New species of the genus Diarthrodes Thomson, 1882 (Copepoda : Harpacticoida : Thalestridae) from Vietnam and North-Western Mexico

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3 authors:

Samuel Gomez
Universidad Nacional Autónoma de México

Elena Chertoprud
Lomonosov Moscow State University

Francisco Neptalí Morales-Serna
Universidad Nacional Autónoma de México

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New species of the genus *Diarthrodes* Thomson, 1882 (Copepoda: Harpacticoida: Thalestridae) from Vietnam and North-western Mexico

Samuel GÓMEZ[1], Elena S. CHERTOPRUD[2] and Francisco Neptalí MORALES-SERNA[1]
(1) *Unidad Académica Mazatlán, Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México, Joel Montes Camarena s/n, Mazatlán, 82040, Sinaloa, México; fax: (52)669 982-61-33.*
E-mail: samuelgomez@ola.icmyl.unam.mx; neptali@ola.icmyl.unam.mx
(2) *Department of Hydrobiology, Biology Faculty, Moscow State University, Moscow 119899, Russia.*
E-mail: horsax@yandex.ru

Abstract: Some specimens of the family Thalestridae (Copepoda: Harpacticoida) were gathered from sediment samples taken in the framework of two short term studies about the effects of organic enrichment on the diversity of benthic copepods from two brackish coastal systems in central (Ensenada del Pabellón lagoon) and southern (Urías system) Sinaloa during the early 1990's and during 2005. Also some specimens of the same family were found in sediment samples taken in year 2004 during a study about the distribution and biogeography of harpacticoid copepods from Southern Vietnam. The specimens collected turned out to belong to five new species of *Diarthrodes*: *D. imitator* sp. nov., *D. tripartitus* sp. nov., *D. hexasetosus* sp. nov., *D. nhatrangensis* sp. nov. and *D. savinkinii* sp. nov. Seven species groups (I (1-2-2), II (1-2-3), III (2-1-3), IV (3-1-3), V (2-2-3), VI (3-2-2), VII (3-2-3)) are herein defined based on the number of segments of the exopod of the antenna, and on the number of segments of the exopod and endopod of the first swimming leg. Another new species attributed to group I (1-2-2), *Diarthrodes apostolovii* sp. nov., is created based on previous illustrations of *D. assimilis* from the Black Sea.

Résumé : *Nouvelles espèces du genre* Diarthrodes *Thomson, 1882 (Copepoda : Harpacticoida : Thalestridae) du Vietnam et du nord-ouest du Mexique.* Quelques spécimens de la famille Thalestridae (Copepoda : Harpacticoida) ont été recueillis des échantillons de sédiment prélevés lors de deux études sur les effets de l'enrichissement en matière organique sur la diversité des copépodes benthiques de deux systèmes côtiers saumâtres dans la partie centrale (lagune Ensenada del Pabellón) et méridionale (système Urías) de Sinaloa pendant le début des années 90 et en 2005. En outre, quelques spécimens de la même famille ont été trouvés dans des échantillons de sédiment prélevés en 2004 au cours d'une étude sur la distribution et la biogéographie des copépodes harpacticoides du Vietnam méridional. Les spécimens rassemblés se sont avérés appartenir à cinq nouvelles espèces de *Diarthrodes* : *D. imitator* sp. nov., *D. tripartitus* sp. nov., *D. hexasetosus* sp. nov., *D. nhatrangensis* sp. nov. et *D. savinkinii* sp. nov. Sept groupes d'espèces (I (1-2-2), II (1-2-3), III (2-1-3), IV (3-1-3), V (2-2-3), VI (3-2-2), VII (3-2-3)) sont définis sur la base du nombre de segments de l'exopode de l'antenne, et sur le nombre des segments de l'exopode et de l'endopode de la première patte. Une autre nouvelle espèce attribuée au groupe I (1-2-2), *Diarthrodes apostolovii* sp. nov., est créée en se fondant sur les illustrations précédentes de *D. assimilis* de la Mer Noire.

Keywords: Harpacticoida ● Thalestridae ● *Diarthrodes* ● New species ● Mexico ● Vietnam

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Introduction

Dana (1855) created the genus *Westwoodia* Dana, 1855 to accommodate *Arpacticus nobilis* Baird, 1845 (= *Diarthrodes nobilis* (Baird, 1845)). Some years later, Claus (1863) allocated this genus into the family Harpactidae Claus, 1863, along with eleven other genera and Boeck (1865) presented a system in which he divided the family Harpactidae into eight sections (Longipedina, Amyonea, Tachidina, Westwoodina, Harpacticina, Ameirina, Porcellidina and Setellina), the section Westwoodina being composed of two genera, *Idya* Philippi, 1843 (= *Tisbe* Lilljeborg, 1853 (Lang, 1948) and *Westwoodia*. Claus' (1863) and Boeck's (1865) systems are quite similar, but differ in that the former attributed the genera *Porcellidium* Claus, 1860 (= *Mucrorostrum* Harris & Iwasaki, 1997 (Walker-Smith, 2001)), *Zaus* Goodsir, 1845, *Alteutha* Baird, 1845, *Eupelte* Claus, 1860 and *Oniscidium* Claus, 1860 (=*Peltidium* Philippi, 1839 (Lang, 1948)) to the family Peltididae, whilst Boeck (1865) included the genera *Zaus* and *Alteutha* in his section Harpacticina, and the genus *Porcellidium* (= *Mucrorostrum*) in the section Porcellidina, both within the family Harpactidae. In his monograph, Brady (1880) followed the systems proposed by Claus (1863) and Boeck (1865) to set the limits of the family, except for including, as in Brady (1880), Claus' (1863) Peltididae amongst the Harpacticidae, the latter being composed of seven genera: *Harpacticus* Milne-Edwards, 1840, *Thalestris* Claus, 1863, *Dactylopus* Claus, 1863 (for a complete list of synonyms see Lang (1948)), *Peltidium* Philippi, 1839, *Westwoodia*, *Ilyiopsyllus* Brady & Robertson 1873 (= *Metis* Sars, 1910) (Lang, 1948), and *Zaus*.

Thomson (1882), following the system proposed by Brady (1880), attributed his genus *Diarthrodes* Thomson, 1882, with its only species, *D. novae-zealandiae* Thomson, 1882, found among kelp in Otago Harbour, New Zealand, to the subfamily Canthocamptineae Brady, 1878 within the family Harpacticidae.

Scott (1894) described the genus *Pseudowestwoodia* T. Scott, 1894, and one year later T. & A. Scott (1895) suggested that *Pseudowestwoodia* and *Pseudothalestris* were identical.

Sharpe (1910) noted that the name *Westwoodia* was preoccupied in Hymenoptera and suggested the name *Parawestwoodia*.

In his monograph, Sars (1903-1911 & 1919-1921) divided the Harpacticoida into the Achirota and the Chirognatha, the latter being composed of the families Harpacticidae Sars, 1904, Peltidiidae Sars, 1904, Tegastidae Sars, 1904, Porcellidiidae Sars, 1904, Idyidae Sars, 1905 (= *Tisbidae* Stebbing, 1910 (Lang, 1948)), Thalestridae Sars, 1905, Diosaccidae Sars, 1906, Canthocamptidae Sars, 1906, Laophontidae T. Scott, 1905, Cletodidae T. Scott, 1905, Anchorabolidae Sars, 1909 (= Ancorabolidae Sars, 1909), Cylindropsyllidae Sars, 1909 (= Cylindropsyllinae Sars, 1909 of the family Canthocamptidae (Martínez-Arbizu & Moura, 1994), Tachidiidae Sars, 1909, Metidae Sars, 1910 and Balaenophilidae Sars, 1910. Sars (1903-1911 & 1919-1921) also united the genera *Pseudothalestris* Brady, 1883 and *Pseudowestwoodia* T. Scott, 1908 with *Westwoodia* (probably unaware of Sharpe's (1910) contribution) and attributed the latter genus to the Thalestridae.

Monard (1927) also unaware of Sharpe's (1910) paper, suggested that the three genera that were united by Sars (1903-1911 & 1919-1921) to define the genus *Westwoodia* (*Pseudothalestris*, *Pseudowestwoodia* and *Westwoodia*) should bear the character of subgenera, followed Sars's system when recognizing the position of *Westwoodia* within the Thalestridae which, at that time was composed of 23 genera, and also noted the close resemblance between *Diarthrodes* and *Pseudothalestris* Brady, 1883. Lang (1936) formally and definitely equated the genera *Arpacticus* Baird, 1845, *Westwoodia*, *Pseudothalestris*, *Pseudowestwoodia* and *Parawestwoodia* with *Diarthrodes*, and allocated the genus in the subfamily Dactylopusiinae Lang, 1936 (correction of Dactylopodiinae for Dactylopusiinae, ICZN 0.1356) within the Thalestridae, and latter in his monograph, he (Lang, 1948) allocated the family in the suprafamily Thalestridimorpha Lang, 1948 within the subsection Podogennonta Lang, 1948. Even though Lang's (1936 & 1948) diagnoses are rather indeterminate and vague (Willen, 2000) his system had been followed until recently when Willen (2000) removed the subfamily Dactylopusiinae from the Thalestridae and raised it to the family level as Dactylopusiidae Lang, 1936 Willen's (2000) course of action was based on the monophyletic status of the Dactylopusiinae as suggested by the autapomorphic shape of P1, the male P2Enp, the praecoxa of the maxillule, the loss of one seta on P4Enp3 and the shape of the praecoxal endite of the maxilla (Willen, 2000). More recently, Boxshall & Halsey (2004) decided to keep Lang's (1936 & 1948) system regarding the acceptance and use of Lang's (1936 & 1948) subfamily Dactylopusiinae and to reject Willen's (2000) system and use of the Dactylopusiidae as a separate family within the Thalestridimorpha. Unfortunately, Boxshall & Halsey (2004) did not justify their decision and Willen's (2000) system is herein adopted.

A number of harpacticoid copepods of the genus *Diarthodes* Thomson, 1882 were found during the course of two short-term studies in a coastal system in central and southern Sinaloa State (Mexico) and in samples taken from Southern Vietnam. The Mexican specimens turned out to be representatives of three new species *D. imitator* sp. nov., *D. tripartitus* sp. nov. and *D. hexasetosus* sp. nov., whereas the material from Vietnam turned out to be representatives of two new species *D. savinkinii* sp. nov. and *D. nhatrangensis* sp. nov.

Currently, 42 species have been recognized within the genus *Diarthrodes* (for a complete list see below). Unfortunately the mouthparts of some species have received little attention thus making difficult further comparisons and phylogenetic analyses. Based on the descriptions and illustrations available, seven species groups (I (1-2-2), II (1-2-3), III (2-1-3), IV (3-1-3), V (2-2-3), VI (3-2-2), VII (3-2-3)) are proposed. These groups are based on the number of segments of the exopod of the antenna, and on the number of segments of the exopod and endopod of the first swimming leg. Such species groups might not reflect phylogeny but are useful for species separation. Also, some brief notes on the possible relationships of the species herein described are presented.

Materials and methods

Sediment samples for meiofauna analyses were taken during sampling campaigns in two brackish systems in central (Ensenada del Pabellón lagoon) and southern (Urías system) Sinaloa during the early 1990's (see Gómez Noguera & Hendrickx, 1997) and during 2005 (unpublished data), respectively. Sediment samples were sieved through 500 µm and 40 µm sieves and benthic copepods were separated from the rest of the meiofauna with a stereo-microscope at 40X magnification. Specimens were stored in 70% ethanol prior to further investigation. Additional sediment samples were taken from the upper sublittoral zone of the Kai River (Nha-Trang Bay, Southern Vietnam) using hand-held plastic corers. These samples were fixed with 4% formalin and copepods were separated by flotation and sieved through 70 µm sieves. Observations and drawings at a magnification of 1000X were made from whole and dissected specimens mounted in lactophenol with a Leica compound microscope equipped with phase contrast and a drawing tube. The type material was deposited in the Copepoda collection of the Instituto de Ciencias del Mar y Limnología, Mazatlán Marine Station (Mexico). The terminology proposed by Huys & Boxshall (1991) for the general description was adopted. Abbreviations used in the text and tables are: P1-P6, first to sixth swimming legs; EXP, exopod; ENP, endopod; P1 (P2-P4) EXP (ENP) 1 (2, 3) denotes the proximal (middle, distal) exopodal (endopodal) segment of P1, P2, P3 or P4; ae, aesthetasc.

Systematics

FAMILY Dactylopusiidae Lang, 1936
Genus *Diarthrodes* Thomson, 1882
Diarthrodes imitator sp. nov.
(Figs 1-6)

Type material

One female holotype (EMUCOP-010591-62) dissected and mounted onto seven slides. Collected in Ensenada del Pabellón lagoon (24º19'-24º35'N, 107º28'-107º45'W) on May 1, 1991; stn. 4 (Gómez-Noguera & Hendrickx, 1997); nitrogen content, 0.027 µmol g^{-1}; carbon content, 1.129 µmol g^{-1}; sediment type, clay (Gómez-Noguera & Hendrickx, 1997). Coll. S. Gómez.

Type locality

Ensenada del Pabellón lagoon, Sinaloa, Mexico (24º19'-24º35'N, 107º28'-107º45'W).

Etymology

The specific name alludes to the strong resemblance to *D. unisetosus* Lang, 1965 and *D. latisetosus* Chislenko, 1978.

Female

Habitus (Fig. 1) fusiform, tapering from posterior margin of cephalothorax to anal somite; maximum width at posterior margin of cephalothorax; total body length measured from tip of rostrum to posterior margin of caudal rami in dorsal view, 324 µm. Rostrum (not illustrated) as in *D. unisetosus* as illustrated by Lang (1965). Prosomites and first to fifth urosomites with plain hyaline frill; dorsal (Fig. 2A) and ventral (Fig. 2B) surface of urosomites plain except for row of spinules along caudal margin of anal segment ventrally. Genital double-somite completely fused dorsally (Fig. 2A) and ventrally (Fig. 2B), and with suture indicating former division laterally as in *D. tripartitus* sp. nov. (see Fig. 7B); genital field as in Fig. 2B; P6 represented by small plate bearing one slender seta. Caudal rami short, about 1.5 times as wide as long, with seven elements (Fig. 2A & B); elements I, II and III situated at the outer distal corner; seta I very long and ventral to element II, the latter transformed into strong spine; seta III slender, longer than and next to element II; setae IV and V normal in shape; seta VI somewhat longer than seta III and situated at inner distal corner; seta VII tri-articulated, situated on top of insertion site of seta VI.

Antennule (Fig. 3A), six-segmented, with aesthetasc on fourth and last segments; surface of first segment with two spinular rows, succeeding segments without spinules. Armature formula, 1-(1), 2-(11), 3-(8), 4-(2+ae), 5-(1), 6-(11 + acrothek). Acrothek consisting of two setae fused

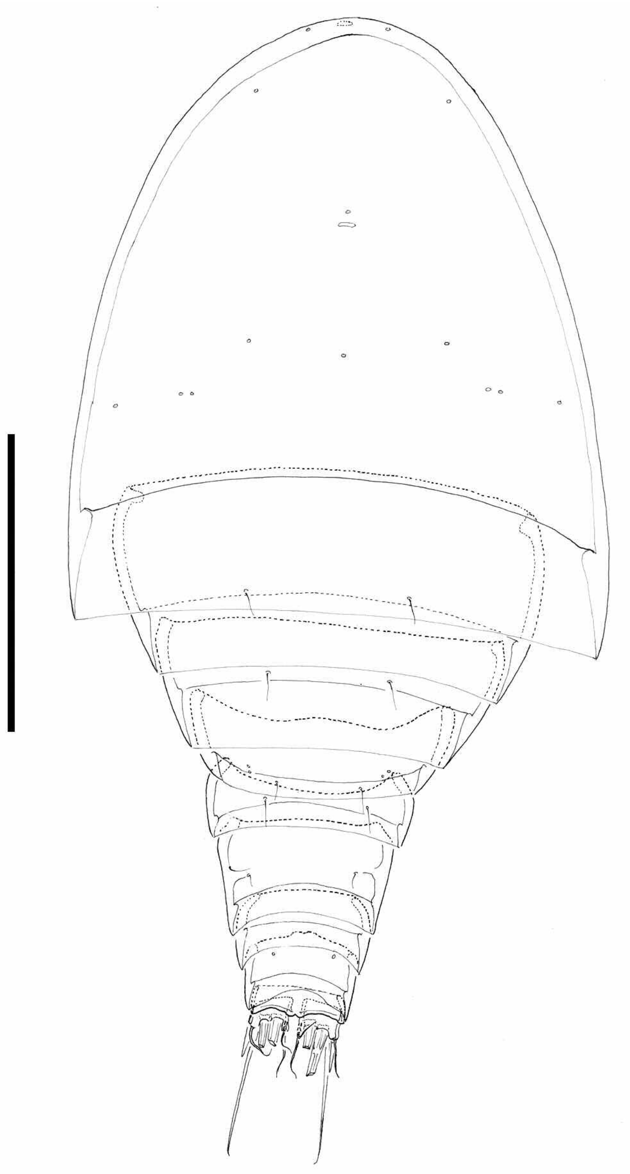


Figure 1. *Diarthrodes imitator* sp. nov. Female. Habitus, dorsal view. Scale bar: 100 µm.

Figure 1. *Diarthrodes imitator* sp. nov. Femelle. Habitus, vue dorsale. Echelle : 100 µm.

