

**A SUBJECT-INDEXED BIBLIOGRAPHY OF THE SYMBIOTIC
BARNACLES OF THE GENUS *OCTOLASMIS* GRAY, 1825
(CRUSTACEA: CIRRIPIEDIA: POECILASMATIDAE)**

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ABSTRACT.- A guide to published research on the pedunculate barnacle genus *Octolasmis* is presented. It is comprised of seven sections, each of which includes an outline of the subject area treated in the section and a list of the publications known to us on the subject.

INTRODUCTION

Members of the phylum Arthropoda, i.e., the jointed-legged animals, including common insects, ticks, spiders, horseshoe crabs, lobsters, and crabs are considered to be among the most successful animals on earth. Some perspectives that support this assertion are the sheer number of species, their reproductive success, and the diversity of ecological niches occupied. Using those criteria, the Crustacea are among the most successful marine animals and, we would argue, a dynamic example of that success is the pedunculate barnacle genus, *Octolasmis*.

Pedunculate barnacles have a history dating back to the upper Silurian, but even at that early date a unique life style, i.e., a symbiotic association with another living animal, had already evolved (Wills, 1963). Although *Lepas* is the pedunculate barnacle most commonly seen attached to flotsam and jetsam, it is the symbiotic life style that recent octolasmids continue to exploit with corals, echinoderms, mollusks, horseshoe crabs, crabs, lobsters, isopods, fish, and sea snakes.

Adults of *Octolasmis* are most likely to be seen on animals that humans encounter regularly, such as edible crabs and lobsters. The species most likely to be seen, *O. warwickii*, is always attached externally on the carapace, antennae, and proximal segments of locomotory appendages of these decapods. Another species likely to be seen, *O. tridens*, is commonly

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attached externally on the mouthparts, along the inner carapace margin, on proximal leg segments, on the bases of epipodites, podobranchs and arthrobranchs, and lining the excurrent branchial passages of lobsters. Interestingly, it is attached internally on crabs, frequently in the branchial chambers, on the inner sides of gills. Still other species, such as *O. angulata*, *O. bullata*, *O. lowei*, and *O. neptuni* are always found internally, usually within the gill chambers of crabs and lobsters.

The mud crab or mangrove crab, *Scylla serrata*, is a favored food from South Africa to Australia and the Philippines. Widespread natural populations of the crabs abound in tropical-temperate shallow seas where the individuals commonly harbor *O. cor* and *O. angulata* in the gill chambers. Edible lobsters also frequently bear octolasmids in the warm, shallow seas, e.g., *Thenus orientalis* typically has *O. warwickii* on the outer carapace margin, *O. tridens* on the inner carapace margin, and *O. lowei* in the gill chambers (Jeffries *et al.*, 1982, 1984).

As fascinating as the live adult barnacles are to observe - in nature and in the laboratory - with their white calcareous plates, pastel body coloration, and unceasing activity - searching, feeding, and copulating - they are but one part of the life cycle (Figure 1). Anatomically, each animal is at once male and female, yet pairing seems to be the normal prelude to the perpetuation of the species. The ensuing egg masses are deposited in the capitular cavity as

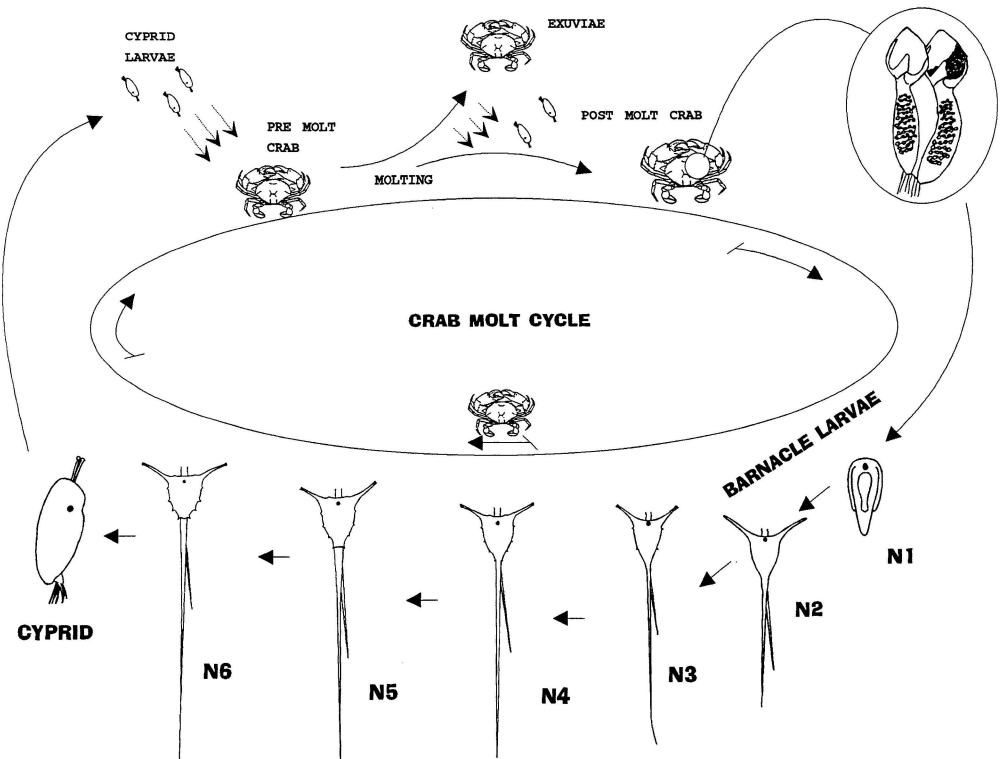


Fig. 1. The typical life cycle of *Octolasmis* includes a sessile adult, six planktonic naupliar larvae and a cypris larva. In several species the cyprides are known to collect on crabs that are approaching ecdysis and to postpone settlement until the crab has completed molting. The duration of the adult barnacle's life is governed by the length of the host's intermolt period. Thus, the barnacle must grow to maturity and reproduce prior to the host's next molt. It is the exploitation of ephemeral animate substrates that has been a central factor in the evolutionary radiation of *Octolasmis*.

ovigerous lamellae and, in a matter of days, the progeny begin their first movements. Soon thereafter they swim free in the capitular cavity, and shortly enter the outside world through the capitular aperture of the parent. As actively swimming, phototactic, nauplius N1 larvae barely visible to the unaided eye and bearing no resemblance to the parent, they have been exquisitely fashioned by evolution to exist as part of the marine plankton in the photic zone.

Within 24 hours after hatching, they molt to the first of the plankton-eating (mostly algae) nauplius stages, N2. Thereafter, each nauplius in turn molts, in *O. cor* at approximately 2-day intervals, becoming N3, N4, N5, and N6 stages. Each stage is somewhat larger, more complex, and better equipped than its predecessor to support two essential activities, swimming and voracious feeding (Figure 1). The Nauplius 6 is the last feeding larval stage, lasting nine days, before it molts to the non-feeding cypris larval stage (Jeffries et al., 1995). The *Octolasmis* cyprids may live over 150 days, but how long they remain competent to continue the life cycle, i.e., to attach and metamorphose to the adult body form, has not been determined. We do not know by what visual and chemical cues they are guided, but unerringly cyprids are attracted to the appropriate host, which for *O. cor* is a *S. serrata*, (instar 13 or larger) preferably one nearing molt (Jeffries et al., 1989, 1992). The settlement site on the host chosen by the cypris larva becomes the attachment point of the peduncular basal disc of the adult barnacle, determining thereby its permanent location.

