimens examined: Muoi in PM1 plot (aasl 66 m, lat. 21°54' N, long. 104°38' E), 1 ♀ on an unknown plant support, 17/V/2017; in P7 plot (aasl 66 m, lat. 21°54'51" N, long. 104°38'22" E), 1 ♀ on an unknown plant support, 21/VII/2017; in P16 plot (aasl 66 m, lat. 21°54'56" N, long. 104°38'46" E), 1 ♀ on *Tephrosia candida* (Fabaceae), 22/VII/2017.

Remarks: This species was described from Hong-Kong by Swirski and Shechter (1961) collected on a wide range of plants and very common on citrus.

Although species of the genus *Phytoseius* are considered to belong to the type III (polyphagous generalist predators) of McMurtry and Croft (1997) and McMurtry *et al.* (2013), its specific biology is totally unknown.

This is the first mention of that species in Vietnam.

Measurements of specimens collected during this study are provided in table 12 and compared with measurements obtained from specimens collected in other countries of Asia and Indian Ocean. Measurements obtained during this study agree well with most obtained from female specimens collected in other countries.

Table 12 Character measurements of adult females of *Phytoseius coheni* collected in this study and those reported in previous studies (localities followed by the number of specimens measured).

Characters	Vietnam	Type material Hong-Kong	Mauritius	Philippines	Taiwan	Thailand
	3, this study	1	2	?	?	?
Dsl	**293** (275 – 310)	269 – 292	293 (289 – 297)	279	295 – 314	280
Dsw at *s4* level	**157** (138 – 175)	142	157 (153 – 160)	160	180 – 249	170
j1	**26** (25 – 28)	29	26 (24 – 28)	26 – 31	28 – 29	26
j3	**20** (18 – 20)	18 – 23	20 (19 – 21)	20 – 23	23 – 25	22
j4	**9** (8 – 10	8	10 (9 – 10)	7 – 12	7 – 8	9
j5	**8**	8	9	7 – 13	6 – 8	8
j6	**10**	8	9	8 – 13	8 – 9	9
J5	**9** (8 – 10)	13	8 (7 – 8)	8 – 13	8	6
r3	**37** (33 – 40)	32	38 (36 – 39)	34 – 39	30 – 41	36
s4	**82** (75 – 93)	66 – 81	74 (72 – 76)	78 – 86	90 – 95	80
s6	**65** (63 – 70)	58 – 74	60 (57 – 63)	65 – 73	82 – 90	67
z2	**12** (10 – 13)	13	12	13 – 14	14 – 15	13
z3	**26** (25 – 28)	27	27 (24 – 29)	26 – 28	29 – 30	28
z4	**12** (11 – 13)	13	13	12 – 14	15	13
z5	**10**	10	10 (9 – 10)	10 – 13	8	10
Z4	**54** (50 – 58)	51 – 64	55 (50 – 59)	54 – 59	56 – 65	53
Z5	**63** (55 – 70)	58 – 71	63 (59 – 66)	70 – 73	70 – 78	61
st1-st1	**52** (50 – 55)	-	-	-	-	-
st2-st2	**59** (55 – 63)	-	60 (59 – 60)	-	-	-
st3-st3	**73** (65 – 80)	-	-	-	-	-
st1-st3	**54** (53 – 55)	-	59 (58 – 59)	-	-	-
st4-st4	**80** (63 – 98)	-	-	-	-	-
gensl	**98** (95 – 100)	-	97	-	-	-
st5-st5	**62** (60 – 63)	-	72 (69 – 74)	-	-	-
gensw post. cor.	**73** (70 – 75)	-	-	-	-	-
Lisl	**27** (25 – 28)	-	28 (27 – 29)	-	16	-
Lisw	**2**	-	-	-	3	-
Vsl	**94** (80 – 103)	86 – 99	98 (95 – 101)	99	98	-
Vsw *ZV2*	**44** (38 – 50)	41 – 48	45 (41 – 49)	44	85	-
Vsw anus	**49** (43 – 53)	48 – 53	53 (52 – 53)	51	-	-
JV5	**44** (43 – 45)	38 – 46	41 (39 – 43)	47 – 52	53	44
Scl	**11** (10 – 13)	-	15 (14 – 16)	-	6	-
Scw	**5**	-	-	-	-	-
SgeIV	**24** (23 – 25)	18 – 23	20 (19 – 20)	20 – 24	15 – 16	21
StiIV	**44** (40 – 50)	38 – 51	42 (40 – 43)	42 – 44	45 – 48	41
StIV	**24** (23 – 25)	20 – 25	25 (23 – 26)	23 – 27	23 – 40	23
SttIV	**20**	18 – 25	21 (20 – 21)	20	30	21
Fdl	**24** (23 – 25)	23 – 25	-	-	-	-
No teeth Fd	**3**	3	-	-	-	-
Mdl	**24** (23 – 25)	23 – 25	-	-	-	-
No teeth Md	**1**	1	-	-	-	-

Sources of measurements – Type material Hong-Kong: Swirski & Shechter (1961), Denmark (1966); Mauritius: Ferragut & Baumann (2019); Philippines: Swirski & Golan (1967) and (identified as *Phytoseius hawaiensis*) Corpuz-Raros & Garcia (1994); Taiwan: Lo (1970) & Tseng (1976); Thailand: (identified as *Phytoseius hawaiensis*) Ehara & Bhandhufalck (1977); - : not provided.

