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On the presence of *Sarcotaces verrucosus* (Copepoda) in the Southwest Atlantic

Raúl A. González¹ and Ruben D. Tanzola²

¹Instituto de Biología Marina y Pesquera "Almirante Storni", Universidad Nacional del Comahue, Costanera s/n - CC 104 (8520) San Antonio Oeste, Río Negro, e-mail: raulg@canaldig.com.ar; ²Departamento de Biología, Bioquímica y Farmacia, Universidad Nacional del Sur, (8000) Bahía Blanca; Argentina

Abstract. A new host and geographical record for *Sarcotaces verrucosus* is presented, being this first record of *Sarcotaces* sp. in the Southwest Atlantic. The taxonomic status of the species parasitizing the Argentine sandperch (*Pseudoperca semifasciata*) from northpatagonian waters is analyzed using light microscopy and SEM observations. Prevalence and intensity were similar to those reported for

other *Sarcotaces* species, and parasitism could be related to the distribution of sandperch in the spawning areas. In the San Matías Gulf, *S. verrucosus* has been found only on *P. semifasciata*, and the absence of this parasite in other demersal fishes inhabiting the same marine environment, suggests high specificity of *S. verrucosus* to the Argentine sandperch.

Key words: *Sarcotaces verrucosus*, Copepoda, *Pseudoperca semifasciata*, fish, Southwest Atlantic

Introduction

Since the discovery of *Sarcotaces* Olsson, 1872 (Crustacea, Copepoda, Philichthyidae), the following species have been described: *S. verrucosus* Olsson, 1872; *S. arcticus* Collet, 1874; *S. pacificus* Komai, 1924; *S. komaii* Shiino, 1953; *S. shiinoi* Izawa, 1974; *S. japonicus* Izawa, 1974 and *S. namibiensis* Reimer, 1991. Two unnamed species of the genus (*Sarcotaces* sp. I and II) were also erected by Avdeev and Avdeev (1975) from New Zealand and Hawaii, respectively.

Seven of these species were recorded in the Northern Pacific and Northern Atlantic Oceans. Only *Sarcotaces* sp. I and *S. namibiensis* were reported from the Southern Hemisphere, in South Pacific Ocean off New Zealand and in South Atlantic Ocean off Namibia, respectively.

Most of the literature regarding *Sarcotaces* consists of descriptive studies (e.g. Dollfus 1928, Kuitunen-Ekbaum 1949, Delamare-Deboutville 1962, Moser 1977, Reimer 1991). Izawa (1973) carried out a precise description of the early larval stages of *S. pacificus*. Notwithstanding, the taxonomic status of several *Sarcotaces* spp. was analyzed by Moser *et al.* (1985) who stated that *S. arcticus*, *S. pacificus*, *S. komaii*, *S. shiinoi* and *S. japonicus*, should be considered

synonyms of *S. verrucosus*, making the latter an ubiquitous species, present in the celomic cavity and body wall of several teleost hosts.

The purpose of this paper is to present the first record of *Sarcotaces* from the Southwest Atlantic Ocean region and to discuss its taxonomic status. This work also contributes new information related to the infestation of *S. verrucosus* on the Argentine sandperch.

Materials and methods

Between April 1990 and December 1993, periodic samples (monthly or bimonthly) of sandperch *P. semifasciata* landings from the San Matías Gulf (41°–42°S 63°–65°W) bottom trawl fishery were obtained, and a visual macroscopic examinations of the body cavity of fishes were performed. Pyriform cysts present in the abdominal region were carefully collected, weighed, measured (length and maximum diameter) and then fixed in 10% formalin. The contents of the cysts were examined for larval and adults stages of copepods and they were carefully removed, measured, and stored in 70% ethanol or 4% formalin.

Male copepods were cleared in a 5% sodium hypochlorite solution. Five of these were prepared for scanning elec-