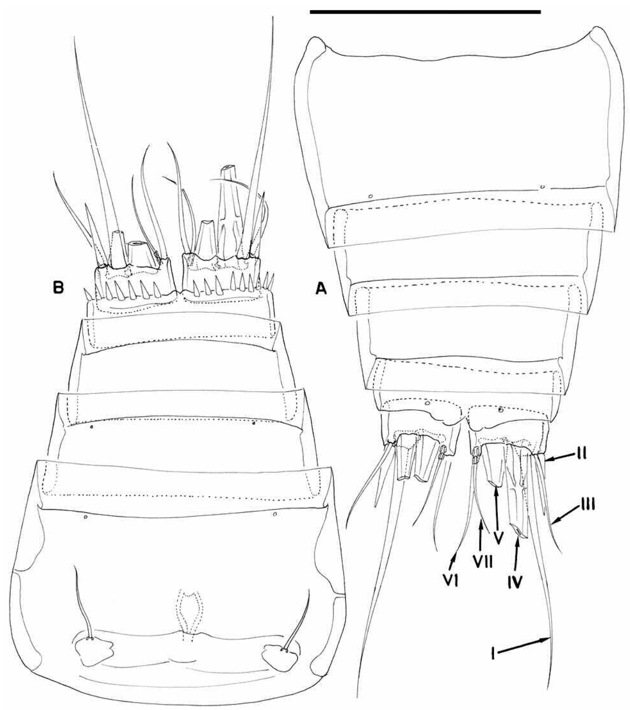


Figure 2. *Diarthrodes imitator* sp. nov. Female. **A.** Urosome, dorsal view, P5 bearing-somite omitted. **B.** Urosome, ventral view, P5 bearing-somite omitted. Scale bar: A, B, 50 µm.

Figure 2. *Diarthrodes imitator* sp. nov. Femelle. **A.** Urosome, vue dorsale, le segment qui porte la P5 a été omis. **B.** Urosome, vue ventrale, le segment qui porte la P5 a été omis. Echelle : A, B, 50 µm.

basally to one aesthetasc.

Antenna (Fig. 4A). Allobasis with trace of division between basis and first endopodal segment, with one abexopodal seta. Exopod one-segmented, with three lateral setae, and one seta and one strong spine apically (Fig. 4B). Free endopodal segment with two lateral spines, distally with one spine, three geniculate setae and one geniculate element fused to slender seta (Fig. 4C).

Mandible with strong gnathobase and unidentate pars incisiva (Fig. 4D). Coxa-basis long and armed with one long seta (Fig. 4E). Exopod and endopod one-segmented; exopod smaller than endopod, with five and six setae respectively (Fig. 4E).

Maxillule (Fig. 3B). Arthrite of praecoxa with two surface setae; distally as figured. Coxa with three, basis with six setae. Endopod and exopod one-segmented, small, with three setae each.

Maxilla (Fig. 4F). Syncoxa with three endites armed with one seta each. Basis produced into strong, serrate claw.

Maxilliped (Fig. 4G). Basis with one proximal and one distal spinular row, with two apical setae. First endopodal segment oval, with one seta halfway of inner margin and one slender apical seta, second endopodal segment with strong claw.

P1 (Fig. 5A). Intercoxal sclerite as in Fig. 5B. Coxa with median row of small spinules, with stronger spinules close to outer distal corner. Basis with inner, transverse spinular row, with spinules at base of inner and outer spines and at base of endopod. Exopod two-segmented, barely reaching

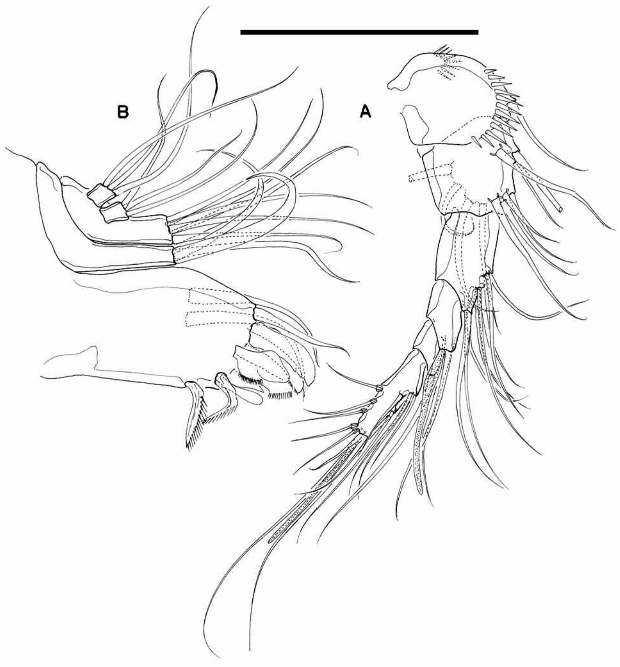


Figure 3. *Diarthrodes imitator* sp. nov. Female. **A.** Antennule. **B.** Maxillule. Scale bar: A, B, 50 µm.

Figure 3. *Diarthrodes imitator* sp. nov. Femelle. **A.** Antennule. **B.** Maxillule. Echelle : A, B, 50 µm.

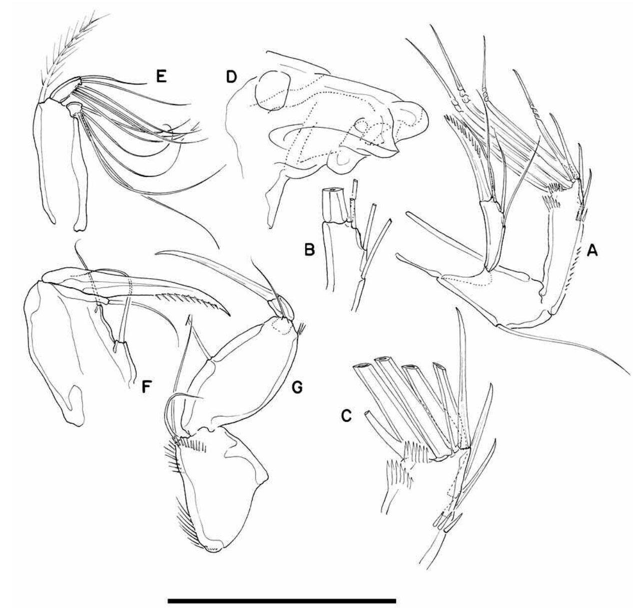


Figure 4. *Diarthrodes imitator* sp. nov. Female. **A.** Antenna. **B.** Distal part of antennary exopode. **C.** Distal part of antennary second endopodal segment. **D.** Mandibular gnathobase. **E.** Mandibular palp. **F.** Maxilla. **G.** Maxilliped. Scale bar: A, D-G, 50 µm; B, C, 25 µm.

Figure 4. *Diarthrodes imitator* sp. nov. Femelle. **A.** Antenne. **B.** Partie distale de l'exopode de l'antenne . **C.** Partie distale du deuxième segment de l'endopode de l'antenne. **D.** Partie distale de la mandibule. **E.** Palpe mandibulaire. **F.** Maxille. **G.** Maxillipède. Echelle : A, D-G, 50 µm ; B, C, 25 µm.

proximal third of first endopodal segment; first segment with one outer spine, second segment with five setae/spines. Endopod three-segmented; first segment about 4.3 times as long as wide, with one seta halfway of inner margin, second segment small, as long as wide, without armature; third segment as large as preceding segment, with one small seta (arrowed in Fig. 5A; the latter is visible only in the left P1, but is absent in right P1) and two spines (outermost smaller).

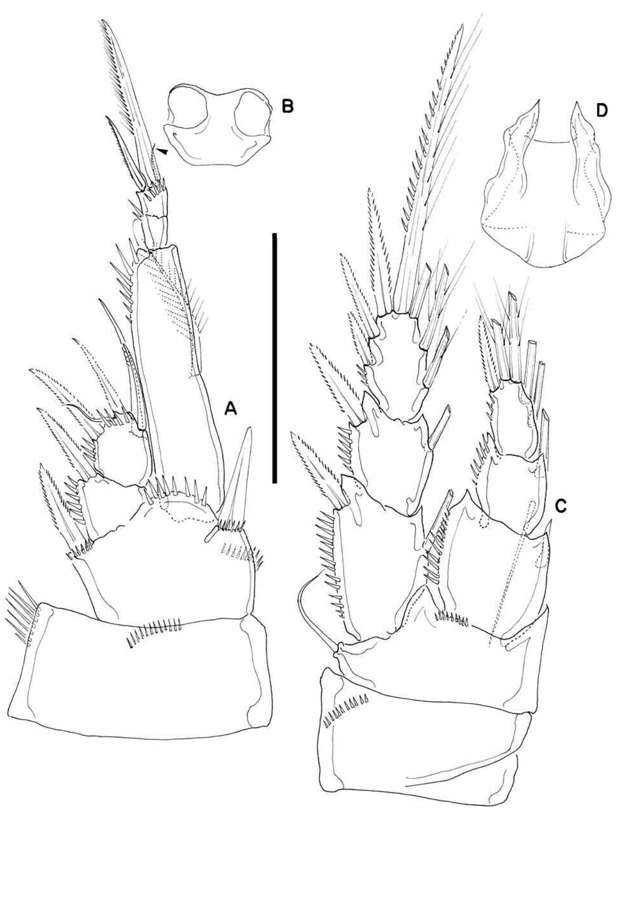


Figure 5. *Diarthrodes imitator* sp. nov. Female. **A.** P1 (small, slender seta arrowed). **B.** Intercoxal sclerite of P1. **C.** P2. **D.** Intercoxal sclerite of P2. Scale bar: A-D, 50 µm.

Figure 5. *Diarthrodes imitator* sp. nov. Femelle. **A.** P1 (petit soie indiquée). **B.** Sclérite intercoxal de P1. **C.** P2. **D.** Sclérite intercoxal de P2. Echelle : A-D, 50 µm.

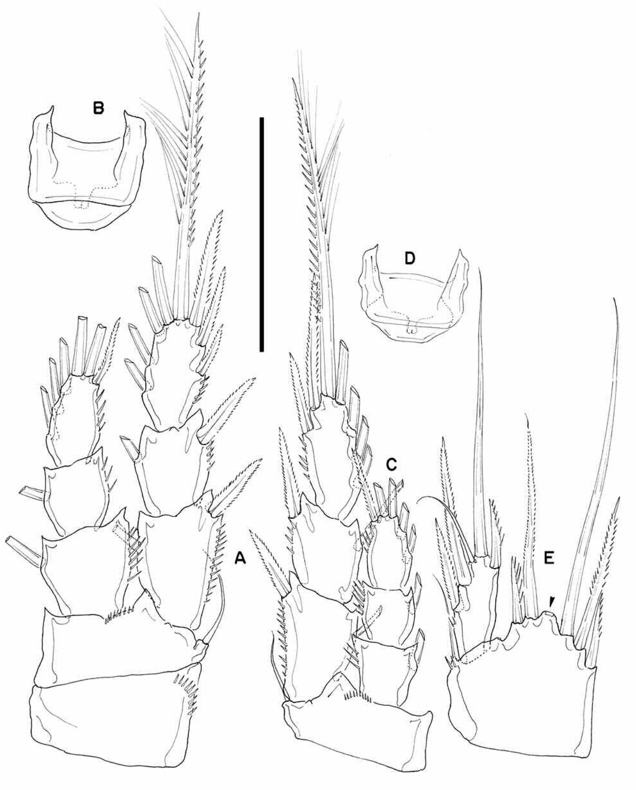


Figure 6. *Diarthrodes imitator* sp. nov. Female. **A.** P3. **B.** Intercoxal sclerite of P3. **C.** P4. **D.** Intercoxal sclerite of P4. **E.** P5 (apical pore arrowed). Scale bar: A-E, 50 µm.

Figure 6. *Diarthrodes imitator* sp. nov. Femelle. **A.** P3. **B.** Sclérite intercoxal de la P3. **C.** P4. **D.** Sclérite intercoxal de la P4. **E.** P5 (pore apical indiqué). Echelle : A-E, 50 µm.

P2 (Fig. 5C). Intercoxal sclerite as in Fig. 5D. Coxa with transverse spinular row close to outer distal corner. Basis with spinules at base of endopod; inner distal corner and middle part acutely produced. Rami three-segmented. EXP1 and EXP2 with inner seta, EXP3 with seven elements. Endopod reaching proximal third of EXP3; ENP1 with one small, inner spine; ENP2 with two inner setae (proximal seta smaller); ENP3 with five setae/spines.

P3 (Fig. 6A). Intercoxal sclerite as in Fig. 6B. Coxa and basis as in P2. Exopod as in P2 except for eight setae/spines in P3EXP3. Endopod as in P2 except for width:length ratio of segments (compare Fig. 5C & Fig. 6A), and for only one inner seta in P3ENP2 and six elements in P3ENP3.

P4 (Fig. 6C). Intercoxal sclerite as in Fig. 6D. EXP1 and EXP2 as in P2, unfortunately the right exopod was lost during dissection; the EXP3 as shown in Fig. 6C is considered herein as an aberration, being the normal condition with eight setae/spines. Endopod barely reaching tip of EXP2; ENP1 and ENP2 with one inner seta; ENP3 with five setae/spines.

P5 (Fig. 6E). Baseoendopodal lobe weakly developed, with five elements as figured and a large apical pore (arrowed in Fig. 6E). Exopod elongate, with five setae/spines.

Armature formula of swimming legs as follows:

	P1	P2	P3	P4
EXP	I-0;I1I,I,1	I-1;I-1;III,I1,2	I-1;I-1;III,I1,3	I-1;I-1;III,I1,3
ENP	0-1;0-0;0,II1,0	0-1;0-2;I,2,2	0-1;0-1;I,2,3	0-1;0-1;I,2,2

Male

Unknown.

Diarthrodes tripartitus sp. nov.
(Figs 7-14)

Type material

One female holotype (EMUCOP-080205-05) and one male allotype (EMUCOP-080205-06 presened in alcohol), two dissected female paratypes (EMUCOP-080205-14, EMUCOP-020805-13), three dissected male paratypes (EMUCOP-080205-10, EMUCOP-0802502-11, EMUCOP -080205-12), and two fifth copepodites, one third copepodite, one fourth copepodite and two male paratypes (EMUCOP-080205-07), one male paratype (EMUCOP-080205-08), and one male and one female paratype (EMUCOP-080205-09) preserved in alcohol. Collected in the Urías system (23º11’06”N, 106º25’06”W) on February 8, 2005; stn. 4 (unpublished data); salinity 38; temperature, 22.6º C; organic carbon content, 3.52%; dissolved oxygen, 5.15 mg.l^{-1}; biochemical oxygen demand (BOD5), 2.34 mg.l^{-1}; sand, 77.4%; silt, 7.54%; clay, 15.1%. Coll. S. Gómez, F. N. Morales-Serna and F. E. Vargas-Arriaga.

Type locality

Urías system, Sinaloa, Mexico (23º11’06”N, 106º25’06”W).

Etymology

The specific name alludes to the three endites in the syncoxa of the maxilla, which differentiates the species from *D. falcipes* Marinoni, 1964 and *D. dissimilis* Lang, 1965.

Female

Habitus (Fig. 7) fusiform, tapering from posterior margin of cephalothorax to anal somite; maximum width at posterior margin of cephalothorax; total body length measured from tip of rostrum to posterior margin of caudal rami in dorsal view, from 312 µm to 385 µm (mean, 343 µm; n = 4). Rostrum (Fig. 7B) fused to cephalic shield, small, general shape as in *D. unisetosus* as illustrated by Lang (1965).

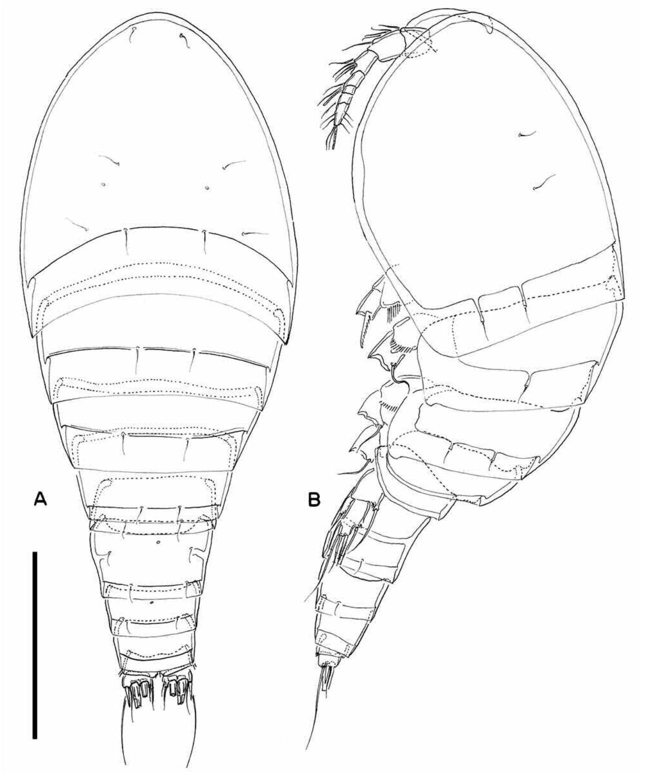
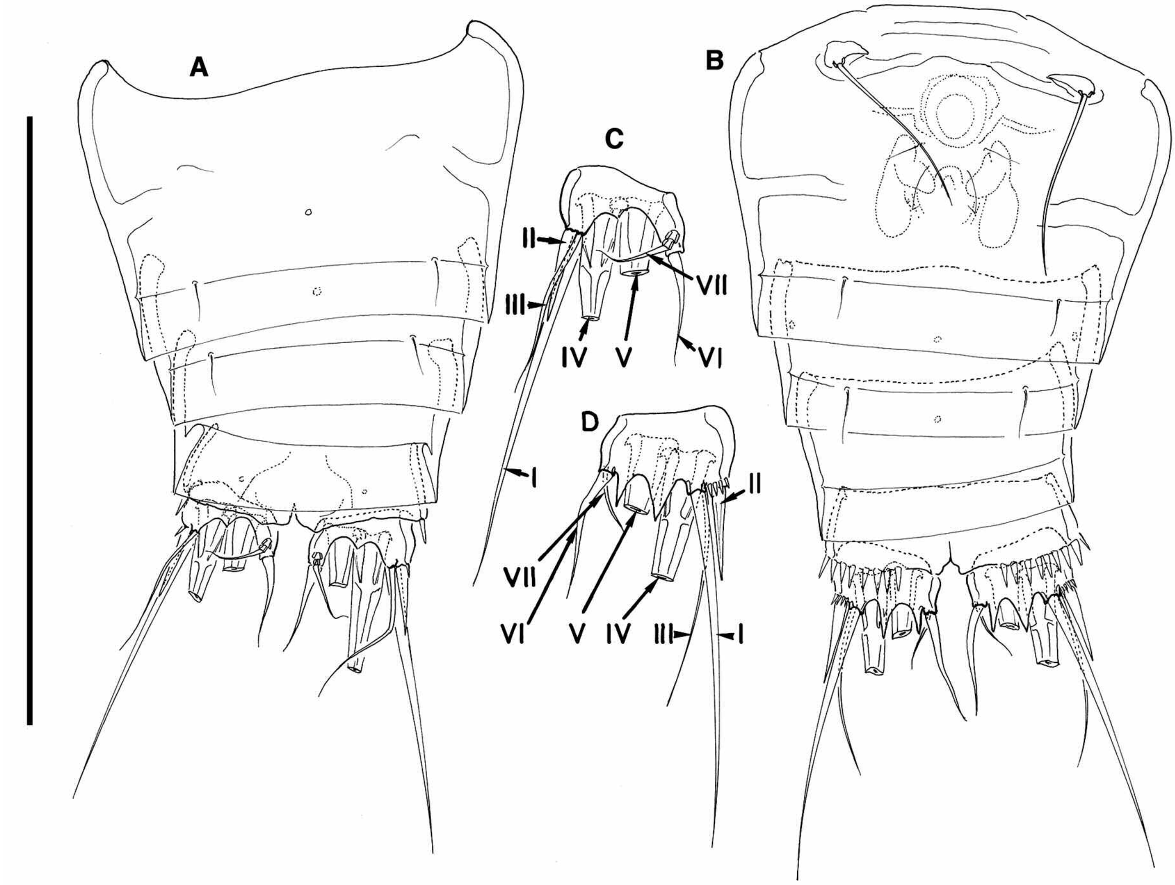


Figure 7. *Diarthrodes tripartitus* sp. nov. Female. **A.** Habitus, dorsal view. **B.** Habitus, lateral view. Scale bar: A, B, 100 µm.

