

## PARASITES OF THE RANIDAE (AMPHIBIA). XIV\*

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No. 72. *Rana pipiens*, the common leopard frog of North America and standard equipment in almost every biological laboratory, has a range from Canada down through the United States east of the Rocky Mountains into Mexico. In addition to furnishing excellent material for the study of anatomy, histology, embryology, and physiology, this animal has proved a treasure-house as a source of parasites of a wide variety of types. During thirty years of use of live frogs (sent in from 18 states, 1 region in Mexico, and 2 provinces of Canada), more than fifty species of parasites have been found, about thirty of which occur fairly commonly. Interest of students has led to a search of available literature and the list has been expanded considerably.

*Rana pipiens* apparently serves as a host to a wide variety of parasitic protozoa, and although possibly only an accidental host to some, is a normal host to many. In addition, a few free-living forms seem to find satisfactory living conditions on the surface of the frog's skin. Tadpoles, possibly because of their feeding habits, seem to be more frequently hosts to such non-parasitic species than do the adults. Only one species of internal parasite—*Opalina larvarum*—seems to be restricted to tadpole hosts, and has been reported quite frequently from tadpoles cap-

tured in northern waters. Most of the parasites of the adults are intestinal forms, although a few are found embedded in the muscles or free in the blood stream. More than thirty species have been reported from *Rana pipiens*, of which eleven are fairly abundant. Twenty genera of protozoa are represented.

## PROTOZOA

## Canada:

*Haemogregarina* sp? of Scott, 1928. Blood.  
*Leptomonas ctenocephali* (experimental). Intestine.

*Trichomonas augusta*. Intestine.

*Trichomonas batrachorum*. Intestine.

## Mexico:

*Cepedea mexicana*. Intestine.

## U. S. A.:

*Chilomastix* sp? of Wenrich, 1947. Intestine.

*Endolimax ranarum*. Intestine.

*Euglena* sp? of Hegner, 1923 (on tadpoles).  
Skin.

*Haemogregarina* sp? of Kudo, 1922. Blood.

*Haptophrya michiganensis*. Intestine.

*Hexamita batrachorum*. Intestine.

*Hexamita intestinalis*. Intestine.

*Hexamita ovata*. Intestine.

*Hexamita (Uraphagus)* sp? of Wenrich, 1935. Intestine.

*Karotomorpho bufonis*. Intestine.

*Karotomorpho swezyi*. Intestine.

*Leishmania donovani* (experimental). Intra-cellular.

*Leptotheca ohlmacheri*. Body cavity cysts.

*Mastigamoeba hylae*. Intestine.

*Myxidium serotinum*. Bladder.

*Nyctotherus* sp? of Zebrowski, 1923. Intestine.

*Opalina larvarum* (in tadpoles). Intestine.

*Opalina obtrigonoidea*. Intestine.

*Opalina obtrigonoidea austriaca*. Intestine.

*Opalina triangularis*. Intestine.

(? = *O. obtrigonoidea*)

*Phacus* sp? of Hegner, 1922 (on tadpoles).  
Skin.

(? = *P. pleuronectes*)

*Retortamonas dobelli*. Intestine.

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*Trepomonas* sp? of Wenrich, 1947. Intestine.  
*Trichomitus parvus*. Intestine.  
*Trichomonas augusta*. Intestine.  
*Trichomonas batrachorum*. Intestine.  
*Trimitus parvus*. Intestine.  
*Trypanosoma rotatorium*. Blood.  
*Trypanosoma* sp? of Drbohlav, 1929. Blood.  
*Trypanosoma* sp? of Nigrelli, 1945. Blood.

Among the Nematodes, about twenty species have been recorded, of which ten are fairly common. Five species of larval forms have been reported, of which one, *Icosiella* sp., is quite common as an encysted form in the body cavity and in the superficial body muscles. The species *Pharyngodon batrachiensis* becomes adult in the tadpole. Fourteen genera are reported.

## NEMATODA

*Canada:*  
*Cosmocercoides dukae*. Rectum.  
*Mexico:*  
*Foleyellides striatus*. Peritoneum (larvae in blood).  
*U.S.A.:*  
 \**Agamascaris odontocephala*. Liver and stomach cysts.  
*Camallanus microcephalus*. Intestine.  
*Camallanus pipientis*. Intestine.  
*Cosmocercoides dukae*. Intestine.  
 \**Eustrongylides ignotus*. Peritoneal cysts.  
 \*\**Filaria* sp? of Leidy, 1852. Intestinal cysts.  
*Foleyella americana*. Mesenteric cysts (larvae in blood).  
 \**Icosiella quadrituberculata*. Muscle cysts.  
*Oswaldocruzia pipiens*. Intestine.  
*Oswaldocruzia subauricularis*. Intestine.  
*Oswaldocruzia walloni*. Intestine.  
*Oxysomatium americana*. Rectum.  
*Oxysomatium georgianum*. Rectum.  
*Oxysomatium longicaudata*. Rectum.  
*Pharyngodon armatus* (female only). Intestine.  
*Pharyngodon batrachiensis* (female only), (in tadpoles). Intestine.  
 \**Physaloptera* sp? larva of Morgan, 1941. Stomach cysts.  
*Rhabdias ranae*. Lungs.

