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ANNOUNCEMENT

STERKIANA is named after Dr. Victor Sterki (1846-1933) of New Philadelphia, Ohio, famed for his work on the Sphaeriidae, Pupillidae, and Valloniidae. It is fitting that this serial should bear his name both because of his association with the Midwest and his work on the living and Pleistocene non-marine Mollusca of North America.

STERKIANA is a quarterly founded in 1959 by a small group of workers on living and fossil non-marine Mollusca. It is issued as separate numbers, consecutively numbered, ten of which may be bound together to form a volume. Each number consists of some 50 pages or more.

The purpose of *STERKIANA* is to publish papers within its field which do not fit the format of other publications in size or illustrations. Because all the work on *STERKIANA* is contributed gratis, prices can be kept to a minimum (see rates below).

Notice of expiration of subscriptions is given on a single page bound as the last page of the last number paid for. No further notice is given.

STERKIANA accepts articles in English, French, and Spanish. Contributors are requested to avoid descriptions of new taxa as the printing process of *STERKIANA* can not supply photographic reproductions of good enough quality to illustrate new taxa. The editor accepts only papers that have been carefully edited and typed on one side of the paper only, on sheets 8½ X 11 inches and double-spaced throughout.

STERKIANA est une collection de travaux sur les mollusques extramarins publiés en anglais, français, et espagnol. L'abonnement annuel pour quatre numéros est de \$2.20 payable à *STERKIANA*. Les numéros parus sont tous disponibles aux prix ci-dessous. Adresser toute correspondance au rédacteur.

STERKIANA es una colección de trabajos sobre los Moluscos extramarinos vivos y fósiles. Se publican trabajos en inglés, francés y español. La correspondencia deberá ser dirigida al Editor.

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CATALOG OF INTRODUCED MOLLUSCS
OF EASTERN NORTH AMERICA
(NORTH OF MEXICO)

DEE S. DUNDEE

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INTRODUCTION

Daily, various foreign organisms are attempting to invade our continent. As Elton (1958) has said, 'no one really knows how many species have been spreading from their natural homes, but it must be tens of thousands....'

These arrive in shipments of goods such as automobiles, household goods, military cargo, luggage of tourists or as stowaways in part, but also 'one of the primary reasons for the spread and establishment of species has been quite simply the movement around the world of man or plants, especially those intentionally brought for crops or garden ornament or forestry' (Elton, 1958). It is also possible that a few arrive through means of their own, such as flying, drifting, or gradually spreading from adjacent areas.

These organisms come from various parts of the world, and there are many of them: corn boring beetles, plant nematodes, termites, moths, cockroaches, fruit flies, bollworms, fire ants, weevils, frogs, snakes, lizards, and even mammals and, as seen here, mollusks—just to name a few.

United States Department of Agriculture Plant Quarantine Division is doing a splendid job of attempting to defent the United States from these invaders. They are on duty at all of our ports of entry inspecting and quarantining materials containing these potential pests. Despite their continued vigilance, however, many of these organisms *do* slip by. Most of these live in cultivated areas or areas modified much by human activities. Only a minority penetrate into natural waters and woodlands. Not all of those that slip by, however, are *able* to become established in the new area in which they find themselves. A few of those which do manage to slip by and become established take over so completely that they drive out the natives.

The molluscan invaders are not limited to land. Both freshwater and marine areas are also involved. Over the years various ones of these mollusks have managed to become established at least well enough so that they have been reported as being present by various malacologists.

OBJECTIVE

The intent of this work is to provide a comprehensive list of the introduced land and freshwater mollusks of North America north of Mexico and east of the Rocky Mountains. This will include existing colonies verified by recent collecting, literature records wherein a species was reported to be established at one time (some may no longer exist if they did not become well established), private and museum collections and individual communications. Also, for comparative interest the interceptions of these mollusks by United States Department of Agriculture are listed.

PROCEDURES

Introductions: All organisms found in nature and those which are found in nurseries and greenhouses are herein considered introductions. The latter are included since they have the potential for becoming established in nature.

Interceptions: Those organisms which are intercepted at ports of entry by United States Department of Agriculture Plant Quarantine officials are not herein considered as truly introduced mollusks since they did not have an opportunity to become established. Those intercepted during the past 20 years will be included for comparison with those that have become established. Those intercepted which are not already established in North America will be grouped in the Appendix.

Initially, the plan was to include a record of each interception, the port at which the interception was made, and the material on which it (they) were found. This information, when compiled, was so voluminous (attributing to the excellent job our United States Department of Agriculture inspectors do!) that it had to be summarized. What appears under each species here is a *summary* of where interceptions have been made over the past 20 years, a list of the different types of materials on which the mollusks have been found, and the various ports from which they have come.

Literature Records: All literature records included here have been accepted without verification by the author who has neither funds nor time to travel to each locality to check on the introduction. An effort has been made to make this catalog as complete as possible; doubtlessly, there will be records which will have escaped attention. In some cases, it has been difficult to determine whether a species is truly an introduced one. South Florida fauna, for example, blends with the Antillean fauna to the point where it is very difficult to determine origins.

Systematics: The only effort made here to update, synonymize or in any way change the names used in the original literature has been, where necessary for clarity, to state equivalent names. This is not, in any sense, looked upon as a taxonomic work.

Museum Records: Those museum records which have been listed previously in the literature are treated as 'literature' records. The 'museum' records listed here are those not previously published and which the author has obtained directly from the museums. Museum records are designated in the text as follows:

American Museum of Natural History	AMNH
Charleston Natural History Museum	CNHM
Chicago Natural History Museum	CNHM
Delaware Museum of Natural History	DMNH

Fort Worth Museum of Science and History FWMH
 Museum of Comparative Zoology, Harvard MCZ
 Museum of Zoology, Univ. of Michigan UM
 National Museum of Canada NMC
 United States National Museum USNM

Author Collections: Collections made by the author and/or her students over the years and not previously published.

Other: Conversations with malacologists, letters, phone conversations. Several malacologists contributed numerous records. Those are designated as follows:

- 1) Drs. Lyle Chichester and Lowell Getz and their students (see acknowledgements): (GG)
- 2) Mr. Harold S. Finberg (HSF)
- 3) Mr. Leslie Hubricht (LH)
- 4) Mr. William L. Pratt (WP)
- 5) Dr. David H. Stansbery (DS)

General: A particular locality is listed herein only once for a species even though there may be several literature and/or museum records for that locality. The first record encountered by the author for a particular species in a given locality was the one used.

In some cases where Pilsbry listed a locality, the author was unable to determine where his information came from, since he chose not to include many references. Therefore, such records are listed herein as '(Pilsbry,)'.

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For providing records of their own: those individuals previously listed.

For doing an excellent typing job despite my poor handwriting: Mrs. Patti Ducote.

For accompanying me on various trips and helping with various aspects: Dr. Harold Dundee.

I also owe thanks to Dr. Daniel Stern, now of the University of Kansas City, who did part of the literature search at a time when he was at the same institution as I and it appeared that we could jointly complete this work.

CLASS GASTROPODA

SUBCLASS PROSOBRANCHIA

ORDER MESOGASTROPODA

Superfamily Viviparacea

FAMILY VIVIPARIDAE

Viviparus malleatus (Reeve)
 = *V. japonicus* von Martens

LITERATURE

- ARIZONA: Tucson (1962), pond on University of Arizona campus (Clench and Fuller, 1965).
 Now extinct (Bequaert and Morris, 1973)
- DELAWARE: Milford in Silver Lake, Sussex County (Clench and Fuller, 1965)
- FLORIDA: St. Petersburg (Abbott, 1950)
- MAINE: Waterville in Messalonskee River (Clench and Fuller, 1965)
- MASSACHUSETTS: Boston-Brookline border in Muddy River (Johnson, 1915); Boston, in Public Garden (Johnson, 1915); Worcester in Lake Quinsigamond (Johnson, 1918); Weymouth in Whitman's Pond (Clench, 1940); Boston, being sold in Chinese quarter (Clench, 1940); Blue Hills Reservation, Houghton Pond (Clench, 1940); Jamaica Pond (Johnson, 1923); Concord River at Concord (Clench and Fuller, 1965); Milton in Pine Tree Brook and Pond; in Blue Hills Reservoir; in Turner's Pond (all in Norfolk County); Boston in Leverett Pond, Jamaica Pond, and Muddy River (Clench and Fuller, 1965); Dover, 1 mile S in Hawes Pond, Brookline and Trout Brook; Lexington, in Peacock Pond; Melrose in pond on Mt. Hood; Lynnfield in Pillings Pond (all Clench & Fuller, 1965)
- MICHIGAN: Jackson in Sparks Park (Clench and Fuller, 1965); Kalamazoo River, 2 miles W Albion (Clench and Fuller, 1965); Red Cedar River, E Lansing (Clench and Fuller, 1965)
- MINNESOTA: Mississippi River at St. Cloud (Dawley, 1944)
- NEW HAMPSHIRE: Rochester in Cochecho River (Peron and Probert, 1973)
- NEW JERSEY: Princeton-Raritan Canal; Menlo Park, Arlington (Clench and Fuller, 1965); Arlington (Richards and Adams, 1929)
- NEW YORK: Niagara Falls off Cayuga Island (Schmeck, 1942); Yonkers, Saw Mill River (Clench and Fuller, 1965); Gashen; Poughkeepsie in Bahnet's Pond; Queen's Village, Freeport (Clench and Fuller, 1965)
- NORTH CAROLINA: Greenville, Pitt County (Clench and Fuller, 1965)
- OHIO: East End Cove, Lake Erie, Sandusky (Clench and Fuller, 1965); Cleveland (Clench and Fuller, 1965)
- OKLAHOMA: Stillwater, Payne County; Ardmore County (Clench and Fuller, 1965); Payne County (Branson, 1959); Carter County (Branson, 1959)

PENNSYLVANIA: Philadelphia in Fairmount Park and Schuylkill River (Richards and Adams, 1929); Lancaster-Hen's Ice Pond; Lake Duffy near Mt. Greta in Lebanon, Haverford College Pond (Clench and Fuller, 1965)

RHODE ISLAND: Hamilton in Nannacatucket River, Washington County

TEXAS: Waco (Clench and Fuller, 1965)

VERMONT: Thetford Center in Lake Fairlee, Orange County; Quechee in Ottauquechee River in Windsor County

ONTARIO: Ottawa (La Rocque, 1953)

MUSEUMS

DELAWARE: Milford in Silver Lake (MCZ)

FLORIDA: Lake Morton, Polk County; Mirror Lake at St. Petersburg (ANSP)

MARYLAND: ¼ mile below Woodrow Wilson Bridge, Prince Georges County in Potomac (ANSP); Lily Pond (MCZ)

MASSACHUSETTS: Fitchburg in Putnam Pond (DMNH); Milton in Pine Tree Brook (DMNH); Melrose at Mt. Hood (MCZ); Lexington: pond at Grore Street and Route 28 (MCZ)

MICHIGAN: 2 miles W Albion, Calhoun County (ANSP)

NEBRASKA: Biology Pond, Doane Collection at Crete (ANSP)

NEW JERSEY: Tenafly in Roosevelt Commons Pond (DMNH); High Point Park in Sawmill Lake (DMNH); Delaware River (ANSP); Asbury Park (ANSP); Milstone River, Kingston; Riverton (ANSP); Menlo Park, Shiner Pond (MCZ)

NEW YORK: New York City, in Central Park (DMNH); Lily Pond, Long Island (MCZ); Queens Village, Long Island (MCZ)

PENNSYLVANIA: ½ mile W Mt. Greta, Lebanon County (ANSP); Mt. Airy; Mill Creek near Bryn Mawr (ANSP); Delaware Canal at Bristol (ANSP)

TEXAS: Dallas County; Tarrant County (FWMNH, Pratt)

WISCONSIN: 10 miles N Green Bay in Green Bay (MCZ); Willow River in Hudson (MCZ)

OTHER

ARIZONA: Tucson on University of Arizona Campus in 1962. No longer there (A.R. Mead)

OHIO: SBass Island in Terwilliger's Pond (DS)
ORIGINAL DISTRIBUTION: Japan

Viviparus viviparus Linnaeus

LITERATURE

EASTERN CANADA: Upper parts of St. Lawrence Estuary (Bousfield, 1955)

QUEBEC: St. Lawrence S shore; Lévis, St. Michel Plage, St. Vallier, Berthier, Montmagny, L'Islet, St. Jean Port Joli, St. Roch des Aulnaies. N. Shore: Chateau Richer, St. Joseph de la Rive, Cap Tourmente, Pte-au-Pic (Bousfield, 1955)

MUSEUMS

MARYLAND: C & O Canal-Seneca, Maryland (NMNH)

WASHINGTON, D. C.: Potomac River--several locations (NMNH) Georgetown

QUEBEC: 2 miles S Iberville (NMNH)

ORIGINAL DISTRIBUTION: Europe

ORDER MESOGASTROPODA

SUPERFAMILY ARCHITAENIOGLOSSA

FAMILY AMPULLARIIDAE

Pomacea paludosa (Say)

LITERATURE

OKLAHOMA: Oklahoma City -- Bell Water Gardens (Branson, 1961)

MUSEUMS

FLORIDA: Cocoa Beach (ANSP); Many Florida records (ANSP); Fort Mead (CNMH); Orlando (CNMH); Aripikoa (CNHM); Lake George (CNHM); Holmes County (CNHM); Lake Jessup (CNHM); Tavares--2 miles E (CNHM); Wakulla River (CNHM); Silver Springs (CNHM); Kissimmee (CNHM); Lake Opokee (CNHM); St. Petersburg

(CNHM); Lake Berisford (CNHM); Everglades (CNHM); Many Florida records (UM); 16 E Everglades in Collier Count (AM); Royal Palm Park (AM); Cedar Keys; Lake Okeechobee (MCZ); Everglades near Miami (MCZ); Paradise Key (MCZ); Tamiami Trail 6 miles E of Everglades (MCZ)

GEORGIA: Hopeton (MCZ)

OTHER

FLORIDA: Clewiston (HSF)

LOUISIANA: New Orleans in Bayou St. John (present through approximately 1965; no longer there--Dundee)

ORIGINAL DISTRIBUTION: Hispaniola

Marisa cornuarietis (Linnaeus)

LITERATURE

FLORIDA: Coral Gables: W boundary in canal, extends W to Everglades (Hunt, 1958); Sold in Miami (Robins 1971); drainage canals in Metro Dade County (Robins, 1971); Everglades East of Ft. Myers (Robins, 1971)

MUSEUMS

FLORIDA: Miami Springs in Ludlam Canal (AM)

ORIGINAL DISTRIBUTION: Northern South America and southern Central America

SUPERFAMILY VALVATACEA

FAMILY VALVATIDAE

Valvata piscinalis (Müller)

LITERATURE

NEW YORK: Angola (on Lake Erie); Lake Erie; Erie County; Monroe County (LaRocque, 1953)

ONTARIO: Toronto Bay (1890) (Latchford, 1914, 1930); Lake Ontario (1899) (Oughton, 1938) at: Niagara-on-the-Lake, Port Weller, Port Dalhousie, Long Branch, mouth of Humber River, Toronto Island, Oshawa, Cobourg, Port Hope, Bay of Quinte. Cornwall; Toronto (La Rocque, 1953)

MUSEUMS

NEW YORK: Lake Ontario, Summerville (UM)

ONTARIO: N shore Hay Bay in Lennox County (ANSP); Lake Erie in Kent County (ANSP); Ponds adjoining Lake Ontario (UM); Lake Ontario at Toronto (UM); Hunters Bay, Toronto (UM); Sunnyside Beach, Lake Ontario, Toronto (UM); Humber Bay, Sunnyside, Toronto (UM); Niagara-on-the-Lake, Lincoln County (UM)

ORIGINAL DISTRIBUTION: Europe

Bithynia tentaculata (Linnaeus)
(= *Bulimus tentaculata*)

LITERATURE

- ILLINOIS: Chicago (1889) (Abbott, 1950)
MICHIGAN: Black Lake in Holland (1891) (Abbott, 1950)
NEW YORK: Oswego (1879) (Abbott, 1950); W. Troy (Ancey, 1880); Albany to Buffalo in Barge Canals (1889) (Abbott, 1950)
OHIO: Ashtabula in Lake Erie (1888) (Abbott, 1950); Sandusky and Toledo (1911) (Abbott, 1950)
VERMONT: Burlington (1890) (Abbott, 1950) Lake Champlain
VIRGINIA: Alexandria in the Potomac River (1927) (only shells taken in 1932) (Pilsbry, 1932)
WASHINGTON, D.C.: (1927) (Abbott, 1950)
ONTARIO: Cornwall (Latchford, 1914); Toronto Bay Island (Latchford, 1914)

MUSEUMS

- ILLINOIS: Beach at Highland Park; lakeshore near Chicago
MICHIGAN: Muskegon Lake in Muskegon (ANSP)
NEW YORK: Oneida Lake, Lower S Bay (ANSP); Erie Canal at Herkimer, Rochester, Baldwinsville (ANSP); Monroe County (ANSP); S end Seneca L. in Watkins Glen (ANSP); Champlain Canal, Troy (ANSP); Oswego Harbor (ANSP); Cohoes (ANSP); Niagara Falls (ANSP); W Troy (ANSP); Albany (ANSP); Syracuse (ANSP); Squaw Island near Buffalo (ANSP); Liverpool (NMNH); Lockport: barge canal (NMNH)
OHIO: S Bass Island in Lake Erie (1950) (DS)
PENNSYLVANIA: Erie (NMNH)
VERMONT: Cedar Beach on Lake Champlain
VIRGINIA: Potomac River at Boling Field; Potomac River near Jones Point Landing; Potomac River 1 mile S Alexandria; Potomac River 1.5 miles above Mt. Vernon (NMNH)
WASHINGTON, D.C.: Tidal Basin (NMNH)
WISCONSIN: Lake Michigan at Milwaukee (NMNH)
ONTARIO: Near Prescott; Canal, Cornwall; Toronto Bay; Lake St. Francis on St. Lawrence; St. Joseph Island; Trenton; Cataraqui Bay; Genessee River at Lake Ontario; Bay of Quinte Lake Ontario; Grenadier Island; Eagle Island, St. Lawrence River; Leeds County (NMNH)

QUEBEC: Lake St. Louis, Lachine (NMNH)

OTHER

- NEW YORK: Amnsville Creek in Westchester County (HSF)
QUEBEC: St. Lawrence and Champlain River junction (HSF)

FAMILY HOMALOGYRIDAE

Homalogyra atomus (Philippi)
LITERATURE

- RHODE ISLAND: Newport (Morse, 1909)
NEW HAMPSHIRE: Hampton Beach (Morse, 1909)

SUPERFAMILY CERITHIACEA

FAMILY MELANIIDAE

Tarebia (= *Thiara*) *granifera* Lamarck
LITERATURE

- FLORIDA: Lithia Spring, Hillsborough County (Abbott, 1952)

TEXAS: San Antonio River; Bexar County; Landa Park; New Braunfels; Comal County, Murray, 1964)

FAMILY MELANIIDAE

Melanooides (= *Thiara*) *tuberculata* (Müller)
LITERATURE

- ARIZONA: Phoenix (present prior to 1955-56 but not there now. Murray, 1971)
FLORIDA: Coral Gables in Lake Osceola on University Miami Campus (Murray, 1971); Miami north side in Greynolds Park (Murray, 1971); Hillsboro State Park, Hillsboro County (Murray, 1971)
TEXAS: San Antonio River, Bexar County (Murray, 1964)

OTHER

- ARIZONA: Del Rio W to Phoenix and into Sunnyside, Nevada; spreading in Mojave Desert (personal communication, Dr. Roy Irwin)
TEXAS: Headwaters of Las Moras Creek, Brackettville, Kinney County (personal communication, Dr. Harold Murray, 1972)
ORIGINAL DISTRIBUTION: Orient

SUBCLASS PULMONATA

ORDER BASOMMATOPHORA

Superfamily Actophila

FAMILY ELLOBIIDAE

Carychium minimum (Miller)

LITERATURE

- MASSACHUSETTS: Quincy (Clapp, 1912)
ORIGINAL DISTRIBUTION: Europe

Superfamily Hygrophila

FAMILY PHYSIDAE

Physa acuta Draparnaud

LITERATURE

- VIRGINIA: Hampton Beach in Bethel Reservoir and Rice's Fossil Pit (Beetle, 1973); Newport News in Lake Maury (Beetle, 1973); York County in Warmley Pond in Colonial National Historical Park (Beetle, 1973). Virginia Beach: on N Carolina border on Hwy 65 in pond behind beach at Cuartuck Sound
MUSEUMS

- MARYLAND: Pools adjacent to C & O Canal, Potomac River 12 miles N D.C. (ANSP)
NEW JERSEY: Harry's Brook, Princeton (ANSP)
ORIGINAL DISTRIBUTION: Europe

FAMILY LYMNAEIDAE

Lymnaea auricularia Linnaeus
LITERATURE

- COLORADO: Colorado Springs: Monument Creek at 6000' (Henderson, 1912); Fowler, in nearby Dotson Reservoir (Henderson, 1919)
ILLINOIS: Chicago: Lincoln Park (Baker, 1901)

KENTUCKY: Eastern Kentucky University Campus (Branson and Batch, 1969)
 MASSACHUSETTS: Boston: Charles River (1913)
 NEW MEXICO: Lake Roberts on Gila River in Grant County (1966); Deming: 8 miles SE in Luna County (Metcalf and Smartt, 1972)
 OHIO: Toledo: NE border 100' from Maumee Bay, Lake Erie (Goodrich, 1911)
 PENNSYLVANIA: Philadelphia: Dobbins Pond (Long, 1912)
 ONTARIO: Kingsville, in Lake Erie opposite Sandusky (Allen, 1911); Toronto: Owen Sound (Latchford, 1930)

MUSEUMS

COLORADO: Palmer Lake (AM)
 MASSACHUSETTS: Cambridge (MCZ)
 MICHIGAN: Lake Huron below Harbor Beach (ANSP) Maple Beach and Stoney Island in Wayne County (MCZ)
 NEW JERSEY: Montclair (MCZ); Arlington (MCZ); Bloomfield in Davy's (AM)
 NEW MEXICO: Murph Lake Reservoir 5 miles N Le-doux, Mora County (ANSP)
 NEW YORK: Prospect Park in Brooklyn (ANSP)
 OHIO: Drift of Lake Erie, Bay Pt, Ottawa County (ANSP)
 PENNSYLVANIA: Willow Grove, Montgomery County (ANSP); Tacomy Creek below Crescentville (ANSP); Philadelphia County (ANSP) Ashbourne (ANSP); Montgomery County (ANSP) Bethlehem (ANSP); Lancaster in Little Conestoga Creek (MCZ)
 VERMONT: Shaftsbury (MCZ)

OTHER

ARIZONA: Tucson in ponds (A. R. Mead)
 NEW YORK: Bronx County in hothouses (HSF)
 ORIGINAL DISTRIBUTION: Recorded in U. S. Miocene and Pliocene; doubtful introduction but included since others consider it as introduced. NW Europe, type locality: Sweden

ORDER STYLOMMATOPHORA

Superfamily Soleolifera

FAMILY VERONICELLIDAE

Veronicella ameghini (Gambetta)

LITERATURE

LOUISIANA: Lafayette: Greenhouse and grounds of Southwestern University (1970) (Dundee, Stutts, Herman, 1971)

AUTHOR COLLECTIONS

ALABAMA: Mobile in Magnolia Cemetery, old Church Street Cemetery; Oaklawn Cemetery (Introduced ca. 1960)
 FLORIDA: Miami; Pensacola; St. Augustine
 LOUISIANA: New Orleans, numerous localities throughout city; introduced ca. 1960
 MISSISSIPPI: Poplarville: in cemetery; Luce-date in cemetery; Hattiesburg, introduced ca. 1966

OTHER

FLORIDA: Tallahassee (personal communication W. Heard, 1973)
 ORIGINAL DISTRIBUTION: Brazil

Veronicella moreleti (Crosse and Fischer)

OTHER

TEXAS: Brownsville, in nursery; Raymondville (USDA memo, 1968). Hidalgo County in nursery (1968) (USDA Cooperative Economic Insect Report, p. 238). Willacy County, in nursery. Cameron County (1968) (Cooperative Economic Insect Report, p. 285)

INTERCEPTIONS: (U.S. Dept. of Agriculture) Collected at ports in: Florida, Louisiana, Pennsylvania, South Carolina, Texas
 Collected in or on: banana, orchid, palm leaf

Imported from: Canal Zone, Costa Rica, Honduras, Mexico, Jamaica
 ORIGINAL DISTRIBUTION: Mexico

Veronicella occidentalis (Guilding)

LITERATURE

OKLAHOMA: Guthrie (greenhouse) Branson, 1962
 OTHER

TEXAS: Raymondville, McAllen (USDA memo, 1968)
 INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Florida, Louisiana, New York, Texas

Collected in or on: bromeliad, caladium, *Dracaena* sp., *Ficus*, orchid, palm, pineapple, philodendron

Imported from: Canal Zone, Colombia, El Salvador, Ecuador, Guatemala, Haiti, Honduras, Mexico, Panama
 ORIGINAL DISTRIBUTION: Southern Mexico, north-western South America, Antilles

Veronicella krausii (Férussac)

LITERATURE

OKLAHOMA: Oklahoma City (greenhouse) (Branson, 1962)

ORIGINAL DISTRIBUTION: Cuba, Puerto Rico, Jamaica

Veronicella sloanii sloanii (Cuvier)

LITERATURE

MASSACHUSETTS: Nantucket (Baker, 1925)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Florida

Collected in or on: orchid

Imported from: Jamaica

Original Distribution: West Indies

Veronicellid or Vaginulid

LITERATURE

PENNSYLVANIA: University Pennsylvania, Philadelphia (greenhouse) (Baker, 1925)

OTHER

TEXAS: Raymondville, McAllen, Edinburg, San Benito (USDA memo, 1968)

SUPERFAMILY ACHATINACEA

FAMILY FERUSSACIIDAE

Cecilioides acicula (Miller)

LITERATURE

FLORIDA: 2 mines N Miami (Clapp, 1915)

MARYLAND: Carroll County: Westminster (Grimm, 1958); Baltimore (Grimm, 1971)

PENNSYLVANIA: Mill Creek, near Black Rock Road; Bryn Mawr, Montgomery County (Pilsbry 1946); Kutztown, Berks County (Sine, 1966)

MUSEUMS

NEW JERSEY: Princeton (ANSP)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Florida, Massachusetts, Michigan, New York, Pennsylvania

Collected in or on: bulb, cactus, carrot, celery, clover, dahlia, gladiolus, lemon plant, orchid, plants, soil, violet

Imported from: British Honduras, Canal Zone, Czechoslovakia, France, Germany, Greece, Israel, Italy, Mexico, Netherlands, Panama, Turkey

ORIGINAL DISTRIBUTION: Central and W Europe

Cecilioides aperta (Swainson)

LITERATURE

FLORIDA: S side Miami River, 2 miles up; Coral Gables (Pilsbry, 1946)

NEW JERSEY: Princeton, greenhouse (Alexander, 1952)

TEXAS: San Antonio: Olmos Park; San Antonio River ½ mile W of State Insane Asylum, Bexar County (Pilsbry, 1950)

OTHER

TEXAS: Tarrant County: Pratt, personal collection

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Florida, Massachusetts, New Jersey

Collected in or on: cafirbread, root, rosemary, soil

Imported from: Azores, Cuba, Dominican Republic, Kenya

ORIGINAL DISTRIBUTION: West Indies

FAMILY SUBULINIDAE

Subulina octona (Bruguère)

(=*Opeas mauritianum* (Pfeiffer))

LITERATURE

FLORIDA: Islamodora Key (Branson, 1969); Brickell's Hammock, Miami; Little River; Coral Gables (Pilsbry, 1946)

NEW YORK: Queens County in greenhouses (Karlin and Naegele 1960)

PENNSYLVANIA: Roxborough section of Philadelphia (Anonymous, 1893); Philadelphia greenhouse (Vanatta, 1916)

VIRGINIA: Arlington (Beetle, 1973)

MUSEUMS

FLORIDA: Palm Beach County (MCZ); Marathon on Key Vaca (AM) Miami (CNHM); Homestead (CNHM); Key West Cemetery (CNHM); Okeechobee Road, Bueson's Park, Dade County (CNHM); Brickell's Hammock (ANSP); Little River in nursery (MCZ); Miami: coconut grove on Fairchild Estates (MCZ)

PENNSYLVANIA: Philadelphia (CNHM)

WASHINGTON, D.C.: in greenhouse (MCZ)

AUTHOR COLLECTIONS

FLORIDA: Miami (1965)

OTHER

FLORIDA: Coconut Grove in Dade County (HSF) Stock Island in Monroe (HSF); Coral Gables (HSF)

NEW YORK: Bronx Botanical Gardens (HSF)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Arizona, Florida, Louisiana, New York, Pennsylvania, Texas, Washington, D.C.

