

## PARASITES OF THE HYLIDAE (AMPHIBIA-HYLINAE). VI

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In this sixth section of the catalog of the parasites of the Hylinae, the following hosts and parasites are included:

1. *HYLA FABER* (Brazil)—*Cosmocerca brasiliensis*, *Foleyella convoluta*, *Oswaldocruzia subauricularis*, *Oxyascaris similis*, *Physaloptera* sp? of Travassos, 1928, *Raillietnema simplex*, and *Spironoura nitida* (Nematoda); larval *Lueheia luehei* (Acanthocephala); *Cepedea plata*, *Nyctotherus faberi*, *N. fulvus*, *N. mogyanus*, *N. ruber*, *Opalina elongata*, *O. faber*, *O. longula*, and *O.* sp? of Carini, 1935 (Protozoa); and *Schmardaella lutzii* (Annelida).
2. *H. FEMORALIS* (U.S.A.)—*Oxysomatium americana* (Nematoda); and *Opalina obtriangoidea*, and *O.* (?) *triangularis* (Protozoa).
3. *H. FREYCINETI* (Australia)—*Dolichosaccus diamesus*, and *Pleurogenes freycineti* (Trematoda); and *Nematotaenia* sp? of Johnston, 1916 (Cestoda).
4. *H. FUSCOVARIA* (S. Amer.)—*Cepedea ciliata*, *Isospora cruzi*, *Nyctotherus incertus*, and *N. ruber* (Protozoa).
5. *H. GOUGHI* (S. Amer.)—*Schmardaella* sp? of Lutz 1928 (Annelida).
6. *H. GRACILENTA* (Australia)—*Parathelandros mastigurus* (Nematoda); and *Mesocoelium microon* (Trematoda).
7. *H. GRATIOSA* (U.S.A.)—*Oxysomatium americana*, and *Spironoura catesbianae* (Nematoda).
8. *H. INFRAFRENATA* = *H. dolichopsis* (Papua)—*Protoopalina papuensis* (Protozoa).
9. *H. JERVISIENSIS* (Australia)—*Aplectana flindersi*, *Hedruris hylae*, and *Raillietnema kartanum* (Nematoda).
10. *H. LANGSDORFII* (Brazil)—*Aplectana* sp? of Travassos, 1925 (Nematoda); and *Nyctotherus faberi*, and *N. fulvus* (Protozoa).
11. *H. LESUERII* (Australia)—*Parapolytoma bulliense* (Trematoda); and *Entamoeba morula*, *E. ranarum*, *Trypanosoma* sp? of Johnston, 1916 and *T.* sp? of Laveran and Mesnil, 1912 (Protozoa).
12. *H. LEUCOPHYLLATA* (Brazil)—*Cepedea mogyana*, and *Nyctotherus ordiniae* (Protozoa).
13. *H. LUTEUS* (Brazil)—*Aplectana acuminata* and *Cosmocerca commutata* (Nematoda).
14. *H. MESOPHAEA* (Brazil)—*Aplectana* sp? of Travassos, 1925, *Oswaldocruzia subauricularis*, and *Thelandros oswaldocruzi* (Nematoda); and larval *Centrorhynchus tumidulus* (Acanthocephala).
15. *H. MICROPS* (Brazil)—*Aplectana* sp? of Travassos, 1925 (Nematoda); and *Nyctotherus vulgaris* (Protozoa).

\* Contributions from the Biological Laboratories of Knox College, No. 115.

