



A new species of the genus *Neophyllobius* Berlese (Acari: Camerobiidae) from Denizli province, Turkey

Mustafa AKYOL 

Department of Biology, Faculty of Arts and Sciences, Manisa Celal Bayar University, Manisa, Turkey
e-mail: mustafa.akyol@cbu.edu.tr

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ABSTRACT: A new species viz. *Neophyllobius denizliensis* sp. nov., collected from soil and litter under *Verbascum* sp., is described and illustrated based on adult female, protonymph and larva. An updated key to all known species of genus *Neophyllobius* of Turkey is provided.

Keywords: Acari, Raphignathoidea, *Neophyllobius*, new species, Turkey.

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INTRODUCTION

Camerobiidae is the second largest family of the superfamily Raphignathoidea. Members of the family Camerobiidae (Acari: Raphignathoidea) are freelifing predatory mites that feed on small arthropods and commonly found in soil and plant litter (Meyer, 1962; Bolland, 1986, 1991; Gerson and Smiley, 1990; Fan and Zhang, 2005; Khanjani et al., 2010, 2014; Fan and Walter, 2011). This family contains seven genera, with more than 160 species, of which *Neophyllobius* Berlese is the largest genus (Khaustov and Abramov, 2017; Akyol, 2018; Zmudzinski, 2020). Up till now, 23 species of *Neophyllobius* have been reported from Turkey (Koç and Ayyıldız, 1996; Koç, 1999, 2001; Koç and Madanlar, 2002; Doğan and Ayyıldız, 2003; Akyol and Koç, 2006a-c; Akyol, 2013, 2018; Uluçay and Koç, 2014; Çobanoğlu and Yeşilayer, 2016; Doğan, 2019). In this paper, a new species, *Neophyllobius denizliensis* sp. nov., is described and illustrated based on the adult female, protonymph and larva from Denizli province (Turkey). Also, a key to all known species of genus *Neophyllobius* of Turkey is partly modified and updated.

MATERIALS AND METHODS

The mite specimens were collected from soil and litter under *Verbascum* sp. (Scrophulariaceae), in Denizli province (Turkey), and brought to the laboratory in plastic bags and extracted by Berlese-Tullgren funnels for seven days. Mites were collected in 70% ethanol and then mounted on slides in modified Hoyer's medium. The mite figures were drawn and measured by means of a research microscope (Nikon Eclipse E 400). The setal nomenclature follows those of Kethley (1990) and Grandjean (1944). All measurements were given in micrometres (µm). Measurements of legs were taken from base of femur to tips of tarsal claws. The specimens mounted on slide are deposited in the (CBZM), Manisa, Turkey.

RESULTS AND DISCUSSION

Family: Camerobiidae Southcott, 1957

Genus: *Neophyllobius* Berlese, 1886

Type species: *Neophyllobius elegans* Berlese, 1886.

Diagnosis: Idiosoma with 15 (excluding *pdx* with 14) pairs of lanceolate setae. One pair of peritremes arising from middle of forepart of stylophore and loop along edges. Counts of setae and solenidia from palptrochanter to palptarsus: 0, 2, 1, 3 + 1 claw, 2 setae + 1-2 eupathidia + 1 solenidion. Genital shields with one pair of setae, anal shields with three pairs of pseudanal setae. Solenidion ω on basal halves of tarsi I and II. Tarsi I-II each with 2 medio-ventral setae in a longitudinal line and III-IV each with 1-2 medio-ventral setae. Counts of setae and solenidia of legs I-IV: coxae (excluding 1*a*, 3*a* and 4*a*) 2 + 1elcp, 1, 2, 2; trochanters 1, 1, 1, 1; femora 3-4, 2-4, 1-3, 1-3; genua 1 + 1κ, 1 + 1κ, 1, 1; tibiae 9 + 1φ, 8 + 1φ, 8 + 1φ, 7 + 1φ; tarsi 9-10 + 1ω, 9-10 + 1ω, 7-8 + 0-1ω, 7-8 (Fan and Zhang, 2005).