Collected in or on: aquatic plants, auto, bromeliad, chrysanthemum, Dion root, 4 o'clocks, orchid, palm leaf, soil with Kalanchoe

Imported from: Bahamas, Brazil, Ecuador, Guam, Guatemala, Honduras, Jamaica, Malaysia, Martinique, Mexico, Netherlands, Nicragua, Panama, Peru, Philippines, Singapore, Thailand, Trinidad

ORIGINAL DISTRIBUTION: Tropical America

Lamellaxis gracilis (Hutton)

LITERATURE

ALABAMA: Birmingham (Wheeler and Archer, 1938); Mobile (Smith, 1912)

FLORIDA: Key West (Smith, 1912); Fort Dallas (Miami) (Binney, 1865; Rhodes, 1938)

GEORGIA: Savannah (Pilsbry, 1946) Chatham (Hubricht, 1964)

LOUISIANA: New Orleans and Baton Rouge (Harry, 1948); Donaldsonville (Harry, 1948)

MISSOURI: St. Louis in greenhouses (Hubricht, 1972)

NEW YORK: Nassau and Suffolk Counties (Karlin and Naegele, 1960)

SOUTH CAROLINA: Charleston (Smith, 1912); Columbia (Townes, 1957)

VIRGINIA: Norfolk, Pittsylvania (Hubricht, 1971)

MUSEUMS

ALABAMA: Montgomery (UM)

FLORIDA: St. Petersburg (ANSP); 10 miles N Blountstown, Calhoun County (ANSP); 424 Hunting Lodge Road - Miami Springs (AM); Ft. Myers (ANSP); Key West (ANSP); Pinecrest (ANSP); Venice Gardens (DMNH); City Park, Tampa (NMNH); Key West (NMNH); Rollins College (NMNH); Brickells Park (NMNH); Deland (NMNH); Tampa (MCZ); W Miami (MCZ); Ft. Myers (MCZ); Long Pine Key (UM)

GEORGIA: Between Savannah and Thunderbolt, Chatham County (UM)

ILLINOIS: Springfield: University of Illinois greenhouse (ANSP)

LOUISIANA: Amelia, Hwy 90 (UM)

NEW YORK: Bayport, Long Island (AM)

TEXAS: Victoria (MCZ); Waco 18 th and Maple (MCZ); Tarrant (FWMSH); Dallas (DMNH); El Paso (NMNH)

AUTHOR COLLECTIONS

ALABAMA: Numerous localities in Mobile

FLORIDA: Pensacola, Jacksonville, St. Augustine, Miami

LOUISIANA: Lake Charles, Ponchatoula, Buras, Belle Chase, Boothville, numerous localities in New Orleans, 3 miles E Chacahoula, Jeanerette

MISSISSIPPI: Biloxi, Bay St. Louis, Hattiesburg, Poplarville, Pass Christian, Gulfport, Moss Point, Natchez, Picayune, Pensacola

TEXAS: Houston, Beaumont, Galveston

OTHER

ARIZONA: In drift of Santa Cruz River at Amado (A.R. Mead)

FLORIDA: Surfside (HSF); Miami (HSF); Clearwater in Pinellas County (HSF); Seminole County along Railroad, Longwood (Hubricht); Marion County, Wiersdale (Hubricht); Lake County, North Bay Street and Laurel Oak Drive, Eustis (Hubricht); Alachua County Sink, NW 6th Street near NW 7th Street, High Springs (Hubricht); Suwannee County along Railroad, Branford (Hubricht); Polk County near Lake Kissamee, 7 miles E Lake Estates (Hubricht); Gochland Nurseries, Pembroke

(Hubricht); Bay County near pond, W Panama City Beach (Hubricht); Citrus County near Lake Tsula, Hernando (Hubricht)
ORIGINAL DISTRIBUTION: Tropics of Old and New World

INTERCEPTIONS (U.S. Dept. of Agriculture)

Collected at ports in: Arizona, Florida, Texas

Collected in or on: orchids, bromelias, ferns, herbs, palms

Imported from: American Samoa, Aruba, Cuba, Ecuador, Guam, Hong Kong, Mexico, Nicaragua, Peru, Venezuela

Lamellaxis micra (d'Orbigny)

LITERATURE

FLORIDA: Garden Key, Dry Tortugas (Clapp, 1911); Key West (Vanatta, 1912); Miami (Pilsbry, 1946)

WASHINGTON, D.C.: Greenhouse (Grimm, 1971)

MUSEUMS

ALABAMA: Mobile (USNM)

FLORIDA: 2 miles W Dania, Broward County (UM); Calhoun County (ANSP); Miami (CNHM); Key West Cemetery (CNHM); Palm Beach (CNHM) 3 miles S of Palm Beach (CNHM); 7 miles N of Palm Beach (CNHM); Tampa (CNHM); Little River (CNHM); St. Petersburg (CNHM)

MARYLAND: Beltsville (USNM); Glendale (USNM)

TEXAS: Aransas County, Mustand Island (MCZ)

AUTHOR COLLECTIONS

ALABAMA: Brewton

FLORIDA: Pensacola

LOUISIANA: Bogalusa, Lafitte, Ponchatoula,

Baton Rouge, Natchitoches, New Orleans

MISSISSIPPI: Picayune, Natchez, Lucedale

OTHER

FLORIDA: Tarpon Springs (HSF); Clewston in Hendry (HSF); Hendry County under palm, jct. Fla 833 and Fla 832, SW of Clewiston (Hubricht, personal communication); Martin County, Port Salerno (Hubricht, personal communication)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Arizona, Florida, Louisiana, New Jersey, New York, South Carolina, Texas

Collected in or on: banana, cactus, ferns, herbs, moss, orchid, palms, walnut log

Imported from: Barbados, British Honduras, Cuba, Dominican Republic, Ecuador, Guatemala, Hawaii, Jamaica, Mexico, Nicaragua, Peru

ORIGINAL DISTRIBUTION: West Indies, Mexico to Bolivia

Lamellaxis mauritanus (Pfeiffer)

LITERATURE

ILLINOIS: in greenhouse (Pilsbry, 1946)

MISSOURI: St. Louis in greenhouses (Hubricht, 1972)

NEW YORK: Hothouses (Pilsbry, 1946); Bird house in Bronx Zoo (Feinberg, 1962)

WASHINGTON, D.C.: in greenhouse (Pilsbry, 1946)

MUSEUMS

FLORIDA: Old cemetery in Key West (CNHM); St. Petersburg (CNHM)

ILLINOIS: Urbana (ANSP); Chicago (USNM); Thatcher Woods, River Forest in Cook County (CNHM)

NEW YORK: Buffalo (ANSP)

PENNSYLVANIA: Philadelphia (ANSP)

OTHER

NEW YORK: Bronx Zoo in New York City (HSF)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Florida

Collected in or on: mint

Imported from: Cuba

ORIGINAL DISTRIBUTION: Tropics

Lamellaxis clavulinus (Potiez and Michaud)

LITERATURE

GEORGIA: Athens - 710 E. Broad (Dundee and Hermann, 1968)

MASSACHUSETTS: Cambridge in greenhouse (Pilsbry, 1912)

MISSOURI: St. Louis in greenhouses (Hubricht, 1972)

NEW YORK: Buffalo in a Bigonia House (Clapp, 1912)

PENNSYLVANIA: Phipps Conservatory, Pittsburgh (Pilsbry, 1946)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: New York, South Carolina

Collected in or on: papaya, stores

Imported from Okinawa

ORIGINAL DISTRIBUTION: Hawaii, Japan, Islands of Indian Ocean

Opeas junceus Gould (=operanum)

MUSEUMS

VIRGINIA: Charles Island (DMNH)

ORIGINAL DISTRIBUTION: New World Tropics

Opeas pumilum (Pfeiffer)

LITERATURE

FLORIDA: Dismal Key (Pilsbry, 1927); Buttonwood Key, Lee County (Vanatta, 1921)

GEORGIA: Savannah (Pilsbry, 1927)

ILLINOIS: Chicago in Garfield Park greenhouse

MISSOURI: St. Louis in greenhouse (Hubricht, 1972)

NEW YORK: Bronx Park, New York City (Pilsbry, 1927); Nassau and Suffolk Counties (Karlin and Naegele 1960)

PENNSYLVANIA: Pittsburgh (Pilsbry, 1946); Philadelphia (Pilsbry, 1927; Vanatta, 1919)

MUSEUMS

NEW YORK: Abraham Rose House: Bayport, Long Island (AM)

OTHER

TEXAS: Dallas Garden Center, Dallas County (personal communication, Dr. Fullington)

INTERCEPTIONS (U.S. Dept. of Agriculture)

Collected at ports in: Florida, New York, Pennsylvania, Texas

Collected in or on: auto, bromeliad, Dracaena, mixed plants, orchid soil

Imported from: Bahamas, Bermuda, British Honduras, Guatemala, Mexico, Nicaragua

ORIGINAL DISTRIBUTION: Tropical America

Opeas octonoides (C. B. Adams)

LITERATURE

FLORIDA: Miami: along Miami River (Rhoades, 1899)

ORIGINAL DISTRIBUTION: Tropical America

Opeas pyrgula (Schmacker and Boettger)

LITERATURE

ALABAMA: Adams, Dallas, Houston, Macon, Mobile, Montgomery Counties (Hubricht, 1965)

GEORGIA: Chatham, Richmond, and Fulton Counties (Hubricht, 1964)

MARYLAND: Baltimore (Grimm, 1971)

NORTH CAROLINA: Wayne County (Hubricht, 1970)

PENNSYLVANIA: Philadelphia (northern, in yards) (Pilsbry, 1946)

SOUTH CAROLINA: Charleston (Hubricht, 1971)

TENNESSEE: Hamilton County (Hubricht, 1973)
 VIRGINIA: Norfolk County (Hubricht, 1971);
 Clarke (Beetle, 1973)
 WASHINGTON, D.C.: (Grimm, 1971)

MUSEUMS

FLORIDA: Homestead (CNHM); Coconut Grove (CNHM)
 LOUISIANA: New Orleans (ANSP)

OTHER

ALABAMA: Mobile along Railroad, Grand Bay; vacant lot, 1915 St. Stephens Road, Pritchard
 FLORIDA: Jacksonville (HSF); Alachua County sink, NW 6th Street near NW 7th Street, High Springs; Lake County, North Bay Street and Laurel Oak Drive, Eustis, Orlando in Orange County (HSF)

LOUISIANA: St. Bernard County roadside, Ys-closkey; Low woods 1.3 miles northwest of Veret

MISSISSIPPI: Jackson roadside, 1 mile N of D'Iberville

NORTH CAROLINA: Asheville in Buncomb County (HSF)

TENNESSEE: Knoxville on University of Tennessee Campus in Knox County (HSF)

TEXAS: San Antonio (HSF)

INTERCEPTIONS (U.S. Dept. of Agriculture)

Collected at ports in: Florida, Massachusetts, New Jersey, New York, Pennsylvania, Texas, Virginia

Collected in or on: orchid, soil

Imported from: Bermuda, British Honduras, Guam, Japan, Vietnam

ORIGINAL DISTRIBUTION: China, Japan

FAMILY ACHATINIDAE

Rumina decollata Linné

LITERATURE

ALABAMA: Mobile (Smith, 1912); Dallas, Montgomery, Perry & Pike Counties (Hubricht, 1965); Demopolis (Pilsbry, 1946)

ARIZONA: Mesa; Phoenix; Tucson, Yuma, Prescott, Tempe, Mesa (Mead, 1953)

FLORIDA: Pensacola (van Hying, T., 1938)

GEORGIA: Savannah (Rascop, 1960); Richmond County (Hubricht, 1964)

LOUISIANA: New Orleans; E Baton Rouge Parish (Viosca, 1928)

MISSISSIPPI: Bay St. Louis (Pilsbry, 1946)

NORTH CAROLINA: Brunswick and New Hanover Counties (Hubricht, 1970); Wilmington in Greenfield Lake (Pilsbry, 1946)

OKLAHOMA: Ada (Branson, 1959)

SOUTH CAROLINA: Columbia; W Columbia; Aiken (Hubricht, 1953); Charleston in 1822 (Townes, 1957); Beaufort, Richmond (Hubricht, 1971)

TEXAS: El Paso (Metcalf, 1968); Brownsville (Ferriss, 1914); Dallas; ½ mile SW Greene, on Guadalupe River; San Antonio; Houston (Cheatum, 1934); Brewster, Irion, Runnels, Comal, Scurry, Coryell, Terrell, Menard, Uvalde Counties (Cheatum, Fullington, Pratt, 1972); Austin, Waco (Strecker, 1935); New Braunfels (Wheeler, 1949); Georgetown (Branson, 1959); Schulenberg, Corpus Christi, Del Rio (Pilsbry, 1946)

VIRGINIA: Norfolk County (Hubricht, 1971)

MUSEUMS

ARIZONA: Yuma (NMNH)

LOUISIANA: New Orleans in Jackson Square (CNHM)

NEW MEXICO: Las Cruces (NMNH); Albuquerque (NMNH)

NORTH CAROLINA: Wilmington (ANSP); Beaufort (CNHM)

SOUTH CAROLINA: Moultrie on Sullivan's Island (MCZ); Cronsley (CNHM)

TEXAS: Lampasas (CNHM); Laredo: 50 miles N (CNHM); San Antonio: Medina Lake (CNHM); Belton (CNHM); Hondo (CNHM); McGregor (CNHM); Schleicher County: 12 W of El Dorado (MCZ); Bryan (MCZ); Alpine (MCZ); Charlotte, Chambers County (MCZ); Karnes County, 3 miles SW Runge (MCZ); NW corner Roundrock, Williamson County (ANSP); E side Padre Island (ANSP); Hayes County (ANSP); Del Rio (ANSP); Corpus Christi (ANSP); Mission in Hidalgo County (NMNH); Camp Bullis in Bexar County (NMNH); Big Spring (NMNH); Fort Worth (NMNH); Concan in Uvalde County (MCZ); La Grange in Fayette County (MCZ); Laredo (MCZ); Bandera Falls in Bandera County (MCZ); Bergheim in Kendall County (MCZ); Brownsville (MCZ); Navasota (MCZ); Utopia (MCZ); 2 miles S Rio Frio in Uvalde County (MCZ); Ogelsby, Coryell County (MCZ); Seguin, Guadalupe County (CNHM); Comal (CNHM) Sanger: 2 miles S (CNHM); San Marcos, State Fish Hatchery (MCZ)

AUTHOR COLLECTIONS

ALABAMA: Grove Hill; Montgomery

LOUISIANA: New Orleans (numerous localities)

TEXAS: 4 miles SE Dripping Springs; Beaumont; Austin

OTHER

TEXAS: San Antonio (Murray, personal communication) common in yards

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: New York, Texas, Virginia

Collected in or on: baggage, cactus, coleus, military cargo, mint, orchid, palm, plum seedling, seed, soil

Imported from: Bermuda, Guatemala, Mexico, Morocco

ORIGINAL DISTRIBUTION: Mediterranean Area: Europe, Asia, Africa

Achatina fulica Bowdich

LITERATURE

For an exhaustive treatment of information about this species the reader is referred to Mead, 1961

MUSEUMS

FLORIDA: Miami (USNM)

OTHER

FLORIDA: N Miami (1966) Reported by Mrs. George Parkhurst to Miami Herald and then to Division of Plant Industry. (Still some snails being found in March of 1973)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

ARIZONA: (Mead, 1959)

Collected at ports in: Baltimore, Delaware, Florida, Maryland, New Orleans, New York, Newark, Washington

Imported from: Caroline Islands, Formosa, Guam, Hawaii, Japan, Mauritius, Okinawa, Pakistan, Philippines, Saipan, Singapore, Thailand, Tinian

Superfamily Oleacinacea

FAMILY TESTACELLIDAE

Testacella haliotoidea Draparnaud LITERATURE

ILLINOIS: Chicago (greenhouse) (Baker, 1901);
in greenhouse (La Rocque, 1953)
NOVA SCOTIA: in greenhouse (La Rocque, 1953)
PENNSYLVANIA: in greenhouse (La Rocque, 1953)
TENNESSEE: no locality given (Getz, 1973)

MUSEUMS

PENNSYLVANIA: Philadelphia (CNHM); Pittsburgh,
Schenley Park (ANSP)
ORIGINAL DISTRIBUTION: W Europe, N Africa,
Great Britain, Canary Islands

Testacella scutella Sowerby LITERATURE

TENNESSEE: University of Tennessee Campus
(Lee, 1950)
ORIGINAL DISTRIBUTION: W Europe, N Africa,
Great Britain, Canary Islands

Testacella maugei Férussac LITERATURE

PENNSYLVANIA: Philadelphia: greenhouse in
Lower Roxborough (Johnson, 1891; Schick,
1895)
ORIGINAL DISTRIBUTION: SW Europe, Great Brit-
ain, Canary Islands, Azores

FAMILY ZONITIDAE

Oxychilus cellarius (Miller) LITERATURE

COLORADO: Boulder, in greenhouse (Cockerell,
1908)
CONNECTICUT: (Pilsbry, 1946)
DELAWARE: (Pilsbry, 1946)
ILLINOIS: (Pilsbry, 1946)
INDIANA: (Pilsbry, 1946)
MAINE: (Pilsbry, 1946)
MARYLAND: Garrett, Allegany, Frederick, Bal-
timore, Harford, Cecil, Kent Counties; Bal-
timore City (Grimm, 1971)
MASSACHUSETTS: (Pilsbry, 1946)
MICHIGAN: (Pilsbry, 1946)
MISSOURI: (Pilsbry, 1946)
NEW HAMPSHIRE: (Pilsbry, 1946)
NEW JERSEY: Cape May, Long Beach (Alexander,
1952)
NEW YORK: Fort Tryon Park in Manhattan, (Ja-
cobson, 1951); Allegany County in greenhouse
(Karlín and Naegelé, 1960)
OHIO: (La Rocque, 1959)
PENNSYLVANIA: (Pilsbry, 1946)
RHODE ISLAND: (Pilsbry, 1946)
SOUTH CAROLINA: (Pilsbry, 1946)
VIRGINIA: Montgomery, Pittsylvania, Roanoke,
Rockbridge, Wythe Counties (Hubricht, 1971)
WASHINGTON, D.C.: in Georgetown suburb (Soel-
ner, 1902)
NEW BRUNSWICK: (La Rocque, 1961)

NOVA SCOTIA: Baddeck in Victoria County; Syd-
ney in Cape Breton County (MacMillan, 1953-
54)

ONTARIO: Ottawa (La Rocque, 1962)

QUEBEC: (Pilsbry, 1946); Montreal, Isle d'Or-
léans, St. Charles River (La Rocque, 1962)

MUSEUMS

COLORADO: Colorado Springs (ANSP)

ILLINOIS: Chicago (MCZ)

INDIANA: Indianapolis (ANSP)

MAINE: Saco (MCZ); Portland (MCZ); Isle A Hau-
te (MCZ)

MARYLAND: Hagerstown (ANSP); Wilmington (ANSP);
WASHINGTON, D.C. (ANSP)

MASSACHUSETTS: Jamaica Plains (MCZ); Melrose
(MCZ); Alston (MCZ); Wade (MCZ); Boston (AM);
Revere (MCZ); Milton (MCZ); Brookline Hyde
Park (MCZ); Newtonville (MCZ); Ashmont (MCZ);
New Bedford (ANSP); Hanover and Rockland in
Plymouth County (ANSP); Dorchester (MCZ);
0.5 mile N Pleasant Bay (MCZ); Duxbury (MCZ);

MICHIGAN: Ann Arbor (ANSP)

NEW JERSEY: Patterson (AM); Long Branch (ANSP);
Union (ANSP); Burlington (MCZ); Montclair
(MCZ)

NEW MEXICO: Santa Fe in greenhouse (ANSP)

NEW YORK: Astoria, Long Island (MCZ); Ithaca,
Cornell Campus (MCZ); Niagara Falls (MCZ);
Brooklyn (AM); Cazenovia (ANSP); Skaneateles
Lake (ANSP); Near Van Etten in Chemung Coun-
ty (ANSP); 1 mile below Walcott on Walcott
Creek, Wayne County (ANSP); Utica (ANSP);
Poughkeepsie (ANSP)

OHIO: Strub Road, Perkins TWP (ANSP)

PENNSYLVANIA: Philadelphia (AM); Easton (ANSP);
Lafayette (ANSP); W Conhooken (ANSP); Ger-
mantown (ANSP); Bethlehem (ANSP); Spring
Mill (ANSP); Lebanon (MCZ)

RHODE ISLAND: Newport (MCZ); Patuxent Falls
(MCZ)

VIRGINIA: Charlottesville (ANSP)

ONTARIO: Bronte, Halton County (ANSP); S of
Corbyville on the Moira River (MCZ); Toron-
to (MCZ)

OTHER

MONTANA: Forestry greenhouses at Montana State
University, Bozeman (1965 and 1967) - per-
sonal communication.

NEW JERSEY: Union in Union County (HSF)

NEW YORK: Bronx Park in Bronx County (HSF);
Westchester County (HSF)

TENNESSEE: University Tennessee Campus in Knox-
ville (HSF)

WEST VIRGINIA: Charleston in Kanawha County
(HSF)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Louisiana, Massachu-
setts, New York, Washington

Collected in or on: cargo, carnation, fern,
mint, primrose

Imported from: Canada, England, Italy, Por-
tugal

ORIGINAL DISTRIBUTION: S Europe, N Africa,
Asia Minor

Oxychilus (=Vitrea) draparnaldi (Beck) (*H. lucida*)

LITERATURE

ARIZONA: Phoenix in greenhouse (Bequaert and
Miller, 1973); Tucson in nursery (Bequaert
and Miller 1973)

COLORADO: Boulder in greenhouse (Cockerell, 1908)

GEORGIA: Fulton County (Hubricht, 1964)

ILLINOIS: Chicago in greenhouse (Baker, 1901)

MARYLAND: Frederick, Carroll, Baltimore Counties; Baltimore City; Washington, D.C. (Grimm, 1971)

MASSACHUSETTS: Boston (Pilsbry, 1946)

NEW JERSEY: Gloucester (Alexander, 1952)

NEW YORK: Broome, Cayuga, Delaware Albany, Allegany Courtland, Erie, Fulton, Genesee, Greene, Jefferson, Livingston, Niagara, Oneida, Orleans, Saratoga, Schuyler, Seneca, Steuben, Tompkins, Warren Counties in greenhouses (Karlin and Naegele 1960)

PENNSYLVANIA: Germantown (Vanatta, 1927)

SOUTH CAROLINA: Charleston (Pilsbry, 1946)

VIRGINIA: Staunton, Norfolk (Pilsbry, 1946); Augusta, Frederick (Beetle, 1973)

WASHINGTON, D.C.: in greenhouse (Soelner, 1902)

NEW BRUNSWICK: in greenhouse (La Rocque, p. 312)

NEWFOUNDLAND: in greenhouse (La Rocque, 1953)

NOVA SCOTIA: Baddeck in Victoria County; Sydney in Cape Breton County (MacMillan 1953-54)

ONTARIO: in greenhouse (La Rocque, 1953)

QUEBEC: Mouth of Magdalen River (La Rocque, 1962)

MUSEUMS

MASSACHUSETTS: Cambridge (MCZ); Melrose (MCZ)

NEW YORK: 262nd Street and Broadway; Bronx (AM)

PENNSYLVANIA: Philadelphia (ANSP, MCZ)

VIRGINIA: Norfolk, old St. Paul's Churchyard, City Hall and Church Street

WEST VIRGINIA: Bolivar (MCZ); Ranson (MCZ)

OTHER

NEW YORK: New York County (HSF); Queens County (HSF); Bronx County (HSF)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Louisiana

Collected in or on: military cargo

Imported from: France

ORIGINAL DISTRIBUTION: W Europe, N Africa, Asia Minor

Oxychilus alliarius (Miller)

LITERATURE

COLORADO: Boulder in greenhouse (Cockerell, 1908); Fort Collins in greenhouse (Pilsbry, 1946)

MICHIGAN: (Burch, 1960)

NEW JERSEY: Newark (Alexander, 1952)

NEW YORK: Poughkeepsie; Brooklyn (Pilsbry, 1946); Suffolk County in greenhouse (Karlin and Naegele, 1960)

MUSEUMS

NEW YORK: (MCZ)

RHODE ISLAND: Edgewood in greenhouse (MCZ)

OTHER

ONTARIO: (La Rocque, 1940) Ottawa (La Rocque, 1940)

ORIGINAL DISTRIBUTION: Central and W Europe, Iceland

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Massachusetts, New

Jersey, New York, North Carolina, Texas, Virginia, Washington, D.C.

