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The genus *Diacyclops* Kiefer in Italy: a taxonomic, ecological and biogeographical up-to-date review (Crustacea Copepoda Cyclopidae).

Род *Diacyclops* Kiefer в Италии: обзор современных представлений о таксономии, экологии и биогеографии (Crustacea Copepoda Cyclopidae).

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КЛЮЧЕВЫЕ СЛОВА: Copepoda, *Diacyclops*, таксономия, экология, биогеография, Италия.

ABSTRACT: A taxonomic, ecological and biogeographical up-to-date review of the genus *Diacyclops* Kiefer in Italy is presented. The articulation pattern of all *Diacyclops* species is reviewed, and four morphological groups are established according to the degree of oligomerization of the swimming legs. An identification key of distinguishing characters of ♀♀ of Italian species and subspecies is provided.

РЕЗЮМЕ: Дан современный обзор таксономии, экологии и биогеографии рода *Diacyclops* Kiefer фауны Италии. Представлен обзор типов сочленения всех видов *Diacyclops*; согласно степени олигомеризации плавательных ног, выделены четыре группировки. Составлен ключ для определения ♀♀ итальянских видов и подвидов этого рода.

Introduction

The genus *Diacyclops* Kiefer, 1927 shows a worldwide distribution, with a few strictly cosmopolitan species. Most members of the genus are widespread in Eurasia and North America, a few species and subspecies are known from the tropics and the temperate Southern Hemisphere.

The genus seems to be particularly diversified in the Palearctic but the high concentration could be probably due to the historically intensive research in the subterranean habitats of that area rather than of any zoogeographical meaning; likewise, the lack of exhaustive information for the Oriental and Australian regions could be related to inadequate and deficient collecting efforts in those countries.

From an ecological point of view, the genus *Diacyclops* is the most successful and diverse of cyclopid genera. It includes land species inhabiting a wide variety of shallow fresh waters, dystrophic ponds, temporary water bodies, riverine wetlands, mosses and brackish inland waters; other species occur in large and small natural and artificial lakes and reservoirs, occasionally in rivers; it is also widely distributed in cave and interstitial waters and in groundwater related habitats, where numerous stygobitic species and subspecies, for the most part belonging to the *Diacyclops languidus-languidoides* group, can be found.

Systematics

Historically, there has been taxonomical confusion and instability regarding the systematic status of the genus *Diacyclops*. Some authors [Rylov, 1948; Damian-Georgescu, 1963], due to a morphological overlap between the genera *Acanthocyclops* and *Diacyclops*, included both genera into the genus *Acanthocyclops*.

Considering the structure of leg 5 as the main unifying generic feature of the family Cyclopidae, Kiefer [1927, 1967] subdivided the genus *Acanthocyclops* into two genera: *Acanthocyclops*, with the subgenera *Acanthocyclops* s.str. and *Megacyclops*, and *Diacyclops*.

Validity of the separation of these genera was questioned by Mazepova [1978] who recognized only *Acanthocyclops* in her monograph devoted to the Baikal cyclopids.

Following Kiefer's suggestion, Monchenko [1985], Dussart & Defaye [1985] and, recently, Einsle [1993] definitely accepted both *Acanthocyclops* and *Diacyclops* as valid taxa.

Nevertheless, recent progress in cyclopoid research in North America and the discovery of new species of *Diacyclops* with an unusual structure and armature of leg 5 [Reid, 1994] have further confused

Table. Number of segments in the legs of *Diacyclops*.

Group	Exopodites P1-P4	Endopodites P1-4
bicuspidatus	3.3.3.3	3.3.3.3
ekmani-stygius	3.3.3.3	3/2.3/2.3/2.3
languidus-languidoides	2.3.3.3	2.2.3.3
virginianus	2.2.2.2/3	2.2.2.2

the status and definition of the genus, proving as well that the systematic relationship and biogeographical patterns within the family Cyclopidae should be further elucidated.

There are presently 107 named species/subspecies of *Diacyclops*, most of them stygophilic or stygoxene inhabitants of different groundwater systems.