The Trematodes are the most abundant and best known group of parasitic worms found in *Rana*

\* Denotes larval forms.

*pipiens*. Sixteen species from eight genera are reported from Canada. Three are larval forms; the adult of only one of these is known. Although the frog may serve as an intermediate host in the life cycle of many flukes, few instances of such intermediate stages have been reported from Canadian examples of *pipiens*. Only seven species from five different genera have been reported from Mexican hosts; all of these apparently finding the frog as their definitive host. Among the flukes reported from the United States, thirty-five species from sixteen genera are recorded from *R. pipiens*. Sixteen of these species are fairly common. Possibly because of a greater number of observers, more of the trematode parasites of the tadpole are reported; at least eleven species have been recorded. Of these at least two become sexually mature in the adult frog. The others (where their life cycle is known) reach maturity in reptiles, birds, or mammals. For a number of parasites life cycles are not as yet completely known so that the ultimate adult and its host cannot be recorded.

## TREMATODA

*Canada:*  
*Cephalogonimus retusus*. Intestine.  
 \**Cercaria vesiculosa*. Encyst in throat muscles.  
 \**Distoma nitidum*. Stomach cysts.  
*Glypthelmins quieti*. Intestine.  
*Gorgodera amplicava*. Bladder.  
*Gorgodera cygnoides*. Bladder.  
*Gorgoderina attenuata*. Bladder.  
*Gorgoderina simplex*. Bladder.  
*Gorgoderina translucida*. Bladder.  
*Haematoloechus breviplexus*. Lungs.  
*Haematoloechus medioplexus*. Lungs.  
*Haematoloechus similiplexus*. Lungs.  
*Haematoloechus variegatus*. Lungs.  
 \**Lechriorchis primus* (in tadpoles). Intestine.  
*Manodistomum occultum*. Intestine and muscle cysts.  
*Megalodiscus temperatus*. Intestine.

## Mexico:

- Cephalogonimus americanus*. Intestine.  
*Glythelmins californiensis*. Intestine.  
*Gorgoderina attenuata*. Bladder.  
*Haematoloechus macrorchis*. Lungs.  
*Haematoloechus medioplexus*. Lungs.  
*Haematoloechus varioplexus*. Lungs.  
*Halipegus termensis* (? = *H. occidualis*).  
 Eustachian tubes.

## U.S.A.:

- \**Alaria intermedia* (also in tadpoles). Muscle and kidney tissue.  
 \**Alaria marcianae* n. comb. (= *Cercaria marcianae* LaRue, 1917) (in tadpoles). Muscle.  
 \**Alaria micradena* n. comb. (= *Cercaria micradena* Cort and Brackett, 1938) (in tadpoles). Nerve cord.  
 \**Alaria mustelae* (also in tadpoles). Muscle tissue.  
*Alassostoma parvum*. Rectum.  
 \**Apharyngostrigea pipientis* (in tadpoles). Intestine.  
*Cephalogonimus retusus*. Intestine.  
 \**Cercaria elodes* (enters tadpole). Notochord.  
 \**Clinostomum complanatum*. Muscles.  
 \**Diplostomulum vegrandis* (in tadpoles). Muscles.  
 \**Diplostomum flexicaudum* (in tadpoles). Eye and muscle tissue.  
 \**Distoma nitidum*. Stomach cysts.  
 \*Distome metacercariae of Stabler and Pennypacker, 1939. Liver cysts.  
 \**Euryhelmis monorchis* (also in tadpoles). Subcutaneous tissue.  
 \**Euryhelmis squamula* (also in tadpoles) (probably *E. monorchis*. *E. squamula* is the European form). Subcutaneous tissue.  
*Glythelmins quieta*. Intestine.  
*Glythelmins subtropica*. Intestine.  
*Gorgodera amplicava*. Bladder.  
*Gorgodera cygnoides*. Bladder.  
*Gorgodera minima*. Bladder.  
*Gorgoderina attenuata*. Bladder.  
*Haematoloechus coloradensis*. Lungs.  
*Haematoloechus complexus*. Lungs.  
*Haematoloechus longipectus*. Lungs.  
*Haematoloechus medioplexus*. Lungs.  
*Haematoloechus similipectus*. Lungs.  
*Haematoloechus variegatus*. Lungs.  
*Halipegus eccentricus* (also in tadpoles). Eustachian tubes.  
*Halipegus occidualis*. Mouth and ears.  
 \**Lechriorchis primus* (in tadpoles). Mouth and intestine.  
 \**Lechriorchis tygarti* (in tadpoles). Mouth and intestine.  
*Loxogenes arcanum*. Visceral cysts and intestine.