Collected in or on: *Aloe* sp., amaryllis, apple, cabbage, cactus, *Convallaria* root, dasheen, elder, *Erica* sp., fern, hydrangea, ivy, orchid, primrose, rhododendron, shamrock, soil, sphagnum moss, sweet orange, *Tradescantia*

Imported from: Azores, Belgium, Brazil, Canada, Iceland, Ireland, Italy, Japan, Mexico, Netherlands, New Zealand, Portugal, Scotland, South Africa

Oxychilus hammonis (Ström)

LITERATURE

NEWFOUNDLAND: Brig Bay (Vanatta, 1925)

ORIGINAL DISTRIBUTION: Western Europe

Superfamily Zonitacea

FAMILY ENDODONTIDAE

Discus rotundatus (Müller)

LITERATURE

MASSACHUSETTS: Dorchester (Clench, 1939); Woods Hole (Pilsbry, 1948)

NEW JERSEY: Milburn (Jacobson, 1954)

NEW YORK: Van Cortlandt Park in Bronx County (Feinberg, 1962); Manhattan Island at Fort Tryon Park (Jacobson, 1951); Long Island at Great Neck on old Grace Estate (Jacobson, 1952); Rockaway Beach (Jacobson, 1954); Tompkins and Westchester Counties in greenhouses (Karlin and Naegele 1960)

NEWFOUNDLAND: Ferryland on the south shore, abundant in ruins of old buildings (Pilsbry, 1948)

MUSEUMS

NEW YORK: Ithaca on Cornell Campus (AM); 149th Street and Railroad Blvd., Neponsit (AM)

OTHER

NEW YORK: Cortland Park in Bronx County (HSF)

ORIGINAL DISTRIBUTION: Central and Western Europe

FAMILY ARIONIDAE

Arion ater (Linnaeus)

LITERATURE

CONNECTICUT: Storrs, University Connecticut Campus (Getz and Wakefield, 1963)

MAINE: Near Basin Falls, 4 miles E Carbers Harbor, Knox County (Clench, 1928)

MICHIGAN: Detroit, 148 Seyburn Avenue (Pilsbry, 1948)

NORTH DAKOTA: (no locality given; presumably in Fargo where North Dakota Agricultural College is located (Post, 1959)

NEWFOUNDLAND: Bay Bulls (Vanatta, 1925)

QUEBEC: Sherbrooke (O'Neill, 1964); Mt. St. Albans, talus slope; Cap des Rosiers, Gaspé (1938); 3 miles S Cap des Rosiers light-house (Pilsbry, 1946)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Florida, Massachusetts, New York, Washington

Collected in or on: bromeliad, cabbage, carnation, cauliflower, English wlnut, leaf, lettuce, plants, quill, shore-drugs, swiss chard

Imported from: England, France, Ireland, Portugal

ORIGINAL DISTRIBUTION: Native to northern and Central Europe. Now also found in Great Britain and New Zealand

Arion subfuscus (Draparnaud)
LITERATURE

CONNECTICUT: (Chichester and Getz, 1969)
MAINE: 14 km N Bangor and 1.5 km W Pushaw Lake (Gleich, 1972); 22 km N Milo (Gleich, 1972); Sandy Stream pond in Baxter State Park - 32 km NW Millinocket (Gleich, 1972)
MARYLAND: Baltimore County; Baltimore City (Grimm, 1971)
MASSACHUSETTS: Boston in gardens between Chestnut and Mt. Vernon Streets above Willow Street; Jamaica Plain (Pilsbry, 1948); Cayuga, Chemung Erie, Tompkins Counties - in greenhouse (Karlin and Naegele, 1960)
NEW HAMPSHIRE: 8 miles NW North Woodstock; 2 miles E Campton; 6 miles S Gorham; 1 mile N Pequaket (Getz, 1962)
NEW YORK: East Aurora (Pilsbry, 1948); Van Cortlandt Park in Bronx County (Feinberg, 1962)
NORTH CAROLINA: Williamsville (Lee, 1950)
PENNSYLVANIA: Haverford (Pilsbry, 1948); Reading (Coller, 1965)
VERMONT: (Chichester and Getz, 1969)
NEW BRUNSWICK: Sackville (Dimelow, 1962)
NEWFOUNDLAND: (Getz, 1973)
NOVA SCOTIA: numerous localities (Ord and Watts, 1949); Wolfville (Moore, 1962); Cape Breton (Macmillan, 1953)
ONTARIO: (Chichester and Getz, 1969)
QUEBEC: Gaspé (Pilsbry, 1948); Cape Road, Grand Grève, Gaspé (Pilsbry, 1948)

OTHER

CONNECTICUT: Fairfield, Hartford, Litchfield, New Haven, Tolland (Chichester, personal communication)
MAINE: Aroostook, Cumberland, Franklin, Hancock, Kennebec, Oxford, Penobscot, Piscataquis, Somerset, Washington, York (Chichester, personal communication)
MASSACHUSETTS: Berkshire, Franklin, Hampshire, Middlesex, Norfolk, Worcester (Chichester, personal communication)
NEW HAMPSHIRE: Carroll, Cheshire, Coos, Grafton, Hillsboro, Merrimack, Sullivan (Chichester, personal communication)
NEW YORK: Delaware, Essex, Franklin, Greene, Hamilton, Putnam, Ulster, Warren, Westchester (Chichester, personal communication)
VERMONT: Bennington, Caledonia, Lamoille, Orange, Orleans, Windham (Chichester, personal communication)
NEW BRUNSWICK: Charlotte, Madawaska (Chichester, personal communication)
NEWFOUNDLAND: Humber, St. George's Port au Port, T. Barbe, White Bay (Chichester, personal communication)

NOVA SCOTIA: Antigonish, Colchester, Guysborough, Halifax, Hants, Kings, Lunenburg, Pictou, Queens (Chichester, personal communication)

ONTARIO: Nipissing (Chichester, personal communication)

QUEBEC: Brome Compton, Gaspé East, St. Jean, St. Maurice, Temiscaming (Chichester, personal communication)

ORIGINAL DISTRIBUTION: Northern and Central Europe

Arion hortensis (Férussac)
LITERATURE

CONNECTICUT: (Getz, 1973); New Haven (Johnson, 1915)
MAINE: 14 km N Bangor and 1.5 km W Pushaw Lake (Gleich, 1972); Bar Harbor (Johnson, 1923); Sandy Stream Pond in Baxter State Park - 32 km NW Millinocket (Gleich, 1972); 22 km N Milo (Gleich, 1972)
MARYLAND: Baltimore City (Grimm 1971)
MASSACHUSETTS: Boston (Binney, 1842)
NEW YORK: Poughkeepsie (Letson, 1905)
PENNSYLVANIA: Philadelphia Germantown-in Wistar Woods (Vanatta, 1927); Pittsburgh: Schenley Park (Pilsbry, 1948)
WASHINGTON D.C.: (Collinge, 1899)
NEWFOUNDLAND: Lark Harbor (Vanatta, 1925); Bay of Islands (Pilsbry, 1948); Beachy Point near Lamond on Bonne Bay (Brooks and Brooks, 1934)
NOVA SCOTIA: (Ord and Watts, 1949) numerous localities; Wolfville (Moore, 1962)
ONTARIO: Wiarton (Oughton, 1948); Toronto: Rosedale Ravine and Old Beltline (Pilsbry, 1948)
QUEBEC: Gaspé; 2 miles N Cap Aux (Pilsbry, 1948)

OTHER

CONNECTICUT: Greenwich, Golde Estate in Fairfield County; Greenwich, Gimbel Estate on King Street in Fairfield County; Greenwich, nursery on North Street in Fairfield County; Hartford, field adjacent to Hartford Public Health Department on Coventry Street; Mystic, E on Wamphassuc Road in New London County (all Chichester, personal communication)
MASSACHUSETTS: Westwood in Norfolk County (Chichester, personal communication)
NEW YORK: Croton Point in Westchester County (HSF)
VIRGINIA: Tazewell County roadside, 1.4 miles W of Tazewell (Hubricht, personal communication)
QUEBEC: Quebec City, Bridge Trailer Camp in Quebec County (Chichester, personal communication)
ORIGINAL DISTRIBUTION: Middle Europe, British Isles
INTERCEPTIONS: (U.S. Dept. of Agriculture)
Collected at ports in: Illinois, Michigan, Ohio, Pennsylvania, Texas, Virginia, Washington, D.C.
Collected in or on: Begonia, cabbage, celery, daffodil, English walnut, leek, lettuce, onion, packing material, pansy, ra-

dish, shamrock, soil, sphagnum, strawberry, violet

Imported from: England, France, Germany, Ireland, Netherlands, Spain

Arion circumscriptus Johnston

(=*A. fasciatus* (Nilsson) of some authors)

LITERATURE

- ILLINOIS: Urbana, city block bounded by Orchard Street, Iowa Avenue, Douglas Street, and Indiana Avenue (Bell, 1948)
- INDIANA: Indianapolis, NE corner Good Avenue and Rawls Avenue (Webb, 1940)
- MAINE: Portland; Thomaston; Kennebunkport; Orono; Bar Harbor (Pilsbry, 1948)
- MARYLAND: Baltimore City (Grimm, 1971)
- MASSACHUSETTS: Natick (Blake, 1933); Chatham; Cape Cod; New Bedford; Woods Hole; S Boston (Pilsbry, 1948)
- MICHIGAN: Ann Arbor, Cat Hole; University of Michigan arboretum (Webb 1941); University of Michigan Mud Lake Area (Getz, 1959)
- NEW YORK: Chautauqua, Delaware, Dutchess, Herkimer, Madison, Montgomery, Oneida, Tompkins, Warren Counties, in greenhouses (Karlin and Naegele 1960); Manhattan Island in Fort Tryon Park (Jacobson, 1951); Westport on Lake Champlain; Lakewood, Lake Chautauqua; Ebenezer, Ithaca Cazenovia Long Island and at Lloyd's Neck, Huntington, Islip, Greenport (Pilsbry, 1948); Niagara Falls (Cockerell, 1904); Buffalo, Buffum Street (Robertson, 1937); Van Cortlandt Park in Bronx County (Feinberg, 1962)
- OKLAHOMA: Boswell, 6.7 miles E on railroad right-of-way paralleling U.S. 70 near Muddy Boggy River (Dundee and Dundee, 1958)
- PENNSYLVANIA: Reading (Coller, 1965); Delaware Water Gap (Franzen, 1947)
- WISCONSIN: Madison (Pilsbry, 1948)
- CANADA: (La Rocque, 1932); Most of Canada (Getz, 1973)
- NEW BRUNSWICK: (La Rocque, 1953)
- NEWFOUNDLAND: (La Rocque, 1953)
- NOVA SCOTIA: Morden and Berwick in Kings County (Pilsbry, 1948); Wolfville (Moore, 1962); Baddeck, Boularderie Island, Glendale, Kingsville Malagauatch, Whycocomagh, East Bay, Louisburg, Northwest Arm along Frenchvale Creek (MacMillan, 1953)
- ONTARIO: Toronto (Pilsbry, 1948); Manotick; Spencerville; Perth (Pilsbry, 1948)
- PRINCE EDWARD ISLAND: Charlottetown (Pilsbry, 1948)
- QUEBEC: St Anne de Bellevue in Jacques Cartier County; Trois Pistoles in Témiscouata County; Montmagny; Val Tetreau in Wright County (Pilsbry, 1948)
- MUSEUMS
- MASSACHUSETTS: Watertown (MCZ)
- OTHER
- CONNECTICUT: Rt. 25, 4.1 miles N of Rt. 127 in Fairfield County; Hartford, adjacent to Hartford Public Health Dept. Land on Coventry Street in Hartford County; New Britain in Stanley Quarter Park in Hartford County; Rt. 44, 1.3 miles W of Rt. 126 in Litchfield

County; Rt. 17, 4.6 miles N of Rt. 79 at Durham in Middlesex County; Tolland, Woods opposite Public School Playground in Tolland County; Rt. 6, 1.4 miles W of Rt. 169 in Windham County (all Chichester, personal communication)

- MAINE: Skowhegan, 2 miles E on Rt. 2 in Somerset County; Topsfield, 3 miles W in WASHINGTON County; Sanford, corner of Windsor at Rt. 109/11 in York County (all Chichester, personal communication)
- MASSACHUSETTS: Rt. 2, 2.1 miles W of Rt. 7 in Berkshire County; Westwood in Norfolk County (Chichester, personal communication)
- NEW JERSEY: Wacktung Reservation in Union County (HSF); Leonia in Bergen County (HSF); Huntington in Suffolk County (HSF); Bronx County (HSF); Rt. 2, 1.5 miles W of Rt. 22 in Rensselaer County (Chichester, personal communication); Rt. 20, 6.4 miles E of Rt. 9 at picnic area in Rensselaer County (Chichester, personal communication); Rt. 14, 0.3 mile S Rt. 54 near Dresden in Yates County (Chichester, personal communication)
- NORTH CAROLINA: Asheville (HSF)
- NEW BRUNSWICK: Fredericton in City Park in York County; Rt. 2 in Prince William picnic area in York County (Chichester, personal communication)
- NOVA SCOTIA: Rt. 14, 6.2 miles from Rt. 2 at Nine Mile bridge in Hants County (Chichester personal communication)
- ONTARIO: Rt. 17, 3.1 miles E of W boundary of Russell County (Chichester, personal communication)
- QUEBEC: Near St. Lazare on Rt. 25A in Bellechasse County; New Richmond on Rt. 6 in Bonaventure County; St. Urbain, 0.1 mile N on Rt. 36 in Chateaugay County; Rt. 6A about halfway between Morris and Rivière au Renard in Gaspé E County; Percé on Rt. 6 in Gaspé County; Matane, 1.6 miles S on Amqui Road in Matane County; 3 miles N Black Lake on Rt. 49 in Mégantic County; Rt. 2, 3 miles E of Rt. 25 in Montmagny County; Just E of Rivière du Loup City Line on Rt. 10 in Rivière du Loup County; Tadoussac 15 miles E on Rt. 15 in Saguenay County; Rt. 39, picnic area between Richmond and Racine in Shefford County; Deauville in Sherbrooke County; Picnic area N of Cabano in Témiscouata County (all Chichester, personal communication)

Arion fasciatus (Nilsson)

(=*Arion circumscriptus* of some authors)

LITERATURE

- CONNECTICUT: Storrs, University of Connecticut campus and nearby gardens, pastures, and fields; Lime Rock, Litchfield County (Getz and Wakefield, 1963)
- MAINE: Portland and Thomaston; Kennebunkport, Orono, Bar Harbor (Pilsbry, 1948); 14 km N Bangor and 1.5 km W Pushaw Lake (Gleich, 1972); 6.5 km SE Milo (Gleich, 1972)
- MARYLAND: Garrett, Baltimore Counties and Baltimore City (Grimm, 1971)
- MASSACHUSETTS: Woods Hole, Boston, Natick (Pilsbry, 1948); Petersham, 2 miles N (Getz

and Wakefield, 1963); Chatham on Cape Cod (Pilsbry, 1948)

NEW HAMPSHIRE: Campton, 2 miles NE at Campton Campsite (Getz and Wakefield, 1963)

NEW YORK: Westport, Lakewood, Goat Island near Niagara, Ithaca, Cazenovia; Long Island at Lloyd's Neck; Huntington; Islip; Greenport (Pilsbry, 1948)

NORTH CAROLINA: Buncombe and Swain Counties (Hubricht, 1970)

PENNSYLVANIA: Delaware Water Gap (Pilsbry, 1948)

RHODE ISLAND: Morden, Berwick (Pilsbry, 1948)

TENNESSEE: Carter and Johnston Counties (Hubricht, 1973)

VERMONT: Chichester and Getz, 1969

WASHINGTON, D.C.: (Collinge, W.E., 1899)

WISCONSIN: Belleville, 5 miles W in picnic area; Eagle River, 1 mile W in maple grove back of motel; Eagle River, 4 miles SE along road in birch-maple; Three Lakes, 1 mile SE along Lake; Hazelhurst, 1 mile S in picnic area; Pelican Lake, 3 miles S in picnic area; Madison, numerous habitats (all from Getz, 1968)

CANADA: Most of it; widespread (Getz, 1973)

NEWFOUNDLAND: Trepassey, Whitbourne (Vanatta, 1925)

ONTARIO: Toronto, Ottawa, Spencerville, Perth (Pilsbry, 1948)

PRINCE EDWARD ISLAND: Charlottetown (Pilsbry, 1948)

QUEBEC: St. Anne de Bellevue, Trois Pistoles, Montmagny, Val Tetreau, Meach Lake (Pilsbry, 1948)

OTHER

CONNECTICUT: Hartford, Litchfield, Middlesex, New Haven, New London, Tolland, Windham (Chichester, personal communication)

MAINE: Androscoggin, Cumberland, Franklin, Hancock, Kennebec, Oxford, Penobscot, Piscataquis, Sagadahoc, Somerset, Washington, York (Chichester, personal communication)

MASSACHUSETTS: Berkshire, Bristol, Franklin, Hampden, Hampshire, Middlesex, Plymouth, Worcester (Chichester, personal communication)

NEW HAMPSHIRE: Merrimack, Rockingham, Sullivan (Chichester, personal communication)

NEW YORK: Albany, Chautauqua, Columbia, Dutchess, Delaware, Erie, Essex, Franklin, Greene, Rensselaer, Seneca, Schoharie, Schuyler, Warren, Wayne (Chichester, personal communication)

NORTH CAROLINA: Yancey County (Hubricht, personal communication)

PENNSYLVANIA: Wayne (Chichester, personal communication); Bedford near Hipple Cave, 0.7 mile E Waterside (Hubricht, personal communication)

RHODE ISLAND: Providence (Chichester, personal communication)

TENNESSEE: Carter and Johnson Counties (Hubricht, personal communication)

VERMONT: Addison, Bennington, Caledonia, Chittenden, Lamoille, Orange, Orleans, Rutland, Windham, Windsor Counties (Chichester, personal communication)

NEW BRUNSWICK: Albert, Carleton, Charlotte, Kings, Madawaska, Perth, Northumberland, Queens, Restigouche, St. John, Sunbury, York Counties (all Chichester, personal communication)

NEWFOUNDLAND: Humber (Chichester, personal communication)

NOVA SCOTIA: Dartmouth in Halifax County; Brooklyn in greenhouse in Hants County; Smiley's Provincial Park in Hants County; Greenfield in Queens County; Between Liverpool and Greenfield Road in Queens County; W of N River turn-off in Queens County; Alma in Albert County (all Chichester, personal communication)

ONTARIO: Russell, Welland (Chichester, personal communication)

QUEBEC: Beauce, Bellechasse, Bonaventure, Broome, Champlain, Compton, Gaspé East, Missisquoi, Quebec, Richmond, Shefford, Sherbrooke, Stanstead Counties (all Chichester, personal communication)

Arion intermedius (Normand)

LITERATURE

CONNECTICUT: (Chichester and Getz, 1969)

MAINE: (Chichester and Getz, 1969)

MARYLAND: Garrett, Baltimore, Talbot, Somerset Counties; Baltimore City (Grimm, 1971)

MASSACHUSETTS: (Chichester and Getz, 1969)

NEW HAMPSHIRE: (Chichester and Getz, 1969)

NEW YORK: Bronx Park (Feinberg 1962; Buffalo (Teskey, 1951)

RHODE ISLAND: (Chichester and Getz, 1969)

QUEBEC: (Getz, 1973)

OTHER

CONNECTICUT: Greenwich in Fairfield County (Chichester, personal communication)

MAINE: York County (Chichester, personal communication)

MASSACHUSETTS: Bristol County (Chichester, personal communication)

NEW HAMPSHIRE: Grafton County (Chichester, personal communication)

NEW YORK: Erie County, Wayne County (Chichester, personal communication); Bronx County (HSF)

RHODE ISLAND: Providence County (Chichester, personal communication)

WASHINGTON, D.C.: National Zoo (HSF)

QUEBEC: Bridge Trailer Camp in Quebec County (Chichester, personal communication)

ORIGINAL DISTRIBUTION: Northern and Central Europe

Arion silvaticus Lohmander

LITERATURE

No exact localities given: '.... Both *A. circumscriptus* and *A. silvaticus* are relatively uncommon, although there are scattered populations throughout the region.' (Chichester and Getz, 1973)

OTHER

CONNECTICUT: Hartford, Litchfield, Tolland (Chichester, personal communication)

MAINE: Androscoggin, Aroostook, Penobscot (Chichester, personal communication)
 MASSACHUSETTS: Berkshire, Franklin, Middlesex, Norfolk, Plymouth (Chichester, personal communication)
 NEW YORK: Essex, Warren, Washington (Chichester personal communication)
 RHODE ISLAND: Washington (Chichester, personal communication)
 VERMONT: Addison, Bennington, Lamoille, Rutland, Washington (Chichester, personal communication)
 NEW BRUNSWICK: Albert, Carleton, Charlotte, Madawaska, Northumberland, Queens, Westmoreland, York (Chichester, personal communication)
 NEWFOUNDLAND: St. Georges, Port-au-Port (Chichester, personal communication)
 NOVA SCOTIA: Antigonish, Halifax, Hants, Queens, Pictou (Chichester, personal communication)
 ONTARIO: Nipissing (Chichester, personal communication)
 QUEBEC: Champlain, Compton, Gaspé East, Quebec (Chichester, personal communication)

FAMILY LIMACIDAE

Milax gagates (Draparnaud)

LITERATURE

ARIZONA: Phoenix, 700 block of W Cambridge Street; N 17th Street (Bequaert & Miller, 1973)
 ARKANSAS: Chicot County (Hubricht, 1972)
 COLORADO: Boulder, in greenhouse (Cockerell, 1908)
 KENTUCKY: Richmond, Sunset Street
 MARYLAND: Somerset County (Grimm, 1971)
 NEW JERSEY: Clifton in market on lettuce (Dundee, 1958)
 NEW YORK: Allegany, Broome, Cayuga, Erie, Franklin, Greene, Suffolk, Tompkins Counties, in greenhouses (Karlin and Naegele, 1960)
 PENNSYLVANIA: Pittsburgh, Phipp's Conservatory and vicinity, Schenley Park (Pilsbry, 1948)
 VIRGINIA: Accomack, Hampton, Newport News, Norfolk, Northampton, Orange, Northumberland Counties (Beetle, 1973)
 NOVA SCOTIA: Amherst (Fox, 1962)

MUSEUMS

TEXAS: Tarrant (FWMSH)

AUTHOR COLLECTIONS

MISSISSIPPI: Vicksburg

OTHER

TEXAS: Austin (Neck, personal communication)
 NOVA SCOTIA: Halifax in Public Gardens in Halifax County (Chichester, personal communication)
 INTERCEPTIONS: (U.S. Dept. of Agriculture)
 Collected at ports in: Florida, Greece, Maryland, Massachusetts, Michigan, New York, Ohio, Pennsylvania, Texas, Virginia, Washington
 Collected in or on: airplane, bamboo, *Begonia*, cabbage, catnip, cauliflower, celery, dahlia, egg plant, endive, fennel, jasmine, leek, lettuce, mint, mustard, orchid, or-

chid grass, rosemary, *Sanseveria*, shamrock, stores, strawberry, thistle, wallflower, wood

Imported from: Azores, Belgium, Brazil, China, Colombia, Colorado, Ecuador, England, France, Germany, Greece, India, Ireland, Italy, Japan, Mexico, Morocco, Netherlands, Nigeria, Norway, Poland, Portugal, Singapore, Spain, Venezuela

ORIGINAL DISTRIBUTION: Western Europe, Mediterranean area, British Isles

Limax maximus Linnaeus

LITERATURE

ALABAMA: Montgomery and Perry Counties (Hubricht, 1965)
 ARIZONA: Flagstaff, 3 miles NW near Museum and Research Center of Northern Arizona (Bequaert & Miller, 1973)
 COLORADO: Boulder in nursery (Henderson, 1919)
 CONNECTICUT: (Chichester and Getz, 1969)
 ILLINOIS: Chicago, in greenhouse (Baker, 1901); Bloomington, 202-204 E Walnut (Dundee and Hermann 1968)
 KANSAS: Lawrence (Leonard, 1959)
 KENTUCKY: Laurel County (Branson and Batch, 1971); Richmond: E Kentucky University and 244 S Collins Street and on Main Street; Lexington, 429 W 4th Street; near Honeybee on McCord Road in Trimble County; Gross's farm on Hwy 1277 in Whitley County; just W Virginia State line on Hwy 80 in Pike County (Branson and Batch, 1969)
 MAINE: Bar Harbor (Lermond, 1909)
 MARYLAND: Taneytown, railroad tracks (Grimm, 1958); Carroll, Baltimore, Prince Georges, Charles, Cecil, Queen Annes, Wicomico, Worcester, Somerset Counties (Grimm, 1971)
 MASSACHUSETTS: Cambridge (Pilsbry, 1948); Nantucket Island (Cockerell, 1911)
 MICHIGAN: (La Rocque, 1953)
 MISSOURI: Christian and St. Louis Counties (Hubricht, 1972)
 NEW JERSEY: Burlington (Cockerell, 1889); Widely distributed (Alexander, 1952)
 NEW YORK: Long Island (Pilsbry, 1948); Cayuga, Chemung, Erie, Monroe, Rockland, Warren Counties, in greenhouses (Karlin and Naegele, 1960); Bronx in Van Cortlandt Park (Feinberg, 1962)
 NORTH CAROLINA: Widely distributed on the Piedmont and coastal plains (Hubricht, 1970)
 OHIO: South Bass Island in Ottawa County, Lake Erie (Langlois, 1965)
 OKLAHOMA: Miami, Ottawa County (Branson, 1963)
 PENNSYLVANIA: Philadelphia (Schick, 1895)
 RHODE ISLAND: Newport (Pilsbry, 1948)
 TENNESSEE: Harrogate, Pruden, Tazewell, Arthur, Cumberland Gap (Lutz, 1950)
 TEXAS: New Braunfels (Strecker, 1935)
 VIRGINIA: Danville, Gretna (Hubricht, 1951); Lexington (Cockerell, 1889)
 NEWFOUNDLAND: St. Johns; Bay Bulls (Pilsbry, 1948)
 ONTARIO: Ottawa (Latchford, 1904); London (Judd, 1958); Toronto (Pilsbry, 1948)

MUSEUMS

NEW YORK: Buffalo (CNHM)
OHIO: Glacial Grooves State Memorial on Kelly's Island in Erie County (OSU)
RHODE ISLAND: Bristol (ANSP)
WASHINGTON, D.C.: (CNHM)

OTHER

CONNECTICUT: Greenwich on Hamilton County in Fairfield County (Chichester, personal communication); New Britain on Shuttle Meadow Avenue in Hartford County (Chichester, personal communication); North Branford in New Haven County (Chichester, personal communication)
MAINE: Acadia National Park in Bear Brook picnic area in Hancock County (Chichester, personal communication)
MISSOURI: Christian County along railroad, Billing (Hubricht)
NEW YORK: Croton Point in Westchester County; E Rockaway in Nassau County (HSF)
OHIO: Columbus (1973) (DS)
VIRGINIA: Talax in Grayson (HSF); 2.1 miles E Gibson Station, Lee County; 0.4 mile E Ft. Blackmore, Scott County
WASHINGTON, D.C.: National Zoo (HSF)
INTERCEPTIONS (U.S. Dept. of Agriculture)
Collected at ports in: Florida, Georgia, New York, Pennsylvania, South Carolina, Washington, D.C.
Collected in or on: beets, cabbage, flax, military cargo, moss packing, orchid, radishes, woody plants
Imported from: Azores, Belgium, Colombia, England, Guatemala, Italy, Lebanon, Morocco, Norway, Tripoli
ORIGINAL DISTRIBUTION: Europe, Asia Minor, North Africa

Linax flavus Linnaeus

LITERATURE

ALABAMA: University (Pilsbry 1928); Auburn University; Unionville (1928) (Pilsbry, 1948)
ARIZONA: Phoenix (Bequaert and Miller, 1972); Tucson (many gardens) (Mead 1952); Cienaga of Babocomari Creek on Brophy Ranch (Bequaert and Miller, 1973); . . . 'the most commonly encountered foreign mollusk in Arizona (Mead, 1953)
ARKANSAS: Pulaski County (Hubricht, 1972); Mt. Magazine, Hot Springs (Pilsbry, 1948)
CONNECTICUT: New Haven (Pilsbry, 1948)
DISTRICT OF COLUMBIA: 1891 (Pilsbry, 1948)
FLORIDA: Tallahassee, 208 5th Avenue (Friedl and Bayne, 1965)
GEORGIA: Athens, Savannah (1895) (Pilsbry, 1948)
ILLINOIS: Chicago, in greenhouses (Pilsbry, 1948)
INDIANA: New Albany (Pilsbry, 1948)
KENTUCKY: Lexington, 429 W4th Street and Murray State University Campus (Branson and Batch, 1969)
LOUISIANA: Ruston (Taylor, 1899) (Branson, 1961); Shreveport (Branson, 1963)

MAINE: Bar Harbor (Johnson, 1922); Portland (Morse, 1864)
MARYLAND: Baltimore, Chestertown (Pilsbry, 1948); Kent (Grimm, 1971)
MASSACHUSETTS: Boston, New Bedford (Pilsbry, 1948)
MICHIGAN: (La Rocque, 1953)
MISSOURI: St. Louis (Pilsbry, 1948)
NEW JERSEY: Burlington, Camden (Pilsbry, 1948); Widely distributed in the state (Alexander, 1952)
NEW YORK: Monroe, Tompkins, Onondaga, Herkimer, Albany, New York Counties (Pilsbry, 1948); Broadway and 262nd Street, Bronx County (Feinberg, 1962)
OKLAHOMA: Adair County (Hubricht, 1971); Westville, 2 miles E on Flint Creek
PENNSYLVANIA: Philadelphia, York, Westchester (Pilsbry, 1948)
SOUTH CAROLINA: Charleston, Graniteville (Pilsbry, 1948)
TEXAS: Waco (Strecker, 1935); New Braunfels (Wheeler, 1949); Houston (1923); Nacogdoches (Pilsbry, 1948)
VIRGINIA: Gretna, Pittsylvania County (Hubricht, 1971); Lexington (Cockerell, 1889); Henrico and Northampton Counties (Beetle, 1973)
QUEBEC: Canada, presumably Quebec (La Rocque, 1962)

MUSEUMS

INDIANA: Terre Haute (CNHM); Indianapolis; Lake Porte (UM); New Albany (UM) Lake Jones in Steuben County (UM)
NEW JERSEY: Adamsville (UM)

AUTHOR COLLECTIONS

LOUISIANA: New Orleans, Kenner, Boothville
MISSISSIPPI: Vicksburg, Port Gibson, Hattiesburg

OTHER

ALABAMA: Mobile County along railroad, Grand Bay (Hubricht, personal communication)
MISSISSIPPI: Monroe County, along railroad, Smithville; Neshoba County, Philadelphia; Bolivar County, along railroad, Cleveland; Tippah County, along railroad, Blue Mountain; Greene County, along railroad, McLain; Stone County, along railroad, MxHenry; Washington County, low woods 2.6 miles N Wayside; Lauderdale County 'Collegetown' in Meridian (Hubricht, personal communication)
MISSOURI: Christian County, along railroad, Hilling (Hubricht, personal communication)
NEW YORK: Bronx County (HSF); Nassau County (HSF)
TENNESSEE: Carter County, Roan Mountain (Hubricht, personal communication)
TEXAS: Tarrant County (Pratt, personal communication)
ORIGINAL DISTRIBUTION: Europe
INTERCEPTIONS: (U.S. Dept. of Agriculture)
Collected at ports in: New York, Pennsylvania
Collected in or on: celery, lettuce, rose
Imported from Greece, Italy, Spain

