Ontogenetic redescription of *Bryobia rubrioculus* (Scheuten, 1857) (Acari: Tetranychidae) from Iran

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**Abstract**

*Bryobia rubrioculus* (Scheuten, 1857), is one of the most important pests of spider mites in Hamedan province, western Iran. This species found on aerial part of deciduous and coniferous trees. All mobile stages (larvae, protonymph, deutonymph and adult female) of *B. rubrioculus* were reared on sweet cherry leaf in germinator under controlled condition and redescription in the present study. Furthermore, a key to Iranian species of the genus *Bryobia* is presented.

**Key words:** Tetranychidae, brown mite, re-describtion, mobile stages, Iran.

**INTRODUCTION**

*Bryobia* Koch, 1836 is the largest genus in phytophagous subfamily Bryobiinae and contains several species of significant economic importance in many parts of the world (Hatzinikolis & Emmanouel, 1991). They have the largest body size in the family Tetranychidae and the adults are easily visible with the naked eyes. Up to now seven species of the genus have been recorded in Iran (Khanjani et al., 2008; Beyzavi et al., 2013; Mahdavi et al., 2013), namely, *Bryobia praetiosa* Koch, 1836; *B. rubrioculus* Scheuten, 1857; *B. neopraetiosa* Meyer, 1974; *B. karooensis* Meyer, 1974; *B. chrysocomae* Meyer, 1974; *B. tuttlei* Smiley and Baker, 1995; *B. mirmoayedii* Khanjani et al., 2008.

The brown apple mite (*Bryobia rubrioculus*) firstly was described by Scheuten (1857) from Germany, which described it as *Sannio rubrioculus*; then Van Eyndhoven (1956) collected this species and placed it in the genus *Bryobia*. *B. rubrioculus* (Scheuten, 1857) is one of the major pests of fruit trees in western Iran, especially in Hamedan province. The highest population of the brown mite was observed on the sweet cherry in western Iran as a predominant pest mite (Khanjani & Haddad Irani-Nejad 2006; Honarparvar et al., 2013). Because the economic importance of *B. rubrioculus* in Iran, and also the unavailability of an appropriate description of it, in the present paper female and immature stages of the species are re-described and all details of morphology such as measurements of setae and number of setae on legs segments in these stages are presented. Furthermore, a key to Iranian species of the genus *Bryobia* is presented.

**MATERIAL AND METHODS**

In late June 2016, the brown mite was collected from sweet cherry orchards (beating method) in Hamedan province, Heydareh village (34° 48’ N; 48° 28’ E) and reared for two generations in germinator under controlled condition: 25 ± 0.5 °C, 16:8 (L: D), and 60 ± 5 RH, in the lab of Bu Ali-Sina university, Hamedan Iran. In the laboratory the different stages of mite were collected from the leaf discs and directly mounted on permanent microscope slides in Hoyer’s medium under a
stereomicroscope, and then the slides were dried in an oven (50°C). All life stages of *Bryobia*
specimens were examined under an Olympus BX51 phase contrast and Differential Interference
Contrast microscope. All drawings were hand-made with a camera Lucida. The terminology and
abbreviations in the morphological descriptions follow Lindquist (1985). All measurements are
given in micrometers (µm). Type materials are deposited in the Collection of the Acerology
Laboratory, University of Bu–Ali Sina (CALBS), Hamedan, Iran.

**RESULTS**

**Family Tetranychidae Donnadieu, 1875**

**Subfamily Bryobiinae Berlese, 1913**

**Tribe Bryobiini Reck, 1952**

**Genus *Bryobia* Koch, 1836**

*Genus* *Bryobia* is characterized as follows: body ovate to obovate; prodorsum with four pairs of
setae (*vi, ve, sci and sce*) of which the anterior two pairs are placed on lobed projections;
opisthosa with three pairs of dorso-central setae (*ci, di, ei*), dorso central seta *fi* located in
lateral position; two pairs of dorsosublateral setae (*c2, d2*); 7 pairs of dorsolateral setae (*c3, d3, e3, e4, 
f1, f3, h1*); peritreme either simple or anastomosing distally. Cocal formula 2–1–1–1; genu I with 8
setae; all true claws, or those of tarsi II–IV, uncinateand provided with tenent hairs; empodium
paddle-like. Intercoxal areas are distinct in having setae 3a and 4a; pregenital area with one pair of
agenital setae (*ag*); genital area with two pairs of setae (*gi–gj*) and three pairs of anal setae (*ps1–3*)

