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DISCOVERY OF TWO PHYTOSEIID SPECIES (ACARI: MESOSTIGMATA): FIRST RECORDS FOR GERMANY AND SPAIN WITH THE PROPOSAL OF A SYNONYMY

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Abstract: Two first records of the family Phytoseiidae are presented, based on material from Germany and Spain. *Amblyseius krantzi* (Chant, 1959) is recorded from Germany and is redescribed here based on the collected specimen. *Amblyseius angulatus* Karg, 1982 is considered a junior synonym of *A. krantzi*. The collected specimen of *Neoseiulus marginatus* (Wainstein, 1961) provides a first record for Spain; the specimen shows the greatest setal length documented so far for this species.
Key words: Acari, Phytoseiidae, predatory mites, faunistics, first records, Germany, Spain.

Descubrimiento de dos especies de ácaros fitoseidos (Acari: Mesostigmata): primeras citas de Alemania y España, y propuesta de sinonimia
Resumen: Se presentan dos primeras citas de la familia Phytoseiidae, basadas en material de Alemania y España. *Amblyseius krantzi* (Chant, 1959) se cita de Alemania y se redescribe a partir del ejemplar recogido. *Amblyseius angulatus* Karg, 1982 se consida sinónimo posterior de *A. krantzi*. El ejemplar colectado de *Neoseiulus marginatus* (Wainstein, 1961) supone la primera cita para España; este espécimen tiene la longitud setal más grande documentada hasta el momento en esta especie.
Palabras clave: Acari, Phytoseiidae, ácaros predadores, faunística, primeras citas, Alemania, España.

Introduction

Species of the predatory mite family Phytoseiidae are important natural enemies of phytophagous mites and small insect pests in natural habitats, agricultural fields and greenhouses (Gerson *et al.,* 2003; McMurtry, 1984). According to the database of Demite *et al.* (2021) in Germany 64 (including 2 species recorded by Faraji *et al.*, 2018) and in Spain 78 valid species of Phytoseiidae were recorded. The works by Karg (1993) and Ferragut *et al.* (2010) are two comprehensive publications for the phytoseiid mite fauna of Germany and Spain, respectively. In this paper, we document new species records for Germany and Spain.

