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Article

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Terrestrial isopods of the subgenus *Hemilepistus* (*Hemilepistus*) Budde-Lund, 1879 (Isopoda: Oniscidea) from Iran

GHASEM M. KASHANI[1, 3, 4], ALIREZA SARI[1] & SHIDOKHT HOSSEINIE (OSTAVANI)[2]

[1]*School of Biology, College of Science, University of Tehran, Tehran, Iran*
[2]*Department of Biology, Faculty of Science, Shiraz University, Shiraz, Iran.*
[3]*Department of Biology, Faculty of Science, University of Zanjan, Zanjan, Iran.*
[4]*Corresponding author; E-mail: kashani_gm@znu.ac.ir*

Abstract

Five species of the subgenus *Hemilepistus* (*Hemilepistus*) collected in Iran are reported. Three of these (*Hemilepistus schirasi*, *H. cristatus* and *H. klugii*) have been previously reported from Iran, one (*H. aphganicus*) is a new record, and the fifth (*H. taftanicus* **n. sp.**) is a new species. *Hemilepistus taftanicus* **n. sp.** is distinguished from other species of the subgenus by the presence of two additional large tubercles on the dorso-median part of pereonites 1–4. All species are allopatric; *H. aphganicus* have the widest range and *H. taftanicus* shows a very restricted one. A key to the Iranian species of the subgenus is provided.

Key words: Oniscidea, *Hemilepistus taftanicus*, new species, Iran

Introduction

The terrestrial isopod fauna of Iran is poorly known and there are only few studies partially (Brandt 1833; Budde-Lund 1885; Arcangeli 1932; Borutzky 1958; Lincoln 1970; Schmalfuss 1992) or totally (Schmalfuss 1986) devoted to this region. The present study is one of the works that were conducted on terrestrial isopods focusing on the subgenus *Hemilepistus* within the genus *Hemilepistus* Budde-Lund, 1879.

Budde-Lund (1879) divided the genus *Porcellio* Latreille, 1804 into seven subgenera, including *Hemilepistus*. He later (Budde-Lund 1885) relied on absence or presence of frontal line between the frons and the epistome in discrimination of two species groups within the subgenus *Hemilepistus* (*Hemilepistus*). This character was used by Verhoeff (1930) to erect two subgenera: *H.* (*Hemilepistus*) and *H.* (*Desertellio*), and he raised *Hemilepistus* to the generic level. Arcangeli (1932) doubted the accuracy of this division, but Lincoln (1970) and Borutzky (1978) confirmed validity of the subgenera and therefore, these were used in their keys.

The subgenus *H.* (*Hemilepistus*) contains nine valid species (Schmalfuss 2003), all of which are burrowing isopods, inhabit arid and subarid regions (Schneider 1970; Linsenmair & Linsenmair 1971; Kozlovskaja & Striganova 1977; Linsenmair 1979), having a broad distribution in North Africa, the Near East and Central Asia (Lincoln 1970; Borutzky 1958, 1978). Members of this subgenus spend most of their time in their burrows, form monogamous pairs and exhibit limited parental care (Marikovski 1969; Schneider 1970; Linsenmair & Linsenmair 1971; Linsenmair 1972, 1979; Schneider 1975; Shachak 1980; Röder & Linsenmair 1999).

To date, three species have been reported from Iran including *H. cristatus* from "Serdscen" (an unknown locality in Iran) (Budde-Lund 1885) and *H. schirasi* and *H. klugii* from Shiraz and Tehran, respectively (Lincoln 1970).

In addition to summarizing the data on the distribution range of the species, the present study adds two additional species to the terrestrial isopod fauna of Iran including *H. aphganicus*, which is broadly distributed in east and northeast Iran and *H. taftanicus* **n. sp.** with limited distribution from southeast Iran. Therefore, the

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total number of species in the subgenus is currently 10. Previous keys to species of the subgenus were given by Lincoln (1970) and Borutzky (1978). In the present paper a key to the Iranian species is provided.

Material and methods

The material of the present study was collected in many localities in Iran (Fig. 1) by the senior author unless otherwise mentioned. The specimens were collected during their above ground activity or by digging their burrows and preserved in 96% ethanol. Total body length was measured from the tip of head to the posterior end of the telson. Digital color images were taken using a Qimaging MicroPublisher 5.0 RTV digital camera and Syncroscopy Auto-Montage (v 5.03.0061) software. The isopods were dissected and body parts were slide-mounted in Euparal (Carl Roth, Karlsruhe). Drawings were made using a camera lucida fitted on an Olympus SZX12 dissecting stereomicroscope and on an Olympus BX51 compound microscope. Due to similarity of pleopod 3–5 exopods in all species of present study, these characters are presented only for *Hemilepistus aphganicus*.

To confirm species identifications, specimens were compared whenever possible with type or non-type material obtained from the Natural History Museum, London (BMNH); Museum für Naturkunde der Humboldt-Universität, Berlin (MNB); Staatliches Museum für Naturkunde, Stuttgart (SMNS); Senckenberg Museum, Frankfurt (SMF); Zoological Museum, University of Copenhagen (ZMUC), Museo Regionale di Scienze Naturali, Torino (MRST) and Smithsonian Institution, National Museum of Natural History (NMNH). Type material of the newly described species is deposited in the Zoological Museum, University of Tehran (ZUTC), SMF and in SMNS. The material for other species is deposited at ZUTC. Some specimens of all the species are kept in the personal collection of the senior author.

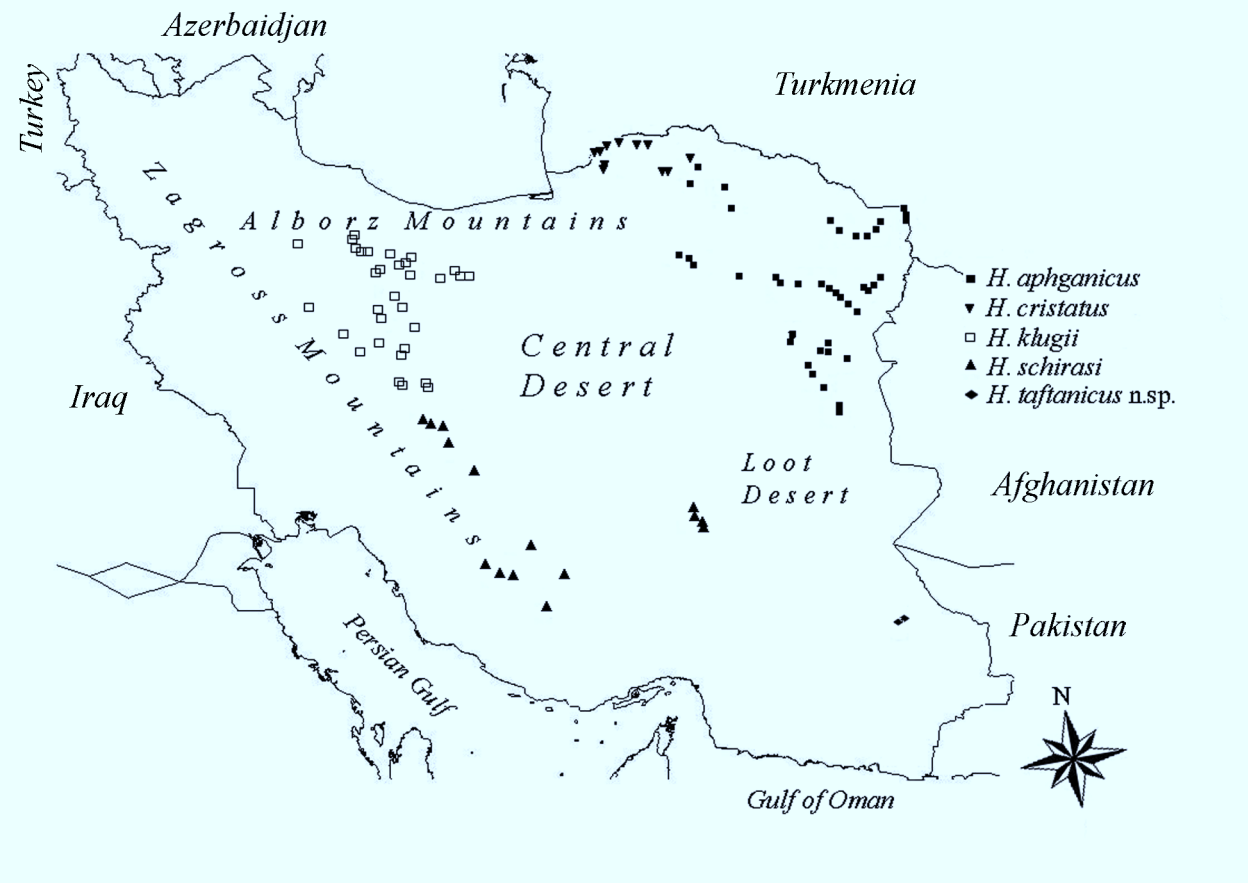

FIGURE 1. Sampling localities of *Hemilepistus* species from Iran.