Wherever the demand for edible crabs exceeds the supply that natural populations can support, attempts at crab husbandry flourish. Sometimes, as in the Straits of Johore, floating rafts and kelongs provide support for large cages in which crabs are held and fed until marketable. Elsewhere, as in the Philippines and in Thailand, ponds adjacent to the sea are equipped with sluice gates which allow a tidal ebb and flow of sea water while containing the crabs for successful aquaculture. In such crab-holding situations crab densities greatly exceed natural populations, *Octolasmis* infestations soar, and crab mortality increases.

The purpose of this paper is to provide an organized guide to the published research and knowledge on barnacles of the genus *Octolasmis* Gray, 1825. It is intended to give efficient access to the major subject areas and background research efforts that have been reported in the literature.

This work is organized into seven sections. Each section has two parts. The first part outlines the subject areas included in the section and cites a few of the most typical and or important references under the subjects. The second part lists all the publications known to us that include material germane to the sections' subjects.

TAXONOMIC TREATMENTS OF *OCTOLASMIS*

Most published works on the genus *Octolasmis* are descriptive in the classical sense of introducing new species, and drawing morphological comparisons between species within the genus. This section includes references to those papers which provide species descriptions, diagnostic drawings and descriptions of whole specimens and specific anatomic parts, taxonomic keys, general geographic distribution information, and the names of repositories where specimens are held. Many of the original species descriptions can be found in just a few important references (Aurivillius, 1892, 1894; Darwin, 1851; Hiro, 1936, 1937, 1939c; Hoek, 1907; Pilsbry, 1907).

Particularly useful to the beginner are reports which include, along with *Octolasmis* species descriptions, keys to the species of a particular region, e.g., the Indian species (Annandale, 1909), the North American species (Pilsbry, 1907), the South African species (Barnard, 1924) and the Philippine species (Rosell, 1972).

Pertinent references:

- | | |
|---|---|
| Annandale, 1905, 1906, 1907, 1909; | Jeffries & Voris, 1979, 1983; |
| Aurivillius, 1892, 1894; | Jeffries et al., 1982, 1984, 1985, 1988, 1989a, |
| Barnard, 1924, 1926; | 1989b, 1991, 1992; |
| Borradaile, 1903; | Kim, 1985; |
| Brian & Dartevelle, 1954; | Korn, 1995 |
| Broch, 1922, 1924a, 1924b, 1927, 1932, | Krüger, 1911; |
| 1947; | Kujawa, 1971; |
| Bullock, 1964; | Lacombe & Jakowska, 1975; |
| Causey, 1960, 1961; | Lanchester, 1902; |
| Coker, 1902; | Lang, 1976, 1977b, 1977c, 1979; |
| Colon-Urban et al., 1979; | Lee, 1992; |
| Daniel, 1955; | Lessona & Tapparone-Canefri, 1874; |
| Darwin, 1851; | Moazzam & Rizvi, 1978, 1982; |
| Dawydoff, 1952; | Monod, 1922, 1974; |
| Day & Morgans, 1956; | Moyse, 1987; |
| De Filippi, 1861; | Newman, 1960a, 1960b, 1961a, 1961b, 1967, |
| DeTurk, 1940; | 1986, 1987; |
| Dinamani, 1964, 1965, 1967; | Newman et al., 1969; |
| Fernando, 1978; | Newman, & Abbott, 1980; |
| Foster, 1980, 1987; | Nilsson-Cantell, 1921, 1925, 1927, 1928, |
| Gannon, 1990; | 1930, 1934a, 1934b, 1937, 1938; |
| Gannon & Wheatly, 1992; | Pearse, 1951; |
| Gittings, 1985; | Pilsbry, 1907, 1928; |
| Gittings et al., 1986; | Rosell, 1967, 1972; |
| Gray, 1825; | Shields, 1992; |
| Gruvel, 1892, 1900, 1902, 1905; | Spears et al., 1994 |
| Haefner, 1985; | Stebbing, 1894, 1895; |
| Hashmi & Zaidi, 1965; | Stubbings, 1964, 1967; |
| Henry, 1954; | Utinomi, 1958, 1968, 1970; |
| Hiro, 1933, 1936, 1937, 1938, 1939a, 1939b, | Verrill, 1922; |
| 1939c; | Weltner, 1922; |
| Hoek, 1875, 1887, 1907, 1913; | Wu, 1967; |
| Holthuis & Mikulka, 1972; | Young, 1995 |
| Hudson & Lester, 1994; | Zevina, 1975, 1982; |
| Hulings, 1961; | Zullo, 1982, 1991; |
| Humes, 1941; | |

THE HOSTS OF *OCTOLASMIS*

Although it has been reported that a few *Octolasmis* species were collected with bottom debris, and some were attached to the protective coverings of animals, e.g., mussel shells and sandy tubes of marine worms, most have been found attached to live animals representing the phyla Cnidaria, Echinodermata, Mollusca, Arthropoda, and Chordata. Of these, by far the most common associations and the largest populations are with marine arthropods, in particular decapod Crustacea (Annandale, 1909; Aurivillius, 1894; Daniel, 1955; Darwin, 1851; Hiro, 1937; and Jeffries et al., 1982).

Octolasmis species descriptions are usually accompanied by the name of the host. But especially useful are a few references that include several species of *Octolasmis* and a list of

their multiple hosts, e.g., Anderson (1994), Annandale (1909), Daniel (1955), Hiro (1937), Jeffries, et al. (1982), Pilsbry (1907), Rosell (1972). More extensive information concerning the hosts is essential to understanding the habitat and the geographic range of each octolasmid species.

Pertinent references:

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|--|---|
| Anderson, 1994; | Jeffries & Voris, 1979, 1983; |
| Annandale, 1905, 1906, 1907, 1909; | Jeffries et al., 1982, 1984, 1985, 1988, 1989a, |
| Arudpragasam, 1967; | 1989b, 1991; |
| Aurivillius, 1892, 1894; | Kujawa, 1971; |
| Barnard, 1926; | Lacombe & Jakowska, 1975; |
| Borradaile, 1903; | Lanchester, 1902; |
| Brian & Dartevelle, 1954; | Lang, 1977a, 1977b, 1977c; |
| Broch, 1922, 1924a, 1924b, 1927, 1932, 1947; | Lee, 1992; |
| Bullock, 1964; | Lessona & Tapparone-Canefri, 1874; |
| Causey, 1960, 1961; | Lyons, 1970; |
| Coker, 1902; | Matheswari & Fernando, 1989; |
| Colon-Urban et al., 1979; | Millard & Brockhuysen, 1970; |
| Daniel, 1955; | Millikin & Williams, 1984; |
| Darwin, 1851; | Moazzam & Rizvi, 1978, 1982; |
| Dawydoff, 1952; | Monod, 1922, 1974; |
| Day & Morgans, 1956; | Moyse, 1987; |
| De Filippi, 1861; | Newman, 1960a, 1960b, 1961a, 1961b, 1967; |
| DeTurk, 1940; | Newman & Abbott, 1980; |
| Dinamani, 1964, 1965; | Nilsson-Cantell, 1930, 1934a, 1934b, 1937; |
| Foster, 1980, 1987; | Pearse, 1932, 1933, 1947, 1951; |
| Gannon, 1990; | Pilsbry, 1907, 1928; |
| Gannon & Wheatly, 1992; | Quinn & Kojis, 1987; |
| Gittings, 1985; | Rosell, 1967, 1972; |
| Gittings et al., 1986; | Ross, 1983; |
| Gray, 1825; | Stebbing, 1895; |
| Gruvel, 1892, 1900, 1902, 1905; | Stubbings, 1964, 1967; |
| Haefner, 1985; | Utinomi, 1968, 1970; |
| Hashmi & Zaidi, 1965; | Verrill, 1922; |
| Henry, 1954; | Voris et al., 1994; |
| Hiro, 1933, 1936, 1937, 1938, 1939a, 1939b, | Voris & Jeffries, 1997; |
| 1939c; | Walker, 1974; |
| Hoek, 1887, 1907, 1913; | Wells, 1966; |
| Holthuis & Mikulka, 1972; | Wu, 1967; |
| Hudson & Lester, 1994; | Zann et al., 1975; |
| Hulings, 1961; | Zann & Harker, 1978; |
| Humes, 1941; | |

ECOLOGY OF *OCTOLASMIS* HOSTS

The best information to date supports the assertion that there are no "free-living" adult octolasmids. All species are found attached to animal hosts under natural conditions. Therefore, the obligatory nature of the symbiotic relationship demands information about host habitats and ecology as a precondition to even a rudimentary understanding of the ecology of *Octolasmis* species.