Limax nictelius Bourguignat

LITERATURE

WASHINGTON, D. C.: in greenhouse (Cockerell, 1901) (Quick, 1960)
ORIGINAL DISTRIBUTION: North Africa

Lehmannia poirieri (Mabille)

(=*Limax marginatus* - *Limax arborum*)

LITERATURE

ALABAMA: Montgomery and Perry Counties (Hubricht, 1965)
ARIZONA: Tucson (Mead, 1953)
ARKANSAS: Chicot, Jefferson, Logan Counties (Hubricht, 1972)
COLORADO: Boulder, in greenhouse (Cockerell, 1917)
LOUISIANA: Shreveport, near King's Hwy. and Line Avenue (Harry, 1951, seen in 1948; not there in 1949)
MARYLAND: Montgomery; Baltimore (greenhouse); Anne, Arundel, Queen Anne's, Caroline, Talbot, Dorchester, Worcester, Somerset Counties (Grimm, 1971)
MISSOURI: St. Louis, greenhouse in Forest Park (Pilsbry, 1948)
NEW YORK: Cortland, Dutchess, Cayuga, Chautauqua, Albany, Chenango, Delaware, Erie, Franklin, Genesee, Nassau, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Richmond, Rockland, Saratoga, Schenectady, Schuyler, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Westchester Counties, in greenhouses (Karlin and Naegele, 1960); (Pilsbry, 1948)
TEXAS: San Antonio (Murray and Wiley, 1968); Fort Worth (Pratt, 1965)
VIRGINIA: Pittsylvania County (Hubricht, 1971); Richmond (Lee, 1950)
NEWFOUNDLAND: Getz, (1973)

MUSEUMS

TEXAS: Tarrant County (FWMSH)

AUTHOR COLLECTIONS

FLORIDA: Pensacola
LOUISIANA: Pineville, Vienna, Delhi, Ponchartraine, Shreveport
MISSISSIPPI: Vicksburg, Hattiesburg, Natchez

OTHER

NEW YORK: Bronx Botanical Gardens, Bronx County (HSF)
TEXAS: Austin (Neck, personal communication); El Paso (personal communication)

ORIGINAL DISTRIBUTION: Europe

INTERCEPTIONS: (U. S. Dept. of Agriculture)

Collected at ports in: Florida, Louisiana, Massachusetts, Pennsylvania, South Carolina, Texas

Collected in or on: avocado, broccoli, bromeliad, burhead, carrot, dasheen, ferns, flowers, leek, lettuce, lily, orchids, Peperomia, turnip

Imported from: Australia, Azores, Colombia, Costa Rica, Cuba, Germany, Guatemala, Italy, Japan, Madeira Islands, Mexico, Netherlands, Peru, Portugal, Spain, Venezuela

Lehmannia valentiana Férussac

(=*L. poirieri* Mabille)

LITERATURE

ARIZONA: Phoenix (Waldén, 1961); Tucson (Mead, 1953); Nogales in Oak Ridge Section, Santa Cruz County (Bequaert and Miller, 1973); Santa Rita Mts., in Madera Canyon (1968) (Bequaert and Miller, 1973); Huachuca Mts., Ramsey Canyon (1967) (Bequaert and Miller, 1973); Chiricahua Mts., Cave Creek at SW Research Station (1966-1970) (Bequaert and Miller, 1973)
KENTUCKY: Pine Mt. State Park in Bell County (Branson and Batch, 1969); 'many states and provinces' (Getz, 1973)
MASSACHUSETTS: Belmont (Walden, 1961)
PENNSYLVANIA: Hartsville (Walden, 1961)

OTHER

ARIZONA: Phoenix, Tucson, Nogales, Santa Rita Mts., in Madera Canyon, Huachuca Mts. in Ramsey Canyon, Chiricahua Mts. on Cave Creek near Portal (Chichester, personal communication)
ARKANSAS: Logan County along railroad, Paris (Hubricht, personal communication)
CONNECTICUT: Bridgeport in greenhouse in Fairfield County; Cromwell greenhouses in Middlesex County; Storrs, in greenhouse, Tolland County (Chichester, personal communication)
MAINE: Androscoggin County, 0.2 mile W Lisbon Town Line; Auburn in greenhouse in Androscoggin County; Presque Isle greenhouse in Aroostook County; greenhouse in Cumberland County (Chichester, personal communication)
MISSISSIPPI: Newton County vacant lot, Union; Bolivar County along railroad, Cleveland; Lauderdale County: 'Collegetown' in Meridian (Hubricht, personal communication)
NORTH CAROLINA: Orange County garden, 5001 Longleaf Drive, Chapel Hill (Hubricht, personal communication)
NEW BRUNSWICK: Newcastle, in greenhouse (Chichester, personal communication)
NOVA SCOTIA: Halifax greenhouse in Halifax County (Chichester, personal communication)
QUEBEC: Sherbrooke County in greenhouse (Chichester, personal communication)
ORIGINAL DISTRIBUTION: Mediterranean area, Spain and Atlantic Island

Superfamily Zonitacea

FAMILY SAGDIDAE

Microconus caeca Guppy

LITERATURE

FLORIDA: St. Augustine; near St. John's River; near Lake Worth; near Hillborough River emptying into Tampa Bay (Dall, 1889)
ORIGINAL DISTRIBUTION: Trinidad

Microconus granum Strebil

LITERATURE

FLORIDA: Archer in Alachua County; Evans Plantation on Rogers River; vicinity of Lake Worth (Dall, 1889)
ORIGINAL DISTRIBUTION: Mexico

FAMILY LIMACIDAE

Deroceras reticulatum (Müller)(=*Limax agrestis* = *Agriolimax agrestis*)

LITERATURE

- ALABAMA: Woodville (Pilsbry, 1948)
 ARIZONA: Phoenix on nursery plants (1969) (Bequaert and Miller, 1973); Tucson (Bequaert and Miller, 1973)
 COLORADO: Boulder (Cockerell, 1904); Fort Collins; Idaho Springs (Pilsbry, 1948)
 CONNECTICUT: (Johnson, 1915)
 ILLINOIS: Champaign, Clark, Douglas, Kankakee, McDonough, Mercer, Piatt, Stevenson, Vermilion Counties (Pilsbry, 1948)
 KENTUCKY: Richmond-Barnesville Road; Winchester, 18 miles SW at Lulbehrud Creek on Hwy. 15; Zachariah (Branson & Batch, 1969)
 LOUISIANA: Ruston, 3 miles W (Branson, 1961)
 MAINE: Portland (Morse, 1864); 14 km N Bangor & 1.5 km W Pushaw Lake (Gleich, 1972); 6.5 km SE Milo (Gleich, 1972); 22 km N Milo (Gleich, 1972); 21 km NE Greenville and 5 km E Moosehead Lake (Gleich, 1972); Sandy Stream Pond in Baxter State Park, 32 km NW of Millinocket (Gleich, 1972); Dwelley Pond, Baxter State Park, 48 km W of Patten (Gleich, 1972); 3 km SW E Outlet Dam on W side Moosehead Lake (Gleich, 1972); 19 km NW Greenville (Gleich, 1972)
 MARYLAND: Garrett, Baltimore, Harford, Somerset Counties; Baltimore City (Grimm, 1971)
 MASSACHUSETTS: Boston (Binney, 1842)
 MICHIGAN: University of Michigan Mud Lake area (Getz, 1959); Ann Arbor; Lansing. Marquette County (Pilsbry, 1948)
 NEW HAMPSHIRE: Mt. Monadnock (Dall, 1916)
 NEW JERSEY: Widely distributed in state (Alexander, 1952); Burlington (Cockerell, 1889)
 NEW YORK: Ithaca, Cornell University Fish Hatchery (Ingram, 1941); Delaware; Broome, Cayuga; Dutchess; Erie; Fulton; Genesee; Herkimer; Jefferson; Livingston; Monroe; Niagara; Ontario; Oneida; Orleans; Queens, Schenectady; Steuben; Sullivan; Tioga; Tompkins; Warren; Wayne Counties, in greenhouses (Karlin and Naegele, 1960)
 OHIO: Cincinnati, Cleveland, Garrettsville, Ravenna, Navarre, Tiffin, Defiance (Pilsbry, 1948)
 PENNSYLVANIA: Philadelphia (Schick, 1895)
 TEXAS: Waco (Strecker, 1935)
 VIRGINIA: Danville; Gretna (Hubricht, 1951); Russell, Wythe, York Counties (Beetle, 1973)
 WISCONSIN: Madison (Pilsbry, 1948)
 NEW BRUNSWICK: Sackville (Dimelow, 1962)
 NEWFOUNDLAND: Bard Harbor Hill; Doctor Hill (Vanatta, 1927) Labrador, Strawberry Harbor and Square Island (La Rocque, 1962); N to Straits of Belle Isle (Pilsbry, 1948)
 ONTARIO: St. Thomas (Cockerell, 1889); Chiefly southern but N to Bear Island, Lake Temagami and to Smoky Falls (Pilsbry, 1948)
 QUEBEC: Ungava; Shawville, Hillcrest Farm (La Rocque, 1962); Gaspé (Pilsbry, 1948); Quebec (Litchford, 1885)
 MUSEUMS
 TEXAS: Tarrant (FWMSH)

OTHER

- CONNECTICUT: Fairfield; Hartford; Litchfield; Middlesex; New London; Tolland; Windham (Chichester, personal communication)
 KENTUCKY: Lexington (HSF)
 MAINE: Androscoggin, Aroostook, Cumberland, Hancock, Oxford, Penobscot, Piscataquis (Chichester, personal communication)
 MASSACHUSETTS: Berkshire, Bristol, Franklin, Hampshire, Middlesex, Norfolk, Plymouth, Worcester (Chichester, personal communication)
 MISSISSIPPI: Hinds County (Hubricht, personal communication)
 NEW HAMPSHIRE: Merrimack; Sullivan (Chichester, personal communication)
 NEW YORK: Albany, Cayuga, Clinton, Columbia, Delaware, Dutchess, Erie, Essex, Franklin, Greene, Putnam, Rensselaer, Seneca, Schoharie, Sullivan, Tompkins, Ulster, Warren, Yates (Chichester, personal communication); Bronx County (HSF)
 NORTH CAROLINA: Asheville (HSF)
 PENNSYLVANIA: Wayne (Chichester, personal communication)
 TENNESSEE: Knoxville (HSF)
 RHODE ISLAND: Washington (Chichester, personal communication)
 VERMONT: Addison, Bennington, Caledonia, Essex, Lamoille, Orange, Orleans, Rutland, Washington, Windham, Windsor (Chichester, personal communication)
 VIRGINIA: Harrisburg in Rockingham County (HSF); Russell and Wood Counties (Hubricht, personal communication)
 NEW BRUNSWICK: Petitcodiac; between Tracadie and St. Isidore; Carleton, Charlotte, Madawaska, Northumberland, Queens, Restigouche, Sunbury, Victoria, Westmoreland, York Counties (Chichester, personal communication)
 NEWFOUNDLAND: Humber; St. Georges-Port au Port; T. Barbe; White Bay (Chichester, personal communication)
 NOVA SCOTIA: Antigonish, Colchester, Halifax, Hants, Pictou Counties (Chichester, personal communication)
 ONTARIO: Dundas, Glengarry, Grenville, Nipissing, Simcoe, Stormont, Welland Counties (Chichester, personal communication)
 QUEBEC: Bagot, Beauce, Bellechasse, Bonaventure, Brome, Champlain, Charlevoix East, Chateauguay, Compton, Drummondville, Frontenac, Gaspé East, Gaspé West, Gatineau, Huntingdon, Jacques Cartier, Joliette, Lévis, Matane, Mégantic, Missisquoi, Montmagny, Montcalm, Montmorency, Nicolet, Portneuf, Quebec, Richelieu, Richmond, Rimouski, Rivière du Loup, Saguenay, Shefford, Sherbrooke, Soulanges, St. Jean, St. Maurice, Stanstead, Temiscouata, Vaudreuil, Wolfe, Counties (all Chichester, personal communication)
 AUTHOR COLLECTIONS
 MISSISSIPPI: Vicksburg Cemetery
 ORIGINAL DISTRIBUTION: Temperate Europe, Great Britain, North Africa
 INTERCEPTIONS: (U.S. Dept. of Agriculture)
 Collected at ports in: Florida, Louisiana, Massachusetts, New York, Pennsylvania, South Carolina, Texas, Washington

Collected in or on: apple, artichoke, beets, bell pepper, *Bryophyllum*, cabbage, calla lilies, carnations, cedar seedlings, celery, chicory, chrysanthemums, endive, escarole, fennel, ferns, gladiolus, grapes, hydrangea, leeks, lettuce, lily, orchid, pampas grass, parsley, strawberry, turnips

Imported from: Argentina, Azores, Belgium, Bermuda, Brazil, Canada, Chile, Colombia, Costa Rica, Denmark, Ecuador, El Salvador, England, France, Iceland, Ireland, Italy, Japan, Lebanon, Madeira Islands, Mexico, Netherlands, New Zealand, Guatemala, Panama, Portugal, Spain, Sweden, U.S. Africa, Venezuela, Wales, Yugoslavia

Deroceras caruanae (Pollonera)

LITERATURE

QUEBEC: (Chichester and Getz, 1969)

OTHER

QUEBEC: Quebec city in greenhouses, Quebec County; Sherbrooke, greenhouse, Sherbrooke County

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Massachusetts, New York, South Carolina, Texas, Virginia

Collected in or on: artichoke, cabbage, cauliflower, celery, fennel, lettuce, stores

Imported from: Denmark, England, Germany, Greece, Italy, Yugoslavia

Superfamily Acavacea

FAMILY STROPHOCHILIDAE

Strophocheilus oblongus (Müller)

LITERATURE

TEXAS: Houston, University Texas Dental Branch (unclear whether 'colony' is in laboratory only or also outdoors) (Wiswell and Brown, 1968)

ORIGINAL DISTRIBUTION: Introduced from Porto Alegre, Brazil in 1966

Orthalicus floridensis Pilsbry

LITERATURE

FLORIDA: Sugarloaf Key; Summerland Key; Big Pine Key; No Name Key, Lower Matecumbe Key; E End Windleys Island; Long Island; Point Charles; Key Largo; Chokoloskee Key; Pavilion Key; Seminole Point; East and Middle Cape Sable; Flamingo; Sandy Key; Sanibel Island (Pilsbry, 1939)

MUSEUMS

FLORIDA: Middle Torch Key, 2 miles N Homestead (DMNH)

ORIGINAL DISTRIBUTION: Tropical America

Orthalicus reses (Say)

LITERATURE

FLORIDA: Key West; Stock Island; Key Vaca; Boca Chica; Sugarloaf Key; Big Pine Key; Little Pine Key; Grassy Key

ORIGINAL DISTRIBUTION: Tropical America

Porphyrobaphe iostoma Sowerby

LITERATURE

COLORADO: Greeley (1953) (Mead, 1953) Snail transported to Tucson and subsequently was dead. Apparently not established.

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Florida, Louisiana, Maryland, New York, Pennsylvania, Vermont, Texas

Collected in or on: bananas

Imported from: Ecuador, Honduras

ORIGINAL DISTRIBUTION: Tropical lowlands of Ecuador and Peru

Superfamily Helicacea

FAMILY PLEURODONTIDAE

Pleurodonte auricoma (Férussac)

LITERATURE

FLORIDA: Lemon City; Little River (Clapp, 1919)

ORIGINAL DISTRIBUTION: Cuba

Zachrysia provisoria (L. Pfeiffer)

OTHER

FLORIDA: Miami (HSF)

ORIGINAL DISTRIBUTION: Cuba

Pleurodonte marginella (Gmelin)

LITERATURE

FLORIDA: Lemon City; Little River (Clapp, 1919)

FAMILY FRUTICICOLIDAE

Bradybaena similis (Férussac)

LITERATURE

ALABAMA: Montgomery; Sumter County (Hubricht, 1965)

LOUISIANA: Alexandria (Hubricht, 1963) New Orleans (Goodrich, 1940) (Harry, 1951)

MISSISSIPPI: Laurel in Jones County (Hubricht, 1960); Taylorsville, Smith County (Hubricht, 1963)

MUSEUMS

FLORIDA: Miami, in nursery (NMNH)

LOUISIANA: Between Iberville and New Orleans (ANSP)

MISSISSIPPI: Jackson (NMNH)

AUTHOR COLLECTIONS

LOUISIANA: Reserve, Romeville, Ft. Pike, Hammond, Houma, Jeanerette, Shriever, Baton Rouge, Kilona, Buras, Boothville, New Orleans (numerous localities), Gretna, Alexandria

MISSISSIPPI: Picayune, Poplarville

OTHER

TEXAS: ¼ mile W of Texas 62 and Texas 2243, Jasper County (Hubricht, personal communication)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Alabama, Delaware,

Florida, Illinois, Louisiana, Maryland, Massachusetts, New York, Pennsylvania, Texas, Vermont, Washington

Collected in or on: African daisy, *Anthurium* leaf, asparagus, auto, baggage, bromeliad, cabbage, carnations, cauliflower, celery, Chinese cabbage, cockscomb, coconut, cor-

dyline leaf, *Dracaena* cutting, *Eryngium*, geranium, leek, lettuce, lilies, marigold, military cargo, mint, moss, orchid, palm, pineapple, pumpkin, red ginger, red pepper, St. Augustine grass, *Selaginella*, snap dragons, strawflower, string beans, sweet potatoes, taro, ti leaf, wax plant

Imported from: Algeria, Australia, Azores, Bermuda, Brazil, Cuba, Fiji, Formosa, Germany, Greece, Guam, Hawaii, Hong Kong, Italy, Jamaica, Japan, Mexico, Morocco, Philippines, Portugal, Puerto Rico, Spain, Vietnam

ORIGINAL DISTRIBUTION: Southeast Asia

Cepolis (Hemitrochus) varians (Menke)

LITERATURE

FLORIDA: Peninsula opposite Miami; Virginia Key; Biscayne Key; Matecumbe Key (Pilsbry, 1939)

FAMILY FRUTICICOLIDAE

Polymita muscarum

LITERATURE

FLORIDA: Library (Clapp, 1919)

Helicella caperata (Montagu)

(= *Jacosta (Candidula) intersecta* (Poiret)

LITERATURE

NORTH CAROLINA: Beaufort (Dundee, 1951)

VIRGINIA: Norfolk and York Counties (Hubricht, 1971); Accomack (Beetle, 1973); Yorktown, (Wood, 1951)

MUSEUMS

NORTH CAROLINA: Harkers Island; Roads Ends; Carteret County (UM)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Delaware, Florida, Illinois, Louisiana, Maryland, Massachusetts, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Texas, Virginia, Washington

Collected in or on: artichoke, cabbage cactus, cardoon, carnation, cauliflower, celery, Christmas rose, coriander seed, cork oak, cumin seed, cuttings, debris, dried peas, flowers, garden balsam seed grain, hazelnut, herbs, Japanese hop, leek, lettuce, military cargo, mixed vegetables, parsley, plant, rosemary, safflower seed, sesame, squash seed, sweet marjoram

Imported from: Algeria, Austria, Azores, Belgium, Cuba, Cyprus, Denmark, England, France, Greece, India, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Tunisia, Turkey

ORIGINAL DISTRIBUTION: Western Europe

Helicella elegans (Gmelin)

LITERATURE

SOUTH CAROLINA: Charleston (Townes, G. F. 1957) Logan Street, St. Peter's churchyard. First seen 1875, still abundant 1931

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Pennsylvania

Collected in or on: debris, 4 o'clocks, *Mirabilis* seed

Imported from: France, Netherlands

ORIGINAL DISTRIBUTION: Mediterranean coasts of France and Spain, Balearic Islands, Morocco to Tunisia

Helicella striata (Müller)

LITERATURE

VIRGINIA: Norfolk (Beetle, 1973)

MUSEUMS

VIRGINIA: Yorktown (ANSP)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Georgia, Illinois, Louisiana, Massachusetts, New York, South Carolina, Texas, Virginia

Collected in or on: bell pepper, military cargo, soil, soil with cuttings, squash, Tilia seed

Imported from: Azores, France, Germany, Greece, Italy, Spain

ORIGINAL DISTRIBUTION: Middle Europe

FAMILY HELICIDAE

Monacha cantiana (Montagu)

LITERATURE

ONTARIO: Hamilton (Pilsbry, 1939)

QUEBEC: Quebec City, an attempted introduction at Ottawa was unsuccessful (La Rocque, 1953); Cliff below Citadel; cliff bordering Plains of Abraham and extending to citadel (Pilsbry, 1939)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Delaware, Illinois, Louisiana, New Jersey, New York, Texas

Collected in or on: baggage, cargo, celery, lettuce, military cargo, plant, soil

Imported from: France, Germany, Italy, Turkey, Yugoslavia

ORIGINAL DISTRIBUTION: Europe, Netherlands, W Germany, France, England

Helicigona (Arianta) arbustorum (Linnaeus)

LITERATURE

NEWFOUNDLAND: St. John's Harbor in 1885 (Pilsbry, 1939)

INTERCEPTIONS (U.S. Dept. of Agriculture)

Collected at ports in: Florida, Georgia, Illinois, Ohio, South Carolina, New York

Collected in or on: auto, cabbage, cauliflower, leek, rose, strawberry

Imported from: Belgium, Europe, France, Germany, Italy, Netherlands

ORIGINAL DISTRIBUTION: Europe

Cochlicella ventrosa (Férussac)

LITERATURE

SOUTH CAROLINA: Moultrieville on Sullivan's Island; Charleston gardens on Beaufair Street and 56 Montague Street (Pilsbry, 1939)

MUSEUMS

SOUTH CAROLINA: Pompion Hill Chapel, Berkeley County

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Florida, Illinois, Louisiana, Massachusetts, New Jersey, New York, North Carolina, Pennsylvania, South Carolina, Virginia

Collected in or on: auto, bean, broccoli, cabbage, cargo, carnation, cedar, celery, citrus, cork oak bark, *Crassula*, leek, lettuce, military cargo, mint, palm, papaya, parsley, soil with *Ficus*, stores, sweet orange, tomato, vegetable stores

Imported from: Azores, Bermuda, Crete, France, Germany, Greece, Italy, Lebanon, Libya, Morocco, Portugal, South Africa, Spain, Turkey, Yugoslavia

ORIGINAL DISTRIBUTION: Mediterranean area

Hygromia hispida (Linnaeus)

LITERATURE

MAINE: Rockland and Thomaston in Knox County (Lermond 1908)
 MASSACHUSETTS: Martha's Vineyard near Gay Head (Pilsbry, 1939)
 NOVA SCOTIA: Halifax (Pilsbry, 1939); Wolfville (Moore, 1962); Victoria; Cape Breton and Inverness Counties (Macmillan, 1953)
 PRINCE EDWARD ISLAND: Charlottetown (Pilsbry, 1939)
 QUEBEC: Montreal (Pilsbry, 1939)

MUSEUMS

MAINE: Thomaston (MCZ)
 NEW BRUNSWICK: (MCZ)
 NOVA SCOTIA: Granton, Pictou County (MCZ)

OTHER

MASSACHUSETTS: (La Rocque, 1940)
 ONTARIO: Ottawa (La Rocque, 1940)
 QUEBEC: Quebec City (La Rocque, 1940)
 INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Delaware, Florida, Georgia, Illinois, Louisiana, Massachusetts, Michigan, New Jersey, New York, North Carolina, Pennsylvania, Texas, Virginia, Washington, D.C.

Collected in or on: amaryllis, apple, cabbage, cactus, cargo, carnation, cauliflower, celery, common smoke-tree, cutting, cypress cones, dahlia, elm log, fennel, flowers, heath, hellebore seed, Japanese hop seed, lettuce, lilac, lily, military cargo, *Nasturtium* seed, plants, primrose, rose, rosemary, saxifrage, shamrock, sphagnum, straw, wallflower, walnut log

Imported from: Australia, Austria, Belgium, Canada, Denmark, England, France, Germany, Greece, Iran, Ireland, Italy, Netherlands, Portugal, Spain, Turkey

ORIGINAL DISTRIBUTION: Europe; northern Asia to the Amur Valley

Hygromia striolata (C. Pfeiffer)

(=*Helix rufescens*)

LITERATURE

MASSACHUSETTS: Naushon Island in Buzzard's Bay (Pilsbry, 1939)
 NOVA SCOTIA: Halifax (Pilsbry, 1939)
 ONTARIO: Ottawa in Rockcliffe Park; Toronto (Pilsbry, 1939)
 QUEBEC: Quebec City on Cliffs and city walls; Lévis; Plains of Abraham (Pilsbry, 1939)

OTHER

NEW YORK: Goat Island near Niagara Falls (La Rocque, 1940)

ORIGINAL DISTRIBUTION: Central Europe, France, England

Otala lactea Müller

LITERATURE

ARIZONA: Phoenix; Tucson (bought live in store); also at N Jackson Avenue area
 FLORIDA: Tierra Verde on Gulf side of Pinellas Bayway about 1.3 miles from Bridge at N end of island (Friedl and Bayne, 1965); Pass-a-Grille (Henderson, 1937); Mud Key, Cabbage Key (van der Schalie, 1938)
 GEORGIA: Savannah Beach (Hubricht, 1963); Cockspur Island in mouth of Savannah River; Sullivan's Island (Pilsbry, 1939); Chatham County (Hubricht, 1964)
 KENTUCKY: Jefferson County (Hubricht, 1968); Ocean Park in Princess Anne County (Grimm, 1964)
 LOUISIANA: New Orleans, Jackson Square (Harry, 1948) (Viosca, P., 1928)
 MARYLAND: from markets: letter from Pilsbry to Henderson (Henderson, 1937)
 MISSISSIPPI: Vicksburg, foot of Jackson Street (Hubricht, 1963)
 MISSOURI: St. Louis (Hubricht, 1972)
 NEW YORK: Buffalo, from markets: letter from Pilsbry to Henderson (Henderson, 1937)
 OHIO: Cincinnati (Ingram, 1952)
 PENNSYLVANIA: from markets: letter from Pilsbry to Henderson (Henderson, 1937)
 TEXAS: Coryell County (Cheatum, Fullington, Pratt, 1972); Galveston, Galvez Hotel; College Station; Fort Worth (Pratt, 1964); Houston in SW section (McClelland, 1950); Port Arthur (Clench, 1944); Port Arthur, in lot near Fruehauf Trucking Company (Grimm, 1964); San Antonio (Murray, 1968); Waco (Strecker, 1935); Bryan, colony started in 1972 (Jackson, 1944)

VIRGINIA: Virginia Beach (dead) (Beetle, 1973)

MUSEUMS

FLORIDA: St. Petersburg (CNHM); Clearwater (ANSP)
 NEW YORK: Rockaway Beach (UM)
 TEXAS: San Marcos (CNHM); Dallas (UM); Galveston County (FWMSH); Tarrant County (FWMSH)

OTHER

FLORIDA: Muller Key (HSF)
 INTERCEPTIONS: (U.S. Dept. of Agriculture)
 Collected at ports in: Alabama, Florida, Illinois, Massachusetts, New York, Ohio, Pennsylvania, South Carolina, Texas, Virginia

Collected in or on: baggage, broccoli, cabbage, cargo, cauliflower, celery, chrysanthemum, debris, jasmine, lettuce, parsley quarters, snails, swiss chard

Imported from: Azores, Bermuda, France, Greece, Italy, Spain, Switzerland, Yugoslavia

ORIGINAL DISTRIBUTION: N Africa and S Europe

Otala (Eobania) vermiculata Müller

LITERATURE

LOUISIANA: New Orleans, Jackson Square (since 1918 - Viosca, 1928) No longer there (Dun-dee)

TEXAS: Bryan, Brazos County (est. 1927) (Jackson, 1944); Waco, McLennan County (Strecker, 1935); Galveston (Pratt, 1964)

MUSEUMS

NEW YORK: New York City (UM)

TEXAS: San Benito in Cameron County (NMNH)

OTHER

TEXAS: Galveston (HSF)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Alabama, Florida, Louisiana, Maryland, Massachusetts, New York, South Carolina, Texas, Virginia

Collected in or on: aster, auto, baggage, bought as food, cabbage, cargo, cauliflower, celery, clematis seed, cypress cone, fennel, Ipomea seed, Iris, leek, lemon, lettuce, lily, mail, military cargo, mint, mixed flowers, fig, narcissus, parsley, potato, railroad car, romaine lettuce, sage leaf, ship's hold, soil, stores, swiss chard