16. H. MINUTA (Brazil)—*Cepedea rubra* (Protozoa).
17. H. MISERA (S. Amer.)—*Schmardaella lutzii* (Annelida).
18. H. NANA (S. Amer.)—*Zelleriella* sp? of Chen & Stabler, 1936 (Protozoa).
19. H. NASICA (Paraguay)—*Cepedea dimidiata paraguayensis*, and *Isospora cruzi* (Protozoa).
20. H. NASUTA (Australia)—*Trypanosoma* spp? of Bancroft, 1890, Johnston, 1916, and Laveran & Mesnil, 1912 (Protozoa).
21. H. NEBULOSA (S. Amer.)—*Cepedea rugosa*, *Myxidium lindoyense*, *Nyctotherus cinctus*, *N. elegans*, *N. ruber*, *Opalina nebulosa*, and *O. sp?* of Carini, 1935 (Protozoa).
22. H. PARDALIS (Brazil)—larval *Lueheia luehei* (Acanthocephala).
23. H. PERONII (Australia)—*Rhabdias hylae* (Nematoda); and *Entamoeba morula* (Protozoa).
24. H. PHRYNODERMA (Brazil)—*Aplectana* sp? of Travassos, et al., 1939 (Nematoda).
25. H. PHYLLOCHROA (Australia)—*Parapolytoma bulliense* (Trematoda).
26. H. POLITAENIA (S. Amer.)—*Nyctotherus ondinae*, *N. ruber*, and *N. sp?* of Carini, 1939 (Protozoa).
27. H. RADDIANA = *H. pulchella* (S. Amer.)—*Acanthocephalus lutzii* (Acanthocephala); and *Cepedea brumpti*, *Mastigamoeba hylae*, *Myxidium immersum*, *Nyctotherus (?) cordiformis*, *N. fragilis*, *Opalina raddiana*, *O. sp?* of Carini 1935, *Trypanosoma rotatorium*, *T. rotatorium major*, and *Zelleriella hylaxena* (Protozoa).
28. H. REGILLA (U.S.A.)—larval *Paralechthiorchis syntomentera* (Trematoda) in tadpoles; larval *Centrorhynchus californicus* (Acanthocephala); and *Nyctotherus (?) cordiformis hylae* (= *N. hylae* of Rosenberg and (?) of Surowiak), *Opalina oregonensis*, *O. virguloidea*, and *Trichomonas augusta* (Protozoa).
29. H. RUBRA (S. Amer.)—larval *Strigea vaginata* (Trematoda); *Cepedea rubra*, *Isospora cruzi*, *Myxidium lindoyense*, *Nyctotherus mogyanus*, *N. tieteanus*, *Opalina elongata*, *O. spp?* of Carini, 1935-1937, *Trypanosoma borrelli*, *T. rotatorium*, and *T. sp?* of Laveran & Mesnil, 1912 (Protozoa); *Dermosporidium hylarum* (Phycomycetes); *Schmardaella lutzii* (Annelida); and *Eutrombicula yorkei*, and *Hanemania newsteadi* (Acarina).
30. H. SEPTENTRIONALIS (Cuba)—*Eustrongylides* sp? of Walton, 1940, *Oswaldocruzia lenteixirai*, and *Pharyngodon bassi* (Nematoda); *Balantidium* sp? and *Nyctotherus* sp? of Metcalf, 1923, *Opalina septentrionalis*, and *Zelleriella* sp? of Metcalf, 1923 (Protozoa); *Schmardaella lutzii* (Annelida); and *Borrelia cubensis* (Bacteria).
31. H. SQUIRELLA (U.S.A.)—*Cosmocercoides dukae*, and *Rhabdias ranae* (Nematoda); larval and adult *Polystoma nearcticum* (Trematoda); *Cylindrotaenia americana* (Cestoda); and larval *Acariscus mansonii* (Acarina).
32. H. TASMANIENSIS (Australia)—*Nyctotherus (?) cordiformis* (Protozoa).
33. H. (?) TSCHUDII (Brazil)—*Aplectana acuminata*, and *Cosmocerca comutata* (Nematoda).
34. H. VENULOSA (S. Amer.)—*Balantidium* sp? of Metcalf, 1923, *Nyctotherus gamarrai*, *Trypanosoma* spp? of Laveran & Mesnil, and of Plimmer, 1912, and *Zelleriella venezuelae* (Protozoa); and *Schmardaella lutzii* (Annelida).

35. *H. VERSICOLOR* (U.S.A.)—larval *Apharyngostrigea pipientis*, *Cercaria amherstensis* (in tadpoles), *C. holthauseni* (in tadpoles), and larval *Polystoma nearcticum* (Trematoda); and *Balantidium* sp? of Metcalf, 1923, *Nyctotherus* (?) *cordiformis*, *Opalina hylaxena*, *O. h. georgiana*, *O. h. mexicana*, *O. h. orbiculata*, *O. h. parvinueata*, *Scyphidia* sp? of Wenrich, 1924 (on tadpoles), *Trichomonas augusta*, *Trypanosoma* (?) *rotatorium*, and *T. sp?* of Negrelli, 1945 (Protozoa).

36. *H. VERSICOLOR CHRYSOSCELIS* (N. Amer.)—*Cepedea* sp? and *Opalina* sp? of Metcalf, 1923 (Protozoa).

37. *H. sp?* (Australia)—*Dolichosaccus* spp? of Johnston, 1912, and *Pleurogenes* sp? of Roberts, 1936 (Trematoda).

