



Original article (Orijinal araştırma)

**A new mite species of the genus *Favognathus* Luxton, 1973
(Acari: Cryptognathidae) from Turkey**

Türkiye'den *Favognathus* Luxton, 1973 (Acari: Cryptognathidae) cinsinin yeni bir akar türü

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Summary

A new species of the genus *Favognathus* Luxton, 1973, *Favognathus manisaensis* sp. nov. is described and illustrated based on the females and males collected from soil and litter under *Pinus* sp. and *Cornus* sp. in Manisa and İzmir Provinces, Turkey between 2011 and 2013. The new species is closely related to *Favognathus distortus* (Kuznetsov, 1974) and *Favognathus bafranus* Doğan, 2008. A key to all known species of *Favognathus* from Turkey is provided.

Keywords: Acari, Cryptognathidae, *Favognathus manisaensis* sp. nov., new species, Turkey

Özet

2011- 2013 tarihleri arasında Manisa ve İzmir illerinden *Pinus* sp. ve *Cornus* sp. altından alınan toprak ve döküntü örneklerinden *Favognathus* Luxton, 1973'in yeni bir türü olan *Favognathus manisaensis* sp. nov. dişi ve erkek bireyleri üzerinden tanımlanmış ve şekilleri çizilmiştir. Yeni tür, kendisine yakın olan *Favognathus distortus* (Kuznetsov, 1974 ve *Favognathus bafranus* Doğan, 2008 türleri ile karşılaştırılmıştır. Türkiye'den bilinen *Favognathus* cinsine ait türler için teşhis anahtarı düzenlenmiştir.

Anahtar sözcükler: Acari, Cryptognathidae, *Favognathus manisaensis* sp. nov., yeni tür, Türkiye

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Introduction

Mites of the superfamily Raphignathoidea are biological control agents of spider mites, eriophyids, and scale insects of agricultural importance. Most of the species are free-living predators, but a few are phytophagous, feeding on moss, and symbionts/parasites of insects (Fan & Zhang, 2005).

The Cryptognathidae was erected by Oudemans (1902) with *Cryptognathus* Kramer as type genus. Members of this family are recognized by the presence of a protective hood anterior of the propodosoma and an extremely extendable gnathosomal base (Doğan, 2008).

The genus *Favognathus* Luxton, 1973 belongs to the family Cryptognathidae and is one of 11 families of the superfamily Raphignathoidea and includes three genera: *Cryptognathus* Kramer, 1879, *Favognathus* and *Cryptofavognathus* Doğan & Dönel, 2010. *Cryptognathus* type species, *Cryptognathus legena* Kramer, 1879, was originally described by Kramer (1879). Kramer's original description is largely insufficient for reliably distinguishing this species from all other species of *Cryptognathus*, but Luxton (1972) provided a brief redescription of the type specimen, which was accidentally destroyed in the process, and designated neotypes. Luxton (1973) established two new subgenera in the family Cryptognathidae: *Cryptognathus (Favognathus)* Luxton, 1973 and *Cryptognathus (Cryptognathus)* Luxton, 1973. Later, Luxton (1987) raised them to generic status. Doğan & Dönel (2010) proposed a new genus *Cryptofavognathus* Doğan & Dönel, 2010 based on *Cryptofavognathus afyonensis* (Koç & Akyol, 2004) as type species and a new species, *Cryptofavognathus anatolicus* Doğan & Dönel, 2010. The genus *Favognathus* is cosmopolitan. Mites of this genus are generally collected from soil, grassy soil, litter, mosses, lichens and bark. Currently, the genus *Favognathus* comprises 41 species occurring in all zoogeographical regions (Doğan, 2008; Khanjani & Ueckermann, 2008; Bagheri et al., 2015).

Ten species of *Favognathus* – *Favognathus acaciae* Doğan & Ayyıldız, 2004, *Favognathus amygdalus* Doğan & Ayyıldız, 2004, *Favognathus bafranus* Doğan, 2008, *Favognathus cucurbita* (Berlese, 1916), *Favognathus erzurumensis* Doğan & Ayyıldız, 2002, *Favognathus luxtoni* Koç & Ayyıldız, 1999, *Favognathus turcicus* Koç & Ayyıldız, 1999, *Favognathus kamili* Dönel & Doğan, 2011, *Favognathus distortus* (Kuznetsov, 1974) and *Favognathus izmirensis* Akyol, 2010 – have been reported from Turkey (Koç & Ayyıldız, 1999; Doğan & Ayyıldız, 2002; 2004; Koç & Akyol, 2004; Doğan, 2008; Akyol, 2011; Dönel & Doğan, 2011). In this paper, a new species, *Favognathus manisaensis* sp. nov. is described and illustrated based on female and male specimens. A key to the species of *Favognathus* from Turkey is also provided.

