

A new Amphinemura from Central Maghreb (Algeria, Tunisia) : *A. berthelemyi* sp. n. (Plecoptera : Nemouridae)

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A new *Amphinemura* from Central Maghreb (Algeria, Tunisia):
A. berthelemyi sp. n. (Plecoptera: Nemouridae)

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Amphinemura berthelemyi sp. n., endemic of the Central Maghreb (western Tunisia and eastern Algeria) is described and compared with its closest relative *A. chiffensis* Aubert, 1956, in both adult and larval stages. All previous records of *A. chiffensis* in Central Maghreb correspond to *A. berthelemyi* sp. n. *A. chiffensis* occurs only in the Moroccan High Atlas. A distribution map is given.

Keywords: *Amphinemura*, *A. chiffensis*, *A. berthelemyi*, new taxon, systematics, taxonomy, zoogeography, Algeria, Tunisia.

INTRODUCTION

Between 1968 and 1971, an intensive study of Tunisian stoneflies was carried out by our late colleague Professor Claude Berthélemy who published his work in a preliminary paper (Berthélemy 1973), but never finished the species descriptions before he died. Among the seven new species mentioned by Berthélemy, six were described afterwards by different authors: *Leuctra tunisica* (Pardo & Zwick 1993), *L. khroumiriensis*, *L. medjerdensis* and *L. sartorii* (Vinçon & Pardo 1998), *Protonemura drahamensis* (Vinçon & Pardo 2006) and *P. algirica bejaiana* (Vinçon & Murányi 2009) (Vinçon & Pardo 1998, 2006; Vinçon & Murányi 2009). The seventh one, *Amphinemura berthelemyi* sp. n., is described here and compared with *A. chiffensis* Aubert, 1956. The previous records of *A. chiffensis* in Tunisia (Béjaoui *et al.* 2003; Béjaoui & Boumaïza 2004) are assigned to *A. berthelemyi* sp. n.

Intensive investigations in eastern Algeria in 2011 close to the Tunisian border (Yasri & Lounaci, unpublished data) followed by complementary studies in 2012 covering eastern and central Algeria and by the revision of the Maghrebin *Amphinemura* specimens stored in the collections of Aubert and Tierno de Figueroa have improved the knowledge of the distributions of *A. berthelemyi* sp. n. and *A. chiffensis*.

MATERIAL AND METHODS

The material is preserved in alcohol. Type specimens are deposited in the Zoological Museum of Lausanne, Switzerland (ZML). Other specimens are held by Yasri (YAS), Boumerdes, Algeria and Vinçon (VIN), Grenoble, France. TDF = Tierno de Figueroa collection. AUB = Aubert collection in the Zoological Museum of Lausanne, Switzerland. BER = Berthélemy collection in Vinçon collection. The

Berthélemy collection is stored in the Museum of Toulouse, except several specimens that are kept in the Vinçon collection. The terminology of the terminalia follows Baumann (1975).

