

A new subterranean amphipod species from Western Anatolia (Türkiye): *Niphargus hasansarii* n. sp. (Amphipoda: Niphargidae)

Batı Anadolu'dan (Türkiye) yeni bir yeraltı amfipod türü: *Niphargus hasansarii* n. sp. (Amphipoda: Niphargidae)

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Abstract: A new amphipod species, *Niphargus hasansarii* n. sp., is described based on a single female specimen collected from Homeros Valley in İzmir Province, Western Türkiye. The species is distinguished by a unique combination of characters, specifically the high setation (≥ 4) along the outer margin of dactyli on both gnathopods, a single spine on the inner margin of the dactyli of pereopods 3–7, three distal setae on the inner lobe of maxilla I, a subrounded third epimeral plate, a single robust seta at the base of uropod I, and distinct facial and lateral spines on the telson lobes. Detailed morphological examination and illustrations of the holotype's appendages were performed. The new species is compared with morphologically similar congeners, and diagnostic differences are highlighted. Although molecular data could not be obtained due to the specimen's preservation conditions and absence of additional material, the combination of unique morphological features strongly supports the species' distinct taxonomic status.

Keywords: Amphipoda, groundwater fauna, stygobiont, taxonomy, İzmir, Türkiye

Öz: Türkiye'nin batısında yer alan İzmir ili Homeros Vadisi'nden toplanan bir dişi bireye dayanarak yeni bir amfipod türü olan *Niphargus hasansarii* n. sp. tanımlanmıştır. Tür, özellikle her iki gnathopodun daktilinin dış kenarı boyunca yüksek kıllılık (≥ 4), 3-7. pereopodların daktilinin iç kenarında tek bir diken, maksilla I'nin iç lobunda üç distal kıl, yarı yuvarlak üçüncü epimeral plaka, uropod I'nin tabanında tek bir sağlam kıl ve telson loblarında belirgin yüz ve yanal dikenler gibi benzersiz bir karakter kombinasyonu ile ayırt edilir. Holotipin uzantılarının ayrıntılı morfolojik incelemesi ve çizimleri yapılmıştır. Yeni tür, morfolojik olarak benzer akrabalarıyla karşılaştırılmış ve tanısal farklılıklar vurgulanmıştır. Örneğin korunma koşulları ve ek materyalin yokluğu nedeniyle moleküler veriler elde edilemediği de, benzersiz morfolojik özelliklerin kombinasyonu, türün ayrı taksonomik statüsünü güçlü bir şekilde desteklemektedir.

Anahtar kelimeler: Amphipoda, yeraltı suyu faunası, stygobiont, taksonomi, İzmir, Türkiye

INTRODUCTION

The genus *Niphargus* Schödte, 1847 comprises nearly 500 species distributed throughout the Western Palearctic, predominantly inhabiting subterranean and freshwater ecosystems (Morhun et al., 2022; Mirghaffari and Esmaili-Rineh, 2024). Caves are well-known biodiversity hotspots for this genus, and some cave systems harbor multiple sympatric *Niphargus* species (Pinkster and Karaman, 1978; Trontelj et al., 2009; Karaman et al., 2010; Marin and Palatov, 2023). Despite this diversity, many *Niphargus* species are known only from their type localities. While the northern and southern limits of the genus's distribution are relatively well established, its eastern and western boundaries remain poorly defined (Fişer et al., 2009). Therefore, faunistic studies in Türkiye and the broader Middle East are crucial to clarifying the genus's biogeographic range and diversity.