38. *H. sp?* (Brazil)—*Ascaris foecunda* (Nematoda); and larval *Clinostomum heluans*, and larval *Echinostoma nephrocystis* (Trematoda).

39. *H. sp?* (Europe)—*Oswaldocruzia* sp? of Dikmans, 1932 (Nematoda).

40. *H. sp?* (Japan)—*Capillaria filiformis* (Nematoda).

41. *H. sp?* (N. Amer.)—*Triatoma sanguisuga ambigua* (Hemiptera).

A survey of the records of this and the earlier studies indicates that the "Tree Frogs" of the family *Hylidae* are widely distributed and heavily parasitized. 71 identified and 5 unidentified host species have been examined as follows: ACRIS (3 spp.) from the U.S.A., AGALYCHNIS (2 spp.) from Central America, HYLA (63 spp.) from all of the continents except Africa (1 sp. from Asia Minor, 14 spp. from Australia, 4 spp. from Central America, 1 sp. from Cuba, 3 spp. from Europe, 2 spp. from Japan, 2 spp. from Mexico, 1 sp. from Papua, 23 spp. from S. America (20 from Brazil), and 12 spp. from the U.S.A. and Canada), PHYLLomedusa (2 spp.) from Central and Northern S. America, and PSEUDACRIS (6 spp.) from the U.S.A. The *Hylidae* apparently originally evolved in the South American rain-forest area (about 100 spp. are reported) and spread to North America (about 50 spp. are known). The presence of over 40 spp. of hylids in Australia necessitates consideration of the possibility of an independent center of origin

from archaic bufonids of the region. This seems doubtful inasmuch as the parasites of the hylids do not seem to have arisen from those of the bufonids as is the case in South America, but show direct relationship to some of the more highly modified types of the less primitive New World host species. Migration from a Western Hemisphere source seems therefore much more plausible than independent origin although it requires the postulation of southern land bridges between Australia and South America, either by direct trans-Pacific crossing or via the Antarctic Continent. Hylids appeared in Australia too late to have entered by way of the Malayan land bridge. Arldt and other paleogeographers have advanced evidences of former land bridges in Late Cretaceous or Early Tertiary times, extending: (a) from Peru westward through the chain of islands of the modern South Pacific to Australia and New Guinea; and (b) from Chile south-eastward through present-day islands to Antarctica and thence westward and northward to Australia

and New Guinea. Such data are not conclusive in the opinion of many other paleogeographers. The Australian hylids are more nearly related to South American species than they are to the North American or European forms and thus a northern pathway from South America to Australia seems to be ruled out even though such a migration should have occurred early enough to have used the Malayan bridge which, however, is usually regarded as having disappeared before the appearance of the hylids. It is difficult to believe that all connecting forms should have entirely been wiped out and replaced by the more modern species which are traceable directly back to a Neotropical ancestry. The present 5 or 6 Eurasiatic hylids (mainly varieties of *Hyla arborea*) are definitely late Tertiary derivatives of North American species and entered their area by way of the Alaska-Siberia preglacial land bridge. These North American forms antedate the Australian forms but could not have been ancestral to them.

Study of the parasites bears out the same general conclusion of the Late Cretaceous and Early Tertiary evolution of the Hylidae inasmuch as few of the nematode, the trematode, or the protozoan species found are truly primitive forms. Metcalf has presented this analysis in detail for the opalinid protozoans, and a survey of the other protozoa and of the metazoa involved substantiate his interpretations.

The two species of *Acris* from North America show the presence of 6 species of nematodes, 3 species of cestodes, and 9 species of protozoans. The two species of *Agalychnis* from

Central America show 2 species of Opalinids. The two species of *Phyllomedusa* from Central America and Northern South America are hosts to 1 species of nematode and to 2 species of protozoans. The six species of *Pseudacris* from North America are parasitized by 9 species of nematodes, 5 species of trematodes (several of them only in larval form), 1 species of cestode, 1 species of a larval acanthocephalan, and 12 species of protozoans. The four identified and two unidentified species of *Hyla* from Eurasia (including Japan) are reported as hosts of 8 adult and 1 larval species of nematodes, 10 adult and 5 larval species of trematodes, 2 adult and 2 larval species of cestodes, 1 adult and 1 larval species of acanthocephalans, 18 identified and 4 unidentified species of protozoans, 1 species of bacterium, and 1 species of a fly maggot. The adults of the larval species are normally found in birds or reptiles, the amphibia serving only as intermediate, or in some cases, as accidental hosts. 14 species of *Hyla* from Australia are parasitized by 8 adult and 2 larval species of nematodes, 18 species (2 not identified) of trematodes, 5 species of adult (3 identified only as to genus) and 1 species of larval cestodes, 1 species of larval acanthocephalans, 18 species of protozoans, and 1 species of a larval dipteran. The one *Hyla* species from Papua was parasitized by a single form of the protozoans. The 4 species of *Hyla* from Central America and the northern border of adjacent South America are hosts to 1 species of trematode, to 9 species of protozoans, and to 1 species of annelid.