Amphinemura chiffensis Aubert, 1956

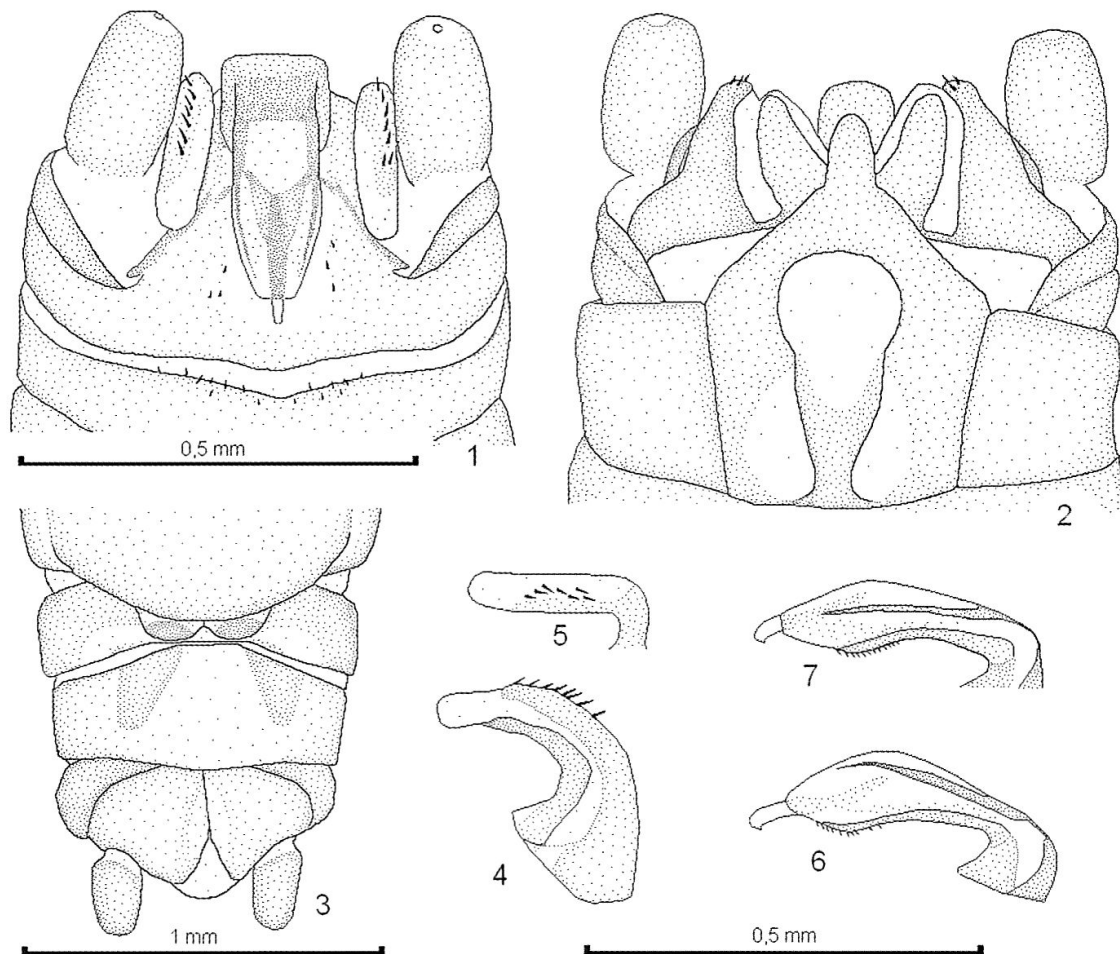
(Figs 1–11)

Amphinemura chiffensis Aubert, 1956 (partim): p. 428 (only the records from the Moroccan High Atlas).

Material: **Morocco**, High Atlas: M’Goun Massif, spring of Asif M’Goun, 2500 m a.s.l., 17.06.1954, 2 ♂♂, 1 ♀ (labelled paratypes) (Vaillant leg, AUB); Oukaïmeden Massif, above the Oukaïmeden ski station, 2600 m, brook, 28.06.1960, 1 ♂, 1 ♀ (AUB); above Oukaïmeden, 2620 m, brook, 3.06.2006, 3 ♀♀ + 1 larva (VIN); above Oukaïmeden, 2800 m, spring, 3.06.2006, 1 ♂ (VIN). Tizi-n-Tichka Pass, 10.04.1997, 1 ♂, 1 ♀ (Luzón-Ortega leg., TDF); Tichka, 1350 m, 30.03.1988, 1 ♀ (Sánchez-Ortega leg., TDF). Aguelmous, n° 14, 3.06.1985, 1 ♀ (Bouzidi leg, BER). Tiferguine, Oukaïmeden tributary, April 1984, 1 ♂, 1 ♀ (BER).