To date, 121 amphipod taxa from 16 families have been recorded in Türkiye's inland waters (İpek and Özbek, 2022). Of these, twelve taxa belong to the genus *Niphargus*: *N. spoeckeri* Schellenberg, 1933; *N. valachicus* Dobreaun and Manolache, 1933; *N. tauri tauri* Schellenberg, 1933; *N. anatolicus* S. Karaman, 1950; *N. orientalis* S. Karaman, 1950; *N. kirgizi* Fişer, Çamur-Elipek and Özbek, 2009; *N. sertaci* Fişer, Çamur-

Elipek and Özbek, 2009; *N. imitator* G. Karaman, 2012; *N. incus* G. Karaman, 2012; *N. religiosus* G. Karaman, 2012; *N. tauri afioni* G. Karaman, 2012; and *N. turcicus* Andreev and Kenderov, 2012. The earliest record of the genus in Türkiye dates to *N. aquilex tauri*, first reported by Schellenberg from a cave in the Taurus Mountains and later elevated to species status in 1933 (G. S. Karaman, 2024). Although several taxa were described in 2012, subsequent studies on the genus in Türkiye remain limited.

The present study describes a new species of *Niphargus* based on a specimen collected from Homeros Valley, İzmir. The new taxon is compared with morphologically similar congeners, and diagnostic differences are discussed in detail. The description is based on a single female specimen, as no additional individuals were found despite repeated field surveys. The original sampling locality had dried out during follow-up efforts, limiting the potential for collecting new material.

MATERIALS AND METHODS

Homeros Valley is a recreational area located within İzmir Province in Western Anatolia, situated between the villages of

Eğridere and Kayadibi, approximately five kilometers from central Bornova and covering about 650 hectares. A small, irregular stream traverses the valley. A single female *Niphargus* specimen was collected from a water trough in this area by Prof. Dr. Hasan M. SARI and subsequently sent to the author.

The holotype was treated with a solution of lactic acid and 10% NaOH for two hours to clean the specimen and prevent breakage of appendages during dissection. The specimen was photographed using an Olympus SZ61 stereomicroscope before dissection. Dissections were carried out in a 50:50 glycerin-ethanol solution under the same stereomicroscope. Appendages and mouthparts were mounted on permanent slides using CMCP-10 high-viscosity mounting medium.

After several days of clearing and drying, the slides were photographed using an Olympus CKX-41 compound microscope equipped with a 5 MP digital camera. Drawings

were produced from the photographs using image-processing software and a Wacom PTH-451 digital drawing tablet. Illustration techniques followed the guidelines of Coleman (2003), and terminology for morphological features and setation formulas adhered to G. S. Karaman (1969, 2012). The distinction between “seta” and “spine” was based on morphological appearance rather than developmental origin. The holotype is deposited in the Collection of the Faculty of Fisheries, Ege University (ESFM), İzmir, Türkiye.

RESULTS

Niphargus hasansarii n. sp., (Figures 1-5)

Holotype: Female, 9.8 mm (ESFM-MALI/23-01), Homeros Valley, Bornova, Izmir Province, Türkiye (38°30'37.94" N 27°13'50.60" E), 05. iii. 2023; 1200 m a.s.l., collected by Dr. Hasan M. SARI.



Figure 1. *Niphargus hasansarii* n. sp., habitus of the holotype female

Etymology: The species epithet is derived from the name of Prof. Dr. Hasan M. SARI, who is a respected scientist working on inland water biology in Türkiye.

Diagnosis:

Niphargus hasansarii n. sp. is defined by a unique combination of morphological characters, which collectively distinguish it from its Anatolian congeners:

- Gnathopods 1–2: Dactyli exhibit a high number of setae (at least 4–5) along the outer margin.
- Mandibular palp: The first article is distal-setae free.

- Maxilla I: Inner lobe with 3 distal setae; outer lobe with 7–8 robust, multi-denticulated spines.
- Pereopods 3–7: Dactyli armed with a single robust spine on the inner margin.
- Pleopods: Each pleopod with one pair of retinacula.
- Uropod I: Peduncle with only a single robust seta at its base.
- Telson: Lobes are elongated, each with 3 apical, 1–2 lateral, and 1–2 distinct facial spines.
- Epimeral plates: Third plate subrounded.

Description of the holotype female: Body elongate; total length approximately 9 mm. Head with short rostrum and rounded lateral cephalic lobes; eyes absent (Figures 1, 5D).

