

Short communication

Expanding distribution of *Boeckella triarticulata* (Thomson, 1883) (Copepoda: Calanoida: Centropagidae) in Southern Italy

Giuseppe Alfonso* and Genuario Belmonte

Department of Biological and Environmental Sciences and Technologies, University of Salento, 73100 Lecce, Italy

*Corresponding author

E-mail: giuseppe_alfonso@yahoo.it

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Abstract

The record of *Boeckella triarticulata* in Southern Italy attests the expanding distribution of this Australasian copepod in Europe. The species was found in 3 recently realized lakes out of 21 water bodies sampled. The young age of the lakes colonized suggests that this species establishes itself in still immature aquatic habitats with a plankton community at an early developmental stage. Drawings of the species are provided and compared to those from literature.

Key words: *Boeckella triarticulata*, Calanoida, freshwater zooplankton, artificial lakes

The genus *Boeckella* (Copepoda Calanoida) comprehends 41 freshwater species (Dussart and Defaye 2002) from the Australasian (22 species) and Neotropical (19 species) Regions. *Boeckella triarticulata* (Thomson, 1883) is the most common Australasian species. It was already known from Australia, New Zealand, Mongolia and Manchuria (Bayly 1992; Dussart and Defaye 2002). The production of large clutches (Twombly et al. 1998), together with the presence of diapause eggs in its life cycle, allow *Boeckella* species to successfully colonize newly formed water bodies, where their establishment is further favored by a still “immature” plankton community (Maly 1984; 1991). Maly (1991) suggested that water connections (rivers and channels) represent the main way for a rapid dispersion of the species on a local scale. On the contrary, aquatic birds were considered by Turner (1991) as the main dispersal vehicles. *B. triarticulata* has been reported for the first time in Europe from Northern Italy fish ponds (Ferrari et al. 1988; Stella 1989) where it probably was accidentally introduced together with the Chinese carp from the Far East. Later this species was found in other three sites of the

same area (Ferrari et al. 1991; Stoch 2005; Ferrari and Rossetti 2006) (Figure 1).

We conducted zooplankton analyses on 21 lakes in the Southern Italy by collecting samples in 4 different dates (in representation of 4 different seasons): June 2005, October 2005, January 2006, April 2007. In each date zooplankton was collected in 3 replicates per site using a plankton net of 200 μm mesh size, and filtering about 1,000 liters of water per sample. Identification was based on the taxonomic keys of Bayly (1992). *B. triarticulata* was found in 3 artificial lakes: Rendina, Lampeggiano, and Basentello (Figure 1). In Rendina *B. triarticulata* was found abundant in June (5,500 adults m^{-3}) and in October (3,300 adults m^{-3}); in January and April the dam was drained. In Lampeggiano the species was found in June (30 adults m^{-3}), October (15 adults m^{-3}), and April (250 adults m^{-3}). In January this dam was drained. In Basentello, never drained, *B. triarticulata* adults were found only in the October samples (3 adults m^{-3}).

We observed that the drawings of this species in the existing literature (Stella 1989; Borutzky 1991, incorrectly described as *B. orientalis*; Bayly 1992; Dussart and Defaye 2001, with the