According to the oligomerization of the swimming legs, Monchenko [1985] arranged some species of *Diacyclops* in four morphological groups, viz. *ekmani, stygius, imparilis* and *minutissimus*. Later on, Reid [1994] updated Monchenko's ranking for all species described at that time.

Combining Monchenko's and Reid's groupings, four new morphological groups could be drew up, viz. *bicuspidatus*, *ekmani-stygius*, *languidus-languidoides*, and *virginianus* (Table).

The most primitive (plesiomorphic) condition belongs to the *bicuspidatus* group which is characterized by 3-segmented rami in all the swimming legs; the other groups are characterized by progressive reduction in the number of articles in anterior and posterior legs. The *ekmani* group shows reduction in the number of articles only in the endopodite of anterior legs, with the minimum reduction in *D. ekmani* (Lindberg, 1950) and *D. chappuisi* Naidenow & Pandourski, 1992, both with all the swimming legs' rami 3-segmented, except the leg 1 endopodite which is 2-segmented. The intermediate *languidus-languidoides* group includes species both with endopodite and exopodite of leg 1 being 2-segmented and with a minor reduction in the posterior legs. The most apomorphic state can be found in the *virginianus* group, with oligomerization of both the anterior and posterior legs (2-segmented endopodite, usually 2-segmented exopodite). Sexual dimorphism has been recently reported in some *Diacyclops* of the *virginianus* group from North America, which are characterized by a 2- (♀) or 3-segmented (♂) leg 4 exopod [Reid, 1994].

Habitat separation among the species of the above groups is evident and correlated with oligomerization of the swimming legs. In fact, the species belonging to the more primitive *bicuspidatus* and *ekmani-stygius* groups are, for the most part, epigean or occasional immigrants in the groundwater habitats; the others, as a rule, can be found in interstitial and groundwater-related habitats, such as caves, springs, phreatic and ipopheric substrates.

To my knowledge, the *bicuspidatus* group at present includes the following species: *D. bicuspidatus* (Claus, 1857); *D. bisetosus* (Rehberg, 1880); *D. thomasi* (Forbes, 1882); *D. navus* (Herrick, 1882); *D. michaelseni* (Mrazek, 1901); *D. skopljensis* (Kiefer, 1932); *D. jeannelli* (Chappuis, 1929); *D. charon* (Kiefer, 1931); *D. haueri* Kiefer, 1931); *D. karamani* (Kiefer, 1932); *D. nearcticus* (Kiefer, 1934); *D. alticola* (Kiefer, 1935); *D. uruguayensis* (Kiefer, 1935); *D. scottsbergi* (Lindberg, 1949); *D. mirnyi* (Borutzky & Vinogradov, 1957); *D. longifurcus* (Shen & Sung, 1963); *D. tenuispinalis* (Shen & Sung, 1963); *D. antrincola* Kiefer, 1967; *D. fontinalis* (Naidenow, 1969); *D. talievi* (Mazepova, 1970); *D. limnobius* (Kiefer, 1978); *D. ruffoi* Kiefer, 1981; *D. iranicus* Pesce & Maggi, 1982; *D. cryonastes* Morton, 1985; *D. palustris* Reid, 1988; *D. yetmani* Reid, 1988; *D. hispidus* Reid, 1988; *D. harryi* Reid, 1992; *D. chrisae* Reid, 1992; *D. sororum* Reid, 1992; *D. alabamensis* Reid, 1992.

The *ekmani-stygius* group includes *D. ekmani*, *D. stygius* sensu str. (Chappuis, 1924); *D. stygius deminutus* (Chappuis, 1925); *D. stygius macedonicus* Petkovski, 1954; *D. haemusi* Naidenow & Pandourski, 1992; *D. chappuisi* Naidenow & Pandourski, 1992.

