Pycnogonids, the Sea Spiders
Their role in marine ecology

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Pycnogonids, popularly known as sea spiders, are a strange group of entirely marine arthropods belonging to the phylum Arthropoda and class Pycnogonida (Gr. pyknos = crowded; gony = knee), which means 'knobby knees'. They are more closely related to spiders rather than to crustaceans (shrimps, lobsters, etc). Pycnogonids are sometimes also called as whip scorpions. These sea spiders resemble the terrestrial spider, but have a skinny body.These are rarely observed as they are small and cryptic, or hidden amongst other organisms, moving slowly over sea weeds, corals, sponges, hydroids. Pycnogonids are usually white or else cryptically coloured in relationship to the colonies of the animals they feed on. They are well camouflaged beneath the rocks and among the algae that are found along shorelines. Their distribution is worldwide and they occur commonly in shallow waters, but can be found in water as deep as 7,000 meters (Dunlop and Arango, 2005).

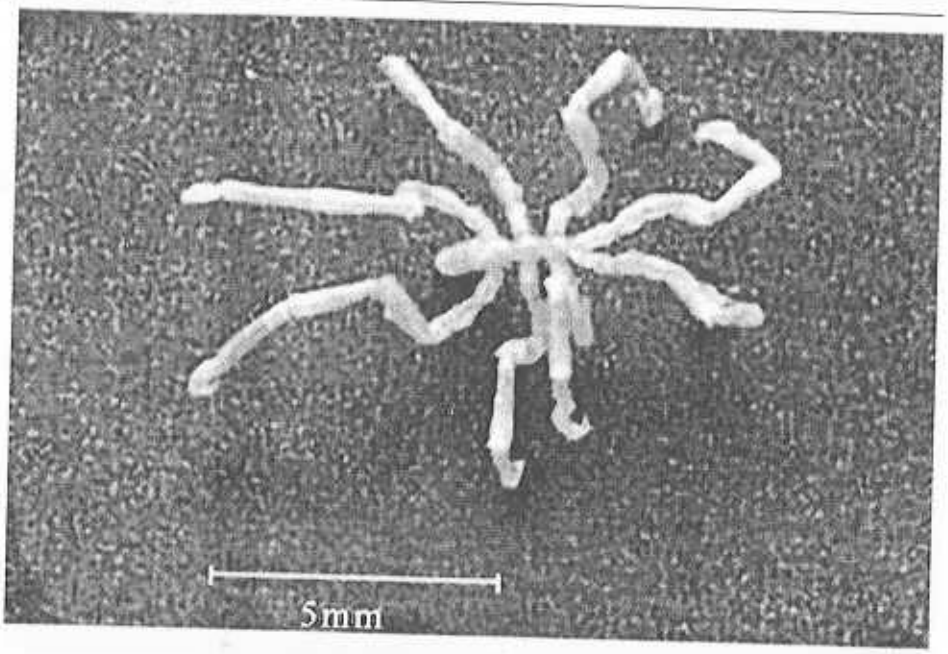

Fig.1: Sea spider (*Endeis mollis*)

The fossil record indicates that pycnogonids branched off early during the emergence of stem-group arthropods with the earliest larvae identified from the Upper Cambrian (about 490M yrs ago) and a crown-group (or near-crown-group) adult from the Silurian period (about 425M yrs ago). The antiquity of the lineage is congruent with the observation that pycnogonids share traits with other ecdysozoans (tardigrades, nematodes, priapulans and their kind), including a terminal mouth and a triradiate pharynx, that could be found in the arthropod ground pattern (Maxmen *et al.*, 2005). There are more than1300 species of pycnogonids described and it is believed that many more species are yet to be discovered mainly from remote deep-sea habitats. Many of the pycnogonid species have been rather vaguely defined in the past, making it nearly impossible to identify any one species with a high degree of certainty. No single clear cut criterion for pycnogonid species identification is currently followed by any of the authors. Most of the literature contains comments such as:1) "resembles the type, except for the following variations~ items: body more (less) slender, legs longer (shorter), legs less (more) spinose, ovigerous leg spines more (less) numerous etc., rendering definitive identification to species nearly impossible. 2) "This problem is not limited to Australian species or to any one family (or genus for that matter), but is a common problem with all current pycnogonid studies (Bonnie, 2002)." 3) "Larvae of pycnogonid species are reported as internal parasites of cnidarians but adults are solitary and free living but often live in close association with invertebrate food hosts or seaweeds, bryozoans, hydroids, and on the surface of stones (Ronald, 2003)." More specific habitat information on these organisms in India is unknown.

