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ON THE TAXONOMIC STATUS OF THE WATER MITE *HYDRYPHANTES NONUNDULATUS* VIETS, 1919 (ACARI, HYDRACHNIDIA, HYDRYPHANTIDAE)

P. V. Tuzovsky

Institute for Biology of Inland Waters of the Russian Academy of Sciences, Borok, Nekouz Distr., Yaroslavl Prov., 152742, Russia; e-mail: tuz@ibiw.yaroslavl.ru

ABSTRACT: The first description of deutonymph and redescription of larva, female and male of the water mite *H. nonundulatus* Viets, 1919 are given. I reject previous proposals (Lundblad1962 and Di Sabatino et al. 2009) to synonymize *H. nonundulatus* with *H. planus,* Thon, 1899.

KEY WORDS: water mite, Hydryphantidae, *Hydryphantes nonundulatus*, morphology, larva, deutonymph, female, male

INTRODUCTION

There is no uniform opinion on the taxonomic status of the water mite *Hydryphantes nonundulatus* Viets, 1919. Originally *H. nonundulatus* was described as a subspecies of *H. bayeri* Pisařovic, 1896 (Viets 1919), but some researchers (Stiller 1960; Szalay 1964) treated itas a subspecies of *H. ruber* (Geer 1778), and Láska 1964 proposed *H. nonundulatus* as a separate species. However, Lundblad (1962) proposed to synonymize this species with *H. planus* Thon, 1899, followed by Di Sabatino et al. (2009, 2010). Morphology of adults *H. nonundulatus* is described a few works (Viets 1919, 1936; Soar and Williamson 1929; Szalay 1964; Láska 1964; etc.). Biesiadka and Cichocka (1990) gave a description of the morphology of the larva of *H. nonundulatus.* Deutonymphs of this species have been previously unknown. The existing descriptions of the larva and adult are incomplete and insufficiently illustrated, complicating identification of this species. Here I describe external morphology of the deutonymph, larva and adults of *H. nonundulatus* and discuss of the taxonomic status of this species.

MATERIALS AND METHODS

Specimens were collected by the author in temporary reservoirs of the European part of Russia. To obtain larvae, water mites were maintained in laboratory (room temperature, natural day-night conditions). Eggs and larvae obtained from females kept individually in glass or transparent plastic vessels of 10–15 mm diameter, and a height of 15 mm.

Idiosomal setae are named according to Tuzovsky (1987): *Fch* — frontales chelicerarum, *Fp* — frontales pedipalporum, *Vi* — verticales internae, *Ve* — verticales externae, *Oi* — occipitales internae, *Oe* — occipitales externae, *Hi* — humerales internae, *He* — humerales externae, *Hv* — humerales ventralia, *Sci* — scapulares internae, *Sce* — scapulares externae, *Li* — lumbales internae, *Le* — lumbales externae, *Si* — sacrales internae, *Se* — sacrales externae, *Ci* — caudales internae, *Pi* — praeanales internae, *Pe* — praeanales externae, *Ai* — anales internae, *Ae* — anales externae.

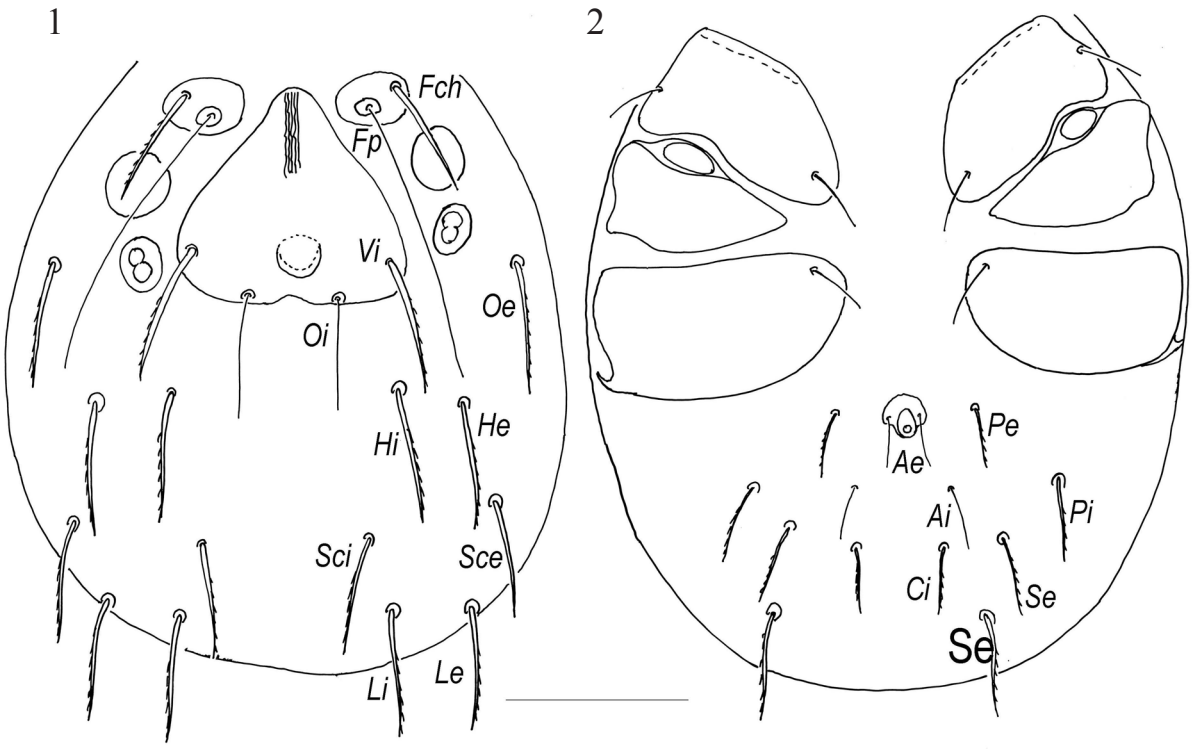
Furthermore, the following abbreviations are used: P-1–5, pedipalp segments (trochanter, femur, genu, tibia and tarsus); I–Leg-1–6, first leg, segments 1–6 (trochanter, basifemur, telofemur, genu, tibia and tarsus) i.e. III–Leg-3 = genu of third leg; C1 — coxal seta located medially on coxa I, C2 — coxal seta located posterolaterally on coxa I, C4 — coxal seta located anteromedially on coxa III; *e* — eupathidium, *s* — solenidion, *ac* — acanthoid seta; I–Leg-6: de1 — distance between the anterior end of segment and eupathidium, ds1 — distance between the anterior end of segment and solenidion; II–Leg-6: de2 — distance between the anterior end of segment and eupathidium, ds2 — distance between the anterior end of segment and solenidion; L — length; W — width; D — diameter; n — number of specimens measured; all measurements are given in micrometers (μm).