*Bryobia rubriculcus* (Scheuten, 1857)

**Female (Figs. 1–16; n= 5):** Color in life greenish-brown. Length of body excluding gnathosoma
522–545 (from the tip of *v1* to the tip of *h1*), including gnathosoma 620–670; width 338–370.

**Dorsum (Figs. 1–2).** Prodorsum with four pairs of setae, with developed anterior lobes (Figs. 1–2).
Outer propodosomal lobes length 20–23 and width 22–26; inner lobes larger than outer lobes 29–
35 and width 15–18, with cone-shaped projection (Fig. 2), incision between median lobes narrow
and deep. Basal width of propodosomal lobes about 110–117. *v2* setae about 1.30 the size of *v1*.
Dorsal body setae spathulate, palmate, rough, serratate, inserted on tubercles, subequal in length, *vi*
is the shortest. Striation transverse under propodosomal lobes, longitudinal between *sc1* and *ci*,
transverse between *ci* and *di*. Opisthosomal area with fine arched reticulation, length of dorsal
setae: *v1* 16–17; *v2* 20–22; *sc1* 18–21; *sc2* 20–21; *c1* 19–20; *c2* 20–21; *c3* 18–20; *d1* 19–21; *d2* 20–21; *d3*
20–22; *e1* 19–20; *e2* 20–21; *e3* 20–21; *f1* 20–21; *f2* 20–21; *h1* 19–22. Distances between setae: *v1–v1* 7–
10; *v1–v2* 30–35; *v1–c1* 205–217; *v2–v2* 75–80; *v2–sc1* 100–109; *sc1–sc1* 200–215; *sc1–sc2* 47–56; *sc2–sc2*
285–312; *c1–c1* 72–78; *c1–c2* 92–104; *c2–c3* 32–43; *c2–d2* 50–62; *c2–d2* 275–294; *c3–c3* 345–358; *c1–d1*
55–73; *d1–d2* 95–115; *d2–d2* 270–289; *d2–d3* 28–35; *d2–e2* 95–114; *d3–d3* 265–280; *c2–d2* 50–62; *e1–e1*
30–35; *e1–e2* 100–115; *e2–e2* 235–248; *e2–e3* 26–31; *e2–f2* 120–135; *e3–e3* 220–238; *e1–f1* 132–143;
*f1–f1* 142–154; *f1–f2* 18–23; *f1–h1* 57–64; *h1–h1* 37–45.

**Gnathosoma (Figs 3–5).** Gnathosoma 115–125 long (from base of infracapitulum to tip of palp)
and 118–125 wide. Stylphore rounded, cleft mediobasally, length equal with width (Fig. 4).
Subcapitulum with two pairs of adoral setae (*or1–or2*) and one capitular seta *m* 33–37 (Fig. 3); Palp
80–85 (from trochanter to tip of tarsus), six segmented, palp tarsus with three simple setae, one
solenidion and three eupathidia; palp tibia with three setae and one claw; palp genu with one seta;
palp femur with one robust seta; trochanter without setae; coxa with one spiniform seta (Fig. 5). Peritreme anastomosed distally in stretched oval shape: length 23–26, width 10–11 (Fig. 6).