The *languidus-languidoides* group consists of *D. languidus* (G.O. Sars, 1862) and *D. languidoides* (Lilljeborg, 1901) with their numerous subspecies, and the following other species: *D. abyssicola* (Lilljeborg, 1901); *D. zschokkei* (Graeter, 1910); *D. clandestinus* (Kiefer, 1926); *D. hypnicola* (Gurney, 1927); *D. hypogeus* (Kiefer, 1930); *D. tantalus* Kiefer, 1937; *D. arenosus* (Mazepova, 1950); *D. incolotaenia* (Mazepova, 1950); *D. jasnitskii* (Mazepova, 1950); *D. improcerus* (Mazepova, 1950); *D. intermedius* (Mazepova, 1952); *D. slovenicus* (Petkovski, 1954); *D. elegans* (Mazepova, 1961); *D. konstantini* (Mazepova, 1961); *D. galbinus* (Mazepova, 1961); *D. versutus*

(Mazepova, 1961); *D. spongicola* (Mazepova, 1961); *D. kyotoensis* Ito, 1964; *D. nagatoensis* Ito, 1964; *D. pelagonicus* Petkovski, 1971; *D. balearicus* Lescher-Moutoue, 1979; *D. cohabitatus* Monchenko, 1980; *D. insularis* Monchenko, 1982; *D. neglectus* Flossner, 1984; *D. lindae* Pesce, 1984; *D. nuragicus* Pesce & Galassi, 1985; *D. ichnusae* Pesce & Galassi, 1985; *D. cristinae* Pesce & Galassi; *D. paralanguidoides* Pesce & Galassi, 1987; *D. paolae* Pesce & Galassi, 1987; *D. maggii* Pesce & Galassi, 1987; *D. sardoi* Pesce & Galassi, 1987; *D. albus*, Reid, 1992.

The *virginianus* group includes, besides *D. virginianus*, the following species: *D yezoensis* (Ito, 1954); *D. imparilis* Monchenko, 1985; *D. eulitoralis* Alekseev & Arov, 1986; *D. dimorphus* Reid (1994) and *D. trajani* (Petkovski, 1954).

However, in the past and more recently there have been numerous problems regarding the *languidus-languidoides* group, and the validity of the most part of the named species and subspecies has been much discussed.

As regards the *languidoides*-complex, Plesa [1969] synonymized the subspecies *hypnicola* (Gurney, 1927), *eriophori* (Gurney, 1927), *badeniae* (Kiefer, 1933), *japonicus* Ito, 1952 and *suonensis* Ito, 1954 with *Diacyclops languidoides clandestinus* (Kiefer, 1926). Dussart & Defaye [1985] synonymized other subspecies of the same group, such as *pragensis* Sladecek & Rrehackova, 1951, *putealis* Chappuis, 1928 and *D. languidoides* f. *gotica* (Kiefer, 1931) with the nominal species.

Later on, Petkovski [1984] pointed out that the geographical and ecological distributions of *D. languidoides slovenicus* Monchenko, 1974, *D. languidoides hypnicola, D. languidoides zschokkei* (Graeter, 1910) *D. languidoides clandestinus* and *D. languidoides languidoides* (Lilljeborg, 1901) completely overlap and, consequently, he elevated them to the rank of distinct species.

Based on the presence/absence of a vestigial exopodal seta on the basipodite of the antenna, Pesce & Galassi [1985] subdivided the *Diacyclops languidoides*-complex into two morphological groups: *languidoides* and *clandestinus*, including respectively epigean or stygophilic species with an exopod and a well-developed armature on the basipodite of the antenna, and groundwater species lacking an exopod on the antenna and with a reduced or absent armature on the relative basipodite. On the same occasion, these authors pointed out the absence of exopodite on the antenna in such other stygobitic genera as *Speocyclops*, *Paragraeteriella*, *Apocyclops*, and *Acanthocyclops* (partim), suggesting as well that the absence of the nominate seta could be regarded as an adaptive preponderance of cyclopid copepods to a subterranean mode of life.

The importance of setation of the basipodite of the antenna in the systematics of the genus *Diacyclops*, as well as of other cyclopids was first emphasized by Monchenko [1982]. Successively, Petkovski [1984] pointed out the absence of a vestigial exopodal seta on the antenna of *D. clandestinus* and *D. imparilis*, observing that the lack of this seta indicated a stygobiont nature of the nominate species.