SYSTEMATICS

Family Hydryphantidae Piersig, 1896
Genus *Hydryphantes* Koch, 1841

Hydryphantes nonundulatus Viets, 1919
Figs 1–28

Material examined. Larvae (n = 58) were reared from six females collected in sedge-sphagnum bog, Yaroslavl Province, Nekouz District near village Postyltsevo, two females 28 May 2000, one female 26 May 2002 and three females 27 May



Figs 1–2. *Hydryphantes nonundulatus* Viets, 1919, larva: 1— dorsal view, 2 — ventral view. Scale bar: 50 μm.

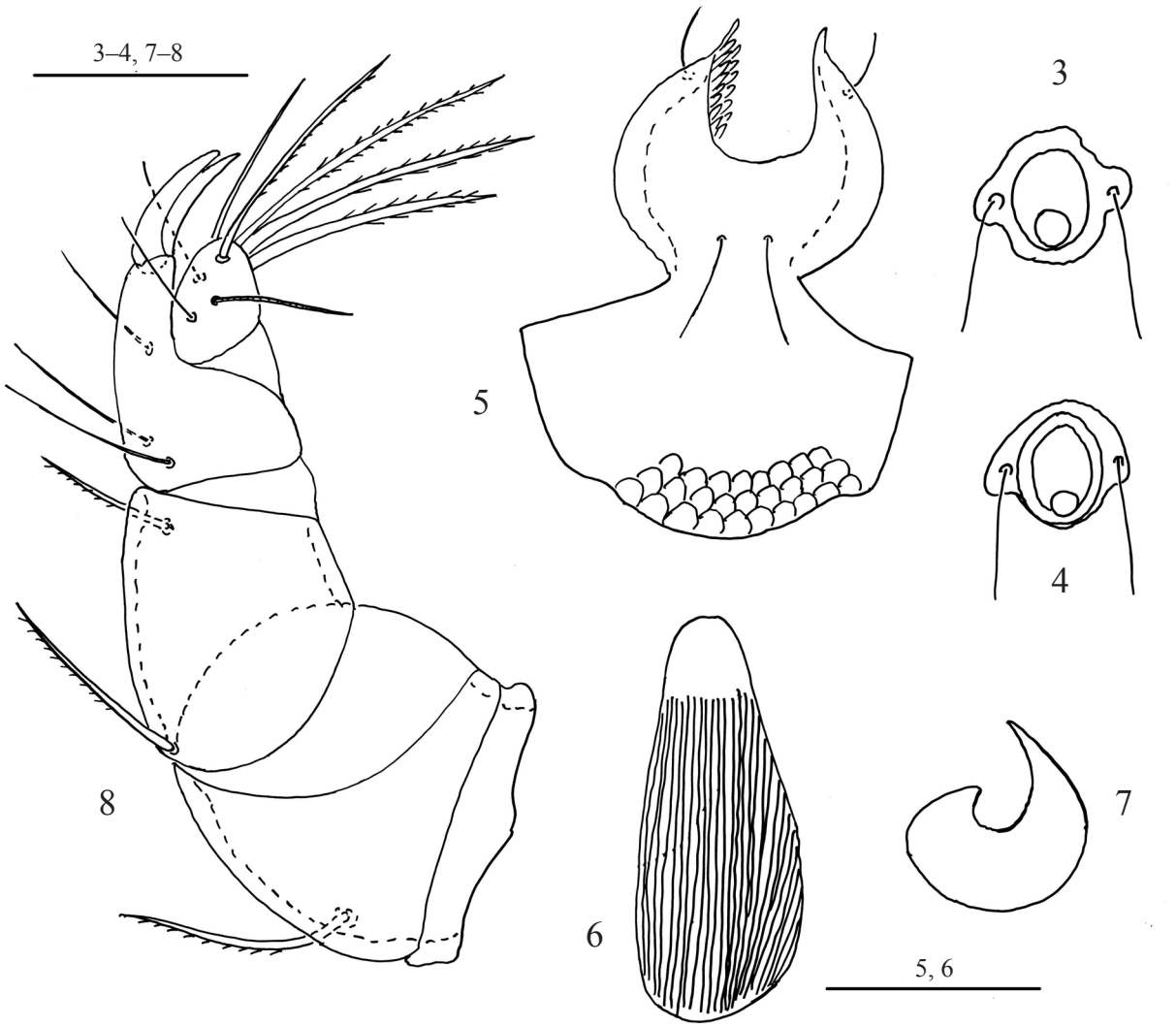
2003, 1 male 1 May 2002, 1 male 15 May 2002, 1 deutonymph 17 April 2000 and 1 deutonymph 26 May 2002, leg. P.V. Tuzovsky. The duration of the embryonic period was 11–14 days.