Phytoseius hongkongensis Swirski & Shechter

Phytoseius (*Phytoseius*) *hongkongensis* Swirski & Shechter 1961: 99; Amitai & Swirski 1966: 22.
Phytoseius (*Pennaseius*) *hongkongensis* Ehara 1966: 25; Ehara 1972: 169; Moraes *et al.* 1986: 211.
Phytoseius hongkongensis Moraes *et al.* 2004a: 240; Chant & McMurtry 2007: 129.

Specimens examined: Muoi in P16 plot (aasl 66 m, lat. 21°54'46" N, long. 104°38'18" E), 2 ♀♀ on *Chromolaena odorata* (Asteraceae), 18/V/2017; in P11 plot (aasl 66 m, lat. 21°54'30" N, long. 104°38'14" E), 1 ♀ on *Mallotus canii* (Euphorbiaceae), 31/V/2017; in P14 plot (aasl 66 m, lat. 21°54'56" N, long. 104°38'45" E), 2 ♂♂ on *C. odorata* (Asteraceae) and 1 ♂ in an unknown host plant, 2/VI/2017; in P15 plot (aasl 66 m, lat. 21°54'56" N, long. 104°38'46" E), 1 ♀ on *C. odorata* (Asteraceae), 2/VI/2017 and 1 ♀ + 1 ♂ on *Rubus alceifolius* (Rosaceae), 3/VI/2017.

Remarks: This species was described from specimens collected on *Heterosmilax gaudichaudiana* and *Urena lobata* in Victoria Mount Forest, Hong Kong Island, Hong Kong.

Although species of the genus *Phytoseius* are considered to belong to the type III (polyphagous generalist predators) of McMurtry and Croft (1997) and McMurtry *et al.* (2013), its specific biology is totally unknown.

This is the first mention of that species in Vietnam.

Measurements of specimens collected during this study are provided in table 13 for females and males and compared with measurements obtained from specimens collected in other countries of Asia and Africa.

Measurements obtained agree well with most of those obtained previously, with slightly shorter dimensions, especially in male specimens.

Phytoseius tixierae Kreiter n. sp.

Zoobank: 7B2DE1ED-FE36-488E-87B2-969ADBB09507

Figs. 4 a – d, 5 a – b, 6 a – c

Diagnose — *Phytoseius tixierae* Kreiter **n. sp.** lacks setae *J2* and *R1* and consequently belongs to the *horridus* species group. This species is unique by the following characters: *z2* and *Z4* smooth, s6 only slightly serrated, setae *j4*, *j5*, *j6*, *J5* also smooth, setae *s6*, *Z4* and *Z5* subequal, *s6* being the longest seta, four macrosetae on leg IV spatulate, *SgeIV* being the shortest and *StiIV* being the longest, with *StIV* and *SttIV* being intermediate and subequal, setae *j1* and *j3* almost equal, setae *JV5* very short, < 20, peritreme reaching the level of setae *j1*.

Description of the adult female of *Phytoseius tixierae* Kreiter n. sp.

n = 4 (Figs. 4 a – b, Figs. 5 a – b)

(in bold, average measurements)

Dorsum — (Fig. 4a) Dorsal shield rugose **271** (250 – 280) long and **130** (125 – 140) wide, smooth, with no visible solenostome, 8 pairs of poorly visible poroids, 14 pairs of dorsal setae and one pair of sub-lateral setae on the dorsal shield: *j1* **23** (21 – 23), *j3* **18** (15 – 23), *j4* **10** (10 – 11), *j5* **10** (10 – 11), *j6* **11** (10 – 13), *J5* **9** (8 – 9), *z2* **12** (10 – 13), *z3* **20** (18 – 25), *z4* **19** (18 – 23), *z5* **12** (9 – 13), *Z4* **57** (48 – 63), *Z5* **53** (48 – 55), *s4* **44** (43 – 45), *s6* **59** (55 – 63), *r3* **30** (28 – 30). Setae *z2*, *j4*, *j5*, *j6*, *z5* and *Z4* smooth, setae *s6* very slightly serrated at the distal third of setae, setae *j1*, *j3*, *z3*, *z4*, *r3*, *s4* and *Z5* serrated.

Peritreme — (Fig. 4a) Extending to the level of setae *j1*.

Venter — (Fig. 4b) All shields smooth.