Recently, Reid [1991] reported the absence of the exopodal seta in some *Diacyclops* from North America, corroborating the hypothesis that the reduction of antennal setation is a widespread phenomenon in the genus *Diacyclops* as well as in the family Cyclopidae, but not exclusive of stygobitic species. At the same time, the author pointed out that "several states occur in which the exopodite seta is smaller than normal, or one or more setae are absent".

As regards *Diacyclops languidus* s.l., the inadequate descriptions and illustrations of its subspecies induced numerous difficulties and mistakes throughout the literature and, at present, the status of this species group is still doubtful.

Provisionally, the Italian species and subspecies of this complex are placed in two morphological groups: *languidus* s.str., including epigean or stygophilic species with a well-developed exopodal seta on the basipodite of the antenna, and *belgicus*, including stygobitic species without exopodal seta.

The genus *Diacyclops* is well represented in Italy where, to my knowledge, 30 species or subspecies belonging to the *bicuspidatus* and *languidus-languidoides* groups are known.

For the most part (the *languidus-languidoides* group) they are stygobionts or stygophiles, cave-dwelling or adapted to interstitial and mossy environments; the others (the *bicuspidatus*-group) can be found in a wide variety of epigean fresh-water bodies, such as lakes, rivers, springs, marsh, brackish inland waters, as well as in ground waters, as occasional or stygophilic immigrants.

Taxonomic account

Family Cyclopidae Burmeister, 1834

Genus *Diacyclops* Kiefer, 1967 emend. Morton, 1985; Reid et al., 1989

Diacyclops antrincola Kiefer, 1967

DISTRIBUTION. East Mediterranean (Italy, Yugoslavia, Greece, NW Turkey).

ECOLOGY. Caves, phreatic (wells) and interstitial habitats (stygobiont).

The species is widespread in different groundwater habitats (caves, wells, hyporheic substrates) of North (Venice), Central (Tuscany, Marche, Latium, Abruzzo and South (Apulia) Italy.

Diacyclops belgicus (Kiefer, 1936)

= *Diacyclops languidus belgicus* Kiefer, 1936

DISTRIBUTION. Europe and former USSR.

ECOLOGY. Cave, phreatic (wells) and interstitial waters (stygobiont).

As regard Italy, *D. belgicus* is known only for phreatic localities in Tuscany (Pesce, unpubl.).

Diacyclops bicuspidatus (Claus, 1857) s.str.

DISTRIBUTION. Cosmopolitan.

ECOLOGY. Springs, ponds, lakes, small rivers,; uncommon in groundwater habitats.

Widespread in both epigean and ground waters of Italy (Alps, central Appenines, Sardinia, Sicily).

Diacyclops bicuspidatus lucanus Pesce & Galassi, 1985

DISTRIBUTION. Endemic to Italy (Basilicata).

ECOLOGY. Phreatic waters, i.e. wells (stigophilic).

Diacyclops bicuspidatus lubbocki (Brady, 1869)

= *Cyclops odessanus* Schmankewitch, 1875
= *Diacyclops bicuspidatus odessanus* Kiefer, 1960

DISTRIBUTION. Palearctic.

ECOLOGY. Inland fresh and brackish epigean waters; cave, phreatic and interstitial (hyporheic) waters (stygophilic?).

Widespread in both epigean and subterranean aquatic habitat of Italy, Sardinia and Sicily included. It is the most common cyclopid in the phreatic biocoenoses (wells) of central Apennines.

Diacyclops bisetosus (Rehberg, 1880)

DISTRIBUTION. Cosmpolitan.

ECOLOGY. Springs, ponds, small lakes, rivers, ground waters (stygoxene).

Widespread in both surface and ground waters of Italy (Alps, central Apennines, Sardinia, Sicily).

Diacyclops charon (Kiefer, 1931)

DISTRIBUTION. Illyrian - Balkanic (Yugoslavia, Italy).

ECOLOGY. Cave, wells, and karstic springs (stygobiont).

As regard Italy, the species is known only for groundwaters (cave, wells) of Venice [Stoch, 1987]. Dussart & Defaye [1985] reported this species from Sardinia too, but the record is to be considered erroneous.

Diacyclops clandestinus (Kiefer, 1926)

= *Diacyclops languidoides clandestinus* Kiefer, 1926

DISTRIBUTION. Palaearctic and Indo-Australian Region.

