Jellyfish under attack: Study uncovers parasitic spillover of a burrowing sea anemone

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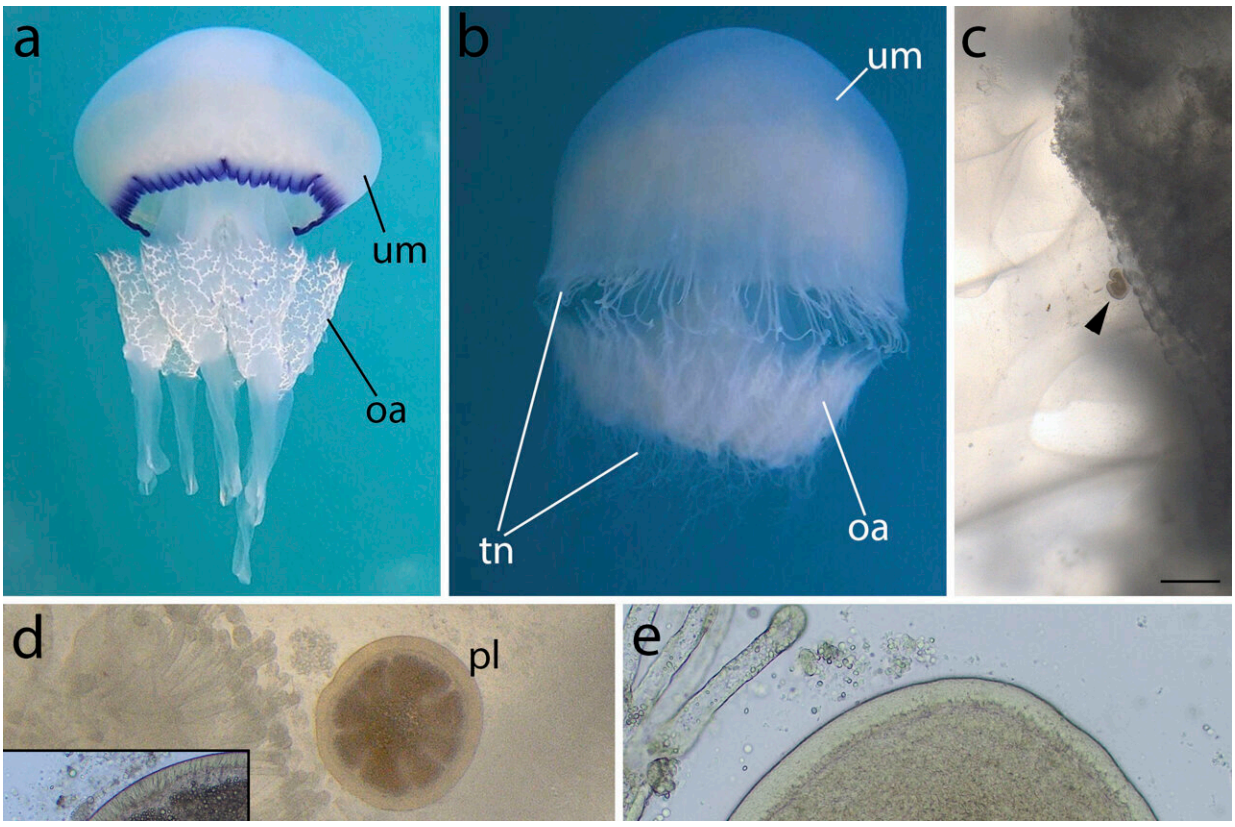