Figure 7. *Diarthrodes tripartitus* sp. nov. Femelle. **A.** Habitus, vue dorsale. **B.** Habitus, vue latérale. Echelle : A, B, 100 µm.

Figure 8. *Diarthrodes tripartitus* sp. nov. Female. **A.** Urosome, dorsal view (P5 bearing-somite omitted). **B.** Urosome, ventral view (P5 bearing-somite omitted). **C.** Left caudal ramus, dorsal view. **D.** Left caudal ramus, ventral view. Scale bar: A, B, 100 µm; C, D, 80 µm.

Figure 8. *Diarthrodes tripartitus* sp. nov. Femelle. **A.** Urosome, vue ventrale (le segment qui porte la P5 a été omis). **B.** Urosome, vue dorsale (le segment qui porte la P5 a été omis). **C.** Furca gauche, vue dorsale. **D.** Furca gauche, vue ventrale. Echelle : A, B, 100 µm ; C, D, 80 µm.



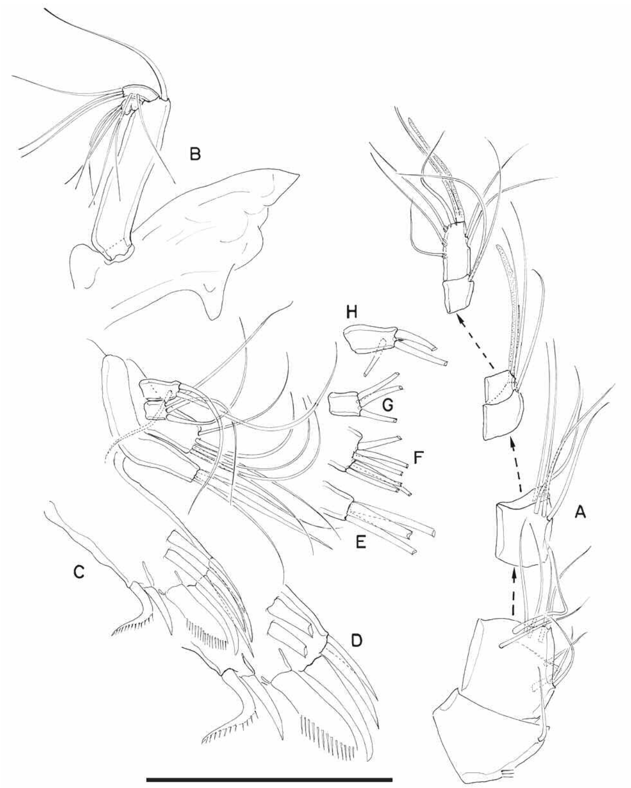


Figure 9. *Diarthrodes tripartitus* sp. nov. Female. **A.** Antennule. **B.** Mandible. **C.** Maxillule. **D.** Distal part of maxillulary arthrite. **E.** Distal part of maxillulary coax. **F.** Distal part of maxillulary basis. **G.** Maxillulary endopod. **H.** Maxillulary exopod. Scale bar: A, B, 50 µm; C, 33 µm; D-H, 25 µm.

Figure 9. *Diarthrodes tripartitus* sp. nov. Femelle. **A.** Antennule. **B.** Mandibule. **C.** Maxillule. **D.** Partie distale de l'arthrite de la maxillule. **E.** Partie distale de la coxa de la maxillule. **F.** Partie distale de la basis de la maxillule. **G.** Endopode de la maxillule. **H.** Exopode de la maxillule. Echelle : A, B, 50 µm ; C, 33 µm ; D-H, 25 µm.

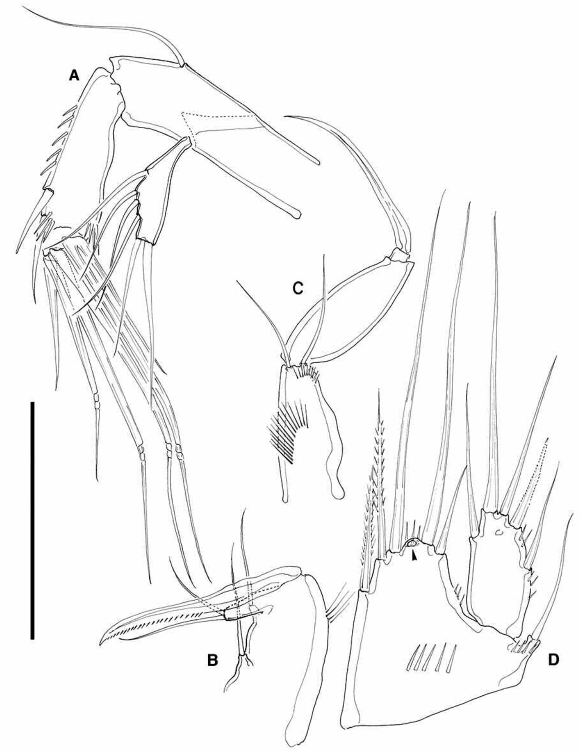


Figure 10. *Diarthrodes tripartitus* sp. nov. Female. **A.** Antenna. **B.** Maxilla. **C.** Maxilliped. **D.** P5 (apical pore arrowed). Scale bar: A, 33 µm; B-D, 50 µm.

Figure 10. *Diarthrodes tripartitus* sp. nov. Femelle. **A.** Antenne. **B.** Maxille. **C.** Maxillipède. **D.** P5 (pore apical indiqué). Echelle : A, 33 µm ; B-D, 50 µm.

Prosomites, and first to fifth urosomites with plain hyaline frill (Figs 7A-B & 8A-B); dorsal (Fig. 8A) and ventral (Fig. 8B) surface of urosomites plain except for row of spinules along caudal margin of anal segment ventrally. Genital double-somite completely fused dorsally (Fig. 8A) and ventrally (Fig. 8B), but with suture indicating former division laterally (Fig. 7B); genital field as in Fig. 8B; P6 represented by two small plates with long, slender seta (Fig. 8B). Caudal rami short, about 1.5 times as wide as long, with seven elements (Fig. 8C & D); elements I, II and III situated at outer distal corner; seta I very long and ventral to element II, the latter transformed into strong spine; seta III slender, longer than and next to element II; setae IV and V normal in shape; seta VI somewhat shorter than seta III and situated at inner distal corner; seta VII triarticulated and situated on top of insertion site of seta VI.

Antennule (Fig. 9A), seven-segmented, with aesthetasc on fourth and last segments; surface of first segment with few spinules, succeeding segments without spinular ornamentation. Armature formula, 1-(1), 2-(10), 3-(6), 4-(2+ae), 5-(1), 6-(2), 7-(6+acrothek). Acrothek consisting of two setae and one aesthetasc fused basally.

Antenna (Fig. 10A). Allobasis with trace of division between basis and first endopodal segment, with one abexopodal seta. Exopod one-segmented, with four lateral and two apical setae (one of them stronger). Free endopodal segment with two lateral spines; apically with one spine, three geniculate setae and one geniculate element fused to slender seta.

Mandible (Fig. 9B) with strong gnathobase and unidentate pars incisiva. Coxa-basis long and armed with one long seta. Exopod one-segmented, smaller than endopod, with four setae. Endopod one-segmented, with five elements.

Maxillule (Fig. 9C). Arthrite of praecoxa with two surface setae, distally as in Fig. 9C, D. Coxa with three (Fig. 9C & E), basis with six setae (Fig. 9C & F). Endopod

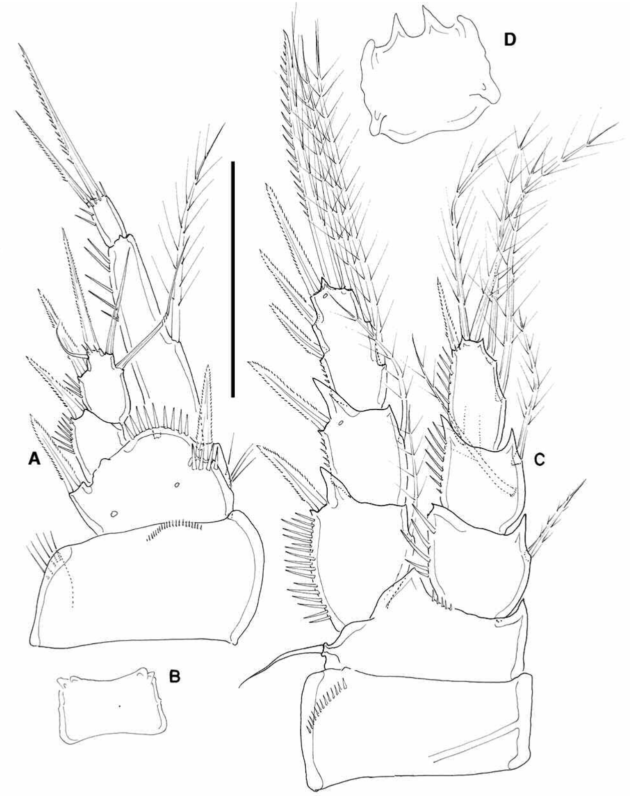


Figure 11. *Diarthrodes tripartitus* sp. nov. Female. **A.** P1. **B.** Intercoxal sclerite of P1. **C.** P2. **D.** Intercoxal sclerite of P2. Scale bar: A-D, 50 µm.

Figure 11. *Diarthrodes tripartitus* sp. nov. Femelle. **A.** P1. **B.** Sclérite intercoxal de la P1. **C.** P2. **D.** Sclérite intercoxal de la P2. Echelle : A-D, 50 µm.

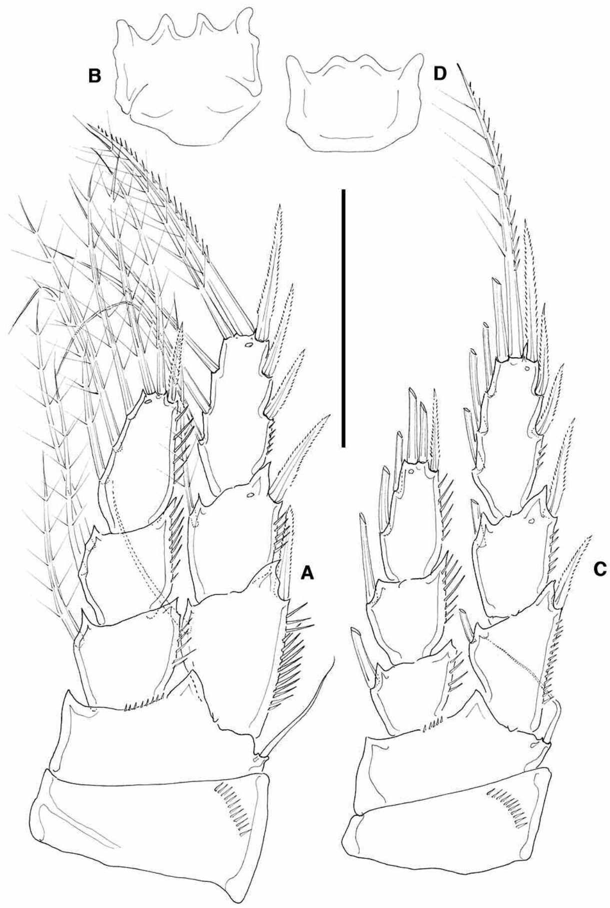


Figure 12. *Diarthrodes tripartitus* sp. nov. Female. **A.** P3. **B.** Intercoxal sclerite of P3. **C.** P4. **D.** Intercoxal sclerite of P4. Scale bar: A-D, 50 µm.

Figure 12. *Diarthrodes tripartitus* sp. nov. Femelle. **A.** P3. **B.** Sclérite intercoxal de la P3. **C.** P4. **D.** Sclérite intercoxal de la P4. Echelle: A-D, 50 µm.

and exopod one-segmented, small, with three setae each (Fig. 9C, G & H).

Maxilla (Fig. 10B). Syncoxa with three endites; proximal and middle endites with one, distal endite with two setae. Basis produced into strong, serrate claw.

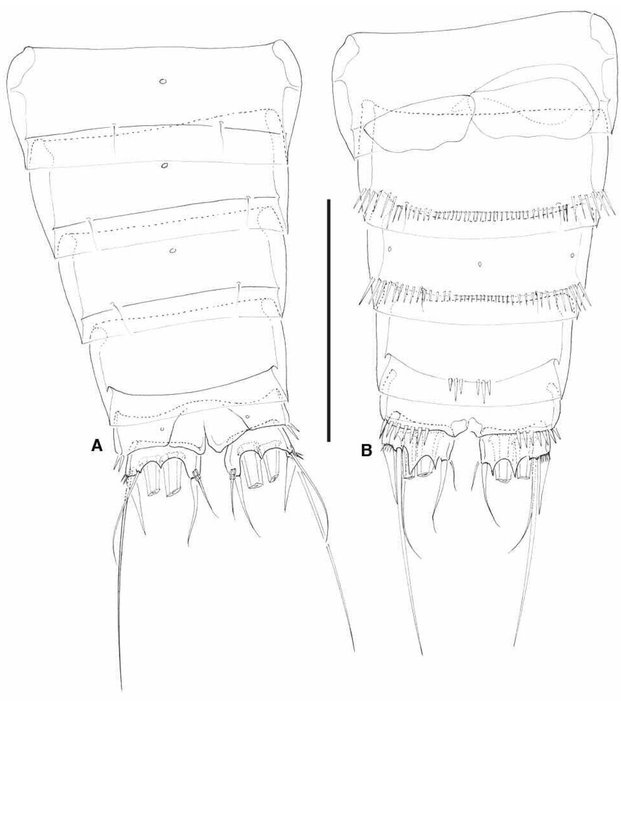


Figure 13. *Diarthrodes tripartitus* sp. nov. Male. **A.** Urosome, dorsal view (P5 bearing-somite omitted). **B.** Urosome, ventral view (P5 bearing-somite omitted). Scale bar: A, B, 50 µm.

Figure 13. *Diarthrodes tripartitus* sp. nov. Mâle. **A.** Urosome, vue dorsale (le segment qui porte la P5 a été omis). **B.** Urosome, vue ventrale (le segment qui porte la P5 a été omis). Echelle : A, B, 50 µm.

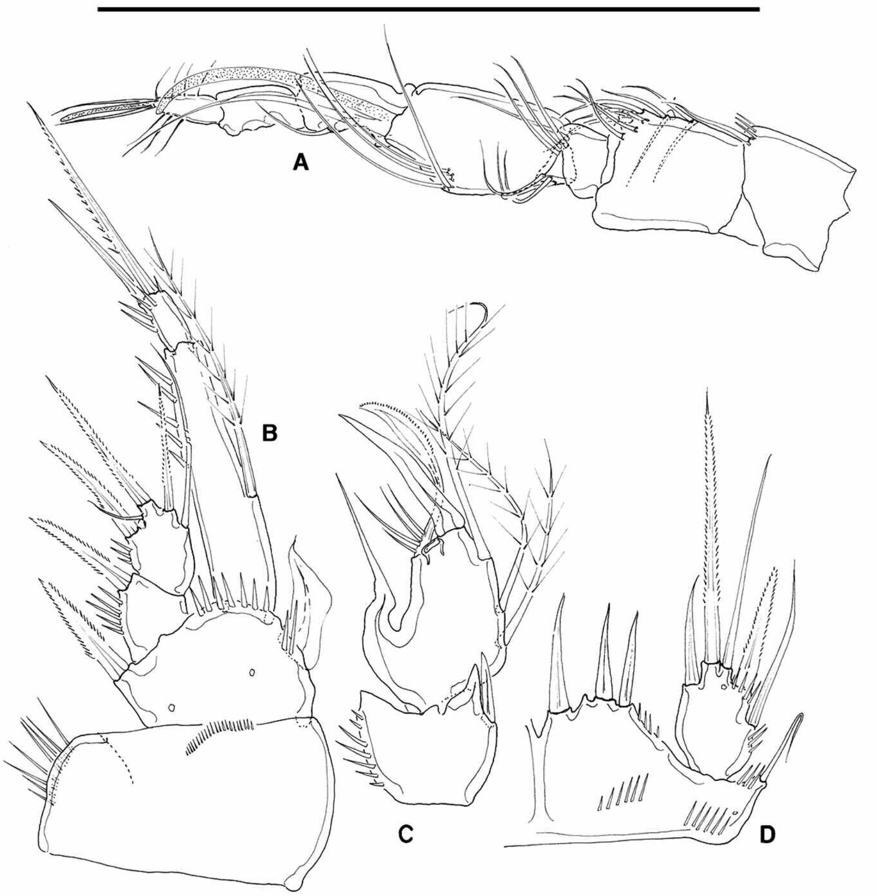


Figure 14. *Diarthrodes tripartitus* sp. nov. Male. **A.** Antennule. **B.** P1. **C.** P2ENP. **D.** P5. Scale bar: A-D, 100 µm.
Figure 14. *Diarthrodes tripartitus* sp. nov. Mâle. **A.** Antennule. **B.** P1. **C.** P2ENP. **D.** P5. Echelle : A-D, 100 µm.

