

A new species of *Erythraeus* (*Erythraeus*) (Acari: Prostigmata: Erythraeidae) from central Kansas

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ABSTRACT — A new species of *Erythraeus* from USA, *Erythraeus* (*Erythraeus*) *aphidivorous* n. sp., collected as an ectoparasite of the sugarcane aphid, *Melanaphis sacchari*, in central Kansas is illustrated and described. It is the seventh report of *Erythraeus* species having the basifemoral setal formula 2-2-2.

KEYWORDS — Parasitengona; taxonomy; ectoparasite; larva

INTRODUCTION

Hitherto 42 species of the subgenus *Erythraeus* (*Erythraeus*) have been described based on larval morphology; among them 20 species were described from Europe, 20 from Asia and two from Africa (Khanjani *et al.*, 2007; Beron, 2008; Haitlinger, 2009a, 2009b, 2010, 2011, 2012; Saboori and Çobanoğlu, 2010, Kamran *et al.*, 2011).

To date, only two species of subgenus *Erythraeus*, based on adults, were found in USA: *Erythraeus* (*E.*) *exilipes* Banks, 1947 and *E.* (*E.*) *simplex* Banks, 1915 (Banks, 1915, 1947; Beron, 2008). In this paper we describe the larva of *Erythraeus* (*Erythraeus*) *aphidivorous* n. sp., which was collected feeding on host aphids *Melanaphis sacchari* (Zehntner) (Hemiptera: Aphididae), from Kansas, U.S.A.

MATERIALS AND METHODS

This description is based on two larval specimens collected in Hays, Kansas, USA feeding on host aphids of *Melanaphis sacchari* (Zehntner) (Hemiptera: Aphididae) on 30 June, 2014. Specimens of *M. sacchari* were collected from sorghum plants directly into 70% ethanol and subsequently examined in laboratory for associated mites. Mite specimens were detached from thorax of the host aphid using an insect pin, cleared in Nessbitt's solution and mounted in Faure medium (Walter and Krantz, 2009). All measurements are given in micrometers (µm) and calculated using a Carl Zeiss Axioscope A1 microscope, and Carl Zeiss Axio Imager A2 with differential interference contrast and phase contrast. The terminology and abbreviations follow Haitlinger (1999, 2013). The holotype and one paratype are deposited at the Museum of Nat-