Key to the Iranian species of the subgenus *Hemilepistus* (*Hemilepistus*)

1. Pereonites 1–3 with no large tubercles along dorsomedian line 2
- Pereonites 1–3 with two large tubercles along dorsomedian line ..... *H. taftanicus* **n. sp.**
2. Head with 12–14 large tubercles on dorsal surface ..... *H. schirasi*
- Head with more than 14 large tubercles on dorsal surface 3
3. Tubercles form a large circle on middle of head 4
- Tubercles form a semicircle on middle of head ..... *H. aphganicus*
4. Posterior margin of pereonite 4 with a trace of tubercles ..... *H. klugii*
- Posterior margin of pereonite 4 without any trace of tubercles ..... *H. cristatus*

Taxonomy

Order Isopoda Latreille, 1817

Suborder Oniscidea Latreille, 1802

Family Agnaridae Schmidt, 2003

***Hemilepistus aphganicus* Borutzky, 1958**
Figs 2A–C, 3

Hemilepistus aphganicus Borutzky 1958: 1471.– 1978: 42.– Lincoln 1970: 125.

Material examined. Iran, Mashhad, 36˚21.8'N, 59˚38.1'E, 8 May 2008, 9 specimens (ZUTC Iso.1004); Mashhad, 36˚09.6'N, 59˚49.2'E, 9 May 2008, 6 specimens (ZUTC Iso.1005); Mashhad to Mozdooran, 36˚01.8'N, 60˚07.4'E, 9 May 2008, 3 specimens (ZUTC Iso.1006); Mozdooran, 36˚11.9'N, 60˚33.4'E, 9 May 2008, 6 specimens (ZUTC Iso.1007); Sarakhs, 36˚33.1'N, 61˚09.4'E, 10 May 2008, 4 specimens (ZUTC Iso.1008); Torbate Jaam, 35˚15.6'N, 60˚38.5'E, 10 May 2008, 5 specimens (ZUTC Iso.1009); Torbate Jaam to Bakhezr, 35˚03.0'N, 60˚29.1'E, 10 May 2008, 8 specimens (ZUTC Iso.1010); Bakhezr, 34˚59.7'N, 60˚20.6'E, 10 May 2008, 4 specimens (ZUTC Iso.1011); Jajarm to Sankhast, 37˚05.6'N, 56˚49.7'E, 12 September 2008, 2 specimens (ZUTC Iso.1012); Esfarayen, 37˚01.6'N, 57˚29.9'E, 12 September 2008, 10 specimens (ZUTC Iso.1013); Esfarayen to Sabzevar, Hokmabad, 36˚37.5'N, 57˚36.5'E, 12 September 2008, 5 specimens (ZUTC Iso.1014); Kashmar to Feyzabad, 35˚12.6'N, 58˚32.4'E, 5 February 2009, 3 specimens (ZUTC Iso.1015); Feyzabad to Torbate Heydarieh, 35˚06.6'N, 58˚58.5'E, 5 February 2009, 3 specimens (ZUTC Iso.1016); Torbate Heydarieh to Rashtkhar, 35˚05.7'N, 59˚26.5'E, 6 February 2009, 2 specimens (ZUTC Iso.1017); Rashtkhar, 34˚59.4'N, 59˚34.8'E, 6 February 2009, 5 specimens (ZUTC Iso.1018); Salami to Khaaf, 34˚42.5'N, 59˚59.9'E, 6 February 2009, 3 specimens (ZUTC Iso.1019); Khaaf, 34˚33.1'N, 60˚09.5'E, 6 February 2009, 5 specimens (ZUTC Iso.1020); Khaaf to Ghaen, 33˚54.4'N, 59˚33.8'E, 6 February 2009, 5 specimens (ZUTC Iso.1021); Ghaen, 33˚44.4'N, 59˚24.1'E, 6 February 2009, 6 specimens (ZUTC Iso.1022); Ghaen to Esfadan, 33˚44.3'N, 59˚28.9'E, 7 February 2009, 2 specimens (ZUTC Iso.1023); Birjand, 32˚59.7'N, 59˚29.5'E, 7 February 2009, 3 specimens (ZUTC Iso.1024); Sarbisheh, 32˚36.6'N, 59˚48.2'E, 8 February 2009, 2 specimens (ZUTC Iso.1025); Arian Shahr, 33˚15.8'N, 59˚16.9'E, 10 February 2009, 7 specimens (ZUTC Iso.1026); Ghaen to Gonabad, 33˚56.9'N, 58˚49.6'E, 10 February 2009, 6 specimens (ZUTC Iso.1027); Bardeskan, 35˚14.9'N, 57˚47.5'E, 11 February 2009, 4 specimens (ZUTC Iso.1028); Bardeskan to Biarjomand, 35˚35.2'N, 56˚46.1'E, 12 February 2009, 7 specimens (ZUTC Iso.1029).

Additional material. Turkmenia, Serakhs, 19 February 1886, leg. the Afghanistan Boundary Commission, det. R. J. Lincoln, 12 specimens (BMNH 1893.2.19:1–12); Pakistan, Belutschestan, misidentified as *H. klugii*, 1 specimen (NMNH under previous name USNM 62994); Pakistan, Belutschestan, misidentified as *H. klugii*, 1 specimen (MNB 21701); Pakistan, Belutschestan, 1915, Verhoeff collection, det. Kashani, 1 specimen (SMF 629); Pakistan, Belutschestan, 1915, misidentified as *H. klugii*, 1 specimen (ZMG

497, now at SFM); Afghanistan, Kabul, Summer 1964, 9 specimens (SMF 7551); Afghanistan, Kabul, 19633, leg. Schneider, 3 specimens (SMNS 12027); Afghanistan, Kabul, 16 May 1970, leg. D. Schneider, det. D. Schneider, 3 specimens (MNB 26292).

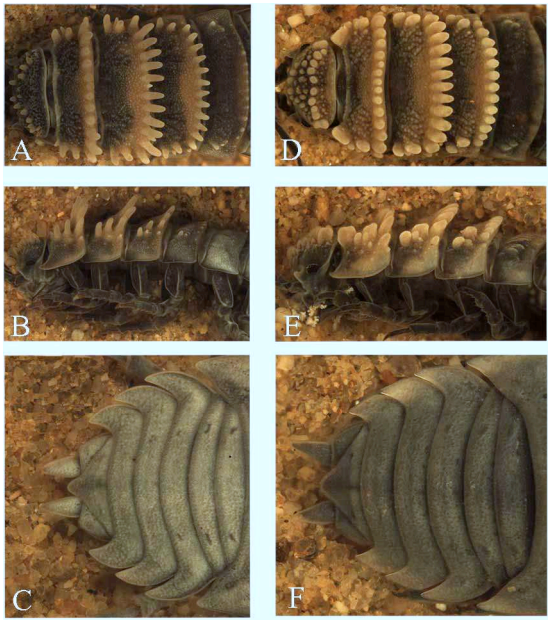

FIGURE 2. *Hemilepistus aphganicus.* A–C. male, 20 mm; *Hemilepistus cristatus.* D–F. Male, 16 mm. A, D. head and four first pereonites, dorsal view; B, E. head and first four pereonites, lateral view; C, F. pleon.