Most authors have named the geographical locations where their *Octolasmis* hosts were collected, but scarcely anything more. Annandale (1909) provided some basic additional information about the collections, such as "...shallow water, littoral, or pelagic". The best of these reports, such as Causey (1960), Dinamani (1964), Gittings et al. (1986), Hiro (1937b),

detailed the measured depths of collections, and thus are of special interest. Foster (1987) generalized about depth ranges of extant barnacle genera, noting that, *Octolasmis* spp. are mostly found in fairly shallow water, and only a few are found in depths greater than 1,000 m.

Pertinent references:

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|---|---|
| Annandale, 1905, 1906, 1907, 1909; | Hulings, 1961; |
| Aurivillius, 1892, 1894; | Humes, 1941; |
| Borradaile, 1903; | Jeffries & Voris, 1979, 1983; |
| Brian & Darteville, 1954; | Jeffries et al., 1982, 1984, 1985, 1988, 1989a, |
| Broch, 1922, 1924b, 1927, 1932, 1947; | 1989b, 1991; |
| Bullock, 1964; | Lanchester, 1902; |
| Causey, 1960, 1961; | Lang, 1976, 1977b; |
| Coker, 1902; | Lessona & Tapparone-Canefri, 1874; |
| Colon-Urban et al., 1979; | Lyons, 1970; |
| Daniel, 1955; | Matheswari & Fernando, 1989; |
| Darwin, 1851; | Moazzam & Rizvi, 1978; |
| Dawydoff, 1952; | Monod, 1922, 1974; |
| Day & Morgans, 1956; | Moyse, 1987; |
| De Filippi, 1861; | Newman, 1960a, 1960b, 1961a, 1961b, 1986; |
| DeTurk, 1940; | Newman & Abbott, 1980; |
| Dinamani, 1964, 1965; | Nilsson-Cantell, 1927, 1928, 1930, 1934a, |
| Foster, 1980, 1987; | 1934b, 1937, 1938; |
| Gannon, 1990; | Pilsbry, 1907, 1928; |
| Gannon & Wheatly, 1992; | Quinn & Kojis, 1987; |
| Gittings, 1985; | Rosell, 1967, 1972; |
| Gittings et al., 1986; | Shields, 1992; |
| Gruvel, 1902, 1905; | Spivey, 1976, 1981; |
| Haefner, 1985; | Stubbings, 1967; |
| Hashmi & Zaidi, 1965; | Utinomi, 1968, 1970; |
| Henry, 1954; | Venkateswaran & Fernando, 1982; |
| Hiro, 1933, 1936, 1937, 1938, 1939a, 1939b, | Verrill, 1922; |
| 1939c; | Walker, 1974; |
| Hoek, 1887, 1907, 1913; | Wells, 1966; |
| Holthuis & Mikulka, 1972; | Young, 1995; |
| Hudson & Lester, 1994; | |

ATTACHMENT SITES ON HOSTS

As noted in the previous section, host ecology - really, the macroecology of *Octolasmis* - is just a beginning. Examination and understanding of the microhabitats where octolasmids live on their hosts, that is, a microecological approach, is the logical path to a definitive understanding of octolasmid ecology.

Published descriptions of the attachment of the octolasmids to various sites on the hosts' anatomical parts have covered the range from very general statements, e.g., attached to the host's exoskeleton or to its gills, to very precise and, therefore, more useful, designations, e.g., attached to the epipodite of the second maxilla, or to the inside, proximal third, of left gill three. The references that provide such details of distribution are few in number and are exemplified by Anderson (1994), Arudpragasam (1967), Bullock (1964), Gannon (1990), Jeffries & Voris (1979, 1983), Jeffries et al. (1982, 1984, 1988, 1989b, 1991), Venkateswaran & Fernando (1982), and Walker (1974).

Pertinent references:

- Anderson, 1994;
 Annandale, 1905, 1906, 1907, 1909;
 Arudpragasam, 1967;
 Aurivillius, 1892, 1894;
 Borradaile, 1903;
 Brian & Dartevelle, 1954;
 Broch, 1922, 1924a, 1924b, 1927, 1932, 1947;
 Bullock, 1964;
 Causey, 1960, 1961;
 Coker, 1902;
 Colon-Urban et al., 1979;
 Daniel, 1955;
 Darwin, 1851;
 Dawydoff, 1952;
 Day & Morgans, 1956;
 De Filippi, 1861;
 DeTurk, 1940;
 Dinamani, 1964, 1965;
 Foster, 1980, 1987;
 Gannon, 1990;
 Gannon & Wheatly, 1992;
 Gittings, 1985;
 Gittings et al., 1986;
 Gruvel, 1902, 1905;
 Haefner, 1985;
 Hashmi & Zaidi, 1965;
 Henry, 1954;
 Hiro, 1933, 1936, 1937, 1938, 1939a, 1939b, 1939c;
 Hoek, 1887;
 Holthuis & Mikulka, 1972;
 Hudson & Lester, 1994;
 Hulings, 1961;
 Humes, 1941;
 Jeffries & Voris, 1979, 1983;
 Jeffries et al., 1982, 1984, 1985, 1988, 1989a, 1989b, 1991;
 Lanchester, 1902;
 Lang, 1976, 1977b, 1977c, 1979;
 Lee, 1992;
 Lessona & Tapparone-Canefri, 1874;
 Lyons, 1970;
 Matheswari & Fernando, 1989;
 Moazzam & Rizvi, 1978, 1982;
 Monod, 1922, 1974;
 Newman, 1960a, 1960b, 1961b;
 Newman & Abbott, 1980;
 Nilsson-Cantell, 1937;
 Pearse, 1951;
 Pilsbry, 1907, 1953;
 Quinn & Kojis, 1987;
 Spivey, 1976;
 Stubbings, 1964, 1967;
 Venkateswaran & Fernando, 1982;
 Verrill, 1922;
 Voris et al., 1994;
 Walker, 1974;
 Wells, 1966;
 Wu, 1967;

THE LIFE HISTORY OF OCTOLASMIDS

Although the genus *Octolasmis* was introduced by Gray in 1825 and a few additional species were introduced by Darwin in 1851, it was very late in the century when Aurivillius (1892, 1894) introduced six new species. However, it was not until the beginning of the twentieth century that the first descriptions of the nauplius larval stages, N1 and N2 were reported by Coker (1902) for *O. mülleri*. It was seventy plus years later that the complete life cycle of *O. mülleri* was described by Lang in 1976. Lang's dissertation (Lang, 1977b) also included descriptions of most of the larval stages of *O. forrestii*. Emulating Lang's culture methods, Colon-Urban et al. (1979) were able to culture and describe nauplius stages N1- N4 of the deep-water species, *O. aymonini geryonophila*.

Jeffries and Voris (1983) reported that although brood size was highly variable in *O. mülleri*, it was related to barnacle size. Matheswari and Fernando (1989) reported that egg numbers, length and breadth, were related to the capitular length and breadth of the parents in five *Octolasmis* species. More recently, culture methods and the life cycle stages of *O. angulata* and *O. neptuni* were described by Lee (1992). Jeffries et al. (1995) described the life cycle stages of *O. cor*, along with methods for their laboratory culture.