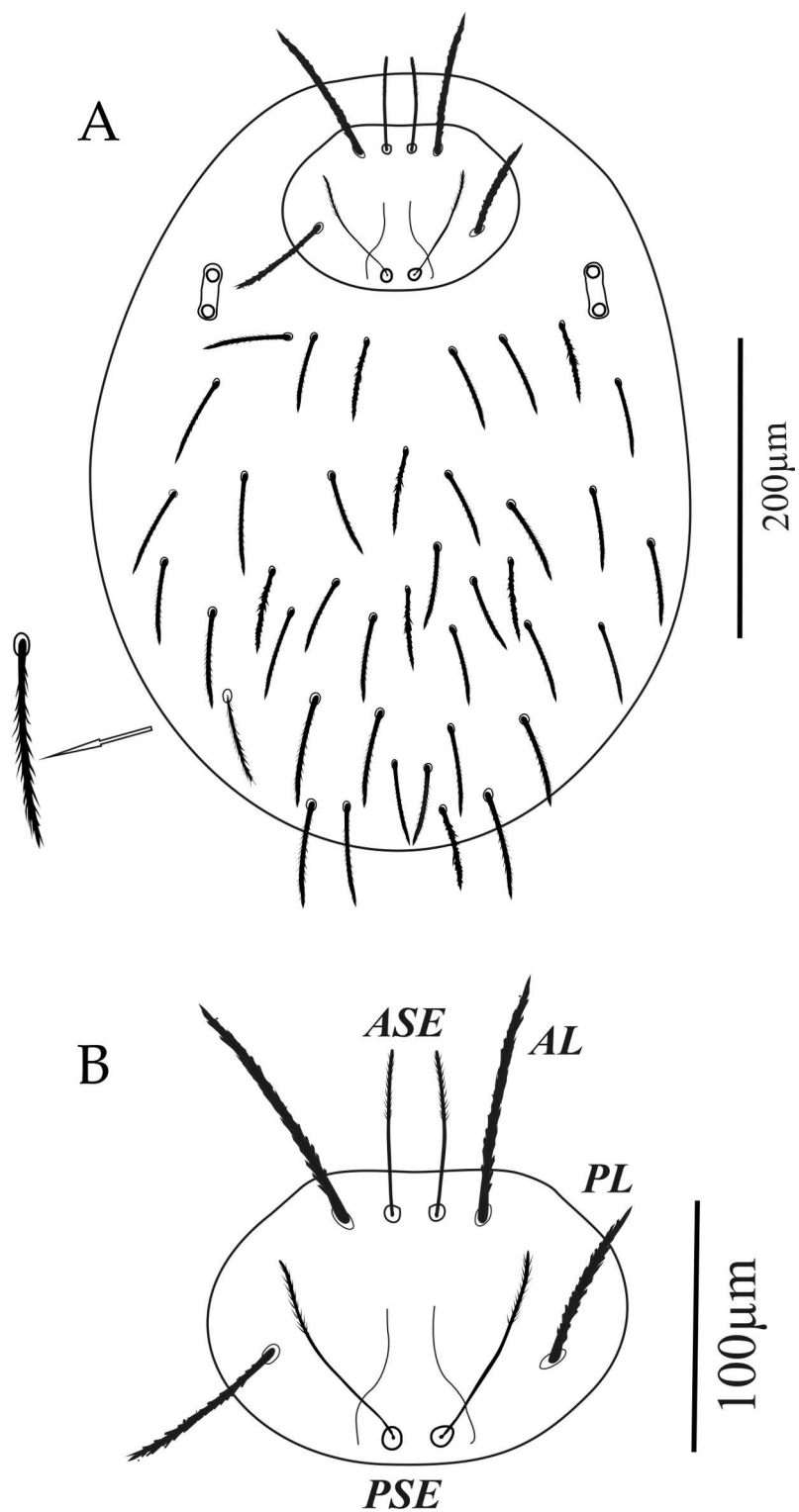


FIGURE 1: *Erythraeus (Erythraeus) aphidivororus* n. sp.: A – Idiosoma dorsal view; B – Scutum.

ural History of Podgorica (Montenegro).

TAXONOMY
FAMILY ERYTHRAEIDAE
ROBINEAU-DESVOIDY, 1828

Erythraeus (Erythraeus) aphidivorous n. sp.
(Figures 1-3)

Diagnosis — Bfn 2-2-2, ASE 57 – 67, AL 93 – 96, TaI 169 – 172, ISD 77 – 80, DS 53 – 62, fD 38 – 40.

Material examined — Holotype (larva). Idiosoma rounded, dorsal surface with 40 setulose setae (38 in paratype). Setae on posterior part of idiosoma slightly shorter than others. Two pairs of eyes, unequal in diameter anterolaterally, in platelets, anterior 19 μ m and posterior 17 μ m (Figure 1A) in diameter (same in paratype). Dorsal scutum pentagonal, 1.4 times wider than long, with two setae AL, distally setulose for one half their length; setae PL shorter, setulose. Anterior border of scutum slightly convex in the middle, posterior border straight (Figure 1B). Sensillary setae ASE distally with very fine setules for one third their length. Sensillary setae ASE short, distally setulose for one quarter their length, located in line between setae AL. ASE < PSE (Figure 1B). Ventral surface of idiosoma with two weakly barbed sternalae 1a (between coxae I), two weakly barbed sternalae 3a (between coxae III) and 16 slightly barbed setae (fV) posterior to coxae III (Figure 2A). Sternalae 1a pointed, 3a bifid at the end, both setulose. Coxalae 1b-3b all barbed (Figure 2A); coxala 1b distinctly longer than coxala 2b and 3b, 2b < 3b. Coxala 1b and 3b pointed, coxala 2b with distal bifid end (Figure 2A). NDV = 40+16 = 56 (in holotype), NDV = 38+16 = 54 (in paratype).

Gnathosoma with smooth galealae (cs), short anterior hypostomae (as1) 10 μ m, relatively long (33 μ m) and smooth posterior hypostomae (as2) (Figure 2B).

Palpfemur and palpgenu with one barbed seta each. Palptibia with 3 setae, 2 setae nude and 1 seta weakly barbed (Figure 2B). Palptarsus with 8 setae (eupathidium and solenidion included), 4 setae nude and 2 setae slightly barbed distally (Figure 2C). Metric data are given in Table 1.