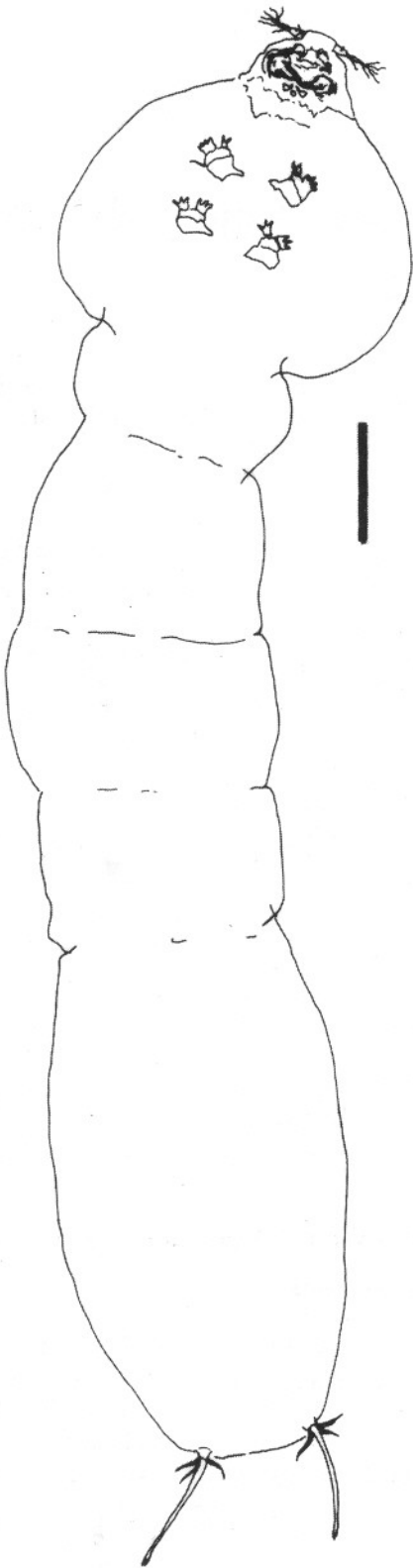


Fig. 1. Male *Sarcotaces verrucosus*, ventral view. Scale bar = 0.2 mm

tron microscopy (SEM) as follows: washed with sterile marine water, fixed in 10% formalin, dehydrated in acetone, dried by CO₂-critical point, and coated with gold. SEM examinations were performed on a JEOL JSM-35 CF SEM working at 5 kV. All measurements are given in mm unless otherwise indicated; ranges are presented in parentheses. Figures were drawn with the aid of a camera lucida.

Prevalence and mean intensity (Margolis *et al.* 1982) were calculated in the samples. Voucher specimens were deposited in the Museo Argentino de Ciencias Naturales Bernardino Rivadavia (Buenos Aires), Invertebrates Collection Number MACN 34014.

Results

Sarcotaces verrucosus Olsson, 1872

Male (Fig. 1; based on 14 fixed specimens): Body elongate, 2.705 (2.425–3.105) long, yellowish with dark inclusions. Cephalothorax small, 0.096 (0.087–0.114) long by 0.170 (0.167–0.195) maximum width at base. Four pairs of cephalic appendages (Fig. 2a). First antennae 4-segmented (Fig. 2b) with basal segment longest and bearing 4 short stout spines (Fig. 2c, arrows). Distal segment with 10–11 apical setae (hard to individualize) (Fig. 2b, c). Second antennae 4-segmented bearing 2 strong claws (Fig. 2d). Relative length of each segment: 1st – 31.4, 2nd – 48.2, 3rd – 10.0 and 4th – 10.4%. Claws attached in the internal border of the 3rd segment and to distal border of the 4th segment, respectively. Second segment with 5 grouped spinules on internal face (Fig. 2d, upper right). Mandibles strong, with claws extending to mid-line (Fig. 2e). Maxillae 3-segmented small, with dentiferous claws and internal forked setae (maxillulae?) (difficult to see using light microscopy) (Fig. 2f). Anterior margin of mouth indented, labrum divided into two parts along mid-line each with several subtriangular processes (Fig. 2f).

First two leg-bearing thoracic segment fused into subcircular complex, wider than rest of thorax; latter without well defined segmentation (Fig. 1). The first pair of thoracopods with exopod and endopod bearing, respectively, 4 and 2 digitiform appendages, and 1 seta on outer distal margin of sympod (Fig. 2g). Second thoracopods similar in size and shape to first pair, with exopod and endopod each bearing 3 digitiform processes and 1 seta on outer distal margin of sympod (Fig. 2h). Length of caudal *rami* variable from undeveloped (primordia) to 0.297 (0.030–0.330) long with 2–3 basal setae and distal end forked. Genital pore not observed.

Female (based on 7 fixed specimens): Body pyriform densely covered with papillae in the anterior 3/4 portion (Fig. 3a). Head consisting of 5 or 6 papillated lobes surrounding mouth (Fig. 3b). Buccal appendages vestigial, forming one pair of small conical appendages (maxillae after Dollfus 1928; mandibles after Kuitunen-Ekbaum 1949) (Fig. 3c). Trunk inflated, with 6 more or less apparent segments.