Remarks. This species differs from the others based on the unique arrangement of tubercles on the head, which form a median semicircle of 6 tubercles surrounding two large ones, and a row of 3–4 large tubercles extending to the postero-lateral margins (Fig. 2A). The absence of small tubercles on the head is conspicuous. This species is the largest among the Iranian representatives of the subgenus (maximum length = 24 mm). Schotte (1993) reported the presence of a single specimen of *H. klugii* from Beluchistan, Pakistan at USNM. Schmalfuss (2003) questioned the presence of this species in Pakistan. Examination of the specimen by the senior author clearly indicates that this specimen belongs to *H. aphganicus*. Based on the presence of strong dorsal tubercles, Schotte (19993) also suggested that "it is quite likely that it can be encountered in the desert areas and sandy dunes near the coast of Pakistan". However, the presence of this and other species of the subgenus *Hemilepistus (Hemilepistus)* in sandy dunes is improbable, and regarding to the report of this species from Kabul, it is more likely that this specimen was found in north of Pakistan. We also examined other material of this species from Belouchistan, Pakistan (SMF 629, SMF 7551 and MNB 21701) that confirms the specimens from Pakistan belong to *H. aphganicus*.

Distribution. Afghanistan; Pakistan; Turkmenia; East and Northeast Iran.

Hemilepistus cristatus **Budde-Lund, 1885**

Figs 2D–F, 4

Hemilepistus cristatus Budde-Lund, 1885: 153.– Borutzky, 1945: 193.– 1978: 34.– Lincoln, 1970: 121.
Hemilepistus uljanini Borutzky, 1955: 216.– 1958: 1469.– 1961: 26.

Material examined. Robate Gharebil, 37˚20.3'N, 56˚15.5'E, 6 May 2008, 7 specimens (ZUTC Iso.1030); [30 km] N of Gonbad Qaboos, 37˚25.6'N, 55˚06.0'E, 10 September 2008, 5 specimens (ZUTC Iso.1031); Gonbad to Maraveh Tappeh, 37˚42.9'N, 54˚53.0'E, 10 September 2008, 9 specimens (ZUTC Iso.1032); Gonbad to Marave Tappeh, 37˚56.1'N, 55˚22.9'E, 10 September 2008, 3 specimens (ZUTC Iso.1033); Hemmatabad, 37˚54.4'N, 55˚42.3'E, 10 September 2008, 5 specimens (ZUTC Iso.1034); Marave Tappeh, 37˚54.2'N,

55˚56.6'E, 10 September 2008, 6 specimens (ZUTC Iso.1035); Bojnourd to Raaz, 37˚41.7'N, 56˚55.2'E, 11 September 2008, 6 specimens (ZUTC Iso.1036); Robat Gharebil, 37˚20.3'N, 56˚15.5'E, 11 September 2008, 3 specimens (ZUTC Iso.1037).

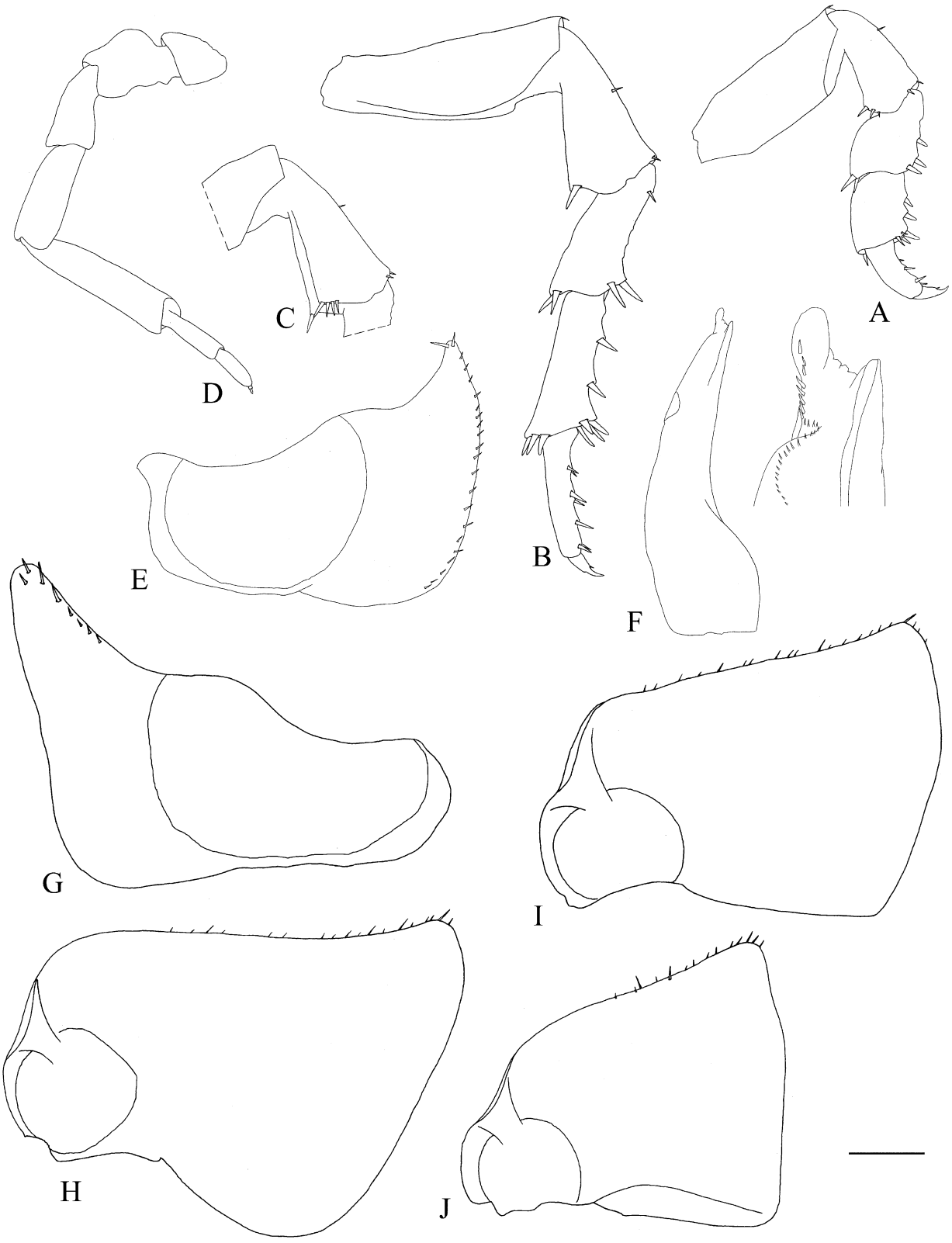

FIGURE 3. *Hemilepistus aphganicus.* Male (from Sarakhs). A, pereopod 1; B, pereopod 7; C, ischium pereopod 7 (caudal view); D, antenna; E, pleopod 1 exopod; F, pleopod 1 endopod and enlarged apex; G, pleopod 2 exopod; H, pleopod 3 exopod; I, pleopod 4 exopod; J, pleopod 5 exopod. Scale: 1 mm for A–D; 0.5 mm for E–J.