Pertinent references:

- | | |
|---|---------------------------------|
| Coker, 1902; | Lang, 1976; 1977b, 1977c, 1979; |
| Colon-Urban et al., 1979; | Lee, 1992; |
| Jeffries & Voris, 1979, 1983; | Matheswari & Fernando, 1989; |
| Jeffries et al., 1985, 1988, 1989a, 1992, 1995; | Moyse, 1987; |
| Kim, 1985; | Zann & Harker, 1978; |

THE MICROANATOMY AND PHYSIOLOGY OF *OCTOLASMIS*

Other invertebrate species better known than *Octolasmis* have achieved notoriety for many reasons - some because they are ubiquitous, because they illustrate some salient feature valuable in phylogeny, or simply because they readily lend themselves to research in say embryology, cell biology, biochemistry, or genetics. The genus *Octolasmis* is not remarkable in any of these areas and remains somewhat enigmatic because our knowledge has not advanced much beyond the level of informed natural history and basic taxonomy.

A few noteworthy exceptions include, Arudpragasam (1967) who tried to relate capitular plate armament to current flow in the host, *Scylla serrata*, gill chamber; Lacombe & Jakowska (1975) who described the cement glands of *O. mülleri* on *Callinectes sapidus*; Gannon & Wheatly (1992) who related high *O. mülleri* infestations in the gill chambers of *C. sapidus* to host respiratory stress; and Moyse (1987) who published a review paper that related lepadomorph barnacle larval shape, including *Octolasmis* spp., to locomotory behavior.

Recently, a comparative study of the capitular plates of most *Octolasmis* spp. has been reported, testing the idea that the plates provide protection and support for the capitulum. In addition, it was demonstrated that much of the plate variation is explained by the barnacle location on hosts and by host characteristics (Voris & Jeffries, 1997).

Pertinent references:

- | | |
|---------------------------------|---------------------------------|
| Arudpragasam, 1967; | Newman, 1960a, 1960b, 1961b; |
| Elfimov, 1995; | Norse & Estevez, 1977; |
| Gannon & Wheatly, 1992; | Overstreet, 1978, 1983; |
| Lacombe & Jakowska, 1975; | Shields, 1992; |
| Jeffries et al., 1995; | Venkateswaran & Fernando, 1982; |
| Lang, 1976, 1977b, 1977c, 1979; | Voris & Jeffries, 1997 |
| Lee, 1992; | Zann & Harker, 1978; |
| Moyse, 1987; | |

ECONOMIC AND COMMERCIAL CONSIDERATIONS

Octolasmis spp. are likely best known to crab fishermen, who readily associate crab vitality with lapsed time since the last crab molt. They are well aware of the effects of barnacle infestation of the gill chambers, and they recognize that the chances of getting a badly infested crab to market alive are diminished thereby. Jeffries et al. (1992) reported 30 percent infestation by *O. cor* and *O. angulata* in natural populations of 856 *Scylla serrata* in Phuket, Thailand and found that infestations by more than one barnacle were uncommon among crabs of less than 70 mm carapace width (instar 13). As mangrove crabs increase in size thereafter, the incidence of *Octolasmis* infestation rises dramatically. Gannon & Wheatly (1992) demonstrated convincingly that physiological stress is imposed on *Callinectes sapidus* by large infestations of the gill chambers by *O. mülleri*.

Pertinent references:

- | | |
|---|---------------------------------|
| Arudpragasam, 1967; | Lang, 1976, 1977b; |
| Bullock, 1964; | Lee, 1992; |
| Coker, 1902; | Monod, 1922; |
| DeTurk, 1940 | Overstreet, 1978, 1979, 1983; |
| Gannon, 1990; | Pearse, 1932, 1947, 1952; |
| Gannon & Wheatly, 1992; | Quinn & Kojis, 1987; |
| Hudson & Lester, 1994; | Ross, 1983; |
| Jeffries & Voris, 1983; | Shields, 1992; |
| Jeffries et al., 1982, 1984, 1985, 1989a, 1991, | Venkateswaran & Fernando, 1982; |
| 1992, 1995; | Voris et al., 1994; |
| Kim, 1985; | Walker, 1974. |

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LITERATURE CITED

- Anderson, D.T., 1994. *Barnacles: Structure, function, development and evolution*. Chapman and Hall, London. 357pp.
- Annandale, N., 1905. Malaysian barnacles in the Indian Museum, with a list of the Indian Pedunculata. *Mem. Asiat. Soc. Bengal*, **1**: 73-83.
- Annandale, N., 1906. Report on the Cirripedia. *Ceylon Pearl Oyster Fish. Suppl. Rep.* **31**: 137-155.
- Annandale, N., 1907. A second species of *Dichelaspis* from *Bathynomus giganteus*. *Rec. Indian Mus.*, **1**: 279-280.
- Annandale, N., 1909. An account of the Indian Cirripedia Pedunculata. Part 1. Family Lepadidae (sensu stricto). *Mem. Indian Mus.*, **2**: 59-137.
- Arudpragasam, K. D., 1967. Distribution and variation of the cirripede *Octolasmis cor* (Aurivillius 1893) in relation to the respiratory current of its host *Scylla serrata*. *Ceylon J. Sci.*, **7** (1&2): 105-115.
- Aurivillius, C. W. S., 1892. Neue Cirripeden aus dem Atlantischen, Indischen und Stillen Ocean. *K. Vetensk. Akad. Forhandl.*, **49**: 123-134.
- Aurivillius, C. W. S., 1894. Studien über Cirripeden. *K. Vetensk. Akad. Hand.*, **26** (7): 1-107.

- Barnard, K. H., 1924. Contributions to the crustacean fauna of South Africa. *Ann. S. Afr. Mus.*, **20**: 1-103.
- Barnard, K. H., 1926. Report on a collection of crustacea from Portuguese East Africa. *Trans. R. Soc. S. Afr.*, **13**: 119-129.
- Borradaile, L. A., 1903. The barnacles (Cirripedia). *Fauna and Geography of the Maldives and Laccadive Archipelagos*, **1**: 440-443.
- Brian, A. & E. Darteville, 1954. Sur un Cirripede pedoncule des cotes d'Angola: *Octolasmis lowei* (Ch. Darwin). *Ann. Mus. Congo Belge Tervuren*, (N.S.) **4** (Zool.) **1**: 140-152.
- Broch, H., 1922. Studies on Pacific Cirripedes. Papers from Dr. Th. Mortensen's Pacific Expedition 1914/16 (10). *Vidensk. Medd. Dan. Naturhist. Foren.*, **73**: 215-358.
- Broch, H., 1924a. Parasitologia mauritanica. -Cirripedia. *Bull. Comité. Étud. Hist. Sci. Afr. Occident. Franc.*, **10**: 1-20.
- Broch, H., 1924b. La faune des cirripedes de L'Afrique occidentale d'après nos dernières connaissances. *Bull. Soc. Sci. Nat. Mar.*, **4** (8): 202-205.
- Broch, H., 1927. Studies on Moroccan Cirripeds (Atlantic coast.) *Bull. Soc. Sci. Nat. Mar.*, **7**: 11-38.
- Broch, H., 1932. Papers from Dr. Th. Mortensen's Pacific Expedition 1914-1916. LVI. Indomalayan Cirripedia. *Vidensk. Medd. Dan. Naturhist. Foren.*, **91**: 1-142.
- Broch, H., 1947. Cirripedes from Indochinese shallow-waters. *Norske. Vidensk. Akad. Mat.-Naturvidensk.*, Kl. **1** (7): 1-32.
- Bullock, J. A., 1964. Variation in the commensal cirriped, *Octolasmis cor* (Aur.), in relation to its position in the branchial chamber of *Scylla serrata* Forskål. *F. M. J.*, **9**: 84-94.
- Causey, D., 1960. *Octolasmis dawsoni*, new species (Cirripedia: Lepadidae) from *Bathynomus giganteus*. *Proc. Biol. Soc. Wash.*, **73**: 95-98.
- Causey, D., 1961. The barnacle genus *Octolasmis* in the Gulf of Mexico. *Turtlex News*, **39** (2): 50-55.
- Coker, R. E., 1902. Notes on a species of barnacle (*Dichelaspis*) parasitic on the gills of edible crabs. *Bull. U. S. Fish Comm.*, **21**: 401-412.
- Colon-Urban, R., P. J. Cheung, G. D. Ruggieri & R. F. Nigrelli, 1979. Observations on the development and maintenance of the deep sea barnacle, *Octolasmis aymonini geryonophila* (Pilsbry). *In. J. Invert. Reprod.*, **1**: 245-252.
- Daniel, A., 1955. The Cirripedia of the Madras Coast. *Bull. Madras Gov. Mus.*, N. S. -Nat. Hist. Sec., **6** (2): 1-40.
- Darwin, C., 1851. *A monograph on the sub-class Cirripedia I. The Lepadidae*: 1-400, 10 pls. (Ray Society, London).
- Dawydoff, C., 1952. Contribution à l'étude des invertébrés la faune marine benthique de L'Indochine. *Bull. Biol. France et Belgique*, **37**: 1-158.
- Day, J. H. & J. F. C. Morgans, 1956. The ecology of South African Estuaries. Part 7. The Biology of Durban Bay. *Ann. Natal Mus.*, **13** (3): 259-312.
- De Filippi, 1861. Sul genere *Dichelaspis* e su di una nuova specie di esso propria del Mediterraneo. *Archivio per la Zoologia L'Anatomia e la Fisiolog.*, **1** (57): 71-73.