Specimens of 2 species of hylids from Mexico and adjacent Central America yielded 1 species of nematode, 1 species of trematode, and 5 species of protozoans. The one hylid species examined from Cuba was host to 2 adult and 1 larval species of the nematodes, 4 species of protozoans, 1 of an annelid, and 1 of a bacterium. 12 species of nematodes (including 3 larval species), 12 species of trematodes (including 4 species of larval forms whose adults are found in birds or reptiles and 2 species of metacercariae whose adults are as yet unknown), 1 adult and 2 larval species of cestodes, 2 species of larval acanthocephalans, 25 species of protozoans, 2 species of larval mites, and 1 species of an hemipteran, have been reported from the genus *Hyla* taken in the United States and in Canada. The 27 South American species of *Hyla* (20 species from Brazil) are hosts to 12 adult and 2 larval species of nematodes, 4 species of larval trematodes, 1 adult and 2 larval species of acanthocephalans, 40 identified species of protozoans, 1 species of an annelid, 1 species of a phycomyete, and 2 species of larval mites.

Among the Nematoda, 22 genera and 40 identified species are present. Eight larval forms, identified only as to their genera, are also reported. *Aplectana* with 4 species, *Cosmocerca* with 3, *Oswaldocruzia* with 7, *Rhabdias* with 3, and *Spironoura* with 4, are the genera most frequently encountered. *Rhabdias* is the most widely distributed genus, species being reported from 11 different hosts, collected from all of the continents where hylids are found. *Cosmocercoides dukae* is the one spe-

cies occurring in the greatest number of hosts, six, although thus far reported only from the North American area. 14 species of nematodes are reported from the U.S.A., 13 from South America, 10 from Australia, 6 from Europe, 3 each from Japan and from Cuba, and 1 from Mexico. *Aplectana acuminata* and *Cosmocerca commutata* are the only species definitely identified as being present on two continents, Europe and South America.

NEMATODE PARASITES<sup>1</sup>

- \**Agamascaris enopla* U.S.A. (1)
- \**Agamascaris odontocephala* U.S.A. (3)
- \**Agamonema* sp? Australia (1)
- Aplectana acuminata* E., S. Amer. (1 each)
- Aplectana flindersi* Australia (1)
- Aplectana hamatospicula* Mexico (1)
- Aplectana* spp? S. Amer. (5)
- Ascaris foecunda* S. Amer. (1)
- Capillaria filiformis* Japan (1)
- Cosmocerca brasiliensis* S. Amer. (1)
- Cosmocerca commutata* E., S. Amer. (1 each)
- Cosmocerca japonica* Japan (1)
- Cosmocercella haberi* U.S.A. (1)
- Cosmocercoides dukae* U.S.A. (6)
- \**Eustrongylides* sp? Cuba (1)
- Foleyella convoluta* S. Amer. (1)
- Hedruris hylae* Australia (1)
- Oswaldocruzia filiformis* E. (1)
- Oswaldocruzia leidyi* U.S.A. (3)
- Oswaldocruzia lenteizeirai* Cuba (1)
- Oswaldocruzia limnodynastes* Australia (1)
- Oswaldocruzia minuta* U.S.A. (1)
- Oswaldocruzia pipiens* U.S.A. (3)
- Oswaldocruzia subauricularis* S. Amer. (3)
- Oswaldocruzia* sp? E. (1)
- Oswaldocruzia* sp? S. Amer. (1)
- Oxyascaris similis* S. Amer. (1)
- Oxysomatium americana* U.S.A. (3)
- Oxysomatium brevicaudatum* E. (1)
- Oxyuris tba* E. (1)
- Parathelandros mastigurus* Australia (2)
- Pharyngodon bassi* Cuba (1)
- \**Pharyngodon confusa* Australia (1)
- \**Pharyngodon* sp? S. Amer. (1)
- \**Pharyngodon* spp? U.S.A. (3)
- Raillietnema kartanum* Australia (1)

<sup>1</sup> \*Denotes larval forms. Number in parentheses indicates the number of host species from which the parasite has been reported. E. refers to Europe.