Leg setal formula:

Leg I: Ta 1 ω , 2 ξ , 25B; Ti 2 φ , 1 κ , 14B; Ge 1 κ , 1 σ , 8B; Tf 5B; Bf 2B; Tr 1B; Cx 1B (Figures 3A-B).

Leg II: Ta 1 ω , 2 ξ , 24B; Ti 2 φ , 15B; Ge 1 κ , 8B; Tf 5B; Bf 2B; Tr 1B; Cx 1B (Figures 3C-D).

Leg III: Ta 1 ξ , 24B; Ti 1 φ , 15B; Ge 8B; Tf 5B; Bf 2B; Tr 1B; Cx 1B (Figures 3E-F).

Etymology — The species was named for its habit of feeding on aphids.

Type material — The holotype and one paratype were collected by J.P. Michaud and Felipe Colares on *Melanaphis sacchari* (on sorghum), 30 June, 2014, at the Agricultural Research Center-Hays, in Hays, KS (38°51' N lat, 99°20' W long), USA. The holotype and one paratype are deposited in the Museum of Natural History, Podgorica, Montenegro.

Remarks — *E. (E.) aphidivorous* n. sp. belongs to the species group with basifemoral formula 2-2-2 (2-2-1). This group includes: *E. (E.) adras-tus* (Southcott, 1961) from Denmark, *E. (E.) tinnae* Haitlinger, 1997 from Canary Islands, *E. (E.) picafor-ticus* Haitlinger, 2002 from Balearic Islands, *E. (E.) kacperi* Haitlinger, 2004 from Cambodia, *E. (E.) yang-shounicus* Haitlinger, 2006 from China, *E. (E.) walii* Kamran, Afzal, Raza, Bashir, Ahmad, 2011 from Pakistan and *E. (E.) etnaensis* Haitlinger, 2011 from Sicily, Italy (Southcott, 1961; Haitlinger, 1997, 2002, 2004, 2006, 2011, Kamran *et al.*, 2011). It differs from *E. (E.) adrastus* in the shorter AW (51 – 54 vs. 63 – 77), in the longer TaI (169 – 172 vs. 95), TiI (278 vs. 131), in the number of fV (8 vs. 12), leg I (1056 – 1076 vs. 575), leg II (978 – 984 vs. 550) and leg III (1261 – 1267 vs. 680); from *E. (E.) tinnae* in the longer ASE (57 – 67 vs. 36), in the shorter AW (51 – 54 vs. 80), PW (105 – 108 vs. 144), AL (93 – 96 vs. 140), PL (69 – 71 vs. 104), TaI (169 – 172 vs. 196) and TiIII (401 – 405 vs. 440); from *E. (E.) picaforticus* in the shorter W (157 – 163 vs. 190), AW (51 – 54 vs. 84), PW (105 – 108 vs. 136), longer TiIII (401 – 405 vs. 362), ISD (77 – 80 vs. 56), and TaI (169 – 172 vs. 156); from *E. (E.) kacperi* in the longer AL (93 – 96 vs. 74), W (157 – 163 vs. 110), L (117 – 125 vs. 90), GL (162 vs. 140), TaI (169 – 170 vs. 134), TiIII (401 – 405 vs. 280), ISD (77 – 80 vs. 68), fD (38 – 40 vs. 29) and fV (16 vs. 8); from *E. (E.) yangshounicus* in the shorter DS (53 – 62 vs. 82 – 130), 1a (46 – 53 vs. 62), PsFd (54 – 58 vs.