In India, Vizhinjam coast is known to harbour a rich diversity of pycnogonid species represented by three species of *Pallenopsis*, two species of *Anoplodactylus* and *Parapallene kempi* (Kurien, 1948). Occurrence of *Nymphopsis acinacispinatus* and *Anoplodactylus sexatilis* are also reported from Arabian Sea (Kurien, 1953) and *Anoplodactylus sandromagni* from Trivandrum (Krapp, 1996). Five species of pycnogonids *Endeis ghaziei, E. meridionalis, E. flaccidus, E. mollis* and *Anoplodactylus investigatoris* have been reported from Madras waters by Rajagopal (1963) and Daniel and Sen (1975). *Propallene kempi,* Calman is a widely distributed form in tropical and temperate waters and has been reported from east coast of India (Daniel and Sen, 1975).

Seasonality in the occurrence of pycnogonids has been observed. They generally occur during March – August and mostly in April (Nakamura and Fujita, 2004). In the month of May 2007, a large number of pycnogonid specimens were collected from a large floating net cage launched in the inshore water of Visakhapatnam at a depth of 10-12 m to culture Asian sea bass. These pycnogonids were identified as *Endeis mollis*, Carpenter. The sea spider *Endeis mollis* belong to the Phylum – Arthropoda, Subphylum – Chelicerata, Class – Pycnogonida, Order – Pantopoda and Family – Endeidae. The body was long, narrow and the colour was pale green to brownish. The proboscis was as long as the body. The specimens collected had 4 pairs of legs, leg span being nearly about

Table.1. List of Pycnogonid species reported from Indian coast.

Species	Distribution	Reference
Achelia boschi	Arabian Sea	Stock, 1992
Ammothella omanensis	Arabian Sea	Stock, 1992
Anoplodactylus cribellatus	Vizhinjam, Andaman Sea, Arabian Sea	Kurian, 1948; Daniel & Sen, 1975, Kurian, 1953
Anoplodactylus sexatilis	Arabian Sea	Kurian, 1953
Anoplodactylus petiolatus	Vizhinjam	Kurien, 1948
Anoplodactylus eroticus	Gulf of Mannar	Stock, 1968
Anoplodactylus investigatoris	Madras	Daniel & Sen, 1975
Anoplodactylus sandromagni	Trivandrum	Krapp, 1996
Callipallene pectinata / Pallene pectinata	Arabian Sea	Calman, 1938
Callipallene(?) echinata	Arabian Sea	Calman, 1938
Colossendeis colossea	Andaman Sea	Daniel & Sen, 1975
Colossea macerrima	Arabian Sea, Andaman Sea, Laccadive Sea	Daniel & Sen, 1975
Endeis flaccidus	Madras	Daniel & Sen, 1975
Endeis meridionalis	Madras	Daniel & Sen, 1975
Endeis mollis	Madras, Gulf of Mannar, Nicobar, Visakhapatnam	Daniel & Sen, 1975, Calman, 1938, Present Authors
Endeis ghaziei	Madras	Rajagopal, 1963
Eurycyde flagella	Andaman Sea	Nakamura & Chullasorn, 2000
Nymphopsis acinacispinatus	Arabian Sea	Kurian, 1953
Nymphon andamanense	Arabian Sea, Andaman Sea	Calman, 1938, Daniel & Sen, 1975
Nymphon foxi	Arabian Sea	Calman, 1938
Nymphon arabicum	Arabian Sea	Calman, 1938
Nymphon longicaudatum	Gulf of Mannar	Daniel & Sen, 1975
Pallenopsis (Bathypallenopsis)annandalei	Laccadive Sea	Daniel & Sen, 1975
Pallenopsis (Bathypallenopsis) safari	Gulf of Mannar	Stock, 1984
Pallenopsis alcocki	Vizhinjam, Andaman Sea	Kurian, 1948, Daniel & Sen, 1975
Pallenopsis crosslandi	Vizhinjam	Kurian, 1948
Pallenopsis ovalis	Andaman Sea	Daniel & Sen, 1975
Parapallene kempi	Bay of Bengal, Waltair, Orissa, Gulf of Mannar, Vizhinjam, Arabian Sea	Kurian, 1948; Kurian, 1953
Propallene kempi	All along the east coast of India	Daniel & Sen, 1975
Pycnogonum indicum	Gulf of Mannar	Daniel & Sen, 1975
Pycnogonum moolenbeeki	Arabian Sea	Stock, 1992
Pycnogonum tesselatum	Arabian Sea	Stock, 1968
Rhopalorhynchus kroeyeri	Arabian Sea, Andaman Sea	Calman, 1938
Seguapallene echinata	Arabian Sea	Calman, 1938

