Entomology 156: Biology Of Parasites
The Crustacea and the Pentastomida

I. Introduction to Crustacea

A. Diverse parasitic groups incl. barnacles, crabs

B. Diverse adaptations to parasitic life

1. Bizarre morphological forms
2. Complex life histories

C. Significant economic affects

D. Higher taxa in complete state of flux

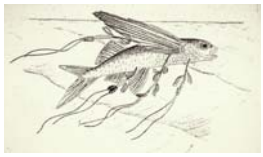
II. Parasitic Copepoda

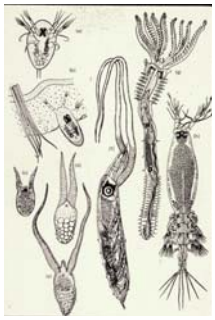
A. Introduction

1. Groups incl. 4 Orders, 20 families, 10,000 species
2. Hosts
   a. External parasites commonly of fish, amphibians
   b. Internal parasites of invertebrates including anemones, nudibranchs, holothurians, starfish, sea urchins, corals, polychetes…..

A. Introduction

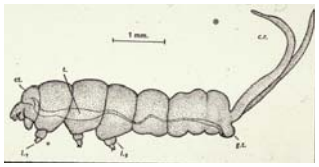
3. Invertebrate hosts of helminth parasites of vertebrates

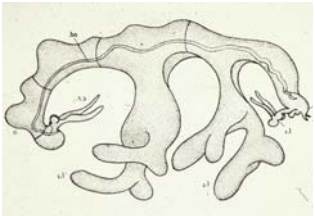


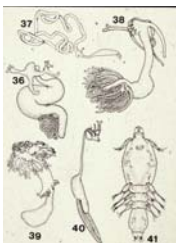


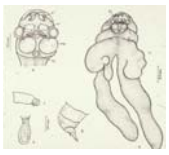
A. Introduction

4. Morphology is bizarre, esp. Lernaeocerids
   a. Reduction in appendages
   b. Adaptations for adhesion
   c. Increase in size and proportion, due to genitals
   d. Fusion of somites, loss of segmentation
   e. Loss of sense organs
   f. Loss of free living instars





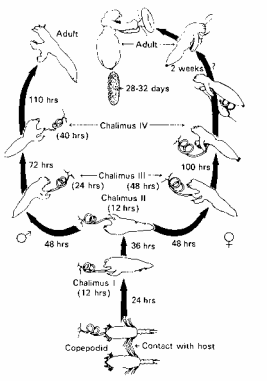




B. Example: Family Lernaeopodidae <u>Salmincola californiensis</u>

1. Common, widespread ectoparasites of fish
2. Morphology highly modified
   a. Adults no sign of segmentation
   b. Females permanently on host skin
      1) Possess anchor or bulla
      2) Specialized jaws or maxillipeds for grasping
      3) No abdomen or legs
      4) Tiny males are free living

3. Biology and life history



3. Biology and life history

   a. Egg hatches and napulius molts immediately to a copepodid
   b. Must find host in 24 hrs
   c. Grabs host with hooks on antennae and maxillae
   d. Attaches frontal filament to structure under skin

3. Biology and life history

e. Molts to first chalmus stage

1) Detach, molt reattach

2) Four chalmus stages

3) Finally detaches

f. Female locates permanent attachment, everts bulla

g. Free living male locates and fertilizes female

III. Subclass Branchiura- The fish lice

A. Introduction

1. Few species, ectoparasites of fishes

a. Swim well, leave and return to host

b. Eggs laid on aquatic substrates

c. Not host specific

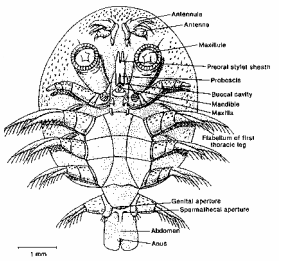
2. Morphology

a. Recognizable as a crustacean

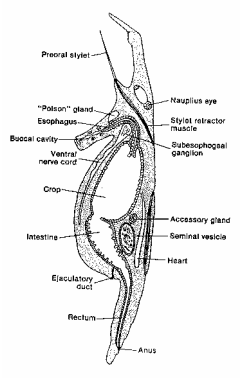
b. Flattened dorso-ventrally

c. Large sucking disks under carapace, modified maxillae

d. Pre-oral spine, questionable function

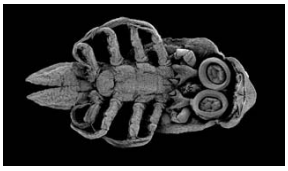


2. Morphology



B. Biology and life history Argulus spp

1. Metamorphosis simple or direct
2. No larval stages- juveniles
3. Sexes different at hatching
4. Suckers develop from primitive maxillules