General view of scyphomedusa hosts Rhizostoma pulmo (a) and Rhopilema nomadica (b) and early stages of the Edwardsiella carnea parasitic planulae (c-g) that were found in them. c. planula (black arrowhead) on the oral arm of R. nomadica. d. planulae (pl) with developing mesenteries (se) and vacuolated spheres that resembled lipid droplets (v). e. spherical planula with mouth (mo). Box contents are detailed in panel g. f. vermiform planula with distinguishable

mouth (mo) and aboral end (ab). Box contents are detailed in panel h. g. extensively ciliated (ci) epidermis of spherical planulae. h. extensively ciliated (ci) epidermis of vermiform planula. um – umbrella (bell), oa – oral arms, tn – tentacles. Scale bar: 1 mm (c), 300 µm (d, e, f), 25 µm (g, h). Credit: *Scientific Reports* (2024). DOI: 10.1038/s41598-024-72168-7

Many marine organisms, like sea anemones, struggle to spread across the ocean, especially if they lack long, mobile larval stages. Unlike their jellyfish relatives, sea anemones do not have a medusa stage, making their dispersal challenging. Their only mobile stage is a tiny larva called a planula.

In many species of sea anemones, the planula persists for only a short period before it settles on the seafloor and transforms into a polyp—a soft, tube-like animal with a central mouth surrounded by tentacles. This brief window reduces the ability of sea anemones to settle in new areas far from where they originated.

Some sea anemones, like the burrowing anemone Edwardsiella carnea, have developed a unique way to overcome the challenges of ocean dispersal. These anemones parasitize jelly-like marine animals called comb jellies (or ctenophores) to spread more easily through the ocean.

The polyps of this species release eggs and sperm into the water, where fertilization happens. The fertilized eggs develop into planulae, which can infect comb jellies by either burrowing into their tissues or being swallowed.

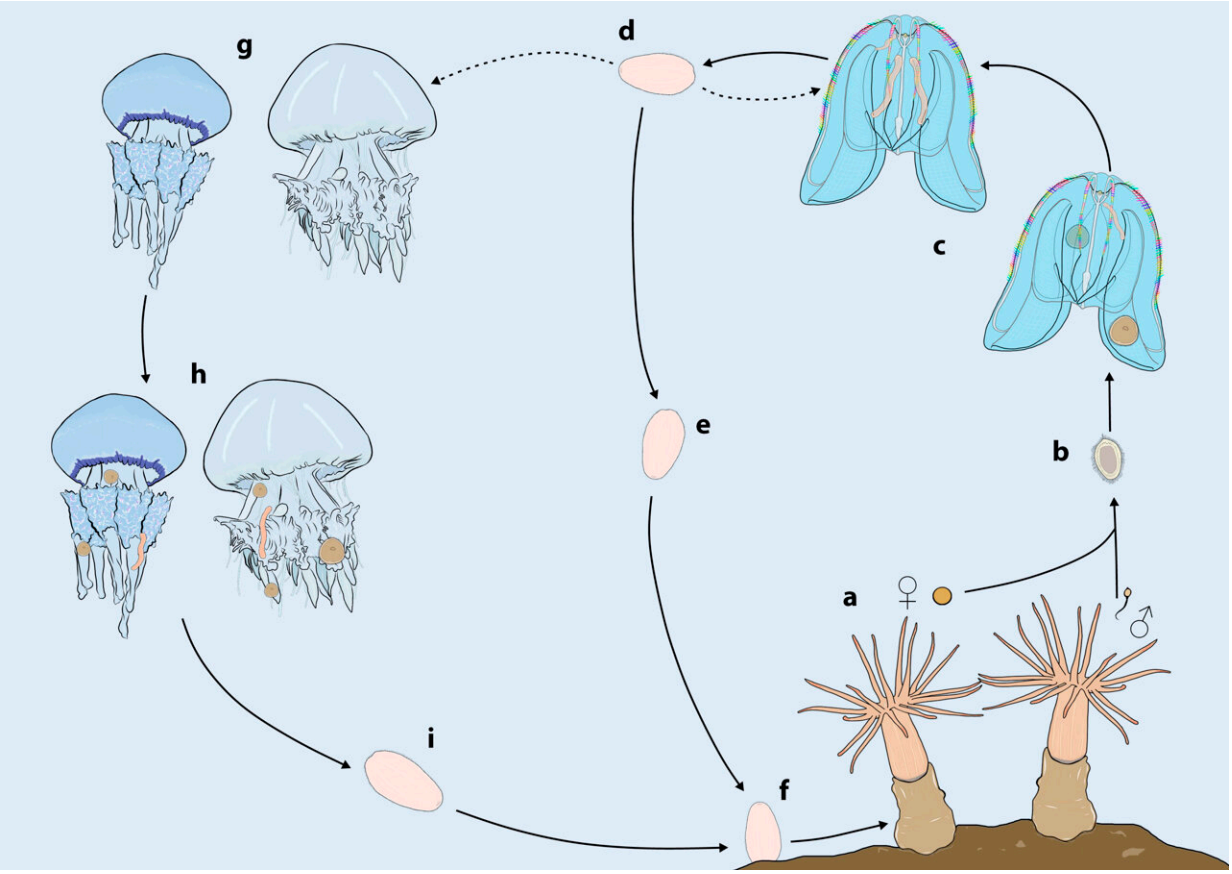
Inside the comb jelly, the planula grows into a worm-like form, which can then be released and settle on the seafloor to develop into a polyp. Comb jellies can host one or many of these parasitic anemones at the