Diagnosis. Larva: posterior plate longer than wide; median eye rather large and situated between rows of setae *Vi* and *Oi*; distance between bases of trichobothria *Oi–Oi* shorter than their length; excretory pore plate as long as or slightly wider than long, bases of setae *Ae* situated near middle of excretory pore plate; venral hypostomal setae longer than dorsal ones; P-4 dorsodistal claw with two unequal clawlets; I/II–Leg-4 solenidion 2.0–2.5 times longer than eupathidium; I/II–Leg-5 with unequal solenidia; I–Leg-6 *de*<ds. **Adults**: frontal plate subquadrate, anterolateral extensions wider than posterolateral extensions, posterior margin concave, posterior projections short, their length equal to 1/4–1/5 length of basal portion of plate, median eye small and situated distinctly posterior at level of anterior setae; P-3 height large than length of segment, with four setae. **Deutonymph**: frontal plate as in adults, P-2 height longer than length of segment, with two long setae, genital field with two pairs subequal acetabula and four to six pairs of thin setae.

Larva. Colour red. Anterior pair of platelets triangular or oval, trichobothria *Fp* long and extending to posterior margin dorsal plate; seta *Fch* thick and two times shorter than *Fp* (Fig. 1). Posterior plate narrows anteriorly and widens posteriorly; median eye rather large and situated between rows setae *Vi* and *Oi*; seta *Vi* thick a little longer than *Fch*; *Oi* long, distance between setae *Oi–Oi* shorter than their length. Other dorsal setae (*Oe, Hi, He, Sci, Sce, Li* and *Le*) thick and nearly subequal. Anterior lateral eyes circular, posterior lateral eyes elongate.

Coxal plates II triangular, with convex posterior margin, coxal plates I and III large, more or less trapezoidal and broadly rounded medially (Fig. 2). Urstigma oval, wider than long, moderate in size. Setae *Si* slightly longer than other ventral idiosomal setae. Setae *Se, Ci, Pi* and *Pe* subequal and slightly longer and thicker than both pairs of anal setae. Excretory pore plate (Figs 3–4) as long as or slightly wider than long (L/W ratio 0.70–1.0), excretory pore situated near posterior margin of plate. Bases of setae *Ae* situated near middle of excretory pore plate.

Capitulum (Fig. 5) with short, wide base, ventral setae longer than dorsal ones. The mouth opening surrounded by numerous papillae. Posterior portion of basal part of capitulum with distinct reticulations.Chelicera with large basal segment and small stylet. Basal segment of chelicera (Fig. 6) with numerous thin strips, cheliceral stylet small and massive (Fig. 7).



