Redescription of a well-known pseudoscorpion species, *Dinocheirus panzeri* (C.L. Koch) (Pseudoscorpiones: Chernetidae)

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**Abstract**

*Dinocheirus* Chamberlin, 1929 which is mostly distributed in the New World currently contains 27 species, of which only three species *D. transcaspius* (Redikorzev, 1922), *D. bulbipalpis* (Redikorzev, 1949) and *D. panzeri* (C.L. Koch, 1837) have been since reported from Europe, the Middle East and Central Asia. *Dinocheirus panzeri* is completely redescribed and illustrated on the basis of a female and three males collected from Iran. Also, a new provincial record of the species is given.

**Keywords:** Arachnida, Chernetinae, Female spermathecae, Sexual dimorphism, New provincial records

1. Introduction

The subfamily Chernetinae Menge, 1855 included a large number of species those must be reexamined for establishing a key character. The chernetines which have been since examined do not have T-shaped spermathecae, a pseudotactile seta on the pedipalpal segments, and sometimes a tactile seta on tarsus IV [1, 9].

Only two species belonging to the subfamily Chernetinae have been since recorded from Iran, *Chernes hahni* (C.L. Koch, 1839) and *Dinocheirus panzeri* (C.L. Koch, 1873) [10]. The lost species is widely found in the Europe, the Middle East and Central Asia [10]. On the basis of the shape of the female spermathecae and the external morphological characters, *Toxochernes panzeri* (C.L. Koch. 1873) was moved to the genus *Dinocheirus* Chamberlin, 1929, and *Chernes rufeolus* (Simon, 1905) and *Dinocheirus bowieri* (Vachon, 1963) were regarded as synonyms of *D. panzeri* by Mahnert [15]. Subsequently, *Toxochernes panzeri caucasicus* Kobakhidze, 1963 was synonymized with *Dinocheirus panzeri* by Schawaller and Dashdamirov [17].

In due attention to the fact that the special morphology of the *Dinocheirus* species may be varied [16] and also in respect to the loss of a full description for the species based on the materials collected from the Middle East and Central Asia, the newly collected materials from Iran are completely redescribed and illustrated here.
2. Material and methods
The specimens examined during this study were deposited in the Acarology Laboratory, Islamic Azad University of Arak (IAUA). The specimens were collected by Berlese funnel, and studied as the permanent slides mounted in Swan’s fluid. An Olympus BH-2 compound microscope was used to examine the specimens. The specimens were measured by an ocular graticule and illustrated with a drawing tube attached to the microscope. Morphological terminology and mensuration follow Chamberlin [5], Harvey [8], Judson [13] and Harvey et al. 2012[11].

The following trichobothrial abbreviations employed: 
\( eb = \) external basal; \( esb = \) external sub-basal; 
\( est = \) external sub-terminal; \( et = \) external terminal; \( ib = \) internal basal; \( isb = \) internal sub-basal; \( ist = \) internal sub-terminal; \( it = \) internal terminal; \( t = \) terminal; \( st = \) sub-terminal; \( b = \) basal; \( sb = \) sub-basal. In addition, the following abbreviations are used: \( mm = \) millimeter; \( L = \) length; \( W = \) width and \( D = \) depth.

Family Chernetidae Menge, 1855
Subfamily Chernetinae Menge, 1855
Genus *Dinocheirus* Chamberlin, 1929
*Dinocheirus tenoch* Chamberlin, 1929, by original designation.

Fig 1-6: *Dinocheirus panzeri* (C.L. Koch, 1873), ♂: 1. Carapace, dorsal view; 2. Tergites X-XI; 3a. Chelicera (serrula exterior omitted); 3b. Rallum; 4. Left coxae, ventral view; 5. Tarsus I; 6. Tarsus IV.