- DeTurk, W. E., 1940. *The parasites and commensals of some crabs of Beaufort, North Carolina*. Ph.D. Thesis - Duke University. Pp.105.
- Dinamani, P., 1964. Variation in form, orientation and mode of attachment of the cirriped, *Octolasmis stella* (Ann.), symbiotic on the gills of lobster. *J. Animal Ecol.*, **33** (2): 357-362.
- Dinamani, P., 1965. *Octolasmis stella* (Annandale), a pedunculate cirriped from the gills of *Puerulus sewelli* Ramadan. *CRUSA*, **8** (1): 92-96.
- Dinamani, P., 1967. Variation in form, orientation and mode of attachment of the cirriped, *Octolasmis stella* (Ann.), symbiotic on the gills of lobsters. *Ceylon J. Sci.*, **7**: 357-362.
- Elfimov, A. S., 1989. *The cyprid larvae of cirripeds and their significance in the formation of fouling*. Ph.D. Thesis - Moscow University. (In Russian).
- Elfimov, A. S., 1995. Comparative morphology of the the thoracian cyprid larvae: Studies of the carapace. In: F. R. Schram and J.T. Hoeg (eds.), *Crustacean Issues 10, New Frontiers in Barnacle Evolution*. Pp. 137-152. A.A. Balkema, Rotterdam.
- Fernando, S. A., 1978. *Studies on the biology of barnacles (Crustacea:Cirripedia) of Porto Novo Region, South India*. Ph.D. thesis, Annamalai University.
- Foster, B. A., 1980. Shallow water barnacles from Hong Kong. In: B. Horton & C.K. Tseng (eds.), *The Marine Flora and Fauna of Hong Kong and Southern China*, **1**. Pp. 207-232. Hong Kong University Press, Hong Kong.
- Foster, B. A., 1987. Barnacle ecology and adaptation. In: A. J. Southward (ed.), *Crustacean Issues 5, 2 Physiology and function*. Pp. 113-133. A.A. Balkema, Rotterdam.
- Gannon, A. T., 1990. Distribution of *Octolasmis muelleri*, an ectocommensal gill barnacle, on the blue crab. *Bull. Marine Sci.*, **46** (1): 55-61.
- Gannon, A. T. & M. G. Wheatly, 1992. Physiological effects of an ectocommensal gill barnacle, *Octolasmis muelleri*, on gas exchange in the blue crab *Callinectes sapidus*. *J. Crust. Biol.*, **12** (1): 11-18.
- Gittings, S. R., 1985. Notes on barnacles (Cirripedia: Thoracica) from the Gulf of Mexico. *Gulf Res. Rep.*, **8** (1): 35-41.
- Gittings, S. R., G. D. Dennis & H. W. Harry, 1986. Annotated guide to the barnacles of the northern Gulf of Mexico. *Biol. Oceanog.*, TAMU-SG-86-402: 1-36.
- Gray, J. E., 1825. A synopsis of the Genera of cirripedes arranged in natural families, with a description of some new species. *Ann. Phil.*, **10**: 97-107.
- Gruvel, A., 1892. Sur quelques nouvelles especes appartenant au genre *Dichelaspis* Darwin. *K. Vetensk. Akad. Forhandl.*, **49**: 109-111.
- Gruvel, A., 1900. Sur quelaues nouvelles especes appartenant au genre *Dichelaspis* Darwin. *Bull. Hist. Nat., Ser. 3.*, **6**: 109-111.
- Gruvel, A., 1902. Revision des cirrhipedes pedoncules. I. Partie systématique. *Nouv. Arch. Mus. Hist. Nat.*, ser. 4, **4**: 215-312, Pl. 11-14.
- Gruvel, A., 1905. *Monographie des cirrhipedes ou thécostraces*. Masson et Cie, Paris. 472pp.
- Haefner, P. A., Jr., 1985. Morphometry, reproduction, diet, and epizoites of *Ovalipes stephensoni* Williams, 1976 (Decapoda, Brachyura). *J. Crust. Biol.*, **5** (4): 658-672.