Male genitalia: Paraprocts: Inner lobe long and cylindrical, with wide base partly covered by apex of hypoproct, then narrowing towards rounded tip (Fig. 2). Median lobe sub-triangular, extending in a narrow finger shaped expansion with a median row of 7 to 8 strong spines; lobe bending dorsally near mid-length and ending in rounded bald tip (Figs 1, 4, 5). Outer lobe narrow, long, strongly bent dorsally, and nearly parallel to outer side of median lobe (Fig. 4). Cercus sub-cylindrical, about twice longer than wide, covered with long thin hairs. Epiproct elongate with median widening, and narrowing towards tip; dorsal median bulge more or less pronounced in lateral view (Figs 6, 7); in dorsal view, epiproct more or less rectilinear on two first thirds (Fig. 1), then gently narrowing until truncate apex where a thin transparent filament rises. Filament like a hollow tube, not open and slightly hooked at tip. Filament extends inside epiproct, slightly enlarging and becoming less and less visible (Figs 1, 6, 7). Filament length variable perhaps according to contraction of epiproct (Figs 6, 7). Dorsal sclerite narrow, nearly rectilinear and extending from base near to tip of epiproct (Figs 6, 7). Ventral sclerite hardly enlarged, covered with a row of short spines along widest part (Figs 6, 7). Tergite IX with two wide spiny bulges strongly raised upward and separated by a shallow median notch. Other tergites without any spines along outer edge. Sternite IX (Fig. 2): Hypoproct nearly pentagonal, narrowing at tip and projecting between the two paraprocts up to base of epiproct. Ventral vesicle racket-shaped, with membranous globular tip and sclerotized rod.

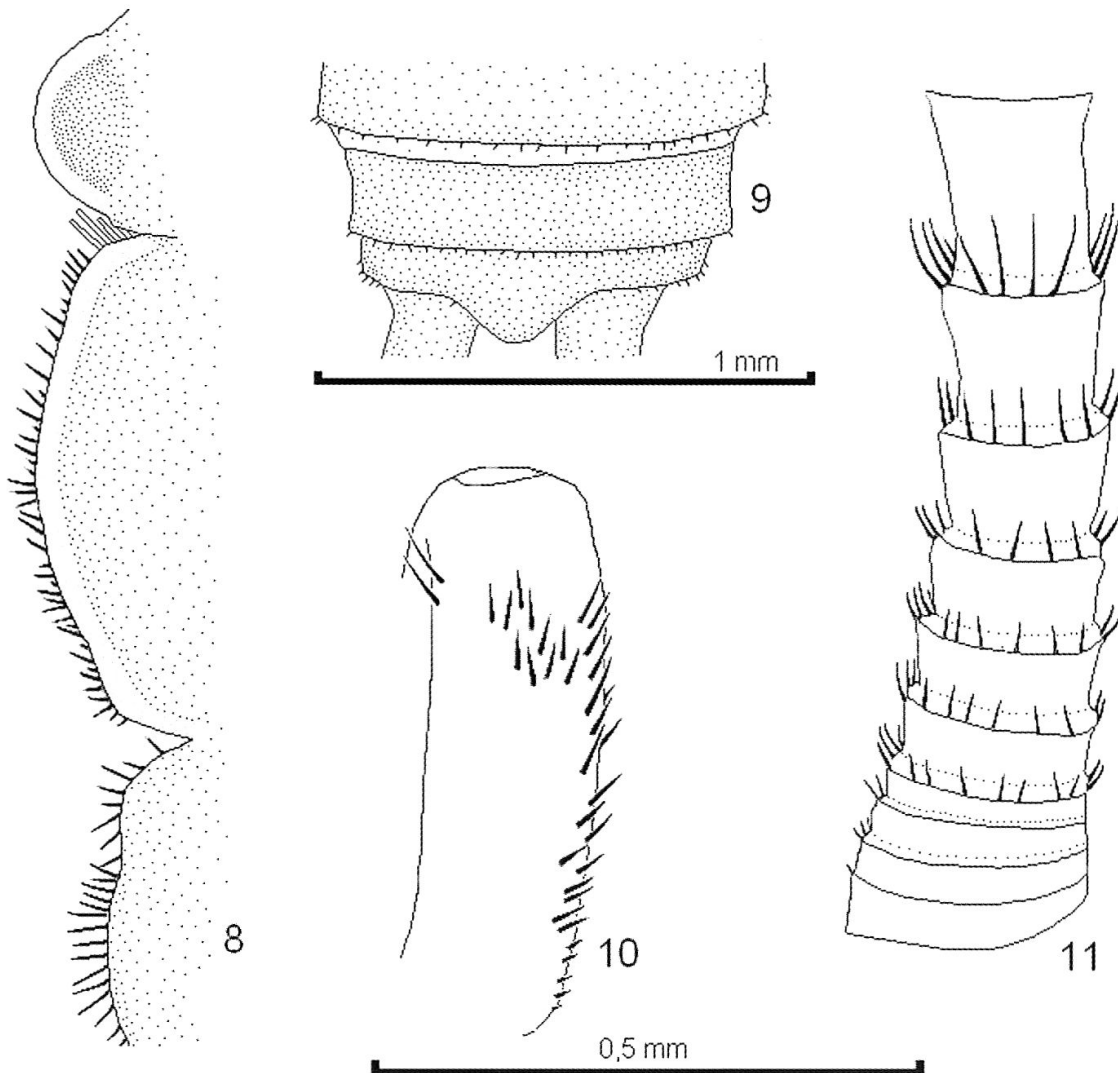
Female genitalia (Fig. 3): Sternite VII: Pregenital plate very wide, nearly extending up to segment edges, projecting backwards, covering more than half the eighth sternite and reaching base of vaginal lobes. Sternite VIII: anterior part of sternite hidden below projection of pregenital plate; two vaginal lobes rounded and separated by a triangular notch medially; membranous field between each lobe and lateral sclerite. Sternite IX with two dark triangular spots close to anterior margin laterally. Paraprocts about triangular with rounded tip. Cercus cylindrical, nearly twice as long as wide and covered with long thin hairs.