3. Diagnosis
The *Chernes* Menge, 1855 species, the only other member of the subfamily Chernetinae recorded from Iran can be separated from the *Dinocheirus* species by loss of long tactile setae on tergite XI, the appearance of female spermathecae (see Mahnert [15]: Figs 1-2) and also with the absence of a long tactile seta on tarsus IV. In respect to the presence of the stout pedipalps, the distal position of a long tactile seta on tarsus IV and the presence of four blades in the
structure of rallum, the species of *Dendrochernes* Beier, 1932 resemble the *Dinocheirus* species, but those can be recognized on the basis of the position of thrichobothrium *st* (located closer to *sb* than to *t* in the *Dendrochernes* species), and also with the shape of female spermathecae (terminated in a very small vesicle in *Dendrochernes* species (see Dashdamirov [6]: Fig. 163)).

*Dinocheirus panzeri* (C.L. Koch, 1837) Figs 1-12

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**Fig 7-9:** *Dinocheirus panzeri* (C.L. Koch, 1873), ♂: 7. Night chela, lateral view; 8. Left chela, dorsal view; 9. Basal segments of pedipalp, dorsal view.

5. Description:

**Males**

**Body length:** 2.25-2.87 mm

**Carapace:** uniformly dark brown, furrows blackish brown; heavily granulate, not coarsely; L/W 1.25-1.72; anterior margin straight; epistome absent; 2 transverse furrows deep and present, anterior furrow situated slightly proximal to middle; eyes/eye spots absent (one male with two eye spots) (Fig. 1); setae short and strongly clavate with terminal denticulations (Fig. 1); anterior margin with 8-10 and posterior margin with 21-24 setae; with 6 pairs of slit-like lyrifissures.

**Tergites:** dark brown, intensively sclerotized, completely granulate; with median suture line, XI not divided; half-tergites I-III uniserate; half-tergites IV-X
with one lateral, one medial and one central discal setae (in one male half-tergite IV with one lateral and one central discal setae); XI with four discal and two long tactile setae situated laterally (Fig. 2); most setae short and stout with terminal denticulations; circum anal setae stout and simple; chaetotaxy 15:17-18:17-18:18-21:19-20:18-21:19:20-21:17-17:19: 13-15:2.

**Sternites:** brown, lighter in color than tergites, lightly sclerotized, less granulate than tergites; III-X with median suture line, XI slightly divided; genital operculum with numerous long, acuminate and straight setae, anterior operculum with 21-22 setae arranged semi-circularly; posterior operculum with 27-31 setae, of which 5-6 situated on posterior margin of the genital aperture; setae on anterior operculum longer than setae on posterior operculum which are generally curved; most setae acuminate and simple, a few setae on lateral edge of half-stermites VII-X short with terminal denticulations; IV with uncerate slightly long setae; V-X with two slightly long setae situated medially; XI with four long median and lateral setae, all short setae denticulate; circum anal setae simple; superstignal setae simple, acuminate and relatively long; genitalia of typical chernetid form; chaetotaxy 21-22(3):27-31(3):(1)9-10(1):19:22-24:22-23:20-21:17-19:15:11:2.

**Pleural membrane:** longitudinally striate with pointed granula.

**Chelicera:** light brown; hand weakly sclerotized, with 5 setae, sb dentate (Fig. 3a); serrula exterior and interior present; serrula exterior with 16-19 blades; ralllum with 4 blades, two basal blades short and simple, third blade relatively long and denticulate, distal blade longest and distinctly denticulate (Fig. 3b); galea long with 5 distinct rami (two apical, two sub-apical, one median); fixed finger with 2 very small apical and 4 intermediate teeth (Fig. 3a); movable finger with galeal seta situated distally, with one blunt sub-apical tooth.