Neophyllobius denizliensis sp. nov.

Female (n=1) (Figure 1)

Body ovoid, length (excluding gnathosoma) 333, width 268.

Gnathosoma (Fig. 1B). Length of gnathosoma 104. Infracapitulum with one pair of subcapitular setae (*m* 21) and two pairs of adoral setae (*or*₁₋₂). Cheliceral stylets retracted, invisible. Palpus five segmented: Tarsus with two setae, one small solenidion and two eupathidia; tibia with three setae and one bladeli-like seta; genu with one serrated seta; femur with two serrated setae and trochanter without setae (Fig 1G).

Dorsum of idiosoma (Fig. 1A) Almost ovoid; integument striated; two pairs of eyes between *sci* and *sce* setae present; fifteen pairs of dorsal setae set on tubercles, *pdx* present, dorsal body setae with denticles. Lengths of setae: *vi* 62, *ve* 52, *sci* 52, *sce* 57, *c*₁ 52, *c*₂ 78, *d*₁ 133, *d*₂ 52, *e*₁ 104, *e*₂ 55, *f*₁ 73, *f*₂ 39, *h*₁ 29, *h*₂ 26, *pdx* 44. Setae *d*₁ and *e*₁ longer than others.

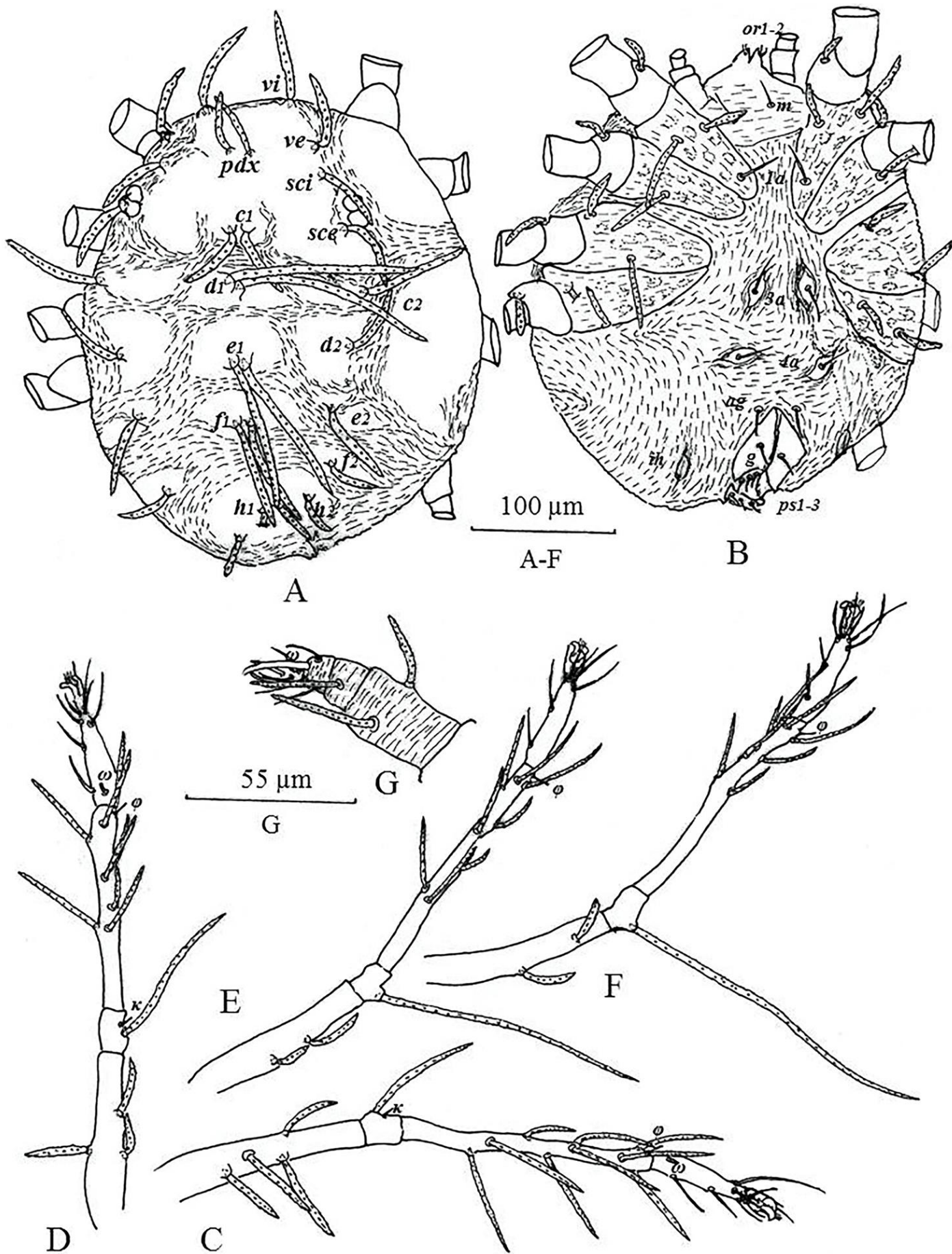


Figure 1. *Neophyllobius denizliensis* sp. nov. (Female) – A. Dorsal view of idiosoma, B. Ventral view of idiosoma, C. Leg I, D. Leg II, E. Leg III, F. Leg IV, G. Palp.