Maxilliped (Fig. 10C). Basis with one proximal and one distal spinular row, with two apical setae. First endopodal segment oval, without armature, second endopodal segment with strong claw.

P1 (Fig. 11A). Intercoxal sclerite as in Fig. 11B. Coxa with median row of small spinules and with stronger spinules close to outer distal corner. Basis with spinules at base of inner spine and at base of endopod, with slender setules close to inner margin on posterior face. Exopod two-segmented, barely reaching half of first endopodal segment; EXP1 with one outer spine; EXP2 with five setae/spines. Endopod two-segmented; first segment very long, about 3.5 times as long as wide, with one seta halfway of inner margin, second segment small, about twice as long as wide, with two apical spines.

P2 (Fig. 11C). Intercoxal sclerite as in Fig. 11D. Coxa with spinular row close to outer distal corner. Basis with few spinules at base of endopod; inner distal corner and middle part acutely produced. Rami three-segmented. EXP1 and EXP2 with inner seta, EXP3 with seven elements. Endopod reaching proximal third of EXP3; ENP1 with one inner seta; ENP2 with two inner setae of about the same length; ENP3 with five setae/spines.

P3 (Fig. 12A). Intercoxal sclerite as in Fig. 12B. Coxa and basis as in P2. Exopod as in P2 except for eight setae/spines in P3EXP3. Endopod as in P2 except for width:length ratio of segments (compare Figs 11C & 12A), and for six elements in P3ENP3.

P4 (Fig. 12C). Intercoxal sclerite as in Fig. 12D. Exopod as in P2 except for eight setae/spines in P4EXP3. Endopod reaching proximal quarter of EXP3; ENP1 and ENP2 with one inner seta; ENP3 with five setae/spines.

P5 (Fig. 10D). Baseoendopodal lobe well developed, reaching distal quarter of exopod, with five elements as figured and a large apical pore (arrowed in Fig. 10D), with an anterior transverse spinular row and few posterior spinules close to distal pore. Exopod elongate, with five setae/spines.

Armature formula of swimming legs as follows:

	P1	P2	P3	P4
EXP	I-0;I1I,I,1	I-1;I-1;III,I1,2	I-1;I-1;III,I1,3	I-1;I-1;III,I1,3
ENP	0-1;0,II,0	0-1;0-2;I,2,2	0-1;0-2;I,2,3	0-1;0-1;I,2,2

Male

General shape of habitus (not shown) as in female; total body length measured from tip of rostrum to posterior margin of caudal rami in dorsal view, from 275 µm to 325 µm (mean, 290 µm; n = 7). Urosome as in female dorsally except for genital somite (Fig. 13A), ventrally with spinules close to posterior margin of third, fourth and fifth urosomites (Fig. 13B).

Antennule (Fig. 14A), eight-segmented, haplocer, with aesthetasc on fifth and last segments; surface of first segment with few spinules, succeeding segments without spinular ornamentation. Armature formula difficult to define, 1-(1), 2-(10), 3-(3), 4-(4), 5-(5+ae), 6-(1), 7-(0), 8-(7+acrothek). Acrothek consisting of two setae and one aesthetasc fused basally.

Antenna, mandible, maxillule, maxilla and maxilliped (not shown) as in female.

P1 (Fig. 14B) as in female except for inner dimorphic spine of basis.

P2EXP (not shown) as in female; P2ENP two-segmented, sexually dimorphic (Fig. 14C).

P3 and P4 (not shown) as in female.

P5 (Fig. 14D). Baseoendopodal lobe reaching distal third of exopod, with three and two anterior, transverse spinular rows, and few spinules along outer margin and at base of outer basal seta. Exopod oval, with five setae/spines.

P6 (Fig. 13) represented by two asymmetrical plates.

Diarthrodes hexasetosus sp. nov.
(Figs 15-20)

Type material

One dissected female holotype (EMUCOP-080205-15) and one dissected female paratype (EMUCOP-080205-16).

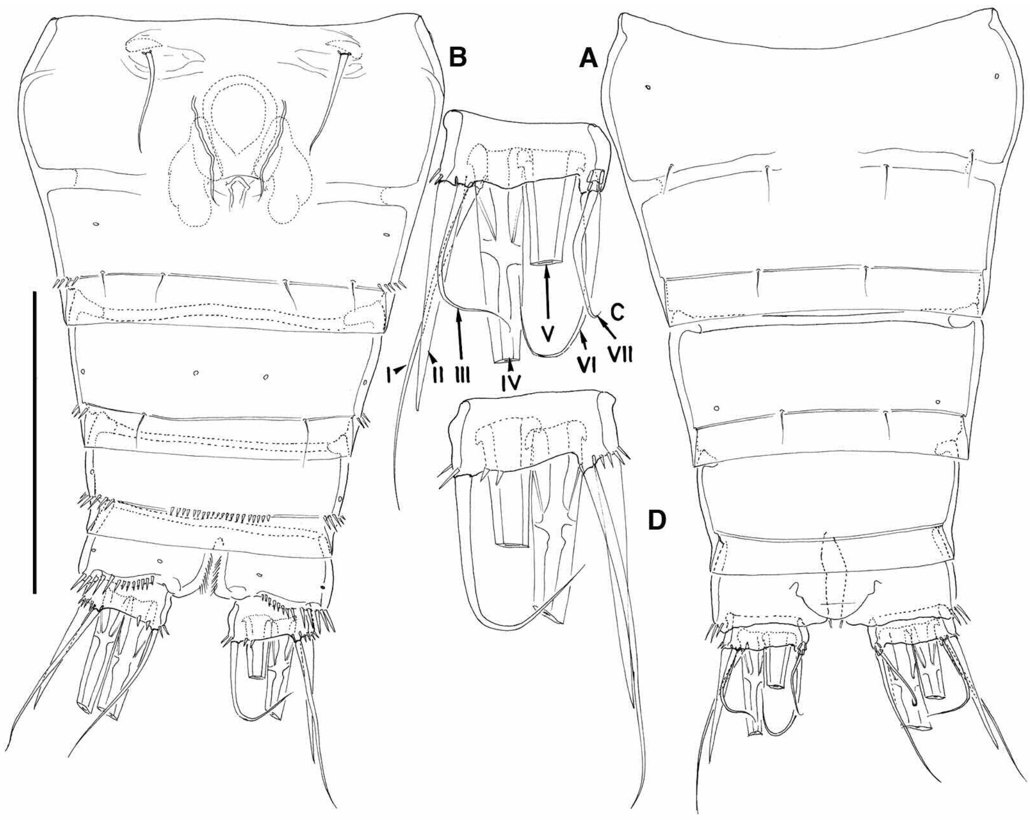


Figure 15. *Diarthrodes hexasetosus* sp. nov. Female. **A.** Urosome, dorsal view (P5 bearing-somite omitted). **B.** Urosome, ventral view (P5 bearing-somite omitted). **C.** Left caudal ramus, dorsal view. **D.** Left caudal ramus, ventral view. Scale bar: A, B, 100 µm; C, D, 50 µm.

Figure 15. *Diarthrodes hexasetosus* sp. nov. Femelle. **A.** Urosome, vue dorsale (le segment qui porte la P5 a été omis). **B.** Urosome, vue ventrale (le segment qui porte la P5 a été omis). **C.** Furca gauche, vue dorsale. **D.** Furca gauche, vue ventrale. Echelle : A, B, 100 µm ; C, D, 50 µm.

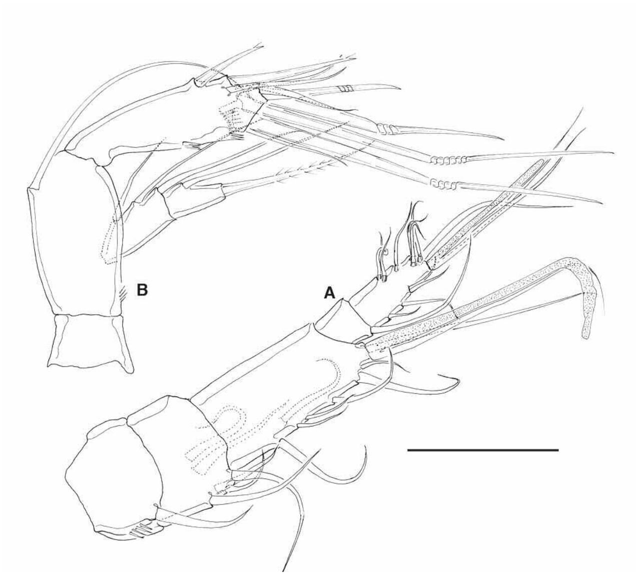


Figure 16. *Diarthrodes hexasetosus* sp. nov. Female. **A.** Antennule. **B.** Antenna. Scale bar: A, 40 µm; B, 32 µm.

Figure 16. *Diarthrodes hexasetosus* sp. nov. Femelle. **A.** Antennule. **B.** Antenne. Echelle : A, 40 µm ; B, 32 µm.

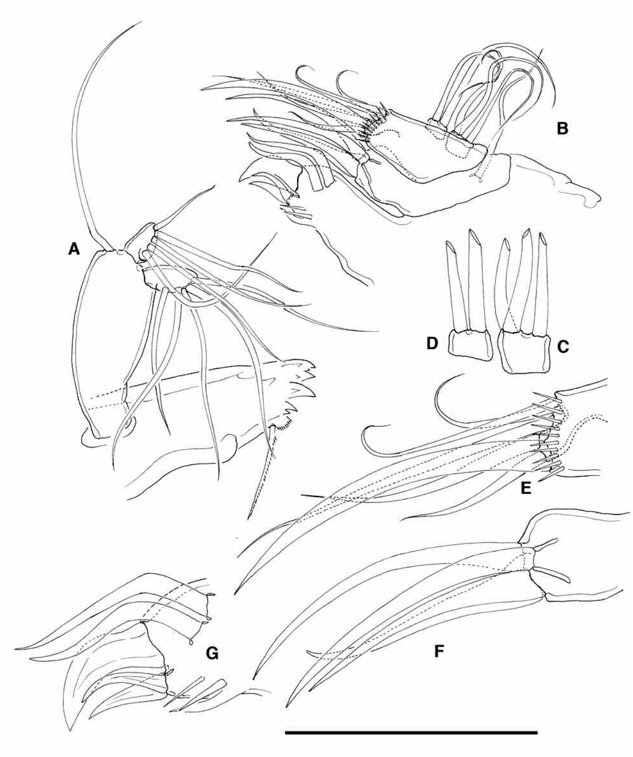


Figure 17. *Diarthrodes hexasetosus* sp. nov. Female. **A.** Mandible. **B.** Maxillule. **C.** Maxillulary exopod. **D.** Maxillulary endopod. **E.** Distal part of maxillulary basis. **F.** Distal part of maxillulary coax. **G.** Distal part of maxillulary arthrite. Scale bar: A, B, 50 µm; C-G, 25 µm.

Figure 17. *Diarthrodes hexasetosus* sp. nov. Femelle. **A.** Mandibule. **B.** Maxillule. **C.** Exopode de la maxillule. **D.** Endopode de la maxillule. **E.** Partie distale de la basis de la maxillule. **F.** Partie distale de la coxa de la maxillule. **G.** Partie distale de l'arthrite de la maxillule. Echelle : A, B, 50 µm; C-G, 25 µm.

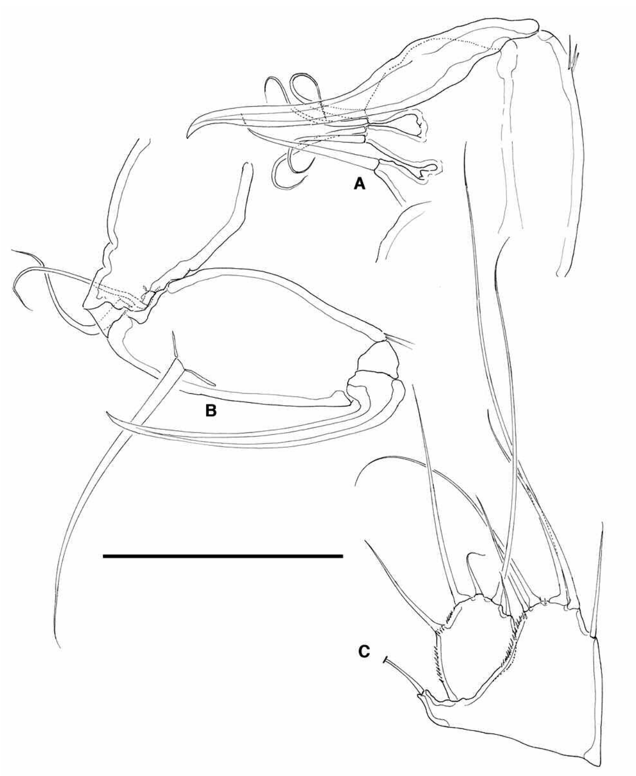


Figure 18. *Diarthrodes hexasetosus* sp. nov. Female. **A.** Maxilla. **B.** Maxilliped. **C.** P5. Scale bar: A, B, 50 µm; C, 100 µm.

Figure 18. *Diarthrodes hexasetosus* sp. nov. Femelle. **A.** Maxille. **B.** Maxillipède. **C.** P5. Echelle : A, B, 50 µm ; C, 100 µm.

Collected in the Urías system (23º11'06"N, 106º25'06"W) on February 8, 2005; stn. 2 (unpublished data); salinity 39; temperature, 21.9ºC; organic carbon content, 4.11%; dissolved oxygen, 2.62 mgl^{-1}; biochemical oxygen demand (BOD_5), 0.93 $mg.l^{-1}$; sand, 80.1%; silt, 6.7%; clay, 13.3%. Coll. S. Gómez, F. N. Morales-Serna and F. E. Vargas-Arriaga.

Type locality

Urías system, Sinaloa, Mexico (23º11'06"N, 106º25'06"W).

Etymology

The specific name alludes to the presence of six setae on the third exopodal segment of the first swimming leg.

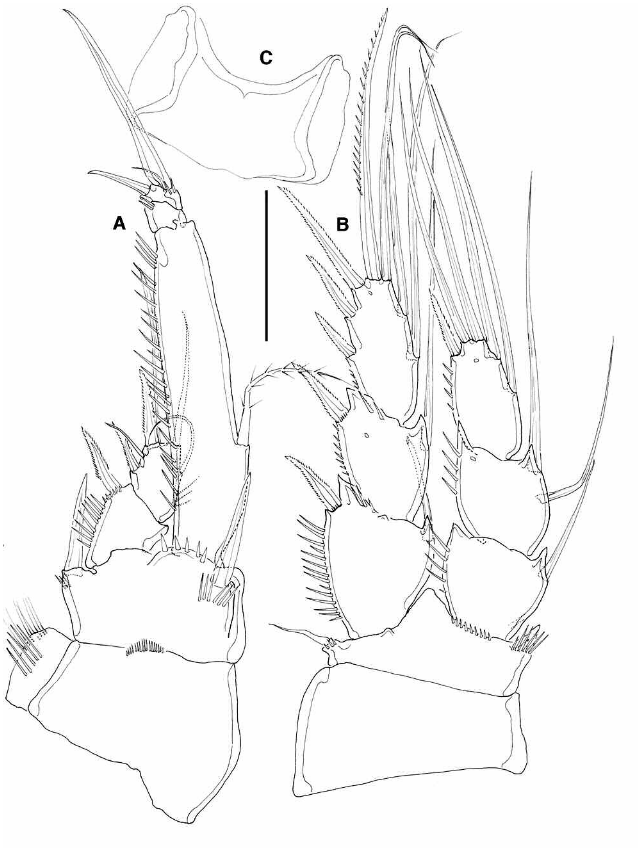


Figure 19. *Diarthrodes hexasetosus* sp. nov. Female. **A.** P1. **B.** P2. **C.** Intercoxal sclerite of P2. Scale bar: A, 46 µm; B, 49 µm; C, 35 µm.

Figure 19. *Diarthrodes hexasetosus* sp. nov. Femelle. **A.** P1. **B.** P2. **C.** Sclérite intercoxal de la P2. Echelle : A, 46 µm ; B, 49 µm ; C, 35 µm.