- Hashmi, S. H. & S. S. H. Zaidi, 1965. Incidence of *Lepas* infestation on the gills of *Scylla serrata* (Forskål) in Karachi waters. *Agric. Pakistan*, **16** (1): 117-129.
- Hay, W. P. & C. A. Shore, 1918. The decapod crustaceans of Beaufort, N. C., and the surrounding region. *Bull. Bur. Fish.*, 35th Col., 1915-16, Document no. 859, pp. 371-475.
- Henry, D. P., 1954. Cirripedia: the barnacles of the Gulf of Mexico. *Fish. Bull. Fish and Wildlife Service*, **55** (89): 443-446.
- Hiro, F., 1933. Report on the Cirripedia collected by the surveying ships of the Imperial Fisheries Experimental Station on the continental shelf bordering Japan. *Rec. Oceanogr. Works Jpn., Tokyo*, **5** (1): 55-61.
- Hiro, F., 1936. Descriptions of three new species of Cirripedia from Japan. *Bull. Biogeogr. Soc. Jpn.*, **6** (23): 221-230.
- Hiro, F., 1937. Studies on Cirripedian Fauna of Japan II. Cirripeds found in the vicinity of the Seto Marine Biological Laboratory. *Mem. Coll. Sci., Kyoto Imp. Univ., S. B.*, **12** (3): 385-478.
- Hiro, F., 1938. Notes on the animals found on *Macrocheira kaempferi* de Haan I. cirripeds, II. Molluscs. *Annot. Zool. Japan*, **17** (3&4): 465-476.
- Hiro, F., 1939a. Studies on the Cirripedian Fauna of Japan III. Supplementary notes on the Cirripeds found in the vicinity of Seto. *Mem. Coll. Sci., Kyoto Imp. Univ. S. B.*, **15** (2): 237-244.
- Hiro, F., 1939b. Studies of the Cirripedian Fauna of Japan V. Cirripeds of the northern part of Honsyu. *Sci. Rep. Tohoku Imperial Univ. Ser. 4*, **14** (2&3): 201-218.
- Hiro, F., 1939c. Studies of the Cirripedian Fauna of Japan IV. Cirripeds of Formosa (Taiwan), with some geographical and ecological remarks on the littoral forms. *Mem. Coll. Sci., Kyoto Imp. Univ., Ser. B*, **15** (2): 245-284.
- Hoek, P. P. C., 1875. Eerste bijdrage tot de Kennis der cirripedien der Nederlandsch fauna. *Tijdschr. Ned.. Dierkd. Ver.*, **2**: 16-61.
- Hoek, P. P. C., 1887. On *Dichelaspis pellucida* Darwin from the scales of an Hydrophid obtained at Mergui. *J. Linn. Soc. Lond. Zool.*, **21**: 154-155.
- Hoek, P. P. C., 1907. The cirripedia of the siboga-expedition A. Cirripedia Pedunculata. *Siboga-Expeditie*, **31a**: 1-127.
- Hoek, P. P. C., 1913. The cirripedia of the Siboga-expedition. Introduction. *Siboga-Expeditie*, **31**: V-XXV.
- Holthuis, L. B. & W. R. Mikulka, 1972. Notes on the deep-sea isopods of the genus *Bathynomus* A. Milne Edwards, 1879. *Bull. Marine Sci.*, **22** (3): 575-591.
- Hudson, D. A. & R. J. G. Lester, 1994. Parasites and symbionts of wild mud crabs *Scylla serrata* (Forskål) of potential significance in aquaculture. *AQCLAL*, **120**: 183-199.
- Hulings, N. C., 1961. The barnacle and decapod fauna from the nearshore area of Panama City Florida. *Q. J. Fla. Acad. Sci.*, **24** (3): 215-222.
- Humes, A. G., 1941. Notes on *Octolasmis mülleri* (Coker), a barnacle commensal on crabs. *Trans. Amer. Microscop. Soc.*, **60**: 101-103.
- Jeffries, W. B. & H. K. Voris, 1979. Observations on the relationship between *Octolasmis grayii* (Darwin, 1851) (Cirripedia, Thoracica) and certain marine snakes (Hydrophiidae). *CRUSA*, **37** (2): 123-132.

- Jeffries, W. B. & H. K. Voris, 1983. The distribution, size, and reproduction of the pedunculate barnacle, *Octolasmis mülleri* (Coker, 1902), on the blue crab, *Callinectes sapidus* (Rathbun, 1896). *Fieldiana Zool.*, N.S. **16**: 1-10.
- Jeffries, W. B., H. K. Voris & S. Poovachiranon, 1992. Age of the mangrove crab *Scylla serrata* at colonization by stalked barnacles of the genus *Octolasmis*. *Biol. Bull.*, **182**: 188-194.
- Jeffries, W. B., H. K. Voris & C. M. Yang, 1982. Diversity and distribution of the pedunculate barnacle *Octolasmis* in the seas adjacent to Singapore. *J. Crust. Biol.*, **2** (4): 562-569.
- Jeffries, W. B., H. K. Voris & C. M. Yang, 1984. Diversity and distribution of the pedunculate barnacle *Octolasmis* Gray, 1825, epizoid on the scyllarid lobster, *Thenus orientalis* (Lund, 1793). *CRUSA*, **46** (3): 300-308.
- Jeffries, W. B., H. K. Voris & C. M. Yang, 1985. Growth of *Octolasmis cor* (Aurivillius, 1892) on the gills of *Scylla serrata* (Forskål, 1755). *Biol. Bull.*, **169**: 291-296.
- Jeffries, W. B., H. K. Voris & C. M. Yang, 1988. *Octolasmis collare*, a new species of pedunculate barnacle from the seas adjacent to Singapore. *Indo-Malayan Zool.*, **5**: 111-116.
- Jeffries, W. B., H. K. Voris & C. M. Yang, 1989a. A new mechanism of host colonization: pedunculate barnacles of the genus *Octolasmis* on the mangrove crab *Scylla serrata*. *Ophelia*, **31** (1): 51-58.
- Jeffries, W. B., H. K. Voris & C. M. Yang, 1989b. Observations on the incidence of the pedunculate barnacle, *Octolasmis warwickii* (Gray, 1825) on horseshoe crabs (Xiphosura) in the seas adjacent to Singapore. *Raffles Bull. Zool.*, **37** (1&2): 58-62.
- Jeffries, W. B., H. K. Voris & C. M. Yang, 1991. Species recognition among the pedunculate barnacles (Cirripedia: Thoracica) on the mangrove crab, *Scylla serrata*. *Raffles Bull. Zool.*, **40** (1): 83-92.
- Jeffries, W.B., H. K. Voris & S. Poovachiranon, 1992. Age of the mangrove crab *Scylla serrata* at colonization by stalked barnacles of the genus *Octolasmis*. *Biol. Bull.* **182**:188-194.
- Jeffries, W.B., H. K. Voris, S. Poovachiranon & L. C. Heil, 1995. The life cycle stages of the lepadomorph barnacle, *Octolasmis cor*, and methods for their laboratory culture. *Phuket Marine Biol. Center Research Bull.* **60**: 29-35.
- Kim, I. H., 1985. *Korean barnacles (Crustacea, Cirripedia, Thoracica)*. Ph. D. Dissertation, Seoul National University. 202 pp., 53pls. (in Korean with English Summary).
- Korn, O. M., 1995. Naupliar evidence for cirripede taxonomy. In: F. R. Schram and J.T. Hoeg (eds.), *Crustacean Issues 10, New Frontiers in Barnacle Evolution*. Pp. 87-121. A.A. Balkema, Rotterdam.
- Krüger, P., 1911. Beiträge zur Cirripedenfauna Ostasiens. *Beitr. Naturgesch. Ostasiens, Abh. Math.-Phys. Klasse der K. Bayer. Akademie der Wissenschaften. Suppl.* **2** (6): 1-52.
- Krüger, P., 1940. Cirripedia. In: H. G. Bronn: *Klassen u. Ordnungen d. Tierreichs*, **5** (Abt. 1, Buch 3): 1-560.
- Kujawa, S. M., 1971. Szczególny przypadek komensalizmu kraba *Geryon quinquedens* Smith z dwoma gatunkami kaczonic *Octolasmis geryonophila* Pilsbry i *O. lowei* Lesson. *Przegląd Zoologiczny*, **15** (3): 285-286.
- Lacombe, D. & S. Jakowska, 1975. Cement glands and attachment of *Octolasmis lowei* to the gills of *Callinectes danae* from Guanabara Bay, Brazil. *Trans. Amer. Microscop. Soc.*, **94** (3): 436.
- Lanchester, F., 1902. On the Crustacea collected during the "Skeat Expedition" to the Malay Peninsula. *Proc. Zool. Soc. Lond.*, **2**: 363-381.