Sternal shield with three pairs of setae and two pairs of lyrifissures; one pair of sternal setae on metasternal shields with a pair of pores; posterior margin straight. Distances between *st1-st1* **46** (43 – 50), *st2-st2* **53** (50 – 55), *st3-st3* **59** (43 – 68), *st1-st3* **58** (55 – 60), *st4-st4* **62** (50 – 75).

Genital shield length **101** (98 – 105), *st5-St5* **56** (50 – 60), width at the level of the posterior corners ot the genital shield **80** (78 – 82).

Table 13 Character measurements of adult females and males of *Phytoseius hongkongensis* collected in this study and those reported in previous studies (localities followed by the number of specimens measured).

Characters	♀					♂	
	Vietnam 5, this study	**Africa** 4	**Type material** **Hong-Kong**, 2	**Taiwan** ?	**Thailand** 5	**Vietnam** 4, this study)	**Hong-Kong** 1
Dsl	**285** (260 – 300)	274 (262 – 285)	264 – 277	304	274 (264 – 294)	**217** (210 – 228)	218
Dsw at *s4* level	**125** (115 – 130)	138 (133 – 145)	134 – 140	196	145 (135 – 150)	**115** (110 – 123)	
j1	**25** (23 – 25)	24 (22 – 26)	25 – 28	30	28 (25 – 30)	**19** (19 – 20)	20
j3	**65** (63 – 68)	67 (59 – 71)	64 – 69	70	72 (70 – 75)	**45** (45 – 46)	53
j4	**5**	5 (5 – 6)	3 – 8	9	5 (4 – 5)	**4**	4 – 8
j5	**5**	5 (5 – 6)	3 – 8	9	4 (4 – 5)	**4**	4 – 8
j6	**5**	6 (5 – 7)	3 – 8	9	6 (5 – 6)	**4**	4 – 8
J2	**9** (8 – 10)	9 (8 – 10)	9 – 12	9	9 (7 – 10)	**5**	-
J5	**6** (5 – 8)	7 (6 – 8)	6 – 9	-	6 (6 – 7)	**5**	4 – 8
r3	**35** (30 – 40)	42 (40 – 43)	36 – 44	45	45 (43 – 47)	**30** (29 – 30)	36
R1	**13** (10 – 15)	16 (14 – 17)	13 – 18	9	16 (15 – 17)	**9** (8 – 10)	12
s4	**95** (90 – 98)	96 (90 – 105)	91 – 102	95	103 (102 – 106)	**65** (63 – 68)	76
s6	**75** (75 – 78)	81 (77 – 86)	75 – 77	91	84 (80 – 90)	**45** (43 – 45)	51
z2	**13** (13 – 15)	12 (10 – 13)	10 – 15	13	17 (16 – 18)	**13** (11 – 14)	10
z3	**44** (43 – 45)	45 (45 – 46)	38 – 40	58	44 (39 – 47)	**32** (30 – 33)	36
z4	**10** (8 – 10)	8	10 – 13	18	10 (8 – 12)	**10** (9 – 10)	9
z5	**5**	4 (3 – 5)	3 – 8	-	4	**3**	4 – 8
Z4	**72** (68 – 75)	74 (67 – 82)	76 – 90	75	79 (75 – 82)	**39** (37 – 40)	53
Z5	**69** (67 – 70)	74 (67 – 85)	55 – 75	83	80 (75 – 84)	**32** (30 – 33)	36
st1-st1	**61** (58 – 63)	-	-	-	-	**50** (48 – 53)	-
st2-st2	**68** (65 – 70)	66	-	-	69 (66 – 70)	**55** (55 – 56)	-
st3-st3	**73** (70 – 75)	-	-	-	-	**63** (63 – 64)	-
st1-st3 ♀ / *st1-st5* ♂	**59** (58 – 60)	60 (58 – 63)	-	-	61 (60 – 62)	**103** (100 – 108)	-
st4-st4	**80** (73 – 83)	-	-	-	-	**54** (53 – 57)	-
Gensl	**113** (110 – 115)					Not applicable	
st5-st5	**61** (58 – 63)	60 (58 – 62)	-	-	64 (63 – 66)	**41** (38 – 43)	-
Gensw post. corn.	**64** (60 – 68)						
Lisl	**19** (18 – 20)	-	-	50	-	Not applicable	
Lisw	**2**	-	-	2	-		
Vsl	**92** (83 – 100)	89 (85 – 93)	-	93	97 (95 – 100)	**82** (78 – 90)	-
Vsw *ZV2*	**50** (49 – 50)	53 (50 – 60)	-	53	55 (52 – 58)	**128** (125 – 130)	-
Vsw anus	**46** (43 – 48)	44 (43 – 45)	-	-	46 (44 – 49)	**52** (50 – 55)	-
JV5	**48** (45 – 50)	-	46 – 61	63	-	**19** (15 – 23)	25
Scl	**15** (13 – 18)	12 (10 – 18)	-	10	10 (9 – 12)	**18** (18 – 19)	23
Scw	**14** (10 – 18)	-	-	-	-	**19** (18 – 20)	23
SgeIV	**26** (25 – 28)	25 (24 – 26)	26 – 33	30	29 (28 – 31)	**23**	29
StiIV	**30**	31 (29 – 32)	29 – 33	30	32 (31 – 32)	**25**	-
StIV	**25** (23 – 25)	24 (22 – 24)	21 – 25	30	26 (24 – 28)	Not applicable	
SttIV	**29** (28 – 33)	24 (22 – 25)	26	30	27 (25 – 28)		
Fdl	**27** (25 – 30)	25	-	-	26 (25 – 27)	**17** (15 – 18)	-
No teeth Fdl	**2**	2	-	-	-	**2**	-
Mdl	**28** (25 – 30)	26	-	-	29 (29 – 30)	**19** (18 – 20)	-
No teeth Mdl	**1**	1	-	-	-	**1**	-
Shaft	Not applicable					**14** (13 – 15)	-
Toe						**6** (4 – 8)	-