*Raillietnema simplex* S. Amer. (1)  
*Rhabdias bufonis* Japan (1)  
*Rhabdias hylae* Australia (3)  
*Rhabdias ranae* U.S.A. (4)  
*Rhabdias* sp? Australia (1)  
*Rhabdias* sp? U.S.A. (2)  
*Spiroonoura catesbianae* U.S.A. (2)  
*Spiroonoura hylae* U.S.A. (1)  
*Spiroonoura nitida* S. Amer. (1)  
*Spiroonoura simpsoni* Australia (1)  
*Thelandros oswaldocruzi* S. Amer. (1)  
*Thubunaia liolopisma* U.S.A. (1)  
 (normally in lizards)

Thirty-one genera (43 identified and 6 unidentified species) of trematodes have been reported from members of the *Hylidae*. *Mesocoelium* with 4 species, *Pleurogenes* with 5, and *Polystoma* with 4 are the best represented genera. *Brachycoelium salamandrae*, *Megalodiscus temperatus*, *Opisthodiscus subclavatus*, and *Polystoma nearcticum* have each been reported from 3 host species. *O. subclavatus* is the only species to be reported from two continents (Australia and Europe). The 2 species of "Cercaria" have been reported from tadpoles, but their life-histories are as yet undetermined and their adult forms not as yet ascertained. 12 additional larval species are recorded—their adult forms being found in fish, reptiles, and birds—with the amphibians merely serving as intermediate hosts. 18 species of parasites are reported from Australia, 15 from Europe, 12 from the U.S.A., 4 from South America, and 1 from Central America and Mexico.

## TREMATODE PARASITES

*Asymphlyodora tincae* E. (1)  
 \**Apatemon gracilis* S. Amer. (1)  
 \**Apharyngostrigea pipientis* U.S.A. (1)  
*Brachycoelium salamandrae* U.S.A. (3)  
*Brachysaccus anartius* Australia (1)  
*Brachysaccus symmetricus* Australia (1)  
 \**Cercaria amherstensis* (tadpoles) U.S.A. (1)  
 \**Cercaria holthauseni* (tadpoles) U.S.A. (1)

\**Clinostomum heluans* S. Amer. (1)  
 \**Dasymetra villicaeca* U.S.A. (2)  
*Distomum* sp? U.S.A. (1)  
*Distomum* sp? Australia (1)  
 \**Dolichoenterum lemirendi* E. (1)  
*Dolichosaccus diamesus* Australia (1)  
*Dolichosaccus ischyurus* Australia (1)  
*Dolichosaccus tryphesus* Australia (1)  
*Dolichosaccus* spp? Australia (2)  
 \**Echinoparyphium recurvatum* E. (1)  
 \**Echinostoma nephrocystis* S. Amer. (1)  
*Glypthelmins quieta* U.S.A. (2)  
*Glypthelmins* sp? U.S.A. (1)  
*Gorgodera australiensis* Australia (1)  
*Gorgodera cygnoides* E. (1)  
*Haematoloechus australis* Australia (1)  
*Haplometra cylindracea* E. (1)  
*Lecithochirium rufoviride* E. (1)  
*Lecithopyge ranae* E. (1)  
*Megalodiscus temperatus* U.S.A. (3)  
*Mesocoelium megaloon* Australia (1)  
*Mesocoelium mesembrinum* Australia (2)  
*Mesocoelium microon* Australia (2)  
*Mesocoelium oligoon* Australia (1)  
 \**Neoreniifer aniarum* U.S.A. (2)  
*Opisthodiscus subclavatus* E., Australia (3)  
 \**Paralechriorchis syntomentera* U.S.A. (1)  
*Parapolytoma bulliense* Australia (2)  
*Pleurogenes claviger* E. (1)  
*Pleurogenes freycineti* Australia (1)  
*Pleurogenes medians* E. (1)  
*Pleurogenes solus* Australia (1)  
*Pleurogenes* sp? Australia (1)  
*Polystoma gallieni* E. (1)  
*Polystoma integerrimum* E. (2)  
*Polystoma naevius* Mex., Cent. Amer. (1)  
*Polystoma nearcticum* U.S.A. (3)  
 \**Proisorhynchus aculeatus* E. (1, exper.)  
 \**Sphaerostoma bramae* E. (1)  
 \**Strigea vaginata* S. Amer. (2)  
 \**Szidatia joyeuxi* E. (1)