- Lang, W. H., 1976. The larval development and metamorphosis of the pedunculate barnacle *Octolasmis mülleri* (Coker, 1902) reared in the laboratory. *Biol. Bull.*, **150**: 255-267.
- Lang, W. H., 1977a. *The barnacle larvae of North Inlet, South Carolina (Cirripedia: Thoracica)*. *Dissertation Abstracts International*, **38** (4).
- Lang, W. H., 1977b. *The barnacle larvae of North Inlet, South Carolina (Cirripedia: Thoracica)*. Ph.D. Dissertation, The University of South Carolina. 179pp.
- Lang, W. H., 1977c. The barnacle larvae of North Inlet, South Carolina (Cirripedia: Thoracica). *Biol. Oceanogr.*, p.1505-B.
- Lang, W. H., 1979. Larval development of shallow water barnacles of the Carolinas (Cirripedia: Thoracica) with keys to naupliar stages. *NOAA Tech. Rep. NMFS Circular*, **421**: 1-39.
- Lee, J., 1992. *Larval development and laboratory culture of Korean barnacles with identification keys to barnacle larvae (Cirripedia: Thoracica)*. Ph. D. Dissertation, Pusan National University, 322 pp.
- Lessona, C. & C. Tapparone-Canefri, 1874. Nota sulla *Macrocheira kaempferi* Sieb. e sopra una nuova sp. del gen. *Dichelaspis*. *Atti. Acad. Sci. Torino*, **9**: 185-194.
- Lyons, W. G., 1970. Scyllarid Lobsters (Crustacea, Decapoda). *Mem. Hourglass Cruises*. **1**(IV): 1-74.
- Macdonald, J. D., 1869. On an apparently new Genus of Minute Parasitic Cirripeds, between *Lepas* and *Dichelaspis*. *Proc. Zool. Soc. Lond.*, pp. 440-444.
- Matheswari, R. & S. A. Fernando, 1989. Fecundity of epizoic barnacles. *Ind. J. Invertebr. Zool. and Aqua. Biol.*, **1** (2): 31-35.
- Millard, N. A. H. & G. J. Broekhuysen, 1970. The ecology of South African estuaries, part X. St. Lucia: A second report. *Zool. Afr.*, **5** (2): 277-307.
- Millikin, M. R. & A. B. Williams, 1984. Synopsis of biological data on the blue crab *Callinectes sapidus* Rathbun. *NOAA Tech. Rep. NMFS. FAO Fisheries Synopsis* No. 138. pp.1-39.
- Moazzam, M. & S. H. Niaz Rizvi, 1978. Pedunculate cirripedes from Pakistan coast. *Pakist. J. Zool.*, **10** (2): 175-190.
- Moazzam, M. & S. H. Niaz Rizvi, 1982. Addition to the pedunculate cirripede fauna of Pakistan coast. *Pakist. J. Zool.*, **14** (2): 234-237.
- Monod, Th., 1922. Sur un *Dichelaspis* de Madagascar, commensal de *Scylla serrata* (Forskål). *Ext. B. S. Zool. Fr.*, **46**: 264-269.
- Monod, Th., 1974. Sur un *Octolasmis* Cirripedia epizoaire sur un *Bathynome* de Guyane. *CRUSA*, **26** (2): 219-222.
- Moyse, J., 1987. Larvae of lepadomorph barnacles. In: A. J. Southward (ed.), *Crustacean Issues 5, Barnacle Biology*. Pp. 329-362. A.A. Balkema, Rotterdam.
- Newman, W. A., 1960a. Five pedunculate cirripeds from the western Pacific, including two new forms. *CRUSA*, **1** (2): 100-116.
- Newman, W. A., 1960b. *Octolasmis californiana*, spec. nov., A pedunculate barnacle from the gills of the California spiny lobster. *Veliger*, **3** (1): 9-11.
- Newman, W. A., 1961a. Notes on certain species of *Octolasmis* (Cirripedia, Thoracica) from deep sea Crustacea. *CRUSA*, **2** (4): 326-329.

- Newman, W. A., 1961b. On certain littoral species of *Octolasmis* (Cirripedia, Thoracica) symbiotic with Decapod Crustacea from Australia, Hawaii, and Japan (plates 21, 22, 23). *Veliger*, **4** (2): 99-107.
- Newman, W. A., 1967. Shallow-water versus deep-sea *Octolasmis* (Cirripedia Thoracica). *CRUSA*, **12** (1): 13-32.
- Newman, W. A., 1986. Origin of the Hawaiian marine fauna: dispersal and vicariance as indicated by barnacles and other organisms. In: A. J. Southward (ed.), *Crustacean Issues 4, Crustacean Biogeography 1. Realized distributions*. Pp. 21-49. A.A. Balkema, Rotterdam.
- Newman, W. A., 1987. Evolution of cirripedes and their major groups. In: A. J. Southward (ed.), *Crustacean Issues 5, Barnacle Biology*. Pp. 3-42. A.A. Balkema, Rotterdam.
- Newman, W. A. & D. P. Abbott, 1980. Cirripedia: the barnacles. In: R. H. Morris (ed.), *Intertidal Invertebrates of California*. Pp. 499-535, Stanford University Press, Stanford, CA.
- Newman, W. A., V. A. Zullo & T. H. Withers, 1969. Part R, Arthropoda 4, Cirripedia. *Treatise on Invertebrate Paleontology*, **1**: R206-R295.
- Nilsson-Cantell, C. A., 1921. Cirripeden-studien zur kenntnis der biologie, anatomie und systematik dieser gruppe. *Zool. Bidr. Upps.*, **7**: 75-404.
- Nilsson-Cantell, C. A., 1925. Neue und wenig bekannte Cirripeden aus den Museen zu Stockholm und zu Upsala. *Ark. Zool. (Stockholm)*, **18A** (3): 1-46.
- Nilsson-Cantell, C. A., 1927. 40. Some barnacles in the British Museum (Nat. Hist.). *Proc. Zool. Soc. Lond.*, pt. 3: 743-790.
- Nilsson-Cantell, C. A., 1928. Studies on cirripeds in the British Museum (Nat. Hist.). *Ann. Mag. Natur. Hist.*, Ser. 10, vol **2**: 1-39.
- Nilsson-Cantell, C. A., 1930. Résultats Scientifiques du Voyage aux Indes Orientales Néerlandaises, Cirripedes. *Mem. Mus. R. Hist. Nat. Belgique*, **3** (3): 1-24.
- Nilsson-Cantell, C. A., 1934a. Indo-Malayan Cirripeds in the Raffles Museum, Singapore. *Bull. Raffles Mus.*, **9**: 42-73.
- Nilsson-Cantell, C. A., 1934b. VI. - Cirripeds from the Malay Archipelago in the Zoological Museum of Amsterdam. *Zool. Meded. (Leiden)*, **17**: 31-63.
- Nilsson-Cantell, C. A., 1937. On a second collection of Indo-Malayan Cirripedes from the Raffles Museum. *Bull. Raffles Mus.*, **13**: 93-95.
- Nilsson-Cantell, C. A., 1938. Cirripedes from the Indian Ocean in the collection of the Indian Museum, Calcutta. *Mem. Indian Mus.*, **13** (Part 1): 1-81.
- Norse, E. A. & M. Estevez, 1977. Studies on portunid crabs from the eastern Pacific. I. Zonation along environmental stress gradients from the coast of Columbia. *Marine Biol.* **40**: 365-373.
- Overstreet, R. M., 1978. Marine maladies? Worms, germs, and other symbionts from the northern Gulf of Mexico. *MASMDP, MASGP* **78-021**: 1-140.
- Overstreet, R. M., 1979. Metazoan symbionts of the blue crab. *Proceed. Blue Crab Colloquium*, Oct.18-19: 81-87.
- Overstreet, R. M., 1983. Metazoan symbionts of Crustaceans. In: A. J. Provenzano (ed.), *The Biology of the Crustacea*, 6. Pp. 155-250. Academic Press, New York.