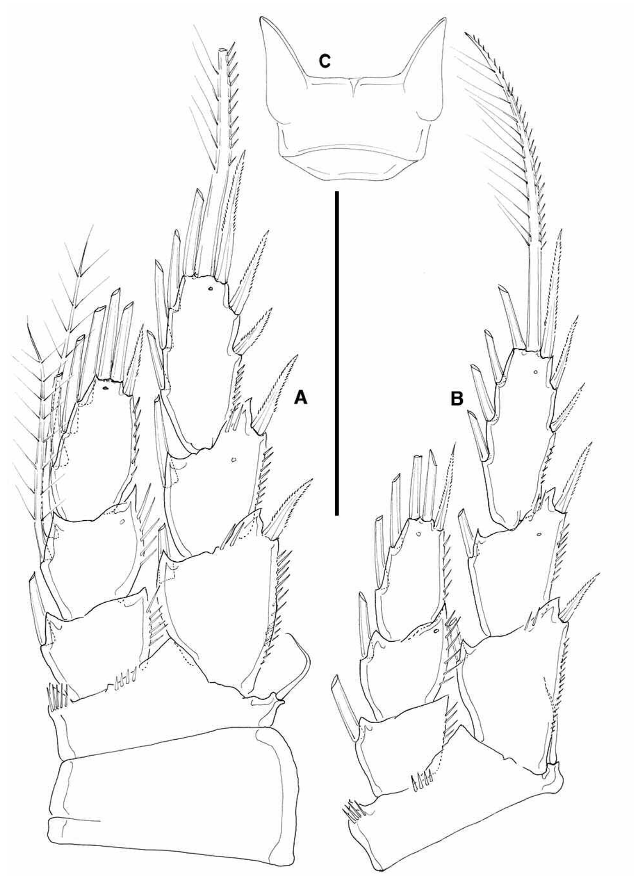


Figure 20. *Diarthrodes hexasetosus* sp. nov. Female. **A.** P3. **B.** P4. **C.** Intercoxal sclerite of P4. Scale bar: A, B, 100 µm; C, 65 µm.

Figure 20. *Diarthrodes hexasetosus* sp. nov. Femelle. **A.** P3. **B.** P4. **C.** Sclérite intercoxal de la P4. Echelle : A, B, 100 µm ; C, 65 µm.

Female

Habitus (not shown) fusiform, tapering from posterior margin of cephalothorax to anal somite; maximum width at posterior margin of cephalothorax; total body length difficult to estimate due to bad condition of the only two specimens. Rostrum (not shown) seemingly as in previous species. Prosomites (not shown), and first to fifth urosomites with plain hyaline frill (Fig. 15A & B); dorsal surface of urosomites without spinular ornamentation (Fig. 15A), ventral surface with few spinules close to distal margin of third (second half of double genital-somite), fourth and fifth urosomites and along posterior margin of anal somite (Fig. 15B). Genital double-somite with trace of subdivision as figured (Fig. 15A & B); genital field as in Fig. 15B; P6 represented by two setae. Caudal rami short, about 4 times as wide as long, with seven elements (Fig. 15C & D); elements I, II and III situated at the outer distal corner; seta I very long and ventral to element II, the latter transformed into strong spine; seta III slender, nearly as long as and next to element II; setae IV and V normal in shape; seta VI longer than seta III and situated at inner distal corner; seta VII triarticulated and situated on top of insertion site of seta VI.

Antennule (Fig. 16A) five-segmented, with aesthetasc on third and last segments, surface of first segment with few spinules, succeeding segments without spinular ornamentation. Armature formula, 1-(1), 2-(6), 3-(8+ae), 4-(1), 5-(11+acrothek). Acrothek consisting of two setae and one aesthetasc fused basally.

Antenna (Fig. 16B). Allobasis without trace of division between basis and first endopodal segment, with one long abexopodal seta. Exopod two-segmented; first segment with two lateral and one apical seta, second segment with one lateral and one apical seta. Free endopodal segment with two lateral spines and two setae; apically with one seta-like element, three geniculate elements, and one geniculate seta fused to slender seta basally.

Mandible (Fig. 17A) with strong gnathobase, unidentate pars incisiva and a pectinate element as figured. Coxa-basis long and armed with one long seta. Exopod and endopod one-segmented, with five setae each.

Maxillule (Fig. 17B). Arthrite of praecoxa with two surface setae and armed laterally and distally as in Fig. 17G. Coxa with four (Fig. 17F), basis with six setae and ornamented with distal spinules (Fig. 17E). Endopod and exopod one-segmented, small; endopod with two, exopod with three setae (Fig. 17C & D).

Maxilla (Fig. 18A). Syncoxa with three endites; proximal endite with one, middle and distal endites with two setae. Basis produced into strong, serrate claw.

Maxilliped (Fig. 18B). Basis without spinules, with two distal setae. First endopodal segment oval, with one seta, second endopodal segment with strong claw.

P1 (Fig. 19A). Coxa with median row of small spinules distally and with anterior strong spinules and posterior setules close to outer distal corner. Basis with spinules at base of inner and outer spines and at base of endopod. Exopod two-segmented, barely reaching proximal third of ENP1; EXP1 with one outer spine; EXP2 with six setae/spines as figured. Endopod two-segmented; first segment very long, about 4.4 times as long as wide, with one inner seta on proximal third, second segment small, about twice as long as wide, unarmed; third segment small, with two spines (innermost longer) and one posterior, small seta.

P2 (Fig. 19B). Intercoxal sclerite as in Fig. 19C. Coxa without spinules. Basis with few spinules at base of endopod, at base of outer seta and on distal inner corner; inner distal corner and middle part acutely produced. Rami three-segmented. EXP1 and EXP2 with inner seta, EXP3 with seven elements. Endopod reaching half of EXP3; ENP1 with one, ENP2 with two inner setae; ENP3 with five setae/spines.

P3 (Fig. 20A). Intercoxal sclerite, coxa and basis as in P2. Exopod as in P2 except for eight setae/spines in P3EXP3. Endopod as in P2 except for width: length ratio of segments (compare Fig. 20A and 19B), and for six elements in P3ENP3.

P4 (Fig. 20B). Intercoxal sclerite as in Fig. 20C. Exopod as in P2 except for eight setae/spines in P4EXP3. Endopod barely reaching tip of EXP2; ENP1 and ENP2 with one inner seta; ENP3 with five setae/spines.

P5 (Fig. 18C). Baseoendopodal lobe well developed, reaching tip of exopod, with five elements, with small spinules along outer margin. Exopod oval, with five setae.

Armature formula of swimming legs as follows:

	P1	P2	P3	P4
EXP	I-0;I1I,I1,1	I-1;I-1;III,I1,2	I-1;I-1;III,I1,3	I-1;I-1;III,I1,3
ENP	0-1;0-0;0,II1,0	0-1;0-2;I,2,2	0-1;0-2;I,2,3	0-1;0-1;I,2,2

Male

Unknown.

Diarthrodes nhatrangensis sp. nov.
(Figs 21-26)

Type material

One dissected female holotype (EMUCOP-190404-01) and one dissected female paratype (EMUCOP-190404-02). Collected in Nha-Trang Bay, Southern Vietnam, in the upper sublittoral zone of the Kai river, between mainland and Mieu Island (12º10'60"N, 109º13'16"W) on April 19, 2004, at a depth of 10.4 m; silted crushed shell; mean particle size, 0.25 mm; silt, 25%. Coll. A. A. Udalov.

Type locality

Nha-Trang Bay, Southern Vietnam (12º10'60"N, 109º13'16"W).

Etymology

The specific name alludes to the type locality.

Female

Habitus (Fig. 21A) fusiform, tapering from posterior margin of cephalothorax to anal somite; maximum width at posterior margin of cephalothorax; total body length from 298 µm (holotype) to 305 µm. Rostrum large, bell-shaped, distinct (Figs 21A & 22A). Prosomites, and first to fifth urosomites with plain hyaline frill; dorsal (Figs 21A & 23A) and ventral (Fig. 24A) surface of urosomites without spinular ornamentation except for spinules along posterior margin of anal somite ventrally. Genital double-somite with trace of subdivision as figured (Figs 21A, 23A & 24A); genital field as in Fig. 24A; P6 represented by two slender setae. Caudal rami short, as wide as long, with seven elements (Figs 23B & 24B); elements I, II and III situated at the outer distal corner; seta I very long and ventral to element II, the latter transformed into strong spine; seta III slender, nearly as long as and next to element II; setae IV and V normal in shape; seta VI longer than seta III and situated at inner distal corner; seta VII triarticulated and situated on top of insertion site of seta VI.

Antennule (Fig. 22B), five-segmented, with aesthetasc on third and last segments, surface of first segment with few spinules, succeeding segments without spinular ornamentation. Armature formula, 1-(1), 2-(11), 3-(10+ae), 4-(1), 5-(8 + acrothek). Acrothek consisting of two setae and one aesthetasc fused basally.

Antenna (Fig. 22C). Allobasis without trace of division between basis and first endopodal segment, with one long abexopodal seta. Exopod three-segmented; first and second

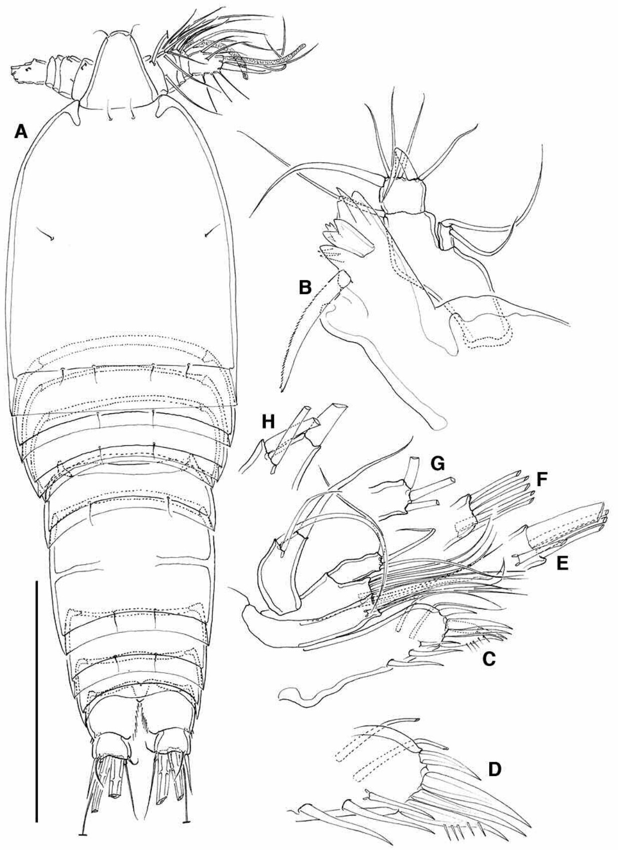


Figure 21. *Diarthrodes nhatrangensis* sp. nov. Female. **A.** Habitus, dorsal view. **B.** Mandible. **C.** Maxillule. **D.** Distal part of maxillulary arthrite. **E.** Distal part of maxillulary coax. **F.** Distal part of maxillulary basis. **G.** Distal part of maxillulary endopode. **H.** Distal part of maxillulary exopod. Scale bar: A, 100 µm; B, C 33 µm; D-H, 18 µm.

Figure 21. *Diarthrodes nhatrangensis* sp. nov. Femelle. **A.** Habitus, vue dorsale. **B.** Mandibule. **C.** Maxillule. **D.** Partie distale de l'arthrite de la maxillule. **E.** Partie distale de la coxa de la maxillule. **F.** Partie distale de la basis de la maxillule. **G.** Partie distale de l'endopode de la maxillule. **H.** Partie distale de l'exopode de la maxillule. Echelle : A, 100 µm ; B, C 33 µm ; D-H, 18 µm.

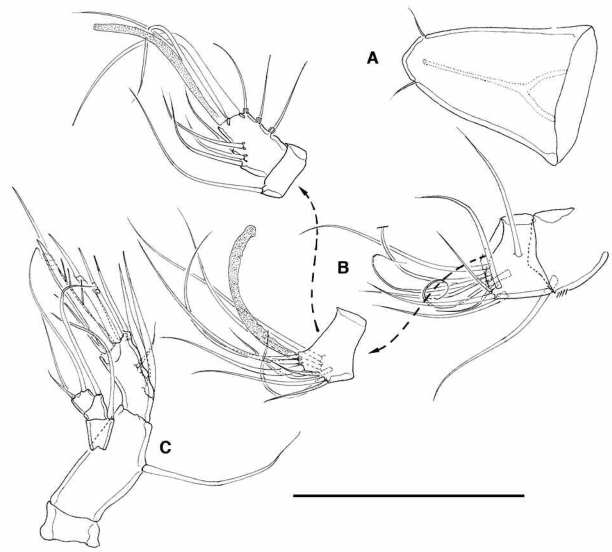


Figure 22. *Diarthrodes nhatrangensis* sp. nov. Female. **A.** Rostrum. **B.** Antennule. **C.** Antenna. Scale bar: A-C, 50 µm.

Figure 22. *Diarthrodes nhatrangensis* sp. nov. Femelle. **A.** Rostre. **B.** Antennule. **C.** Antenne. Echelle : A-C, 50 µm.

segments with one seta, third segment with three setae as figured. Free endopodal segment with two lateral spines and one seta; apically with one spine, three geniculate elements and one geniculate seta fused to slender element.

Mandible (Fig. 21B) with strong gnathobase, bidentate pars incisiva and a strong element as figured. Coxa-basis long and armed with one long seta. Exopod and endopod one-segmented; endopod with two, exopod with six setae.

Maxillule (Fig. 21C). Arthrite of praecoxa with two surface setae and armed laterally and distally as in Fig. 21D. Coxa (Fig. 21E) and basis (Fig. 21F) with five setae. Endopod and exopod one-segmented, large, with three setae each (Fig. 21G & H).

Maxilla (Fig. 23C). Syncoxa with three endites; proximal and middle endites with one, distal endite with two setae. Basis produced into strong, serrate claw.

Maxilliped (Fig. 23D). Basis with transverse spinular row, with one apical seta. First endopodal segment without armature, second endopodal segment with strong claw.

P1 (Fig. 25A). Intercoxal sclerite as in Fig. 25C. Coxa without spinules. Basis with spinules close to inner proximal corner and at base of endopod. Exopod two-segmented, reaching proximal half of first endopodal segment; EXP1 with one outer spine; EXP2 with five setae/spines. Endopod two-segmented; first segment elongate, about 2.5 times as long as wide (measured at its widest part), with one seta halfway of inner margin, second segment small, about twice as long as wide, with two spines (outermost smaller).

P2 (Fig. 25B). Intercoxal sclerite as in Fig. 25D. Coxa without spinules. Basis without spinules; inner distal corner and middle part acutely produced. Rami three-segmented. EXP1 and EXP2 with inner seta, EXP3 with seven elements. Endopod reaching half of EXP3; ENP1 with one, ENP2 with two inner setae (distalmost smaller); ENP3 with five setae/spines.

P3 (Fig. 26A). Intercoxal sclerite as in Fig. 26C. Coxa and basis as in P2. Exopod as in P2 except for eight setae/spines in P3EXP3. Endopod as in P2 except for six elements in P3ENP3.

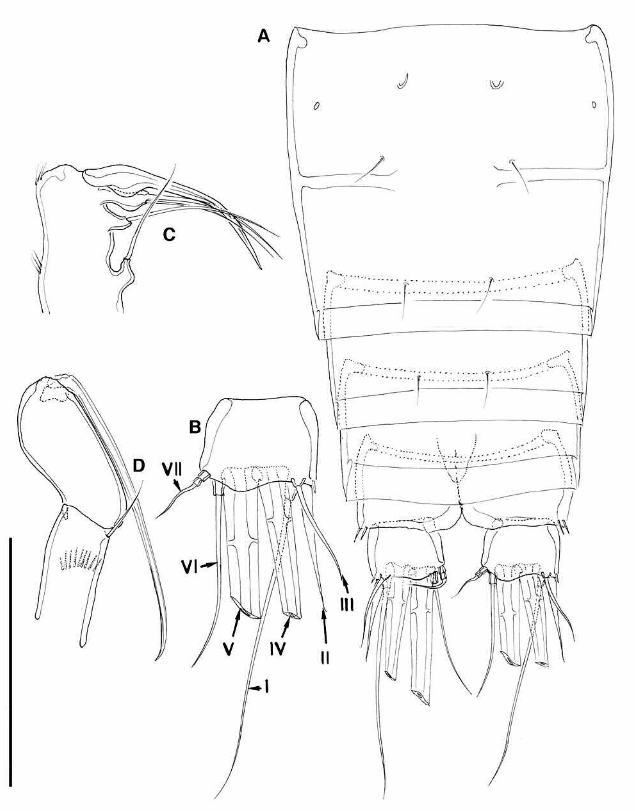


Figure 23. *Diarthrodes nhatrangensis* sp. nov. Female. **A.** Urosome, dorsal view (P5 bearing-somite omitted). **B.** Right caudal ramus, dorsal. **C.** Maxilla. **D.** Maxilliped. Scale bar: A, C, D, 50 µm; B, 33 µm.

Figure 23. *Diarthrodes nhatrangensis* sp. nov. Femelle. **A.** Urosome, vue dorsale (le segment qui porte la P5 a été omis). **B.** Furca droite, vue dorsale. **C.** Maxille. **D.** Maxillipède. Echelle : A, C, D, 50 µm ; B, 33 µm.

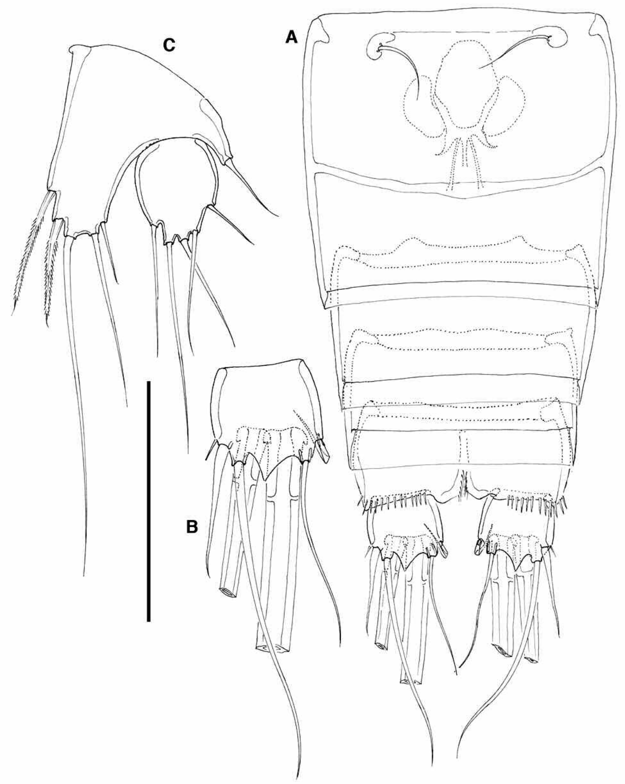


Figure 24. *Diarthrodes nhatrangensis* sp. nov. Female. **A.** Urosome, ventral view (P5 bearing-somite omitted). **B.** Right caudal ramus, ventral view. **C.** P5. Scale bar: A, C, 50 µm; B, 33 µm.