Figs 1–7. *A. chiffensis*: — 1: male abdomen in dorsal view; — 2: male abdomen in ventral view; — 3: female abdomen in ventral view; — 4: paraproct in lateral view (outer lobe on the left and median lobe on the right); — 5: median lobe of the paraproct in dorsal view; — 6: epiproct in lateral view from M'Goun; — 7: idem from Oukaïmeden (♂ Figs. 1, 2, 4–7: scale = 0.5 mm, ♀ Fig. 3: scale = 1 mm).

Larva (Figs 8–11) (specimen from Oukaïmeden, 2620 m a.s.l.). Lateral sides of pro- and metanotum with a fringe of strong short setae (Fig. 8). All tergites with a fringe of tiny scattered spines on outer edge (Fig. 9). Anterior femora with a longitudinal row of strong setae on outer edge and a sub-transversal set of strong setae before femora tip; setae less long than half femora's width (Fig. 10). Cercus: segment 9 about as long as wide, segments 5–9 with a crown of strong setae shorter than half segment's length (Fig. 11).

Affinities: *A. chiffensis* sp. n. is related to the European and Turkish *A. standfussi* Ris, 1902, as previously mentioned by Aubert (1956), but is also related to *A. sulcicollis* (Stephens, 1835) occurring in the whole of Europe and its Spanish congeners *A. guadarramensis* (Aubert, 1952) and *A. hibernatarii* Pardo, 1989. Nevertheless, it differs from both species in many details such as the longer length of the cercus, the shape of the epiproct and paraprocts, the two rounded vaginal lobes of the female subgenital plate. It is also closely related to *A. berthelemyi* sp. n., as explained in the following description of this species.



Figs 8–11. *A. chiffensis* larva: — 8: pro and meta-thorax in dorsal view; — 9: tip of the abdomen in dorsal view; — 10: anterior femora in dorsal view; — 11: first segments of the cercus (Fig. 9: scale = 1 mm, Figs. 8, 10, 11: scale = 0.5 mm).

Geographical distribution: *A. chiffensis* is a High-Atlas micro-endemic species (Fig. 12). The previous records from the Algerian Tell Atlas Djurdjura and near Blida (Aubert 1956; Lounaci & Vinçon 2005) and those from Tunisia (Béjaoui *et al.* 2003; Béjaoui & Boumaïza 2004), belong to *A. berthelemyi* sp. n. Moreover, the records of *A. chiffensis* in the Moroccan Rif (Aubert 1961; Bouzidi 1989; Sánchez-Ortega & Azzouz 1998; Lounaci & Vinçon 2005; Errochdi & El Alami 2008) are assigned to a further new species (not yet published). The occurrence of *A. chiffensis* in the Middle-Atlas is doubtful since it is not mentioned in the main contributions concerning this mountain range (Dakki 1986, 1987).