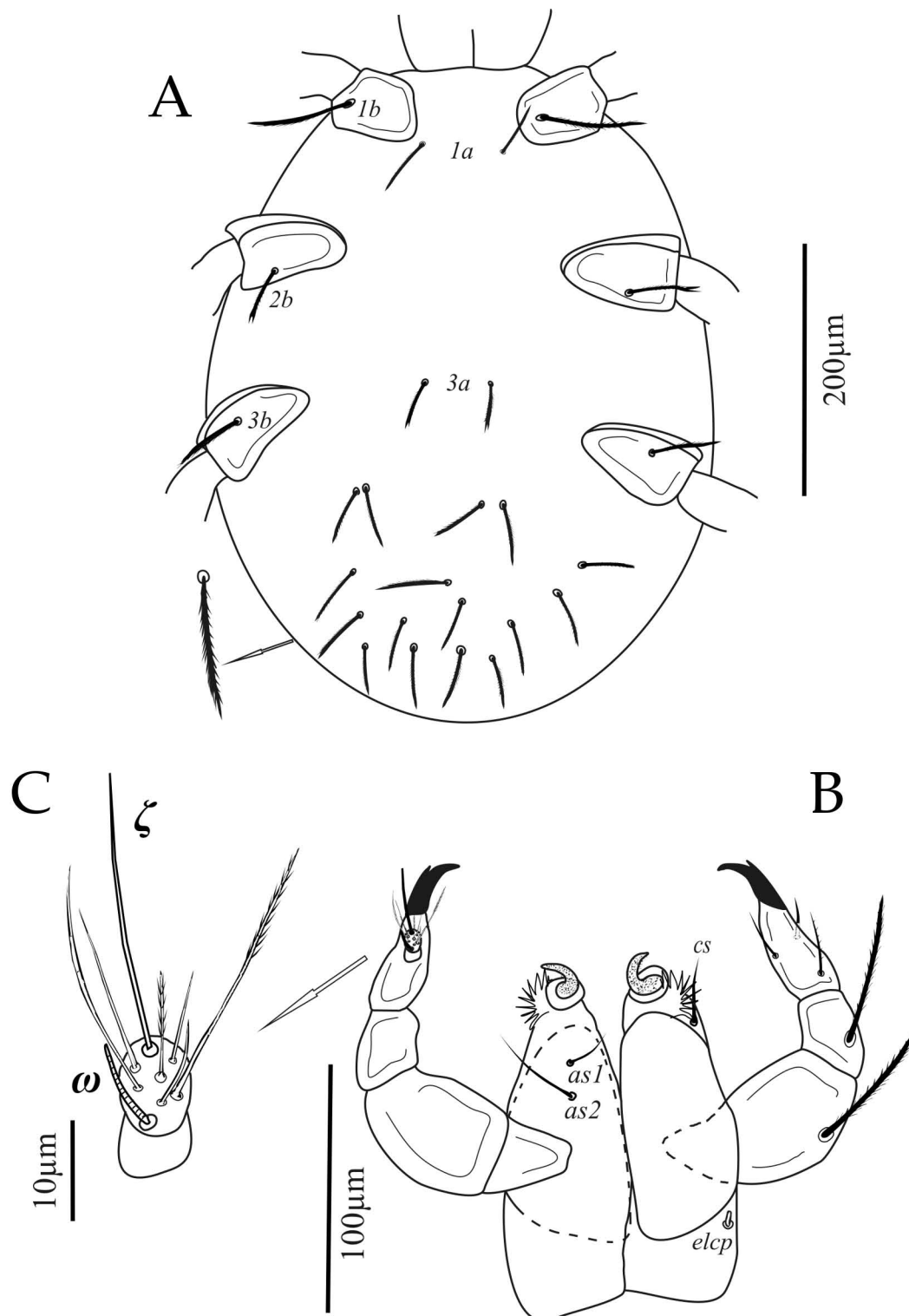


FIGURE 2: *Erythraeus (Erythraeus) aphidivorus* n. sp.: A – Idiosoma; ventral view; B – Ventral view (left) and dorsal view of gnathosoma (right); C – Palptarsus.