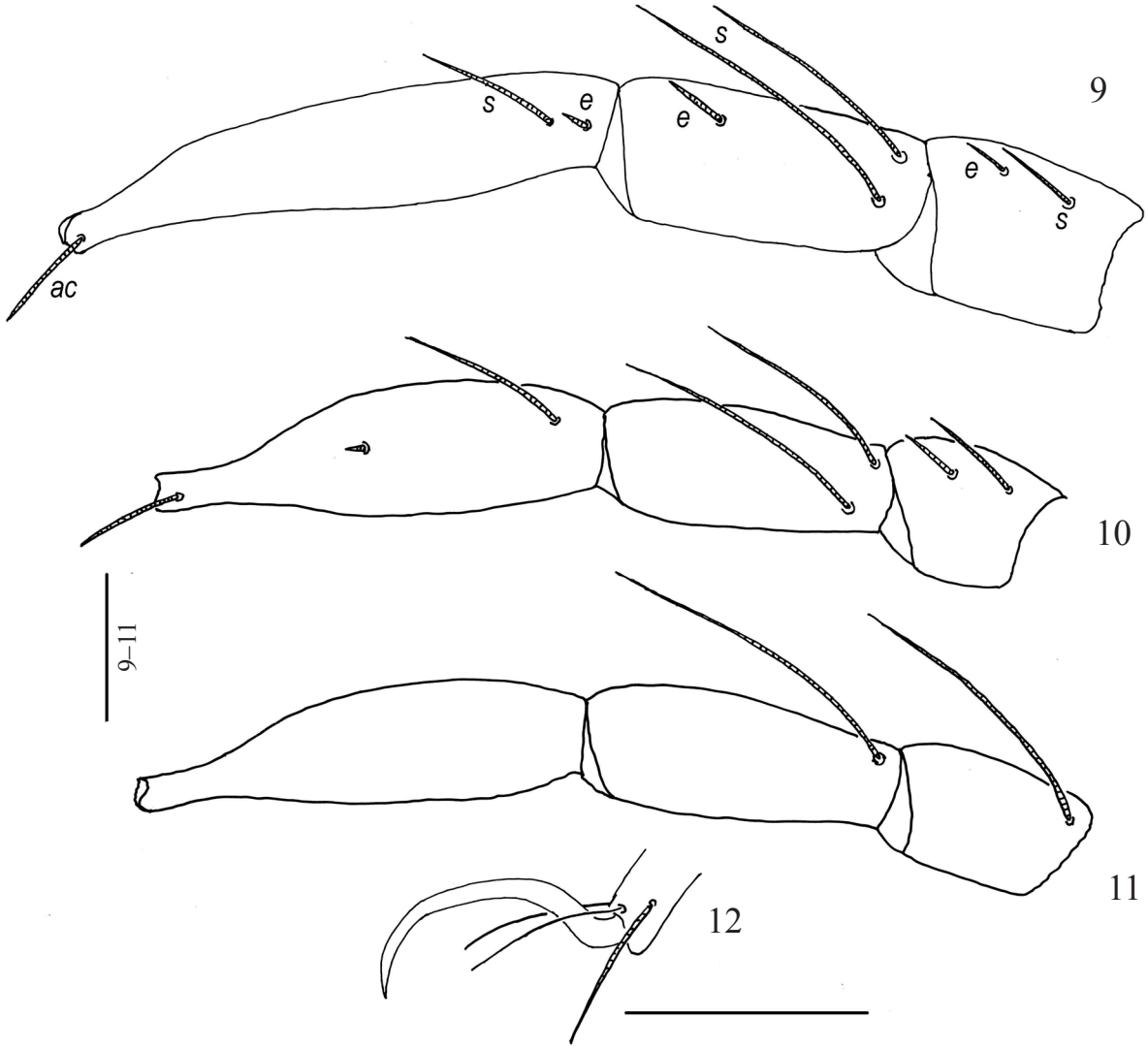
Figs 3–8. *Hydryphantes nonundulatus* Viets, 1919, larva: 3–4 — excretory pore plate, 5 — capitulum, 6 — chelicera, dorsal view, 7 — cheliceral claw; 8 — pedipalp. Scale bars: 3–4, 7–8 = 20 μm, 5–6 = 50 μm.

Pedipalp moderately developed (Fig. 8): P-1 short without seta; P-2 large with convex dorsal margin and single dorsal setae proximally to middle of segment; P-3 with two unequal setae (proximal and distal); P-4 with three thin unequal setae and large dorsodistal bifurcate claw with unequal clawlets; P-5 small with single solenidion, and five long, thick and two short, thin setae.

Shape and arrangement of specialized setae on terminal legs segments shown on Figs 9–11. I/II–Leg-4 solenidion shorter than segment but 2.0–2.5 times longer than eupathidium; I/II–Leg-5 with unequal proximal solenidia; I–Leg-6 eupathidium short and situated anteriorly of solenidion basis; II–Leg-6 solenidion proximal and eupathidium submedial; III–Leg-4 proximal solenidion slightly shorter than III–Leg-5 solenidion. I–Leg-6 and II–Leg-6 with relatively long distal acanthoid setae. Empodium large and crescent on all tarsi, ambulacra short and thin (Fig. 12).

Measurements, n=10. Dorsal plate L 41–44, W 48–54; setae *Fch* L 28–32, setae *Fp* L 60–67, setae *Vi* L 35–38, setae *Oi* L *27*–35, setae *Oe, Hi, He, Sci, Sce, Li, Le* and *Si* L 28–32; setae *Ci*, *Se, Pi, Pe* 16–19; setae *Ai* and *Ae* 10–13; distance between setae *Vi–Vi* 38–44, distance between setae *Oi–Oi* 19–27; excretory pore plate L 8–11, W 10–13; urstigma L 9–12, W 12–14; basal segments of chelicerae L 77–85, cheliceral stylet L 20–21; strips on basal segment of chelicera W 0.8–1.4, distance between strips on basal segment of chelicera 0.8–1.5; pedipalpal segments (P-1–5) L: 6–7, 22–30, 25–32, 15–19, 9–11; legs segments L: I–Leg-1–6: 22–28, 13–23, 16–19, 26–31, 33–39, 63–69; II–Leg-1–6: 22–26, 10–20, 13–16, 18–21, 35–37, 53–60; III–Leg-1–6: 22–28, 16–22, 12–16, 22–25, 37–42, 50–55.