Ecology: According to previous records from the High Atlas (Aubert 1956, 1961; Miron 1972; Pihan & Mohati 1983; Bouzidi 1989) and from our own investigations, *A. chiffensis* is a strongly crenophilic and orophilic species mainly occurring in springs, brooks and small rivers, between 2500–2800 m a.s.l. Nevertheless,



Fig. 12. Distribution map of *A. chiffensis* and *A. berthelemyi* sp. n.

it can also occur exceptionally in lower reaches (Tichka, 1350 m a.s.l.). Its presence could be linked with *Ranunculus* and plant detritus on rough sandy substrates (Bouzidi 1989).

***Amphinemura berthelemyi* Vinçon, Yasri & Lounaci sp. n.**

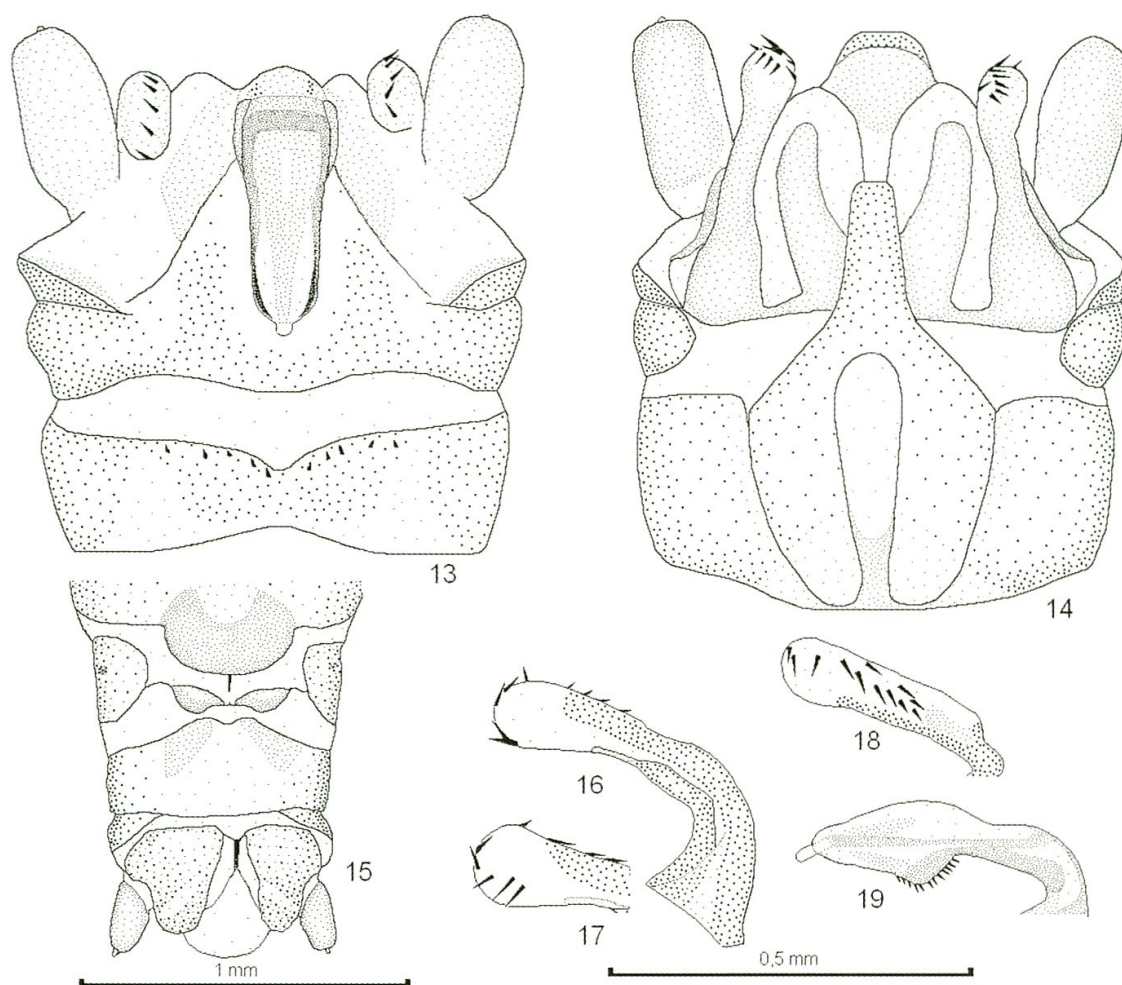
(Figs 13–23)

Amphinemura sp. nov. Berthélemy 1973

Amphinemura sp. 1: Lounaci & Vinçon 2005: p. 117 (records from Tunisia)

Amphinemura chiffensis auctt., nec Aubert 1956: Aubert 1956 (partim): p. 428 (records from the Algerian Chiffa Valley near Blida); Béjaoui *et al* 2003; Béjaoui & Boumaïza 2004; Lounaci & Vinçon 2005: p. 117 (records from Algeria).