Antennae. Antenna I approximately half the body length, with peduncular articles in ratio 80:55:30 and a 22-segmented flagellum. Each flagellar article with distal setae and an aesthetasc from segment 3 onward. Accessory flagellum biarticulated (Figure 3A). Antenna II shorter than antenna I (~1:1.7); peduncular articles 4 and 5 subequal; flagellum with 10 segments and distal aesthetascs (Figure 3B).

Mouthparts. Upper and lower lips rounded, both with numerous distal minute setae (Figures 2D–E). Maxilla I with inner lobe bearing three distal setae, outer lobe with seven serrated teeth, and a short two-articled palp barely reaching the base of the outer lobe's teeth, bearing six distal and one subdistal setae (Figure 2B). Maxilla II plates equal in length, with setae on convex margins (Figure 2F). Maxilliped with inner plate bearing five spines and several setae; outer plate with 12 spines and 6–7 setae; four-articled palp with setae along inner margins (Figure 2G).

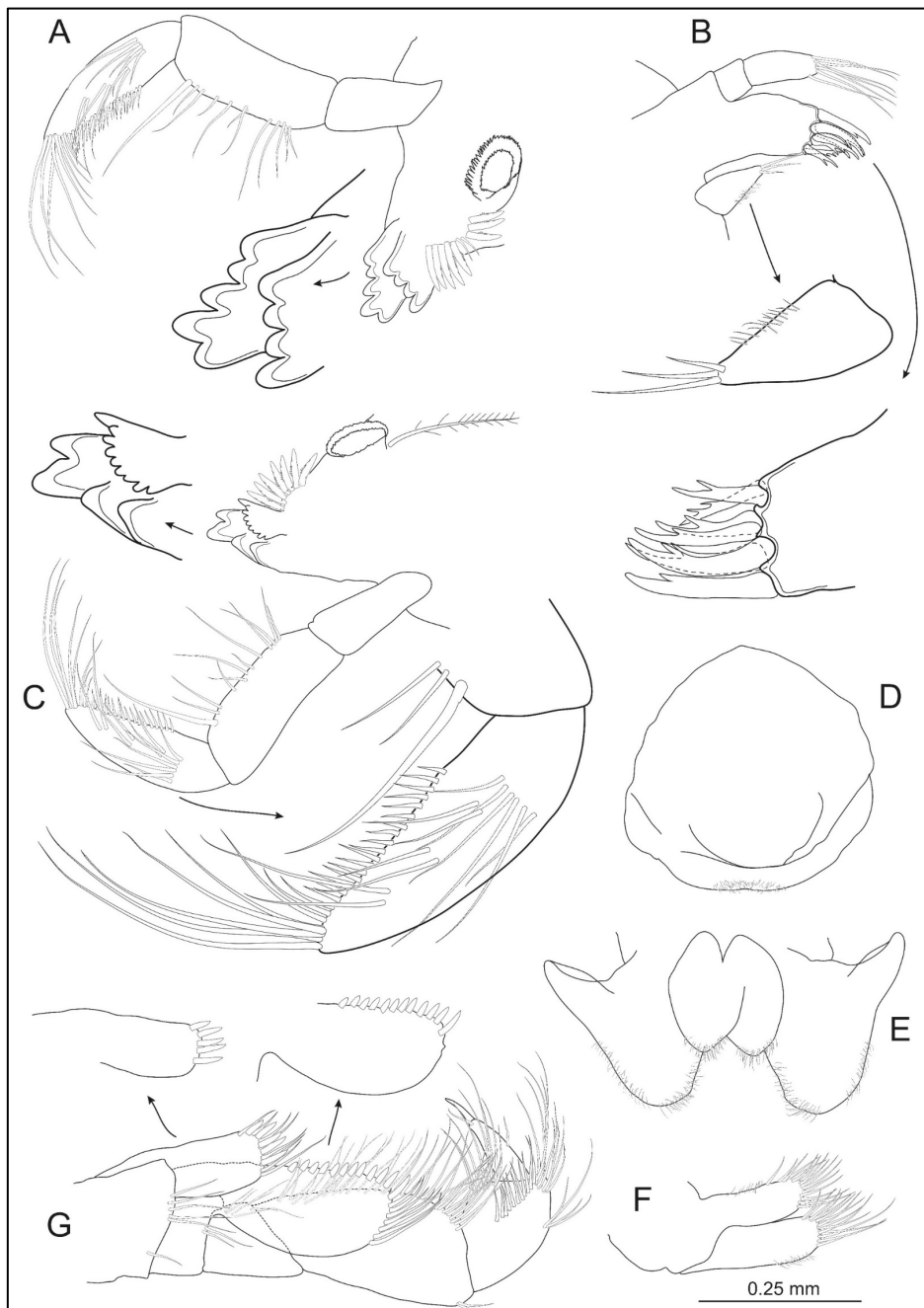


Figure 2. *Niphargus hasansarii* n. sp., mouthparts of the holotype female (A: left mandible; B: maxilla 1; C: right mandible; D: upper lip; E: lower lip; F: maxilla 2; G: maxilliped)