In Turkey, raphignathoid mite fauna is not known for many provinces. In order to contribute to the raphignathoid mite fauna in Turkey, we are continuing our sampling studies in provinces of the Aegean Region and this study is one of them.

Material and Methods

Collecting

The soil and litter samples were taken from *Pinus* sp. and *Cornus* sp. in Manisa and İzmir Provinces between 2011 and 2013. They were brought to the laboratory in plastic bags and extracted in Berlese funnels for 7 days. Mites were collected in vials filled with 70% ethanol.

Slide mounting

Mites were cleared in lactophenol solution and mounted in Hoyer's medium on microscopic slides. These slides were labeled with the collecting data (Akyol, 2007) and deposited in the Zoological Museum of Manisa Celal Bayar University (CBZM), Manisa, Turkey.

Illustrations and measurements

Specimens were examined and drawn using a Nikon microscope with 100 magnifications with a camera lucida. All measurements are given in micrometers (µm) with the holotype measurements followed by the minimum and maximum values of paratypes in parentheses. Chelicerae were measured from basal articulations to tips of movable digits. Palps were measured from the base of the trochanters to the tips of palp tarsi. Idiosomal lengths were measured from the anterior to the posterior margins

(including hood and anal covers). Idiosomal widths were measured across maximum width of the idiosoma between leg II and III. Setae and solenidia were measured from alveoli to tips. Legs were measured from the base of the trochanters to tips of claws.

Terminology

Terminology follows that of Luxton (1973). Dorsal setal and leg setal designations follow Kethley (1990) and Grandjean (1944), respectively.

Results and Discussion

In this paper, a brief definition of the genus species description, type materials, remarks and key to the Turkish species of *Favognathus* are given.

Taxonomy

Family Cryptognathidae Oudemans, 1902

Cryptognathidae Oudemans, 1902: 59. Type genus: *Cryptognathus* Kramer, 1879:156.

Genus *Favognathus* Luxton, 1987

Favognathus Luxton, 1987: 113. Type species: *Cryptognathus cucurbita* Berlese, 1916, was original designation by Berlese (1916).

Cryptognathus (*Favognathus*) Luxton, 1973: 62. Type species: *Cryptognathus cucurbita* Berlese, 1916, raised to genus by Luxton (1987).

Diagnosis

This genus can be defined by the wedge-shaped prosternal apron at base of gnathosoma, which is ornamented with dimples, and the presence of one or two pairs of aggenital setae and two pairs of genital setae.

Favognathus manisaensis sp. nov. (Figures 1 & 2)

Diagnosis (female and male)

The anterior margin of the hood smooth, hood with 7-8 dimples in each longitudinal row, dorsum completely reticulated and covered with punctations and faint striae, rosette patterns present, dorsum with two pairs of rosettes, prosternal apron with 12-17 faveolae, sternocoxal region non-porous and faintly striated, venter partly reticulated and with striae, genu II with solenidion κ , number of leg setae tarsi: 17-14-10-10 (including solenidia) and *tc* on tarsus II dissimilar.

Female (n = 8): Holotype – body length (including hood and anal covers) 301 (300-327) and width 173 (161-190).

Gnathosoma (Figure 1g): Palp 90 (76-95), chelicerae 102 (87-111), palp tarsus with four eupathidia, four setae and one solenidion, and tibia with three, genu with two and femur with three setae.

Dorsum (Figure 1a): Length of hood 72 (64-77), anterior margin of the hood smooth 7-8 dimples in each longitudinal row; dorsum completely reticulated and covered with punctations and faint striae; dorsal shield with 11 pairs of simple setae; a pair of eyes and a pair of postocular bodies laterally between setae *sci* and *sce*; two pairs of slit-like cupules (*ia* and *im*); cluster of cells associated with setae c_1 and d_1 , these rosette patterns consist of three or seven cells; and surface reticulum in region of setae f_1 , h_1 and h_2 not apparent. Dimensions of dorsal setae are as follows: vi 14 (15-21), ve 22 (21-28), sci 27 (21-28), sce 29 (28-31), c_1 39 (35-42), d_1 41 (35-42), e_1 41 (36-42), e_2 36 (33-42), f_1 37 (36-42), h_1 33 (30-35) and h_2 31 (19-29); and distances between setae $vi-vi$ 34 (29-35), $vi-ve$ 9 (10-15), $ve-ve$ 34 (34-42), $ve-sci$ 7 (9-12), $sci-sci$ 48 (48-63), $sce-sce$ 97 (97-103), $sce-c_1$ 16 (16), c_1-c_1 65 (58-72), d_1-d_1 111 (114-115), d_1-e_1 42 (41-47), e_1-e_1 76 (74-86), e_1-e_2 18 (17-21), e_2-e_2 97 (97-106), e_1-f_1 53 (49-53), f_1-f_1 29 (24-34), f_1-h_1 26 (25-28), h_1-h_1 12 (13-14), h_1-h_2 28 (26-29) and h_2-h_2 70 (72-74).