**Venter (Figs. 7–8).** Striation transverse between *1a* and *3a*, cuticle between *3a* and *4a* without
striation, anogenital area striation V-shaped (Fig. 7). Anogenital area with one pair of agenital
setae, two pairs of genital setae (*g1–2*), three pairs of pseudanal setae (*ps1–3*) and two pairs of
ventrocaudal (*h2–3*) setae. Length of ventral setae: *1a* 42–47; *1b* 41–46; *1c* 17–20; *2b* 25–27; *3a* 42–
45; *3c* 31–36; *4a* 35–41; *4c* 33–35; *ag* 39–45; *g1* 40–44; *g2* 39–42; *Ps1* 35–37; *Ps2* 36–39; *Ps3* 38–41;
*h2* 28–32; *h3* 34–37 (Figs. 8).
Legs (Figs. 9–16). Leg I 638–658 long (measured from coxa to tarsus) subequal with body length, leg II 358–380, leg III 349–365, leg IV 445–462 (Figs. 9–13). Length of segments of leg I as follows: femur 175–183, genu 75–82, tibia 123–138, tarsus 118–129 (Figs. 9–10). Setal formulae of legs I–IV segments as follows: coxae 2+elcp–1+1–1; trochanters 1–1–1–1; femora 9–5–5–5; genua 4–4–3–3; tibiae 9+1φρ–5–5–5; tarsi 13+2 duplexes–10+1ω+1 duplex–10+1ω–10.

Dorsum (Figs. 17–18). Prodorsal lobes similar in shape to females, outer propodosomal lobes length 13–16 and width 17–18; inner lobes larger than outer lobes 19–21 and width 13–14, with cone-shaped projection (Fig. 18), basal width of propodosomal lobes about 80–85. Dorsal body setae like to female. Lengths of dorsal setae: v1 13–16; v2 20–22; sc1 17–18; sc2 19–21; c1 19–20; c2 18–22; c3 19–20; d1 18–20; d2 19–20; d3 20–21; e1 19–20; e2 20–21; e3 19–21; f1 19–21; f2 19–22; h1 17–19. Distances between setae: v1–v1 9–13; v1–v2 17–22; v1–c1 171–179; v2–v2 51–55; v2–sc1 77–84; sc1–sc1 152–160; sc1–sc2 40–44; sc2–sc2 200–217; c1–c1 60–64; c1–c2 71–80; c2–c3 31–40; c2–d2 40–47; c2–c2 210–220; c3–c3 275–290; c1–d1 45–51; d1–d2 83–89; d2–d2 208–214; d2–d3 25–29; d2–e2 79–87; d3–d3 211–222; c2–c2 39–46; e1–e1 24–29; e1–e2 78–85; e2–e2 190–198; e2–e3 20–28; e2–f2 88–95; e3–e3 180–200; e1–f1 100–108; f1–f1 118–125; f1–f2 15–18; f1–h1 44–53; h1–h1 32–39.

Gnathosoma. Gnathosoma 95–100 long (from base of infracapitulum to tip of palp) and 93–97 wide. Stylophore rounded, cleft mediobasally, length equal with width. Subcapitulum with two pairs of adoral setae (or1– or2) and one capitular seta m 22–26; Palp 67–70 (from trochanter to tip of tarsus), six segmented, and its chaetotaxy same with female. Peritreme Anastomosed distally in an oval enlargement: 20–22 length, 8–9 width.

Venter. Anogenital area (Fig. 19) with one pair of aggenital setae, one pair of genital setae (g1), three pairs of pseudanal setae (ps1–3) and two pairs of ventrocaudal (h2–3) setae. Length of ventral setae: 1a 28–30; 1b 32–35; 1c 15–17; 2a 16–18; 3a 27–28; 3c 20–22; 4a 19–22; 4c 16–17; ag 18–20; g1 15–17; Ps1 14–17; Ps2 13–15; Ps3 16–18; h2 16–18; h1 19–20.

Legs (Figs. 20–23). Length of legs I–IV respectively (measured from coxa to tarsus), 353–370; 230–240; 245–253; 275–284. Length of segments of leg I as follows: femur 98–102; genu 44–49; tibia 63–67; tarsus 76–82. Setal formulae of legs segments as follows: coxae 2+elcp–1–1–1; trochanters 1–1–1–0; femora 9 [8]–5–3–2; genua 4–4–3–3; tibiae 9 +1φρ–5–5–5; tarsi 13+2ω+2 duplexes–10+1ω+1 duplex–10+1ω–10.
Protonymph (Figs. 24-30; n= 5): In life, color can change from olive green to dark brown. Length of body excluding gnathosoma 325–345, including gnathosoma 410–423; width 290–300.