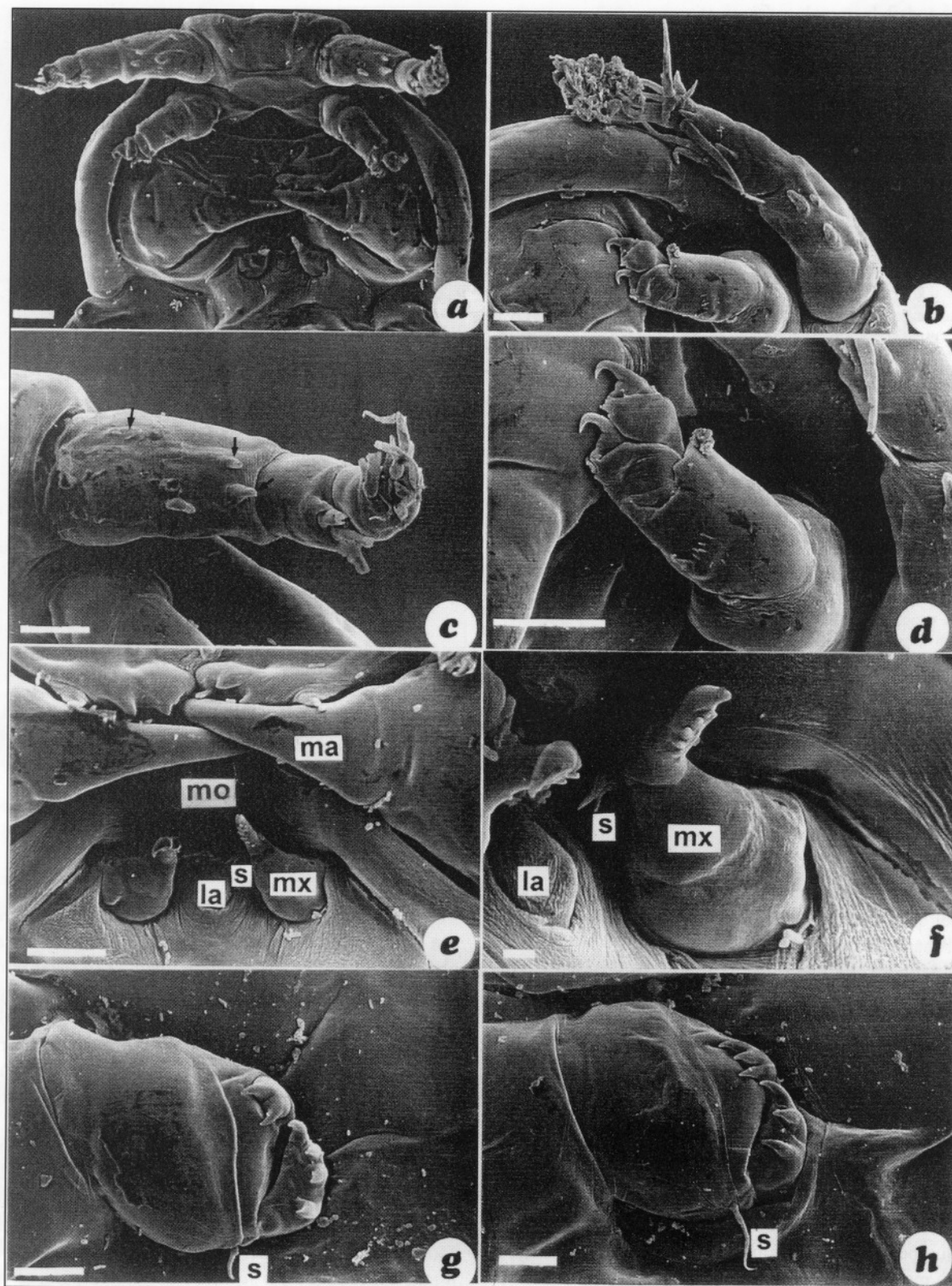


Fig. 2. Fine morphological details of male *Sarcotaces verrucosus* examined by SEM: **a** – cephalothorax, ventral view; **b** – first and second antennae (right); **c** – first antenna (left); **d** – second antenna (right) and detail of spinules (arrow) at upper right; **e** – oral appendages; **f** – maxilla, labium and seta; **g** – first thoracopod (left); **h** – second thoracopod (right). **Abbreviations:** la – labium, ma – mandible, mo – mouth, mx – maxilla, s – seta. Scale bars (except 3f) = 10 µm; scale bar in 3f = 1 µm