- Pearse, A. S., 1932. Observations on the parasites and commensals found associated with crustaceans and fishes at Dry Tortugas, Florida. *Carnegie Inst. Wash. Publ.* No. **435**, 103-115.
- Pearse, A. S., 1933. Parasites of Siamese fishes and crustaceans. *J. Siam Soc., Nat. Hist. Suppl.*, **9** (2): 179-191.
- Pearse, A. S., 1947. On the occurrence of ectoconsorters on marine animals at Beaufort, N.C. *J. Parasitol.*, **33**: 453-458.
- Pearse, A. S., 1951. Parasitic Crustacea from Bimini, Bahamas. *Proc. U. S. Nat. Mus.*, **101**: 341-372.
- Pearse, A. S., 1952. Parasitic Crustacea from the Texas coast. *Publ. Inst. Mar. Sci. Univ. Tex.*, **2** (2): 7-42.
- Pilsbry, H. A., 1907. The barnacles (Cirripedia) contained in the collections of the U.S. National Museum Smithsonian Institution. *U.S. Natl. Mus. Bull.*, **60**: 1-122.
- Pilsbry, H. A., 1928. Littoral barnacles of the Hawaiian Islands and Japan. *Proc. Acad. Nat. Sci. Philadelphia*, **79**: 305-317.
- Pilsbry, H. A., 1953. Notes on Floridan barnacles (Cirripedia). *Proc. Acad. Nat. Sci. Philadelphia*, **105**: 13-28.
- Quinn, N. J. & B. L. Kojis, 1987. Reproductive biology of *Scylla* spp. (Crustacea:Portunidae) from the Labu Estuary in Papua New Guinea. *Bull. Marine Sci.*, **41** (2): 234-241.
- Rosell, N. C., 1967. The Philippine Cirripedian fauna: I. some pedunculate cirripeds from Iloilo waters and adjacent seas. *Nat. Appl. Sci. Bull.*, **20** (4): 277-319.
- Rosell, N. C., 1972. Some barnacles (Cirripedia Thoracica) of Puerto Galera found in the vicinity of the U.P. Marine Biological Laboratory. *Nat. Appl. Sci. Bull.*, **24** (4): 143-243.
- Ross, D. M., 1983. Symbiotic relations. In: F.J. Vernberg & W.B. Vernberg (eds.), *The Biology of Crustacea*, 7. Pp. 163-212. Academic Press, New York.
- Shields, J. D., 1992. Parasites and symbionts of the crab *Portunus pelagicus* from Moreton Bay, eastern Australia. *J. Crust. Biol.*, **12** (1): 94-100.
- Spears, T., L. G. Abele & M. A. Applegate, 1994. Phylogenetic Study of Cirripedes and Selected Relatives (Thecostraca) Based on I&S rDNA Sequence Analysis. *J. Crust. Biol.*, **14**(4): 641-656.
- Spivey, H. R., 1976. The cirripeds of the Panama Canal. *Corrosion Marine Fouling*, **1** (1): 43-50.
- Spivey, H. R., 1981. Origins, distribution and zoogeographic affinities of the Cirripedia (Crustacea) of the Gulf of Mexico. *J. Biogeogr.*, **8**: 153-176.
- Stebbing, T. R. R., 1894. A new pedunculate cirripede. *Ann. Mag. Natur. Hist.*, Ser. 6, **13**: 443-447.
- Stebbing, T. R. R., 1895. Notes on Crustacea. Two new pedunculate Cirripedia. *Ann. Mag. Natur. Hist.*, Ser. 6, **15**: 18-25.
- Stubbings, H. G., 1964. Cirripedia from the Congo estuary and adjacent coasts in the Musée Royal de l'Afrique Centrale, Tervuren, Belgium. *Revue Zool. Bot. Afr.*, **69** (3&4): 329-347.
- Stubbings, H. G., 1967. The cirriped fauna of tropical west Africa. *Bull. B. Mus.(Nat. Hist.) Zool.*, **15** (6): 227-319.
- Utinomi, H., 1958. Studies on the cirripedian fauna of Japan. VII. Cirripeds from Sagami Bay. *Publ. Seto Mar. Biol. Lab.*, **6** (3): 51-71.

- Utinomi, H., 1968. Pelagic, shelf and shallow-water Cirripedia from the Indo-West Pacific. *Vidensk. Medd. Dan. Naturhist. Foren.* **131**:161-186.
- Utinomi, H., 1970. Studies on the cirripedian fauna of Japan. IX. Distributional survey of thoracic cirripeds in the southeastern part of the Japan Sea. *Publ. Seto Mar. Biol. Lab.*, **17** (5): 339-372.
- Venkateswaran, K. & S. A. Fernando, 1982. Distribution and variation in form of the epizoic cirriped *Octolasmis cor* (Aurivillius, 1893). *Indian J. Mar. Sci.*, **11**: 243-246.
- Verrill, A. E., 1922. Decapod Crustacea of Bermuda. Pt. 2. Macrura. *Trans. Conn. Acad. Arts Sci.*, **26**: 1-179.
- Visscher, J. P., 1928. Reactions of the cyprid larvae of barnacles at the time of attachment. *Biol. Bull.* **54**: 327-335.
- Voris, H. K., W. B. Jeffries & S. Poovachiranon, 1994. Patterns of distributions of two barnacle species on the mangrove crab *Scylla serrata*. *Biol. Bull.*, **187** (3): 346-354.
- Voris, H. K. & W. B. Jeffries, 1997. The size, distribution, and significance of capitular plates in pedunculate barnacles of the genus *Octolasmis*. *J. Crust. Biol.*, (In press).
- Walker, G., 1974. The occurrence, distribution and attachment of the pedunculate barnacle *Octolasmis mülleri* (Coker) on the gills of crabs, particularly the blue crab, *Callinectes sapidus* Rathbun. *Biol. Bull.*, **147**: 678-689.
- Wells, H. W., 1966. Barnacles of the northeastern Gulf of Mexico. *Q. J. Fla. Acad. Sci.*, **29** (2): 81-95.
- Weltner, W., 1922. Cirripedia der Deutschen Tiefsee-Expedition In: *Wiss. Ergeb. der Deutschen Tiefsee-Exped.*, **23** (2): 59-112.
- Wills, L. J., 1963. *Cyprilepas holmi* Wills 1962, a pedunculate cirripede from the upper Silurian of Oesel, Esthonia. *Paleontology*, **6**(1):161-165.
- Wu, S. K., 1967. Two new records of Octolasmid cirripeds from Taiwan. *CRUSA*, **12**: 274-278.
- Young, P. S. 1995. New interpretations of South American patterns of barnacle distribution. In: F. R. Schram and J.T. Hoeg (eds.), *Crustacean Issues 10, New Frontiers in Barnacle Evolution*. Pp. 229-253. A.A. Balkema, Rotterdam.
- Zann, L. P., R. J. Cuffey & C. Kropach, 1975. Fouling organisms and parasites associated with the skin of sea snakes. In: W. A. Dunson (ed.), *Biology of Sea Snakes*. Pp. 251-265. University Park Press, Baltimore, Maryland.
- Zann, L. P. & B. M. Harker, 1978. Egg production of the barnacles *Platylepas ophiophilus* Lanchester, *Platylepas hexastylus* (O. Fabricius), *Octolasmis warwickii* Gray and *Lepas anatifera* Linnaeus. *CRUSA*, **35** (2): 206-214.
- Zevina, G. B., 1975. Cirripedia Thoracica of the American Mediterranean. *Tr. Inst. Okeanol. Akad. Nauk.*, SSSR **100**: 233-258.
- Zevina, G. B., 1982. Barnacles of the suborder Lepadomorpha (Cirripedia Thoracia) of the world ocean. II. Family Lepadidae. *Opredeliteli Fauna SSSR*, **133**: 1-221.
- Zullo, V. A., 1982. Cirripedia. In: S. P. Parker, (ed.), *Synopsis and Classification of Living Organisms*. Pp. 220-232. McGraw-Hill, New York.

Zullo, V. A., 1991. Zoogeography of the shallow-water cirriped fauna of the Galápagos Islands and adjacent regions in the tropical eastern Pacific. In: M. J. James (ed.), *Galapagos Marine Invertebrates. Taxonomy, Biogeography, and Evolution in Darwin's Islands*. Pp. 173-192. Plenum Publishing Co., New York.

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