Imported from: Algeria, Belgium, Bermuda, Cuba, Cyprus, England, France, Germany, Gibraltar, Greece, Israel, Italy, Lebanon, Libya, Mexico, Monaco, Morocco, Netherlands, Poland, Spain, Sweden, Turkey, Yugoslavia

Cepaea hortensis (Müller)

LITERATURE

MAINE: Bass Island, Washington County: Bar Harbor (Clapp, 1907); Little Duck Island, 8 miles S Mt. Desert (Pilsbry, 1939); Matinicus Island (Pilsbry, 1939); Duck Harbor, on Isle au Haute (Johnson, 1915); E Boothbay (Gilmore, 1947); Pumpkin Knob (Pilsbry, 1939); White Bull Island (Mazyck, 1914); Sheepscot Bay (Pilsbry, 1939); Portland (1843) (Johnson, 1906); Seal Rock (Pilsbry, 1939); Rockport (Cockerell, 1899); Little Egg Rock Kennebunkport (Johnson, 1906); Sprucehead Island (Johnson, 1915); Isle au Haute (Pilsbry, 1939); Brown Cow (Johnson, 1913); Inner Green and Cliff Islands in Casco Bay (Pilsbry, 1939)

MASSACHUSETTS: Cape Ann region (1837); Salt, Eagle, House, Little and Outer Gooseberry Islands (Pilsbry, 1939); Kettle Island (Pilsbry, 1939); Edgartown, Martha's Vineyard (Johnson, 1915); Manchester (Pilsbry, 1939); Magnolia (Cockerell, 1890); Nantucket (Pilsbry, 1890); Gloucester; Bass Rocks; Rockport; Old Harbor, Cohasset; High Pines near Duxbury; Cape Cod at Chatham (1837); Provincetown cemetery; Snow's Point, Chappaquidic Island; in shell heaps near Bay Head, Martha's Vineyard, Nantucket, and Tuckernuck Island (Pilsbry, 1939); Orleans and Cohasset (Johnson, 1906)

NEW HAMPSHIRE: Wood Island, Portsmouth (Pilsbry, 1939)

NEW YORK: Astoria; Lloyd's Neck (1894--extinct); Flushing (1906) Long Island (Pilsbry, 1911); Douglaston; Jamaica (Flipse, 1948)

OHIO: Cincinnati (Ingram, 1952)

NEW BRUNSWICK: Grand Manan (Pilsbry, 1939); (La Rocque, 1961)

NEWFOUNDLAND: Two Codroy valleys; Serpentine

River; East River at Hawkes Bay (Johnson, 1906). Doctor Hill; Bard Harbor Hill; Highland of St. John; St. John's Bay; Straits of Belle Isle; French (=Tweed) Island; Lark Island; Bay of Islands (Vanatta, 1927). Tucker's Head; Lord and Lady Cove above Lomand; Killdevil Mt.: summit; Main Arm and Southern Arm of Bonne Bay; Deer Arm of Bonne Bay; Point Riche of Ingonachoix Bay (Vanatta, 1930). Hanna's Head; Bay of Islands (Brooks and Brooks, 1940)

NOVA SCOTIA: Yarmouth and vicinity; East Jordan, Digby Neck; Cape Breton Island (Pilsbry, 1939). Halifax, Mwhone Bay (Wintenberg, 1919). Wolfville (Moore, 1962). Victoria, Cape Breton, and Inverness Counties (Macmillan, 1953)

ONTARIO: Toronto (Oughton, 1938)

PRINCE EDWARD ISLAND: Bloomfield, Douglas and Souris (Pilsbry, 1939). Curtan Island (Johnson, 1906)

QUEBEC: Neuville; Pointe aux Trembles (Clapp, 1911). Plains of Abraham; Rimouski, 1 or 2 miles from St. Lawrence; Gaspé Basin; Bonaventure Island (Pilsbry, 1939). Percé at 1200 elevation (Pilsbry, 1903). Anticosti Island (Pilsbry, 1939). Basin; Grindstone and Alright; Magdalen Islands (Clapp, 1901). Ruisseau de la Grande Carrière on St. Lawrence; Brandy Pots Island; Hare Island; Barchois; Cap Rouge (La Rocque, 1962)

St. PIERRE AND MIQUELON: (Johnson, 1906); Pilsbry, 1939)

MUSEUMS

MAINE: Bar Harbor (CNHM). Cliff Island, Casco Bay, Great Bass Island, Portland (ANSP). Moore Island; Cape Porpoise (NMNH)

MASSACHUSETTS: Swampscott; Boston (CNHM). Nantucket, Clements, New Bedford (ANSP). Duxbury in Plymouth County (UM). Salem Harbor Island (NMNH)

NEW JERSEY: Tompkins (AM)

NEW YORK: Utica (CNHM)

PENNSYLVANIA: Lancaster (CNHM); Philadelphia (ANSP)

RHODE ISLAND: Little Compton (NMNH)

VIRGINIA: Lynchburg (CNHM)

NEWFOUNDLAND: Harry's Run (AM). Sprucebrook (UM). White Point, Bonne Bay; Ingonachoix Bay (ANSP)

NOVA SCOTIA: Clements Port, Weymouth, Badalock, Margaree Harbor (UM). Sable Island (NMNH). North End Little Narrows Ferry; Culloden; along Jordan River; Shelbourne County; E. Ferry, Digby Neck; Mt. Uniacke; Benton Station; New Glasgow (ANSP)

QUEBEC: Alright Island; Magdalen Island (ANSP)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Delaware, Illinois, Virginia

Collected in or on: baggage, cargo, lilac, maiden pink, pine needles

Imported from: England, France, Germany, Switzerland

Cepaea nemoralis (Linnaeus)

LITERATURE

COLORADO: West Cliff, Custer County; Intro-

duced from Burlington, New Jersey (Rowley, 1893)

KENTUCKY: Louisville (Reed, 1964). Lexington-Scott Street and Railroad; 328 Aylesford Place (Branson and Batch, 1969)

MARYLAND: Frederick County (Grimm, 1971)

MASSACHUSETTS: Boston in Jamaica Plain in vacant lot in 1000 block of Centre Street (Rehder, 1947). Rockport in Plymouth County (Cockerell, 1899). Lynn; Norwell, Cape Ann; Martha's Vineyard (Dexter, 1966). Marion at Archer Estate on Stetson Road (Johnson, 1927)

MISSOURI: St. Louis on Principia School Grounds (Remington and Clench, 1924)

NEW JERSEY: Burlington (1857) still there 1937 (Alexander, 1952)

NEW YORK: New York City in Springfield Gardens, Queens (1916) (Landman, 1956). Brighton, Monroe County (suburb of Rochester); Long Island at Flushing (1906); Astoria; Lloyd's Neck (extinct before 1894) (Blakeslee, 1945). Douglaston and Jamaica on Long Island (Flipse, 1948). Rockaway Beach (Jacobson, 1955). Western New York: many large populations (Reed, 1964). Dansville, 1 - 3 miles W on Rte. 245, Livingston County (Reed, 1964). Queens County in greenhouse (Karlin and Naegele, 1960)

PENNSYLVANIA: Blairsville in W Pennsylvania (Introduced from Lexington, Virginia) (Pilsbry, 1939)

RHODE ISLAND: Norwood (Matteson, 1945). Newport in abandoned quarry near Rogers High School (Clench, 1960)

TENNESSEE: Knoxville (Barber, 1918)

VIRGINIA: Rockbridge County (Middleton, 1932). Shenandoah County (Rehder, 1947). Madison Heights: Main Street between 3rd and 9th, Amherst County; Snowdon along James River, Rt. 521, Amherst County; Forest on Rt. 450; Crozier, Rt. 6, Goochland County; Buena Vista, between 12th and 13th Streets, Rt. 521, Rockbridge County; Bacova Junction on Rt. 615, Bath County; Covington, Alleghany County; Clifton Forge, Alleghany County; Iron Gate, Alleghany County; Lick Run, Botetourt County (Reed, 1964). Augusta; Bath; Bedford; Chesapeake Counties (Beetle, 1973); Staunton in Augusta County (Vanatta, 1936)

WASHINGTON, D.C.: (Grimm, 1971)

WISCONSIN: Baraboo in Sauk County (Doubtful, Pilsbry, 1939)

NOVA SCOTIA: Sable Island (La Rocque, 1953)

ONTARIO: Toronto (Oughton, 1938); London (Judd, 1953); Owen Sound; Meaford on S Georgian Bay (La Rocque, 1953)

QUEBEC: Anticosti Island; Magdalen Islands; Entry Island (La Rocque, 1962)

MUSEUMS

INDIANA: New Albany; Floyd County at Falls of the Ohio River (CNHM)

MASSACHUSETTS: Chatham Old Harbor Road; Cape Cod (Louis Estates at Marion, ANSP); South Dartmouth, Bristol Colony, Wareham, Stoney Brook, Hyde Park, Boston University Campus,

Roslindale (MCZ); Gloucester, Essex County (CM); Rose Point, Wareham (NMNH)

NEW HAMPSHIRE: Berlin in Coos County (MCZ)

NEW JERSEY: Seaside Park, Brant Beach, Beach Haven, Tuckerton (DMNH)

NEW YORK: Brooklyn, Bay Parkway, Washington Cemetery, Flatbush on Long Island (UM); Flushing on Long Island (MCZ); Lynnbrook in Nassau County (ANSP); Bank of Erie Canal, Winton Road and French Road, Rochester (AM)

OHIO: Cincinnati (MCZ)

SOUTH CAROLINA: Roebock in Spartanburg County (CM)

TEXAS: Beeville in Galveston County (Old Island and railroad station) (NMNH)

VIRGINIA: Richmond, Henrico County (CNHM); Lexington, Staunton (ANSP); Harrisburg (AM)

NOVA SCOTIA: E Peteswick, Halifax County (UM)

ONTARIO: S Hampton (UM); Sieberton (CM)

QUEBEC: Bonaventure Island, Gaspé County (UM)

OTHER

NEW YORK: Rochester, Monroe County (HSF); E Rockaway, Nassau County, 1961 (HSF)

INTERCEPTIONS: (U.S. Dept. of Agriculture) Collected at ports in: Louisiana, Maryland, New Jersey, New York, South Carolina Collected in or on: auto, baggage, military cargo, moss, vehicle Imported from: England, France, Germany, Ireland

ORIGINAL DISTRIBUTION: Central and Western Europe

Helix punica Müller
MUSEUMS

LOUISIANA: New Orleans for sale in French Market (AM)

Helix axia Müller
LITERATURE

FLORIDA: Pass-a-Grille (Henderson, 1936)

ORIGINAL DISTRIBUTION: S Spain, Morocco, Algeria

Helix cantiana Montagu
LITERATURE

QUEBEC: In Citadel (1886) (Cockerell, 1889)

ORIGINAL DISTRIBUTION: Europe

Helix pomatia Linnaeus
LITERATURE

MASSACHUSETTS: Plymouth, 27 Nelson Street (1928) (Turner, 1961)

MICHIGAN: Jackson (Archer, 1937); Kalamazoo, (Hanna, 1963)

WISCONSIN: Milwaukee, introduced on an island on Milwaukee River and on a point in Pine Lake, Waukesha County, 30 miles from Milwaukee (Washburn, 1941). Glendale, 20' N of where Pierron Road dead ends (1956) (McClary, 1965)

MUSEUMS

INDIANA: Center of Connersville (MCZ)

FLORIDA: Lake Okeechobee (CNHM)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Alabama, Delaware, Illinois, Massachusetts, Michigan, New Jersey, New York, Ohio, Texas, Virginia

Collected in or on: baggage, bought as food, cabbage, lettuce, mail, seeds, stores, violet

Imported from: Austria, Czechoslovakia, France, Germany, Greece, Hong Kong, Italy, Switzerland, Yugoslavia

ORIGINAL DISTRIBUTION: Central Europe

Helix aspersa Müller
LITERATURE

ARIZONA: Tucson (Mead, 1953); Yuma, Prescott, Phoenix (in irrigated gardens and nurseries (Bequaert and Miller, 1973)

LOUISIANA: Shreveport, in nursery (Branson, 1961). Baton Rouge (Featherman, 1871). Still present 1964. New Orleans (Tryon, 1866); last reported 1928; no longer present (Hermann and Dundee, 1964)

MAINE: Portland (1938) No longer in existence (Norton, 1936)

MASSACHUSETTS: Woods Hole (1883) specimens from Ireland released (Rees, 1955)

MICHIGAN: Nursery sales grounds in Ingham, Oakland, Saginaw and Wayne County (Hanna, 1969)

NEW MEXICO: Santa Fe (1945) (Cockerell, 1946); Albuquerque, in yard (CEIR, 1973); Roswell and Las Cruces (Mead, 1952)

SOUTH CAROLINA: Charleston in St. Phillips Cemetery (1851) (Townes, 1957)

TEXAS: Brewster County (Cheatum, 1972); Waco (Strecker, 1935); Fort Worth in Tarrant County, in nursery (1963); Dallas (1962) County (Prstt, 1964)

VIRGINIA: Norfolk County (Hubricht, 1971); Chesapeake County (Beetle, 1973)

MUSEUMS

NEW YORK: Bought in city. (MCZ); Staten Island (AM)

TEXAS: San Marcos (CNHM)

VIRGINIA: Virginia City (CNHM)

OTHER

TEXAS: Houston (McGee, personal communication); El Paso (Metcalf, personal communication); San Antonio (1968) (Murray, personal communication) now abundant in watered yards

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Alabama, Arizona, Delaware, Florida, Georgia, Illinois, Louisiana, Massachusetts, New Jersey, New York, Ohio, Pennsylvania, South Carolina, Texas, Virginia

Collected in or on: agave, apple, asparagus, auto, baggage, broccoli, beets, bought as food, cabbage, cactus, carnation, chestnut, chicory, citrus, cladium, *Coriander*, crew food, *Crassula* sp., dahlia, eggcrate, *Erysimum*, flowers, four o'clock flowers, geranium, herbs, lemon, lily, mail, mandarin orange, military cargo, leek, mint, onion, orange, orchid, palm, pepper, philodendron, rose, *Sedum* sp., sorrel leaf, squash, string beans, sweet orange, wood

Imported from: Algeria, Australia, Azores,

Belgium, Colombia, Crete, England, France, Germany, Greece, Haiti, Ireland, Israel, Italy, Mexico, Netherlands, Peru, Portugal, Spain, Turkey, United Kingdom

Also collected in Michigan on a shipment of plants from California (adults and subadults). Eggs were found at a nursery in Saginaw, Michigan (Hanna, 1969)

ORIGINAL DISTRIBUTION: Europe

Helix melanostoma Drap.
OTHER

NEW YORK: Bought in New York City (HSF)

ORIGINAL DISTRIBUTION: Southern Europe

Helix aperta Born
MUSEUMS

LOUISIANA: New Orleans (CNHM) (no longer present, Dundee)

MASSACHUSETTS: Nahant (CNHM)

OTHER

NEW YORK: Bought in New York City (HSF)

INTERCEPTIONS: (U.S. Dept. of Agriculture)

Collected at ports in: Alabama, Delaware, Georgia, Illinois, Louisiana, Maryland, Massachusetts, New Jersey, New York, North Carolina, Pennsylvania, South Carolina, Texas, Virginia

Collected in or on: apple, artichoke, baggage, beet, cabbage, cargo, carrot, celery, cauliflower, fennel, leek, lettuce, mint, moss, parsley, railroad car, rosemary, shrub-althea, spinach, stores, squash, swiss chard, tomato

Imported from: Africa, Azores, Belgium, England, France, Germany, Greece, Italy, Morocco, Netherlands, Spain

ORIGINAL DISTRIBUTION: Southern Europe, North Africa

Gulella bicolor Hutton
LITERATURE

FLORIDA: Miami in Coconut Grove Park (Jacobson, 1957)

LOUISIANA: New Orleans, 20 localities around the city (Dundee and Watt, 1951)

SOUTH CAROLINA: Charleston, near Cooper Road, N of Lee Street (Hubricht, 1953)

AUTHOR COLLECTIONS

LOUISIANA: Boothville

MISSISSIPPI: Vicksburg

OTHER

FLORIDA: 15 miles W Miramar, Broward County (Hubricht, personal communication)

TEXAS: Rabb Palm Grove, Cavern County (Neck, personal communication)

ORIGINAL DISTRIBUTION: Southern Africa

CLASS PELECYPODA

ORDER EULAMELLIBRANCHIATA

Suborder Heterodonta

Superfamily Sphaeriacea

FAMILY CORBICULIDAE

Corbicula manilensis (Philippi)
(=*C. fluminea* and *C. leana*)

LITERATURE

ALABAMA: Escambia River, 3 miles E Century. Tombigbee River, 13 miles E Silas; Mobile River, 1 mile N Bucks and at Chastang Bluff E of Chastang (Hubricht, 1963). Alabama River, Claiborne (Hubricht, 1965). Choctaw Bluff in Clarke County; Cahaba River, 1.5 miles SW Spratt in Perry County; Tombigbee River, McCarty's Ferry SE of Ararat; Tuscahoma Landing ESE Butler in Choctaw County; Lock 3 SE Whitfield, below Demopolis Dam; 1.5 miles NE Cochran in Pickens County; Successnochee Creek E of Bellamy in Butler County; Tuscahoma Landing (Hubricht, 1966)

ARIZONA: Phoenix (Dundee and Dundee, 1958). Main canal 4 miles NW Parker (Keup, Horning and Ingram, 1963)

FLORIDA: Ochlockonee River, 11 miles NW Tallahassee. Lake Hicpochee on Caloosahatchee River Canal (Clench, 1970). Chipola River, 2 miles E Clarksville; Appalachicola River at US 90 1/2 mile W Chattahoochee; Withlacoochee River at Sedge of Inglis in Levy County on US 19 and 98 (Heard, 1964)

GEORGIA: Altamaha River, 3 miles from confluence with Oconee River; Flint River in Crawford County (Sickel, 1973). Savannah River, 9 miles NE Milhaven, Screven County (Fuller and Powell, 1973)

ILLINOIS: Ohio River just E of Fort Massac and Metropolis in Massac County (Fechtner, 1962); Mississippi River at Granite City (1966) (Tomerson and Myer, 1960). Mississippi River, throughout the Illinois section; Wabash River up from Ohio River to White County; Mississippi River, Cairo on Missouri side just below Illinois-Missouri bridge (Parmalee, 1965)

KENTUCKY: Ohio River (= *C. leana*), Cincinnati down to Warsaw (Keup, Horning, Ingram, 1963). Green River, below Central City to above Paradise; 100 miles upstream from confluence of Green and Ohio Rivers; Knoxville on Tennessee River (Bates, 1962). Kentucky River, mouth of Silver Creek in Madison County; Camp Daniel Boone in Jessamine County; mouth of Red River in Estil County (Branson and

Batch, 1969). Tennessee River, below Pickwick dam in Hardin County (Sinclair and Ingram, 1961)

LOUISIANA: Calcasieu River at mile 66 in Calcasieu Parish; Bayou Magasille in Assumption Parish; Bayou Sorrell at the locks in Iberville Parish (Dundee and Harman, 1963). Amite River at Port Vincent (Heard, 1966). Pearl River, just above entrance of Coburn Creek near Bogalusa. Now also in East Pearl and West Pearl (Gunning and Suttikus, 1966)

OHIO: Ohio River, Cincinnati (Keup, Horning and Ingram, 1963)

OKLAHOMA: Bethany, Lake Overholser (Clench, 1972)

PENNSYLVANIA: New Jersey: Delaware River between Philadelphia and Trenton (Fuller and Powell, 1973)

SOUTH CAROLINA: PeeDee River, 3 miles SE of Society Hill, Darlington County (Fuller and Powell, 1973)

TENNESSEE: Nolichucky River, 3.5 miles SE Warrensburg, Greene County (Clench and Stansbery, 1969)

TEXAS: El Paso to Radium Springs in Dona Ana County, New Mexico (Metcalf, 1966). Monte Alto Reservoir (Delta Lake) in Hidalgo County; Irrigation Canal on US 281 near Relampago, Hidalgo Corpus Christi 25 miles W in Lake Mathis (Murray, 1971)

WEST VIRGINIA: Kanawha River at Chelyan (Thomas and Mackenthum, 1964)

MUSEUMS

ALABAMA: Tombigbee River below Demopolis Dam, 2 miles E McDowell, Sumter County (MCZ)

ARKANSAS: Block River, Pocahontas, Randolph County (MCZ)

FLORIDA: Withlacoochee River, below Dam, Citrus County (MCZ)

OTHER

ARIZONA: Lake Mead in Mohave County; Yuma County; Maricopa County; Yavapai County in Verde River

KENTUCKY: Rock Castle River, Livingston; Barren River (DHS)

MISSISSIPPI: Tombigbee River, above Columbus downstream to impoundment (DHS)

OHIO: Muskingum River, Beverly; Lowell; Devols Dam, Marietta; Licking River; Olentangy River, Delaware Reservoir (DHS)

APPENDIX

(Mollusks imported at United States Ports, intercepted by U.S.D.A. since 1955 but not established)

Achatina achatina (Linnaeus)

Collected at ports in: New York

Collected in or on: cargo

Imported from: Ghana

Achatina fulica (Linnaeus)

Collected at ports in: Arkansas, Delaware, Florida, Maryland, New York, South Carolina, Texas, Washington

Imported from: Caroline Island, Formosa, Guam, Hawaii, Japan, Mauritius, Okinawa, Pa-

kistan, Philippines, Saipan, Singapore, Thailand, Tinian, Vietnam

Bradybaena circulus (Pfeiffer)

Collected at ports in: Delaware

Collected in or on: cargo

Imported from: Okinawa

Bradybaena despecta (Pfeiffer)

Collected at ports in: Delaware, North Carolina

Collected in or on: aircraft, cargo, stores

- Imported from: Japan, Okinawa, Taiwan, Vietnam
- Bradybaena fodiens (Pfeiffer)**
Collected at ports in: Florida, Texas
Collected in or on: cargo, orchid, parsley seed, soil, spinach
Imported from: Brazil, Guam, Japan, Mexico, Okinawa, South Pacific
- Bradybaena mighelsiana (Pfeiffer)**
Collected at ports in: Washington
Collected in or on: mail
Imported from: Okinawa
- Bradybaena serotina (A. Adams)**
Collected at ports in: Delaware, South Carolina, Texas
Collected in or on: cargo
Imported from: Okinawa
- Bradybaena sieboldtiana (Pfeiffer)**
Collected at ports in: Texas
Collected in or on: cargo
Imported from: Korea
- Bradybaena tourannensis (Souleyet)**
Collected at ports in: Washington
Collected in or on: celery
Imported from: Japan
- Clausilia lineolata (Held)**
Collected at ports in: Louisiana, New York, South Carolina
Collected in or on: military cargo
Imported from: Italy, Libya, Morocco, Spain
- Cochlicella barbara (Linnaeus)**
Collected at ports in: Alabama, Delaware, Georgia, Louisiana, Maryland, New Jersey, New York, North Carolina, Pennsylvania, South Carolina, Texas, Virginia
Collected in or on: auto, amaryllis, baggage, cabbage, cactus, cargo, carnation, cedar of Lebanon, chicory, common 4 o'clock, garlic, Jasmine, leaf, lentil, military cargo, mint, olive, parsley, radish, red pepper, rosemary, soil, spinach, sweet pea, swiss chard, verbascus, watercress
Imported from: Algeria, Australia, Azores, Crete, France, Germany, Greece, Ireland, Italy, Japan, Lebanon, Libya, Morocco, Spain, Tunisia, Turkey
- Cochlicella conoidea (Draparnaud)**
Collected at ports in: Louisiana, New York, North Carolina, Pennsylvania, South Carolina, Texas, Virginia
Collected in or on: auto, bean seed, cargo, herbs, military cargo, pear, seed
Imported from: Greece, Italy, Morocco, Spain
- Deroceras agreste (Linnaeus)**
Collected at ports in: Massachusetts
Collected in or on: leek
Imported from: England
- Deroceras caruanae (Pollonera)**
Collected at ports in: Massachusetts, New York
Collected in or on: artichoke, cabbage, celery, lettuce, soil
Imported from: Denmark, England, Germany, Italy
- Deroceras laeve (Müller)**
Collected at ports in: Louisiana
Collected in or on: banana
Imported from: El Salvador
- Drymaeus alternans (Beck)**
Collected at ports in: Florida, Texas
Collected in or on: bromeliad, cargo, orchid
Imported from: Costa Rica, Guatemala, Honduras, Mexico, Nicaragua
- Drymaeus cuernavacensis (Crosse & Fischer)**
Collected at ports in: Texas
Collected in or on: orchid
Imported from: Mexico
- Drymaeus hegewischi (Pfeiffer)**
Collected at ports in: Texas
Collected in or on: cargo, bromeliad, orchid
Imported from: Costa Rica, Mexico
- Drymaeus hepatostomus (Pfeiffer)**
Collected at ports in: Texas
Collected in or on: *Selaginella*
Imported from: Mexico
- Drymaeus heyneimanni (Pfeiffer)**
Collected at ports in: Texas
Collected in or on: orchid
Imported from: Mexico
- Helicella amanda (Rossmassler)**
Collected at ports in: South Carolina, Texas
Collected in or on: cargo, stores
Imported from: Italy
- Helicella apicina (Lamarck)**
Collected at ports in: Delaware, Georgia, New York, North Carolina
Collected in or on: cargo, herb, vehicle
Imported from: Azores, France, Libya, Tunisia
- Helicella arigonis (Rossmassler)**
Collected at ports in: Delaware
Collected in or on: cargo
Imported from: Libya
- Helicella armillata (Lowe)**
Collected at ports in: Massachusetts
Collected in or on: herb
Imported from: Azores
- Helicella barcinensis (Bourguignat)**
Collected at ports in: Delaware
Collected in or on: cargo
Imported from: Spain
- Helicella calcarata (Benson)**
Collected at ports in: New York
Collected in or on: herb
Imported from: Malta
- Helicella candidula (Studer)**
Collected at ports in: Louisiana, Maryland, New Jersey, New York, Pennsylvania
Collected in or on: cargo, cauliflower, 4 o'clocks, lettuce, soil
Imported from: Belgium, Denmark, England, France, Italy, Netherlands
- Helicella cincta (Müller)**
Collected at ports in: Florida, Michigan, New York
Collected in or on: baggage, stores
Imported from: Greece, Italy, Spain
- Helicella conspurcata (Draparnaud)**
Collected at ports in: Delaware, Florida, Illinois, Louisiana, Maryland, Massachusetts, New Jersey, New York, North Carolina, Pennsylvania, South Carolina, Texas, Virginia, Washington
Collected in or on: artichoke, Bougainville flowers, cabbage, cargo, carnation, dried peas, *Euphorbia* seed, Grecian laurel, figs,