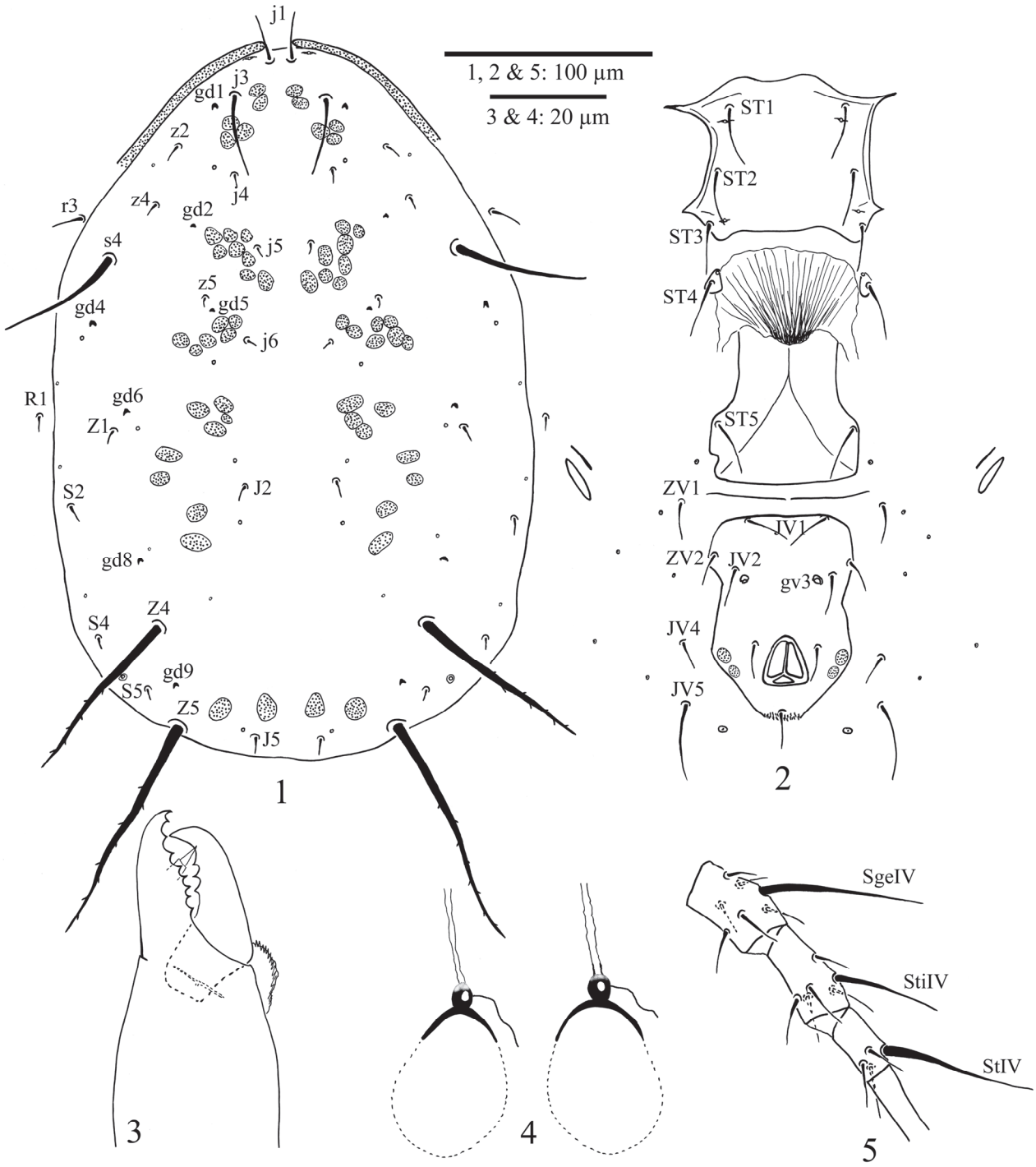
Material and Methods

Mites were collected either by extraction from field-collected soil samples using a MacFadyen high-gradient extractor (MacFadyen, 1961) or by washing leaves. The collected mites were preserved in ethanol 70%. Phytoseiid specimens were cleared in a mixture of Nesbitt and lactophenol solutions 1:1, and mounted in modified Hoyer's medium as described by Faraji & Bakker (2008). Drawings were made with the aid of a camera lucida (drawing tube) attached to an Olympus phase contrast microscope. The notations used for dorsal and ventral setations follow those of Lindquist & Evans (1965) as adapted by Rowell *et al*. (1978) and Chant & Yoshida-Shaul (1991), respectively. The notation for gland pores (solenostomes) or lyrifissures (poroids) is according to Athias-Henriot (1975). All measurements are in micrometers (µm). The classification system follows that of Chant & McMurtry (2007). The voucher specimens of mites are deposited in the Acari collection of MITOX Consultants/Eurofins, Amsterdam Science Park.

Taxonomy

***Amblyseius krantzi* (Chant, 1959)** (Figs. 1–5)
Typhlodromus (*Amblyseius*) *berlesei* Chant (1957)
Typhlodromus (*Amblyseius*) *krantzi* Chant (1959) (original designation)
Amblyseius (*Amblyseius*) *krantzi* (Chant), Muma (1961)
Typhlodromus krantzi (Chant), Hirschmann (1962)
Amblyseius krantzi (Chant), Wainstein (1975); Kolodochka & Gwiazdowicz (2016)
Typhlodromips krantzi (Chant), Moraes *et al.* (1986); Moraes *et al.* (2004)
Amblyseius frutexis Karg, 1993, synonymy according to Kolodochka & Gwiazdowicz (2016)
Amblyseius angulatus Karg, 1982 new synonym

FEMALE – One specimen measured.
Idiosomal setal pattern: 10A:9B/JV–3:ZV–3.
Dorsal idiosoma (Fig. 1) – Dorsal shield oval and completely smooth, 330 long and 213 wide at j_6 level; with 19 pairs of dorsal setae (r_3 and R_1 included); dorsal shield setae smooth, except for Z_4 and Z_5, serrated; lengths: j_1 26, j_3 41, j_4, j_5, j_6, J_2, J_5, z_5, Z_1, S_2, S_4 and S_5 5–7, z_2 and z_4 8, Z_4 90, Z_5 112, s_4 66; setae r_3 16 and R_1 9 on lateral integument; Z_4, Z_5 and s_4 are the longest setae, dorsal shield with 7 pairs of solenostomes (gd_1, gd_2, gd_4, gd_5, gd_6, gd_8, gd_9) and 15 pairs of small poroids.
Peritreme – Extending almost beyond setae j_1 (Fig. 1).
Ventral idiosoma (Fig. 2) – Sternal shield slightly wider than long, posterior margin almost straight, smooth at the central area with a few lateral striae, 73 long, 79 wide at level of setae ST_2, three pairs of setae and two pairs of pores (iv_1 and iv_2), ST_1 30, ST_2 28, ST_3 27; distances between ST_1–ST_3 57 and ST_1–ST_1 55, ST_2–ST_2 66; metasternal setae ST_4 27 and a pair of poroids (iv_3) on small platelets; genital shield smooth width at widest point 73, ST_5 28; two pairs of metapodal