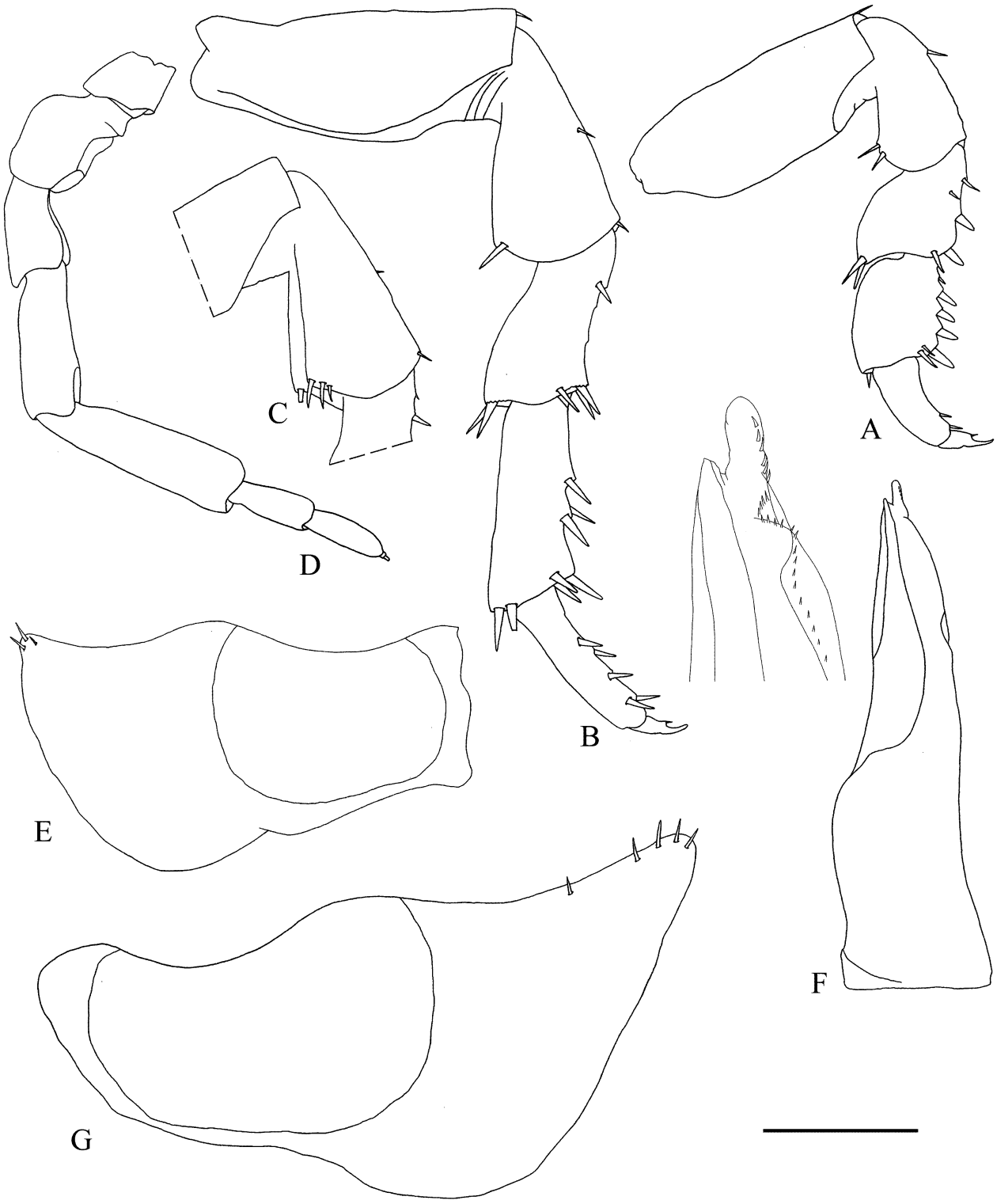

FIGURE 4. *Hemilepistus cristatus.* Male (from Robate Gharebil). A, pereopod 1; B, pereopod 7; C, ischium pereopod 7 (caudal view); D, antenna; E, pleopod 1 exopod; F, pleopod 1 endopod and enlarged apex; G, pleopod 2 exopod. Scale: 1 mm for A–D and 0.5 mm for E–G.

Additional material. Iran, [3 km] S of Marave Tappeh, 37˚54'N, 55˚56'E, 28 June 2001, leg. T. Osten, det. H. Schmalfuss (SMNS 1158); Persia, Serdscen, leg. Lessona, det. Arcangeli, misidentified as *H. crenulatus*, syntypes, more than 50 specimens (MRST Is-371); Persia, Serdscen, syntypes, 2 specimens

(BMNH 1956.10.10:156–157); Persia, Serdscen, Norman collection, cotypes, 4 specimens (BMNH 1911.11.8:10443–46); Turkmenia, Ashkhabad, leg. Walter in Budde-Lund collection, det. R. J. Lincoln, misidentified as *H. klugii*, 5 specimens (BMNH 1921.10.18:4097–4101).

Remarks. Based on the pattern and number of tubercles on the head, this species is more similar to *H. klugii* than any other species (compare Fig. 2D and 5A). Contrary to Budde-Lund (1885), Arcangeli (1932) contended that these species are synonymous based on comparison of specimens from Serdscen and Tehran at MRST. Examination and comparison of these material with the specimens from different localities and dates in Iran clearly showed that these are distinct species, based on the following criteria: the number of large tubercles on the head in *H. cristatus* is usually more than those in *H. klugii* and there are always many smaller tubercles on the head; large tubercles in mature individuals of *H. cristatus*, as opposed to tubercles in *H. klugii* that are nearly of the same size, are different in size and posterior tubercles are conspicuously larger than anterior ones; postero-lateral tubercles on the head as well as the lateral tubercles on the pereonites usually merge to form cube-shaped tubercles; posterior tubercles on pereonite 1–2 are large and form an upright crest in both sexes (in *H. klugii*, only in males if at all); size of tubercles on pereonite 3 is markedly smaller than that on pereonites 1–2 (not much smaller in *H. klugii*); the largest individuals of *H. cristatus* (19 mm) are smaller than adult specimens of *H. klugii* (22 mm), which is reflected on the diameter of their nest entrance (personal observations).

In his review of the subgenus, Lincoln (1970) placed the specimens from Serdscen in *H. cristatus* but he identified the specimens from Ashkhabad as *H. klugii*. Examination of material by G. M. K. revealed that the latter belongs to *H. cristatus*, and the data on geographical distribution support this identification. Schmalfuss (2003) questioned the presence of this species in Iran while its type locality in Budde-Lund (1885) recorded as Serdscen in Persia.

Distribution. Southern Turkmenia; Northeast Iran.

***Hemilepistus klugii* (Brandt, 1833)**
Figs 5A–C, 6

Porcellio klugii Brandt, 1833: 179.
Hemilepistus klugii Budde-Lund, 1885: 152.– Borutzky, 1945: 195.– 1951: 162.– 1978: 32.– Lincoln, 1970: 113.
Hemilepistus klugei Borutzky, 1958: 1464.