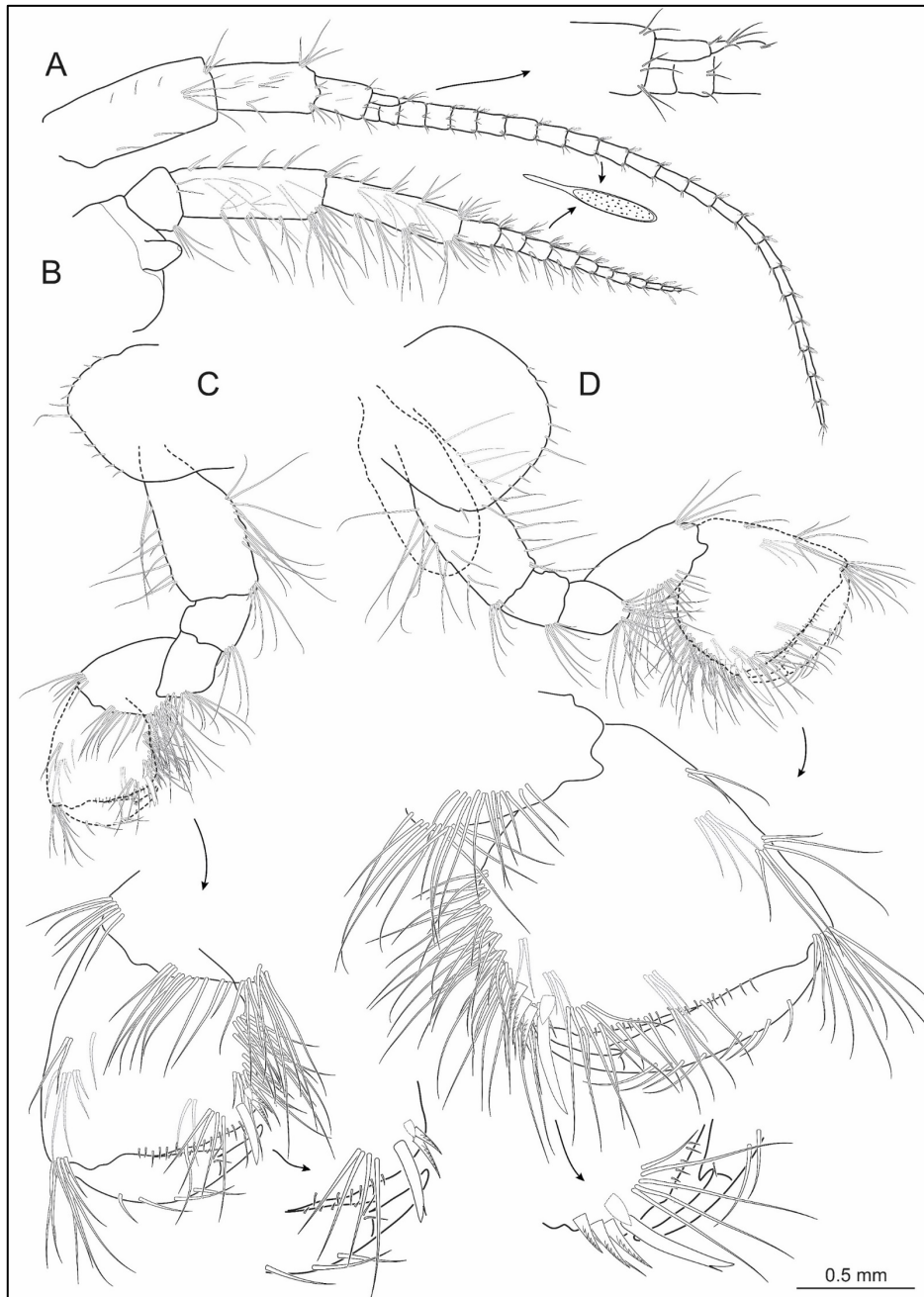


Figure 3. *Niphargus hasansarii* n. sp., extremities of the holotype female (A: antenna 1; B: antenna 2; C: gnathopod 1; D: gnathopod 2)

Gnathopods. Gnathopod I smaller than II; coxa wider than long; propodus trapezoid with weakly convex palm (~1/3 length), armed with one S-spine, two L-spines, and a subcorner R-spine. Dactylus with four marginal setae (Figure 3C). Gnathopod II propodus longer than wide with convex palm; similar spine formula as in gnathopod I; dactylus with 9 outer and 6 inner setae (Figure 3D).

Pereopods. Pereopods 3 and 4 similar in morphology and setation (Figures 4A–B). Pereopods 5–7 progressively longer; coxae bilobed in 5 and 6, single-lobed in 7. Basis with anterior spiniform setae, posterior margins with soft

setae. Merus, carpus, and propodus with regular setae/spine groups. Dactyli approximately 2.5–3.5 times longer than wide, each with a single spine on the inner margin (Figures 5A–C).

Pleopods and Urosome. Each pleopod with two retinacula and unequal rami. Uropod I peduncle longer than rami; inner ramus longer, armed with lateral and distal spines, and bearing two groups of distolateral setae (Figure 4E). Uropod II with rami and peduncle subequal (Figure 4D). Uropod III peduncle broad; inner ramus scale-like, outer ramus two-articled (tip broken in holotype) (Figure 4C).

Telson. Slightly wider than long with deep cleft; each lobe with 3 distal, 2 lateral, 1 mesial, and 1 facial spine; outer margins with short setae (Figure 4I).

Other characters. Coxal gills on pereopods 2–6, oostegites with marginal setae present on pereopods 2–5. Males unknown.