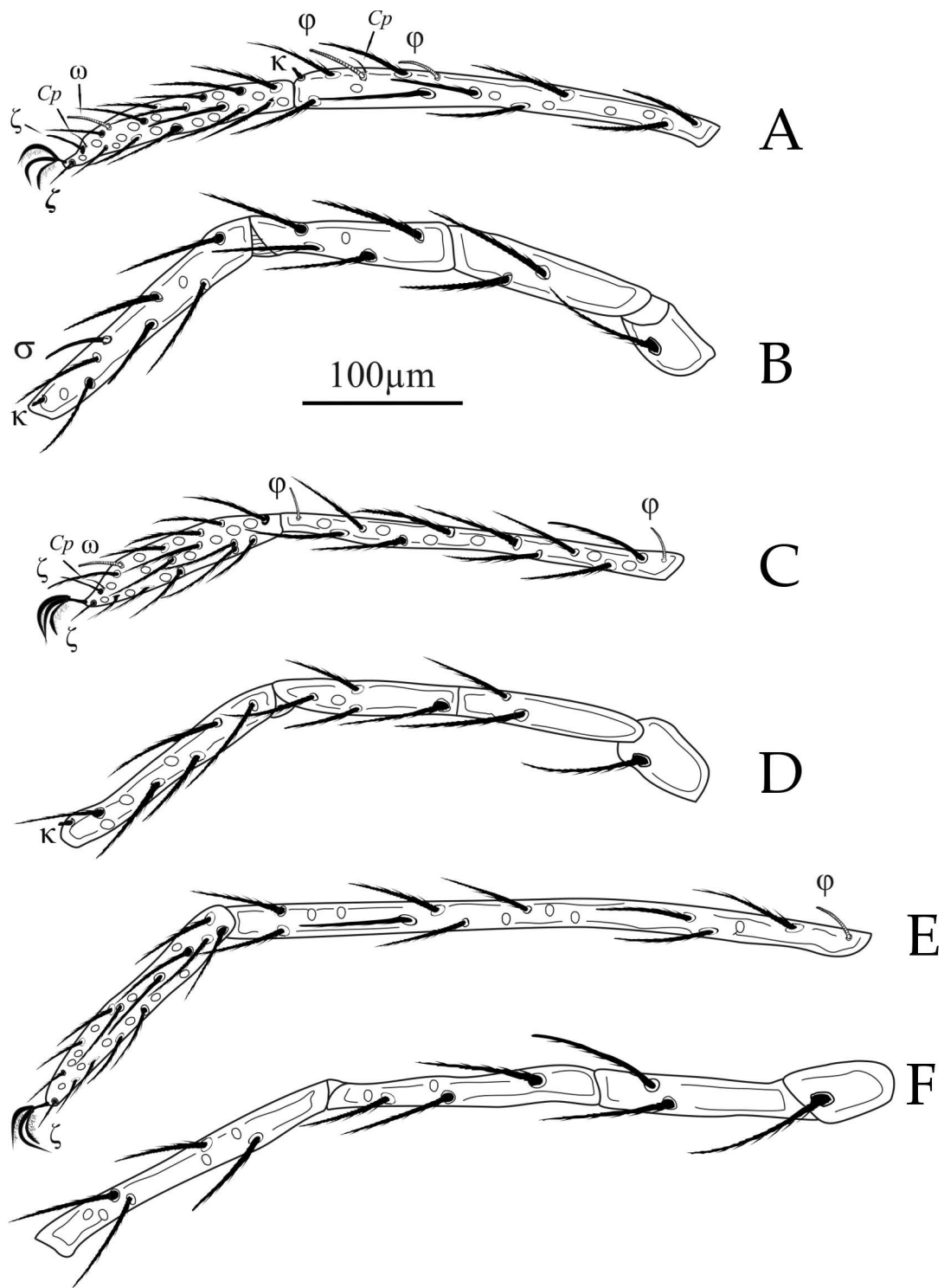


FIGURE 3: *Erythraeus (Erythraeus) aphidivorous* n. sp.: A – Leg I, tarsus-tibia; B – Leg I, trochanter-genu; C – Leg II, tarsus-tibia; D – Leg II, trochanter-genu; E – Leg III, tarsus-tibia; F – Leg III, trochanter-genu.

66 – 74), TaI (169 – 172 vs. 192), TiIII (401 – 405 vs. 496), in longer L (117 – 125 vs. 104), W (157 – 163 vs. 140), and fD (38 – 40 vs. 56), from *E. (E.) etnaensis* in longer ASE (57 – 67 vs. 38), ISD (77 – 80 vs. 54), L (117 – 125 vs. 108), in shorter AL (93 – 96 vs. 108), DS (53 – 62 vs. 80 – 100), *1a* (46 – 53 vs. 80), and *1b* (92 – 101 vs. 118), in different NDV (54 – 56 vs. 84), and TaI (1 ω , 2 ξ , 25B vs. Ta 1 ω , 2 ξ , 18B) and from *E. (E.) walii* in the longer L (117 – 125 vs. 77 – 83), W (157 – 163 vs. 112 – 120), PW (105 – 108 vs. 50 – 53), ISD (77 – 80 vs. 58 – 63), AP (51 – 56 vs. 45 – 47), AL (93 – 96 vs. 73 – 78) and ASE (57 – 67 vs. 26 – 28).