Material examined. Qom, Qanavat, 34˚37.0'N, 51˚01.3'E, 3 September 2004, 6 specimens (ZUTC Iso.1038); Pishva, 35˚12.3'N, 51˚48.5'E, 16 March 2008, leg: E. Entezari, 10 specimens (ZUTC Iso.1039); [35 km] N of Isfahan, 33˚01.1'N, 51˚31.5'E, 10 February 2008, 6 specimens (ZUTC Iso.1040); Isfahan to Meymeh, 33˚04.6'N, 51˚29.0'E, 14 February 2008, 4 specimens (ZUTC Iso.1041); Meymeh to Delijan, 33˚38.3'N, 50˚59.0'E, 14 February 2008, 3 specimens (ZUTC Iso.1042); [20 km] S of Tehran to Qom, 35˚15.4'N, 51˚10.0'E, 8 April 2008, 8 specimens (ZUTC Iso.1043); Meshkat, 34˚12.4'N, 51˚16.3'E, 8 April 2008, 5 specimens (ZUTC Iso.1044); Hosnijeh, 33˚03.9'N, 51˚01.3'E, 11 April 2008, 8 specimens (ZUTC Iso.1045); Dehaq, 33˚07.1'N, 50˚56.6'E, 11 April 2008, 6 specimens (ZUTC Iso.1046); Borzak, 33˚46.8'N, 51˚04.4'E, 11 April 2008, 4 specimens (ZUTC Iso.1047); Robat Karim, 35˚36.3'N, 51˚11.8'E, 24 April 2008, 7 specimens (ZUTC Iso.1048); Parand, 35˚27.4'N, 50˚57.9'E, 24 April 2008, 7 specimens (ZUTC Iso.1049); Saveh, Zavieh, 35˚17.7'N, 50˚28.4'E, 24 April 2008, 5 specimens (ZUTC Iso.1050); Komijan to Khondab, 34˚36.8'N, 49˚07.6'E, 25 April 2008, 6 specimens (ZUTC Iso.1051); Arak, 34˚04.6'N, 49˚49.4'E, 26 April 2008, 2 specimens (ZUTC Iso.1052); Mahallat to Delijan, 33˚53.2'N, 50˚32.1'E, 26 April 2008, 10 specimens (ZUTC Iso.1053); Delijan to Qom, Imamzade Abdollah, 34˚22.5'N, 50˚36.1'E, 26 April 2008, 9 specimens (ZUTC Iso.1054); Garmsar, 35˚15.4'N, 52˚11.2'E, 5 May 2008, 4 specimens (ZUTC Iso.1055); Boien Zahra, 35˚46.4'N, 50˚01.7'E, 1 June 2008, 7 specimens (ZUTC Iso.1056); Tehran, Eshtehard, 35˚42.7'N, 50˚46.6'E, 15 June 2008, 3 specimens (ZUTC Iso.1057); Boien Zahra to Qazvin, 35˚51.7'N, 50˚03.7'E, 15 June 2008, 3 specimens (ZUTC Iso.1058); Qazvin, 36˚03.9'N, 50˚03.6'E, 15 June 2008, 4 specimens (ZUTC Iso.1059); Qidar, Ardalan village, 35˚53.6'N, 48˚54.7'E, 21 June 2008, 10 specimens (ZUTC Iso.1060); Eyvankey,

35˚21.1'N, 52˚03.2'E, 8 September 2008, 4 specimens (ZUTC Iso.1061); Garmsar, 35˚14.5'N, 52˚21.1'E, 8 September 2008, 5 specimens (ZUTC Iso.1062); [20 km] N of Qom, 34˚49.7'N, 50˚51.1'E, 11 November 2008, 7 specimens (ZUTC Iso.1063).

Additional material. Iran, Tehran, 1862–63, leg. G. Doria, more than 50 specimens (MRST Is-243); Iran, Qom, 14 February 1937, leg. Danish, det. G. M. Kashani, 1 specimen (SMNS 11278); Iran, [150 km] N Isfahan, 4 June 1975, leg. Bauer, det. G. M. Kashani, 5 specimens (SMNS 11020); Iran, Kashan, 30 September 1977, leg. Volz, det. G. M. Kashani (SMNS 11062); Iran, Tehran, Budde-Lund collection, 2 specimens (BMNH 1921.10.18:4110–4111); Azerbaidjan, S Baku, [20 km] N Salayany, 30 April 1996, leg. N Schwaller, det. H. Schmalfuss, 1 specimen (SMNS 11530); Caucasus, leg. Olivier, syntype, 1 specimen (MNB 7083); Caucasus, Budde-Lund collection, 4 specimens (BMNH 1921.10.18:4106–4109).

Remarks. This species is different from the others in the arrangement of tubercles on the head. There is a large circle of eight tubercles in the middle of the head which may encircle no or few large ones, and a row of 3–5 large tubercles runs to the postero-lateral margins (Fig. 5A).

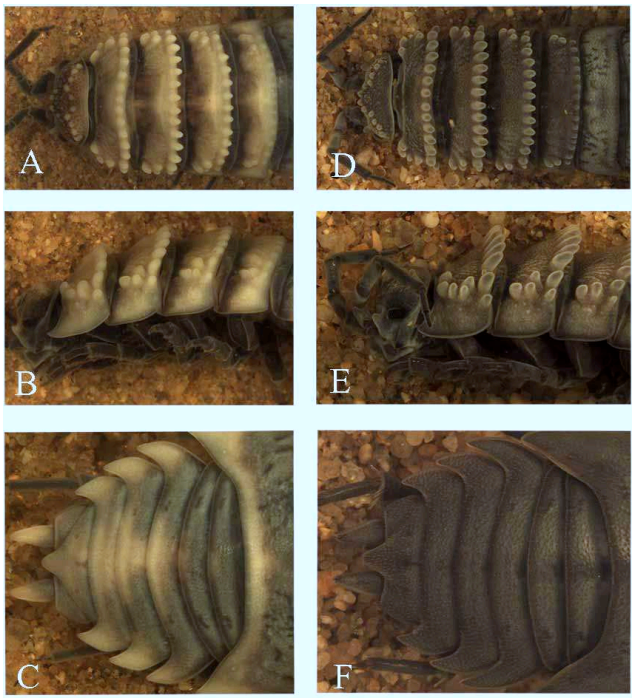

FIGURE 5. *Hemilepistus klugii*. A–C, male, 20 mm; *Hemilepistus schirasi*. D–F, male, 17 mm. A, D, head and first four pereonites, dorsal view; B, E. head and four first pereonites, lateral view; C, F. pleon.

The type locality of this species is Caucasus (Brandt 1833). Lincoln (1970), by comparing the syntype material and other material from Caucasus, identified the specimens in Budde-Lund collection from Tehran as *H. klugii*. Examination of same material by G. M. K. and their comparison with new material from Iran resulted in no concrete decision on their belonging to two separate species. This is based on the similarity in arrangement of tubercles on the head and pereonites. However, due to their separate geographical localities, their situation as the same species remains a subject under discussion. Lincoln (1970) also assigned the specimens collected from Ashkhabad to *H. klugii* but examination of material revealed that they belong to *H. cristatus*.

Distribution. Caucasus, Azerbaidjan; Central Iran.

***Hemilepistus schirasi* Lincoln, 1970**
Figs 5D–F, 7

Hemilepistus schirasi Lincoln, 1970: 127.– Borutzky, 1978: 44.