- household, *Laburnum* sp., lettuce, military cargo, mint, oleander, pine cone, prickly pear, rosemary, sage, seed, soil, straw, vehicle, wild cucumber
 Imported from: Azores, Belgium, England, Europe, France, Greece, Israel, Italy, Jordan, Malta, Morocco, Portugal, Spain, Tunisia, Turkey
- Helicella convexa* (Pfeiffer)**
 Collected at ports in: Florida, New York, South Carolina
 Collected in or on: *Bryophyllum*, cargo, military cargo, orchid, soil
 Imported from: Bermuda, British Honduras
- Helicella corrugata* (Gmelin)**
 Collected at ports in: Massachusetts
 Collected in or on: olive, plant
 Imported from: Italy
- Helicella cretica* (Férussac)**
 Collected at ports in: Alabama, Delaware, Georgia, Illinois, Louisiana, Maryland, Massachusetts, Michigan, New York, North Carolina, Pennsylvania, South Carolina, Texas, Virginia, Washington, D.C.
 Collected in or on: airplane, asparagus, beans, bulb, canary grass, cabbage, cargo, cedars of Lebanon, celery, chicory, cumin seed, dried daisies, flowers, globe artichoke, herbs, household goods, leek, lettuce, marjoram, military cargo, parsley, plants, radish, seeds, wild cucumber
 Imported from: Algeria, Crete, Cyprus, France, Greece, Israel, Italy, Lebanon, Libya, Spain, Tunisia, Turkey
- Helicella derbentina* (Andrezejowski)**
 Collected at ports in: Alabama, Delaware, Louisiana, New Jersey, New York, Ohio, South Carolina, Tennessee, Virginia
 Collected in or on: airplane, auto, baggage, cargo, cauliflower, *Lavendula*, legume seed, lettuce, military cargo, pistachio
 Imported from: Europe, France, Greece, Iran, Italy, Lebanon, Turkey
- Helicella elegans* (Gmelin)**
 Collected at ports in: Pennsylvania
 Collected in or on: debris, 4 o'clocks, *Mirabilis* seed
 Imported from: France, Netherlands
- Helicella explanata* (Müller)**
 Collected at ports in: North Carolina
 Collected in or on: cargo
 Imported from: Greece
- Helicella figulina* (Parreys)**
 Collected at ports in: Delaware, Illinois, New York
 Collected in or on: cabbage, cargo, *Galanthus*, military cargo
 Imported from: Greece, Israel, Turkey
- Helicella gigaxi* (Charpentier)**
 Collected at ports in: New Jersey
 Collected in or on: cargo, 4 o'clocks, parsley
 Imported from: Italy
- Helicella itala* (Linnaeus)**
 Collected at ports in: Alabama, Louisiana, Pennsylvania, New Jersey, New York
 Collected in or on: baggage, cabbage, cargo, carrot, cauliflower, endive, escarole, herbs, leek, lettuce, military cargo, mint, olive, parsley, seed, snaketree
 Imported from: Bulgaria, France, Italy, Netherlands, Yugoslavia
- Tricia (Helicella) holotricha* (Boettger)**
 Collected at ports in: Texas
 Collected in or on: stores
 Imported from: Spain
- Tricia (Helicella) lanuginosa* Boissy**
 Collected at ports in: Louisiana
 Collected in or on: cargo
 Imported from: Spain
- Helicella joppensis* (Roth)**
 Collected at ports in: Alabama, Delaware, Louisiana, Massachusetts, New York, Pennsylvania
 Collected in or on: cargo, lentil seed, parsley, sand, soil, sunflower stem
 Imported from: Israel, Lebanon, Turkey
- Helicella krynickii* (Andrezejowski)**
 Collected at ports in: Delaware, Louisiana, Maryland, New Jersey, New York, South Carolina, Texas
 Collected in or on: cabbage, cargo
 Imported from: Israel, Turkey
- Helicella larnacensis* (Kobelt)**
 Collected at ports in: Virginia
 Collected in or on: cumin, seed
 Imported from: France
- Helicella littoralis* (Mousson)**
 Collected at ports in: New York
 Collected in or on: cargo, military cargo
 Imported from: Greece, Turkey
- Helicella maritima* (Draparnaud)**
 Collected at ports in: Alabama, Delaware, Florida, Illinois, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, New York, Ohio, Pennsylvania, South Carolina, Virginia, Washington, Wisconsin
 Collected in or on: almond, asparagus, baggage, barley, cabbage, camomile, carduncellus seed, cork oak, with *H. aspersa*, endive, 4 o'clocks, seed, geranium, grapefruit, grass peavine, hemp, herbs, herb, mail, military cargo, peach, plane, rose, rosemary, safflower seed, strawberry, sweet marjoram, thyme
 Imported from: Algeria, Azores, France, Greece, Israel, Italy, Libya, Morocco, Poland, Spain, Tunisia, Turkey
- Helicella meda* (Porro)**
 Collected at ports in: Louisiana, New York, Pennsylvania
 Collected in or on: cargo, herb, maidenhair fern
 Imported from: Italy, Malta
- Helicella neglecta* (Draparnaud)**
 Collected at ports in: Delaware, Louisiana
 Collected in or on: auto, general cargo, military cargo
 Imported from: France, Italy, Libya, Portugal, Spain, Turkey
- Helicella neritella* (Lamarck)**
 Collected at ports in: Florida
 Collected in or on: orchid
 Imported from: Jamaica

- Helicella obvia* (Menke)
Collected at ports in: New York, South Carolina
Collected in or on: leek, stores
Imported from: France
- Helicella oweniana* (Pfeiffer)
Collected at ports in: Louisiana, Texas
Collected in or on: bromeliad, palm
Imported from: Mexico
- Helicella peritella* (Lamarck)
Collected at ports in: Florida
Collected in or on: orchid
Imported from: Jamaica
- Helicella profuga* (Schmidt)
Collected at ports in: Louisiana
Collected in or on: cargo, military cargo
Imported from: Greece, Spain
- Helicella protea* (Ziegler)
Collected at ports in: Delaware, Florida, Louisiana, Michigan, New Jersey, New York, Virginia, Washington, D.C.
Collected in or on: aster seed, cargo, chicory, conehead thyme, fennel seed, herbs, lentil seed, marigold seed, military cargo, string beans
Imported from: Lebanon, Malta, Morocco, Israel, Turkey, United Arab Republic
- Helicella pyramidata* (Draparnaud)
Collected at ports in: Alabama, Delaware, Louisiana, Massachusetts, Michigan, New York, North Carolina, South Carolina, Virginia
Collected in or on: amaryllis, anise, beans, cactus, cargo, celery, fig, *Lathyrus*, military cargo, oregano, plant residue, rosemary, seed, snails as such, soil
Imported from: Crete, Germany, Greece, Italy, Libya, Spain, Turkey
- Helicella seetzoni* (Koch.)
Collected at ports in: New York
Collected in or on: baggage
Imported from: Israel
- Tricia* (*Helicella*) *striolata* (Pfeiffer)
Collected at ports in: Alabama, Delaware, Louisiana, New Jersey, New York, Ohio, Texas
Collected in or on: Arabian coffee, cargo, chicory, eggplant, escarole, fennel, hazelnut, leek, lettuce, orchid, palm, parsley, seeds, spinach, snaketree, soil, sweet marjoram, tea
Imported from: Israel, France, Italy, Mexico
- Helicella substriata* (Gray)
Collected at ports in: Florida
Collected in or on: orchid
Imported from: Cayman Islands
- Helicella terrestris* (Pennant)
Collected at ports in: New York
Collected in or on: with mollusks
Imported from: Italy
- Helicella trochoides* (Poiret)
Collected at ports in: Delaware, Louisiana, New Jersey, New York, North Carolina, Pennsylvania, Texas, Virginia
Collected in or on: cargo, clematis seed, 4 o'clocks, military cargo, pine cone, soil
Imported from: Crete, Italy, Morocco, Greece, Netherlands, Spain
- Helicella tuberculosa serrulata* (Beck)
Collected at ports in: Massachusetts
Collected in or on: sand
Imported from: Israel
- Helicella variabilis* (Draparnaud)
Collected at ports in: Delaware, Florida, Georgia, Illinois, Louisiana, Maryland, Massachusetts, New Jersey, New York, North Carolina, Pennsylvania, South Carolina, Texas, Virginia
Collected in or on: apple, auto, baggage, cabbage, camomile, cargo, cauliflower, chickpea seed, fennel 4 o'clock, globe artichoke, grape, iron pipes, *Lathyrus* seed, lettuce, military cargo, plum, sainfoin seed, seed, soil on auto, spinach, stores, sumac seed, swiss chard, vehicle, vetch
Imported from: Crete, Europe, France, Italy, Libya, Morocco, Portugal, Spain, Turkey
- Helicella vestalis* (Pfeiffer)
Collected at ports in: Louisiana
Collected in or on: cargo
Imported from: Turkey
- Helicella virgata* Da Costa
Collected at ports in: Delaware, Louisiana, Massachusetts, New York, Pennsylvania, Ohio, South Carolina, Texas, Virginia
Collected in or on: cabbage, cactus, cargo, endive, *Iromea* seed, leek, military cargo, soil, stores
Imported from: England, France, Greece, Ireland, Italy, Morocco, Portugal, Spain
- Helicina zephrina* Duclos
Collected at ports in: Florida, Illinois, Pennsylvania, Texas, Virginia
Collected in or on: bromeliad, cut flower, cactus, orchid, palm, pepper, Spanish moss
Imported from: Guatemala, Mexico
- Helicina cespitum* (Draparnaud)
Collected at ports in: Florida, Louisiana, New York, North Carolina, South Carolina, Texas, Washington, D.C.
Collected in or on: baggage, beans, cabbage, cargo, leek, lettuce, military cargo, *Onobrychis* seed, *Sanguisorba* seed, stores, sweet orange, swiss chard
Imported from: Algeria, France, Italy, Libya, Spain, Turkey
- Helicina chrysocheila* Binney
Collected at ports in: Florida, Louisiana, Texas
Collected in or on: leaf, palm, orchid, soil
Imported from: British Honduras, Mexico
- Helicina convexa* (Pfeiffer)
Collected at ports in: South Carolina
Collected in or on: cargo
Imported from: Bermuda
- Helicina denticulata* Shuttleworth
Collected at ports in: Florida, New York
Collected in or on: banana, orchid
Imported from: British Honduras, Honduras
- Helicina dysonic* (Pfeiffer)
Collected at ports in: Florida
Collected in or on: orchid
Imported from: Honduras
- Helicina strebeli* (Pfeiffer)
Collected at ports in: Illinois

- Collected in or on: parsley
Imported from: Mexico
- Helix leucorum** Linnaeus
Collected at ports in: New York, Washington, D.C.
Collected in or on: cargo, mail, plant
Imported from: Italy, Syria, Turkey
- Helix mazzullii** Jan
Collected at ports in: New York
Collected in or on: baggage
Imported from: Italy
- Helix radiosa** Ziegler
Collected at ports in: New York
Collected in or on: baggage
Imported from: Greece
- Helix secernenda** Rossmassler
Collected at ports in: Massachusetts
Collected in or on: baggage
Imported from: Italy
- Helix vulgaris** Rossmassler
Collected at ports in: Illinois, North Carolina
Collected in or on: baggage
Imported from Turkey
- Hemitrochus androsi** (Dall)
Collected at ports in: Florida
Collected in or on: orchid, tomato
Imported from: Bahamas
- Hemitrochus streator** Pilsbry
Collected at ports in: Florida
Collected in or on: orchid
Imported from: Cayman Islands
- Hygromia cinctella** (Draparnaud)
Collected at ports in: Delaware, Louisiana, Massachusetts, New Jersey, New York, Pennsylvania, Virginia
Collected in or on: althea seed, cabbage, cargo, clematis seed, common tansy, fern, flowers, 4 o'clocks, hellebore seed, lettuce, military cargo, rose, seeds, string beans
Imported from: Italy, France, Turkey
- Iberus alonensis** (Férussac)
Collected at ports in: New York
Collected in or on: baggage
Imported from: Spain
- Lamellaxis mexicanus** (Pfeiffer)
Collected at ports in: Azores
Collected in or on: orchid
Imported from: Mexico
- Lehmannia poirieri** (Mabille)
Collected at ports in: Texas
Collected in or on: orchid, plants
Imported from: Guatemala, Mexico
- Milax budapestensis** (Hazay)
Collected at ports in: Maryland
Collected in or on: rosemary
Imported from: England
- Milax insularis** (Lesson & Pollonera)
Collected at ports in: New York
Collected in or on: cabbage, celery
Imported from: Italy
- Monacha carthusiana** (Müller)
Collected at ports in: Delaware, Illinois, Louisiana, Massachusetts, New Jersey, New York, North Carolina, Texas, Virginia
Collected in or on: artichoke, baggage, beans, bulb and cable wire, cargo, cauliflower, cedar, clematis seed, flower, lettuce, military cargo, origanum, parsley, rose, sainfoin, seed, soil, stores
Imported from: England, France, Greece, Italy, Lebanon, Morocco, Netherlands, Spain, Turkey, United Arab Republic
- Monacha olivieri** (Férussac)
Collected at ports in: Delaware, Louisiana, Massachusetts, New Jersey, New York, North Carolina, Pennsylvania, Texas, Washington, D.C.
Collected in or on: cargo, hawksbeard, herbs, military cargo, plants, seed, soil
Imported from: Germany, Greece, Israel, Italy, Portugal, Turkey, Yugoslavia
- Monacha obstructa** (Férussac)
Collected at ports in: Louisiana, Maryland, New York, Pennsylvania, Texas, Virginia
Collected in or on: apple, cargo, stores
Imported from: Greece, France, Lebanon
- Monacha rizzae** (Aradas)
Collected at ports in: New York
Collected in or on: baggage
Imported from: Italy
- Monacha schotti** (Pfeiffer)
Collected at ports in: Louisiana, Maryland, Texas
Collected in or on: coriander, soil, stores
Imported from: Israel, Lebanon
- Monacha syriaca** (Ehrenberg)
Collected at ports in: Louisiana, Maryland, New York, Pennsylvania, Texas
Collected in or on: cargo, cactus, herbs, leaf, pomegranate, quince
Imported from: Israel, Lebanon, Turkey, Libya
- Orthalicus boucardi** (Pfeiffer)
Collected at ports in: Texas
Collected in or on: bromeliad
Imported from: Mexico
- Orthalicus decolor** (Strebel)
Collected at ports in: Florida, Texas
Collected in or on: bromeliad, orchid
Imported from: Guatemala, Mexico
- Orthalicus obductus** (Shuttleworth)
Collected at ports in: Maryland, South Carolina
Collected in or on: banana
Imported from: Honduras
- Orthalicus pulchellus protoglyptus** (Pilsbry)
Collected at ports in: Florida
Collected in or on: orchid
Imported from: Venezuela
- Orthalicus undatus** (Bruguère)
Collected at ports in: Florida
Collected in or on: baggage, orchid, plant, cut flowers
Imported from: Canal Zone, Mexico, Jamaica
- Pallifera costaricensis** (Mörch)
Collected at ports in: California, Florida, Texas, Virginia
Collected in or on: bromeliad, orchid, palm
Imported from: Guatemala, Honduras, Mexico, Nicaragua
- Polygyra bahamensis** (Vanatta)
Collected at ports in: Florida

- Collected in or on: orchid
Imported from: Bahamas
- Polygyra matermontana** (Pilsbry)
Collected at ports in: Arizona
Collected in or on: banana
Imported from: Mexico
- Polygyra richardsoni** (Martens)
Collected at ports in: Texas
Collected in or on: plant
Imported from: Mexico
- Praticolella ampla** (Pfeiffer)
Collected at ports in: Texas
Collected in or on: plant
Imported from: Mexico
- Praticolella berlandieriana** (Moricand)
Collected at ports in: Texas
Collected in or on: plant
Imported from: Mexico
- Radiodiscus proameri** H. Baker
Collected at ports in: Texas
Collected in or on: orchid
Imported from: Mexico
- Retinella hammonis** (Ström)
Collected at ports in: Massachusetts, New Jersey
Collected in or on: plant
Imported from: Singapore
- Solaropsis monile** (Broderip)
Collected at ports in: Alabama, Florida, Louisiana, New York, South Carolina
Collected in or on: banana
Imported from: Costa Rica, Ecuador
- Succinea horticola** Reinhardt
Collected at ports in: Washington, D.C.
Collected in or on: Azalea, cargo, quince, winter jasmine
Imported from: Japan, Okinawa
- Theba pisana** (Müller)
Collected at ports in: Alabama, Delaware, Florida, Georgia, Illinois, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Virginia, Washington, Wisconsin
Collected in or on: airplane, artichoke, auto, baggage, beans, beets, begonia, bell pepper, bought as food, cabbage, Calla lily, camomile; carnation seed, carrot, crate, cauliflower, cedar of Lebanon, cipolino, citrus, cork, cork oak, cow pea, cypress cone, dry hides, endive, equipment, faba bean, general cargo, immortelle stem, Japanese hop seed, leek, lettuce, mail, melon, military cargo, mimosa, parsley, pepper, quackgrass, refrigerator, rosemary, ship quarters, snapdragon, spinach, straw with horse, string bean, sweet marjoram, sweet orange, sweetpea seed, tomato, *Vicia*
Imported from: Crete, Cuba, Cyprus, France, Germany, Gibraltar, Greece, Israel, Italy, Lebanon, Libya, Morocco, Netherlands, North Africa, Portugal, Spain, Yugoslavia, Turkey, United Arab Republic
- Theba virgata** (Müller)
Collected at ports in: Ohio
Collected in or on: cargo
Imported from: Italy
- Vaginulus alte** (Férussac)
Collected at ports in: Texas
Collected in or on: cargo
Imported from: Hawaii
- Vaginulus linguaeformis** Semper
Collected at ports in: Florida
Collected in or on: plants
Imported from: Peru
- Vaginulus olivaceus** (Stearns)
Collected at ports in: Florida
Collected in or on: orchid
Imported from: Nicaragua
- Vaginulus plebeius** Fischer
Collected at ports in: Louisiana
Collected in or on: orchid
Imported from: El Salvador
- Vaginulus pulcher** Colosi
Collected at ports in: Florida
Collected in or on: bromeliad
Imported from: Ecuador
- Vallonia pulchella** (Müller)
Collected at ports in: Florida
Collected in or on: carnation, chrysanthemums, geranium
Imported from: Argentina
- Vitrina diaphana** (Draparnaud)
Collected at ports in: Pennsylvania
Collected in or on: cabbage
Imported from: France

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TWO RARE MOLLUSK RECORDS FOR WISCONSIN

On September 13, 1973 I found two specimens of *Elliptio complanatus* (Dillwyn) in the South Fork of the Flambeau River in Price County. Baker (1928, *The Fresh water Mollusca of Wisconsin, Part II*) considered this a very rare species in Wisconsin, it having been found in only two places in the west end of Lake Superior at his time.

This record is also unusual in that the Flambeau River is part of the Mississippi drainage but *E. complanatus* is usually associated with the Atlantic drainage.

On September 18, 1973 I found a live specimen of *Simpsoniconcha ambigua* (Say) in the Wolf River in Shawano County. This may have been the first live specimen from Wisconsin. Baker only says, 'there is no variation in the few dead shells found.' Dead shells had been found only at Kilbourn (Wisconsin Dells) in Baker's time.

Both species were kindly identified by Dr. Henry van der Schalie.

Harold A. Mathiak

BUTTONS TO PEARLS TO CHIPS OR A NEW USE FOR CLAMS

Another major development is taking place in the utilization of freshwater clams. A new market for clam shells developed in late Fall of 1973 when the Tennessee Shell Company started making novelties of crushed and polished bits of shells imbedded in clear plastic. The novelties such as small owls, book ends, and crosses are attractive, reasonably priced and probably will command a large market. I have also heard of shell fragments being used in the construction of sinks or counter tops.

These new uses could revive commercial clamming where operations had terminated because of insufficient numbers of large clams of the species desired for the pearl culture industry. All species and all sizes are utilized or at least bought for crushing and imbedding.

Two days spent on the Mississippi River with

a commercial clammer from southern Wisconsin showed clams being sorted as follows:

For pearl culture. Large *Megaloniatis gigantea* which would not pass through a four-inch circular hole and some other species which would not pass through a two and five-eighths inch hole. These consisted primarily of *Amblyma plicata*. There were relatively few *Quadrula quadrula*, *Q. pustulosa*, and *Arcidens confragosus* shells which were large enough to be saved for pearl culture purposes.

For crushing. The smaller shells of the above species went into the crushing bins. Other species of all sizes also were earmarked for crushing. On the second day alone I salvaged 58 *Truncilla truncata* shells ranging from 20-50 mm in length, with about another dozen not picked up. We took about 3500 pounds of clams in about seven hours of dredging. The clamming was done in 30 to 35 feet of water.

Already the clammer says the larger sizes are hard to find in his area. However, the smaller clams seem to be unbelievably numerous in the river below Harpers Ferry. The bars were often loaded to capacity even after having been worked only a few minutes. Commercial clamming on Lake Pepin farther up the river apparently has ceased since last year because of the shortage of clams.

The question arises as to what effect the taking of small clams will have on the mussel populations. Many of the minor channels and sloughs are not being worked. Also, the channel most used by the river barges is usually avoided for safety reasons. Therefore it would seem that species depletion is less likely than a trend toward increasing scarcity of old and large clams. Many species did not really increase greatly in numbers despite their virtually complete protection prior to 1973 when no market for them existed. I do not know what effect, if any, resulted from the small holes made in the shells when breaking out the hooks.

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FLUORESCENCE IN THE MUCUS OF *ANGUISPIRA CUMBERLANDIANA* (LEA)

A recent paper (Rawls and Yates, 1971) described the occurrence of fluorescence in the mucus of certain endodontid snails exposed to ultraviolet light and suggested that the phenomenon would be observable in all genera of the family.

Shortly thereafter, Rawls and Baum (1971) surveyed a number of species of polygyrid snails and concluded that fluorescence, when observed in land snails, would be found to occur in all members of a given species but not necessarily in all representatives of a given genus or higher group.

Rawls and Yates (1971) reported fluorescence in *Anguispira alternata* Say and *A. kochi* (Pfeiffer), as well as in *Discus patulus* (Deshayes) and *Helicodiscus parallelus* (Say), and Baum and Rawls (1972) described the role played by pseudomonad bacteria in the fluorescence observed in *A. kochi*.

We now wish to report the occurrence of fluorescence in the mucus of *Anguispira cumberlandiana* (Lea), and to relate the fluorescence to the presence of pseudomonad bacteria in the mucus of members of this species. The research on which this paper is based is part of a continuing study by the senior author, supported by a grant from the Council on Faculty Research, Eastern Illinois University.

A part of our study has involved collecting living specimens of land snails from any and all localities, checking them for fluorescence, and taking mucus samples for bacterial cultures and analysis. One of our group chanced to be in northern Alabama for a brief time and took advantage of the opportunity to collect *Anguispira cumberlandiana* at Cave Springs Cave, six miles north of New Hope, in Madison County. Specimens of several other families were also collected, and all were returned to our laboratory for inclusion in the study.

The specimens of *cumberlandiana* fluoresced under ultraviolet light, as we expected. The color observed was a bright blue, the intensity being greatest along the edge of the mantle and the least over the surface of the body and the head; no fluorescence was apparent on the sole of the foot.

Mucus samples from *A. cumberlandiana* were examined with the aid of an Aminco-Bowman spectrophotofluorimeter. Two excitation peaks (absorption maxima) were observed; one at about

320 nm and another at about 415 nm. At these values, there were two fluorescence emission peaks; one at about 440 nm and another at about 485 nm, respectively.

Bacterial cultures were obtained from mucus samples, using the technique described by Baum and Rawls (1972), and the bacteria were identified as pseudomonads. Spectrophotofluorimetric examination of the pigments produced by these bacteria in culture shows two excitation peaks; one at about 302 nm and another at about 365 nm. A single emission peak was observed at about 417 nm.

Comparison of the fluorescence curves of raw mucus and bacterial pigments substantiates the view that fluorescence in *Anguispira cumberlandiana* is caused by pigments produced by pseudomonads living in the mucus of the snails.

We are no nearer than before to answers for questions suggested in earlier papers. The details of the chemistry of the pigments still elude us, although some progress is being made, and we still lack an understanding of why some species of snails fluoresce and others do not. This paper establishes, however, that a third species of *Anguispira* exhibits fluorescence, and that the fluorescence is a function of the presence of pseudomonad bacteria which live in the snail mucus.

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ECOLOGICAL NOTES ON THE TREMATODE PARASITES OF *HELISOMA ANCEPS* (MENKE) IN A EUTROPHIC LAKE, INCLUDING A CHECK-LIST OF THE CERCARIAE THAT OCCUR ON MOLLUSKS INDIGENOUS TO OTSEGO COUNTY, NEW YORK

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ABSTRACT

A population of *Helisoma anceps* (Menke) was studied from June 1972 to June 1973 at the State University of New York College at Oneonta Biological Field Station, Cooperstown, Otsego County, New York. Monthly collections of snails were made to determine the species of larval trematodes developing within this particular host. Water temperature and pH were measured during each collection to determine their effect on the incidence of infection.

Two species of larval trematodes were found. *Plagitura parva* Stunkard, 1933, was found in every collection made. In contrast, *Crassiphiala bulboglossa* (Van Haitzma, 1925) was found in only two collections. The metacercariae of this species were found on the golden shiner, *Notemmalus crysoleucas* (Mitchell), and may have been a factor in annual kills of this species in this biotope.

Differences in the seasonal abundance of each trematode are correlated with the habits of the definitive host. In addition, the behavior of each cercaria is correlated with that of the second intermediate host.

A checklist was constructed from the literature to facilitate identification of cercariae that occur on mollusks found in Otsego County. This checklist is organized first, according to the family in which the molluscan host is placed and second, according to the morphological group the cercaria belongs to.

INTRODUCTION

The snail-trematode relationship is economically important because of the pathological effect of trematodes on man and other vertebrates. The widespread development of water resources has often resulted in the creation

of favorable conditions for lentic snails and the trematode parasites associated with them. Studies on the ecological relationships between snails and their parasites are therefore important contributions to those concerned with aspects of trematode control.

The Digenea (Platyhelminthes: Trematoda), with rare exceptions, are endoparasites of vertebrates and are characterized by two or more asexual generations and host alternation (Yamaguti 1958). They are found in the lungs, bile ducts, alimentary canals and circulatory systems of their definitive hosts (Smyth 1966). Other sites include the gall bladder, kidneys, ureter, air sacs of birds, eyes and sinus cavities (Hyman 1951).

The digenetic trematodes are unique in that they exhibit life cycles that employ members of the Phylum Mollusca as first intermediate hosts. Figure 1 represents the variations that may exist within that framework (Cheng 1964).

The Digenea are often more specific to their molluscan hosts than to their vertebrate hosts. For example, *Heterobilharzia americana* Price, 1929, has been reported from the following organisms; dog, raccoon, nutria, swamp rabbit, mouse, hamster, cotton rat, white-tailed deer and opossum (Malek *et al.* 1961, Lee 1962a, Kaplan 1964, Byrd *et al.* 1967). However, experimental infection has been successful in only the following closely related snails; *Lymnaea humilis* and *L. columella* (Malek 1967). A limited number of species possess a wider intermediate host selection. However, they seem to be the exception rather than the rule.

When adult Digenea of one species develop in a variety of vertebrates, they may show great morphological variation depending upon the specific host. Figure 2 illustrates adult specimens of *Metorchis conjunctus* (Cobbold, 1860) collected from various vertebrates in Canada. All are drawn to the same scale and represent a good example of the morphological variation that may exist (Cameron 1944). This

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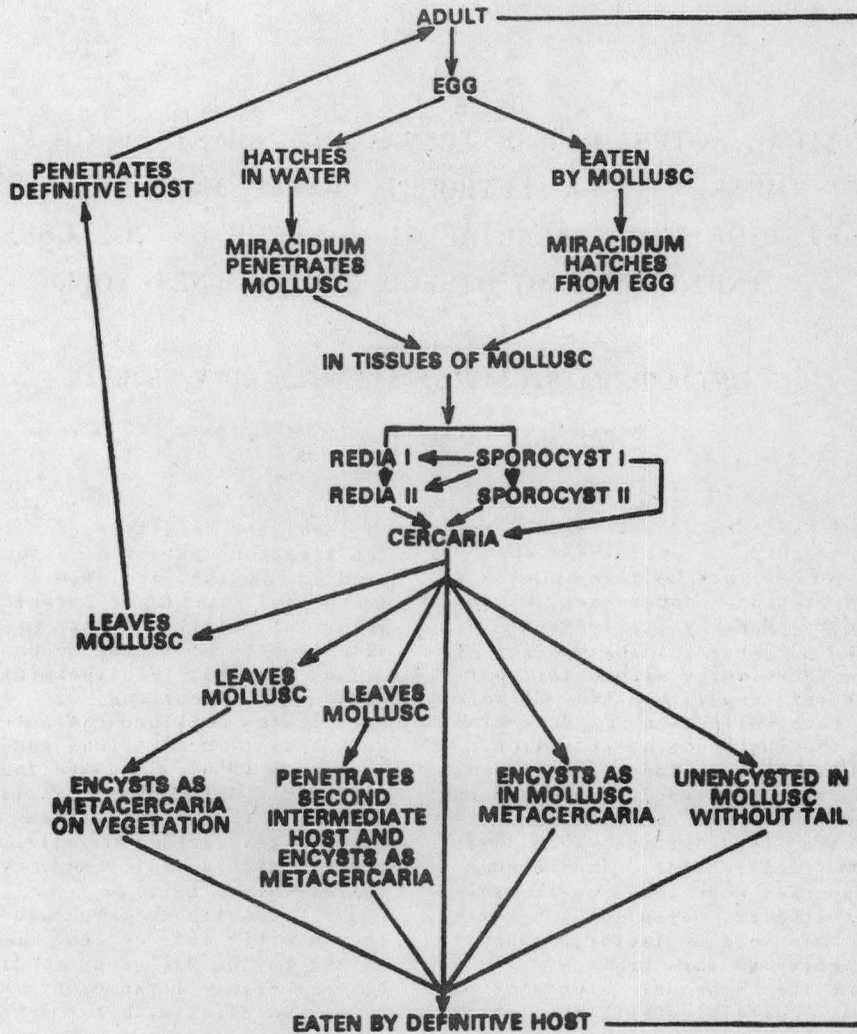


Fig. 1. Variations in the life cycle of the digenetic trematodes (Modified from Cheng, 1964).

variation, coupled with the subjectivity of different workers, has resulted in the creation of many genera and species which are merely convenient associations and are not based on characters of any phylogenetic significance (Cameron, 1964).