Types: **Holotype** male: **ALGERIA**, El Kala, Algerian slope of the Khroumir Mountains, 180 m a.s.l., 24.03.2012 and 3 ♂♂, 2 ♀♀ paratypes, same locality, 03.03.2012, deposited in the Museum of Zoology, Lausanne, Switzerland (ZML). Other material: El Kala: Oued Haddada, brook flowing from Djebel Haddada (Haddada village), 180 m, 03.03.2012, 1 ♂ (VIN); 24.03.2012, 3 ♂♂, 2 ♀; Oued Dar Essalem, other brook flowing from Djebel Haddada (Haddada village), 190 m, 23.04.2011, 3 ♂♂, 1 ♀ (VIN); 03.03.2012, 2 ♂♂, 1 ♀; 24.03.2012, 4 ♂♂, 8 ♀♀; 02.05.2012, 5 ♂♂, 17 ♀♀ (YAS); Small Kabylia, above Aokas, above Tizi n’Berber Pass, second brook left side of road W16, 900 m, 18.04.2012, 1 ♂, 2 ♀♀ (VIN); Large Kabylia, between the Tagma Pass and Kebouche Adekar, below Djebel Toukra, 1000 m, 17.04.2012, 1 ♂ (VIN); N.E. Tizi Ouzou, Djurdjura, Illilten, 1010 m, 11.05.2009, 1 ♂ nymph; Ath Zikki, 1050 m, 15.05.2009, 1 ♂ nymph (Haouchine & Lounaci leg.); Tell Atlas, near Blida, Chiffa Valley, Ruisseau des Singes brook, 23.03.1953, 4 ♂♂, 1 ♀ (Vaillant leg, AUB); Chiffa Valley, oued Chiffa before the junction with the Ruisseau des Singes brook, 270 m, 28.03.2012, 1 ♂ (YAS). **TUNISIA**, Aïn Drahem: Oued ed Demène, near Ben Metir dam, 450 m, 1 larva, 9.01.1970; 1 ♂, 19.04.1970; 1 ♂, 2 ♀♀, 9.05.1970 (BER); Oued el Lil trib., 1 km from «Vent»

