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Ecology & Evolutionary Biology 4274
Lecture Exam #3

Nematoda, Misc. phyla & Arthropoda, ecology and evolution

December 14, 2011

Read through the exam once before you begin. Read the questions CAREFULLY; be certain to provide all of the information requested. In instances in which you are asked to answer only a SUBSET of the questions, if you answer more questions than indicated, your answers will be graded in order, and you will be graded only on the number of questions you are required to answer. Note: for HOST species, the common name is sufficient; for parasite taxa the correct full scientific name is required.

1. Answer EIGHT (8) of the following 10 questions. (16 points)

- (i) Identify the **etiological agent** of whipworm disease in humans.
- (ii) Identify a **species** of enoplean for which humans can serve as both intermediate and definitive host.
- (iii) Identify a **phylum** of parasites which, despite the distinctive morphology of its members, appears to be most closely related to the rotifers.
- (iv) Identify **2 orders** of nematodes that include species that undergo development in the lungs as a normal aspect of life in their definitive host. _____ and _____
- (v) Identify an **order** of hexapods that includes some species that are parasitic as adults and other species that are parasitic as larvae.
- (vi) Identify **2 species** of nematodes that are known to infect the eyes of their vertebrate hosts.
_____ and _____
- (vii) Identify a **genus** of crustacean which, among other negative effects, both castrates its host and induces it to ventilate the egg-bearing region of its body.
- (viii) *Plica polonica* is associated with infection with what **subspecies** of hexapod?
- (ix) Fleas, lice, flies, and bed bugs belong to what **subphylum** of arthropods?
- (x) Identify a **subclass** most of the species of which parasitize the respiratory system of snakes, among other cold-blooded vertebrates as adults.

2. Each of the following statements is **INCORRECT** in one or more respects. Select **FOUR (4)** of the following 6 statements and **REWRITE** them so that the information they convey is **CORRECT**; in each case all taxa listed must remain in the statement (i.e., the statements cannot be corrected by removing host or parasite taxa). (12 points)

- (i) Soft ticks (i.e., ixodids) are much more important as vectors of bacterial and viral diseases of humans than are hard ticks (i.e., argasids).

- (ii) Species of *Caligus* differ from other ectoparasitic arthropods such as the Siphonaptera, Hippoboscidae and *Argulus* in that, whereas members of the former are dorso-ventrally flattened, members of the latter are not.

- (iii) The various forms of larval migrans in humans are caused by species of *Toxocara* and *Parelaphostrongylus* that normally parasitize other animals such as dogs; this is not the case for species of *Wuchereria* and *Ancylostoma*.

- (iv) The gut parasite *Trichinella spiralis* is the smallest intracellular parasite known.

- (v) Whereas *Myxobolus* currently belongs to a phylum that also includes free-living species, that is not the case for taxa such as *Pediculus*.

- (vi) Heavy infections with *Ascaris lumbricoides*, while irritating, are not deadly; in contrast heavy infections with *Enterobius vermicularis* can be fatal.

3. Describe one of the 6 trends in adaptations towards parasitism seen among parasitic copepods. Provide a genus of copepod that illustrates the trend you have chosen. (3 points)

OR

Explain one of the 4 rules that have been developed to describe the evolutionary association between parasites and their hosts. (3 points)

4. For FOUR (4) of the following 6 parasites, identify the site and type of host in which you would expect to find the stage indicated. (12 points)

	Site	Type of Host
(i) Adult females of <i>Tunga penetrans</i>	_____	_____
(ii) Spores of <i>Myxobolus cerebralis</i>	_____	_____
(iii) Adults of <i>Trichinella spiralis</i>	_____	_____
(iv) Larvae of <i>Gasterophilus intestinalis</i>	_____	_____
(v) J2s of <i>Dirofilaria immitis</i>	_____	_____
(vi) Adults of <i>Demodex folliculorum</i>	_____	_____

5. The following table comes from a Connecticut DEP survey of the parasites of bluegill sunfish in Mansfield Hollow pond. The data provided summarize the results of the metazoan parasites found in 5 individual bluegill sunfish specimens (Nos. 1–5). In total, the DEP researchers found 6 different species of parasites; although they were not able to identify the parasites to species, they were able to give numerical designations to each species encountered. In each case, the number of specimens found in each host individual is given before the name of each parasite species. Use the data provided in the table below to answer FIVE (5) of the following 7 questions regarding parasite ecology. (15 points)