Sources of measurements – For ♀♀: Africa (Benin: 1♀, Kenya: 2♀, Malawi: 1♀): Ueckermann *et al.* (2007); Hong-Kong: Swirski & Shechter (1961), Denmark (1966) & Ehara & Lee (1971); Taiwan: Tseng (1976). For ♂♂: Hong-Kong: Swirski & Shechter (1961). - : not provided.

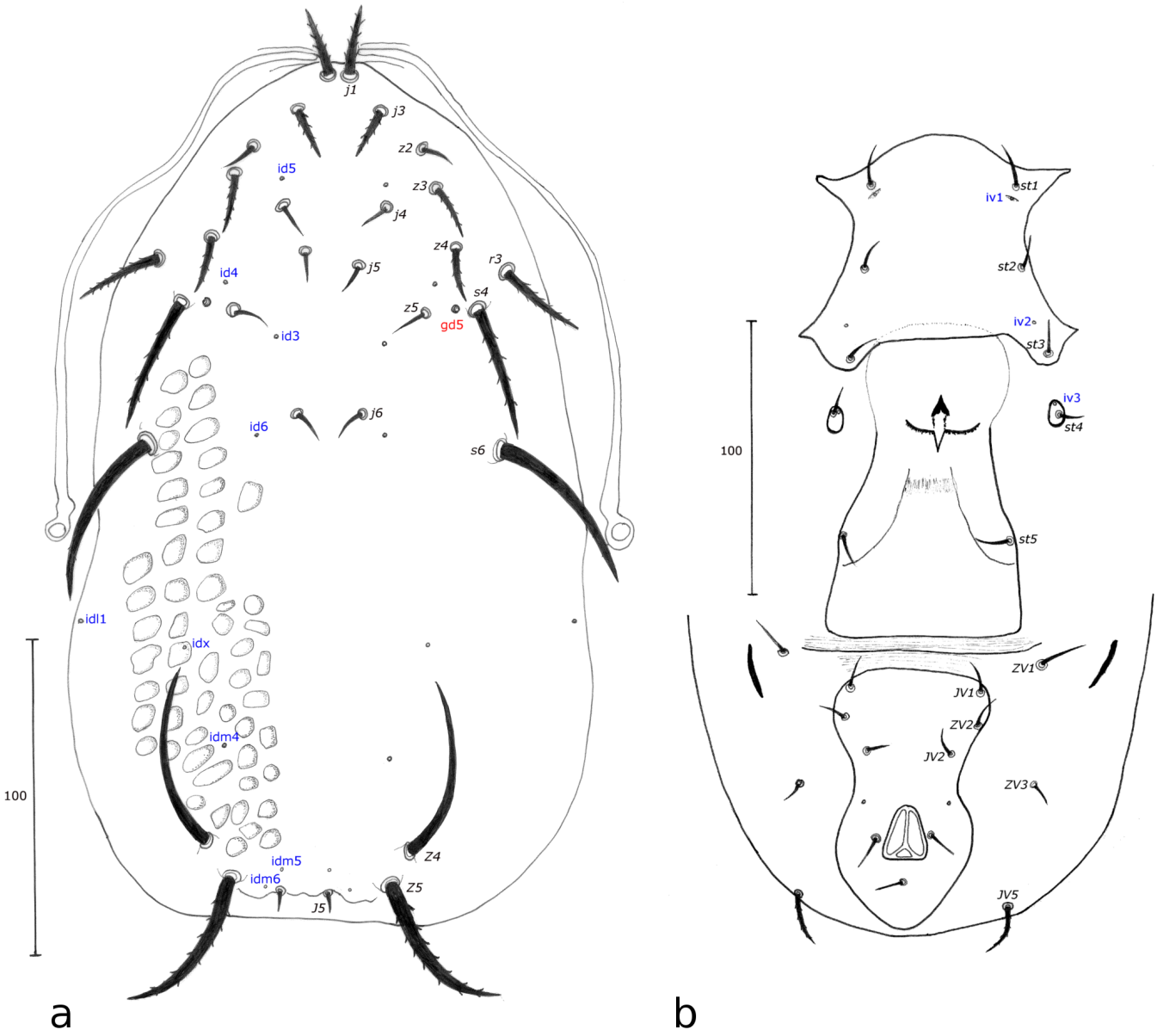


Figure 4 Female of *Phytoseius tixierae* Kreiter **n. sp.**. a – Dorsal shield and peritreme; b – Ventral shields.