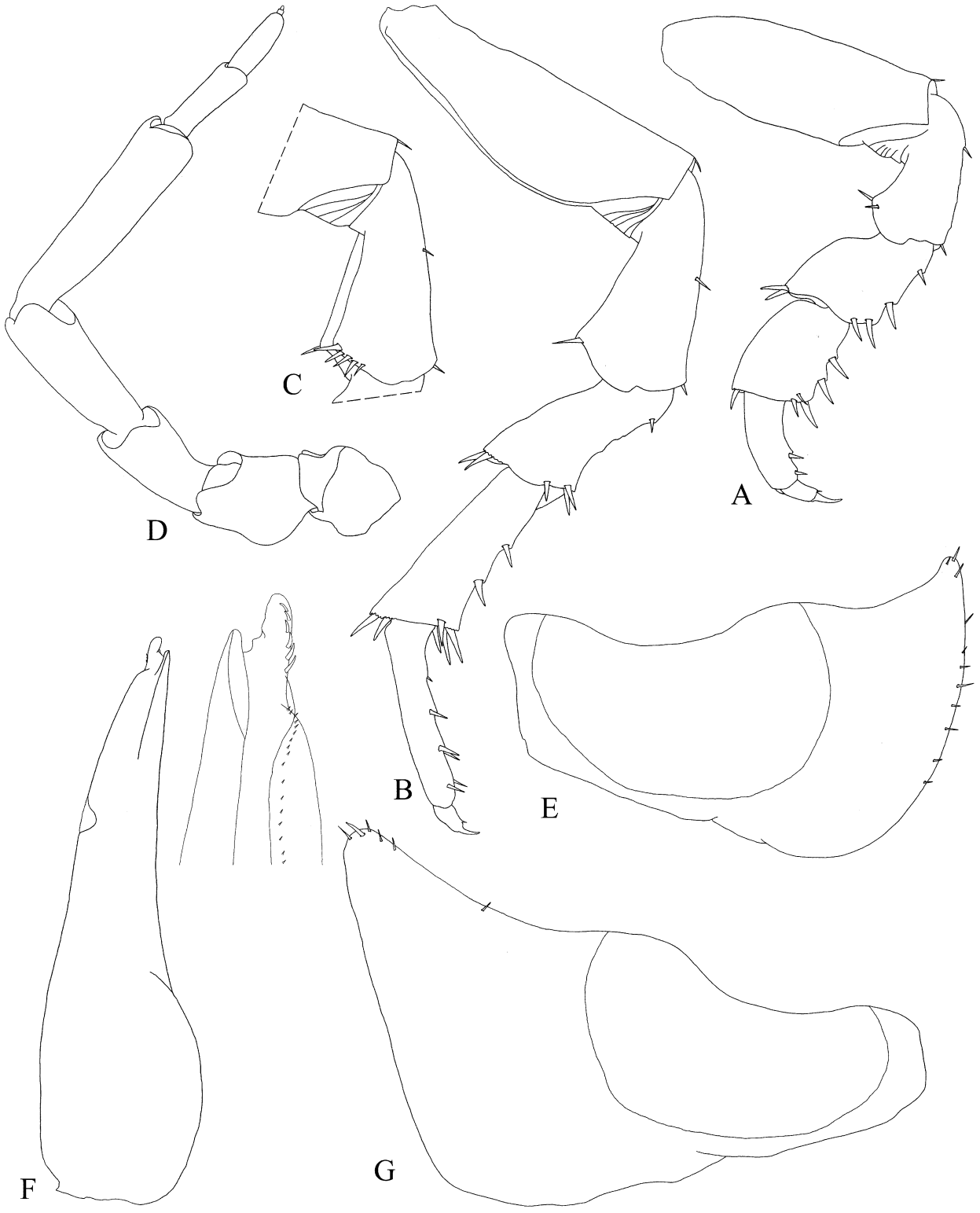

FIGURE 6. *Hemilepistus klugii*, male (from Garmsar). A, pereopod 1; B, pereopod 7; C, ischium pereopod 7 (caudal view); D, antenna; E, pleopod 1 exopod; F, pleopod 1 endopod and enlarged apex; G, pleopod 2 exopod. Scale: 1 mm for A–D and 0.5 mm for E–G.

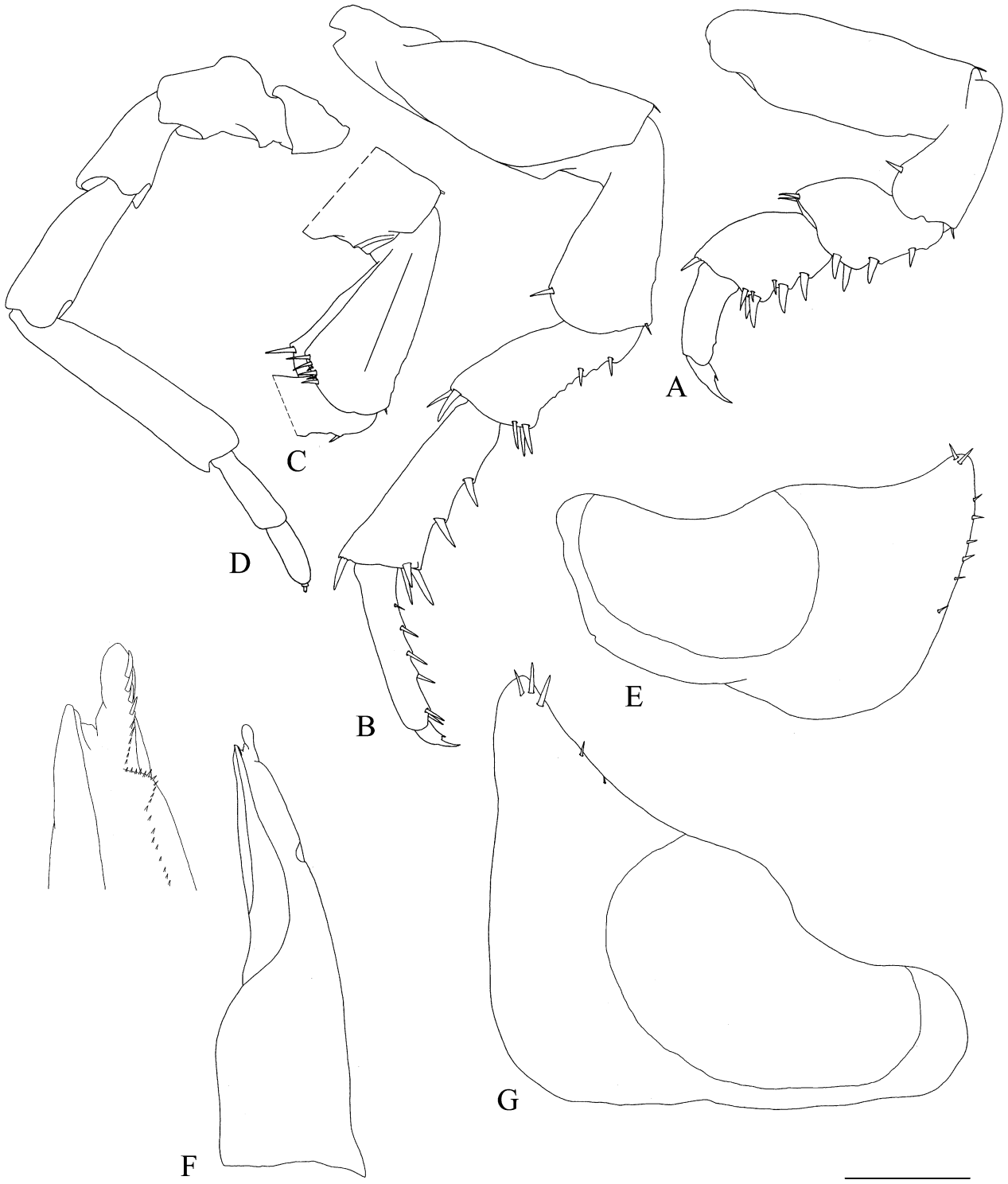

FIGURE 7. *Hemilepistus schirasi*, male (from Zahed Shahr), A, pereopod 1; B, pereopod 7; C, ischium pereopod 7 (caudal view); D, antenna; E, pleopod 1 exopod; F, pleopod 1 endopod and enlarged apex; G, pleopod 2 exopod. Scale: 1 mm for A–D and 0.5 mm for E–G.