Life cycles of Digenea represent three main evolutionary stocks. These may be illustrated by *Fasciola hepatica* Linnaeus, 1758, *Sellacostyle mustelae* Wallace, 1925 and *Schistosomium douthitti* (Cort, 1915).

The life cycle of *F. hepatica* involves penetration of the miracidia into a few closely related freshwater snails. Upon leaving these organisms, cercariae encyst on emergent aquatic vegetation. Infection of the definitive host and completion of the life cycle occurs with ingestion of metacercariae infected plants (Thomas 1883).

The miracidia of *S. mustelae* penetrate the freshwater snail *Cameloma rufum* (Haldeman). Upon leaving the snail, cercariae become encysted within a freshwater fish. The definitive host (mink) is infected by eating an infected fish (Wallace 1935).

S. douthitti miracidia penetrate representatives of two families of freshwater snails. After development, cercariae leave the snail and penetrate directly through the skin of the definitive host and mature in its circulatory system (Price 1931).

Smyth (1966) mentions the importance of the miracidium in the life cycles of the Digenea, since during this stage actual penetration of the intermediate host occurs. Many miracidia show geotactic, phototactic and thigmotactic responses of different intensity and their behavior is probably closely related to the be-

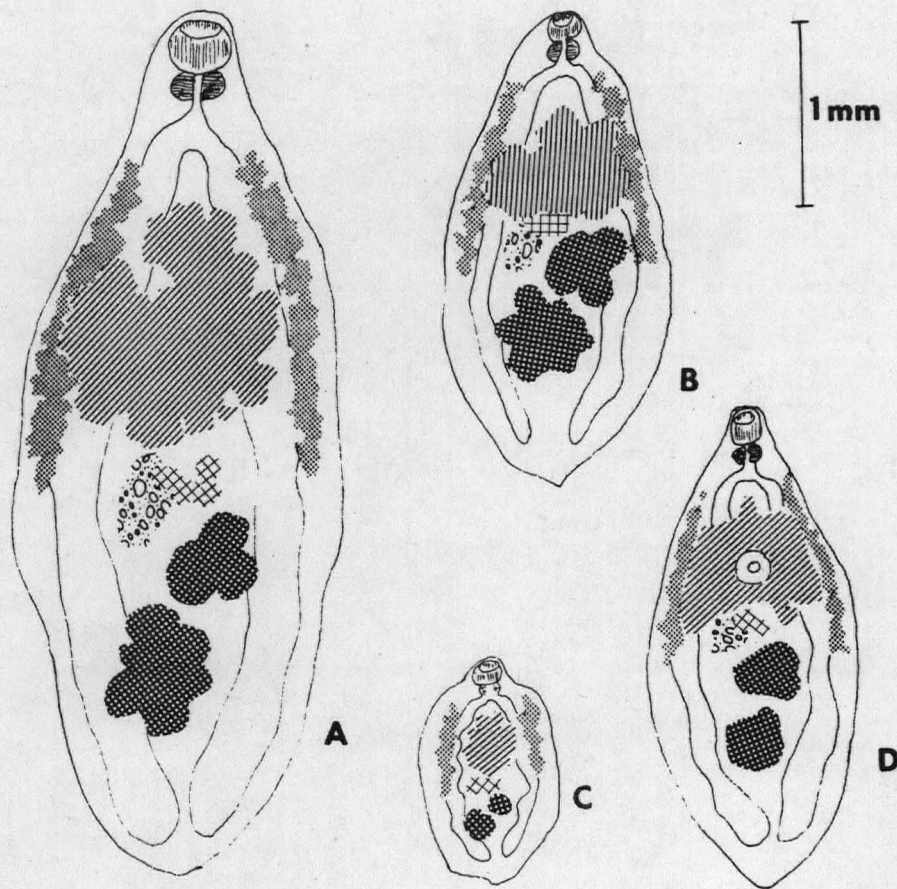


Fig. 2. *Metorchis conjunctus* (Cobbold, 1860) from various hosts and drawn to the same scale. A, from raccoon; B, from ferret; C, mink; D, cat (Modified from Cameron, 1944)

havior of the organism that they seek. Cameron (1964) mentions the importance of the physical environment at stages of the life cycle when an external existence is necessary. Limiting factors may include temperature, humidity, oxygen content and also those factors that are limiting to the intermediate host species necessary for completion of the trematode life cycle.

Mattes (1926) has shown that pH is an important variable in the hatching of water borne miracidia. He claims that after increasing the acidity from 8.0-8.5 to 5.5-6.0, hatching of *F. hepatica* eggs occurs in approximately fifteen minutes. However, in alkaline situations (pH 7.5 or above) there is a complete failure to hatch and the miracidia eventually die within the ova.

Data illustrating the effects of temperature (8° - 26° C) on miracidia of *F. hepatica* show

lower temperatures are more favorable for survival. Miracidia kept at lower temperatures remained active for 48 to 72 hours while those kept at higher temperatures survived for a maximum of 8 hours (Griffiths 1939a). Similarly, the survival of the miracidia of *S. douthitti* is only 1.5 hours at 35°C, but 11 hours at 8° C (Farley 1967).

The mechanism which brings the miracidium in direct contact with the molluscan host is speculated to include a primary reaction of the miracidium to light, gravity, pH, salinity and temperature. This may be followed by a chemotactic response to the tissues of the intermediate host, if it is within sensing distance (Smyth 1966).

The above host detecting mechanisms sometimes fail and miracidia have been known to penetrate organisms such as turbellarians and oligochaetes. Miracidia of *Schistosoma man-*

soni Sambon, 1907 have been shown to penetrate the wrong intermediate host, merely to be destroyed by tissue reactions (Smyth 1966). Griffiths (1939a) illustrated this point by exposing eleven species of snails from the lower St. Lawrence valley to miracidia of *F. hepatica* which commonly parasitize lymnaeid snails. He noted that on exposure the miracidia readily attack freshwater snails other than the Lymnaeidae. Other findings show that the process by which miracidia locate the molluscan host is a random one favoring animals with soft bodies and rejecting such hard objects as stones (Griffiths 1939a).

Upon penetration of the miracidium, functional changes may be observed within the molluscan host. These include changes in growth rates, fecundity, behavioral changes which may increase the rate of predation by the vertebrate host, and an increase in the mortality rate (Wright 1966).

Early investigators realized that without life history information and a knowledge of the adult forms, it was difficult to formulate an accurate system for the classification of cercariae found in mollusks. Necessity has dictated classifications that are based largely on superficial characters placing cercariae into purely temporary and convenient arrangements until further study permits the formulation of more natural groups (Cort 1915). This artificial taxonomy has resulted in the treatment of cercariae as an almost independent group, which explains how a trematode species may have two very different names (Dawes 1968).

Cort (1915) makes reference to the extensive, yet tentative and artificial classification of cercariae developed by Lühe in 1909. Even though numerous attempts have been made to improve upon that scheme, it is still the basis of our present day classification. Figure 3 illustrates the morphological types used in Lühe's classification (from Cort, 1915; Dawes, 1968).

FIELD STUDIES

A population of *Helisoma anceps* (Menke) (Basomatophora: Planorbidae) present in Moe Pond, Otsego County, Cooperstown, New York was studied between June 1972 and June 1973. This study was conducted to survey the seasonal distribution of larval trematodes infecting this particular population. Effects of temperature, pH and age of snails on the incidence of infection were also examined.

Description of the biotope

Moe Pond is an artificial, eutrophic lake located approximately 1.5 km west of Cooperstown, New York. At its maximum the lake is 3.7 m deep with an effective length and width of 750 m and 330 m, respectively. Extremely turbid waters restrict the growth of most aquatic macrophytes to depths of 0-12 cm (Hermann 1972).

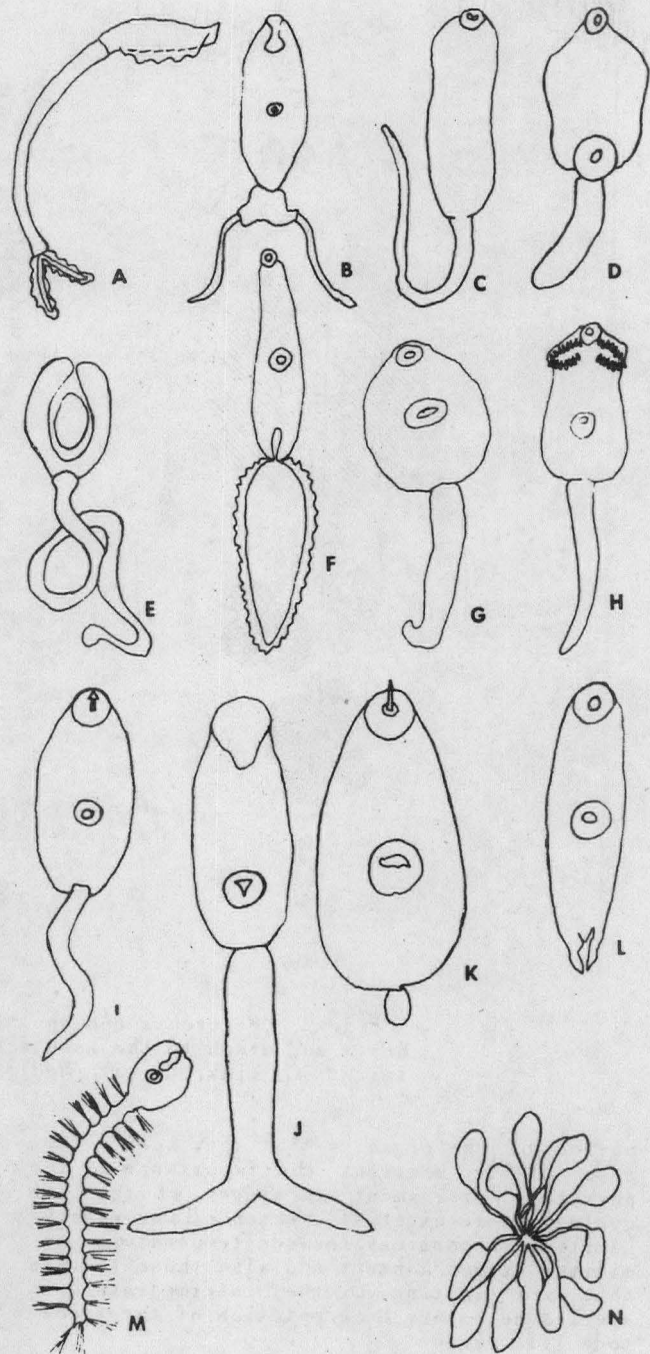


Fig. 3. Morphology of cercariae. A, Lophocercariae; B, Gasterostome; C, Monostome; D, Amphistome; E, Cystocercous; F, Rhopalocercous; G, Gymnocephalous; H, Echinostome; I, Xiphidiocercariae; J, Furcocercous; K, Microcercous; L, Cercariaeae; M, Trichocercous; N, Rattenkonigcercariae. (A, F, G, H, I, L modified from Dawes 1968; B, C, D, E, M, N modified from Cheng, 1964; J, K modified from Malek 1962).

Snails were collected from the southwest side of the lake in the shallow waters adjacent to the shoreline. The substrate in this area is silt and aufwuchs covered channery and sand derived from Devonian shales and glacial deposits (Herrman 1972).

Methods

Monthly collections of *H. anceps* were made from June 1972 to June 1973. No collections were made during the winter months, since at this time the water in the collection area would freeze completely to the substrate making sampling impossible. Herrmann (1972), who studied the dynamics of this population also experienced the same difficulties.

Snails were obtained by using a triangle net and by picking individuals off the substrate. Water temperature and pH were recorded during each collection period. A Helige comparator, (Model No. 607-A26) was utilized for the determination of pH. For the trip back to the laboratory the snails were placed in jars containing wet leaves. At the laboratory each snail was isolated in a glass container filled with distilled water. Examination for shed cercariae was made once daily for a period of 48 hours. Practically all infected snails placed in water different from their own habitat can be expected to shed cercariae within that period (Bourns 1963). The percent of infected snails was recorded for each collection date. In addition, size data were recorded on infected snails.

All cercariae studied were examined both alive and mounted. The method recommended by Knudsen (1966) was used for mounting. This involved using a 1:1 mixture of Turtox CMC-10 and Turtox CMC-S, which will kill, stain, clear and mount cercariae from either water or alcohol.

Initially, cercariae were identified according to the classification developed by Lühe. Emerging cercariae were then determined to species. In order to become familiar with the species that might have been present, a checklist was constructed that includes cercariae that utilize freshwater snails indigenous to Otsego County, New York, as intermediate hosts. The species on this checklist were then organized into a dichotomous key to further simplify the identification process. The key is organized first, according to the family of the molluscan host that the cercaria develops in and second, according to the morphological group to which the cercaria belongs. For each larval trematode, molluscan host species are given.

The reader interested in more detailed information concerning each cercaria should consult these citations. Parasite synonymies can be found in the publications by Yamaguti (1958) and Schell (1970). Northeastern North American snails may be determined by using Harman and Berg (1971).

A CHECKLIST OF THE CERCARIAE DEVELOPING IN MOLLUSCAN HOSTS INDIGENOUS TO OTSEGO COUNTY, NEW YORK

ANCYLIDAE

- 1a. Tail entirely undeveloped ... Cercariaeae
 Family Lissorchiidae
Lissorchis mutabile (Cort, 1918)
 (= *Triganodistomum mutabile* (Cort, 1919))
 (= *Cercariaeum mutabile* Cort, 1918)
 Develops in *Laevapex fuscus* (Adams) and *Ferrissia rivularis* (Say) (Smith 1968), see also Planorbidae.
- 1b. Tail present 2
- 2a. Stylet present Xiphidiocercariae
 Family Plagiiorchiidae
Haematoloechus sp.
 Develops in *Ferrissia parallela* (Halderman) (Smith 1959), see also Planorbidae.
- 2b. Stylet absent; ventral sucker at or near the posterior end of the body.. Amphistome
 Family Paramphistomidae
Megalodiscus temperatus (Stafford, 1905)
 (= *Diplodiscus temperatus* Stafford, 1905)
 Develops in *Ferrissia parallela* (Halderman), *Laevapex fuscus* (Adams) and *Ferrissia fragilis* (Tryon) (Smith 1967), see also Planorbidae.

PLANORBIDAE

- 1a. Tail entirely undeveloped ... Cercariaeae
 Family Lissorchiidae
Lissorchis mutabile (Cort, 1918)
 (= *Cercariaeum mutabile* Cort, 1918)
 (= *Triganodistomum mutabile* (Cort, 1919))
 Develops in *Helisoma campanulatum* (Say) and *H. trivolvis* (Say) (Wallace, 1941), see also Ancyliidae
 Family Cyclocoelidae
Tracheophilus cymbium (Diesing, 1850)
 Develops in *Helisoma trivolvis* (Say) (Stunkard 1934).
- 1b. Tail present 2
- 2a. Tail long with the base forming a cavity into which the body can be retracted Cystocercous
 Family Hemiuridae
Halipegus eccentricus Thomas, 1939
 Develops in *Helisoma trivolvis* (Say) (Thomas 1939), see also Physidae.
- 2b. Tail base not as above 3
- 3a. Tail forked Furcocercous
 Family Strigeidae
Apatemon gracilis (Rudolphi, 1819)
 (= *Cercaria burti* Miller, 1923)
 (= *Cercaria pseudoburti* Rankin, 1939)
 Develops in *Helisoma anceps* (Menke) (Stunkard et al. 1941), see also Lymnaeidae
Strigea elegans Chandler and Rausch, 1947
 Develops in *Gyraulus parvus* (Say) (Pearson 1959).
 Family Diplostomatidae
Diplostomulum scheuringi Hughes, 1929
 (= *Diplostomulum trituri* Kelley, 1934)
 Develops in *Helisoma anceps* (Menke) (Ettges 1961)

- Alaria arisaemoides* Augustine and Uribe, 1927
 Develops in *Planorbula armigera* (Say) and *Promenetus exacuus* (Say) (Pearson 1956)
- Alaria mustelae* Bosma, 1931
 Develops in *Planorbula armigera* (Say) (Pearson 1956)
- Alaria intermedia* (Oliver and Oldlaug, 1938)
 Develops in *Planorbula armigera* (Say) and *Helisoma trivolvis* (Say) (Pearson 1956)
- Uvulifer ambloplites* (Hughes, 1927)
 (= *Cercaria bessiae* Cort and Brooks, 1928)
 Develops in *Helisoma trivolvis* (Say) and *H. campanulatum* (Say) (Hoffman 1956).
- Family Spirorchidae
- Spirorchis elegans* Stunkard, 1923
 Develops in *Helisoma anceps* (Menke) and *Menetus dilatatus buchanaensis* (Lea) (Goodchild and Kirk 1960).
- Spirorchis elephantis* (Cort, 1917)
 (= *Cercaria elephantis* Cort, 1917)
 Develops in *Helisoma trivolvis* (Say) and *Helisoma campanulatum* (Say) (Wall 1941a).
- Spirorchis parvus* (Stunkard, 1932)
 (= *Haematotrema parvum* Mehra, 1934)
 Develops in *Helisoma trivolvis* (Say) and *H. campanulatum* (Say) (Wall 1940, 1941b).
- Family Schistosomatidae
- Gigantobilharzia gyrauli* (Brackett, 1940)
 (= *Cercaria gyrauli* Brackett, 1940)
 Develops in *Gyraulus parvus* (Say) (Brackett 1940)
- Family Clinostomatidae
- Clinostomum marginatum* (Rudolphi, 1819)
 (= *Clinostomum heterostomum* MacCallum, 1899)
 Develops in *Helisoma anceps* (Menke) and *H. campanulatum* (Say) (Hopkins, 1933).
- 3b. Tail not forked 4
- 4a. Ventral sucker absent Monostome
- Family Notocotylidae
- Quinqueserialis quinqueserialis* (Barker and Laughlin, 1911)
 (= *Notocotylus quinqueserialis* Barker and Laughlin, 1911)
 Develops in *Gyraulus parvus* (Say) (Herber 1942)
- 4b. Ventral sucker present 5
- 5a. Ventral sucker at or near the posterior end of the body Amphistome
- Family Paramphistomatidae
- Wardius zibethicus* Barker and East, 1915
 Develops in *Helisoma anceps* (Menke) (Murrell, 1963, 1965)
- Megalodiscus microphagus* Ingles, 1936
 Develops in *Gyraulus* sp. (Macy, 1960a).
- Megalodiscus temperatus* (Stafford, 1905)
 (= *Diplodiscus temperatus* Stafford, 1905)
 Develops in *Helisoma trivolvis* (Say), *Helisoma anceps* (Menke), and *Helisoma campanulatum* (Say) (Herber 1939), see also Ancyliidae
- Zygocotyle lunata* (Diesing, 1836)
 (= *Cercaria poconensis* Willey, 1930)
 Develops in *Helisoma anceps* (Menke) and *Helisoma trivolvis* (Say) (Willey 1936, 1941).
- Allassostoma parvum* Stunkard, 1916
 (= *Cercaria inhabilis* Cort, 1914?)
 (= *Cercaria convoluta* Faust, 1919?)
 Develops in *Helisoma trivolvis* (Say) (Beaver 1939a)
- 5b. Ventral sucker away from the posterior end of the body 6
- 6a. Stylet present Xiphidiocercariae
- Family Plagiochiidae
- Plagitura parva* Stunkard, 1933
 Develops in *Helisoma anceps* (Menke) (Stunkard, 1936)
- Glythelmins pennsylvaniensis* Cheng, 1961
 Develops in *Helisoma trivolvis* (Say) (Cheng, 1961)
- Eustomos chelydrae* MacCallum, 1921
 Develops in *Helisoma anceps* (Menke) (Krull 1934, McMullen, 1935a), see also Lymnaeidae.
- Family Macroderoididae
- Alloglossidium corti* (Lamont, 1921)
 (= *Plagiorchis ameiurensis* McCoy, 1928)
 (= *Plagiorchis corti* Lamont, 1921)
 (= *Alloglossidium kenti* Simer, 1929)
 Develops in *Helisoma trivolvis* (Say) and *H. campanulatum* (Say) (Crawford 1937, McMullen 1935b)
- Macroderoides typicus* (Winfield, 1929)
 (= *Plesiocreadium typicum* Winfield, 1929)
 Develops in *Helisoma trivolvis* (Say) and *H. campanulatum* (Say) (McMullen 1935b).
- Family Cephalogonimidae
- Cephalogonimus americanus* Stafford, 1902
 Develops in *Helisoma anceps* (Menke) and *H. trivolvis* (Say) (Lang 1968)
- Family Auridistomatidae
- Auridistomum chelydrae* (Stafford, 1900)
 (= *Cercaria concavocorpa* (Sizemore)
 Develops in *Helisoma trivolvis* (Say) (Ralph 1938).
- Family Lissorchiidae
- Lissorchis fairporti* Magath, 1917
 Develops in *Helisoma trivolvis* (Say) (Magath 1918)
- Family Haplometridae
- Haematoloechus medioplexus* Stafford, 1902
 (= *Pneumonoeces medioplexus* Stafford)
 Develops in *Planorbula armigera* (Say) (Krull 1930), see also Ancyliidae.
- Haematoloechus parviplerus* (Irwin, 1929)
 (= *Pneumonoeces parviplerus* Irwin)
 (= *Pneumobites parviplerus* (Irwin))
 Develops in *Gyraulus parvus* (Say) (Krull 1930, 1931)
- 6b. Stylet absent; anterior end with a collar of spines Echinostome
- Family Echinostomatidae
- Petasiger nitidus* Linton, 1928
 Develops in *Helisoma anceps* (Menke) and *H. campanulatum* (Say) (Beaver 1939b).
- Echinostoma revolutum* (Froelich, 1802)
 (= *Cercaria trivolvis* Cort, 1914)
 (= *Cercaria helvetica* XXIV, Dubois, 1928)
 Develops in *Helisoma trivolvis* (Say),

see also Physidae and Lymnaeidae (Beaver 1937)

Family Psilostomatidae

- Ribeiroia thomasi* (McMullen, 1938)
- (=*Psilostomum ondatrae* Price, 1931)
- (=*Cercaria thomasi* McMullen, 1938)
- Develops in *Helisoma anceps* (Menke) (Beaver 1939c).

PHYSIDAE

- 1a. Tail long with the base forming a cavity into which the body can be retracted Cystocercous Family Heriuridae
Halipegus eccentricus Thomas, 1939
Develops in *Physa sayii crassa* Walker, *Physa parkeri* Currier, and *Physa gyrina* Say (Thomas 1939), see also Planorbidae.
- 1b. Tail base not as above 2
- 2a. Tail forked Furcocercous Family Schistosomatidae
Gigantobilharzia huronensis Najim, 1950
Develops in *Physa gyrina* Say (Najim 1950)
Trichobilharzia cameroni Wu, 1953
Develops in *Physa gyrina* Say (Wu 1953a).
Trichobilharzia physellae (Talbot, 1936) (= *Pseudobilharziella querquedulae* McLeod, 1937)
Develops in *Physa gyrina* Say (McLeod and Little 1942).
Schistosomatium douthitti (Cort, 1915)
Develops in *Physa gyrina* Say (Prince 1931). See also Lymnaeidae
Family Spirorchidae
Vasotrema robustum Stunkard, 1928
Develops in *Physa gyrina* Say and *Physa integra* Haldeman (Wall 1951).
Family Diplostomidae
Posthodiplostomum minimum (MacCallum, 1921)
Develops in *Physa heterostropha* Say (Miller, 1954).
Family Strigeidae
Cotylurus flabelliformis (Faust, 1917)
(= *Tetracotyle flabelliformis* (Faust, 1917)
(= *Cercaria douglasi* Cort, 1917)
Develops in *Physa sayii* Tappan and *Physa parkeri* Currier (VanHaitsma 1930a), see also Lymnaeidae.
- 2b. Tail not forked 3
- 3a. Ventral sucker absent Monostome Family Notocotylidae
Notocotylus urbanensis (Cort, 1914)
Develops in *Physa gyrina* Say (Cort 1915).
- 3b. Ventral sucker present 4
- 4a. Ventral sucker at or near the posterior end of the body Amphistome Family Heronimidae
Heronimus chelydrae (MacCallum, 1921)
(= *Aorchis extensus* Barker and Parsons, 1917)
(= *Heronimus geomydae* MacCallum, 1921)

(= *Heronimus maternum* MacCallum, 1921)
Develops in *Physa integra* Haldeman (Crandall 1960), *Physa gyrina* Say (Ulmer and Sommer 1957), and *Physa sayii* Tappan (Ulmer 1960).

Family Paramphistomidae

Paramphistomum cervi (Schrank, 1790)
(= *Cercaria pigmentata* Sonsino, 1892)
Develops in *Physa* sp. (Schell 1970) see also Lymnaeidae.

- 4b. Ventral sucker away from the posterior.. 5
- 5a. Stylet present Xiphidiocercariae Family Plagiochiidae
Zeugorchis syntomentera Sumwalt, 1926
Develops in *Physa gyrina* Say (Ingles, 1933).
Haplometrana intestinalis Lucker, 1931
(= *Haplometrana utahensis* Olsen, 1937)
Develops in *Physa ampullacea* Gould and *Physa gyrina* Say (Schell 1961).
Glypthelmins quieta (Stafford, 1900)
(= *Cercaria mesotyphla* Miller, 1935)
Develops in *Physa gyrina* Say, *Physa integra* Haldeman, *Physa gyrina hildrethiana* (Lea), and *Physa halei* Lea (Leigh 1946).
Lechriorchis primus Stafford, 1905
Develops in *Physa gyrina* Say, *Physa parkeri* Currier, and *Physa ancillaria* Say (Talbot 1933).
Family Telorchidae
Telorchis bonnerensis Waitz, 1960
Develops in *Physa gyrina* Say, *Physa propinqua* Tryon, and *Physa ampullacea* Gould (Schell 1962).
Telorchis medius Stunkard, 1915
Develops in *Physa integra* Haldeman (McMullen 1934)
- 5b. Stylet absent; anterior end with a collar and crown of spines .. Echinostome Family Echinostomatidae
Echinostomum callawayensis Barker and Noll, 1915
Develops in *Physa gyrina* Say (Macy 1942).
Echinoparyphium flexum (Linton, 1892)
Develops in *Physa integra* Haldeman (McCoy 1928), see also Lymnaeidae.
Echinostoma revolutum (Froelich, 1802)
(= *Cercaria trivolvis* Cort, 1914)
(= *Cercaria helvetica* XXIV Dubois, 1928)
Develops in *Physa gyrina* Say, *Physa occidentalis* Tryon, and *Physa rivalis* Sowerby (Beaver 1937), see also Planorbidae and Lymnaeidae.

LYMNAEIDAE

- 1a. Tail forked Furcocercous Family Schistosomatidae
Heterobilharzia americana Price, 1929
Develops in *Lymnaea columella* Say (Lee 1962b).
Schistosomatium douthitti (Cort, 1915)
Develops in *Lymnaea stagnalis* (Linnaeus) and *Lymnaea palustris* Müller (Price 1931), see also Physidae.

Family Diplostomidae

Diplostomum flexicaudum (Cort and Brooks, 1928)

Develops in *Lymnaea catascopium* (Say), *Lymnaea stagnalis* (Linnaeus), *Lymnaea palustris* (Müller), *Lymnaea humilis* Say (Cort et al. 1957), *Lymnaea catascopium* (Say), *Lymnaea stagnalis* Linnaeus, *Lymnaea stagnalis* Walker, and *Lymnaea humilis* Say (Van Haitsma 1931).