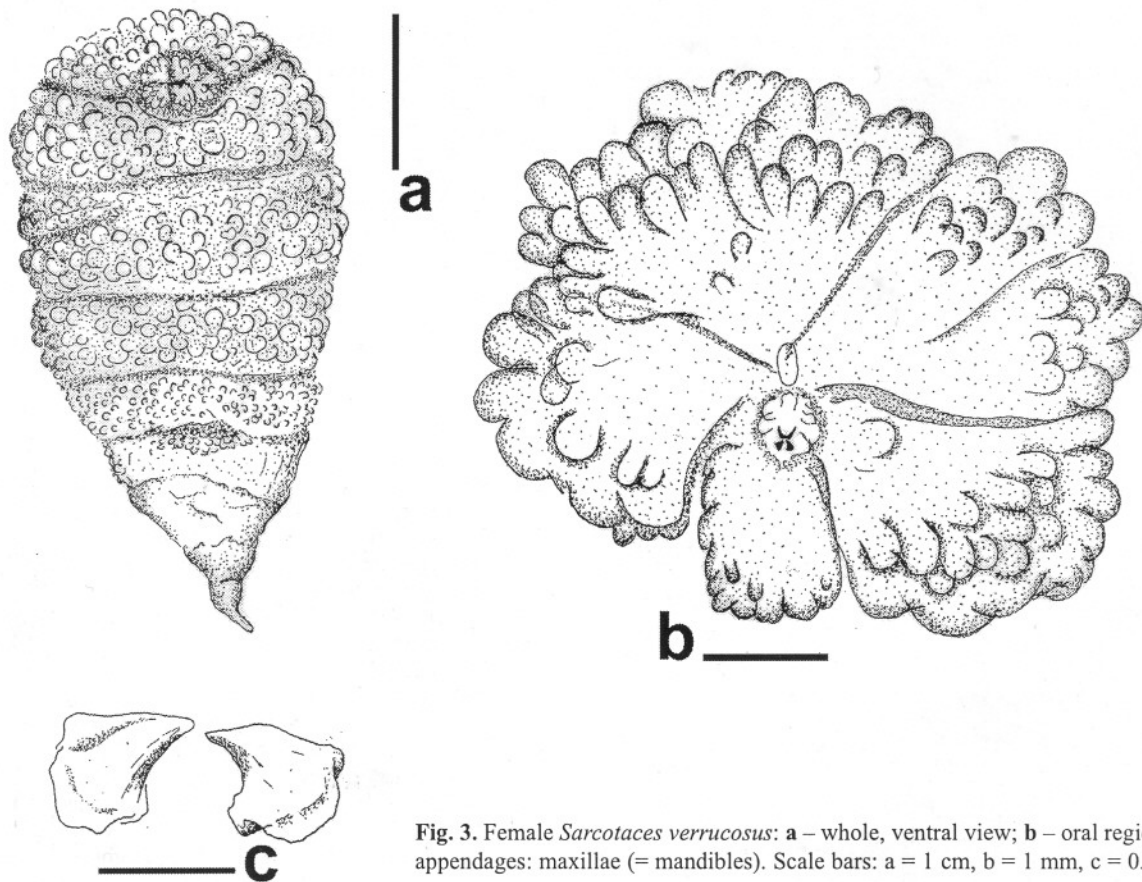


Fig. 3. Female *Sarcotaces verrucosus*: a – whole, ventral view; b – oral region; c – oral appendages: maxillae (= mandibles). Scale bars: a = 1 cm, b = 1 mm, c = 0.05 mm

Abdomen conical, 5-segmented, with papillae on first and second segments only, third segment partially covered with papillae, last two segments smooth. Abdominal papillae smaller than those in trunk.

All females filled with black fluid (“hemosiderin” after Moser *et al.* 1985); some also containing eggs and developing nauplii. Eggs elliptical (Fig. 4a), their major and transverse diameters ranging between 150–180 and 105–150 μm , respectively. Nauplii (Fig. 4b) were found enclosed in eggs ($180 \times 140 \mu\text{m}$) and free ($170 \times 120 \mu\text{m}$).

Mean length of the cyst was 40.70 (SD = 6.77, $n = 24$), mean width (greatest diameter) of 22.64 (SD = 5.09, $n = 17$). Mean weight of cysts was 11.45 g (SD = 5.83, $n = 28$).

All cysts harbored only one female of *S. verrucosus*. Forty-two percent of females were associated with males in cyst. Number of males within cyst ($n = 15$) ranged from 0 to 26, with mean number 4.46 (DE = 7.05) males per cyst.

Prevalence of *S. verrucosus* in each sample ranged between 0.0 and 9.7. Mean prevalence in all samples ($n = 19$) was 3.23 (SD = 2.61). On 1806 fishes examined, 44 specimens (2.5%) harbored cysts of *S. verrucosus*. The number of cysts per host was 1 in 43 (97.7%) infected specimens. Only once (2.3%) 3 cysts were found on one same fish.