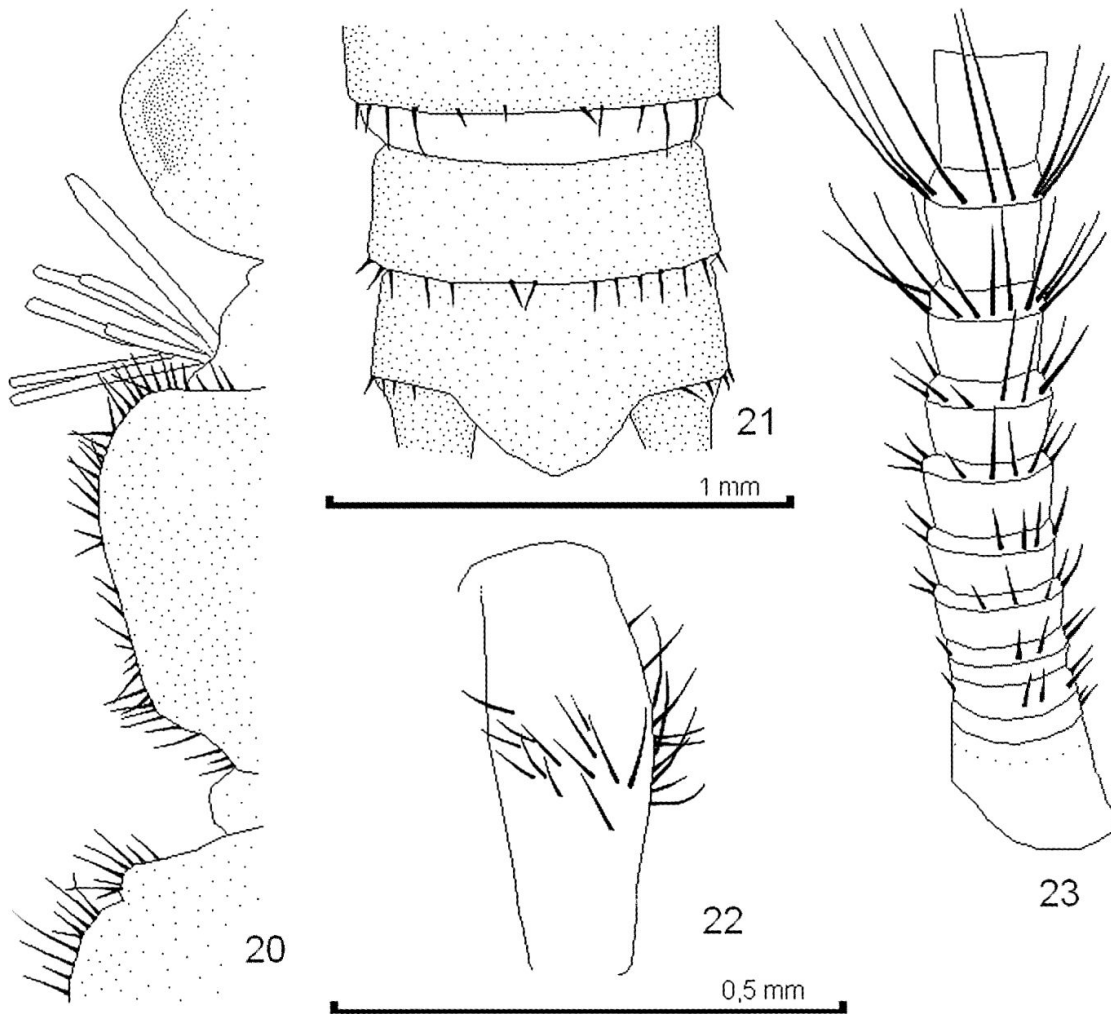


Figs 13–19. *A. berthelemyi* sp. n.: — 13: male abdomen in dorsal view; — 14: male abdomen in ventral view; — 15: female abdomen in ventral view; — 16: paraproct in lateral view (outer lobe on the left and median lobe on the right); — 17: paraproct in lateral view (specimen from Aokas); — 18: median lobe of the paraproct in dorsal view; — 19: epiproct in lateral view (♂ Figs. 13, 14, 16–19: scale = 0.5 mm, ♀ Fig. 15: scale = 1 mm).

pass, above Ben Metir dam, 750 m, 1 exuvia, 19.04.1969 (BER). Oued el Lebga, Oued el Lil trib., above Ben Metir dam, 450 m, 19.04.1970, 6 larvae; 9.05.1970, 1 ♂, 2 ♀♀, 3 larvae (BER).

Description: Medium sized species: body length: male 5.3–7.2 mm, female 7.2–8.5 mm. Macropterous, wing length: male 6.7–7.5 mm, female 7.3–8.7 mm. General colour light brown. Head light brown slightly darker on anterior part, in front of ocellae. Antennae blackish, covered with thin hairs and with an apical crown of bristles on each antennal segment. Pronotum brown with dark pattern. Legs whitish, with dark longitudinal strips, covered with thin hairs. Body covered with short thin hairs.

Male genitalia: Paraprocts: Inner lobe long, cylindrical, slightly curved inward, narrowing towards tip (Fig. 14). Median lobe with rounded base (Fig. 14), with a finger shaped expansion that bends dorsally along internal side of cercus (Fig. 13, 14); dorsal extension enlarged towards tip (Figs 16, 17), covered with thin hairs and a first median set of 8–9 strong spines (Fig. 18), followed by a second set of



Figs 20–23. *A. berthelémy* sp. n. larva: — 20: pro and meta-thorax in dorsal view; — 21: tip of the abdomen in dorsal view; — 22: anterior femora in dorsal view; — 23: first segments of the cercus (Fig. 21: scale = 1 mm, Figs. 20, 22, 23: scale = 0.5 mm).