One pair of narrow metapodal shields **24** (20 – 28) long and **2** wide.

Ventrianal shield with three pairs of preanal setae (*JV1*, *JV2* and *ZV2*) and a pair of pores. Membrane surrounding ventrianal shield with two pairs of setae (*ZV3* and *JV5*), and no visible poroids in our specimens; ventrianal shield **92** (85 – 98) long, **51** (50 – 53) wide at level of anterior corners (*ZV2*), and **44** (43 – 45) wide at level of *anus*.

JV5 short, **19** (15 – 20) long, and serrated.

Chelicera — Chelicerae not clearly visible and therefore not drawn. Fixed digit **17** (14 – 20) long with apparently 2 teeth; and movable digit **18** (15 – 20) long with apparently 1 tooth.

Spermatheca — (Fig. 5a) Spermatheca with calyx pocular (Denmark and Evans 2011), 10 long and 5 wide, and a small atrium. Ductus minor not visible but large ductus major well visible in all specimens.

Legs — (Fig. 5b) Four macrosetae on leg IV, all spatulate: *SgeIV* 10, *StiIV* **39** (38 –

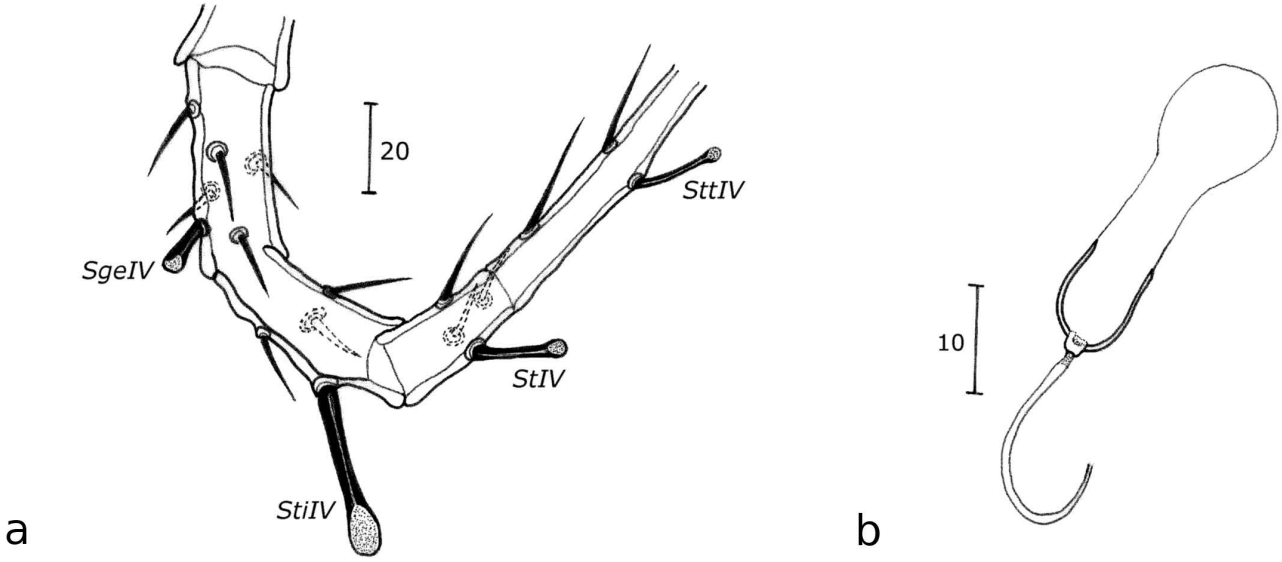


Figure 5 Female of *Phytoseius tixierae* Kreiter **n. sp.**. a – Insemination apparatus; b – Genu, tibia and basitarsus of the leg IV.

40), *StIV* **21** (20 – 23), *SttIV* **19** (18 – 20). Genu II with 7 setae and Genu III with 6 setae, chaetotactic formula of genu II: *2-2/0, 2/0-1; genu III: 1-2/0, 2/0-1*.