ECOLOGY. Interstitial (phreatic, hyporheic) waters (stygobiont).

D. clandestinus is a stygobiont species, well represented in phreatic and underflow waters of Italy (North, Central Apennines and Sardinia). According to Pesce & Galassi [1987] it is the most widely distributed cyclopoid copepod in the groundwater of Italy.

Diacyclops crassicaudis s.str. (G.O. Sars, 1863)

DISTRIBUTION. Cosmopolitan.

ECOLOGY. Cold-stenothermal glacial relict lakes, ponds, temporary water bodies, ground waters (cave, hyporheic) (stygoxene).

Poorly represented in Italy, this otherwise widespread species is, up to now, known only from Latium.

Diacyclops crassicaudis var. *cosana* Stella & Salvadori, 1954

DISTRIBUTION. Endemic to Italy (Tuscany).

ECOLOGY. Cave waters (stygobiont).

Diacyclops crassicaudis lagrecai Pesce & Galassi, 1987

DISTRIBUTION. Endemic to Italy (Sicily).

ECOLOGY. Phreatic brackish waters (wells) (stygobiont).

Diacyclops crassicaudis trinacriae Pesce & Galassi, 1987

DISTRIBUTION. Endemic to Italy (Sicily).

ECOLOGY. Phreatic brackish waters (wells) (stygobiont).

Diacyclops cristinae Pesce & Galassi, 1987

DISTRIBUTION. Endemic to Italy (Latium).

ECOLOGY. Phreatic waters (wells) (stygobiont).

Diacyclops hypnicola (Gurney, 1927)

DISTRIBUTION. Palaearctic.

ECOLOGY. Hypnous swamps, mosses; stygoxene inhabitant of local groundwater systems (stygophilic).

The species is known for a single locality (well) in Italy (Tuscany).

Diacyclops ichnusae Pesce & Galassi, 1985

DISTRIBUTION. Endemic to Italy (Sardinia).
ECOLOGY. Hyporheic waters (stygobiont).

Diacyclops languidoides (Lilljeborg, 1901) s.str.

DISTRIBUTION. Cosmopolitan.
ECOLOGY. Epigean (swamps, springs, small rivers) and subterranean (cave, phreatic and hyporheic) waters (stygophilic).
Widely distributed in Italy, both in epigean and underground waters of the Alpine and Apennine provinces [sensu Pesce, 1985].

Diacyclops languidoides aprutinus Pesce & Fabrizi, 1979

DISTRIBUTION. Endemic to Italy (Abruzzo).
ECOLOGY. Phreatic fresh waters (wells) (stygobiont).

Diacyclops languidoides italianus (Kiefer, 1931)

= *Diacyclops languidoides* f. italiana Kiefer, 1931
DISTRIBUTION. Italy, Ukraine.
ECOLOGY. Phreatic waters (wells) (stygophilic).
The only reliable record of this subspecies from Italy is that of Kiefer [1931] for cave waters of Venice.

Diacyclops languidoides nagysalloensis Kiefer, 1927

DISTRIBUTION. Italy, Hungary, Greece, Ukraine.
ECOLOGY. Phreatic fresh and brackish waters (wells) (stygophilic).
At present, this subspecies is known for a single locality (well) in South Italy (Basilicata).

Diacyclops languidus (G.O. Sars, 1863) s.str.

DISTRIBUTION. Cosmopolitan.
ECOLOGY. Fresh water (small water reservoirs, dystrophic waters bodies, small temporary waterbodies, mosses, marshes); rarely in ground waters (stygoxene).
D. languidus s.str. has been reported from the hyporheic zone of Adige River (Venice) [Kiefer, 1981] and from phreatic waters (wells) of Basilicata [Pesce, 1984]. Recently, the species has been collected from wells and hyporheic habitats in Tuscany, Abruzzo and Apulia [Pesce, unpubl.].

Diacyclops lindae Pesce, 1986

DISTRIBUTION. Endemic to Italy (Basilicata).
ECOLOGY. Brackish phreatic waters (wells) (stygophilic).