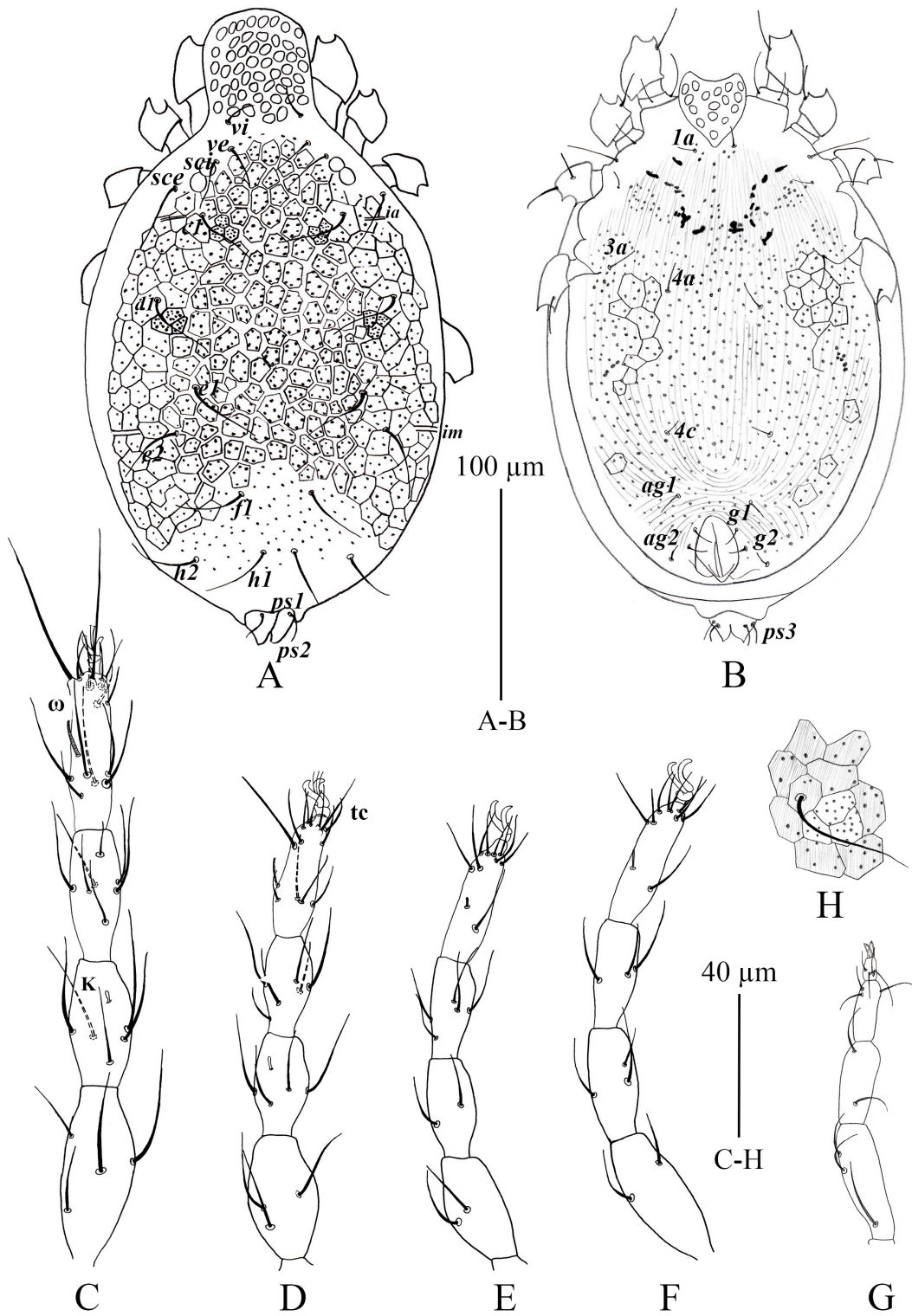


Figure 1. *Favognathus manisaensis* sp. nov. (female): A. dorsal view of idiosoma, B. ventral view of idiosoma, C. leg I, D. leg II, E. leg III, F. leg IV, G. palp, and H. setae d_1 and rosette patterns.