Among the Cestodes, 9 genera—with 7 identified and 5 unidentifiable species (5 of the 12 are larval forms)—are parasitic in the *Hylidae*. At least 1 species of a proteocephalid is present in encysted form, 2 species of *Sparganium* larvae and 1 species of a larval "Taenia" are reported. *Ophiotaenia* is represented by 2 species, one each from Australia and from the United States. *Nemato-taenia dispar* has been recovered

from 2 host species, 1 each from Europe and from the United States. Probably this same species has been recovered from 2 host species in Australia, but the identification was not completely established. *Cylindrotaenia americana* has been reported from 3 different U.S.A. hosts. Australia reports 5 species, the U. S. A. 5 species, Europe 3 species and Japan 1 species of tapeworms. South America has no recorded findings of cestodes as parasites of the hylids.

## CESTODE PARASITES

- Baerietta japonica* Japan (1)  
*Cylindrotaenia americana* U.S.A. (3)  
 \**Diphyllobothrium erinacei* E. (1)  
*Nematotaenia dispar* E., U.S.A. (1 each)  
*N. spp?* Australia (2)  
*Ophiotaenia hylae* Australia (1)  
*Ophiotaenia magna* U.S.A. (1)  
*Ophiotaenia sp?* Australia (1)  
 \*Proteocephalid cysts U.S.A. (1)  
 \**Sparganum spp?* Australia (2)  
 \**Taenia sp?* U.S.A. (1)  
 \**Tetrathyridium sp?* E. (1)  
*Triplotaenia mirabilis* Australia (1)

Acanthocephala (2 adult and 7 larval species) are represented by 3 genera. Hosts from Australia, Europe, North America, and South America, have been found to be parasitized.

## ACANTHOCEPHALAN PARASITES

- \**Acanthocephala hylae* Australia (2)  
*Acanthocephala lutzii* S. Amer. (1)  
*Acanthocephala ranae* E. (1)  
 \**Centrorhynchus aluconis* E. (1)  
 \**Centrorhynchus californicus* U.S.A. (1)  
 \**Centrorhynchus tumidulus* S. Amer. (1)  
 \**Centrorhynchus spp?* U.S.A. (2)  
 \**Lueheia luehei* S. Amer. (2)

The Protozoa of the *Hylidae* have been carefully studied by Carini and by Metcalf, and are perhaps better known than are any of the other groups of parasites. 21 genera (plus 2 unidentified protozoans) and 81

species (plus 49 unidentified and possibly identical species) have been reported. Australia is represented by 10 genera and 15 species of protozoans, and New Guinea by 1 species. Asia is represented by 1 species, present both in Japan and in Asia Minor. Europe is represented by 9 genera and 22 species. In North America, the U. S. A. records show the presence of 10 genera and 39 species, Mexico the presence of 2 genera and 2 species, Central America and adjacent South America 3 genera and 4 species, and Cuba 4 genera and 4 species. South American records show the presence of 9 genera and 46 species. The genus *Opalina* is represented by 39 species, some of which are probably duplicates. As the author has pointed out earlier (1941), *Opalina obtrigonoidea* and *O. triangularis* are probably identical, with *O. triangularis* having priority. The validity of the varietal forms of *O. hylaxena*, of *O. obtrigonoidea* (? *O. triangularis*), and of *O. virguloidea* was also questioned in the same article. *Opalina* is primarily a genus of the Western Hemisphere, although one species has invaded Eurasia. The reported presence of the genus in Australia is seriously to be doubted. The genus *Nyctotherus* is represented by 24 species, again some of which are undoubtedly cases of overlapping identifications. The genus is of New World origin, but has penetrated into Europe as *N. cordiformis* and into Australia. The identification of *N. cordiformis* in other than European hosts is to be questioned (1941). *Trypanosoma* is represented by 18 species (some unquestionably are overlapping

identifications) from Australia, Europe, North America, and South America. With the possible exception of *T. grylli*, students of the group seriously question whether any of the species reported from the *Hylidae* are other than host variants of *T. rotatorium*. *Cepedea*, represented by 11 species found in tropical and sub-tropical American hosts, is preëminently a South American genus. 5 species of *Protoopalina* are reported. Members of this genus are late invaders of the hylids, being found only in Europe and Australia—areas in which the hylids are relatively new invaders. The reported presence of *P. intestinalis* (a European form) in an Australian hylid is to be questioned. *Zelleriella*—with 5 species reported—is another tropical form, and thus far has been found only in the New World as far as hylid hosts are concerned. At least 8 different hosts have been reported as carrying *Balantidium* species, but as specific identifications are lacking, further comment is impossible at present. The genus *Iso-spora* is the only other protozoan genus with as many as 3 species that parasitize hylids. *Trichomonas augusta* in 6 host species, *Nyctotherus* ? *cordiformis* (U.S.A.) in 8 hosts, *Opalina chlorophili* in 6 hosts, *O. triangularis* (? *obtrigonoidea*) in 10 hosts, *O. virguloidea* in 5 hosts, and *Trypanosoma rotatorium* in 14 hosts, are the least host-specific species.