IV. Subclass Cirripeda- the parasitic barnacles

A. Introduction

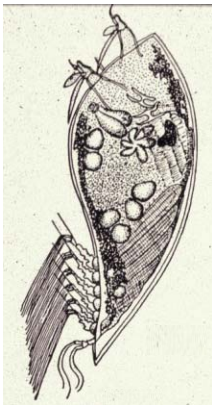
1. Order Rhizocephala, 2 genera, example: Sacculina
2. Internal parasites of crabs and other Crustacea

IV. Subclass Cirripeda- the parasitic barnacles

3. Adult root-like morphology
   a. Completely ramifies internal organs and spaces
   b. No gut or appendage
   c. Nutrient uptake by root like processes

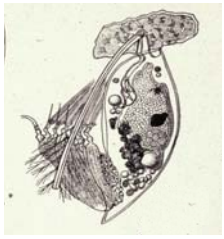
B. Biology and life history

1. Napulius hatches from egg
   a. Molts four times
   b. No mouth or gut, non-feeding stage



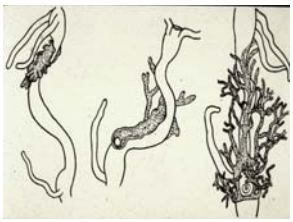
B. Biology and life history

2. Molts to cypris
   a. Attaches to crab host
   b. Sheds appendages, muscles with molt



B. Biology and life history

3. Becomes kentrogon- hypodermic
   a. Injects mass of cells
   b. Migrate to host intestine, attaches

B. Biology and life history

4. Matures to rhizocephalan
   a. Grows into central mass with ramifying adsorptive processes
   b. Gonads develop, break through weakened cuticle
   c. Free living cypris males?
5. Controversy regarding sexuality and mating


C. Host pathology

1. Parasitic castration
2. Changes in secondary sexual characteristics: male to female
3. Liver, connective tissue and thoracic ganglion damage

VI. Subclass Pentastomida the tongue worms

A. Introduction: worm like parasites of the lungs of predatory vertebrates

1. Hosts

a. Adult worms in predator vertebrate

1) Respiratory system of reptiles, amphibians, esp. snakes
2) Air sacks of sea birds
3) Naso-pharynx of canines and felines

2. Evolution and phylogeny

a. Numerous hypothetical affiliations: mites Tartigrades, etc
b. Wingstand: crustacean- similar spermatozoa
c. Riley: crustacean- embryogenesis, gametogenesis
d. Able 1989: definitely marine Crustacea based on shared derived characters in 16s ribosomal RNA sequence
e. Traditionally considered discrete phylum
f. Speculation on very ancient origins

3. Morphology

a. Segmented body with annuli
b. Body regions: forebody and hindbody
c. Two pair sclerotized double or single hooks with muscles near mouth

3. Morphology

d. Thin cuticle sometimes with spines

e. Simple digestive tract, open mouth

f. Dimorphic, males smaller

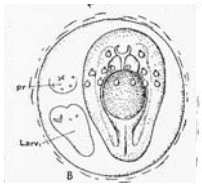
B. Biology and life history: perpetuates in predator, prey interaction

1. Adults feed on predator host fluid and blood

2. Eggs laid, swallowed and defecated

a. Viscid, cling together

b. Withstand desiccation



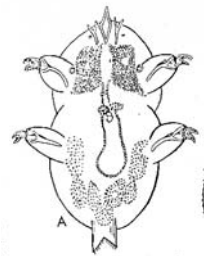
B. Biology and life history: perpetuates in predator, prey interaction

3. Larvae hatch when feces ingested by prey animal

a. Massive infections of small rodents

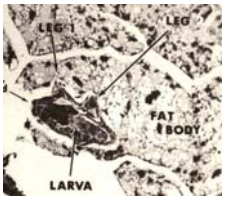
b. Penetrates intestine, migrates anywhere

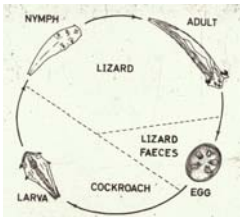
c. Oval, four short legs, penetration organ



4. Molts to quiescent nymph

   a. Released when the host ingested by predator
   b. Penetrates intestine, migrates to lungs, matures
   c. Several molts





4. Molts to quiescent nymph

5. Examples
   a. Porocephalius crotali in snake-rodent prey cycle
   b. Linguatula serriata in predator-livestock, ungulate cycle
      1) Adults in naso-pharynx of cats, dogs, foxes, et al
      2) Larvae and nymphs in any mammal