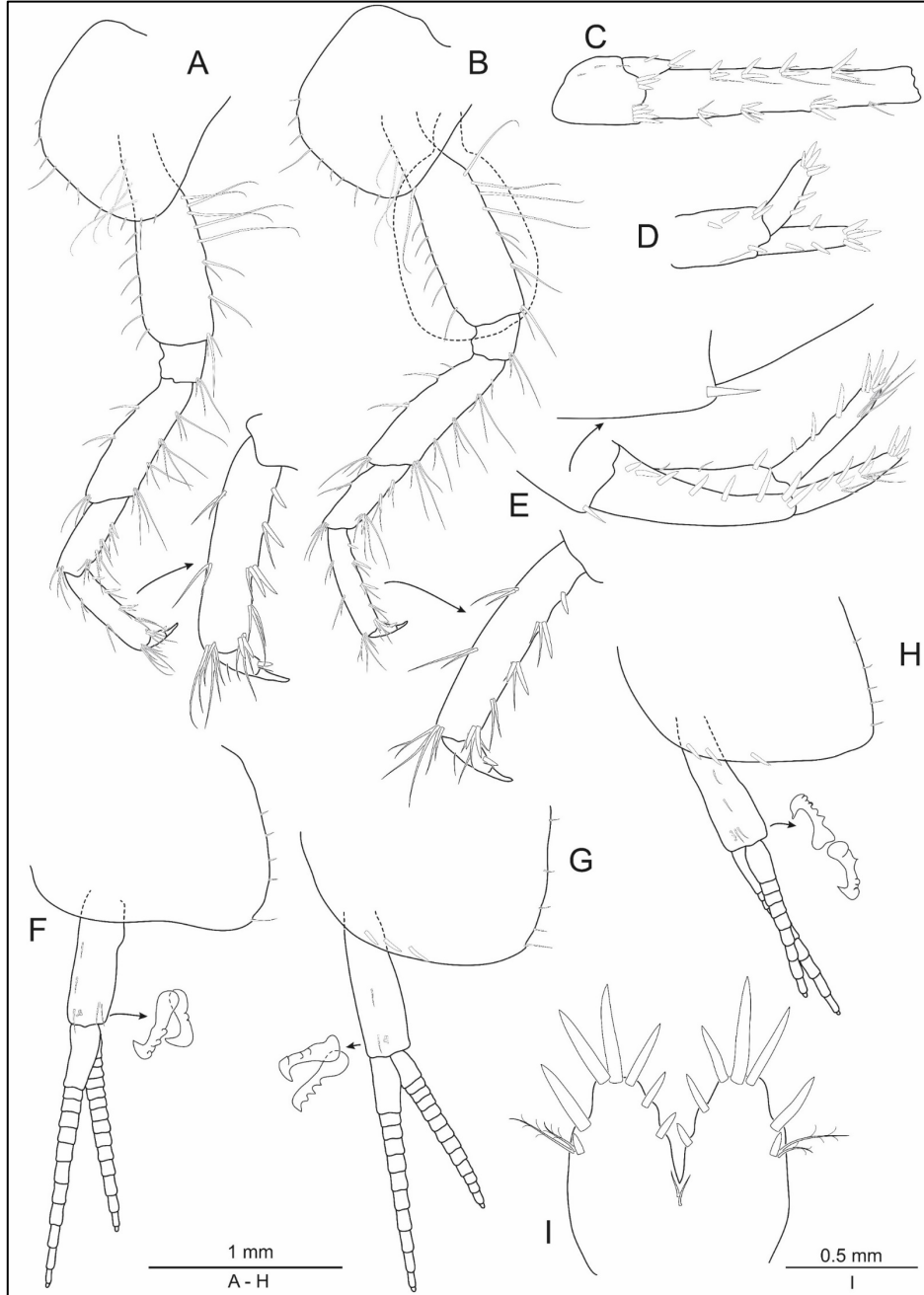


Figure 4. *Niphargus hasansarii* n. sp., extremities of the holotype female (A: pereopod 3; B: pereopod 4; C: uropod 3; D: uropod 2; E: uropod 1; F: pleopod 1; G: pleopod 2; H: pleopod 3; I: telson)

Remarks and affinities: The newly described species is morphologically similar to *N. anatolicus* (*N. a.*), but *Niphargus hasansarii* n. sp. differs from it by having 3 distal setae on the inner lobe of maxilla 1 (1-2 distal setae in *N. a.*). In addition, the presence of a short maxilla 1 palpus with 6 distal setae (longer and with 4 distal setae in *N. a.*), the presence of three groups

of B-setae on the inner surface of the third mandibular palp (two setae in *N. a.*), the presence of facial spines on the telson lobes (no facial spines in *N. a.*) and the presence of two groups of distolateral setae on the ramus of uropod 1 (one in the female of *N. a.*) are some other characters that distinguish the new species from *N. anatolicus*.