Tables (2-3) display differences *E. (E.) aphidivorous* **sp. nov.** in measurements and numbers of setae from all other species of this group.

Key for the subgenus *Erythraeus* (*Erythraeus*) of the world with 2 setae on BFe I-III

1. Ta I < 110, Ti I < 150..... *E. (E.) adrastus* (Southcott, 1961); Denmark
— Ta I > 120, Ti I > 160 2
2. Ti III < 300 3
— Ti III > 340 5
3. Ta I > 160..... *E. (E.) walii* Kamran, Afzal, Raza, Bashir, Ahmad, 2011; Pakistan
— Ta I < 150..... *E. (E.) kacperi* Haitlinger, 2004; Cambodia
5. Ta I > 180, Ti III > 430..... *E. (E.) tinnae* Haitlinger, 1997; Canary Islands
— Ta I < 180, Ti III < 430..... 6

TABLE 1: Metric data of *Erythraeus* (*Erythraeus*) *aphidivorous* **n. sp.** larvae (H, holotype; P, paratype).

Character	H	P	Character	H	P
IL	538	665	PaFe (W)	52	48
IW	418	577	PaGe (L)	34	32
L	117	125	PaGe (W)	24	24
W	163	157	Ta I	172	169
AW	51	54	Ti I	278	278
PW	108	105	Ge I	195	198
AA	11	12	Tf I	134	138
SB	8	9	Bf I	146	140
ISD	80	77	Tr I	68	62
AP	56	51	Cx I	74	71
AL	93	96	Ta II	155	156
PL	69	71	Ti II	266	269
ASE	57	67	Ge II	163	157
PSE	80	81	Tf II	124	117
GL	162	162	Bf II	125	129
DS	58-62	53-59	Tr II	60	58
PsFd	58	54	Cx II	91	92
PsGd	71	71	Ta III	184	179
<i>1a</i>	53	46	Ti III	401	405
<i>3a</i>	38	35	Ge III	213	216
<i>1b</i>	92	101	Tf III	158	170
<i>2b</i>	42	36	Bf III	147	145
<i>3b</i>	45	48	Tr III	63	59
cs	35	34	Cx III	95	93
as1	10	11	Leg I	1076	1056
as2	33	40	Leg II	984	978
OD	33	30	Leg III	1261	1267
PaFe (L)	68	67	IP	3321	3301

TABLE 2: Metric data for world described species (larvae) of subgenus *Erythraeus* (*Erythraeus*).

Taxa	L	W	AW	PW	ISD	AL	PL	ASE	PSE	1a	1b	2b
<i>E. (E.) adrastus</i>	100-112	141-167	63-77	105-118	65-70	73-84	55-62	14-24	58-67	89	87	30
<i>E. (E.) tinnae</i>	132	194	80	144	76	140	104	36	92	76	128	54
<i>E. (E.) picaforticus</i>	120	190	84	136	56	-	84	46	90	64	114	53
<i>E. (E.) kacperi</i>	90	110	52	100	68	74	-	30	-	-	88	-
<i>E. (E.) yangshuounicus</i>	104	140	60	112	72	102	-	62	70	62	108	34
<i>E. (E.) walii</i>	77-83	112-120	45-48	74-77	58-63	73-78	50-53	26-28	64-68	50-52	71-76	-
<i>E. (E.) etnaensis</i>	108	150	58	110	54	108	76	38	-	-	-	-
<i>E. (E.) aphidivorous n. sp.</i>	117-125	157-163	51-54	105-108	77-80	93-96	69-71	57-67	80-81	46-53	92-101	36-42
Taxa	3b	DS	TaI	TaII	TaIII	Ti I	Ti II	Ti III	Ge I	Ge II	Ge III	IP
<i>E. (E.) adrastus</i>	37	30-54	95	-	-	131	-	-	-	-	-	1805
<i>E. (E.) tinnae</i>	70	70-130	196	182	204	300	304	440	220	188	224	3756
<i>E. (E.) picaforticus</i>	-	60-76	156	142	172	214	224	362	166	140	188	3034
<i>E. (E.) kacperi</i>	-	38-54	134	120	132	184	180	280	150	120	144	2420
<i>E. (E.) yangshuounicus</i>	46	82-130	192	184	-	346	332	496	230	184	236	-
<i>E. (E.) walii</i>	-	32-43	172-177	110-114	125-127	173-176	158-163	248-251	137-140	108-113	123-126	2280-2301
<i>E. (E.) etnaensis</i>	-	80-100	164	162	172	262	280	406	198	168	218	3332
<i>E. (E.) aphidivorous n. sp.</i>	45-48	53-62	169-172	155-156	179-184	278	266-269	401-405	195-198	157-163	213-216	3301-3321