**Pedipalps:** reddish brown; heavily sclerotized; basal segments completely granulate, chelal hand not granulate, and basal half of the fingers with fine granules (Figs 7-9); coxa with 30-33 setae, most setae acuminate, three setae short and denticulate, of which 2 situated apically and one located on manducatory process; manducatory lobe with 6 setae, one apical, one marginal and five discal setae; trochanter swollen, with 2 dorsal rounded humps, L/W 1.64-1.88; femur with distinct pedicle, L/W 2.41-2.45; patella with 5 lyrifissures situated basally (Fig. 9), L/W 2.28; chela with distinct pedicle; setae on basal segments and chelal hand mostly short, stout and denticulate, a few simple setae present; chelal fingers mostly with simple and acute setae, a few setae on fixed chelal finger dentate; chelal hand with a distinct protuberance in dorsal view (Fig. 8), and distinctly stout and plump in lateral view (Fig. 7); chela (with pedicel) L/W 2.31-2.43; chela (without pedicel) L/W 2.13-2.28; hand (with pedicel) L/W 1.20-1.35; movable finger slightly shorter than hand with pedicel; hand 1.01-1.03 times longer than movable finger; fixed finger with 8 and movable finger with 4 trichobothria (Figs 7-8); fixed finger with trichobothria ib and ist situated sub-basally, it and isb situated between et and est, trichobothrium esb located far of eb, ib located slightly distal to esb, est situated approximately in middle of the finger, and it located closer to et than to isb; movable finger with trichobothrium t situated in distal third of the finger, and st situated distinctly closer to t than to sb; fixed finger with 42-46 and movable finger with 42-45 cusped teeth; cusped teeth not reduced at base of fixed finger; movable finger with 4 internal, and 4-6 external accessory teeth, and fixed finger with 4 internal and 4-5 external accessory teeth; prolateral face of chelal hand and fixed finger with several sense spots (Figs 7-8); movable finger with 9-10 sense spots on prolateral face (Fig. 7); venom apparatus present only in movable finger (Fig. 7), nodus ramosus situated at same level as st or slightly distal to st.
Legs: brown; granulate; sub-terminal setae curved and simple; arolia simple and shorter than claws; claws smooth and symmetrical (Figs 5-6); coxal setae arranged: 12-13:15-21:24-26:45-52; coxal setae simple and acute; posterolateral corner of coxa IV normal (Fig. 4); acuminate setae mostly longer than denticulate setae; most setae on femur and patella I short, stout and denticulate; prolateral margin of tibia I with only one fine denticulate seta situated medially, L/D 3.40-3.63; prolateral margin of tarsus I with simple and acute setae, retrolateral margin with only 2-3 denticulate setae situated basally (Fig. 5), L/D 5.14-6.00; femur IV with simple setae, L/D 1.53-1.57; patella IV with short and denticulate setae, L/D 2.69-2.74; retrolateral margin of tibia IV with denticulate and prolateral margin with simple setae, without tactile seta, L/D 4.54-5.00; prolateral margins of tarsus IV with simple setae, basal three fourth of retrolateral margin with denticulate setae, tactile seta present situated distally (TS = 0.72-0.74), retrolateral margin with a very small bulge situated in basally (Fig. 6), L/D 6.14-6.25.

Dimensions in mm: Carapace: 0.79-0.89/0.62-0.71. Pedipalp: trochanter 0.41-0.47/0.25; femur 0.66-0.70/0.27-0.29; patella 0.64-0.73/0.28-0.32; chela (with pedicel) 1.12-1.27/0.46-0.55; chela (without pedicel) 1.05-1.17; hand (with pedicel) L 0.62-0.66; movable finger L. 0.61-0.64. Leg I: femur 0.22-0.24/0.15-0.17; patella 0.33-0.41/0.13-0.14; tibia 0.34-0.40/0.10-0.11; tarsus 0.36-0.42/0.07. Leg IV: femur 0.22-0.26/0.14-0.17; patella 0.43-0.52/0.16-0.19; Femur + patella 0.60-0.72/0.16-0.19; tibia 0.50-0.60/0.11-0.12; tarsus 0.43-0.50/0.07-0.08.