Discussion

The taxonomic status of the species grouped in *Sarcotaces* has been discussed in detail by Moser *et al.* (1985) and our observations are consistent with them. Males and females of *Sarcotaces* spp. express great phenotypic variability (body size and shape, development of body appendages, superficial tubercles, pigmentation). Several features (e.g. thoracopod setae, basal maxillae setae, and spines on the antennae segments of the males) are difficult to study using light microscopy.

Most identifications of *Sarcotaces* spp. have been based on morphological studies using light microscopy. In the present work, fine morphological details were examined by SEM, and our specimens agree with the descriptions of Moser *et al.* (1985). Therefore, we consider that the parasites found in *Pseudoperca semifasciata* are *Sarcotaces verrucosus* Olsson, 1872.

Reimer (1991) described *S. namibiensis* on the basis of 1 male and 3 female specimens but he provided few morphological details. Because of the probable cosmopolitan character of *S. verrucosus*, the phenotypic plasticity of the genus, and the likely observational errors in the designation of most

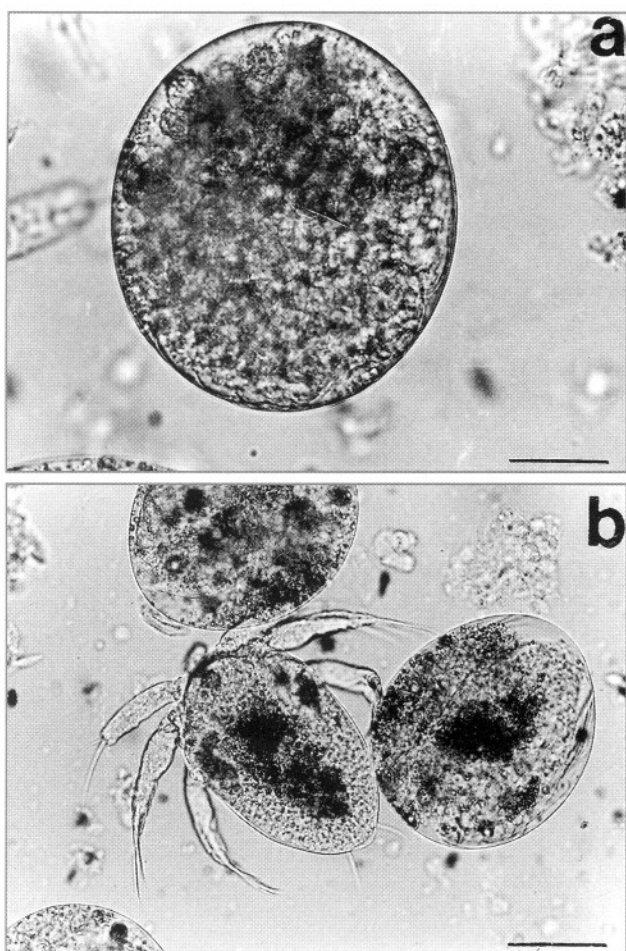


Fig. 4. Egg (a) and nauplii (b) of *Sarcotaces verrucosus*. Scale bars: a = 0.05 mm, b = 0.1 mm

of species of the genus suggested by Moser *et al.* (1985), the validity of Reimer's (1991) species identification should be reviewed.

The prevalence values observed in this study agree with those reported by Stanley (1988) for *S. arcticus* on silvergray rockfish *Sebastes brevispinis*. Moser *et al.* (1985) suggested that higher prevalence could be associated with the distribution zones of the host, and pointed out that the remaining of young *S. brevispinis* in shallow waters would contribute to a high infection by *S. arcticus*.

González (1998) studied ecological aspects of the infestation of *S. verrucosus* on *P. semifasciata* in San Matías Gulf, and found higher prevalence in mature males and females of sandperchs. He suggested that the prevalence could be associated to the permanent residence of mature sandperchs in reproductive areas during the spawning season.

There are no previous records of *Sarcotaces* spp. for the Southwest Atlantic. *S. verrucosus* has been found only on *P. semifasciata* specimens in the San Matías Gulf. The

absence of this parasite in other demersal fishes inhabiting the same marine environment, suggests a high specificity of *S. verrucosus* to the Argentine sandperch.

Larval stages found in some cysts are similar to the first and second nauplii stages described by Izawa (1973) for *S. pacificus*. The eggs and larvae found in this work were in general slightly larger than those of Izawa's description, while the mean length of the female specimens was higher. This latter difference can be attributed to the above mentioned phenotypic plasticity of the adult stages of this species.

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