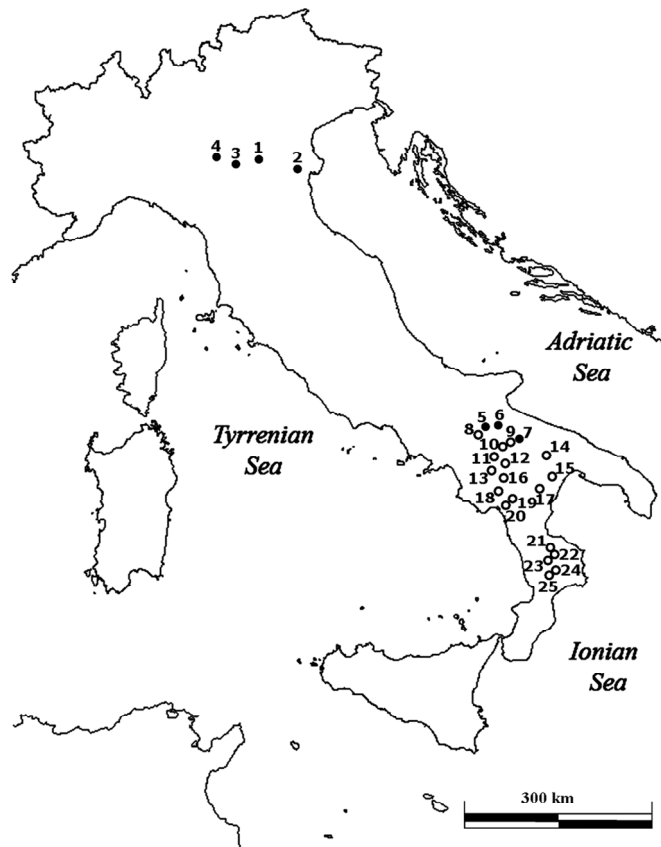


Figure 1. Distribution of *Boeckella triarticulata* in Italy. Sites 1, 2, 3, 4 in the Northern Italy (references in the text); sites 5 (Rendina), 6 (Lampeggiano), and 7 (Basentello) in Southern Italy (present study). Sites 8-25 represent all the other lakes sampled in which *B. triarticulata* was not found (see also Annex 1).

original drawings by Thomson 1883) do not show an additional short spine at the external distal corner of the 1st and the 2nd articles of female P5 exopodites (Figure 2, H) present in the specimens we collected. The additional, short spine sometimes is present also on the external distal corner of the 3rd article. This morphological character is evident in both Northern and Southern Italian populations. We did not study directly Australasian specimens; therefore we are wary of considering this additional short spine as an exclusive characteristic of Italian populations, but allegedly an overlooked morphological character.

The current distribution of *B. triarticulata* in Northern Italy (Figure 1), and the wide hydrological net in that area (the River Po basin), appear to fit the hypothesis of Maly (1991) about

the role of the water connections in the dispersal of this species on a local scale. But the occurrence of *B. triarticulata* in Southern Italy cannot be related to water connections because of the long distance from Northern Italian sites. Furthermore the Southern dams were built by using local material and never fish or plant species were introduced from the North or other Countries; sport or recreation activities are not allowed. In our opinion *B. triarticulata* could be arrived in Southern Italy from the North with migrating aquatic birds (the interested dams lie along a seasonal bird migration route connecting Northern to Southern Italy). The absence of *B. triarticulata* in all the other water bodies studied, is allegedly due to its preference for “precocious” stages in the ecological succession of systems (as hypothesized by Maly 1991).