#### PROTOZOAN PARASITES

- "Amoeba" sp? Australia (1)  
*Balantidium* sp? Australia (1)  
*Balantidium* sp? Cent. & S. Amer. (1)  
*Balantidium* sp? Cuba (1)  
*Balantidium* sp? Mexico & Cent. Amer. (1)  
*Balantidium* sp? S. Amer. (1)
- Balantidium* sp? U.S.A. (2)  
*Cepedea baudinii* Mex. & Cent. Amer. (1)  
*Cepedea brumpti* S. Amer (1)  
*Cepedea ciliata* S. Amer. (1)  
*Cepedea dimidiata paraguayensis* S. Amer. (1)  
*Cepedea globosa* Cent. Amer. (1)  
*Cepedea mogyana* S. Amer. (1)  
*Cepedea multiformis* Cent. & S. Amer. (1)  
*Cepedea plata* S. Amer. (1)  
*Cepeda rubra* S. Amer. (2)  
*Cepedea rugosa* S. Amer. (1)  
*Cepeda* sp? U.S.A. (1)  
*Cytamoeba grassi* E. (1)  
*Eimeria belacvini* E. (1)  
*Entamoeba morula* Australia (3)  
*Entamoeba ranarum* Australia (1)  
*Eutrichomastix* sp? Australia (1)  
*Giardia agilis* E. (1)  
*Haemogregarina hylae* Australia (1)  
*Hexamita intestinalis* U.S.A. (2)  
*Hexamita* sp? U.S.A. (1)  
*Iso-spora cruzi* S. Amer. (4)  
*Iso-spora hylae* E. (1)  
*Iso-spora vladimirovi* E. (1)  
*Mastigamoeba hylae* S. Amer. (1)  
*Mixidium immersum* S. Amer. (1)  
*Mixidium lindoyense* S. Amer. (2)  
*Myxobolus hylae* Australia (1)  
 "Myxosporidium" sp? Australia (1)  
*Nyctotherus cinctus* S. Amer. (1)  
*Nyctotherus cordiformis* Australia (2)  
*Nyctotherus cordiformis* E. (1)  
*Nyctotherus cordiformis* S. Amer. (2)  
*Nyctotherus cordiformis* U.S.A. (6)  
*Nyctotherus cordiformis hylae* E. (1)  
*Nyctotherus cordiformis hylae* U.S.A. (1)  
*Nyctotherus cunhai* S. Amer. (1)  
*Nyctotherus elegans* S. Amer. (1)  
*Nyctotherus faberi* S. Amer. (1)  
*Nyctotherus fragilis* S. Amer. (1)  
*Nyctotherus fulvus* S. Amer. (1)  
*Nyctotherus gamarrai* S. Amer. (1)  
*Nyctotherus hylae* E. (1)  
*Nyctotherus incertus* S. Amer. (1)  
*Nyctotherus mogyanus* S. Amer. (2)  
*Nyctotherus ondinae* S. Amer. (2)  
*Nyctotherus ruber* S. Amer. (3)  
*Nyctotherus tieteanus* S. Amer. (1)  
*Nyctotherus vulgaris* S. Amer. (1)  
*Nyctotherus* spp? Australia (2)  
*Nyctotherus* sp? Cuba (1)  
*Nyctotherus* sp? E. (1)  
*Nyctotherus* spp? N. Amer. (3)  
*Nyctotherus* sp? S. Amer. (1)  
*Opalina chlorophili* U.S.A. (6)  
*Opalina elongata* Cent. & S. Amer. (1)  
*Opalina elongata* S. Amer. (2)  
*Opalina faber* S. Amer. (1)  
*Opalina guatamalae* Mex. & Cent. Amer. (1)