5–6 strong spines placed around tip of lobe (Figs 13, 14, 16, 17). Outer lobe long, strongly bent dorsally, closely connected to outer side of median lobe, narrowing apically (Fig. 16). Cercus sub-cylindrical, about twice as long as wide, covered with long thin hairs. Epiproct elongate, with conspicuous dorso-medial bulge and rounded apex in lateral view (Fig. 19); in dorsal view enlarged in first third, and then slightly narrowing towards truncate apex (Fig. 13). Transparent filament short, bent downwards, apparently not open at tip, extending inside epiproct and getting less and less visible (Figs 13, 19). Dorsal sclerite of epiproct nearly rectilinear, extending from base near to tip of epiproct (Fig. 19). Ventral sclerite strongly bulged and covered with a row of spines along bulgy part; bulge placed near mid-length of epiproct (Fig. 19). Tergite IX with two wide bulges of spines strongly raised upward and separated by a shallow median notch. Other tergites without any spines along outer edge. Sternite IX: Hypoproct nearly pentagonal, ending in finger shaped expansion reaching base of epiproct. Ventral vesicle racket-shaped and membranous except sclerotized rod; vesicle slightly widened toward tip (Fig. 14).

Female genitalia (Fig. 15): Sternite VII: Pregenital plate rounded, covering near half segment's width, projecting backward on eighth sternite but not reaching base of vaginal lobes. Sternite VIII: two rounded vaginal lobes separated medially by a shallow membranous field and from lateral sclerites by another membranous field less wide than width of one lobe. Posteriorly, each lobe with rounded outer edge and rectilinear inner edge (Fig. 15). Sternite IX with two dark triangular spots near anterior margin, laterally. Paraprocts more or less triangular with rounded tip. Cercus cylindrical, nearly twice as long as wide and covered with long thin hairs.

Larva (Figs 20–23). A previous detailed description is given by Béjaoui & Boumaïza (2004) (sub nom. *A. chiffensis*). Lateral sides of pronotum and metanotum with a fringe of strong setae (Fig. 20). All tergites with strong spines on outer edge (Fig. 21). Anterior femora with a sub-transversal set of setae in half distal part of femora; some setae longer than half femora's width (Fig. 22). Cercus: segment 9 about as long as wide, segments 8–9 with a crown of strong setae, some of them much longer than segment's length (Fig. 23).

Affinities: *A. berthelemyi* sp. n. is related to *A. chiffensis* from which it differs, in the male imago, by the median lobe of the paraprocts enlarging in its distal part and carrying a set of strong apical setae (Figs 16–18); in *A. chiffensis* the median lobe is not enlarged and bald at the tip (Figs 4, 5). The spiny bulge of the epiproct is clearly prominent in *A. berthelemyi* sp. n. instead of being hardly pronounced in *A. chiffensis* (Figs 6, 7, 19). The female pre-genital plate of sternite 7 is much wider in *A. chiffensis* (Figs 3, 15); subgenital plate vaginal lobes clearly separated by a shallow notch in *A. berthelemyi* sp. n. (Fig. 15), while closely connected in *A. chiffensis* (Fig. 3). Larvae pilosity much stronger in *A. berthelemyi* (Fig 20–23) than in *A. chiffensis* (Figs 8–11).

Geographical distribution and ecology: *A. berthelemyi* sp. n. has a wide distribution area extending from the Tunisian Khroumiry up to the Algerian Tell Atlas near Blida (Fig. 12). It occurs in brooks and torrents between 200–1000 m a.s.l. and emerges in spring (III–V).

Etymology. This species is dedicated to the late Professor Claude Berthélemy who was the first to collect and recognize this new species (Berthélemy 1973).

RÉSUMÉ

Amphinemura berthelemyi sp. n., endémique du Maghreb central (ouest de la Tunisie et est de l'Algérie), est décrite et comparée à l'espèce la plus proche *A. chiffensis* Aubert, 1956 aux stades imaginal et larvaire. Toutes les citations d'*A. chiffensis* dans la partie centrale du Maghreb correspondent à *A. berthelemyi* sp. n. *A. chiffensis* n'est présente que dans le Haut-Atlas Marocain. Une carte de distribution est présentée.

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