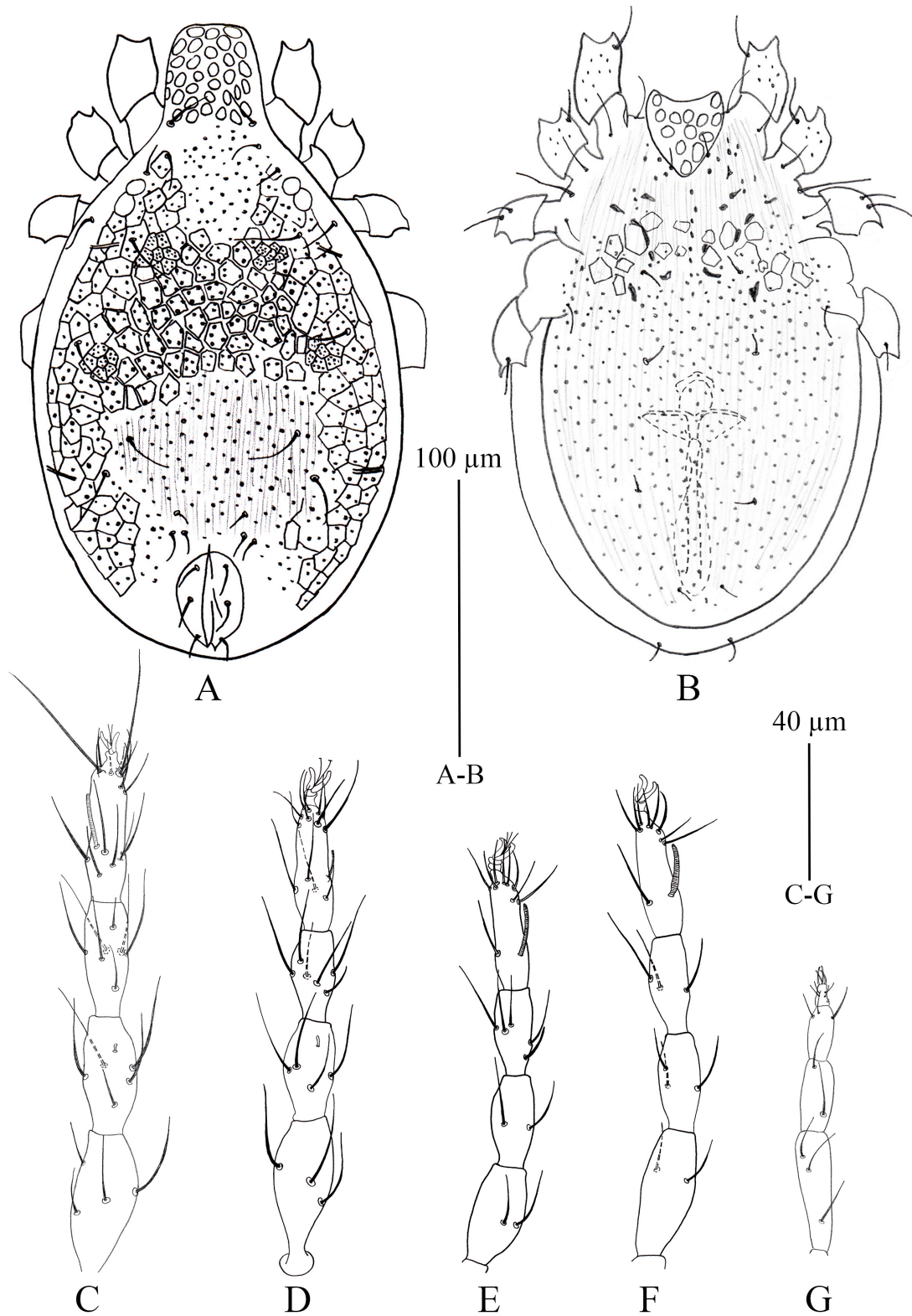


Figure 2. *Favognathus manisensis* sp. nov. (male): A. dorsal view of idiosoma, B. ventral view of idiosoma, C. leg I, D. leg II, E. leg III, F. leg IV, and G. palp.

