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SHORT COMMUNICATION

Confirming predictions: the invasive isopod *Ianiropsis serricaudis* Gurjanova, 1936 (Crustacea: Peracarida) is abundant in the Lagoon of Venice (Italy)

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The janirid isopod Ianiropsis serricaudis*, native to the North-West Pacific region, has recently been identified as a non-indigenous species in several localities in the Northern Hemisphere. Hereby, we present evidence of its occurrence in the Mediterranean Sea, namely in the Lagoon of Venice (Italy). This finding confirms the hypothesis that this species is more widespread in Europe than expected, but has long been underreported on account of the small size of isopods (most of them being in the size range of 3 to 20 mm) and the taxonomic complexity of the genus.*

Key words: marine crustaceans, introduced species, fouling, lagoons

INTRODUCTION

Ianiropsis (G.O. Sars, 1897-99) is a complex and poorly understood genus composed of species similar to one another (BRUSCA & IVERSON, 1985), as well as similar to *Janira* (Leach, 1814). Species within this genus are mainly indigenous in the Pacific Ocean, apart from *Ianiropsis breviremis* (G.O. Sars, 1883), which occurs in the North-East Atlantic, and *Ianiropsis palpalis* (Barnard, 1914) on the South African coast. Recently, the species *Ianiropsis serricaudis* (Gurjanova, 1936) was identified in North America, on both the Pacific and Atlantic coasts, and in Europe, so far only reported from England and the Netherlands (HOBBS *et al.* 2015 and references therein). The authors predicted that the species is probably more widespread than previously reported along North American and European coasts. This work confirms their hypothesis, providing evidence of the presence of *I. serricaudis* in an Adriatic lagoon.

MATERIAL AND METHODS

The Lagoon of Venice (northern Adriatic Sea) covers an area of approximately 550 km^2 and is divided into three hydrographic basins: northern basin, central basin (including the town of Venice) and Chioggia basin. The average annual temperature in the lagoon is 17.18 ± 0.46 °C and salinity is 29.82 PSU ±2.3 (BANDELJ *et al.,* 2012).

In July 2012 an extensive sampling survey of hard bottom benthic communities of this lagoon was performed. The target were some stations assumed to be preferential sites

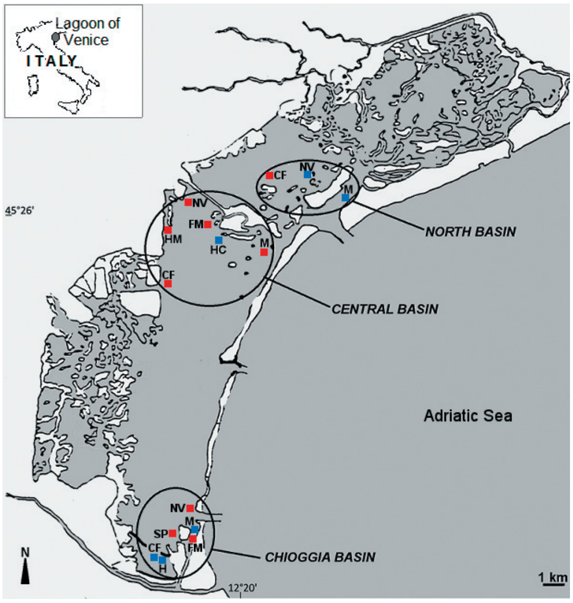

Fig. 1. Study area: the Lagoon of Venice, North-Adriatic Sea. Sampling stations: marina (M), clam farm (CF), fish market (FM), seafood processing (SP), harbor (H: HM- commercial terminal of Marghera, HC- cruise line terminal), no-vector (NV). Colored squares indicate levels of abundance of Ianiropsis serricaudis*: blue: 3; red: 4 (see text for definition of abundance levels)*