same time, and carry the parasitic planulae for long distances, across the ocean.

A study led by Prof. Tamar Guy-Haim from the Israel Oceanographic and Limnological Research (IOLR) and Ben-Gurion University, and the doctoral student Anastasiia Iakovleva, along with Dr. Arseniy R. Morov from the Guy-Haim Lab in IOLR and Prof. Dror Angel from the University of Haifa, has uncovered the first documented cases of parasitic burrowing anemone planulae in scyphozoan medusae ("true jellyfish").

The study, published in *Scientific Reports*, identified Edwardsiella carnea planulae in the Mediterranean barrel jellyfish (Rhizostoma pulmo) and the invasive nomad jellyfish (Rhopilema nomadica), using both morphological and molecular-genetic analyses.

These findings indicate a "parasitic spillover"—an ecological phenomenon that occurs when a parasite, typically associated with one host species, begins to infect a new host.



Life cycle of a burrowing sea anemone Edwardsiella carnea. a. adult female and male polyps release gametes to the water column. b. a free-swimming pre-parasitic planula is formed following fertilization. c. the planula infects the ctenophore host Mnemiopsis leidyi and develops into vermiform parasitic stage. d. a post-parasitic planula leaves the ctenophore host into the water column (e) where it can either settle in the seabed (f) and develop into a polyp (a) or reinfect another ctenophore or infect schyphozoan host Rhopilema nomadica or Rhizostoma pulmo (hypothetical spillover) (g-h). a post-parasitic planula may leave the schyphozoan host, traveling in the water column (i) where it can settle on the seabed (f) and develop into a polyp. The dashed line represents an alternate pathway. Credit: *Scientific Reports* (2024). DOI: 10.1038/s41598-024-72168-7

This finding is particularly astonishing because parasite-host

relationships are usually evolutionarily conserved, meaning parasites typically infect species they have co-evolved with over long periods, often developing very specific ways to survive and thrive within those hosts. It is rare for a parasite to switch to a different species in an evolutionarily separate group.

To explain their findings, the researchers proposed that the sea anemone's host choice is driven by the availability of gelatinous zooplankton during seasonal jellyfish blooms rather than due to evolutionary ties.

This research highlights how parasites can adapt to new hosts in rapidly changing marine ecosystems, especially under an exacerbating climate change that is evident in the Mediterranean Sea. The implications of this host switch could be significant, especially as jellyfish blooms have become more frequent and intense in this region in recent decades.

Further research is planned to investigate the broader impact of this parasitism on jellyfish populations, particularly regarding their reproduction, growth, and survival.

More information: Anastasiia Iakovleva et al, From ctenophores to scyphozoans: parasitic spillover of a burrowing sea anemone, *Scientific Reports* (2024). DOI: 10.1038/s41598-024-72168-7

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