Description of the adult male of *Phytoseius tixierae* Kreiter n. sp.

n = 1 (Figs 6 a – c)

Dorsum — (Fig. 6a) Dorsal shield rugose 200 long and 113 wide, with no visible solenostome. The dorsal shield bears 14 pairs of dorsal setae and 1 pair of sub-lateral setae situated on the dorsal shield: *j1* 20, *j3* 16, *j4* 10, *j5* 8, *j6* 9, *J5* 6, *z2* 10, *z3* 18, *z4* 18, *z5* 10, *Z4* 30, *Z5* 28, *s4* 35, *s6* 35, *r3* 25. Setae *z2*, *j4*, *j5*, *j6*, *z5* and *Z4* smooth, setae *s6* very slightly serrated, setae *j1*, *j3*, *z3*, *z4*, *r3*, *s4* and *Z5* serrated, like in the female.

Peritreme — (Fig. 6a) Extending to the level of setae *j1*.

Venter — (Fig. 6b) Sternal shield smooth. Distances between *st1 – st1* 43, *st2 – st2* 48, *st3 – st3* 50, *st1 – st5* 90, *st4 – st4* 43, *st5 – st5* 35. Ventrianal shield with three pairs of pre-anal setae, *JV1*, *JV2* and *ZV2*. Pre-anal pores absent. Membrane surrounding ventrianal shield with one pair of setae *JV5*; ventrianal shield 75 long, 90 wide at anterior corners and 50 wide at level of paranal setae. Short setae *JV5* serrated, 10 long.

Chelicera – Fixed digit 15 long, with 2 teeth visible and movable digit 15 long with 1 tooth visible. Spermatodactyl circumflex accent shaped, shaft (Fig. 6c) 11, toe 9.

Legs — Legs IV with four spatulate macrosetae like in the female: *SgeIV* 5, *StiIV* 10, *StIV* 15, *SttIV* 15. Chaetotactic formula of genu II and III similar to that of females.

Specimens examined — Muoi in P4 experimental plot (aasl 66 m, lat. 21°54'41" N, long. 104°38'7" E), 1 ♀ + 1 ♂, 12/05/2017 and in P12-P13 plots (aasl 66 m, lat. 21°54'50" N, long. 104°38'45" E), 3 ♀♀ on *Bambusodae* sp. (Poaceae).

Type material — The holotype female, 3 paratype females, and 1 paratype male on 3 slides deposited in CBGP, in Montpellier SupAgro Acarology collection, France.

Etymology — The name "*tixierae*" refers to our colleague Professor-Dr Marie-Stéphane Tixier (Montpellier SupAgro) to whom this species is dedicated for her huge contribution to