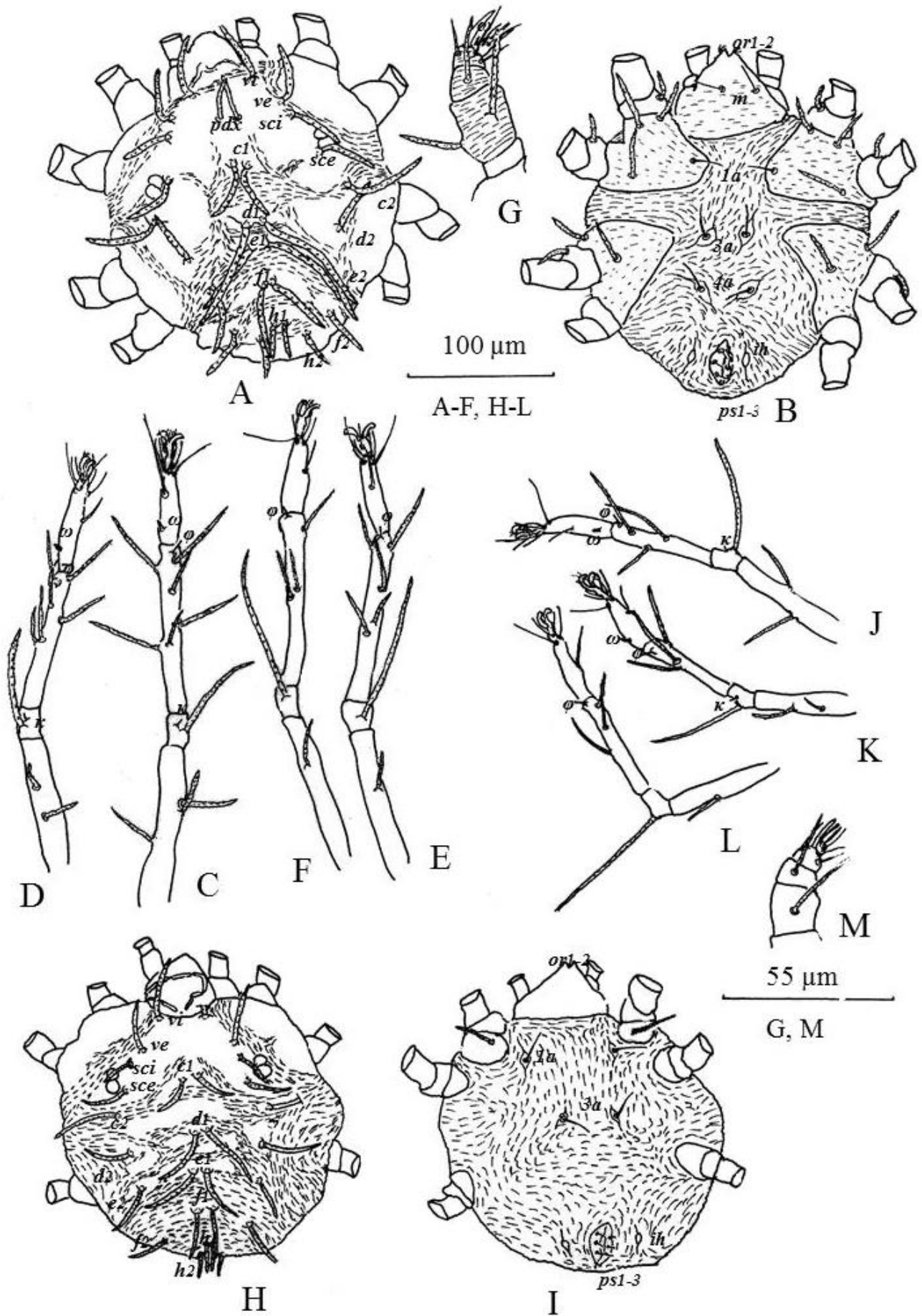


Figure 2. *Neophyllobius denizliensis* sp. nov., Protonymph (A-G) and Larva (H-M) – A. Dorsal view of idiosoma, B. Ventral view of idiosoma, C. Leg I, D. Leg II, E. Leg III, F. Leg IV, G. Palp, H. Dorsal view of idiosoma, I. Ventral view of idiosoma, J. Leg I, K. Leg II, L. Leg III, M. Palp.

Venter of idiosoma (Fig. 1B). All ventral surface striated. All coxal area with slightly striated and reticulated. Venter with three pairs of smooth setae (*1a* 21, *3a* 29, *4a* 16). Endopodal shields absent. Anogenital area with one pair of aggenital setae (*ag* 10), one pair of genital setae (*g* 10) and three pairs of pseudanal setae (*ps*₁₋₃). Cupules *ih* situated laterally to anal opening.

Legs (Figs 1C-F). Length of legs: leg I 442, leg II 382, leg III 421, leg IV 424. Setal formula of leg segments (solenidia in parentheses) as follows: coxae 3-1-2-2, trochantera 1-1-1-1, femora 4-3-2-2, genua 1(+κ)-1(+κ)-1-1, tibiae 9(+φ)-8(+φ)-8(+φ)-7(+φ), tarsi 10(+ω)-10(+ω)-8-8. Tarsi I-IV with two midventral setae. All genual setae whip-like.

Protonymph (n= 3) (Figures 2A-G)

Length of body (excluding gnathosoma) (minimum and maximum measurements): 182-216, width 169-203.

Gnathosoma (Fig. 2B). Length of gnathosoma 65. Infracapitulum with one pair of setae medioventrally (*m* 10-13) and two pairs of adoral setae (*or*₁₋₂). Cheliceral stylets retracted, invisible. Palpus five segmented: Tarsus with two setae, one small solenidion and two eupathidia; tibia with three setae and one bladeli-like seta; genu with one serrated seta; femur with two serrated setae and trochanter without setae (Fig 2G).

Dorsum of idiosoma (Fig. 2A). Dorsum as in female. Lengths of setae (minimum and maximum measurements): *vi* 39-47, *ve* 34-39, *sci* 31-34, *sce* 34-39, *c*₁ 34-39, *c*₂ 47-57, *d*₁ 60-78, *d*₂ 31-39, *e*₁ 39-52, *e*₂ 31-34, *f*₁ 34-42, *f*₂ 26-31, *h*₁ 21-23, *h*₂ 18-23.