for non-indigenous species (NIS) introduction due to the human activities they host (Fig. 1): shellfish farms of the Manilla clam *Ruditapes philippinarum* (Adams & Reeve, 1850), commercial and touristic harbors, marinas, and sites of seafood trade and processing. Sites distant from the above-mentioned locations and not directly influenced by anthropogenic activities responsible for NIS introduction were also surveyed in each sub-basin ("no-vector" stations in Fig. 1). Samples were collected from one of the artificial hard substrates that is known to be suitable for the settlement of non-indigenous biota: the partially submerged wooden poles that are widely disseminated along the lagoon channels to indicate the navigable paths (MARCHINI *et al.*, 2007). The community occurring on these substrates has been described by SCONFIETTI *et al.* (2003) and CORRIERO *et al.* (2007). Overall, 15 stations were sampled by scraping the wooden poles with a hand-held rigid net operated from a boat. Three replicates were collected from each station under the lowest tide level, resulting in a total sampling area of approximately 0.68 m^2 per each station. Samples were then preserved in formaldehyde and identified in the laboratory. The abundance of macroinvertebrate taxa was estimated following a semi-quantitative scale, which considers four levels: 1= presence of isolated individuals / colonies, 2= a few individuals / a few small colonies, 3= numerous individuals / large well-established colonies, 4= overwhelming abundance (SCONFIETTI *et al.,* 2003).

Ianiropsis serricaudis was identified following DOTI & WILSON (2010) and HOBBS *et al.* (2015). Specimens of *I. serricaudis* were deposited in the Museum of Natural History of Venice with the code MSNVE 23357.

RESULTS AND DISCUSSION

The specimens collected in the Lagoon of Venice display the diagnostic characters of *I. serricaudis* indicated by DOTI & WILSON (2010) and HOBBS *et al.* (2015). The specimens have elongate segments 6 and 7 of antennal peduncle (Fig. 2a,b), two claws on dactyli of peraeopod 1 (Fig. 3a) and three claws on peraeopod 7 (Fig. 3b). They also have three or four denticles on lateral margin of pleotelson, along the posterior half of the margin (Fig. 3c), maxilliped palps elongated and visible in dorsal view (Fig. 2b, 3d, e).

Ianiropsis serricaudis was a dominant species among the crustacean assemblages of the Lagoon of Venice in 2012. It was present in all stations and all replicates within stations, including "no-vector" stations, often being the most abundant species and reaching hundreds of individuals in several samples, up to about one thousand specimens in Marghera harbor (central lagoon). Other peracarids reaching comparably high abundance in Venice assemblages were *Apocorophium* spp., *Ericthonius* spp., *Jassa* spp. and the non-indigenous *Caprella scaura* (Templeton, 1836) and *Paranthura japonica* (Richardson, 1909). Other prevalent NIS co-occurring with *I. serricaudis* in our samples were: *Botrylloides violaceus* (Oka, 1927), *Didemnum vexillum* (Kott, 2002), *Hydroides dianthus* (Verrill, 1873), *Styela plicata* (Lesueur, 1823) and *Tricellaria inopinata* (d'Hondt & Occhipinti Ambrogi,

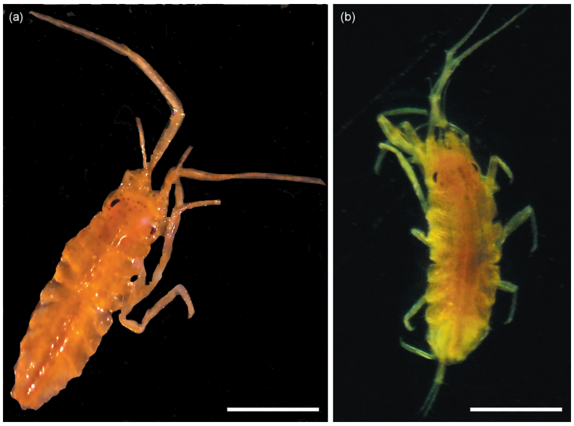

Fig. 2. a, b). Two specimens of Ianiropsis serricaudis *from the Lagoon of Venice (scale bar: 1 mm).*

1985); an associated community comparable with those described in the North American and European introduction range of *I. serricaudis* (HOBBS *et al.,* 2015).