Figure 24. *Diarthrodes nhatrangensis* sp. nov. Femelle. **A.** Urosome, vue ventrale (le segment qui porte la P5 a été omis). **B.** Furca droite, vue ventrale. **C.** P5. Echelle : A, C, 50 µm ; B, 33 µm.

P4 (Fig. 26B). Intercoxal sclerite as in Fig. 26D. Exopod as in P2 except for eight setae/spines in P4EXP3. Endopod reaching proximal third of EXP3; ENP1 and ENP2 with one inner seta; ENP3 with five setae/spines.

P5 (Fig. 24C). Baseoendopodal lobe well developed, reaching tip of exopod, with five elements. Exopod oval, with five setae.

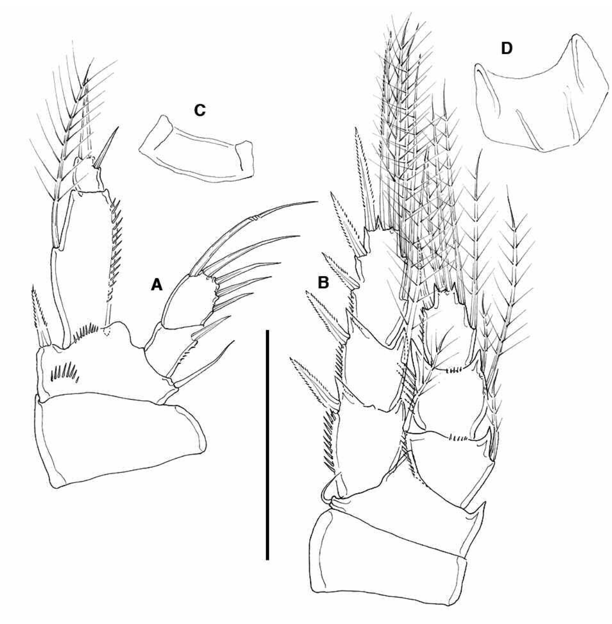


Figure 25. *Diarthrodes nhatrangensis* sp. nov. Female. **A.** P1. **B.** P2. **C.** Intercoxal sclerite of P1. **D.** Intercoxal sclerite of P2. Scale bar: A-D, 50 µm.

Figure 25. *Diarthrodes nhatrangensis* sp. nov. Femelle. **A.** P1. **B.** P2. **C.** Sclérite intercoxal de la P1. **D.** Sclérite intercoxal de la P2. Echelle : A-D, 50 µm.

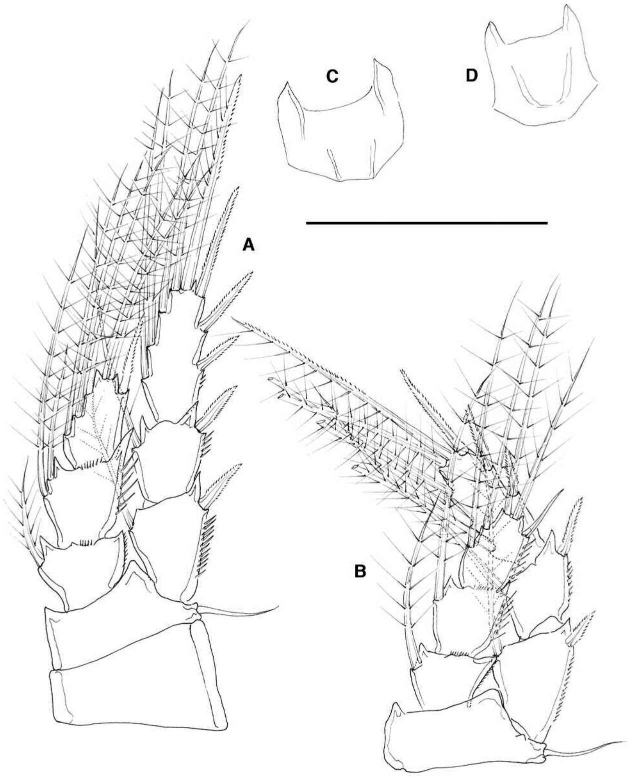


Figure 26. *Diarthrodes nhatrangensis* sp. nov. Female. **A.** P3. **B.** P4. **C.** Intercoxal sclerite of P3. **D.** Intercoxal sclerite of P4. Scale bar: A-D, 50 µm.

Figure 26. *Diarthrodes nhatrangensis* sp. nov. Femelle. **A.** P3. **B.** P4. **C.** Sclérite intercoxal de la P3. **D.** Sclérite intercoxal de la P4. Echelle : A-D, 50 µm.

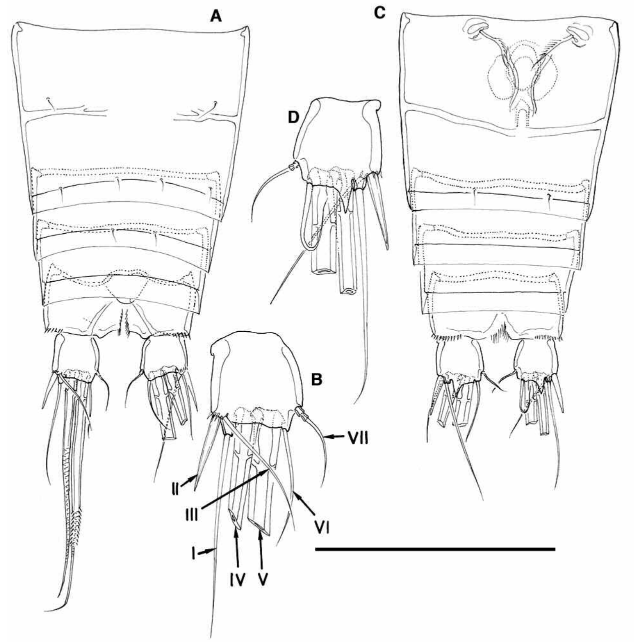


Figure 27. *Diarthrodes savinkinii* sp. nov. Female. **A.** Urosome, dorsal view (P5 bearing-somite omitted). **B.** Left caudal ramus, dorsal view. **C.** Urosome, ventral view (P5 bearing-somite omitted). **D.** Left caudal ramus, ventral view. Scale bar: A, C, 100 µm; B, D, 50 µm.

Figure 27. *Diarthrodes savinkinii* sp. nov. Femelle. **A.** Urosome, vue dorsale (le segment qui porte la P5 a été omis). **B.** Furca gauche, vue dorsale. **C.** Urosome, vue ventrale (le segment qui porte la P5 a été omis). **D.** Furca gauche, vue ventrale. Echelle : A, C, 100 µm ; B, D, 50 µm.

Armature formula of swimming legs as follows:

	P1	P2	P3	P4
EXP	I-0;III,I,1	I-1;I-1;III,I1,2	I-1;I-1;III,I1,3	I-1;I-1;III,I1,3
ENP	0-1;0,II,0	0-1;0-2;I,2,2	0-1;0-2;I,2,3	0-1;0-1;I,2,2

Male

Unknown.

Diarthrodes savinkinii sp. nov.
(Figs 27-31)

Type material

One dissected female holotype (EMUCOP-190404-03), one fourth copepodite and three fifth copepodite paratypes preserved in alcohol (EMUCOP-190404-04). Collected in Nha-Trang Bay, Southern Vietnam, in the upper sublittoral zone of the Kai river, between mainland and Mieu Island (12º10'60"N, 109º13'16"W) on April 19, 2004, at a depth of 10.4 m; silted crushed shell; mean particle size, 0.25 mm; silt, 25%. Coll. A. A. Udalov.

Type locality

Nha-Trang Bay, Southern Vietnam (12º10'60"N, 109º13'16"W).

Etymology

The species is named in honour to Dr Oleg Vladimirovits Savinkin (Severstov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russia).

Female

Habitus (not shown) fusiform, tapering from posterior margin of cephalothorax to anal somite; maximum width at posterior margin of cephalothorax; total body length 409 µm. Rostrum (not shown) large, bell-shaped, distinct. Prosomites, and first to fifth urosomites with plain hyaline frill; dorsal (Fig. 27A) and ventral (Fig. 27C) surface of urosomites without spinular ornamentation except for spinules along posterior margin of anal somite ventrally. Genital double-somite with trace of subdivision as figured

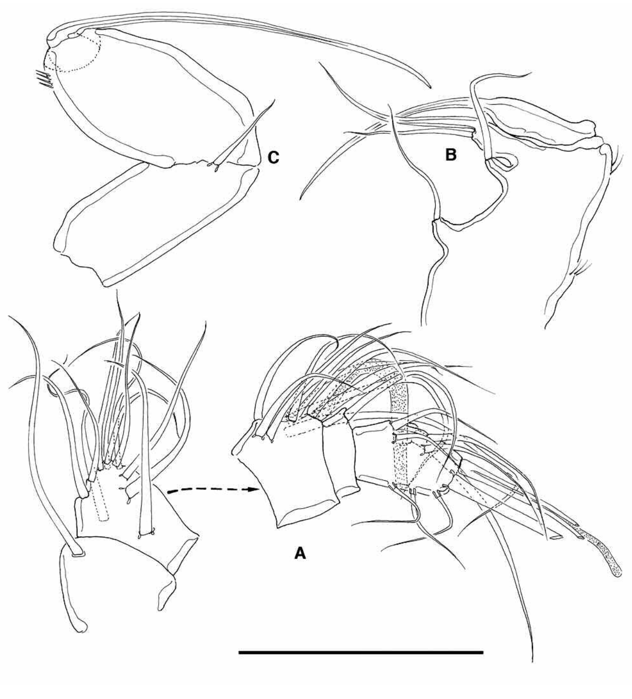


Figure 28. *Diarthrodes savinkinii* sp. nov. Female. **A.** Antennule. **B.** Maxilla. **C.** Maxilliped. Scale bar: A-C, 50 µm.

Figure 28. *Diarthrodes savinkinii* sp. nov. Femelle. **A.** Antennule. **B.** Maxille. **C.** Maxillipède. Echelle : A-C, 50 µm.

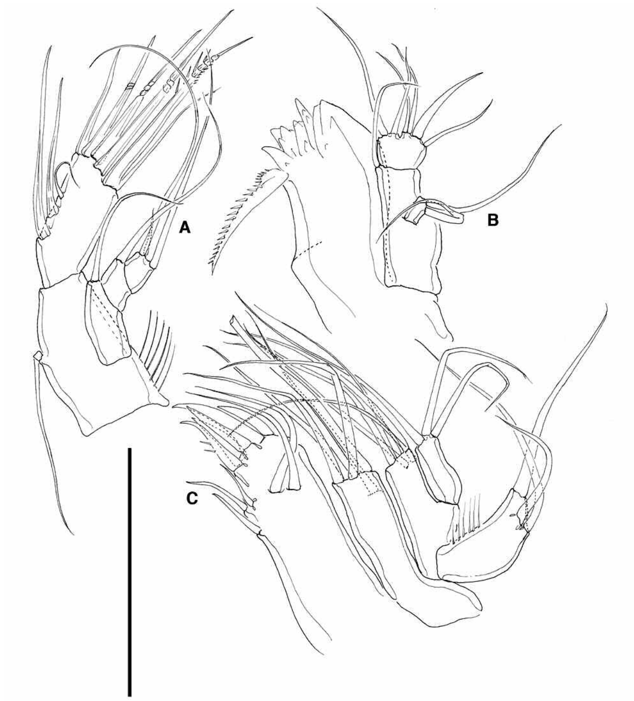


Figure 29. *Diarthrodes savinkinii* sp. nov. Female. **A.** Antenna. **B.** Mandible. **C.** Maxillule. Scale bar: A, B, 50 µm; C, 33 µm.

Figure 29. *Diarthrodes savinkinii* sp. nov. Femelle. **A.** Antenne. **B.** Mandibule. **C.** Maxillule. Echelle : A, B, 50 µm ; C, 33 µm.

(Fig. 27A & C); genital field as in Fig. 27C; P6 represented by two setae. Caudal rami slightly longer than wide, with seven elements (Fig. 27B & D); elements I, II and III situated at the outer distal corner; seta I very long and ventral to element II, the latter transformed into strong spine; seta III slender, longer than and next to element II; setae IV and V normal in shape; seta VI as long as seta III and situated at inner distal corner; seta VII triarticulated.

Antennule (Fig. 28A), five-segmented, with aesthetasc on third and last segments, surface of segments without spinules. Armature formula, 1-(1), 2-(11), 3-(10+ae), 4-(1), 5-(8+acrothek). Acrothek consisting of two setae and one aesthetasc fused basally.

Antenna (Fig. 29A). Allobasis without trace of division between basis and first endopodal segment, with one long abexopodal seta. Exopod three-segmented; first and second segments with one seta, third segment with three setae as figured. Free endopodal segment with two lateral spines and one seta; apically with one spine, three geniculate elements and one geniculate seta fused to slender element.

Mandible (Fig. 29B) with strong gnathobase, bidentate pars incisiva and a strong element as figured. Coxa-basis long and armed with one long seta. Exopod and endopod one-segmented; endopod with two, exopod with six setae.

Maxillule (Fig. 29C). Arthrite of praecoxa with two surface setae, laterally with three and distally with five. Coxa and basis with five setae. Endopod and exopod one-segmented, large, with three setae each.

Maxilla (Fig. 28B). Syncoxa with three endites; proximal and middle endites with one, distal endite with two setae. Basis produced into strong, serrate claw.

Maxilliped (Fig. 28C). Basis without spinules, with one apical seta. First endopodal segment without armature, second endopodal segment with strong claw.

P1 (Fig. 30A). Intercoxal sclerite as in *D. nhatrangensis* sp. nov. Basis with spinules at base of endopod. Exopod two-segmented, reaching proximal half of first endopodal segment; EXP1 with one outer spine; EXP2 with six setae/spines. Endopod two-segmented; first segment elongate, about 2 times as long as wide (measured at its widest part), with one seta halfway of inner margin, second segment small, about twice as long as wide, with two spines (outermost smaller).

P2 (Fig. 30B). Intercoxal sclerite as in *D. nhatrangensis* sp. nov. Basis with spinules at base of endopod; inner distal corner weakly produced, middle part acutely produced. Rami three-segmented. EXP1 and EXP2 with inner seta, EXP3 with seven elements. Endopod reaching half of

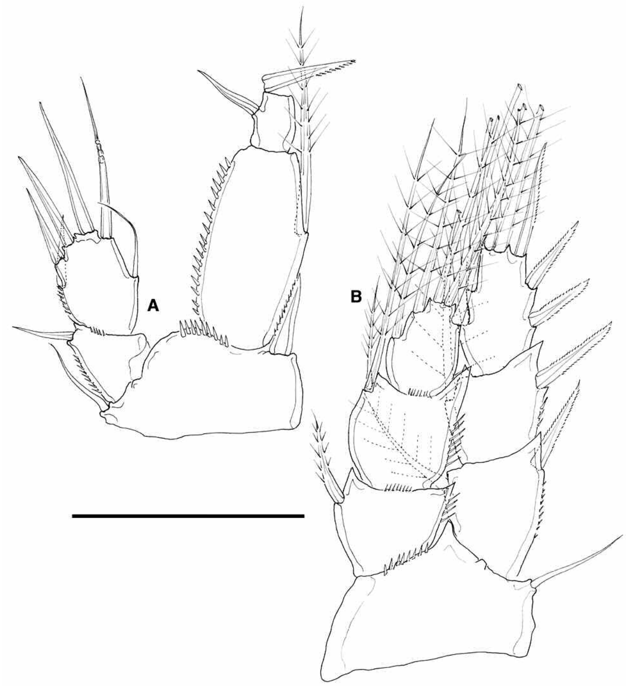


Figure 30. *Diarthrodes savinkinii* sp. nov. Female. **A.** P1. **B.** P2. Scale bar: A, B, 50 µm.
Figure 30. *Diarthrodes savinkinii* sp. nov. Femelle. **A.** P1. **B.** P2. Echelle : A, B, 50 µm.

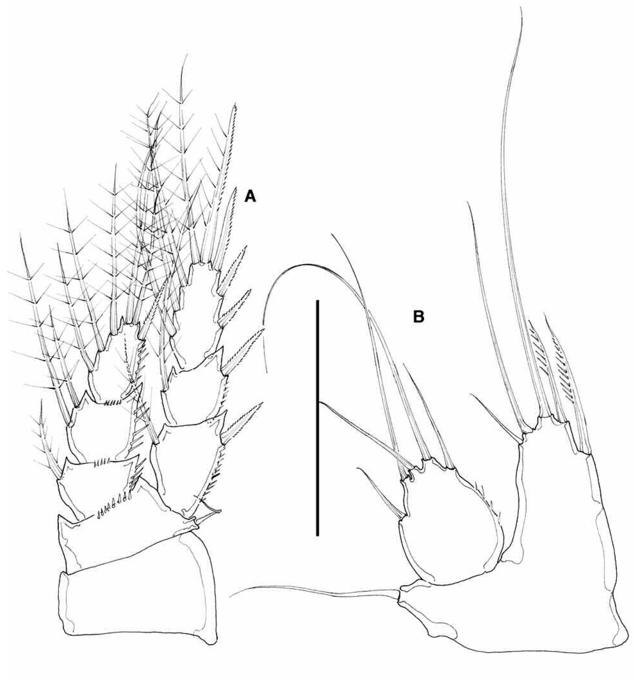


Figure 31. *Diarthrodes savinkinii* sp. nov. Female. **A.** P3. **B.** P5. Scale bar: A, 71 µm; B, 50 µm.
Figure 31. *Diarthrodes savinkinii* sp. nov. Femelle. **A.** P3. **B.** P5. Echelle : A, 71 µm ; B, 50 µm.