*Opalina helenae* Cent. & S. Amer. (2)  
*Opalina hylaxena* U.S.A. (3)  
*Opalina hylaxena georgiana* U.S.A. (1)  
*Opalina hylaxena mexicana* U.S.A. (1)  
*Opalina hylaxena orbiculata* U.S.A. (1)  
*Opalina hylaxena parvinnucleata* U.S.A. (1)  
*Opalina longula* S. Amer. (1)  
*Opalina moreletii* Cent. Amer. (1)  
*Opalina nebulosa* S. Amer. (1)  
*Opalina oblanceolata* U.S.A. (1)  
*Opalina obtrigona* Asia Minor (1)  
*Opalina obtrigona* E. (1)  
*Opalina obtrigona* Japan (1)  
*Opalina obtrigonoidea* U.S.A. (4)  
*Opalina obtrigonoidea orbiculata* U.S.A. (1)  
*Opalina oregonensis* U.S.A. (1)  
*Opalina pickeringii* U.S.A. (2)  
*Opalina raddiana* S. Amer. (1)  
*Opalina septentrionalis* Cuba (1)  
*Opalina terrae-mariae* U.S.A. (1)  
*Opalina triangularis* U.S.A. (5)  
*Opalina virguloidea* Mexico (1)  
*Opalina virguloidea* U.S.A. (3)  
*Opalina virguloidea macronucleata* U.S.A. (1)  
*Opalina virguloidea micronucleata* U.S.A. (1)  
*Opalina* sp? Australia (1)  
*Opalina* spp? E. (3)  
*Opalina* spp? S. Amer. (5)  
*Opalina* spp? U.S.A. (4)  
*Protoopalina adelaidensis* Australia (1)  
*Protoopalina australis* E. (1)  
*Protoopalina hyalarum* E. (1)  
*Protoopalina intestinalis* Australia (1)  
*Protoopalina intestinalis* E. (1)  
*Protoopalina papuensis* New Guinea (1)  
*Retortamonas dobelli* U.S.A. (1)  
*Scyphidia* sp? U.S.A. (1)  
*Trichomonas augusta* Mexico (1)  
*Trichomonas augusta* U.S.A. (6)  
*Trichomonas batrachorum* E. (1)  
*Trypanosoma borrelli* S. Amer. (1)  
*Trypanosoma grylli* U.S.A. (1)  
*Trypanosoma hylae* E. (1)  
*Trypanosoma rotatorium* E. (1)  
*Trypanosoma rotatorium* S. Amer. (2)  
*Trypanosoma rotatorium* U.S.A. (4)  
*Trypanosoma rotatorium major* S. Amer. (1)  
*Trypanosoma* spp? Australia (4)  
*Trypanosoma* spp? E. (3)  
*Trypanosoma* spp? S. Amer. (3)  
*Trypanosoma* spp? U. S. A. (3)  
*Zelleriella hylaxena* S. Amer. (1)  
*Zelleriella venezuelae* S. Amer. (1)  
*Zelleriella* sp? Cuba (1)  
*Zelleriella* sp? S. Amer. (1)  
*Zelleriella* sp? U.S.A. (1)

One member of the annelid group has been reported from 9 different

species of the Neotropical *Hylidae*.

*Schmardaella lutzii*. 4 host species from Central and adjacent South America. 1 host species from Cuba. 2 host species from South America.

*Schmardaella* sp? (probably *S. lutzii*). 2 different host species from South America.

Three genera and 4 species of larval ticks have been recorded as feeding on 3 different host species of New World hylids.

\**Acariscus mansonii* U.S.A. (1)

\**Eutrombicula yorkei* S. Amer. (1)

\**Hannemania hylae* U.S.A. (1)

\**Hannemania newsteadi* S. Amer. (1)

Larval dipterans are reported from Australia and Europe (2 genera and 2 species) as parasitic in members of the *Hylidae*.

\**Batrachomyia* sp? Australia (1)

\**Lucilia bufonivora* E. (1)

One hemipteran is reported as feeding on a North American hylid

*Triatoma sanguisuga ambigua* U.S.A. (1)

Two genera and 2 species of bacteria have been isolated from host lesions, one from Cuba and one from Europe. *Borrelia cubensis* n. comb., is suggested for *Spirochaeta cubensis* Hoffman, 1923, inasmuch as the genus *Spirochaeta* s.s. is now reserved for the nonparasitic members of that group of organisms.

*Borrelia cubensis* Cuba (1)

*Micrococcus batrachorum* E. (1)

One mold has been isolated from skin lesions on a South American species of *Hyla* (*H. rubra*).

*Dermosporidium hyalarum* S. Amer. (1)

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