The continuing erosion of taxonomic expertise has been recently identified as one of the top issues that relate to invasive alien species management in Europe (OJAVEER *et al.,* 2014). Diminutive taxa that receive poor attention in routine surveys are likely to be disregarded or misidentified, thus contributing to the underestimation of the phenomenon of marine invasions. This is the case of the isopod *I. serricaudis*, having been repeatedly introduced throughout the Northern Hemisphere without even being noticed (HOBBS *et al.,* 2015), and sometimes being misidentified with juveniles of *Janira maculosa*. It is likely that the same mistake has occurred in previous studies of the Lagoon of Venice so that old records of *J. maculosa* in the Lagoon of Venice (SCONFIETTI, 1988) could actually refer to *I. serricaudis*. Unfortunately, crustacean samples referred in SCONFIETTI (1988) were not available for re-examination and therefore the hypothesis of misidentification remains speculative. For the same reason, the date of the first introduction of *I. serricaudis* in the Lagoon of Venice cannot be assessed with certainty, similarly to the case of another North-West Pacific isopod, *P. japonica* (MARCHINI *et al.,* 2014).

The introduction of *I. serricaudis* in the Lagoon of Venice could have occurred via aquaculture, directly from the native area or from another introduced area in Europe, from where Venice shellfish farmers might have imported commercial bivalves. Alternatively, it could have arrived with ballast water or on the hull of ships, in association with fouling organisms such as ascidians and bryozoans. All these vectors can be classified at the "possible" level of certainty, according to the definitions of MINCHIN (2007). In fact, there is no direct evidence for any of them, and the fact that other isopods have been associated with such vectors (HEWIIT & CAMPBELL, 2001; GOLLASCH *et al.,* 2002; LAVESQUE *et al.,* 2013; MARCHINI *et al.,* 2014) does not allow excluding any of them.

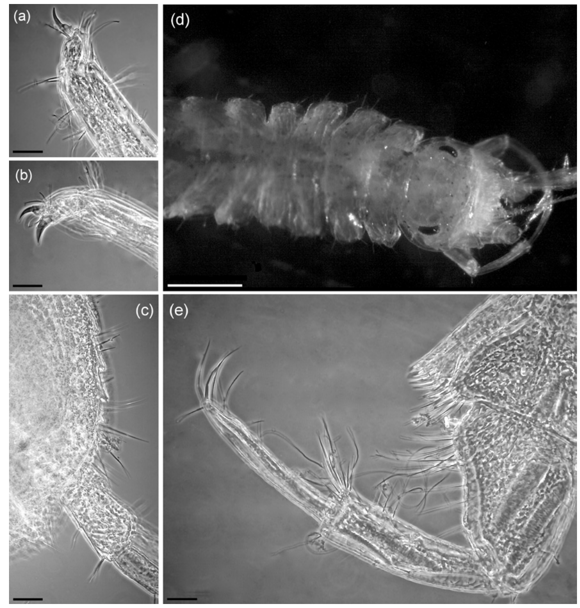

Fig.3. Details of Ianiropsis serricaudis *from the Lagoon of Venice; (a) close-up of the two claws of pereopod 1; (b) close-up of the three claws of pereopod 7; (c) four denticles on the lateral margin of the pleotelson; (d) dorsal views of* Ianiropsis serricaudis *with visible maxilliped palps; (e) close-up of one maxilliped palp (white scale bar 200 μm, black scale bar 500 μm)*