3 times the length of body (Fig. 1). The body was translucent. The ovigerous legs which are present only in the males of this group were located at the ventral side that wrap around the egg mass. The size of the specimens from proboscis to anus ranged from 10-190µm. The *Endeis mollis* specimens collected from Visakhapatnam consisted mainly of brooding males carrying eggs and were found associated with hydroids. Though Pycnogonid-hydrozoan associations have been previously described from other countries, this is the first report from Indian waters (Veena *et al.*, 2008).

These marine arthropods are long legged and their body is so reduced that reproductive organs are located in the legs. While most species have 4 pairs of legs like their terrestrial counterparts, there are some Decalopoda and Dodecalopoda species having 5 and 6 pairs of legs respectively. Proboscis is the most prominent external feature of pycnogonids which is a movable organ and shows wide variation in size and shape among families. The shape and internal structure has been related to specialised feeding habits, sometimes specific to a particular host among parasitic species (Fry 1965, Staples and Watson 1987).

Sex organs in sea spiders are found in the long joints of legs. Males and females can be easily differentiated by the absence of ovigers in females of the families Phoxichilidiidae and most Pycnogonidae species. The presence of cement glands on the femora indicates a male specimen (AAS, 2005), although hermaphrodite species *Aschorhynchus corderoi* are also reported (Miyazaki & Makioka 1993). Females release the eggs which the male gathers and glues together into a ball which he carries with a special extra pair of legs, during brooding period. Eggs hatch into larvae with only 3 pairs of legs and huge pincers which then attaches to a cnidarian host. The larva, called "the protonymphon larva," has a suctorial mouth, and two pairs of appendages. It makes its way to a juvenile host where it eats host tissues and fluids, and undergoes several moults. Sometimes these larvae even live internally in the host. Finally, they emerge from the juvenile host as the predatory adults. The juvenile host may or may not be the same as the adult host. For example, some pycnogonids whose adults are predatory on hydroids spend their larval period in the gills of clams (Ronald, 2003).

Little is known of feeding habits of deepwater species. Majority of

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Pycnogonids are carnivorous, preying on bryozoans, hydroids and sedentary polychaetes. However, some species such as *Achelia longipes* feed on the new shoots of red algae that grow on the polyzoan colonies and a few other species such as *Endeis laevis* feed on the detritus that collects around the bases of these colonies. Adult pycnogonids either suck the juices from soft-bodied invertebrates or browse on hydroids and bryozoans through their long proboscis. Scientists have learned that adult pycnogonids have taste preferences for a particular type of prey that develop depending on what they are fed on while they are juveniles.

Larvae live as parasites on hydroids and other cnidarians sometimes causing a sort of gall. It is difficult to assess the importance of the role played by pycnogonids in the marine food chain but their impact on individual hydroid and bryozoan colonies as a consequence of their feeding can be significant (Museum Victoria, 2006). Sea spider predation or parasitism is a potential threat to all corals, soft corals, and sea anemones that are kept in aquaria. If an aquarium system gets infected, just how easy it is to control the pest species will really depend on the type of pycnogonid that is present. The large forms are typically slow, and readily apparent, and may be easily removed from aquaria. The small forms, on the other hand, may be quite difficult to see, as they may be as small, or smaller, than the polyps of small-mouthed corals. Additionally, they may live under the coral mucus layer, and this would further obscure them. They do not appear to be easily removed by "dips," poisons, or potential predators. Frankly, if they are found on corals in any tank, the best likely option would be to remove the coral from the tank, and simply dispose of it (Ronald, 2003). These animals are not necessarily rare in the wild, but since they are cryptic and small, they are easily been overlooked. They just "appear out of nowhere" for those fortunate enough and do no harm to captive marine livestock (Bob Fenner, 2007). The current species reported from Visakhapatnam and others reviewed in this contribution are only a small glimpse of the pycnogonid species diversity within India and much more work remains to be done. There may be lots of new species of this uncommon genus awaiting discovery from Indian waters.

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