Deutonymphs. Colour red. Idiosoma oval and somewhat flattened dorsoventrally. Trichobothria *Fp, Oi* and setae *Pi* not associated with



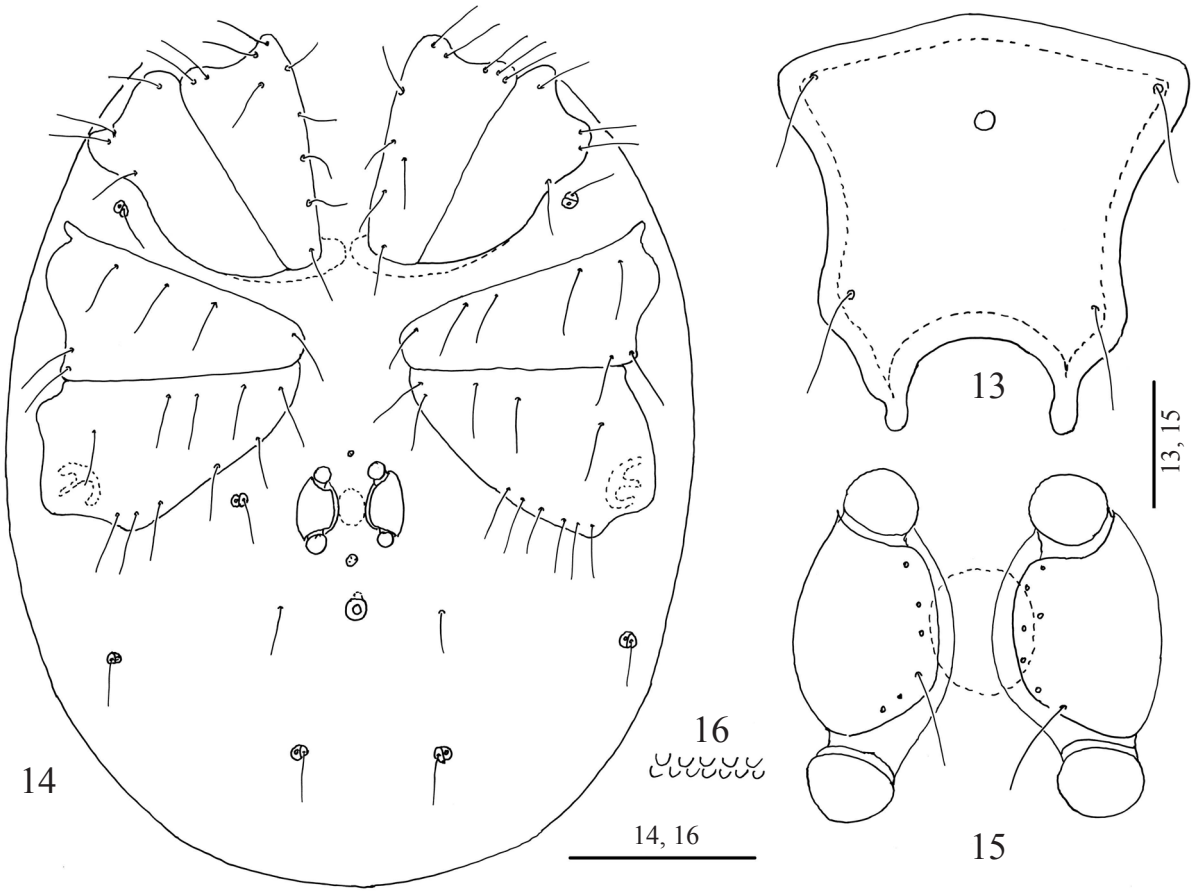
Figs 9–12. *Hydryphantes nonundulatus* Viets, 1919, larva: 9 — I–Leg-4–6; 10 — II–Leg-4–6; 11– III–Leg-4–6; 12 — claws of leg I. Simple setae on I–III–Leg-4–6 are not shown. Scale bars: 20 μm.

glandularia, other idiosomal setae associated with glandularia. Frontal plate (Fig. 13) subquadrate (L/W ratio 0.95–1.05), anteriolateral extensions wider than posteriolateral extensions; anterior margin obtuse-angled or slightly convex, posterior margin concave; posterior projections short, their length equal to 1/3–1/4 length of basal portion of plate; frontal eye situated distinctly posterior to trichobothria *Fp*. Coxal plates (Fig. 14) arranged in four groups, with a few fine setae each. Coxal plates I+II with a small subcutaneous posteriomedial extension on each side. Genital field (Fig. 15) with two pairs of subequal acetabula and four to six pairs of thin setae. Excretory pore surrounded by a sclerotized ring. Papillae of integument short, distally rounded (Fig. 16).

Capitulum (Fig. 17) with short rostrum (base of capitulum/rostrum L ratio 5.3–5.5) and convex basal part. Chelicera (Fig. 18) rather slender, basal segment with large dorsal obtuse-angled hump near middle, cheliceral stylet moderately long. Pedipalp compact (Fig. 19): P-1 with one to two setae, P-2 with 6–11short, thick setae, P-3 height large than length of segment with two long, thin setae; P-4 slightly tapering distally, with three distal setae and a short, thick dorsodistal spine; P-4 shorter than P-2+P-3.