TABLE 3: Chaetotaxy of the body and leg segments for world described species (larvae) of subgenus *Erythraeus* (*Erythraeus*).

Taxa	Bf	Ge I-III	Ti I-III	Ta I-III	fD	fV	NDV	FPp
<i>E. (E.) adrastus</i>	2-2-2	8-8-8	-	-	-	12	-	0-B-B-BBB-NNNNNN ω ζ
<i>E. (E.) tinnae</i>	2-2-2	8-8-8	14-15-14	24-18-22	47	15	62	0-B-B-NNN-NNNBBBB ω ζ
<i>E. (E.) picaforticus</i>	2-2-2	8-8-8	11-15-14	22-21-21	72	24	96	0-B-B-BBB-NNNNNB ω ζ
<i>E. (E.) kacperi</i>	2-2-1	8-8-8	14-14-14	19-19-18	29	8	37	0-B-B-NNN-NNNNNN ω ζ
<i>E. (E.) yangshounicus</i>	2-2-1	8-8-8	14-15-15	22-20(?)	56	14	70	0-B-B-BNN-NNNNN ω ζ
<i>E. (E.) walii</i>	2-2-2	8-8-7	14-15-14	21-15-18	32	10	42	0-B-B-BN-NNNBB ω ζ
<i>E. (E.) etnaensis</i>	2-2-2	8-8-8	14-15-14	18-16-18	64	20	84	0-B-B-NNN(?)
<i>E. (E.) aphidivorous n. sp.</i>	2-2-2	8-8-8	14-15-15	25-24-24	38-40	16	54-56	0-B-B-BNN-NNNNNB ω ζ
Taxa	ζ I-III	ω I-III	e I-III	φ I-III	σ I-III	κ (Ti) I-III	κ (Ge) I-III	
<i>E. (E.) adrastus</i>	1-1-0	1-1-0	0-0-0	2-2-0	-	-	-	
<i>E. (E.) tinnae</i>	1-1-0	0-0-0	0-0-0	2-2-1	1-0-0	1-0-0	1-1-0	
<i>E. (E.) picaforticus</i>	2-2-1	1-1-0	0-0-0	2-2-1	1-0-0	1-0-0	1-1-0	
<i>E. (E.) kacperi</i>	2-2-1	1-1-0	0-0-0	2-2-1	0-0-0	1-0-0	1-1-0	
<i>E. (E.) yangshounicus</i>	2-2(?)	1-1(?)	0-0-0	2-2-1	1-0-0	1-0-0	1-1-0	
<i>E. (E.) walii</i>	2-2-1	1-1-0	1-1-1	1-1-1	1-1-0	1-1-1	1-1-0	
<i>E. (E.) etnaensis</i>	2-2-0	1-1-0	0-0-0	2-2-1	1-0-0	1-0-0	0-0-0	
<i>E. (E.) aphidivorous n. sp.</i>	2-2-1	1-1-0	0-0-0	2-2-1	1-0-0	1-0-0	1-1-0	

(?) - *E. (E.) yangshuounicus* TaI broken.(?) - *E. (E.) etnaensis* palptarsus slightly visible.

6. W > 180, PW > 130.....*E. (E.) picaforticus*
Haitlinger, 2002; Balearic Islands
— W < 170, PW < 120 7
7. Ti III < 430 8
— Ti III > 450.....*E. (E.) yangshuounicus*
Haitlinger, 2006; China
8. DS > 70, ISD < 70, fD > 45.....
.....*E. (E.) etnaensis* Haitlinger, 2011; Sicily
— DS < 70, ISD > 70, fD < 45.....
.....*E. (E.) aphidivorous n. sp.* ; U.S.A.

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