Diacyclops maggii Pesce & Galassi, 1987

DISTRIBUTION. Endemic to Italy (Unbria, Apulia).
ECOLOGY. Fresh and brackish phreatic waters (wells) (stygophilic).

Diacyclops nanus (G.O. Sars, 1863)

DISTRIBUTION. Cosmopolitan.
ECOLOGY. Shallow distrophic water bodies, lakes, temporary waters; rarely in subterranean waters (stygoxene).
As regard Italy, this otherwise common species has been recorded only from North Italy (Lombardia).

Diacyclops nuragicus Pesce & Galassi, 1985

DISTRIBUTION. Endemic to Italy (Sardinia).
ECOLOGY. Phreatic fresh waters (wells) (stygobiont).

Diacyclops paolae Pesce & Galassi, 1987

DISTRIBUTION. Endemic to Italy (Central Apennines: Tuscany)
ECOLOGY. Phreatic fresh waters (wells) (stygobiont).

Diacyclops paralanguidoides Pesce & Galassi, 1987

DISTRIBUTION. Endemic to Italy (Central and Southern Apennines: Emilia-Romagna; Marche; Molise).
ECOLOGY. Phreatic fresh waters (stygobiont).

Diacyclops ruffoi Kiefer, 1981

DISTRIBUTION. Endemic to Italy (Venice).
ECOLOGY. Hyporheic waters (stygobiont).

Diacyclops sardous Pesce & Galassi, 1987

DISTRIBUTION. Endemic to Italy (Sardinia).
ECOLOGY. Phreatic brackish waters (wells) (stygobiont).

Diacyclops tantalus (Kiefer, 1937)

DISTRIBUTION. Illyrian - Balkanic.
ECOLOGY. Cave waters only (stygobiont).
The only available records of this interesting species are those from Venice [Stoch, 1987].

Diacyclops zschokkei (Graeter, 1910)

= *Diacyclops languidoides zschokkei* Kiefer, 1929
= *Diacyclops languidoides putealis* Lescher-Moutoue, 1974
DISTRIBUTION. Palaearctic.
ECOLOGY. Widely distributed in different epigean and ground water bodies (stygophilic).
The only reliable record of this species from Italy is that from Tuscany [Pesce & Galassi, 1987]; other ones from the same country: Central Apennines [Pesce &

Fabrizi, 1979]; the north-western Apennines [Franciscolo, 1955] are strongly doubtful.