Venter of idiosoma (Fig. 2B). With three pairs of setae (*1a* 16-18, *3a* 16-18, *4a* 10-13) and three pairs of pseudanal setae (*ps*₁₋₃). Aggenital and genital setae absent. Cupules *ih* situated laterally to anal opening.

Legs. (Figs 2C-F). Length of legs (minimum and maximum measurements): leg I 299-343, leg II 268-299, leg III 281-315, leg IV 273-325. Setal formula of leg segments (solenidia in parentheses) as follows: coxae 3-1-2-0, trochanters 1-1-1-0, femora 3-2-1-1, genua 1(+κ)-1(+κ)-1-1, tibiae 6(+φ)-6(+φ)-5(+φ)-3(+φ), tarsi 8(+ω)-8(+ω)-7-5.

Larva (n= 1) (Figures 2H-M)

Length of body (excluding gnathosoma) 190, width 203.

Gnathosoma (Figs 2I, M). Length of gnathosoma 65. Infracapitulum with two pairs of adoral setae (*or*₁₋₂), and without setae *m*. Cheliceral stylets retracted, invisible. Palpus five segmented: Tarsus with two setae and two eupathidia; tibia with three setae and one bladeli-like seta; genu with one serrated seta; femur with one serrated setae and trochanter without setae. Palpal solenidion absent (Fig. 2M).

Dorsum of idiosoma (Fig. 2H). As in protonymph except fourteen pairs of dorsal setae set on small tubercles, *pdx* absent, dorsal body setae with minute denticles. Length of

setae: *vi* 29, *ve* 29, *sci* 21, *sce* 34, *c*₁ 29, *c*₂ 42, *d*₁ 47, *d*₂ 34, *e*₁ 39, *e*₂ 29, *f*₁ 34, *f*₂ 26, *h*₁ 16, *h*₂ 13.

Venter of idiosoma (Fig. 2I). Venter with two pairs of setae (*1a* 16, *3a* 16), three pairs of pseudanal setae (*ps*₁₋₃). Setae *4a*, aggenital and genital setae absent. Cupules *ih* situated laterally to anal opening.

Legs (Figs 2J-L). Lengths of legs: leg I 260, leg II 221, leg III 247. Setal formula of leg segments (solenidia in parentheses) as follows: coxae 1-0-0, trochanters 0-0-0, femora 2-2-1, genua 1(+κ)-1(+κ)-1, tibiae 3(+φ)-3(+φ)-3(+φ), tarsi 7(+ω)-7(+ω)-5. All tarsi with one midventral setae.

Male and Deutonymph. Unknown.

Etymology. This species is named after the locality, Denizli, where it was found.

Material examined. Holotype female, three female protonymphs and one larva from litter and soil under *Verbascum* sp., 37°22'38"N 29°25'56"E, 1084 m a.s.l., 14 July 2019, Acipayam district, Denizli province, Turkey, coll. M. Akyol.

Remarks. *Neophyllobius denizliensis* **sp. nov.** is similar to *N. hispanicus* Bolland in that setae *e*₁ do not reach the margin of dorsum, *c*₁ reach the base of *d*₁, *pdx* do not reach the base of *d*₁, and same the legs chaetotaxy (Bolland, 1991). However, it differs from *N. hispanicus* by the following combination of characters: (1) almost dorsocentral setae longer (*pdx* 44, *c*₁ 52, *d*₁ 133, *e*₁ 104, *f*₁ 73) in the new species versus (*pdx* 40, *c*₁ 40, *d*₁ 85, *e*₁ 80, *f*₁ 60 in *N. hispanicus*); (2) third seta on femur I the longest seta in the new species, whereas shortest in *N. hispanicus*; (3) first and second setae on femur II same in length in the new species oppose to second setae the longest in *N. hispanicus*; (4) palp tarsus with ω in the new species, versus without in *N. hispanicus*; (5) ratio *d*₁/*h*₁ 4.58 in the new species (2.83 in *N. hispanicus*).

Key to *Neophyllobius* species of Turkey

This key is partly modified and updated from Akyol (2013) and Bolland (1991).