- Megalodiscus temperatus* (metacercariae and adults in tadpoles and adult frogs). Metacercariae in skin, adults in intestine.  
*Monostoma ornatum*. Body cavity.  
 \**Zeugorchis erinus* (in tadpoles). Intestine

*Alaria marcianae* and *Alaria micradena* are presented as new combinations inasmuch as the metacercariae of these forms from the frog have been experimentally raised (particularly *A. micradena*) in pigeons and seem to belong to the genus *Alaria*. The original reports of these experiments pointed out the proper position of the metacercariae but did not make the combinations indicated.

Members of the Cestoda are not common in *Rana pipiens* but a few specimens of *Cylindrotaenia* are found each year in the frogs collected in the field. *Cylindrotaenia* (2 species) and *Nematotaenia dispar* become adult in the frog, although the record for *N. dispar* (a European form) is possibly a misidentification of a *Cylindrotaenia* species. Larval forms of *Ophiotaenia perspicua* have been reported from tadpoles, and one record of this form as an adult in adult frogs has been listed. Unidentified larval tapeworms are frequently present in adult frogs, but identification is difficult and seldom attempted.

## CESTODA

## Canada:

- ?*Nematotaenia dispar*. Intestine.

## U. S. A.:

- Cylindrotaenia americana*. Intestine.  
*Cylindrotaenia guardijugosa*. Intestine.  
 \**Ophiotaenia perspicua* (also in tadpoles). Liver of tadpoles.  
 Proteocephalidae of Fortner, 1923. In cysts.

Two leeches—*Haementeria montifera* and *Macrobdella decora*—have been taken from the surface of adult frogs collected at various stations in the United States.

\* Denotes larval forms.

One larval mite—*Hannemania penetrans*—has been recorded several times from specimens of *R. pipiens* caught in the southern United States.

At least six species of mosquitoes are known to feed on the blood of the adult frog, and several have been shown to be the vectors of microfilariæ of at least three species of *Foleyella*, although *F. americana* is the only microfilariid definitely recognized from *R. pipiens*.

#### DIPTERA

<i>Aedes aegypti</i> .	<i>Culex fatigans</i> .
<i>Aedes atropalpus</i> .	<i>Culex pipiens</i> .
<i>Culex apicatis</i> .	<i>Culex quinquefasciatus</i> .

Probably the surfaces of both tadpoles and adults carry a rich bacterial flora, but only three species of internal parasites are known. One, *Proteus hydrophilus*, is the cause of "red-leg disease" which so frequently plagues the aquarium stock of our laboratories. Another is an intestinal form indistinguishable from *Eschreischia coli*. The third is an acid-fast form—*Mycobacterium ranae*—although it is questionable whether tuberculosis is a "white plague" among the Amphibia. A number of forms isolated from fish and reptiles have been grown successfully in Amphibia. A more

thorough study would undoubtedly increase our knowledge of the parasitic flora of Amphibia greatly.

#### BACTERIA

U. S. A.:

*Escherichia coli*. Intestine.  
*Mycobacterium marinum* (experimental).  
 Tissues.  
*Mycobacterium piscium* (exp.). Tissues.  
*Mycobacterium ranae*. Tissues.  
*Mycobacterium thamnopheos* (exp. in adults and tadpoles). Tissues.  
*Proteus hydrophilus*. Muscle tissue.  
*Serratia anolium* (exp.). Intestine.

The fish mold *Saprolegnia parasitica* (Oömycetes) frequently attacks frogs kept in the laboratory aquarium.

At least two species of protozoans, four of nematodes, five of trematodes, and possibly one of tapeworms can be expected as parasites of almost every batch of *Rana pipiens* used in the laboratory, particularly if they were collected from the field and not raised commercially. In the latter case parasite collecting is usually poor. It adds interest, and possibly information, if students are encouraged to look for evidences of parasitism as well as to perform the usual laboratory exercises. Preserved as well as live material can be used, but one seldom finds other than nematodes, trematodes, and tapeworms in preserved frogs.