IX. Parasite Effects upon Host Behavior

A. Trematode-corals-Fish Interactions (Aeby 1991)

1. Life-cycle of trematode worm Plagioporus
   a. Metacercariae of trematode in tentacles of coral (= intermediate host)
   b. Adult in fish (= definitive host) that eats coral polyps

2. Effects of metacercariae on polyps
   a. Tentacles brightly colored, rather than transparent
   b. Tentacles swollen and cannot be retracted into calices (calcium carbonate exoskeleton)
   c. Altered appearance and behavior might increase vulnerability to predation

3. Growth of corals
   a. Parasitized corals grew 50% more slowly than unparasitized polyps
   b. Growth of corals in cages that excluded fish predators was identical to growth of corals exposed to fish predation
      (1) Caged parasitized growth = uncaged parasitized growth
      (2) Caged unparasitized growth = uncaged unparasitized growth

4. Predation
   a. Uncaged parasitized corals had fewer metacercariae cysts than caged parasitized corals
   b. Interpreted by authors as due to fish predation
   c. Tentacles that had been eaten were replaced by unparasitized tentacles

5. Conclusion: Everybody wins
   a. Predation is beneficial to coral because it removes cysts and coral can grow faster
   b. Predation is beneficial to the fish as it gets food
   c. Predation is beneficial to the parasite, because it completes its life-cycle

B. Trematode-Killifish-Bird Interaction (Lafferty & Morris, 1996)

1. Life-cycle
   a. Metacercariae in killifish, Fundulus
   b. Predatory wading birds get infected when they eat killifish

2. Parasitized killifish exhibited conspicuous behavior
   a. Parasitized fish spent more time at surface than did unparasitized fish
   b. Parasitized fish underwent behaviors such as "flashing" and "shimmying"
   c. The higher the intensity of parasites in a fish, the more conspicuous behaviors it exhibited (Fig. 1)

3. Differential predation experimental design
   a. Two large cages built
      (1) One covered to prevent bird access to fish
      (2) Other uncovered, birds could feed on fish
   b. Stocked each cage with equal numbers of parasitized and unparasitized fish
   c. Ran experiment for 20 days and then sampled fish to determine relative numbers of parasitized and unparasitized fish
   d. Results (Fig 2)
      (1) Enclosed pen (no bird predation, but natural mortality)
         a) Unparasitized fish went from 53 to 50
         b) Parasitized fish: 95 to 91
      (2) Open pen (bird predation and natural mortality)
(a) Unparasitized fish: 53 to 49
(b) Parasitized fish: 95 to 44

e. Conclusion:
   (1) Parasitized fish were 31 times more likely to be eaten than unparasitized fish in the same habitat.
   (2) Heavily parasitized fish were more likely to be eaten than lightly parasitized fish

f. Implications
   (1) Trematode parasites might benefit birds by acting as a delivery system that enables birds to eat fish that are otherwise difficult to capture
   (2) Parasites might allow the persistence of a predator in areas where one could not previously exist.

C. Acanthocephalan effects upon intermediate host behavior
   1. Life-cycle
      a. Adults in vertebrates
         (1) In intestinal lumen
         (2) Proboscis can be removed (worms move)
      b. First intermediate host is an arthropod
         (1) Insects in terrestrial systems
         (2) Crustaceans in aquatic systems
      c. CYSTACANTH
         (1) Cyst
         (2) Develops from egg eaten by intermediate host
      d. Final host infected by eating intermediate host
      a. Paper first to demonstrate parasites with field and lab studies that host behavior was influenced in a manner that would increase predation by final host
      b. Organisms
         (1) Pillbug Armadillidium = intermediate host
         (2) Starlings = final host
      c. Humid chamber Results
         (1) Parasitized & unparasitized preferred humid side of chamber,
         (2) Parasitized spent more time in less humid region than Unparasitized = increased exposure for P
      d. Shelter preference
         (1) Unparasitized showed high preference for shelter
         (2) Parasitized showed random behavior for shelter (= increased exposure for parasitized pillbugs)
      e. Background preference
         (1) Parasitized more likely to be on white substrate than unparasitized
         (2) Parasitized more easily seen
      f. Effects on hosts
         (1) Parasitized females grew less than unparasitized females
         (2) Both males & females were castrated
         (3) Thigmotaxis = collect with a group
      g. Starling predation studies
(1) Nestlings were ligatured nestlings a pipe cleaner
   (a) Birds couldn’t swallow
   (b) Able to collect pillbugs fed to nestlings by parents
(2) Captured pillbugs near nests (Prevalence very low Table 9)
(3) Determined prevalence of worms in nestlings = Higher than expected
(4) Cage feeding experiment (Table 12)
   (a) Black & white floor equal in area
   (b) Moistened black portion (humid)
   (c) Released 20 isopods [half infected]
   (d) More infected isopods (33/46; 71.7%) were eaten than uninfected (23/52; 44.2%)
   h. Concluded that apparent preference for infected isopods was a result of increased encounters with infected individuals