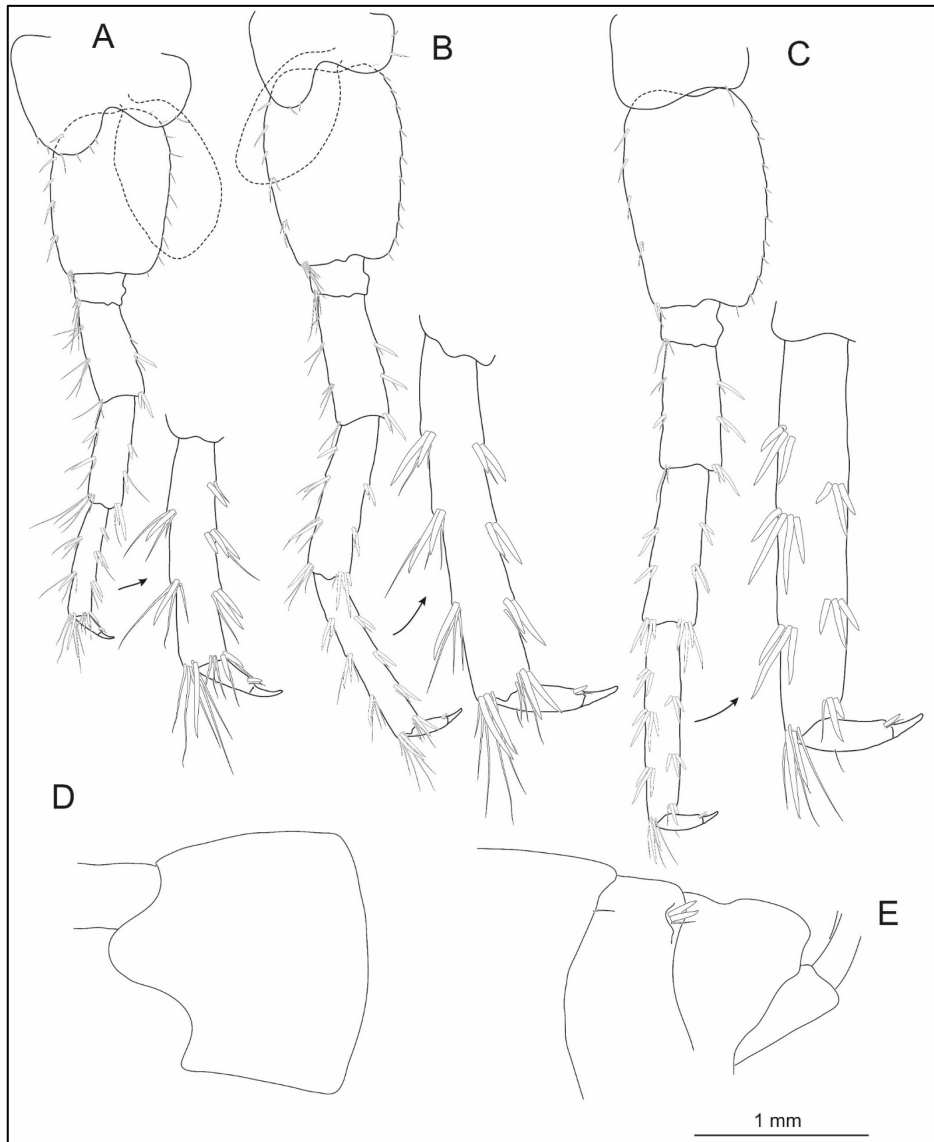


Figure 5. *Niphargus hasansarii* n. sp., extremities of the holotype female (A: pereopod 5; B: pereopod 6; C: pereopod 7; D: head; E: urosomites)

The differences between the newly described species and other species described from Türkiye in terms of morphological characters are as follows: it is distinguished from *N. kirgizi* by having two retinacula on each of its pleopods (three retinacula in *N. kirgizi*); from *N. imitator*, *N. tauri tauri* and *N. tauri afioni* by having numerous setae on the outer margin of the dactyl of gnathopods 1 and 2 (one seta in the others); from *N. sertaci* by having 1 spiniform seta at urosomal segment 1 at ventroposterior margin (2 spiniform setae in *N. sertaci*); from *N. religiosus* and *N. turcicus* by having no setae on the first segment of the mandibular palp (with setae in the others); from *N. orientalis*, *N. incus*, and *N. valachicus* by having only one spine on the inner margin of the dactyls of pereopods 3-7 (with more than one spines in the mentioned ones) and, from *N. spoeckeri* by having subrounded epimeral plates (pointed in *N. spoeckeri*).