Host specimen	digeneans (gut)	cestodes (gut)	copepods (gills)	nematodes (gut)
No. 1	4 <i>Crepidostomum</i> sp. 1 1 <i>Bunodera</i> sp. 1	12 <i>Proteocephalus</i> sp. 1	22 <i>Ergasilus</i> sp. 1 1 <i>Caligus</i> sp. 1	1 <i>Camallanus</i> sp. 1
No. 2	14 <i>Crepidostomum</i> sp. 1 0 <i>Bunodera</i> sp. 1	2 <i>Proteocephalus</i> sp. 1	25 <i>Ergasilus</i> sp. 1 1 <i>Caligus</i> sp. 1	4 <i>Camallanus</i> sp. 1
No. 3	1 <i>Crepidostomum</i> sp. 1 0 <i>Bunodera</i> sp. 1	10 <i>Proteocephalus</i> sp. 1	20 <i>Ergasilus</i> sp. 1 1 <i>Caligus</i> sp. 1	3 <i>Camallanus</i> sp. 1
No. 4	0 <i>Crepidostomum</i> sp. 1 0 <i>Bunodera</i> sp. 1	3 <i>Proteocephalus</i> sp. 1	60 <i>Ergasilus</i> sp. 1 1 <i>Caligus</i> sp. 1	2 <i>Camallanus</i> sp. 1
No. 5	109 <i>Crepidostomum</i> sp. 1 15 <i>Bunodera</i> sp. 1	11 <i>Proteocephalus</i> sp. 1	70 <i>Ergasilus</i> sp. 1 1 <i>Caligus</i> sp. 1	5 <i>Camallanus</i> sp. 1

Example: Provide an example of a parasite population:
The 38 specimens of *Proteocephalus* sp. 1 in all 5 fish specimens.

- (i) Identify the parasite species that was found to exhibit the highest intensity of infection in any single one of the 5 fish sampled.
- (ii) Identify a parasite species that was found to exhibit a prevalence of 100% in the 5 fish sampled.
- (iii) Provide an example of a parasite community.
- (iv) Provide an example of a potentially interactive parasite infracommunity.
- (v) Provide an example of a parasite infrapopulation.
- (vi) Which of these 6 parasite species comes closest to exhibiting a negative binomial distribution?
- (vii) Identify the parasite species that exhibited the lowest prevalence of infection in the 5 fish sampled.

6. Address TWO (2) of the following 3 scenarios. (12 points)

- (i) Last March, as part of his medical internship in Anchorage, Alaska, Tonito participated as a doctor for the Iditarod sled dog race. It was very exciting, and a great learning experience but, one of the most intriguing infections he encountered occurred well after the conclusion of the race in a “musher” whose team was lost during a blizzard and who reappeared after spending 3 weeks in the wild. With a substantial amount of investigation, Tonito determined that the man was suffering from a fairly serious infection of *Trichinella spiralis*. Assuming the man was free of infection at the beginning of the race, describe a scenario that might have led to his acquiring an infection with this parasite in the wild.
- (ii) Oratato has just returned from a 2-week internship with the Peace Corps in Africa and has discovered that he is infected with all 3 of the following parasite species. Over the course of his trip he slept in open huts in villages in a diversity of locations both near fast flowing streams and in deeper jungle situations. He drank water that was unfiltered, ate food that was unwashed, and, sadly, forgot his mosquito net at home. For each of the following parasite species describe how he most likely acquired the infection and also whether he is likely to come down with the full extent of the disease each species has the potential to cause.

a. *Wuchereria bancrofti*

b. *Trichuris trichiura*

c. *Onchocerca volvulus*

- (iii) The last night of her business trip to China, Adrianna was treated to a celebratory dinner that boasted a selection of delicacies... These included seared (but not cooked) pork sausages, a delightful tray of sashimi and other raw fish items, and an “interesting” beverage, imported from western Africa, containing multiple tiny little live copepods. Not wanting to offend her hosts, Adrianna decided that she should partake of at least one of these 3 offerings. Assuming that all 3 were infected with parasites, in each case describe the parasite infection she is at risk of acquiring and the potential pathogenicity associated with each.

a. seared pork sausages

Potential parasite:

Pathogenicity:

b. sashimi:

Potential parasite:

Pathogenicity:

c. copepod “beverage”:

Potential parasite:

Pathogenicity:

7. Complete TWENTY (20) of the 24 blank cells in the following table of HUMAN parasites. If you determine that a particular cell does not apply, write N/A as your answer for that cell. Note: each row must represent a DIFFERENT parasite species (30 points; 1.5 pts per blank cell).

Disease	Stage infective to definitive host	Etiological agent	Life cycle stage exiting definitive host	monoxenous or heteroxenous
		<i>Dirofilaria immitis</i>		
scabies	adults		adults	
		<i>Onchocerca volvulus</i>		
Hookworm disease				
		<i>Ascaris lumbricoides</i>		
	N/A	Trombiculidae	N/A	
Elephantiasis				

 Bonus: On our class field trip to the Thayer Farm field station in Cooperstown, New York, what group of insects did Maria very effectively demonstrate differ from termites in that they do NOT host cellulose-consuming gut protozoans?