Material examined. Isfahan, [20 km] N of Shahreza, 32˚12.5'N, 51˚50.3'E, 10 February 2008, 3 specimens (ZUTC Iso.1064); S of Shiraz, 29˚27.4'N, 52˚41.5'E, 12 February 2008, 5 specimens (ZUTC Iso.1065); Shiraz to Fasa, 29˚16.8'N, 52˚58.7'E, 12 February 2008, 6 specimens (ZUTC Iso.1066); Zahed Shahr, Dashte Gribaygan, 28˚35.9'N, 53˚55.5'E, 13 February 2008, 8 specimens (ZUTC Iso.1067); Neyriz to Abadeh Tashk,

29˚16.3'N, 54˚17.6'E, 13 February 2008, 5 specimens (ZUTC Iso.1068); Abadeh Tashk to Arsanjan, 29˚48.8'N, 53˚35.6'E, 13 February 2008, 4 specimens (ZUTC Iso.1069); Abadeh to Shahreza, 31˚19.9'N, 52˚28.6'E, 14 February 2008, 7 specimens (ZUTC Iso.1070); Shahreza, 31˚54.2'N, 51˚55.5'E, 14 February 2008, 6 specimens (ZUTC Iso.1071); Talkhouncheh, 32˚15.8'N, 51˚34.7'E, 11 April 2008, 7 specimens (ZUTC Iso.1072); Isfahan, Karkavand, 32˚20.8'N, 51˚26.2'E, 11 April 2008, 5 specimens (ZUTC Iso.1073); Isfahan to Shahreza, 32˚12.5'N, 51˚50.3'E, 14 May 2008, 6 specimens (ZUTC Iso.1074); Shiraz, Sarvestan, 29˚14.7'N, 53˚15.7'E, 20 May 2008, 3 specimens (ZUTC Iso.1075); [5 km] S of Kerman, 30˚13.3'N, 57˚03.9'E, 25 February 2008, 7 specimens (ZUTC Iso.1076); [5 km] N of Kerman, 30˚20.4'N, 57˚02.6'E, 26 February 2008, 9 specimens (ZUTC Iso.1077); [20 km] N of Kerman, 30˚34.4'N, 56˚51.1'E, 26 February 2008, 5 specimens (ZUTC Iso.1078); Shahreza, 1 June 2008, leg: M. Tarahomi, 1 specimen (ZUTC Iso.1079).

Additional material. Iran, Shiraz, leg. Collar, det. R. J. Lincoln, holotype, male (ZMUC CRU-1577); Iran, Shiraz, leg. Collar, det. R. J. Lincoln, paratype, 1 specimen (ZMUC CRU-1578); Iran, Shiraz, leg. Collar, det. R. J. Lincoln, paratype, 1 specimen (BMNH 1970:199); Iran, Shiraz, Budde-Lund collection, det. R. J. Lincoln, 1 specimen (BMNH 1921.10.18:4142); Iran, S Isfahan, 1976, leg. Graff, det. H. Schmalfuss (SMNS 11018); Iran, S Isfahan, 1976, leg. Graff, det. H. Schmalfuss, 4 specimens (SMNS 11030).

Remarks. This species is well distinguishable from other species based on small number of tubercles on the head forming a semicircle of 6 large tubercles in the middle and a row of three tubercles extending to the postero-lateral corners (Fig. 5D).

Distribution. Central to South Iran.

***Hemilepistus taftanicus* n. sp.**
Figs 8, 9

Material examined. Holotype: male, 16 mm, [26 km] N of Khash in way to Zahedan around Taftan Mount, 28˚22.7'N, 60˚59.9'E, 29 February 2008 (ZUTC Iso.1001).

Paratypes: 1 male and 1 female, same data as for holotype (SMNS T606); 1 male and 1 female, same data as for holotype (SMF 34829); 1 male and 2 females, same data as for holotype (ZUTC Iso.1002), 2 males and 2 females, [25 km] N of Khash in way to Zahedan, 28˚22.8'N, 61˚00.8'E, 30 February 2008 (ZUTC Iso.1003).

Diagnosis. Head with 20–26 large tubercles, forming a large circle in middle surrounding at least two large tubercles, and two (not one) rows of tubercles extending to postero-lateral corners of head (Fig. 8A, B). Two large tubercles on dorso-median portion of pereonites 1–4 (Fig. 8B). Fourteen large tubercles along posterior margin of pereonites 1–3. Three rows of 2–3 large tubercles on lateral margins of pereonite 1 setting at right angles to posterior tubercles (Fig. 8C). Pereonite 4 with faint traces of tuberosity.

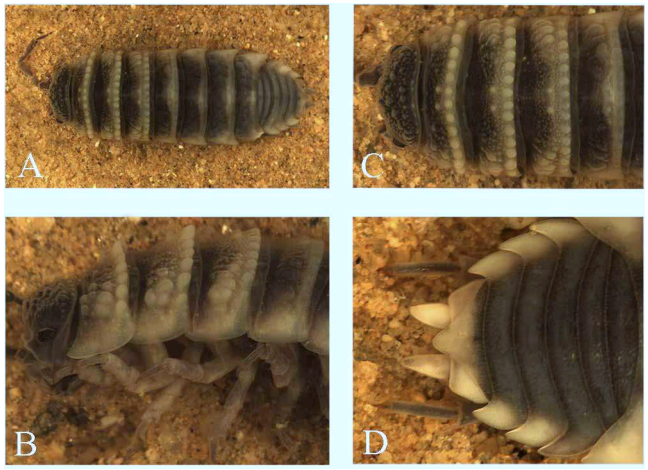

FIGURE 8. *Hemilepistus taftanicus* **n. sp.**, holotype, male, 16 mm. A, whole body; B, head and four first pereonites, lateral view; C, head and first four pereonites, dorsal view; D, pleon.

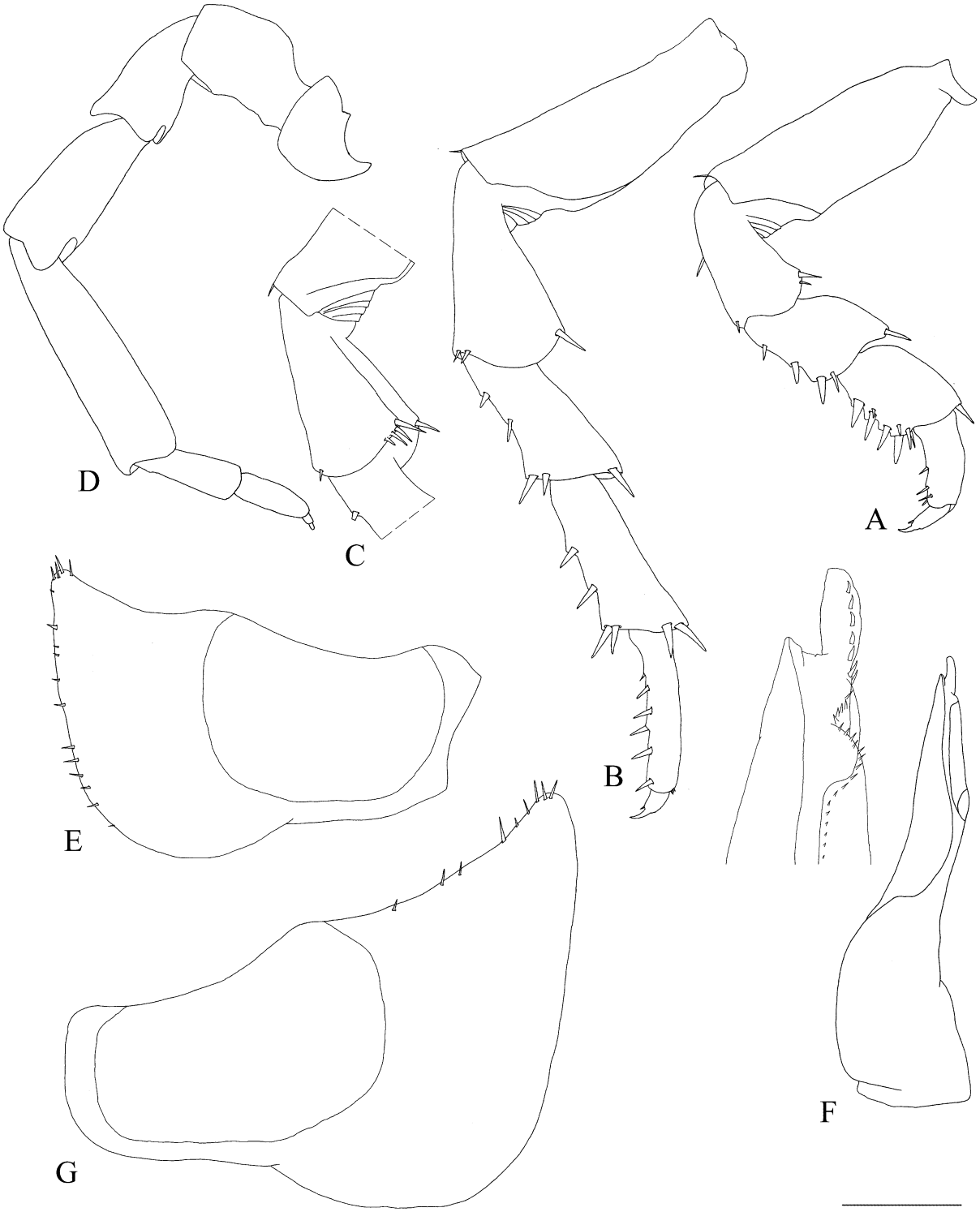

FIGURE 9. *Hemilepistus taftanicus* **n. sp.**, male. A, pereopod 1; B, pereopod 7; C, ischium pereopod 7 (caudal view); D, antenna; E, pleopod 1 exopod; F, pleopod 1 endopod and enlarged apex; G, pleopod 2 exopod. Scale: 1 mm for A–D and 0.5 mm for E–G.