EXP3; ENP1 with one, ENP2 with two inner setae (distalmost smaller); ENP3 with five setae/spines.

P3 (Fig. 31A). Intercoxal sclerite and coxa as in *D. nhatrangensis* sp. nov. Basis as in P2. Exopod as in P2 except for eight setae/spines in P3EXP3. Endopod as in P2 except for six elements in P3ENP3.

P4 (not shown) badly damaged during dissection. Probably as in *D. nhatrangensis* sp. nov.

P5 (Fig. 31B). Baseoendopodal lobe well developed, reaching far beyond exopod, with five elements. Exopod oval, with five setae.

Armature formula of swimming legs as follows:

	P1	P2	P3	P4
EXP	I-0;III,I1,1	I-1;I-1;III,I1,2	I-1;I-1;III,I1,3	I-1;I-1;III,I1,3
ENP	0-1;I,I,0	0-1;0-2;I,2,2	0-1;0-2;I,2,3	0-1;0-1;I,2,2

Male

Unknown.

Discussion

The genus *Diarthrodes* Thomson, 1882 was created to allocate *D. novae-zealandiae* Thomson, 1882 from Otago Harbour (New Zealand). At present there are 42 valid species within *Diarthrodes*. These are: *D. nobilis* (Baird, 1845), *D. minutus* (Claus, 1863), *D. ponticus* (Kričagin, 1873), *D. novae-zealandiae*, *D. imbricatus* (Brady, 1883), *D. andrewi* (T. Scott, 1894), *D. major* (Scott & Scott, 1895), *D. pygmaeus* (Scott & Scott, 1895), *D. assimilis* (Sars, 1906), *D. sarsi* (A. Scott, 1909), *D. pusillus* (Brady, 1910), *D. tumidus* (Brady, 1910), *D. intermedius* (T. Scott, 1912), *D. nanus* (T. Scott, 1914), *D. purpureus* (Gurney, 1927), *D. aegideus* (Brian, 1927), *D. roscoffensis* (Monard, 1935), *D. gurneyi* Lang, 1948, *D. campbelliensis* Lang, 1948, *D. feldmanni* Bocquet, 1953, *D. cystoecus* Fahrenbach, 1954, *D. falcipes*, *D. unisetosus*, *D. dissimilis*, *D. glaber* Wells, 1967, *D. hirami* Por, 1967, *D. fahrenbachi* Bodin, 1968, *D. drachi* Bodiou, 1974, *D. gravellicola* Soyer, 1975, *D. ponticus orientalis* Apostolov, 1975, *D. tetrastachyus* Yeatman, 1976, *D. lilacinus* Pallares, 1977, *D. parvulus* Pallares, 1977, *D. latisetosus* Chislenko, 1978, *D. zavodniki* Apostolov & Petkovski, 1980, *D. brevipes* Wells & Rao, 1987, *D. imitator* sp. nov., *D. tripartitus* sp. nov., *D. hexasetosus* sp. nov., *D. nhatrangensis* sp. nov., *D. savinkinii* sp. nov. and *D. apostolovii* sp. nov.

Unfortunately the mouthparts of some species have received little attention and some other species have been reported with different armature complements in mouth appendages or swimming legs, thus making difficult and even senseless further comparisons and phylogenetic analyses. Evidently, an in depth revision of the genus is urgently needed to shed some light on the phylogenetic relationships of the species currently attributed to the genus *Diarthodes*.

The species within *Diarthodes* can be grouped into seven groups based on the combination of the number of segments of the antennal exopod, the number of segments of P1 endopod, and the number of segments of P1 exopod (Table 1). Such species groupings might not reflect phylogeny and should be taken cautiously, but it is useful for species separation. These groups are:

I (1-2-2) (A2EXP one-segmented, P1EXP two-segmented, P1ENP two-segmented).

T. Scott (1912) described *D. intermedius* (= *Pseudothalestris intermedia* T. Scott, 1912 (Lang, 1936)) from South Orkney Islands (Scotia Bay). T. Scott's (1912) description lacks detail and only the female antennule and the maxilliped, female P1, female and male P2, and female and male P5 are shown in his illustrations and nothing is said about the A2EXP. It has to be noted that Pallares (1977) probably unaware of Lang's (1948) decision to consider *D. nanus* and *D. intermedius* as distinct species, kept Lang's (1936) view regarding the synonymy of these two species.

The condition of the A2EXP of *D. intermedius* remains unknown and there is little to attribute this species to group I (1-2-2) but it is suggested to provisionally allocate this species to this species group.

Brady (1910) described *D. tumidus* (= *Pseudothalestris tumida* Brady, 1910 (Lang, 1936)) from Observatory Bay (Kerguelen). The condition of the A2EXP regarding the number of segments (see also Lang, 1948: 537), and the number of setae on the P1EXP2, P1ENP1 and ENP2 remains unclear and it is suggested to attribute provisionally *D. tumidus* to this species group.

Apostolov (1972) reported *D. assimilis* from the Black Sea but omitted any comment on the morphology of the species. Apostolov's (1972) figures clearly show that his material does not belong to *D. assimilis* but to a new species, *Diarthrodes apostolovii* sp. nov. (see below for description) herein placed in group I(1-2-2).

II (1-2-3) (A2EXP one-segmented, P1EXP two-segmented, P1ENP three-segmented).

III (2-1-3) (A2EXP two-segmented, P1EXP one-segmented, P1ENP three-segmented).

IV (3-1-3) (A2EXP three-segmented, P1EXP one-segmented, P1ENP three-segmented).

V (2-2-3) (A2EXP two-segmented, P1EXP two-segmented, P1ENP three-segmented).

VI (3-2-2) (A2EXP three-segmented, P1EXP two-segmented, P1ENP two-segmented).

Diarthrodes zavodniki, *D. savinkinii* sp. nov. and *D. nhatrangensis* sp. nov. are the species within this group (Table 1f). *Diarthrodes zavodniki* is unique within this group by the presence of two outer spines only on P2-P4EXP3. Two outer spines have been reported also in the P3EXP3 and P4EXP3 of *D. hirami* and *D. gurneyi* (see Gurney, 1927, Lang, 1948), and in the P2EXP3 of *D. minutus* (see Sars, 1906).

VII (3-2-3) (A2EXP three-segmented, P1EXP two-segmented, P1ENP three-segmented).

Diarthrodes apostolovii sp. nov.

Diarthrodes assimilis? *sensu* Apostolov (1972: 217-218, figs 84-93)

Material examined.

None. Diagnosis based on Apostolov's (1972) original figures.

Type locality

Black Sea.

Etymology

This species is named after Dr. A. Apostolov for his contribution to the knowledge of harpacticoid copepods from the Black Sea.

Male

Habitus fusiform, tapering from posterior margin of cephalothorax to anal somite; maximum width at posterior margin of cephalothorax; total body length from 700 µm to 750 µm. Prosomites and urosomites without spinular ornamentation, except for ventral spinules on posterior margin of anal somite. Caudal rami short, about 1.5 times as wide as long.

Antennule, eight-segmented, haplocer.

Antenna with allobasis armed with one abexopodal seta. Exopod one-segmented, with four lateral and two apical setae. Free endopodal segment with two lateral spines; apically with one spine, three geniculate setae and one geniculate element fused to slender seta.

Mandible, maxillule and maxilla unknown.

Basis of maxilliped with one apical seta. First endopodal segment oval, without armature, second endopodal segment with strong claw.

P1 with two-segmented rami. Exopod two-segmented, barely reaching half of first endopodal segment; EXP1 with one outer spine; EXP2 with six setae/spines. ENP1 elongate, about 7.3 times as long as wide, with one inner seta on proximal quarter; ENP2 with two pectinate spines (outermost shorter) seta halfway of inner margin.

P2EXP three-segmented; EXP1 and EXP2 with inner seta; EXP3 with seven setae/spines. Endopod two-segmented, sexually dimorphic; ENP1 with inner seta; ENP2 with six elements (five elements plus outer apophysis?).

P3EXP three-segmented; EXP1 and EXP2 with inner seta; EXP3 with eight setae/spines. Endopod three-segmented; ENP1 with one, ENP2 with two inner setae; ENP3 with six setae/spines.

P4EXP unknown. Endopod three-segmented; ENP1 and ENP2 with one inner seta; ENP3 with five setae/spines.

Baseoendopodal lobe of P5 with one inner and two apical elements. Exopod with 5 elements.

P6 represented by two plates with three setae each.

Armature formula of swimming legs as follows:

	P1	P2	P3	P4
EXP	I-0;I1I,I1,1*	I-1;I-1;III,I1,2	I-1;I-1;III,I1,3	I-1;I-1;III,I1,3**
ENP	0-1;0,II,0	Dimorphic	0-1;0-2;I,2,3	0-1;0-1;I,2,2

*The shape of the elements (except for proximal outer spine) of P1EXP2 is difficult to define from Apostolov's (1972) figure. However, based on other species this seems to be the most probable armature formula.

**The P4EXP remains unknown, but based on other species, this seems to be the most probable armature formula.

Female

Unknown.

Remarks

Apostolov (1972) reported *D. assimilis* from the Black Sea but omitted any comment on the morphology of the species and presented only illustrations of the male habitus, antennule, antenna, maxilliped, P1, P2, P3, P4ENP, P5 and P6. Apostolov's (1972) figures clearly show that his material does not belong to *D. assimilis* but to a new species, *Diarthrodes apostolovii* sp. nov. This new species has been allocated herein in group I(1-2-2) by the combination of a two-segmented A2EXP, P1ENP and P1EXP. *Diarthrodes apostolovii* sp. nov. seems to be more closely related to *D. glaber* and *D. hirami* by the presence of six (one inner, two apical and three outer) elements on the two-segmented P1EXP2. *Diarthrodes apostolovii* sp. nov. and *D. glaber* can be separated from *D. hirami* by the armature formula of P3EXP3 (with three outer elements in *Diarthrodes apostolovii* sp. nov. and *D. glaber*, but with two outer spines only in *D. hirami*) and P3ENP3 (with three inner setae in *Diarthrodes apostolovii* sp. nov. and *D. glaber*, but with two inner setae only in *D. hirami*). *Diarthrodes glaber* can be separated from *D. hirami* by the number of segments of the female antennule (six-segmented in *D. glaber*, five-segmented in *D. hirami*) and by the armature formula of P4EXP3 (with three outer spines in *D. glaber*, but with two outer spines in *D. hirami*). Unfortunately, the antennule and the armature formulae of P2ENP and P4EXP of *D. apostolovii* sp. nov. remain unknown and nothing can be said on this regard.

Diarthrodes imitator sp. nov. has been placed in group II(1-2-3) based on the one-segmented exopod of the antenna, the two-segmented P1EXP and the three-segmented P1ENP. *Diarthrodes imitator* sp. nov., *D. unisetosus* from Dillon Beach (California), *D. latisetosus* from the Sea of Japan, and *D. aegideus* from Italy are unique within this species group in that they possess two inner setae in the P2ENP2. On the other hand, *D. imitator* sp. nov. seems to be more closely related to *D. unisetosus* and to *D. latisetosus* than to *D. aegideus*. *Diathrodes imitator* sp. nov. and *D. unisetosus* share the armature formula of all swimming legs (except for P1ENP3 -with two elements in *D. unisetosus*, but with three elements in *D. imitator* sp. nov.), the P1-P4 EXP:ENP length ratio, the number of segments of female antennule, and the number of setae on the maxillary endites and endopod of maxilliped. Also, it has to be noted that these two species and *D. gurneyi* from Port Taufiq (Egypt) are unique within this group in that they possess one inner seta in P3ENP2. However, *D. gurneyi* is unique within this group in the P3-P4EXP3 (with two outer spines only). *Diarthrodes imitator* sp. nov. and *D. unisetosus* differ in the relative length of the setae of the baseoendopod and exopod of female P5 (compare Lang's (1965: 189) figure 103-f and Fig. 6E in the present study), number of setae of female P6 (with two setae in *D. unisetosus*, but with one seta in *D. imitator* sp. nov.), antenna (with allobasis in *D. unisetosus*, but with basis in *D. imitator* sp. nov.), and antennary exopod (with seven setae in *D. unisetosus*, but with five elements in *D. imitator* sp. nov.). Differences were observed also in the number of setae on the coxa, basis and endopod of the maxillule and in the number of setae of the exopod and endopod of the mandible. *Diarthrodes imitator* sp. nov. and *D. latisetosus* share the presence of an antennary basis and the armature formulae of all swimming legs except for P3ENP2 (with two inner setae in *D. latisetosus*, but with one inner seta in *D. imitator* sp. nov. – the latter condition is similar for *D. unisetosus* and *D. gurneyi*). From Chislenko's (1978) illustrations of *D. latisetosus*, these two species can be separated also by the ventral spinular ornamentation of urosomites (with spinules in *D. latisetosus*, but without spinules in *D. imitator* sp. nov.), number of segments of the female antennule (seven-segmented in *D. latisetosus*, but six-segmented in *D. imitator* sp. nov.), number of setae on the antennary exopod (with seven setae in *D. latisetosus*, but with five setae in *D. imitator* sp. nov.), relative length of P3ENP (reaching tip of P3EXP2 in *D. latisetosus*, but reaching middle of P3EXP3 in *D. imitator* sp. nov.) and P4ENP (reaching proximal third of P4EXP2 in *D. latisetosus*, but reaching tip of P4EXP2 in *D. imitator* sp. nov.), relative length of female P5EXP and baseoendopodal and exopodal setae (compare Chislenko's (1978: 166) figure 4-7, and Fig. 6E in the present study). Differences were found also in the number of setae of the female antennule, of the endopod of the mandible, of the coxa, basis, exopod and endopod of the maxillule, and of the first endopodal segment of the maxilliped. However, these setae are often difficult to see and there is little point in trying to analyze these differences. The male of *D. imitator* sp. nov. remains unknown and nothing can be said about the differences in the dimorphic features between these species.

Diarthrodes tripartitus sp. nov. has been placed in group I (1-2-2) by the combination of the one-segmented exopod of the antenna, and the two-segmented P1EXP and P1ENP. *Diarthrodes tripartitus* sp. nov., *D. falcipes* from southeastern Brazil and *D. dissimilis* from Dillon Beach (California) share the seven-segmented female antennule and the armature formula of P1-P4 (except for P1ENP2 with two elements in *D. dissimilis* and *D. tripartitus* sp. nov., but with three elements in *D. falcipes*) and the sexual male dimorphism (number of segments of the male antennule, shape of the inner spine of basis of P1, and armature formula and relative length of the setae of the male P5) and are unique within this species-group by the presence of two inner setae in the female P2ENP2 (as in *D. imitator* sp. nov., *D. unisetosus*, *D. latisetosus* and *D. aegideus*). From their descriptions, *D. dissimilis*, *D. falcipes* and *D. tripartitus* sp. nov. cannot be separated neither by the armature formula of P1-P4 (except, as noted above, for P1ENP2) nor by the EXP:ENP length ratio of the male and female P1-P4, nor by the male P5. *Diarthrodes dissimilis* (see Lang, 1965), *D. falcipes* (see Marinoni, 1964) and *D. tripartitus* sp. nov. can be separated by the female P5 BENP:EXP length ratio. The female P5 baseoendopodal lobe reaches the middle and the distal third of the exopod in *D. dissimilis* and *D. tripartitus* sp. nov., respectively. The baseoendopodal lobe reaches the tip of the exopod in *D. falcipes*. Marinoni (1964) omitted the description/illustration of the mandible and the maxillule. From Marinoni's (1964) and Lang´s (1965) descriptions of the maxilliped and maxilla of *D. falcipes* and *D. dissimilis* respectively, the maxilliped of *D. tripartitus* sp. nov. is more similar to that observed for the latter in the lack of the single accessory seta of the claw. The maxilla of *D. dissimilis* possesses two endites with two setae each. The maxilla of *D. falcipes* was described as possessing two endites, the proximal and distal endites with one and two setae, respectively. *Diarthrodes tripartitus* sp. nov. was shown to possess three endites on the maxillary syncoxa. The proximal and middle endites bear one seta each, and the distal endite bears two slender elements.

Diarthrodes hexasetosus sp. nov. has been attributed to species-group V(2-2-3) based on the presence of a two-segmented exopod of the antenna, two segmented P1EXP and three-segmented P1ENP. The armature formulae of P2-P4 remain unknown for *D. pusillus* and *D. sarsi*. The P1EXP of the latter is also unknown. Also the condition of the antenna (with basis or allobasis) remains doubtful for all the species within this group. The rest of the species share the same armature formula of P1-P4, and *D. hexasetosus* sp. nov. seems to be unique in that this species possesses six setae/spines in the P1EXP2.

The species-group herein referred to as group V(3-2-2) is defined by the presence of a three-segmented exopod of the antenna, and a two-segmented P1EXP and P1ENP. To this group belong *D. zavodniki* from Rovinj (Yugoslavia), and *D. savinkinii* sp. nov. and *D. nhatrangensis* sp. nov. from southern Vietnam. The female of *D. zavodniki* remains unknown and so the condition of the female antennule and P2ENP. On the other hand, the males of *D. savinkinii* sp. nov. and *D. nhatrangensis* sp. nov. remain unknown thus being impossible further comparisons between these two species and *D. zavodniki*. Within this group *D. zavodniki* seems to be unique in that this species presents two outer spines in P2-P4EXP3 (the other two species possess three outer spines). *Diarthrodes savinkinii* sp. nov. and *D. nhatrangensis* sp. nov. share the armature formula of P1ENP and P2-P3 (the armature formula of P4 of *D. savinkinii* sp. nov. remains unknown), and the armature formulae and general shape of mouthparts. These two species can be separated by the armature formula of P1EXP (with six setae/spines in *Diarthrodes savinkinii* sp. nov., but five elements in *D. nhatrangensis* sp. nov.), and by the relative length of the setae of the P5 (compare Fig. 24C and 31B).