II–Leg-5 (Fig. 20) and III/IV–Leg-3–5 (Fig. 21) with long swimming setae. Number of swimming setae: II–Leg-5, 7–11; III–Leg-3–5, 1–2, 5–10, 8–10; IV–Leg-3–5, 2–4, 9–11, 10–13. All legs with simple hook-like claws (Fig. 22).

Measurements (n=2). Idiosoma L 930–1190; coxal plates I+II L 210–250; coxal plates III+IV L 335–365; genital plate L 85–100, W 55–65; genital acetabula (ac. 1–ac. 2) D 25–30, 28–33; capitu-



Figs 13–16. *Hydryphantes nonundulatus* Viets, 1919, deutonymph: 13 — frontal plate, 14 — ventral view; 15 — genital field; 16 — fragment of integument. Scale bars: 100 μm.

lum L 225–265; basal segment of chelicera L 235–275, cheliceral stylet L 115–130; pedipalpal segments (P-1–5) L: 55–65, 80–105, 60–65, 135–150, 25–27; leg segments L: I–Leg-1–6: 65–75, 75–90, 85–105, 135–165, 160–190, 175–205; II–Leg-1–6: 60–75, 85–95, 100–125, 185–215, 235–265, 250–275; III–Leg-1–6: 60–75, 100–110, 110–125, 200–240, 250–290, 260–290; IV–Leg-1–6: 135–170, 125–145, 160–190, 285–315, 285–325, 260–280.

Adults. Females and males similar to deutonymph, but differ in structure of external genital organ, larger size, number of idiosomal glandularia (setae *Pi* associated with glandularia) and more numerous setae on all segments of appendages. Males and females do not exhibit external sexual dimorphism, but mature females larger than males.

Frontal shield (Fig. 23) subquadrate (L/W ratio 0.95–1.13), anteriolateral extensions wider than posteriolateral extensions, anterior margin obtuse-angled or slightly convex, posterior margin convex, posterior projections short, their length equal to 1/4–1/5 length of basal portion of plate. Median eye small and situated distinctly posterior at level of anterior setae.

All coxal plates with rather numerous setae (Fig. 24). Genital field with three pairs of acetabula, anterior pair of acetabula larger than second pair but slightly smaller than posterior pair of acetabula. Acetabular plate elongate (L/W ratio 2.0–2.2), with 17–23 pairs of medial setae (Fig. 25).

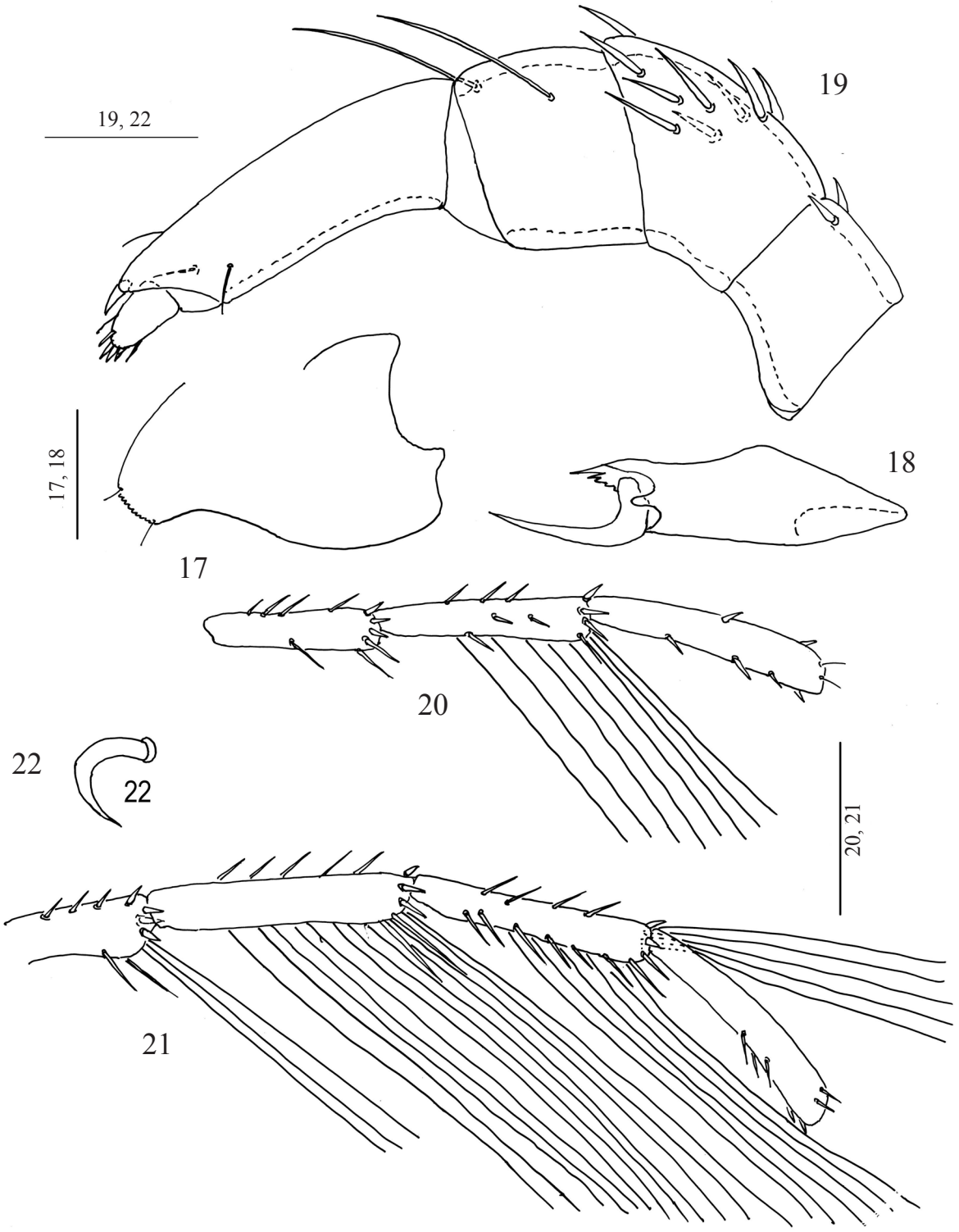
Capitulum (Fig. 26) with short rostrum (base of capitulum/rostrum L ratio 4.2–5.5) and convex basal part.