The Lagoon of Venice is a hotspot of introduction of marine NIS in the Mediterranean Sea (OCCHIPINTI-AMBROGI *et al.,* 2011). Many species introduced there in the 1980s-1990s by aquaculture or shipping are now well-established there and very widespread in the Mediterranean Sea and along European Atlantic coasts, e.g. the erect bryozoan *T. inopinata* and the caprellid amphipod *C. scaura* (COOK *et al.,* 2013; ROS *et al.,* 2014). *Ianiropsis serricaudis* might have had a similar fate and may have already been introduced in other Mediterranean localities that are known to share many NIS in common with Venice, as a result of aquaculture transfers, e.g. Mar Piccolo of Taranto (Apulia, Southern Italy) or Lake Fusaro (Sicily, Italy), and so may be expected to be already present or may subsequently do so.

CONCLUSION

The present work confirms the prediction by HOBBS *et al.* (2015) that *I. serricaudis* is "going global" and adds the Adriatic Sea to its already wide introduction range. Notwithstanding its diminutive size, the very high abundances reached by its population in the Lagoon of Venice, as well as in other introduction sites (HOBBS *et al.,* 2015) suggest possible impacts via competition, grazing and predation. Further studies are needed to investigate potential competition with native crustaceans or facilitation mediated by other introduced species.

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REFERENCES

BANDELJ, V., C. SOLIDORO, D. CURIEL, G. COSSARINI, D.M. CANU & A. RISMONDO. 2012. Fuzziness and heterogeneity of benthic metacommunities in a complex transitional system. PloS one, 7(12): e52395.

BRUSCA, R.C. & E.W. IVERSON. 1985. Guide to the Marine Isopod Crustacea of Pacific Costa Rica. Universidad de Costa Rica. Rev. Biol. Trop., 33 (1): 1-77.

COOK, E.J., J. STEHLÍKOVÁ, C.M. BEVERIDGE, M.T. BURROWS, H. DE BLAUWE & M. FAASSE. 2013. Distribution of the invasive bryozoan *Tricellaria inopinata* in Scotland and a review of its European distribution. Aq. Inv., 8(3): 281-288.

CORRIERO, G., C. LONGO, M. MERCURIO, A. MARCHINI & A. OCCHIPINTI-AMBROGI. 2007. Porifera and Bryozoa on artificial hard bottoms in the Venice Lagoon: Spatial distribution and temporal changes in the northern basin. Ital. J. Zool., 74(1): 21-29.

DOTI, B.L. & G.D. WILSON. 2010. The genera *Carpias* Richardson, *Ianiropsis* Sars and *Janaira* Moreira & Pires (Isopoda: Asellota: Janiridae) from Australia, with description of three new species. Zootaxa, 2625: 1-39.

GOLLASCH, S., E. MACDONALD, S. BELSON, H. BOTNEN, J.T. CHRISTENSEN, J.P. HAMER, G. HOUVENAGHEL, A. JELMERT, I. LUCAS, D. MASSON, T. MCCOLLIN, S. OLENIN, A. PERSSON, I. WALLENTINUS, L.P.M.J. WETSTEYN, T. WITTLING. 2002. Life in ballast tanks. In: E. Leppäkoski, S. Gollasch, S. Olenin (Editors.) Invasive aquatic species of Europe. Distribution, impacts and management, Springer Netherlands, pp. 217-231.

HEWITT, C.L. & M.L. CAMPBELL. 2001. The Australian distribution of the introduced sphaeromatid isopod, *Paracerceis sculpta*. Crustaceana, 74(9): 925-936.

HOBBS, N-V., E. LAZO-WASEM, M. FAASSE, J.R. CORDELL, J.W. CHAPMAN, C.S. SMITH, R. PREZANT, R. SHELL & J.T. CARLTON. 2015. Going global: The introduction of the Asian isopod *Ianiropsis serricaudis* Gurjanova (Crustacea: Peracarida) to North America and Europe. Aq. Inv., 10(2): 177-187.