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Table 1. Armature formulae of the species groups of the genus Diarthrodes.
Tableau 1.

I (1-2-2) (A2EXP one-segmented, P1EXP two-segmented, P1ENP two-segmented).

I(1-2-2)	A1 No. segm.	A2 Basis/Allo	A2EXP No. segm/setae	P1 EXP	P1 ENP	P2 EXP	P2 ENP	P3 EXP	P3 ENP	P4 EXP	P4 ENP
[1]*D. andrewi*	7	-	1/5?	0,121	1,020	-,-,—-	-,-,—-	-,-,—-	-,-,—-	-,-,—-	-,-,223
[2]*D. dissimilis*	7	Allobasis	1/7	0,113	1,020	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,1,221
[3]*D. falcipes*	7	Allobasis	1/6	0,113	1,030	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,1,221
[4]*D. glaber*	6	Allobasis	1/5	0,123	1,020	1,1,223	1,1,221	1,1,323	1,2,321	1,1,323	1,1,221
[5]*D. gravellicola*	6	Allobasis	1/4	0,113	1,020	1,1,223	1,1,221	1,1,323	1,2,321	1,1,323	1,1,221
[6]*D. hirami*	5	Allobasis	1/5	0,123	1,020	1,1,223	1,1,221	1,1,322	1,2,221	1,1,322	1,1,221
[7]*D. intermedius*	7	-	-	0,111	1,020	-,-,—-	-,-,—-	-,-,—-	-,-,—-	-,-,—-	-,-,—-
[8]*D. tumidus*	8	Allobasis	1or2?/4	0,121	1,—-	-,-,—-	-,-,—-	-,-,—-	-,-,—-	-,-,—-	-,-,—-
[9]*D. apostolovii* sp. nov.	-	Allobasis	1/6	0,123	1,020	1,1,223	-,-,—-	1,1,323	1,2,321	-,-,—-	1,1,221
[10]*D. tripartitus* sp. nov.	7	Basis	1/6	0,113	1,020	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,1,221

[1]After T. Scott (1894), Lang (1948). [2]After Lang (1965). [3]After Marinoni (1964). [4]After Wells (1967). [5]After Soyer (1974). [6]After Por (1967). [7]After T. Scott (1912), Lang (1948). [8]After Brady (1910), Lang (1948). Brady (1910) showed four setae on the P1EXP2, two outer elements in P1ENP1 and four elements in P1ENP2. [9]After Apostolov (1972) (see group VII (3-2-3) and description of the species below). [10]Present study.

II (1-2-3) (A2EXP one-segmented, P1EXP two-segmented, P1ENP three-segmented).

II(1-2-3)	A1 No. segm.	A2 Basis/Allo	A2EXP No. segm/setae	P1 EXP	P1 ENP	P2 EXP	P2 ENP	P3 EXP	P3 ENP	P4 EXP	P4 ENP
[11]*D. nanus*	7	Basis[a]	1/7;1/6[b]	0,113	1,0,020	1,1,223	1,1,221	1,1,323	1,2,321	1,1,323	1,1,221
[12]*D. aegideus*	7	-	1/7	0,113	1,0,020	1,1,223	1,2,221	1,1,323	1,2,221	1,1,323	1,1,221
[13]*D. gurneyi*	7	-	1/6	0,113	1,0,020	1,1,223	1,1,221	1,1,322	1,1,321	1,1,322	1,1,221
[14]*D. unisetosus*	6	Allobasis	1/6	0,113	1,0,020	1,1,223	1,2,221	1,1,323	1,1,321	1,1,323	1,1,221
[15]*D. drachi*	7	Allobasis	1/7	0, 113	1,0,020	1,1,223	1,1,221	1,1,323	1,2,321	1,1,323	1,1,221
[16]*D. parvulus*	7	-	1/7	0,113	1,0,020	1,1,123	1,1,221	1,1,123	1,2,221	1,1,123	1,1,221
[17]*D. latisetosus*	7	Basis	1/7	0,113	1,0,030	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,1,221
[18]*D. novae-zealandiae*	9?	-	1/3	-,—-	1,0-0?[a]	-,-,—-	-,-,—-	-,-,—-	-,-,—-	-,-,—-	-,-,—-
[19]*D. imitator* sp. nov.	6	Basis	1/5	0,113	1,0,030	1,1,223	1,2,221	1,1,323	1,1,321	1,1,323	1,1,221

[11]After T. Scott (1914), Lang (1948), Pallares (1977). Pallares (1977) unaware of Lang's (1948) decision to consider *D. nanus* and *D. intermedius* as distinct species, kept Lang's (1936) view regarding the synonymy of these two species. Also, it has to be noted that Pallares (1977, Lam. I, Fig. 13) erroneously omitted the outer spine of P1EXP1 of *D. parvulus*; [a]Pallares (1977, Lám. I, Fig. 4) showed the A2 with basis; [b]Lang (1948) diagnosed the species as having a one-segmented A2EXP with six setae. [12]After Brian (1927), Lang (1934, 1948). [13]After Gurney (1927), Lang (1948). [14]After Lang (1965). [15]After Bodiou (1974). [16]After Pallares (1977). Pallares (1977, Lam. I, Fig. 13) erroneously omitted the outer spine of P1EXP1. [17]After Chislenko (1978). [18]After Thomson (1882), Lang (1948). [a]The condition of the P1ENP of *D. novae-zealandiae* remains doubtful and has been provisionally attributed to this species group. [19]Present study.

III (2-1-3) (A2EXP two-segmented, P1EXP one-segmented, P1ENP three-segmented).

III(2-1-3)	A1 No. segm.	A2 Basis/Allo	A2EXP No. segm/setae	P1 EXP	P1 ENP	P2 EXP	P2 ENP	P3 EXP	P3 ENP	P4 EXP	P4 ENP
[20]*D. purpureus*	5	-	2/3,2	1,2,4	1,0,020	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,1,221

[20]After Gurney (1927), Lang (1948)

.../...

IV (3-1-3) (A2EXP three-segmented, P1EXP one-segmented, P1ENP three-segmented).

IV(3-1-3)	A1 No. segm.	A2 Basis/Allo	A2EXP No. segm/setae	P1 EXP	P1 ENP	P2 EXP	P2 ENP	P3 EXP	P3 ENP	P4 EXP	P4 ENP
[21]*D. fahrenbachi*	-	Basis	3/1,1,4	020	1,0-1,030	-,-,—-	-,-,—-	-,-,—-	-,-,—-	-,-,—-	-,-,—-
				123[c]			1,1,222				1,1,221[b]
[22]*D. nobilis*	5	Allobasis	3/2,1,4[d]	124[e]	1,0,020	1,1,223	1,2,221[a]	1,1,323	1,2,321	1,1,323	1,2,221[g]
			2/1,3[h]	224[f]							

[21]After Bodin (1968). [22]After Sars (1906), Gurney (1927), Lang (1948), Apostolov (1973), Vervoort (1964), Pallares (1968, 1977), Claus (1863), Chislenko (1967), Apostolov & Marinov (1988). Apostolov (1972) reported *D. nobilis* from the Black Sea but omitted any comment on the morphology of the species. Pallares (1977) reported *D. nobilis* from Isla de Los Estados but omitted the description of her material. [a]Sars (1906), Vervoort (1964) and Apostolov & Marinov (1988) reported the presence of two inner setae on P2ENP2 and one outer spine on P2ENP3; [b]Sars (1906) and Vervoort (1964) reported one inner seta on P4ENP2; [c]Vervoort (1964), Apostolov (1973) and Apostolov & Marinov (1988) reported one inner, two apical and three outer elements in one-segmented P1EXP. It has to be noted that Vervoort (1964: 144) reversed the P1EXP and P1ENP in his written description; [d]Sars (1906), Vervoort (1964), Pallares (1968) and Apostolov & Marinov (1988) showed a three-segmented A2EXP with two, one and four setae on the proximal, medial and distal segments, respectively; [e]Pallares (1968: 248, Lám. II, Fig 1) reported the presence of eight setae in the written description and seven setae in her illustration of P1EXP, and Sars (1906) and Michailova-Neikova & Voinova-Stavreva (1971) described the P1EXP as having seven elements; [f]Chislenko (1967) showed the P1EXP with eight elements; [g]Apostolov & Marinov (1988) reported the presence of two inner setae on P4ENP2; [h]The A2EXP shown by Claus (1863, Taf. XXI, Fig. 3) seems to be two-segmented, with one and three setae on the first and second segments, respectively, and Lang (1948: 530) re-diagnosed the species with a three-segmented A2EXP with seven setae in all.

V (2-2-3) (A2EXP two-segmented, P1EXP two-segmented, P1ENP three-segmented).

V(2-2-3)	A1 No. segm.	A2 Basis/Allo	A2EXP No. segm/setae	P1 EXP	P1 ENP	P2 EXP	P2 ENP	P3 EXP	P3 ENP	P4 EXP	P4 ENP
[23]*D. campbellensis*	6	-	2/2,5	0,113	1,0,030	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,1,221
[24]*D. imbricatus*[a]	-	-	2/4?	0,112	1,0,020	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,1,221
[25]*D. pusillus*	8	-	2/-,-	0,013	1,030	-,-,—-	-,-,—-	-,-,—-	-,-,—-	-,-,—-	-,-,—-
[26]*D. pygmaeus*	7	-	2/3,4	0,113	1,0,0-0	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,1,221
[27]*D. sarsi*	6	-	2/1,3	0,—-	1,0,030	-,-,—-	-,-,—-	-,-,—-	-,-,—-	-,-,—-	-,-,—-
[28]*D. hexasetosus* sp. nov.	5	Allobasis	2/3,2	0,123	1,0,030	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,1,221

[23]After Lang (1934), Lang (1948). [24]After Brady (1883), T. Scott (1912), Lang (1948). [a]Female unknown. [25]After Brady (1910), Lang (1948). [26]After T. Scott & A. Scott (1895), Lang (1948), Apostolov & Marinov (1988). Apostolov (1972) reported *D. pygmaeus* from the Black Sea but omitted any comment on the morphology of the species. [27]After A. Scott (1909), Lang (1948). [28]Present study.

VI (3-2-2) (A2EXP three-segmented, P1EXP two-segmented, P1ENP two-segmented).

VI(3-2-2)	A1 No. segm.	A2 Basis/Allo	A2EXP No. segm/setae	P1 EXP	P1 ENP	P2 EXP	P2 ENP	P3 EXP	P3 ENP	P4 EXP	P4 ENP
[29]*D. zavodniki*	-	Allobasis	3/1,1,4	0,121	1,020	1,1,222	-,-,—-[a]	1,1,322	1,2,321	1,1,322	1,2,221
[30]*D. savinkinii* sp. nov.	5	Allobasis	3/1,1,3	0,123	1,110	1,1,223	1,2,221	1,1,323	1,2,321	-,-,—-	-,-,—-
[31]*D. nhatrangensis* sp. nov.	5	Allobasis	3/1,1,3	0,113	1,110	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,1,221

[29]after Apostolov & Petkovski (1980). [a]The female remains unknown. [30]Present study. [31]Present study.

VII (3-2-3) (A2EXP three-segmented, P1EXP two-segmented, P1ENP three-segmented).

VII(3-2-3)	A1 No. segm.	A2 Basis/Allo	A2EXP No. segm/setae	P1 EXP	P1 ENP	P2 EXP	P2 ENP	P3 EXP	P3 ENP	P4 EXP	P4 ENP
[32]*D. assimilis*	5	-	3/2,1,4	0,113	1,0,020	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,1,221
[33]*D. brevipes*	6	Allobasis	3/2,1,3	0,123	1,0,030	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,2,221

[34]*D. cystoecus*	6[e]	-[a]	3/2,1,2[b]	0,123[g]	1,0,030[c]	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,1,221
		Allobasis[d]	3/1,1,2[f]		1,0,020[g]						
[35]*D. feldmanni*	6	Allobasis	3/2,1,2	0,123	1,0,030	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,1,221
[36]*D. lilacinus*	8	Basis[a]	3/2,1,4	0,113	1,0,030	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,2,221
[37]*D. minutus*	6		3/2,1,4[e]	0,113[b]	1,0,020[b]	1,1,222[d]	-,-,—-	-,-,—-	-,-,—-	-,-,—-	-,-,—-
				0,112[a]	1,0,030[c]						
[38]*D. ponticus*	6[b]	Allobasis	3/2,1,3	0,123	1,0,020	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,1,221
	-[a]	Basis[d]	3/2,1,2[e]	0,023[c]							
[39]*D. ponticus orientalis*	6	Allobasis	3/2,0,3	0,123	1,0,020	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,1,221
[40]*D. roscoffensis*	8	-	3/2,1,4	0,023	1,0,020	1,1,223	1,1,221	1,1,323	1,2,2(3)21	1,1,323	1,1,221
[41]*D. tetrastachyus*	7	Allobasis	3/1,1,4	0,023	1,0,020	1,1,223	1,2,221	1,1,323	1,2,321	1,1,323	1,2,221
[42]*D. major*	8		3/2,1,3	0,113	1,0,020	1,1,223	1,1,221	1,1,323	1,2,321	1,1,323	1,2,221

[32]After Sars (1906), T. Scott (1912), Lang (1948), Apostolov & Marinov (1988). Apostolov (1972) reported *D. assimilis* from the Black Sea but omitted any comment on the morphology of the species. Apostolov's (1972) figures clearly show that his material does not belong to *D. assimilis* but to a new species, *Diarthrodes apostolovii* sp. nov. (see below for description) herein placed in group I(1-2-2). [33]After Wells & Rao (1987). [34]After Pallares (1977), Fahrenbach (1954, 1962), Wells & Rao (1987). Pallares (1977) supports Fahrenbach's (1962) opinion that *D. cystoecus* and *D. feldmanni* are in fact synonyms, but refrained from synonymising these species because she could not make comparisons with fresh material of *D. feldmanni*. Pallares (1977) suggested that Fahrenbach (1954) based his description of *D. cystoecus* on a male and not on a female as Fahrenbach (1954) assumed. Pallares (1977) might be right based on the P5 presented by Fahrenbach (1954), but it is also evident that the specimen was a copepodite (probably CIV or CV) based on the lack of sexual dimorphism in A1 and P2ENP. On the other hand, from Fahrenbach's table (1962: 311-312, Table I) about the development of *D. cystoecus* it is not possible to be certain if he (Fahrenbach, 1954) described a fourth or fifth male copepodite. Wells & Rao (1987) found specimens of *D. cystoecus* in samples taken from the Middle and South Andamans and observed four varieties of females that, to a greater or lesser degree, differ from Pallares' (1977) description (Wells & Rao, 1987). However, based on the evident similarity to *D. cystoecus* and given the insufficient evidence to place their material in separate species, Wells & Rao (1987) preferred to attribute their material to *D. cystoecus* rather than to create at least two new species and/or subspecies. [a]Pallares (1977) did not mention whether the A2 present basis or allobasis; [b] Pallares (1977) showed a three-segmented A2EXP with two, one and two setae on proximal, medial and distal segment, respectively (the same armature for A2EXP was observed by Wells & Rao (1987)); [c] Pallares (1977) reported two spines and a small setae apically on P1ENP3; [d]Fahrenbach (1954, 1962) presented A2 with allobasis; [e]Fharenbach (1954) showed a six-segmented A1; [f] Fharenbach (1954) three-segmented A2EXP bearing one, one and two setae in the proximal, medial and distal segment respectively; [g] Fharenbach (1954) described an armature of 0,123 and 1,0,020 for P1EXP and ENP (the same armature formula was given by Wells & Rao (1987)). [35]After Bocquet (1953). Bocquet (1953) did not give the armature for P2-P4EXP1, EXP2 and ENP1. These have been inferred from other species. [36]After Pallares (1977). [a]Pallares (1977: 6) described de A2 with allobasis, but in her Lám. II, Fig. 4, she showed the A2 with basis. [37]After Claus (1863), Apostolov & Marinov (1988). Apostolov (1972) reported *D. minutus* from the Black Sea but omitted any comment on the morphology of the species. [a]Apostolov & Marinov (1988) showed the P1EXP2 with four setae/spines and did not mention the armature formulae for the other legs; [b]the armature formula and number of segments of P1 is not clear enough in Claus (1863) and Sars (1906) showed the P1EXP2 with five elements; [c]Sars (1906) illustrated the P1ENP3 with two claws and one small seta; [d]Sars (1906) illustrated the male P2EXP3 with two outer spines; [e]Sars (1906) illustrated the A2EXP as three-segmented, with two, one and four setae on the proximal, medial and distal segments respectively. [38]After Brian (1921, 1927), Farran (1913), Monard (1928), Lang (1948), Apostolov (1973), Por (1960) (as *D. dubius* (Brian)), Apostolov & Marinov (1988) (both as *D. ponticus* and as *D. dubius*). Apostolov (1972) reported *D. ponticus* and *D. dubius* from the Black Sea but omitted any comment on the morphology of the species. [a]Apostolov (1973) remained silent regarding the number of segments of A1; [b]Lang (1948) diagnosed the species as having a five- or six-segmented A1, and Farran (1913), Por (1960) and Apostolov & Marinov (1988) reported a six-segmented A1; [c]Brian (1921, 1927), Farran (1913), Monard (1928), Lang (1948), Por (1960) and Apostolov & Marinov (1988) reported the P1EXP2 without inner seta; [d]Por (1960) reported the A2 with basis; [e]Por (1960) reported the presence of a three-segmented A2EXP with two, one and two setae on the proximal, medial and distal segments, respectively. [39]After Apostolov (1975), Apostolov & Marinov (1988). [40]After Monard (1935), Lang (1948). [41]After Yeatman (1976). [42]After T. Scott & A. Scott (1895), Lang (1948), Chislenko (1967).