Dorsum (Figs. 24–25). Prodorsum with four pairs of setae, with weakly developed anterior lobes, outer propodosomal lobes length 6–8 and width 13–14; inner lobes larger than outer lobes 8–11 and width 8–9, basal width of propodosomal lobes about 70–72 (Fig. 25). First propodosomal setae about half the length of the second one, all setae inserted on small tubercles. Lengths of dorsal setae: v1 9–10; v2 19–21; sc1 15–16; sc2 17–18; c1 18–20; c2 17–18; c3 16–18; d1 17–18; d2 17–19; d3 18–19; e1 17–19; e2 18–19; e3 18–19; f1 16–17; f2 17–18; h1 17–18. Distances between setae: v1–v1 11–12; v1–v2 16–19; v1–c1 137–149; v2–v2 42–47; v2–sc1 59–67; sc1–sc1 132–142; sc1–sc2 36–42; sc2–sc2 194–200; c1–c1 51–55; c1–c2 66–71; c2–c3 33–38; c2–c2 33–40; c2–c2 188–200; c1–c3 263–275; c1–d1 46–53; d1–d2 33–37; d1–d2 68–72; d2–d2 185–197; d2–d3 19–21; d2–e2 64–70; d3–d3 187–196; c2–d2 36–40; e1–e1 18–20; e1–e2 69–71; e2–e2 162–169; e2–e3 18–21; e2–f2 80–85; e3–e3 152–157; e1–f1 77–81; f1–f1 100–105; f1–f2 10–15; f1–h1 38–42; h1–h1 21–23.

Gnathosoma—Gnathosoma 73–85 long (from base of infracapitulum to tip of palp) and 75–80 wide. Subcapitulum with two pairs of adoral setae (or1—or2) and one capitular seta m 16–18; Palp 60–65 (from trochanter to tip of tarsi) and chaetotaxy same with female. Peritreme 14–15 length and 6–7 width.

Venter. Anogenital area (Fig. 26) with one pair of aggenital setae, three pairs of pseudanal setae (ps1–3) and two pairs of ventrocaudal (h2–3) setae. Length of ventral setae: 1a 23–25; 1b 28–30; 1c 14–15; 2a 12–14; 3a 22–25; 3c 14–15; ag 13–16; Ps1 9–10; Ps2 10–12; Ps3 11–12; h2 10–11; h3 11–12.

Legs (Figs. 27–30). Length of legs I–IV respectively (measured from coxa to tarsus): 283–292; 194–204; 205–210; 216–230. Length of segments of leg I as follows: femur 69–73; genu 36–38; tibia 44–46; tarsus 63–66. Setal formulae of legs segments as follows: coxae 2+e1c–1–0; trochanters 0–0–0; trochanter 0–0–0; femora 3–3–2; genua 4–4–2–2; tibiae 5 +1φφ–5–5–5; tarsi 9+1ω+2 duplexes–8+1ω+1 duplex–8–6.

Larva (31–36; n= 5): Larva is rounded, almost disk like, and orange green colored. Length of body excluding gnathosoma 258–265, including gnathosoma 333–343; width 238–248.