LAVESQUE, N., J.C. SORBE, G. BACHELET, B. GOUILLIEUX, X. DE MONTAUDOUIN, P. BONIFACIO, H. BLANCHET & S. DUBOIS. 2013. Recent discovery of *Paranthura japonica* Richardson, 1909 (Crustacea: Isopoda: Paranthuridae) in European marine waters (Arcachon Bay, Bay of Biscay). BioInvasions Rec., 2(3): 215-219.

MARCHINI, A., R. SCONFIETTI & T. KRAPP-SCHICKEL. 2007. Role of the artificial structures on biodiversity: the case of arthropod fauna in the N-Adriatic lagoons. Studi Trent. Sci. Nat. Acta Biol., 83: 27-31.

MARCHINI, A., J-C. SORBE, F. TORELLI, A. LODOLA & A. OCCHIPINTI-AMBROGI. 2014. The non-indigenous *Paranthura japonica* Richardson, 1909 in the Mediterranean Sea: travelling with shellfish? Mediterr. Mar. Sci., 15(3): 545-553.

MINCHIN, D. 2007. Aquaculture and transport in a changing environment: Overlap and links in the spread of alien biota. Mar. Pollut. Bull., 55(7): 302-313.

OCCHIPINTI-AMBROGI, A., A. MARCHINI, G. CANTONE, A. CASTELLI, C. CHIMENZ, M. CORMACI, C. FROGLIA, G. FURNARI, M.C. GAMBI, G. GIACCONE, A. GIANGRANDE, C. GRAVILI, F. MASTROTOTARO, C. MAZZIOTTI, L. ORSI-RELINI & S. PIRAINO. 2011. Alien species along the Italian coasts: an overview. Biol. Invasions, 13(1): 215-237.

OJAVEER, H., B.S. GALIL, S. GOLLASH, A. MARCHINI, D. MINCHIN, A. OCCHIPINTI-AMBROGI & S. OLENIN. 2014. Identifying the top issues of marine invasive alien species in Europe. Manag. Biol. Invasion., 5(2): 81-84.

ROS, M., J.M. GUERRA-GARCÍA, C. NAVARRO-BARRANCO, M.P. CABEZAS & M. VÁZQUEZ-LUIS. 2014. The spreading of the non-native caprellid (Crustacea: Amphipoda) *Caprella scaura* Templeton, 1836 into southern Europe and northern Africa: a complicated taxonomic history. Mediterr. Mar. Sci., 15, 145-155.

SCONFIETTI, R. 1988. Researches on spatial distribution of amphipods, isopods and tanaids (Peracarida) in a Mediterranean estuary (River Dese, Lagoon of Venice). Crustaceana, 55(2): 193-201.

SCONFIETTI, R., A. MARCHINI, A. OCCHIPINTI-AMBROGI & C.F. SACCHI. 2003. The sessile benthic community patterns on hard bottoms in response to continental vs. marine influence in Northern Adriatic lagoons. Oceanol. Acta, 26(1): 47-56.

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Potvrda predviđanja: venecijanska laguna (Italija) obiluje invazivnim jednakonošcem *Ianiropsis serricaudis* Gurjanova, 1936 (Crustacea: Peracarida)

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SAŽETAK

Janiridni jednakonošci *Ianiropsis serricaudis*, koji izvorno potječu iz sjeverozapadne pacifičke regije, nedavno su identificirani kao alohtona vrsta na nekoliko lokaliteta u sjevernoj hemisferi. Ovime iznosimo dokaze o njihovom pojavljivanju u Sredozemnom moru, i to u venecijanskoj laguni (Italija). Ovi nalazi potvrđuju tezu da je ova vrsta rasprostranjenija u Europi nego što se mislilo, ali se o njoj dugo vremena malo izvješćivalo zbog veličine jednakonožaca (većina je veličinom varirala između 3 i 20 mm) te zbog taksonomske složenosti roda.

Ključne riječi: morski rakovi, alohtone vrste, onečišćenje, lagune