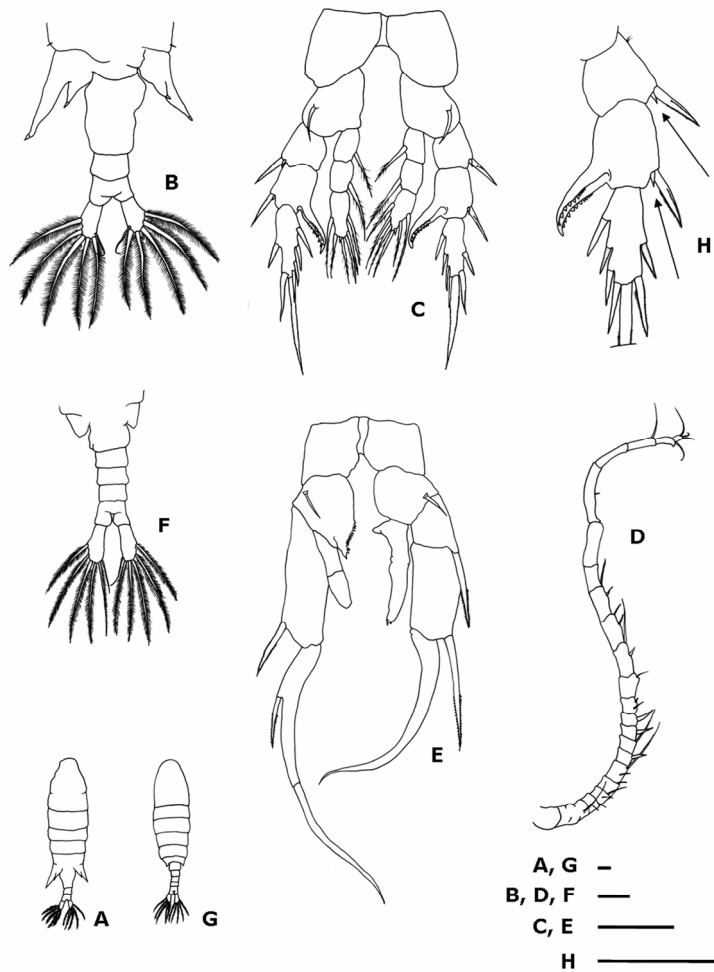


Figure 2. *Boeckella triarticulata*: A, female habitus; B, female urosome; C, female P5; D, male geniculate antennula; E, male P5; F, male urosome; G, male habitus; H, detail of first and second articles of female P5 exopodite. Arrows indicate the small spines. Scale bar 0.1 mm.

Rendina and Lampeggiano have been filled only recently (2002) and they are periodically drained too. On the contrary Basentello (in the same valley) is 30 years old and it is not subject to periodical drainage, and here we found *B. triarticulata* adults less abundant. We think that when *B. triarticulata* (as resting eggs) began to be transported in Southern Italian lakes (presumably only after 1985) it found several aged lakes (Basentello at that time was more than 10 years old) maybe difficult to colonize. The colonization of all the other lakes studied in Southern Italy probably failed because they were older or, in those cases when the lake was young, they are in different eco-climate conditions (e.g. see the altitude in Annex 1). As a consequence, it

could be interesting to study Rendina and Lampeggiano in the next future, to observe the destiny of *B. triarticulata* in older communities and how (or if) it will affect the future zooplankton composition in these dams.

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References

- Bayly IAE (1992) The non-marine Centropagidae (Copepoda: Calanoida) of the world. SPB Academic Publishers, The Hague
- Borutzky EB, Stepanova LA, Kos MS (1991) Key to Calanoida of freshwaters of the USSR. Academy of Sciences of the USSR, Zoological Institute, St Petersburg 'Nauka'
- Dussart BH, Defaye D (2001) Copepoda. Introduction to the Copepoda. (2nd edition). Backhuys Publishers, Leiden
- Dussart B, Defaye D (2002) World Directory of Crustacea Copepoda of Inland Waters. 1 – Calaniformes. Backhuys, Leiden
- Ferrari I, Colombo G, Stella E (1988) Analisi di comunità zooplanctoniche in stagni destinati a piscicoltura in provincia di Modena. Paper presented at 8th A.I.O.L. Congress, Pallanza 1-3 June, pp 375-381
- Ferrari I, Farabegoli A, Pugnetti A, Stella E (1991) The occurrence of a Calanoid Australasian species, *Boeckella triarticulata* (Thomson), in fish ponds of Northern Italy. *Verhandlungen Internationale Vereinigung Limnologie* 24: 2822-2827
- Ferrari I, Rossetti G (2006) New records of the Centropagid *Boeckella triarticulata* (Thomson, 1883) (Copepoda: Calanoida) in Northern Italy: evidence of a successful invasion? *Aquatic Invasions* 1: 219-222, <http://dx.doi.org/10.3391/ai.2006.1.4.5>
- Maly EJ (1984) Dispersal ability and relative abundance of *Boeckella* and *Calamoecia* (Copepoda: Calanoida) in Australian and New Zealand waters. *Oecologia* 62: 173-181, <http://dx.doi.org/10.1007/BF00379010>
- Maly EJ (1991) Dispersal ability and its relation to incidence and geographic distribution of Australian centropagid copepods. *Verhandlungen Internationale Vereinigung Limnologie* 24: 2828-2832
- Stella E (1989) Contributo alla conoscenza di *Boeckella triarticulata* (Thomson) (Copepoda Calanoida) di alcuni stagni dell'Italia Settentrionale adibiti a piscicoltura. *Rivista di Idrobiologia* 28: 1-2
- Stoch F (2005) Copepoda Calanoida. In: Ruffo S, Stoch F (eds), Checklist e distribuzione della fauna italiana. Memorie del Museo Civico di Storia Naturale di Verona, 2.serie, Sezione Scienze della Vita 16, pp 91-92
- Turner JT (1991) Biogeography of Australasia Freshwater Centropagid Copepods: vicariance or dispersal? *Journal of Biogeography* 18(4): 467-468, <http://dx.doi.org/10.2307/2845488>
- Twombly S, Clancy N, Burns CW (1998) Life history consequences of food quality in the freshwater copepod *Boeckella triarticulata*. *Ecology* 79 (5): 1711-1724