Description. Maximum length 18 mm. Color gray, tubercles (except head) and epimera off white, anterior half of pereon much lighter.

Head with 20–26 large tubercles and many smaller tubercles. Eyes with 26–27 large ommatidia. *Antenna* long and slender with flagellum of two equal size articles (Fig. 9D); flagellum to peduncle segment 5 ratio, 3:5. *Pereon* somewhat rectangular.

Pereonite 1 with 14 well developed tubercles along posterior margin; two large tubercles on the dorso-median portion just in front of posterior ones; three rows of 2–3 large tubercles on lateral margins. Antero-lateral projection of epimera short with rounded apex. *Pereonite 2 and 3* with similar arrangement of tubercles as pereonite 1 but smaller in size and with fewer marginal tubercles. Pereon tergite 4 with faint traces of tuberosity. Pereon tergites 5–7 smooth, slightly broader than 1–4. *Pleon* short, smooth and narrower than pereon.

Telson triangular with margins slightly concave and narrow apex, almost 2 times as wide as long (Fig. 8D).

Pereopod 1 basis elongated; ischium short and triangular; merus and carpus equipped with strong spines; carpus with depression on rostral surface equipped with slender scales; propodus short and narrow (Fig. 9A).

Pereopod 7 basis elongated; ischium triangular with straight sternal margin; merus and carpus equipped with strong spines on sternal and distal margins; propodus narrow and long; dactylus with slender scales on sternal surface (Fig. 9B, C).

Pleopods 1–2 exopods with well developed pseudotracheae (Fig. 9E, G); *pleopods 3–5* exopods with small pseudotracheae.

Uropodal protopod with conspicuous incision on lateral margin; exopod short and conical, endopod with a proximal connection to protopod.

Pereopods without particular sexual specializations. In male, pleopod 1 exopod with two lobes in posterior margin (Fig. 9E); apex of endopod finger-like, equipped with spines (Fig. 9F); pleopod 2 exopod large with long outer lobe (Fig. 9G).

Etymology. The name refers to the nearest and highest Mount, Taftan, in the region where the species was found.

Distribution. Southeast Iran.

Discussion

Borutzky (1958) presented a distribution map for all species of the subgenus *Hemilepistus* (*Hemilepistus*) that were known at the time. Although this account included some erroneous information, it revealed all species were allopatric in distribution. Certain species (e. g. *H. reaumurii*) showed a broad and continuous geographical range (Lincoln 1970; Shachak & Yair 1984), while others presented a limited (e. g. *H. rhinoceros* Borutzky, 1958) or a disjunct distribution (e. g. *H. crenulatus* (Pallas, 1771)). In a smaller scale, this pattern is true about Iranian species. Based on published data (Borutzky 1958, 1978; Lincoln 1970) and examination of material, *Hemilepistus aphganicus* has a broad and continuous distribution range in Afghanistan, Pakistan, north and northeastern Iran, and south Turkmenia. The distribution range of this species in Iran is limited by the central desert. In northeast Iran, the distribution of this species has expanded to border that of *H. cristatus* (Fig. 1), but the two species remain separated by low mountains. The distribution of *Hemilepistus cristatus* is continuous in northeastern Iran (limited to the Alborz Mountains in the south and the Caspian Sea in the west) and southern Turkmenia (Borutzky 1945, 1955, 1961, 1978; Lincoln 1970). *Hemilepistus klugii* has a disjunct distribution including Azerbaidjan (Brnandt 1833; Budde-Lund 1885; Lincoln 1970; Borutzky 1978) and Iran (Budde-Lund 1885; Lincoln 1970 and the present study). These are separated by the Alborz Mountains in north and northwest Iran, which prevent the species to show populations continuity. The distribution of *H. klugii* in Iran (Fig. 1) is limited by the central deserts in the east and the Zagross Mountains in the west. Although it appears that there is no geographical barrier to prevent these populations from spreading to the south, where they would coincide with the northernmost distribution range of *Hemilepistus schirasi*, the two species are strictly allopatric. *Hemilepistus schirasi* is an endemic species with a broad distribution in central to south Iran and is limited by the Zagross Mountains in the west and south (Fig. 1). A population of this species occurs also in pistachio fields in Kerman, but this was not observed in such a field in neighboring cities. Therefore, it appears that the presence of *H. schirasi* in Kerman is due to synanthropical activities. *Hemilepistus taftanicus* **n. sp.** was found from a locality near Mount Taftan

in the southeast Iran, and compared to the other species which were also found in the open areas, it is the only species in the subgenus inhabiting merely the vicinity of the mountainous regions. This species shows a restricted distribution around Taftan Mount. The two latter species were only found in Iran and here considered as endemic while the others were found in neighboring countries.

Differences in the shape of first and second pleopods as well as seventh pereopod and telson are the main diagnostic characters for the members of the subgenus *Hemilepistus* (*Desertellio*) (e. g. Borutzky 1945), while these characters show phenotypic stasis in all members of the subgenus *Hemilepistus* (*Hemilepistus*) (Lincoln 1970). Although many terrestrial isopods exhibit an intraspecific variability of dorsal tuberculation (Schmalfuss 1975, 1992, 1996; Kwon & Taiti 1993; Schmalfuss *et al.* 2004; Kamilari & Sfenthourakis 2009), the main diagnostic characters of species of the subgenus *H. (Hemilepistus)* are the arrangement and number of tubercles on the body (Lincoln 1970; Borutzky 1978). Based on this instability in use of tuberculation as a diagnostic character in other isopod species, workers may consider the members of *H.* (*Hemilepistus*) as subspecies. This is noteworthy that in addition to unique tuberculation, some species of the subgenus (e. g. *H. magnus*) show marked characters such as head shape and body size (Lincoln 1970; Borutzky 1978; personal observation by G.M.K.). Moreover, in the elegant contribution by Schmalfuss (1975), he mentioned that in *H. reaumurii* "the numbers of tubercles remains constant during ontogeny and that the individuality of tuberculation as a whole is unaffected by the moult". This seems to be also applicable to other species of the subgenus *H.* (*Hemilepistus*). Therefore, results of the present study on the subgenus *H.* (*Hemilepistus*) strongly support the use of tuberculation by Lincoln (1970), Borutzky (1978) and Schmalfuss (1975), and emphasis on validity of tuberculation as a high value character at species level. As classified by Mayr & Ashlock (1991), sympatric-allopatric relationship of populations is another type of reliable taxonomic characters. Therefore, allopatric distribution of all species and no record of hybrid zone confirm that all of these belong to separate species. Among descriptive characters of the subgenus *H.* (*Hemilepistus*), the relative value of tuberculation is in priority. This is supported by allopatry as a complementary character of the subgenus. These characters facilitate the taxonomic decisions on species of the subgenus *H.* (*Hemilepistus*). However, future studies using molecular markers may shed more light to taxonomy of the subgenus *H.* (*Hemilepistus*).

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