Venter (Figure 1b): Prosternal apron wedge-shaped, with 12-17 faveolae; venter covered with punctations; sternocoxal area nonporous and faintly striated; coxal region posterolaterally with reticulations; venter with four pairs of ventral setae $1a$ 14 (14-15), $3a$ 21 (15-17), $4a$ 17 (14-18), $4c$ 15 (13-19), genital opening with two pairs of genital setae g_1 14 (13-15), g_2 15 (13-16) and two pairs of aggenital setae ag_1 14 (12-13), ag_2 11 (8-14); distances between setae $1a-1a$ 18 (17-20), $3a-3a$ 34 (37-40), $4a-4a$ 44 (43-54), $4c-4c$ 48 (44-53), ag_1-ag_1 32 (25-34), ag_2-ag_2 43 (43-49); and anal opening terminal, with three pairs of pseudanal setae ps_1 14 (14-16), ps_2 13 (12-13) and ps_3 11 (10-12).

Legs (Figure 1c-f): Length of legs I-IV (from base of trochanter to tip of tarsal claw): 210 (196-216), 163 (144-168), 153 (148-166) and 175 (168-185), respectively. Setal formulae of legs I-IV: coxae 2-1-2-1, trochanters 1-1-2-1, femora 4-3-2-2, genua 5(+κ)-4(+κ)-2-3, tibiae 5(+φρ, +ω)-5(+φρ)-4(+φρ)-3 and tarsi 15(+φρ, +ω)-12(+φρ, +ω)-9(+ω)-9(+ω). Setae *tc* on tarsi II dissimilar.

Male (n = 3) (Figure 2): Body length (including hood and anal covers) 230 (218-223) and width 138 (133-136). The male is smaller than the female.

Gnathosoma (Figure 2g): Palp 87 (75-76), chelicerae 74 (68-73), palp tarsus with four eupathidia, four setae and one solenidion, and tibia with three, genu with two, and femur with three setae.

Dorsum (Figure 2a): Length of hood 52 (55-57), anterior margin of the hood smooth 7-8 dimples in each longitudinal row; dorsum covered with punctations and faint striae, with complete reticulations; dorsal shield with 11 pairs of simple setae; a pair of eyes and a pair of postocular bodies laterally between setae *sci* and *sce*; two pairs of slit-like cupules (*ia* and *im*); and cluster of cells associated with setae c_1 and d_1 ; surface reticulum in region of setae e_1 , e_2 , f_1 , h_1 and h_2 not apparent (Figure 2a). Dimensions of dorsal setae are as follows: vi 14 (15), ve 14 (16-17), *sci* 12 (14-16), *sce* 20 (17-23), c_1 28 (22-25), d_1 28 (25-26), e_1 25 (24-26), e_2 20 (18-22), f_1 7 (6-9), h_1 7 (6-8) and h_2 11 (10-11); and distances between setae $vi-vi$ 29 (24-29), $vi-ve$ 9 (6-7), $ve-ve$ 32 (26-28), $ve-sci$ 7 (7-10), *sci-sci* 45 (40-43), *sce-sce* 90 (78-84), *sce-c₁* 11 (9-14), c_1-c_1 59 (53), d_1-d_1 97 (83-91), d_1-e_1 39 (35-37), e_1-e_1 60 (52-54), e_1-e_2 16 (10-13), e_2-e_2 75 (67-75), e_1-f_1 33 (23-28), f_1-f_1 23 (21-22), f_1-h_1 6 (4-5), h_1-h_1 20 (15-17), h_1-h_2 3 (3) and h_2-h_2 29 (25-29).

Venter (Figure 2b): Prosternal apron wedge shaped, with 13-16 faveolae; venter covered with punctations except in sternocoxal area; area of coxal region posterolaterally with reticulations and faint reticulations medioventrally, and with punctations except in the sternocoxal area; venter with four pairs of ventral setae $1a$ 14 (11-12), $3a$ 16 (14-15), $4a$ 16 (14-15) and $4c$ 10 (9-10), and two pairs of aggenital setae ag_1 5 (8) and ag_2 6 (5-9); distances between setae $1a-1a$ 10 (14-16), $3a-3a$ 34 (29-30), $4a-4a$ 38 (29-36), $4c-4c$ 42 (34-36), ag_1-ag_1 16 (13-14) and ag_2-ag_2 25 (22-25); and anal opening terminal, with three pairs of pseudanal setae, ps_1 8 (7), ps_2 12 (11-14) and ps_3 12 (10-12).