Figs. 1–5. *Amblyseius krantzi* (Chant), female, **1.** Dorsal view of idiosoma, **2.** Ventral view of idiosoma, **3.** Chelicera, **4.** Spermathecae, **5.** Leg IV.

shields, primary 22 long and accessory 14 long; ventrianal shield smooth more or less vase-shaped (Fig. 2), length 101, width at level of setae ZV_2, 68, and width at level of paranal setae 68; with three pairs of preanal setae (JV_1 24, JV_2 19, ZV_2 18); four pairs of setae surrounding ventrianal shield on integument (JV_4 13, JV_5 40, ZV_1 21), six pairs of poroids surrounding ventrianal shield. Ventrianal shield with a pair of elliptical gland pores (gv_3) posteromesad to JV_2, distance between these pores 35.

Spermatheca – Calyx cup-shaped 8 long, 14–16 in diameter; atrium O-shaped (Fig. 4).

Chelicera – Fixed digit 31 long with about 8 teeth and a *pilus dentilis*; movable digit 33 long with 3 teeth (Fig. 3).

Legs – Leg IV (Fig. 5) with three pointed macrosetae, SgeIV 79, StiIV 51, StIV 73; SgeI 44, SgeII 40, SgeIII 35, StiIII 28, SgeII 35, SgeI 37; length of legs from the base of coxae to the tip of claws: leg I 375, leg II 313, leg III 308, leg IV 418; chaetotactic formulae of genua and tibiae I–II–III–IV with 10(2–2/1, 2/1–2) – 8(2–2/1, 2/0–1) – 7(1–2/1, 2/0–1) – 7(1–2/0, 2/1–1) and 10(2–2/1, 2/1–2) – 7(1–1/1, 2/1–1) – 7(1–1/1, 2/1–1) – 6(1–1/0, 2/1–1) setae respectively.

DISTRIBUTION – Alaska, Canada, Germany (this study), Kazakhstan, Poland, Russia, Switzerland, USA (Washington) (Demite *et al.*, 2021).

SPECIMEN EXAMINED – One female, 3 October 2018, soil of

forest predominantly covered by Norway spruce (*Picea abies*) on 580 m a.s.l., Swabian Alb, Germany (48°35'29.7"N 9°51'50.8"E), collector: Jan Hendrik Moos.

REMARKS – The features and measurements for the specimen collected in Germany fit very well with those provided in the original description and those re-described by Kolodochka & Gwiazdowicz (2016) from Poland. The lack of setae ZV_3 is a unique feature of this species, which makes it easy to recognize this species among all *Amblyseius* species at least those distributed in Europe. Karg (1982) described *A. angulatus* from Switzerland and did not compare it with *A. krantzi*. Because there are no morphological differences between these two species, we consider them conspecific.

***Neoseiulus marginatus* (Wainsein, 1961)** (Figs. 6–10)
Typhlodromus marginatus Wainstein (1961) (original designation)
Amblyseius (*Amblyseius*) *marginatus* (Wainstein), Ehara (1966)
Amblyseius (*Typhlodromopsis*) *marginatus* (Wainstein), Arutunjan (1970)
Amblyseius marginagus [sic] (Wainstein), Kolodochka (1973)
Amblyseius (*Neoseiulus*) *marginatus* (Wainstein), Karg (1991)
Amblyseius marginatus (Wainstein), Salmane (1999)