1. Tarsus IV with one midventral seta 2
- Tarsus IV with two midventral setae 4
2. Femur IV with two setae 3
- Femur IV with one setae *N. orhani* Doğan and Ayyıldız
3. Tarsus II with 10(+ω) setae .. *N. fani* Doğan and Ayyıldız
- Tarsus II with 9(+ω) setae *N. yunusi* Akyol and Koç
4. Femur II with three setae 5
- Femur II with four setae *N. sultanensis* Akyol and Koç
5. Distal end of the tibia I with one solenidion 6

- Distal end of tibia I with two solenidion	
..... <i>N. karabagiensis</i> Akyol and Koç	
6. Setae c_1 just reaching, or shorter than the distance to bases of e_1	11
- Setae c_1 long, passes at least bases of e_1	7
7. Setae e_1 as long as or shorter than c_1	9
- Setae e_1 longer than c_1	8
8. d_1 longest setae, tarsi II with 9(+ ω) setae	
..... <i>N. izmirensis</i> Akyol	
- e_1 longest setae, tarsi II with 10(+ ω) setae	
..... <i>N. podocarpus</i> Bolland	
9. Setae e_1 shorter than c_1	10
- Setae e_1 as long as c_1	<i>N. pathenocissi</i> Bolland
10. d_1 longest setae	<i>N. afyonensis</i> Akyol and Koç
- c_1 longest setae	<i>N. turcicus</i> Koç and Ayyıldız
11. Setae d_1 do not reach at all the bases of f_1	18
- Setae d_1 reach or pass bases of f_1	12
12. Setae e_1 do not reach margin of the dorsum	13
- Setae e_1 reach margin of the dorsum	17
13. Setae e_1 do not pass bases of h_1	14
- Setae e_1 pass bases of h_1	<i>N. populus</i> Akyol and Koç
14. Setae c_1 pass easily bases of d_1	16
- Setae c_1 just reach bases of d_1	15
15. First seta on femur I is the shortest	
..... <i>N. demirsoyi</i> Akyol and Koç	
- Setae on femur I equal in length except for distal setae	
..... <i>N. persiaensis</i> Khanjani and Ueckermann	
16. Setae c_1 , d_1 , e_1 and f_1 almost subequal length	
..... <i>N. bolvadinensis</i> Akyol and Koç	
- Setae c_1 , d_1 , e_1 and f_1 not subequal length	
..... <i>N. denizliensis</i> sp. nov.	
17. Most distal seta on femur I longer than the third one ...	
..... <i>N. lachishensis</i> Bolland	
- Most distal seta on femur I shorter than the third one	
..... <i>N. communis</i> Bolland	
18. The third seta on femur I longer than 1/2 the length of the fourth	20
- The third seta on femur I shorter than 1/2 the length of the fourth	19

19. Setae pdx reaching the marginal side of the dorsum	<i>N. lamimani</i> Bolland
- Setae pdx not reaching the marginal side of the dorsum ...	<i>N. olurensis</i> Doğan and Ayyıldız
20. Some dorsacentral setae reach the bases of the next dorsacentral setae and longer than the other dorsacentral setae, i.e. e_1 and f_1 , tarsi II with 9(+ ω) setae	<i>N. ayvalikensis</i> Akyol
- All dorsacentral setae bases of the next dorsacentral setae	21
21. Genu I setae not reaching second row of tibia setae	<i>N. atriplicis</i> Bolland
- Genu I setae reaching or longer than distance to second row of tibia setae.....	22
22. Genu II setae not whip-like	<i>N. ayyildizi</i> Koç and Madanlar
- Genu II setae whip-like	23
23. Setae pdx shorter than c_1	<i>N. askalensis</i> Doğan and Ayyıldız
- Setae pdx equal in length with c_1	<i>N. quercus</i> Uluçay and Koç

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Conflict of interest

The author declares that there is no conflict of interest regarding the publication of this paper.

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