Chelicera (Fig. 27) rather slender, basal segment with large dorsal hump near middle.

Pedipalp compact (Fig. 28): P-1 with 3–5 dorsodistal setae; P-2 with 6–13 setae; P-3 height longer than length of segment, with 4 setae; P-4 tapering distally, shorter than P-2+P-3, with three thin setae and short, thick dorsodistal spine.

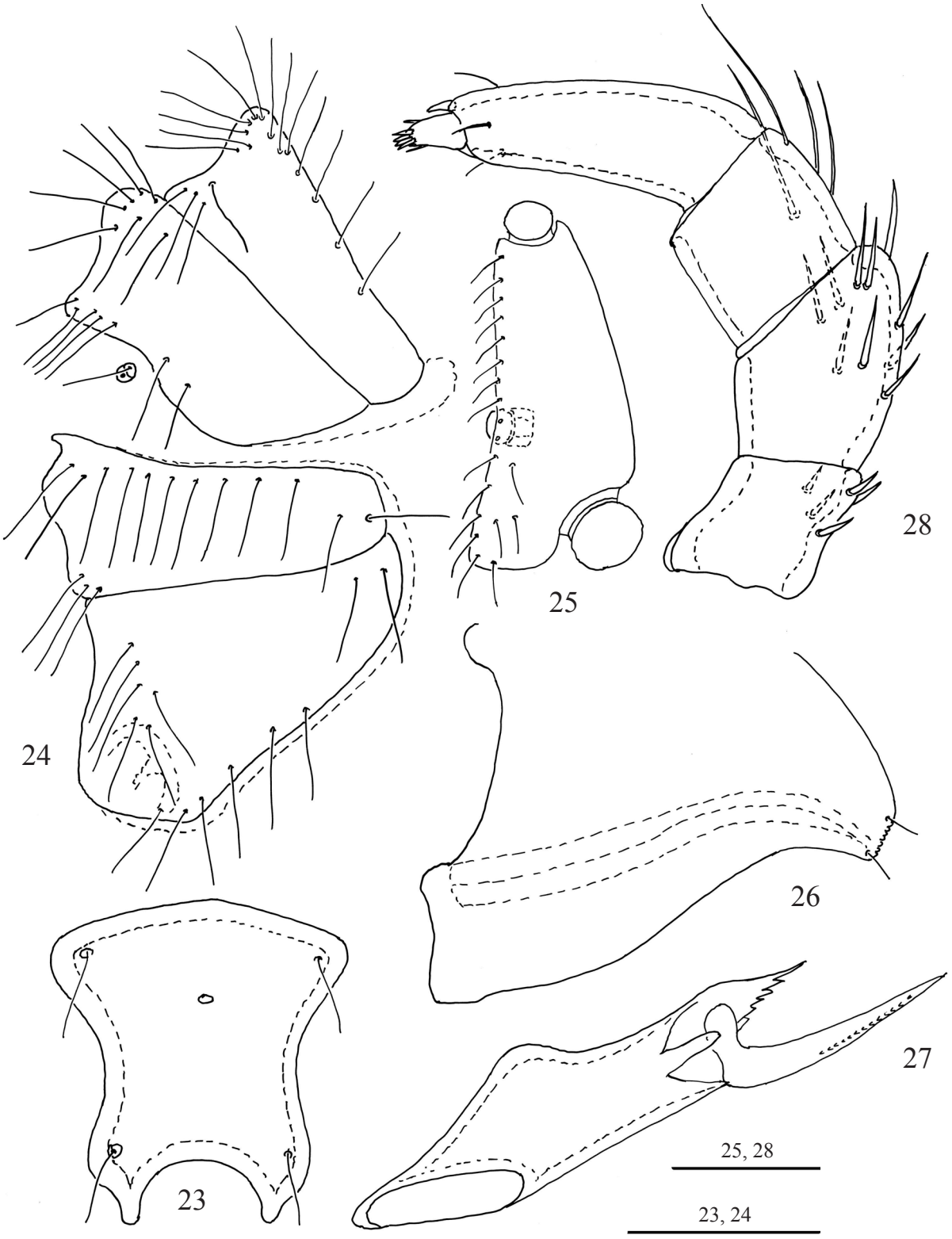
Number of swimming setae: II–Leg-4–5, 0–1, 11–15; III–Leg-3–5, 3–4, 9–15, 11–17; IV–Leg-3–5, 2–4, 12–17, 12–19.