Key to females of *Diacyclops* species/ subspecies recorded in Italy

1. Both rami of swimming legs 3-segmented 2
the *bicuspidatus*-group
- Leg 1 with both rami 2-segmented; leg 2 with 2-segmented endopodite and 3-segmented exopodite; legs 3-4 with both rami 3-segmented 12
the *languidus-languidoides* group
2. Antennula with 17 articles 3
- Antennula with less than 17 articles 5
3. Innermost terminal caudal seta shorter or about as long as outermost; leg 4 endopodite 3 not much elongated, inner terminal spine longer than outermost ....
.... *D. bisetosus*
- Innermost terminal caudal seta longer or about as long as outermost; leg 4 endopodite 3 slender (over twice longer than broad), inner terminal spine shorter or about as long as outermost 4
4. Inner terminal spine of leg 4 endopodite 3 shorter than outermost; inner terminal caudal seta slightly longer or about as long as outermost ....
.... *D. bicuspidatus bicuspidatus*
- Inner terminal spine of leg 4 endopodite 3 as long as outermost; inner terminal caudal seta about twice longer than outermost .... *D. charon*
5. Antennula with 14 articles 6
- Antennula with 12 articles 7
6. Caudal rami 6-7 times longer than broad ....
.... *D. bicuspidatus lubbocki*
- Caudal rami about 10 times longer than broad ....
.... *D. bicuspidatus lucanus*
7. Legs 2-3 endopod 2 with 1 inner seta ..... *D. antricola*
- Legs 2-3 endopod 2 with 2 inner setae 8
8. Leg 4 endopod 3 about as long as broad ....
.... *D. crassicaudis crassicaudis*
- Leg 4 endopod slender, 1.5-2.0 times longer than broad
.... 9
9. Caudal rami about 4.5 times longer than broad ....
.... *D. crassicaudis trinacriae*
- Caudal rami less than 4 times longer than broad 10
10. Innermost terminal caudal seta longer than outermost 11
- Innermost terminal caudal seta shorter or about as long as outermost .... *D. crassicaudis lagrecai*
11. Inner terminal spine of endopod 3 of leg 4 as long as outermost .... *D. ruffoi*
- Inner terminal spine of endopod 3 of leg 4 longer than outermost .... *D. crassicaudis* var. *cosana*
12. Antennula with 16 articles 13
- Antennula with 11 articles 14
13. Antenna with exopodal seta .... *D. languidus*
- Antenna without exopodal seta .... *D. belgicus*
14. Lateral seta of caudal ramus inserted at about middle of ramus .... *D. nanus*
- Lateral seta of caudal ramus inserted at distal 2/3 to 3/4 of ramus 15
15. Antenna with exopodal seta 16
(the *languidoides* s.str. group)
- Antenna without exopodal seta 17
(the *clandestinus* group)
16. Caudal rami 4-6 times longer than broad 18
- Caudal rami less than 4 times longer than broad 19
17. Caudal rami slender, 5-6 times longer than broad .....
.... *D. paralanguidoides*
- Caudal rami short, 2-4 times longer than broad 26
18. Terminal inner spine of endopod 3 of leg 4 as long as outermost 20
- Terminal inner spine of endopod 3 of leg 4 longer than outermost .... *D. languidoides languidoides*
19. Innermost terminal caudal seta longer than outermost, leg 4 endopod 3 stout, about 1.7 times longer than broad 21
- Innermost terminal caudal seta shorter than outermost, leg 4 endopod 3 stout, about 1.2 times longer than broad 22
20. Innermost terminal caudal seta 2 times longer than outermost .... *D. tantalus*
- Innermost and outermost terminal caudal seta subequal in length .... *D. languidoides nagysalloensis*
21. Innermost terminal caudal seta about 2 times longer than outermost; inner terminal spine of endopod 3 of leg 4 shorter than the article .... *D. zschokkei*
- Innermost terminal caudal seta less than 2 times longer than outermost; inner terminal spine of endopod 3 of leg 4 longer or as long as the article 23
22. Innermost terminal spine of endopod 3 of leg 4 shorter than the article; dorsal caudal seta longer than ramus
.... 24
- Innermost terminal spine of endopod 3 of leg 4 slightly longer, or as long as the article; dorsal caudal seta shorter than ramus .... *D. languidoides italianus*
23. Terminal spines of endopod 3 of leg 4 slender and thin; basipodite of the antenna with reduced armature
.... *D. maggii*
- Terminal spines of endopod 3 of leg 4 normally developed; basipodite of the antenna with reduced armature 25
24. Leg 4 endopod 3 stout, 1.0-1.1 times longer than broad; genital somite broader than long ....
.... *D. hypnicola*
- Leg 4 endopod 3 1.3-1.5 times longer than broad; genital somite about as long as broad ....
.... *D. languidoides aprutinus*
25. Terminal inner spine of endopod 3 of leg 4 as long as outermost and shorter than the article ....
.... *D. cristinae*
- Terminal inner spine of endopod 3 of leg 4 longer than outermost and about as long as the article ....
.... *D. lindae*
26. Leg 4 endopod 3 about as long as broad ...... *D. paolae*
- Leg 4 endopod 3 ca. 1.2-1.5 times longer than broad .. 27
27. Inner terminal spine of endopod 3 of leg 4 shorter than the article 28
- Inner terminal spine of endopod 3 of leg 4 slightly longer than the article 29
28. Inner terminal caudal seta over 2 times longer than outermost .... *D. nuragicus*

- Inner terminal caudal seta as long as outermost, or slightly shorter (rarely slightly longer) than outermost .... *D. clandestinus*

29. Caudal rami about 3.5 times longer than broad, inner terminal seta slightly longer than outermost .... *D. sardous*

- Caudal rami about 2 times longer than broad, inner terminal seta slightly shorter, or as long as outermost .... *D. ichnusae*

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