The newly described species is also similar to *N. sertaci*,

which was recorded from a very nearby area, in many morphological features. Since the holotype and paratypes were male individuals, Fişer et al. (2009) could not describe the female of *N. sertaci* in the original description of the species. The presence of an additional spiniform seta at the base of the nail on pereopods 3, 4, and 7 in the largest individual was mentioned as a variation. However, they stated that the presence of two spiniform setae at the base of uropod 1 is not a variable character. The female individual examined in this study is not ovigerous, and there was one spiniform seta at the base of uropod 1. Similarly, there is no additional spiniform seta at the base of the nail on pereopods. In addition, there are some differences in the armaments of the maxilliped; while the new species has 5 distal and 12 lateral spines on the inner and outer lobes of the maxilliped, respectively, *N. sertaci* has 3-4 distal and 8 lateral spines (flattened thick setae) on the mentioned parts.

DISCUSSION

The discovery of *Niphargus hasansarii* n. sp. contributes to our understanding of the diversity and distribution of subterranean amphipods in Türkiye. Morphologically, the species is closest to *N. sertaci*, which was also described from İzmir Province and is located approximately 5 km away from the Homeros Valley. The consistent morphological differences between these two taxa, despite geographic proximity, suggest higher-than-expected species richness in this region.

Karst regions across Türkiye, particularly in Western and Eastern Anatolia, provide ideal habitats for stygobiont organisms. Although karstified geological structures are widespread in eastern Türkiye, most *Niphargus* species have been reported from the west and northwest, likely due to sampling bias rather than true absence. A similar pattern is observed in adjacent regions such as northern Iran, where numerous *Niphargus* species have recently been described (Esmaili-Rineh et al., 2015; Mamaghani-Shishvan et al., 2024).

Repeated field attempts to resample the type locality of *N. hasansarii* n. sp. were unsuccessful due to drying of the aquatic habitat. Thus, only one non-ovigerous female specimen was available for this description. Although molecular data could not be obtained from the specimen due to preservation limitations, the combination of diagnostic morphological characters—including telson armature, setation of gnathopods and mouthparts, and epimeral plate shape—supports the validity of the new species. Previous studies have also accepted new species descriptions based solely on morphology when molecular data were unavailable (cf. Marin and Palatov, 2023).

The description based on a single holotype is a necessary taxonomic step due to the environmental degradation of the type locality. Following recent precedents in stygobiotic research (e.g., Marin and Palatov, 2023), we document this species to prevent its potential loss from scientific record due to habitat drying.

This study supports Fişer et al. (2009)'s hypothesis that Western Türkiye may serve as a zone of adaptive radiation for *Niphargus*. Additionally, the findings align with Esmaili-Rineh

et al. (2015)'s assertion that the genus remains poorly documented in the Middle East. Future integrative studies incorporating both morphological and molecular data are essential to elucidate whether Western Anatolia, like the Balkans and Zagros, constitutes a hotspot for *Niphargus* diversity.

“Nomenclatural acts”: This work and the nomenclatural acts it contains have been registered in ZooBank. The ZooBank Life Science Identifier (LSID) for this publication is: lsid:zooBank.org:pub:795F7EF4-9067-4ED9-80DE-033B9FB15FD3

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AUTHOR CONTRIBUTIONS

In this study, all contributions except for sample provision are the responsibility of the author.

CONFLICT OF INTEREST

No conflicts of interest.

ETHICAL APPROVAL

Since this study is on a group of invertebrate organisms, ethical approval is not required.

DECLARATION OF AI USE

English translation and editing assistance was partially supported by artificial intelligence-based tools (ChatGPT, OpenAI, 2025).

DATA AVAILABILITY

The data generated and analyzed during the current study are available from the corresponding author on reasonable request.

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