FEMALE – One specimen measured.
Idiosomal setal pattern: 10A:9B/JV–3:ZV.
Dorsal idiosoma (Fig. 6) – Dorsal shield oval and smooth with some lateral striae, 385 long and 217 wide at j_6 level; with 19 pairs of dorsal setae (r_3 and R_1 included); dorsal shield setae smooth, except for Z_4 and Z_5, finely and sparsely serrated; lengths: j_1 19, j_3 35, j_4 24, j_5 21, j_6 24, J_2 30, J_5 13, z_2 30, z_4 33, z_5 21, Z_1 33, Z_4 57, Z_5 73, s_4 45, S_2 44, S_4 40, S_5 33; setae r_3 28 and R_1 30 on lateral integument; dorsal shield with 7 pairs of solenostomes (gd_1, gd_2, gd_4, gd_5, gd_6, gd_8, gd_9) and 15 pairs of small poroids.
Peritreme – Extending almost beyond setae j_1 (Fig. 6).
Ventral idiosoma (Fig. 7) – Sternal shield wider than long, posterior margin slightly concave, smooth at the central area with a few lateral striae, 74 long, 80 wide at level of setae ST_2, three pairs of setae and two pairs of poroids (iv_1 and iv_2), ST_1 36, ST_2 36, ST_3 34; distances between ST_1–ST_3 70 and ST_1–ST_1 59, ST_2–ST_2 69; metasternal setae ST_4 33 and a pair of pores (iv_3) on small platelets; genital shield smooth, width at widest point 85, ST_5 33; two pairs of metapodal shields, primary 33 long and accessory 17 long; ventrianal shield pentagonal with some transverse striae (Fig. 7), length 139, width at level of setae ZV_2, 109, and width at level of paranal setae 90; with three pairs of preanal setae (JV_1 32, JV_2 30, ZV_2 30); four pairs of setae surrounding ventrianal shield on integument (JV_4 30, JV_5 61, ZV_1 29, ZV_3 22), five pairs of poroids and one pair of small platelets surrounding ventrianal shield. Ventrianal shield with a pair of small round gland pores (gv_3) posteromesad to JV_2, distance between these pores 28.
Spermatheca – Calyx saccular 22 long, atrium forked with a neck 9 long between calyx and atrium (Fig. 9).
Chelicera – Fixed digit 32 long with about 4 teeth (3 subapical and one at the level of *pilus dentilis*) and a *pilus dentilis*; movable digit 33 long with 3 teeth (Fig. 8).
Legs – Leg IV (Fig. 10) with one pointed macrosetae, StIV 85, other legs without macrosetae; length of legs from the base of coxae to the tip of claws: leg I 395, leg II 303, leg III 300, leg IV 408; chaetotactic formulae of genua and tibiae I–II–III–IV with 10(2–2/1, 2/1–2) – 7(2–2/0, 2/0–1) – 7(1–2/1, 2/0–1) – 7(1–2/0, 2/1–1) and 10(2–2/1, 2/1–2) – 7(1–1/1, 2/1–1) – 7(1–1/1, 2/1–1) – 6(1–1/0, 2/1–1) setae respectively.

DISTRIBUTION – Algeria, Armenia, Azerbaijan, France, Georgia, Greece, Hungary, Iran, Israel, Kazakhstan, Kenya, Latvia, Moldova, Russia, Serbia, Spain (this study), Turkey, Turkmenistan & Ukraine (Demite *et al.*, 2021).

SPECIMEN EXAMINED – One female, 8 August 2002, on leaves of European grape (*Vitis vinifera*), The vineyard was located near the village of Baldomar (community Artesa del Segre) in the province of Lleida, Catalonia, Spain (41°55'15.6"N 1°01'05.6"E), collector: Frank Bakker.

