

seismicity, causally supports the hypothesis of hydroseismicity. Pore pressure diffusion guided by a permeable fracture zone in this region, is a plausible mechanism for this swarm type hydroseismicity. A comprehensive analysis leads to the inference that earthquake swarm nucleation is a result of time-dependent stress changes induced by water infiltration due to excess rainfall in areas straddling the seismic zone, like Varikuntapadu Mandal in Nellore, in addition to the constant tectonic stress prevailing in the region.

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Parasitic nematode in dead stranded dugong on Mithapur coast, Okha, Gujarat, India

The dugong is a herbivorous marine mammal and the only extant species of family Dugongidae. It has a large distribution range, which includes subtropical and tropical countries in world. In India, the mammal is distributed in the Andaman and Nicobar Islands, Gulf of Mannar and Palk Bay, Tamil Nadu and Gulf of Kachchh, Gujarat^{1–4}. In Gujarat, the current population status of dugong is unknown and its sighting is rare. Here we report the presence of parasites in a dead dugong stranded at Mithapur (22°25'14.5"N, 68°59'34.8"E), Okha, Gujarat on 3 January 2013.

Dugongs are susceptible to a wide range of diseases, including parasitic and infectious diseases⁵. This marine mammal serves as an ideal host to diverse forms of parasites that thrive in the internal organs and also external parasites on its body surface⁵. Blair⁶ lists an array of parasitic infestations from the species of order Sirenia (Dugong and Manatee). Over the years, at least 19 species of trematodes and one species of nematode have been described from dugongs⁵. Barnacles and copepods were observed residing as unusual parasites on dugong⁷.

Major internal parasites are commensal organisms, but few parasites have also been related with disease⁵.

The internal parasitic nematode, *Paradujardinia halicoris* is the only species found in the dugong stomach, reported from several countries, including Australia, the Philippines Red Sea, Papua New Guinea, India, Sri Lanka, Madagascar, Malaysia, Palau and Japan^{6,8}. One species of nematode (*P. halicoris*) and three species of trematode parasites have been observed from dugongs in the Gulf of Mannar, but external parasites have not been reported⁹.

Nematodes were observed in the stomach of the dead stranded dugong during post-mortem. The sample was collected and preserved. Scanning electron microscope (SEM) was used with the standard protocol. The images were captured on a SEM CARL ZEISS (model no. EVO-18) at the Gujarat Ecological Education and Research (GEER) Foundation, Gandhinagar. SEM revealed more accurate details of morphological structures of the specimen¹⁰. Identification of specimens was done in consultation with the relevant literature^{11–14}. For further confirma-

tion, the photographs were sent to David Blair, James Cook University, Australia.

From morphological details of the sample (Figure 1) and SEM observations (dead sample – dried) (Figure 2), the species was identified as *Paradujardinia halicoris* (Owen, 1833)¹⁵. Blair also approved and confirmed the species. SEM revealed certain distinct features of this species, specifically three lips at the anterior end of the specimen (Figure 2). This helped validate our observations.

A total of around 18 individuals of the species were observed, which were about 80–100 mm in length. The external morphological characteristics of species are as follows^{11–14}. A well-marked constriction separates the head from the neck. Mouth with three well-defined rounded lips. Male is slightly smaller than female.

Although over the years several dead stranded dugongs have been recorded² and necropsied, there was no record of this parasite from their body. To the best of our knowledge, there seem to be no previous records on endoparasitic infestation in dugongs in Gujarat.

Several decades earlier, a study had described a dugong infection by 540



Figure 1. *Paradujardinia halicoris*: a, live; b, dead.

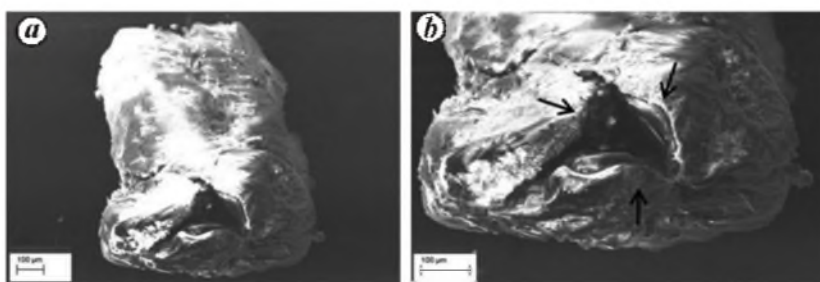


Figure 2. Scanning electron photomicrographs of *P. halicoris*. a, Anterior end of the worm. b, Arrows indicate three lips.

nematode parasites of *P. halicoris*, from the Red Sea region¹⁶. According to his report, these nematodes had severely damaged the internal organs of the host by piercing the successive mucosal, glandular and muscular layers of the stomach. The infestations by the nematodes were also reported to cause swelling of the gastric walls and severe ulceration. However, to date no such similar endoparasitic infestation has been reported in dugong species from Indian coastal areas such as the Gulf of Mannar, where milder colonization of 40–50 nematodes has frequently been found in the dugong autopsied. In the present study, it was observed that there were only around 18 nematodes in the dead dugong. Precise cause of death of the mammal was not determined, but according to the post-mortem report, the internal and external organs of the dead dugong were not damaged.

This nematode record will pave the way for understanding dugong parasitic infections in Gujarat. Such information will help identify the health status of dugongs. Dead stranded dugongs should be properly assessed for parasites during post-mortem in future. This can help

improve and enhance knowledge related to this vulnerable marine mammal.

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