Legs (Figure 2c-f): Length of legs I-IV (from base of femur to tip of tarsal claw): 186 (177-182), 148 (136-144), 148 (127-145) and 169 (161-163), respectively. Setal formulae of legs I-IV: coxae 2-1-2-1, trochanters 1-1-2-1, femora 4-3-2-2, genua 5(+k)-4(+k)-2-3, tibiae 5(+φρ, +ω)-5(+φρ)-4(+φρ)-3 and tarsi 15(+φρ, +ω♂)-12(+φρ, +ω♂)-9(+ω♂)-9(+ω♂). Setae *tc* on tarsus II dissimilar.

Etymology: This species is named after the type locality, Manisa, where it was found.

Type materials

Holotype female, two paratype females and two males from litter and soil under *Pinus* sp., 900 m.a.s.l., Spil Mountain, Manisa Province, 23 December 2011; four females and one male from litter and soil under *Pinus* sp., 1200 m.a.s.l., Bozdağlar Mountains, Gölcük, Ödemiş District, İzmir Province, 26 November 2012; and one female from litter and soil under *Cornus* sp., 750 m.a.s.l., Gölet Region, Kula district, Manisa Province, 27 May 2013, Turkey, coll. M. Akyol.

Remarks

The new species, *F. manisaensis* sp. nov., resembles *F. distortus* and *F. bafranus* in having the anterior edge of hood smooth, dorsum completely reticulated and with two pairs of rosettes. However, it can be differentiated by the following characters: dorsal body completely punctuated and striated; venter with no reticulate pattern behind sternocoxal area medioventrally; and ratio $c_1-c_1/d_1-d_1/e_1-e_1/f_1-f_1$ 1.8-2.8/3.4-4.8/2.4-3.1/1.0 in the new species, whereas, no punctuations in the reticulate cells on the edge of the dorsum and dorsum without striae reticulate pattern behind the sternocoxal area medioventrally; and ratio $c_1-c_1/d_1-d_1/e_1-e_1/f_1-f_1$?/2.8/2.2/1.0 in *F. distortus* (Kuznetsov & Livshitz, 1974; Fan, 1997; Dönel & Doğan, 2011). Setal formula of tarsi 17-14-10-10, hood with 6-8 dimples in each longitudinal row, prosternal apron with 12-17 foveole in the new species, whereas, setal formula of tarsi 16-12-10-10, hood with 5-6 dimples in each longitudinal row, and prosternal apron with 11 foveole in *F. bafranus* (Doğan, 2008).

The male can be distinguished from the female by the following features: anal and genital shields coalesced posterodorsally, setae f , h_1 and h_2 standing together as a cluster, with an aedeagus, genital setae absent, all tarsi with solenidion $\omega\delta$, and body smaller.

Key to the Turkish species of *Favognathus*

1. Genu II with solenidion k 3
 - Genu II without solenidion k 2
2. Genu I with solenidion k , genu IV with 2 setae *F. luxtoni* Doğan & Ayyıldız, 1999
 - Genu I without solenidion k , genu IV with 3 setae *F. erzurumensis* Doğan & Ayyıldız, 2002
3. Anterior margin of hood smooth 4
 - Anterior margin of hood denticulate *F. izmirensis* Akyol, 2011
4. Dorsal shield partly or completely reticulated 5
 - Dorsal shield without reticulations, completely punctate *F. kamili* Dönel & Doğan, 2011
5. Dorsal shield partly reticulated 6
 - Dorsal shield completely reticulated 9
6. Dorsum with rosette patterns 7
 - Dorsum without rosette patterns 8
7. Femur II with two setae *F. turcicus* Koç & Ayyıldız, 1999
 - Femur II with three setae *F. amygdalus* Doğan & Ayyıldız, 2004
8. Prosternal apron with 14 dimples *F. acaciae* Doğan & Ayyıldız, 2004
 - Prosternal apron with 17 dimples *F. cucurbita* (Berlese, 1916)
9. Setal formula of tarsi 16-12-10-10, hood with 5-6 dimples in each longitudinal row, prosternal apron with 11 foveole *F. bafranus* Doğan, 2008
 - Setal formula of tarsi 17-14-10-10, hood with 6-8 dimples in each longitudinal row, prosternal apron with 12- 17 foveole 10
10. Dorsal body completely punctuated and striated *F. manisaensis* sp. nov.
 - Dorsal body partly punctuated and without striae *F. distortus* (Kuznetsov, 1974)

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