Measurements, female (n=8). Idiosoma L 1500–1750; dorsal plate L 410–475, W 425–465;



Figs 17–22. *Hydryphantes nonundulatus* Viets, 1919, deutonymph: 17 — capitulum; 18 — chelicera; 19 — pedipalp; 20 — II–Leg-4–5; 21 — IV–Leg-3–6; 22 — claw. Scale bars: 17–18 = 100 μm, 19, 22 = 50 μm; 20–21 = 200 μm.

genital flap L 260–290, W 110–125; genital acetabula (ac. 1–ac. 3) D 50–63, 37–42, 65–75; capitulum L 330–340, rostrum L 60–75, chelicera L 325–350, cheliceral stylet L 175–190; pedipalpal segments (P-1–5) L: 75–85, 125–150, 75–88, 185–200, 25–30; legs segments L: I–Leg-1–6: 100–125, 110–140, 150–165, 225–265, 250–290, 260–290; II–Leg-1–6: 110–140, 135–150, 175–215, 300–350, 360–420, 385–425; III–Leg-1–6: 100–140, 135–150, 185–215, 310–365, 385–440, 385–425; IV–Leg-1–6: 200–225, 200–215, 275–315, 450–515, 450–515, 375–425.



Figs 23–28. *Hydryphantes nonundulatus* Viets, 1919, adults: 23 — frontal plate; 24 — coxal plates; 25 — genital plate; 26 — capitulum; 27 — chelicera; 28 — pedipalp. Scale bars: 23–24 = 200 μm, 25–28 = 100 μm.

Measurements, male (n=2). Idiosoma L 1370–1500; dorsal plate L 425–440, W 375–390; genital flap L 260–275, W 125–140; genital acetabula (ac. 1–ac. 3) D 42–50, 32–35, 62–65; capitulum L 285–310, rostrum L 55–62, chelicera L 285–315, cheliceral stylet L 140–150; pedipalpal segments (P-1–5) L: 70–75, 120–130, 80–88, 160–180, 25–30; legs segments L: I–Leg-1–6: 100–110, 120–130, 140–150, 210–225, 250–260, 300–315; II–Leg-1–6: 110–125, 125–150, 180–

190, 300–310, 260–375, 385–400; III–Leg-1–6: 110–125, 130–140, 180–190, 325–340, 375–385, 385–400; IV–Leg-1–6: 185–200, 180–200, 275–290, 435–460, 435–450, 300–385.

Remarks. The water mite *Hydryphantes nonundulatus* Viets, 1919 is similar to *H. planus* (Thon, 1899). However, the following clear differences can be found in the morphology of larvae, deutonymphs and adults of *H. nonundulatus* (character states of *H. planus* are given in parenthesis, for larvae after Tuzovsky 2014, for deutonymphs and adults after Gerecke 1996 and Tuzovsky 2014, respectively): larvae: the distance between bases of trichobothria *Oi* shorter than the lengths of these setae, Fig. 1 (longer), I–Leg-4 solenidion 2.0–2.5 times longer than eupathidium, Fig. 9 (subequal), I–Leg-6 de < ds, Fig. 9 (de=ds); deutonymph and adults: the rostrum is moderately long, Figs 17, 26 (short), the frontal plates of the median eye are situated distinctly posterior to trichobothria *Fp,* Figs 13, 23 (at level of trichobothria *Fp*); in adults, P-3 with 4 setae, Fig. 28 (5–7 setae).

The larva of *H. nonundulatus* is similar to that of *H. ruber.* In *H. nonundulatus*, the median eye is situated between rows setae *Vi* and *Oi* (Fig. 1), P-4 dorsodistal bifurcate claw with unequal clawlets (Fig. 8); I–III–Leg-6 relatively short: 63–69 μm, 53–60 μm, 50–55 μm, respectively. In contrast, in *H. ruber* the median eye is situated between setae *Vi*, P-4 dorsodistal bifurcate claw with subequal clawlets (Wainstein 1980), I–III–Leg-6 long: 72–76 μm, 63–65 μm, 60–63 μm, respectively (measurements are given for the Yaroslavl specimens of both species).

In deutonymphs and adults of *H. nonundulatus*, the frontal plate with a concave posterior margin, the median eye is situated distinctly posterior at level of anterior setae (Figs 13, 23), P-3 height is longer than length of segment (Figs 19, 28), in adults P-3 with 4 setae. The frontal plate of *H. ruber* with a straight posterior margin, the median eye is situated at the level or slightly posterior to the anterior setae (Gerecke1996, Tuzovsky 2014): P-3 height smaller than length of segment, in adults P-3 with 6–8 setae.

Because morphology of all active stages of clearly differs between *H. nonundulatus, H. ruber*, and *H. planus*, the former should be treated as a distinct species.

Distribution. Europe (K. Viets 1936, 1956; K.O. Viets 1978, 1987). This species is reported from Russia for the first time.

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