Dorsum (Figs. 31–32). Prodorsum without lob, with four pairs of setae, (Fig. 32). Lengths of dorsal setae: v1 9–10; v2 16–18; sc1 17–19; sc2 17–19; c1 17–19; c2 17–19; c3 14–16; d1 18–19; d2 19–20; d3 18–20; e1 20–22; e2 19–20; e3 19–20; f1 20–21; f2 20–22; h1 20–22. Distances between setae: v1–v1 8–12; v1–v2 11–14; v1–c1 78–91; v2–v2 39–43; v2–sc1 32–41; sc1–sc1 101–110; sc1–sc2 32–41; sc2–sc2 155–161; c1–c1 48–53; c1–c2 48–57; c2–c3 33–34; c2–c2 20–29; c2–c2 155–160; c3–c3 230–239; c1–d1 37–45; d1–d2 28–30; d1–d2 62–66; d2–d2 163–168; d2–d3 15–19; d2–e2 52–60; d3–d3 168–175; c2–e2 22–28; e1–e1 15–19; e1–e2 56–63; e2–e2 142–158; e2–e3 11–17; e2–f2 55–65; e3–e3 133–139; e1–f1 48–53; f1–f1 68–72; f2–f2 6–10; f1–h1 22–28; h1–h1 11–16.

Gnathosoma—Gnathosoma 70–78 long (from base of infracapitulum to tip of palp) and 70–74 wide. Subcapitulum with two pairs of adoral setae (or1—or2) and without capitular seta Palp 52–55 long, number of palp segment and setae are same with adult female. Peritreme 9–11 length and 5–6 width.

Venter. Anogenital area (Fig. 33) with two pairs of pseudanal setae (ps1–3) and two pairs of ventrocaudal (h2–3) setae. Length of ventral setae: 1a 20–22; 1b 24–25; 3a 20–21; Ps1 9–10; Ps2 9–10; Ps3 8–9; h2 10–13; h3 12–14.

Legs (Figs. 34–36). Length of legs I–III: 231–245; 175–184; 181–190. Length of segments of leg I as follows: femur 55–58; genu 29–32; tibia 35–36; tarsus 57–60. Setal formulae of leg segments as follows: coxae 1+e1c–0; trochanters 0–0–0; femora 3–3–2; genua 4–4–2; tibiae 5 +1φφ–5–5–5; tarsi 7+1 duplexes–7+1 duplex–6.
DISCUSSION

_Bryobia rubrioculus_ (Scheuten, 1857) is one of the most important pests on fruit trees in Iran, especially in Hamedan province. Forasmuch as the original description of the species (Scheuten, 1857) is old and unavailable, also prior re-descriptions don’t provide complete information about it, so we decided to re-describe the mobile stages of this species in detailed. This re–description resemble the re–description by Meyer (1987) from South Africa in having most same characters but it differs by: (Female): measurements of dorsal setae 16–22; peritrem length 23–26 and 10–11 width; femur I with 17 setae in Iranian specimens opposed to dorsal setae 25–27; peritrem length 19 and 9 width; femur I with 16–18 setae in South Africa specimens.

**Key to species of the Iranin _Bryobia_ (♀):**

1. Prodorsal lobes poorly developed ..................................................................................................................2
   - Prodorsal lobes well developed ....................................................................................................................3
2. Empodium I with a pair of tenent hairs and femur I of female with 8 setae.................................
   - Empodium I with four pair of tenent hairs and femur I of female with 10-11 setae...........
     ........................................................................................................................................... _B. tuttlei_ Smiley & Baker, 1995
3. Tarsi III and IV each with pair of duplex setae.........................................................................................4
   - Tarsus III with a pair of duplex setae; solenidion on tarsus IV well separated from tactile setae ....5
4. Dorsal body setae of female 33 μm long; dorsal body setae of larva 21-28; prodorsum with outer lobes triangular; femur I with 18-22 setae.............................................................................. _B. praetiosa_ Koch, 1836
   - Dorsal body setae of female 25-30 μm long; dorsal body setae of larva 14-18; prodorsum with outer lobes teat-like; femur I with 21-25 setae.................................................... _B. neopraetiosa_ Meyer, 1974
5. Empodium I with a pair of tenent hair ....................................................................................................... 6
   - Empodium I with ten pair of tenent hair............................................................................. _B. mirmoayedi_ Khanjani et al. 2008
6. Femur I with 12-13 setae; end of peritrem branches......................... _B. chrysocomae_ Meyer, 1974
   - Femur I with 17 setae; end of peritrem sausage-like structure...... _B. rubrioculus_ Scheuten, 1857

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