Female
Body length: 2.90 mm
Carapace: brown, furrows reddish brown; L/W 1.27; anterior margin with 6 and posterior margin with 17 setae; with 6 pairs of slit-like lyrifissures. Tergites: brown; half-tergites I-II uniserate; half-tergite III-VII with one lateral and one central discal setae; half-tergites VIII-X with one lateral, one medial and one central discal setae; XI with four discal and two long tactile setae situated laterally; chaetotaxy...
16:19:19:20:20:19:20:16:17:12:2. **Sternites**: light brown; anterior operculum with 14 short simple setae arranged in a small central semi-circle; posterior operculum with 13 simple setae situated marginally; setae on anterior operculum shorter than setae on posterior operculum; spermathecae consisting of two very long tubes, each tube terminated in a huge vesicle (Fig. 12); chaetotaxy 14(3)13(3):17(1):20:23:24:22:18:17:12:2. **Chelicera**: galea long with 6 distinct rami (two apical, one sub-apical, two median and one sub-median). **Pedipalps**: reddish brown; trochanter L/W 1.67; femur L/W 2.59; patella L/W 2.26; chelal hand with normal shape and relatively stout (Figs 10-11); chela (with pedicel) L/W 2.78; chela (without pedicel) L/W 2.49; hand (with pedicel) L/W 1.53; movable finger shorter than hand with pedicel; hand 1.11 times longer than movable finger; fixed finger with 40 and movable finger with 41 cusped teeth; cusped teeth continued to base of fixed finger; movable finger with 7 internal and 2 external accessory teeth, and fixed finger with 8 external and 4 internal accessory teeth; prolateral face of fingers with a few sense spots; nodus ramosus situated at same level as st. **Legs**: brown; coxal setae not counted; tibia I L/D 4.22; tarsus I L/D 6.83; femur IV L/D 1.75; patella IV L/D 2.82; tibia IV L/D 5.27; tarsus IV with a long tactile seta setuited distally (TS = 0.73), retrolateral margin with a very small bulge situated in basally, L/D 6.00.

Dimensions in mm: **Carapace**: 0.89/0.70. **Pedipalp**: trochanter 0.45/0.27; femur 0.75/0.29; patella 0.70/0.31; chela (with pedicel) 1.25/0.45; chela (without pedicel) 1.12; hand (with pedicel) L.0.69; movable finger L. 0.62. **Leg I**: femur 0.25/0.16; patella 0.39/0.13; tibia 0.38/0.09; tarsus 0.41/0.06. **Leg IV**: femur 0.28/0.16; patella 0.48/0.17; Femur + patella 0.70/0.17; tibia 0.58/0.11; tarsus 0.48/0.08.

6. Remarks
It is worthy to mention that the cheliceral rallum of **Dinocheirus panzeri** (C.L. Koch) reported from the Europe was described with three blades by Beier [1], while it contains four blades in the newly collected specimens from Iran. The granulation pattern of the pedipalpal chela is the other observable difference between the last examined specimens, e.g. the prolateral face of the chelal hand is granulated in the materials from the Caucasus, Azerbaijan and Georgia (judging from Schawaller and Dashdamirov [17]). Fig. 69; Dashdamirov and Schawaller [1], Fig. 10A), but it is smooth in the newly collected specimens from Iran. The morphometric characters, the trichobothriotaxy, the pedipalpal shape, the cheliceral chaetotaxy and also the figure of the female spermathecae have no significant differences in the specimens which have been described or illustrated until yet (e.g. 1, 2, 7, 15, 17).

A sexual dimorphism can be apparently observed in **D. panzeri**, e.g. the pedipalpal size and proportions (chela (with pedicel) is 2.78x longer than breadth in the female from Iran, while it is 2.31-2.43x longer than breadth in the males from Iran), and also the form of chela (chela has a distinct protuberance in the males). Noticeably, these sexual differences were associated with their different modes of life by Muchmore [16].

Additionally, **D. panzeri** was previously reported from Chalus-Mazandaran Province and Nav’s valley-Guilan Province-northern Iran by Beier [1] and Mahnert [14] and in this present study, it is reported for the first time from Eastern Azerbaijain Province. The species **D. panzeri** can be found in common habitats of pseudoscorpions e.g. in litter and tree bark [e.g. 7] and also in rotten elm [12]. During the recent collections of pseudoscorpions in western north of Iran, it is collected from soil and litters.

7. Conflict of interest statement
The authors declare that they have no competing interests and have not a financial relationship with the organization that sponsored the research.

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9. References
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