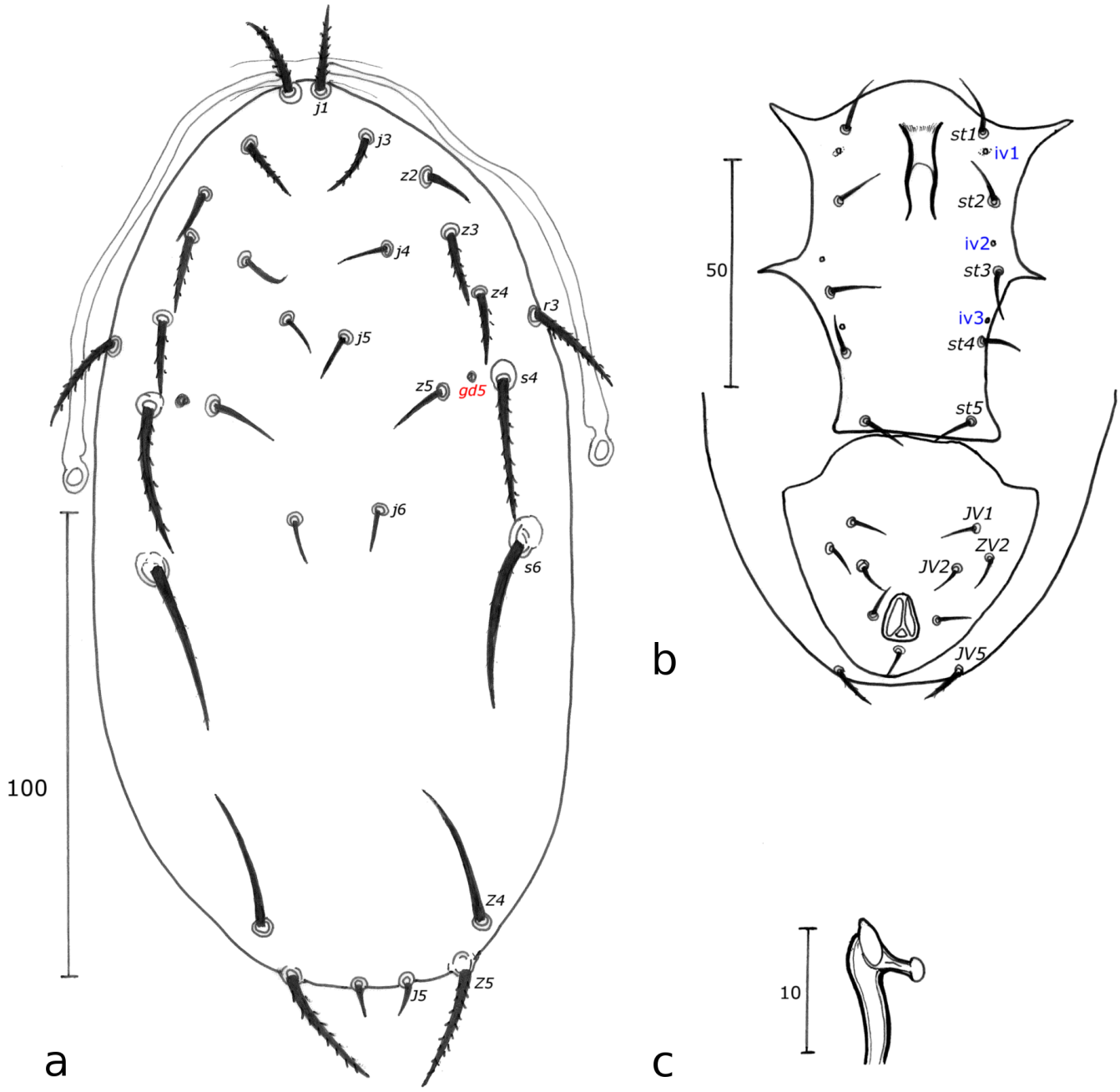


Figure 6 Male of *Phytoseius tixierae* Kreiter **n. sp.**. a – Dorsal shield and peritreme; b – Ventral shields; c – Spermatodactyl.

the knowledge of mites and especially to the taxonomy of Phytoseiidae and her great assistance with this paper.

Remarks — Measurements of specimens collected during this study are provided in table 14 for females and for the single male and compared with measurements obtained from specimens of the closest described species.

Females of *Phytoseius tixierae* Kreiter **n. sp.** (Table 14) resembles that of *P. huaxiensis* Xin, Liang and Ke but differs in having *s6* only slightly serrated, shorter *s4*, *s6*, *Z4*, *Z5* and *JV5*. It also resembles *P. indicus* Bhattacharyya but differs in having *s6* only slightly serrated, shorter

s4, *s6*, *Z4*, *JV5, Z4* not serrated but *z4* serrated and longer. It is also related to *P. kazusanus* Ehara but differs in having *s6* only slightly serrated, *z4* serrated, longer *Z5*, *JV5* and *StIV and Z4* not serrated. It is also very close to *P. longchuanensis* Wu but differs from this species by having longer setae except *s4* and *Z4*, *s6* only slightly serrated, *z4* serrated, longer *JV5* and 4 macrosetae on the leg IV instead of zero. It is also very similar to *P. rimandoi* Corpuz but differs from this species in having shorter *s6*, *Z4* smooth. Finally, the closest species is *P. nudus* Wu and Li but the new species differs from this species in having *z4* strongly serrated (only slightly serrated in the former), and the dorsal shield rugose (smooth in the former).

Males of *Phytoseius tixierae* Kreiter **n. sp.** (Table 14) also resembles to the males of *P. huaxiensis* and *P. kazusanus* that are the only species for which males have been described. But males of the new species differ from males of the former species in having *s6* only slightly

Table 14 Character measurements of adult females and one adult male of *Phytoseius tixierae* Kreiter **n. sp.** collected in this study and close species reported in previous studies (localities followed by the number of specimens measured).