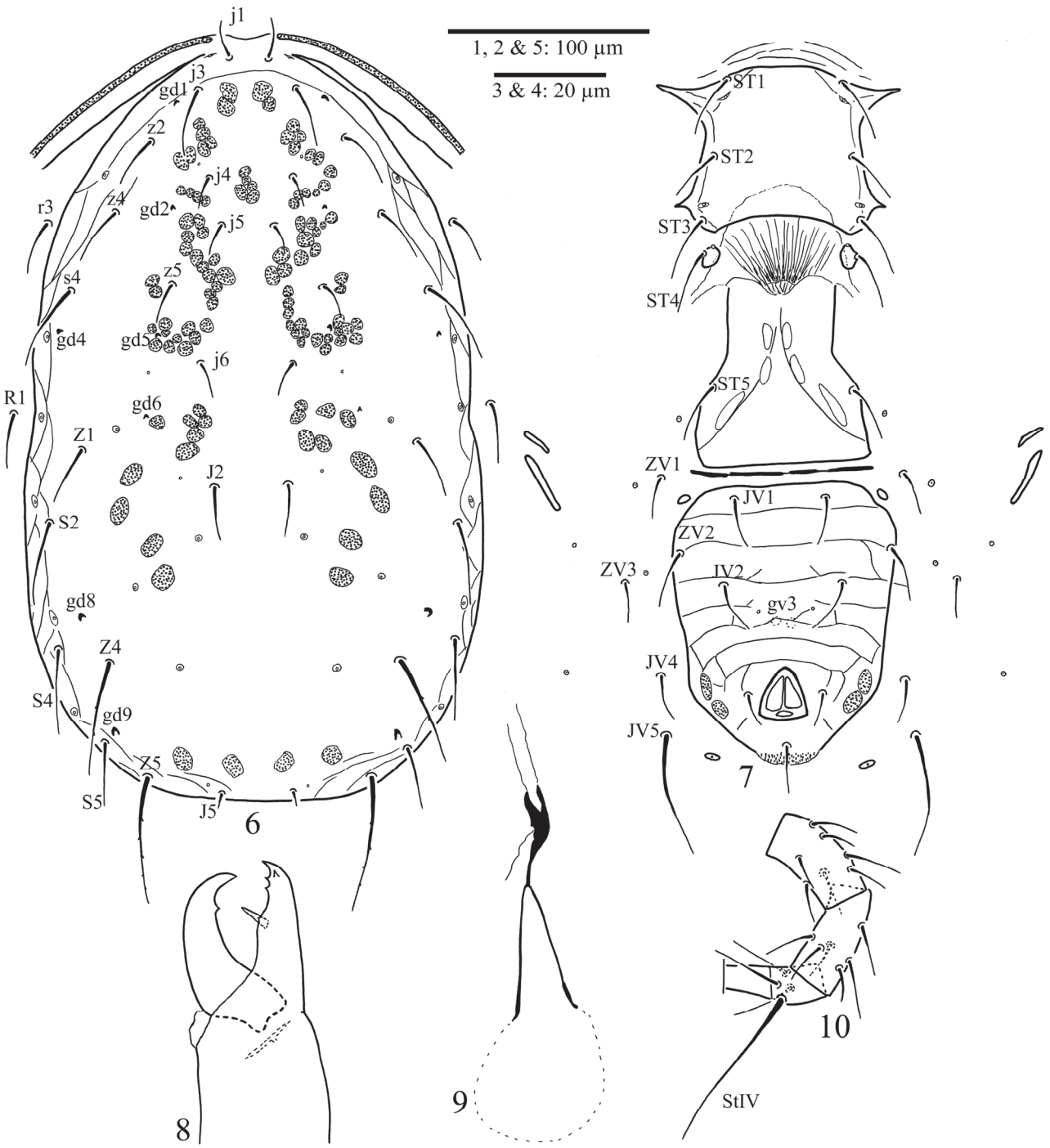
REMARKS – This is the first record of *N. marginatus* from Spain. The setal length and dorsal shield dimension of the specimen collected in northern Spain are much higher than those reported from other countries (Table I.)

Table I. Comparison between some setal lengths and dorsal shield dimensions of the specimen of *Neoseiulus marginatus* (Wainstein) found in Spain and four populations collected in Iran, Israel, Turkey and Ukraine, DSL: Dorsal Shield Length; DSW: Dorsal Shield Width. 1: This study; 2: Rahmani *et al.* (2010); 3: Palevsky *et al.* (2009); 4: Faraji *et al.* (2011); 5: Livshitz & Kuznetsov (1972).

	Spain[1]	Iran[2]	Israel[3]	Turkey[4]	Ukraine[5]
DSL	385	348–352	334–350	320	325
DSW	217	190–198	173–179	180	?
j_1	19	15–17	16–18	15	15–18
j_3	35	22–24	22–25	25	20–22
j_4	24	14–18	15–17	15	15–18
j_5	21	16–18	14–17	14	15–18
j_6	24	20	16–20	15	15–18
J_2	30	21–25	20–22	18	15–18
J_5	13	9	11–14	12	13
z_2	30	22–26	19–23	21	20–22
z_4	33	22–24	20–24	21	20–22
z_5	21	17–19	15–18	14	15–18
Z_1	33	20–24	22–24	17	20–22
Z_4	57	47–53	46–54	44	43
Z_5	73	51–59	63–74	50	59
s_4	45	30–34	30–36	34	30–32
S_2	44	38–42	34–40	31	30–32
S_4	40	32–38	33–37	33	30–32
S_5	33	25–29	28–36	23	20–22
r_3	28	14–18	20–24	18	?
R_1	30	10–14	21–26	20	?
Jv_5	61	?	?	48	48
StIV	85	52–58	70–77	70	76

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Figs. 7–11. *Neoseiulus marginatus* (Wainstein), female, **6.** Dorsal view of idiosoma, **7.** Ventral view of idiosoma, **8.** Chelicera, **9.** Spermatheca, **10.** Leg IV.

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