Annex 1. Records of *Boeckella triarticulata* in Italy

Site number (Map ref.)	Locality	Record coordinates		Altitude (m) a.s.l.	Year of first filling	Record date	Reference
		Latitude, °N	Longitude, °E				
1	Massa Finalese	44°51'34"	11°14'14"	13	—	1986	Ferrari et al. 1988; Stella 1989
2	Ostellato	44°44'38"	11°58'43"	2	—	late 1980's	Ferrari et al. 1991
3	Rio Saliceto	44°48'09"	10°49'08"	25	—	2001	Stoch 2005
4	River Po -Viadana	44°54'48"	10°32'14"	23	—	2005	Ferrari and Rossetti 2006
5	Rendina	41°02'02"	15°44'14"	199	2002	27/06/2005; 14/10/2005	Present study
6	Lampeggiano	41°03'03"	15°52'06"	243	2002	27/06/2005; 14/10/2005; 01/04/2007	Present study
7	Basentello	40°50'56"	16°14'18"	269	1974	14/10/2005	Present study
8	Monticchio	40°55'58"	15°36'44"	664	Natural lake	Not found	Present study
9	Genzano	40°51'01"	16°03'16"	413	1992	Not found	Present study
10	Acerenza	40°46'25"	15°55'05"	443	1992	Not found	Present study
11	Pignola	40°35'16"	15°44'49"	776	Natural lake	Not found	Present study
12	Camastra	40°31'56"	15°59'27"	542	1970	Not found	Present study
13	Marsico	40°25'50"	15°44'32"	775	1995	Not found	Present study
14	S. Giuliano	40°36'33"	16°30'43"	109	1956	Not found	Present study
15	Gannano	40°17'50"	16°27'33"	104	1956	Not found	Present study
16	Pertusillo	40°16'54"	15°58'19"	536	1962	Not found	Present study
17	Senise	40°10'34"	16°20'24"	254	1982	Not found	Present study
18	Laudemio	40°08'38"	15°50'13"	1523	Natural lake	Not found	Present study
19	Cogliandrino	40°04'52"	15°55'51"	671	1975	Not found	Present study
20	Rotonda	40°03'21"	15°52'43"	919	Natural lake	Not found	Present study
21	Cecita	39°23'41"	16°32'15"	1130	1951	Not found	Present study
22	Ariamacina	39°19'48"	16°32'37"	1320	1950	Not found	Present study
23	Arvo	39°14'36"	16°30'52"	1290	1927	Not found	Present study
24	Ampollino	39°11'54"	16°38'31"	1285	1927	Not found	Present study
25	Passante	39°06'09"	16°30'44"	1119	1980	Not found	Present study