	♀							♂		
Characters	***Phytoseius tixierae*** Kreiter **n. sp.**	***Phytoseius huaxiensis*** Xin, Liang & Ke	***Phytoseius indicus*** Bhattacharyya	***Phytoseius kazusanus*** Ehara	***Phytoseius longchuanensis*** Wu	***Phytoseius nudus*** Wu & Li	***Phytoseius rimandoi*** Corpuz-Raroz	***Phytoseius tixierae*** Kreiter **n. sp.**	***Phytoseius huaxiensis*** Xin, Liang & Ke	***Phytoseius kazusanus*** Ehara
	4	Xin, Liang & Ke 9	1?	8	2	?	1?	1	2	?
Dsl	**271** (250 – 280)	-	260 – 299	284	268	285	332	200	222	228
Dsw at *s4* level	**130** (125 – 140)	-	136 – 145	153	196	145	186	113	118	144
Ds	rugose	rugose	rugose	rugose	rugose	smooth	rugose	smooth	?	?
j1	**23** (21 – 23)	28	20 – 27	25 (25 – 26)	17	23	26	20	21	19
j3	**18** (15 – 23)	20	22 – 27	19 (18 – 19)	17	18	16	16	21	17
j4	**10** (10 – 11)	10	8 – 9	9	7	13	8 to 12	10	9	8
j5	**10** (10 – 11)	8	6 – 12	8 (8 – 9)	7	13	8 to 12	8	7	8
j6	**11** (10 – 13)	11	9 – 12	10	7	13	8 to 12	9	10	8
J5	**9** (8 – 9)	9	8 – 9	9 (9 – 10)	7	9	8 to 12	6	7	7
r3	**30** (28 – 30)	36	30 – 36	31 (31 – 32)	24	33	36	25	28	26
s4	**44** (43 – 45)	57	60 – 72	48 (47 – 49)	55	43	48	35	43	37
s6	**59** (55 – 63) sl. ser.	70 ser.	60 – 72 ser.	59 (58 – 61) ser.	58 ser.	61 ser.	58 ser.	35	48	36
z2	**12** (10 – 13) not ser.	13 not ser.	10 – 12 not ser.	14 (13 – 14) not ser.	14 not ser.	13 not ser.	8 to 12 not ser.	10	11	13
z3	**20** (18 – 25)	35	26 – 29	29 (28 – 29)	34	20	24	18	31	23
z4	**19** (18 – 23) ser.	17 ser.	10 not ser.	16 (16 – 17) ser.	10 not ser.	20 serrul.	22 ser.	18	19	14
z5	**12** (9 – 13)	11	8 – 9	11 (10 – 11)	7	13	8 to 12	10	10	9
Z4	**57** (48 – 63) not ser.	72 not ser.	48 – 52 ser.	63 (62 – 64) ser.	69 not ser.	53 not ser.	56 ser.	30	43	37
Z5	**53** (48 – 55)	69	52 – 65	62 (61 – 62)	38 – 41	56	52	28	37	35
st1-st1	**46** (43 – 50)	-	-	-	-	-	-	43	-	-
st2-st2	**53** (50 – 55)	-	-	-	-	-	-	48	-	-
st3-st3	**59** (43 – 68)	-	63	-	-	-	-	50	-	-
st1-st3 ♀ / *st1-st5* ♂	**58** (55 – 60)	-	63	-	-	-	-	90	-	-
st4-st4	**62** (50 – 75)	-	-	-	-	-	-	43	-	-
Gensl	**101** (98 – 105)	-	-			-			Not applicable	
st5-st5	**56** (50 – 60)	-	-	-	-	-	-	35	-	-
Gensw post. corn.	**80** (78 – 82)		-			-				
Lisl	**24** (20 – 28)	-	-	-	-	-	-		Not applicable	
Lisw	**2**	-	-	-	-	-	-			
Vsl	**92** (85 – 98)	-	90	-	-	-	-	75	-	-
Vsw *ZV2*	**51** (50 – 53)	-	45	-	-	-	-	90	-	-
Vsw anus	**44** (43 – 45)	-	-	-	-	-	-	50	-	-
JV5	**19** (15 – 20) ser.	44	36 ser.	41 (40 – 41)	10	20	-	10	19	16
SgeIV	**10** spat.	-	12 – 20 spat.	10 (9 – 10) spat.		14 spat.	6 spat.	5	-	8
StiIV	**39** (38 – 40) spat.	-	32 – 40 spat.	31 (31 – 32) spat.	No macrosetae	43 spat.	42 spat.	7	-	11
StIV	**21** (20 – 23) spat.	-	18 – 20 spat.	26 (26 – 27) spat.		21 spat.	24 spat.	13	-	19
SttIV	**19** (18 – 20) spat.	-	22 spat.	21 (20 – 21) spat.		21 spat.	24 spat.	15	-	16
Scl	**10**	-	-	-	-	-	-		Not applicable	
Scw	**5**	-	-	-	-	-	-			
Fdl	**17** (14 – 20)	-	-	-	-	-	-	15	-	-
No teeth Fd	**2**	-	-	-	-	-	3	2	-	-
Mdl	**18** (15 – 20)	-	-	-	-	-	-	15	-	-
No teeth Md	**1**	-	-	-	-	-	1	1	-	-
Shaft	Not applicable							11	-	-
Toe								9	-	-

Sources of measurements – For ♀♀: *Phytoseius huaxiensis*: Xin *et al.* (1982); *P. indicus* (= *P. neglectus* Gupta): Bhattacharyya (1968) and Gupta (1969); *P. kazusanus*: Ehara in Ehara *et al.* (1994); *P. longchuanensis*: Wu (1997); *P. nudus*: Wu & Li (1984); *P. rimandoi*: Corpuz (1966). For ♂♂: *P. huaxiensis*: Xin *et al.* (1982); *P. kazusanus*: Ehara in Ehara *et al.* (1994). - : not provided.

serrated, and shorter *s4*, *s6*, *z3*, *Z4*, *Z5* and *JV5*. Males of the new species differ from males of *P. kazusanus* in having *s6* only slightly serrated, shorter *Z4*, *Z5* and *JV5*, *z4* serrated and longer and *Z4* not serrated.

Conclusion

The fauna of Phytoseiidae of Vietnam is now composed of 20 species, 12 already known from previous studies and 8 added in this paper. As this number of species is still far below the anticipated real number of phytoseiid species present in this tropical biodiversity hotspot, follow-up survey work is urgently needed.

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