Diplostomum baerieucoliae Hoffman and Hundley 1957

Develops in *Lymnaea palustris* (Müller) (Hoffman and Hundley 1957)

Family Strigeidae

Cotylurus flabelliformis (Faust, 1917)

(= *Cercaria douglasi* Cort, 1917)

(= *Tetracotyle flabelliformis* (Faust, 1917))

(= *Cercaria flabelliformis* Faust, 1922)

Develops in *Lymnaea stagnalis* (Linnaeus) (Oliver and Cort 1941), *Lymnaea catascopium* (Say) (Cort et al. 1944), *Lymnaea catascopium* (Say), *Lymnaea stagnalis* (Linnaeus), and *Lymnaea stagnalis* (Van Haitsma 1930a), see also Physidae

Cotylurus communis (Hughes, 1928)

(= *Strigea michiganensis* Haitsma, 1930)

Develops in *Lymnaea catascopium* (Say) (Van Haitsma 1930b).

1b. Tail not forked 2

2a. Ventral sucker absent Monostome

Family Notocotylidae

Notocotylus stagnicola Herber, 1942

Develops in *Lymnaea catascopium* (Say) (Herber 1942) and *Lymnaea palustris* (Müller) (Wu 1953b).

2b. Ventral sucker present 3

3a. Ventral sucker located posteriorly Amphistome

Family Paramphistomidae

Strichorchis subtriquetrus (Rudolphi, 1814)

Develops in *Lymnaea humilis* Say (Bennett and Humes 1939)

Cotylophoron cotylophorum (Fischoeder, 1901)

Develops in *Lymnaea humilis* Say (Bennett 1936).

Paramphistomum cervi (Schränk, 1790)

(= *Cercaria pigmentata* Sonsino, 1892)

Develops in *Lymnaea columella* Say (Krull 1933a) and *Lymnaea* sp. (Schell 1970), see also Physidae

3b. Ventral sucker not as above 4

4a. Stylet present Xiphidiocercariae

Family Plagiiorchiidae

Eustoma chelydrae MacCallum, 1921

Develops in *Lymnaea stagnalis* (Linnaeus) and *Lymnaea catascopium* (Say) (McMullen 1935a), see also Planorbidae.

Plagiiorchis muris Tanabe, 1922

Develops in *Lymnaea catascopium* (Say) (Sowerby) (McMullen 1937) and *Lymnaea palustris* (Müller) (Lang 1963).

Plagiiorchis micracanthos Macy, 1931

Develops in *Lymnaea catascopium* (Say) (McMullen 1937)

Plagiiorchis vespertilionis parorchis Macy, 1960

Develops in *Lymnaea stagnalis* (Linnaeus)

Plagiiorchis goodmani Najarian, 1961

Develops in *Lymnaea palustris* Müller (Najarian 1952, 1961)

Plagiiorchis proximus Barker, 1915

Develops in *Lymnaea catascopium* (Say) (McMullen 1937) and *Lymnaea palustris* Müller (Lang 1963).

4b. Stylet absent 5

5a. Anterior end with a collar and crown of spines Echinostome

Echinostoma revolutum (Froelich, 1802)*

(= *Cercaria trivolvis* Cort, 1914)

(= *Cercaria helvetica* XXIV Dubois, 1928)

Develops in *Lymnaea peregra* (Müller),

Lymnaea pervia, *Lymnaea radix*, *Lymnaea*

stagnalis (Linnaeus), *Lymnaea swinhoe*,

Lymnaea columella Say, *Lymnaea palustris*

(Müller) (Beaver 1937), see also Physidae

and Planorbidae.

Euparyphium beaveri Beaver, 1941

Develops in *Lymnaea catascopium* (Say)

(Beaver 1941a).

Echinoparyphium flexum (Linton, 1892)

Develops in *Lymnaea palustris* (Müller)

(McCoy 1928), Najarian 1953, 1954).

Hypoderma conoideum (Bloch, 1792)

Develops in *Lymnaea stagnalis* (Linnaeus)

(Schell 1970).

Family Cathaemasiidae

Cathaemasia hians (Rudolphi, 1809)

Develops in *Lymnaea* sp. (Schell 1970).

5b. Anterior end rounded Gymnocephalose

Family Fasciolidae

Fasciola gigantica Cobbold, 1855

Develops in *Lymnaea columella* Say (Allicata 1953).

Fasciola hepatica Linnaeus, 1758

Develops in *Lymnaea columella* Say (Griffiths 1939b), *Lymnaea stagnalis* (Linnaeus),

Lymnaea palustris (Müller) (Kendall 1949),

and *Lymnaea truncatula* (Müller)

Fascioloides magna (Bassi, 1875)

Develops in *Lymnaea humilis* Say, *Lymnaea*

columella Say (Krull 1933b), *Lymnaea*

stagnalis (Linnaeus) (Wu and Kingscote 1953),

Lymnaea humilis Say, *Stagnicola palustris*

(Müller) (Swales 1935), and *Lymnaea*

palustris (Müller) (Knapp and Shaw 1963).

VIVIPARIDAE

1a. Tail stumpy and short Microcercous

Family Nanophyetidae

Sellacotyle mustelae Wallace, 1935

(= *Cercaria microcercous*)

Develops in *Campeloma rufum* (Haldeman)

(Wallace 1935).

Family Troglotrematidae

Troglotrema mustelae Wallace, 1932

(= *Cercaria trigonura* Cort, 1914)

* Family Echinostomatidae

- Develops in *Campeloma rufum* (Haldeman) (Wallace 1932).
- 1b. Tail long 2
- 2a. Tail very large and forked with the base forming a cavity into which the body can be retracted. Furcocystocercous *Cercaria brookoveri* Faust, 1918
Develops in *Campeloma* sp. (Faust 1918).
- 2b. Tail forked Furcocercous
Family Cyanathocotylidae
Linstowiella szidati (Anderson, 1944)
(=*Paracoenogonimus szidati* (Anderson, 1944))
(=*Cercaria szidati* Anderson, 1944)
Develops in *Campeloma rufum* (Haldeman) (Anderson 1944, Anderson and Cable 1950).
Family Brachylaemidae
Leucochloridiomorpha constantiae (Müller, 1935)
(=*Leucochloridiomorpha macrocotyle* Gower, 1938)
Develops in *Campeloma decisum* (Say) (Allison 1940).

HYDROBIIDAE

- 1a. Tail entirely undeveloped ... Cercariaeae
Family Monorchhiidae
Asymphylogora amnicolae Stunkard, 1959
Develops in *Amnicola limosa* (Say) (Stunkard 1959)
- 1b. Tail present 2
- 2a. Tail very large with the base forming a cavity into which the body can be retracted Cystocercous
Family Azygiidae
Azygia longa (Leidy, 1851)
Develops in *Amnicola limosa* (Say) (Sillman 1953a, 1962)
- 2b. Tail without cavity 3
- 3a. Stylet present Xiphidiocercariae
Family Prosthogonimidae
Prosthogonimus macrorchis Macy, 1934
(=*Prosthogonimus rudolphii* Skrjabin, 1919)
Develops in *Amnicola limosa* (Say) (Morgan and Hawkins, 1949, Macy 1939).
- 3b. Stylet absent 4
- 4a. Anterior end with a collar and crown of spines Echinostome
Family Echinostomatidae
Echinochasmus donaldsoni Beaver, 1941
Develops in *Amnicola limosa* (Say) (Beaver 1941b).
- 4b. Crown of spines absent; tail with finfolds Pleurolophocercous
Family Heterophyidae
Apophallus brevis Ransom, 1920
Develops in *Amnicola limosa* (Say) (Miller 1946)
Family Opisthorchiidae
Metorchis conjunctus (Cobbold, 1860)
Develops in *Amnicola limosa* (Say) (Cameron 1944).
Opisthorchis tonkae Wallace and Penner, 1939
Develops in *Amnicola limosa* (Say) (Wallace 1940, Sillman 1953b).

RESULTS

Figure 4 shows the abundance of snails found at the collecting site during the course of this study and the water temperature and pH variations that occurred. A total of 223 specimens of *H. anceps* were collected with 22.8% of them shedding cercariae. Two different cercarial groups were represented. Xiphidiocercariae (represented by *Plagiatura parva* Stunkard, 1933) were present in every collection made while strigeid cercariae (represented by *Crassiphiala bulboglossa* Van Haitsma, 1925) were found in only 2 collections.

Figure 5 shows the monthly shedding pattern by cercarial groups from *H. anceps* at this collecting site. Monthly variations in water temperature and pH are again shown for comparison with these data. Figure 6 shows the diameter of specimens of *H. anceps* that shed cercariae. No juvenile snails (individuals less than 9 mm in this population) (Hermann 1972) were found to be infected. This observation is in agreement with previous reports (Ewers 1964, Farley 1967). No cases of multiple infections were found during this study.

DISCUSSION

Noble (1960) has referred to the total parasite fauna of a plant or animal as its 'parasite mix.' Examinations of the interrelations between parasites, vectors and hosts are a necessary prerequisite for understanding why particular parasite mixes occur (Noble 1960). By studying one organism involved in this association in depth, a better understanding of the entire ecological complex may be gained.

Variations in the incidence of infection by trematodes in populations of freshwater gastropods are probably due to the differences in the environment, physiology and behavior of the snails they inhabit. Since different snail and parasite species are specialized for existence under different environmental conditions, cercarial emergence peaks, if present, should be expected to differ between localities and during different seasons (Hunter and Wigington 1972).

Although the literature on changes in cercarial infections of freshwater snail populations is not abundant, it is important to evaluate the methods and conditions of each previous study before making any comparisons with other data. Factors to be considered should include methods of snail host examination, geographic location, annual succession in any given area and habitat type, including many environmental parameters and presentation of data (Hunter and Wigington 1972).

Life cycle of *Helisoma anceps* (Menke)

The population dynamics of *H. anceps* in Moe

Pond have been examined by Hermann (1972). Figure 7 illustrates its life cycle in the study area. One cohort, hatching from eggs oviposited in early June, is distinguishable until late September when it supplements the adult population that normally survives a two year period.

Cercarial groups present

The life cycle of *Crassiphiala bulboglossa* Van Haitms, 1925 was described by Hoffman (1956). Miracidia hatch in water and penetrate *Helisoma anceps*. Upon penetration strigeid cercariae develop in daughter sporocysts. After leaving the snail, the cercariae encyst as metacercariae on a freshwater fish. In Moe Pond the golden shiner, *Notemigonus crysoleucas* (Mitchell), serves as the second intermediate host. The life cycle is completed when a metacercaria infected fish is eaten by the eastern belted kingfisher, *Megaceryle alcyon* (Linnaeus).

Cercariae that actively penetrate fish as second intermediate hosts are typically representatives of the order Strigeata (Strigeidae, Diplostomidae and Cyanthocotylidae) and complete their development in piscivorous birds and mammals (Ginetsinskaya 1961). When cerca-

riae penetrate the tissues of a fish they cause mechanical damage, hemorrhage and possibly toxic damage. Although the damage done by one cercaria may not affect the host, heavy infections may result in death (Hoffman 1967). Laboratory studies have shown that mortality results after exposing fish to 'high numbers' of cercariae (Spall and Summerfelt 1970). Host reactions include stress and trauma from penetration of cercariae, hemorrhage, congestion, edema, and the presence of leucocytes around the area of invasion (Spall and Summerfelt 1970). Other reports mention reduced weight and smaller size in heavily parasitized fish (Bangham 1938, Hunter and Hunter 1938, Huggins 1959). However, fish in natural populations often appear unharmed by heavy infections (Evans and Mackiewicz 1958, Spall and Summerfelt 1970).

Early spring kills of *N. crysoleucas* have been observed the last several years in Moe Pond. During the spring of 1972 death of the fish corresponded to the time when cercariae of *C. bulboglossa* were emerging from *H. anceps*. In addition, all collected dead fish were heavily infected with the metacercariae of this species. In light of previously mentioned reports on cercarial pathogenicity to fish, it

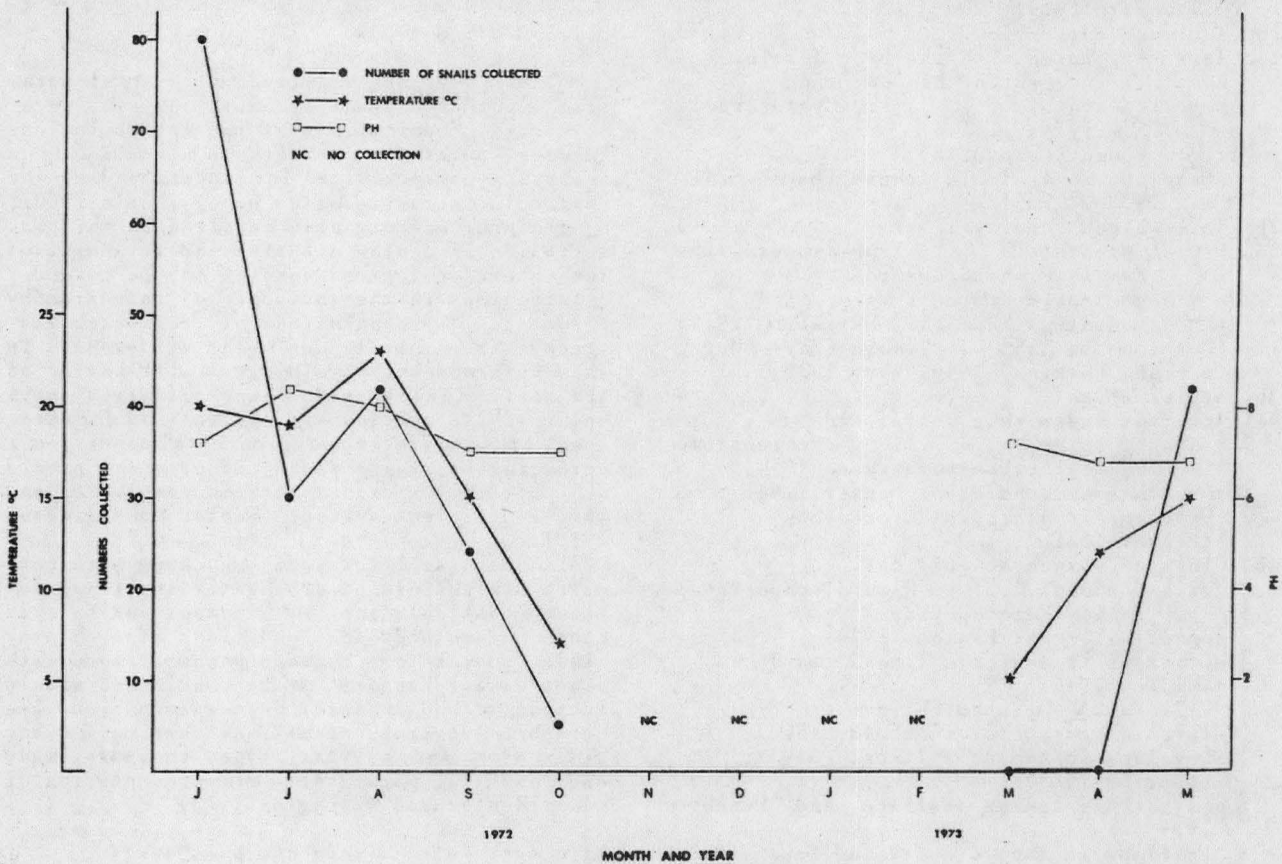


Fig. 4. Number of snails collected and the physical parameters measured during the course of the study.

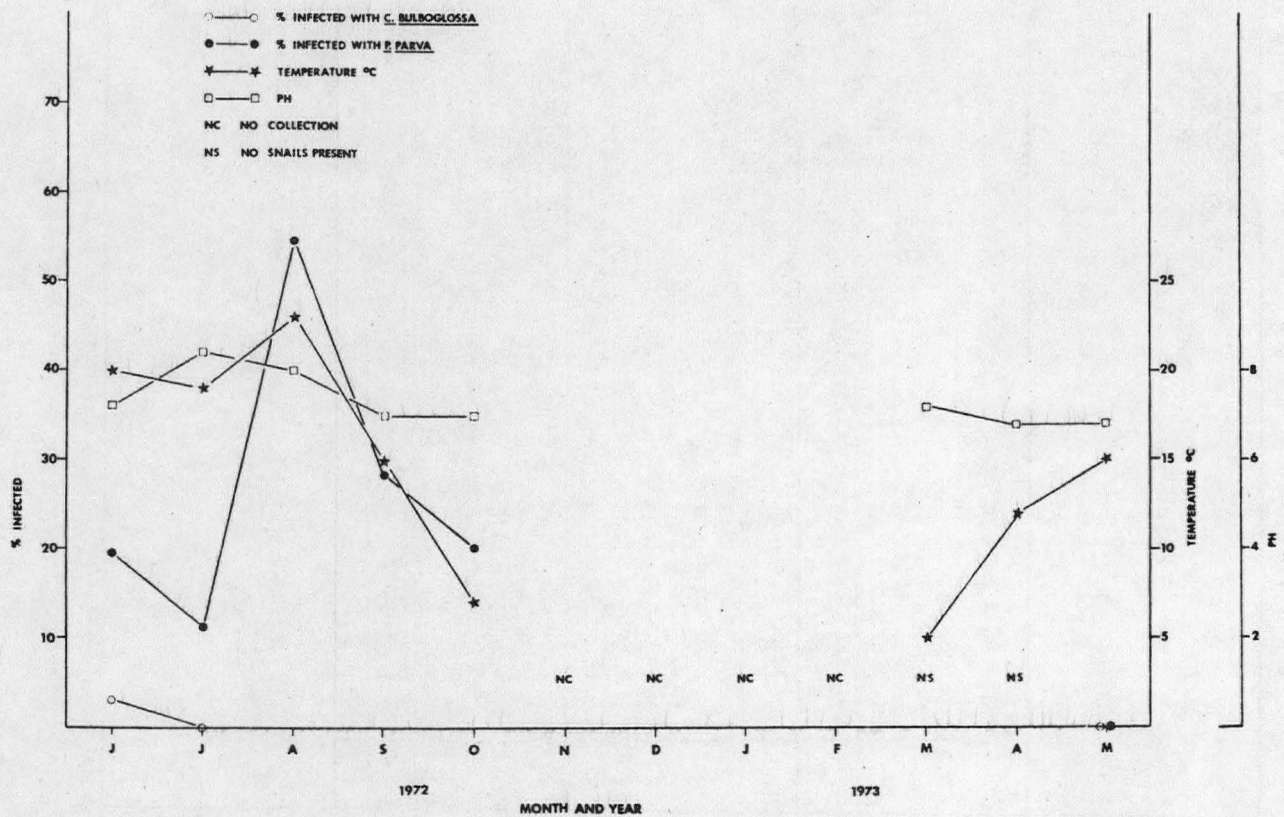


Fig. 5. Monthly shedding pattern by cercarial groups from *H. anceps*. Water temperature °C and pH are shown for comparison.

seems safe to assume that these heavy infections, possibly coupled with other unexamined factors, may have contributed to the death of these fish.

The seasonal occurrence of *C. bulboglossa* in Moe Pond was restricted when contrasted to the xiphidiocercariae (*P. parva*) collected. However, differences in the habits of their definitive hosts can help to explain this. The kingfisher retreats in winter from bodies of water that are completely frozen over, such as Moe Pond, and takes up residence along the local rivers. In addition, the kingfisher is a territorial bird, guarding his hunting grounds from others of his own species, therefore reducing the number of available definitive hosts in any one area (Bent 1964). Rankin (1939) observed a similar situation in relation to furcocercous larval trematodes collected in Massachusetts. He noted that furcocercous cercariae are parasitic in hosts that may only occasionally frequent the biotopes under consideration. Therefore, the presence of larvae that parasitize these definitive hosts may be considered as only oc-

casional or accidental parasites of their intermediate hosts found in these environments. Similarly, McCoy (1929) mentioned that the larval trematode fauna of a lake are constantly changing, probably dependent on the vertebrate hosts visiting that area.

The life cycle of *Plagitura parva* Stunkard, 1933 was described by Stunkard (1936). Eggs containing miracidia are eaten by *Helisoma anceps* and xiphidiocercariae develop in daughter sporocysts. The cercariae encyst as metacercariae in Megaloptera larvae and in the snails *Physa heterostropha* (Say), *Lymnaea columella* Say, *L. stagnalis* (Linnaeus) and *Campeoloma* sp. Completion of the life cycle occurs when metacercariae infected larvae or snails are eaten by the common newt, *Notopthalmus viridescens* (Rafinesque). In Moe Pond *Physa heterostropha* and the larvae of *Corydalis cornutus* (Linnaeus) (Megaloptera: Corydalidae) probably serve as second intermediate hosts.

In contrast to the cercariae of *C. bulboglossa*, the larvae of *P. parva* were present throughout the collecting period. The differ-

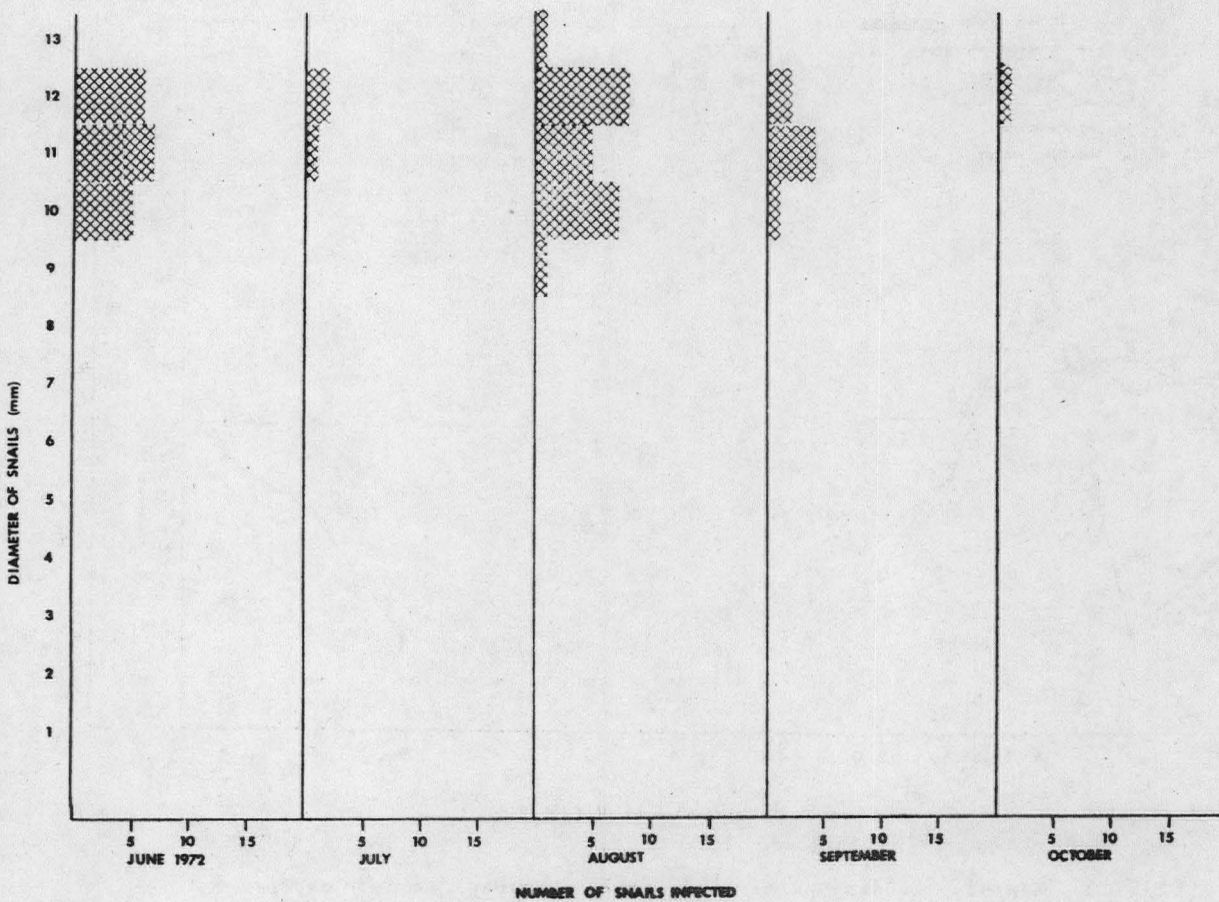


Fig. 6. Diameter of specimens of *H. anceps* that shed cercariae.

ence in temporal distribution of these two species can be correlated with the abundance of their definitive hosts in the aquatic habitat. *Notophthalmus viridescens* can be found swimming in open water or crawling along the bottom of streams and pools. In permanent aquatic habitats they are active throughout the winter (Bishop 1941). Furthermore, to avoid direct sunlight they prefer to congregate in patches of aquatic plants (Bishop 1941). This aggregation along the periphery of the pond places them in the same microhabitat as the snail hosts, facilitating reinfection. The situation in Moe Pond concerning *P. parva* is in agreement with that observed by Rankin (1939) for the cercariae of *Gorgoderina attenuata* Stafford, 1902, that also matures in an amphibian. The behavior of the definitive host results in distribution of miracidia in the habitat of the intermediate host in the spring. Therefore, cercarial emergence peaks in those areas occur in the late summer and early fall.

An interesting correlation can be made between the behavior of the cercariae collected and that of the host they must penetrate. The cercariae of *C. bulboglossa* must penetrate a freshwater fish. These cercariae were always found suspended in the water and rarely ever congregated along the bottom or sides of the container. This behavior would insure success in locating a limnetic freshwater fish. On the other hand, the cercariae of *P. parva* were rarely suspended in the water, but preferred to creep along the bottom of the container. This behavior would facilitate the location of snails or immature insects.

Incidence of infection

An overall incidence of infection of 22.8% was found in 223 snails. These data can be compared with those of studies where similar techniques were used for determination of infections (Bourns 1963, Hunter and Wigington 1972).

Using similar techniques, Hunter and Wig-

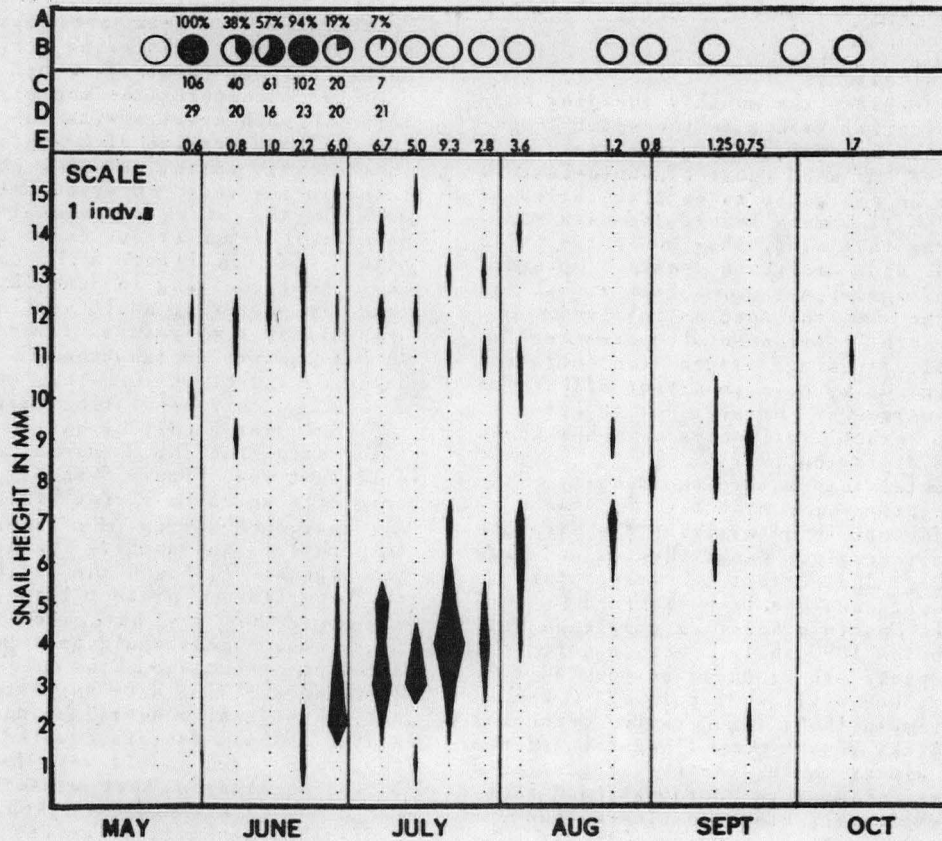


Fig. 7. Size-frequency histogram *Helisoma anceps*, Moe Pond 1971. The number of snails in each size class is represented by the width of the vertical line. Row A, the relative number of eggs collected; Row B, illustrates data in Row A; Row C, the average number of eggs for each sample date; Row D, the average number of eggs per egg mass; Row E, the number of snails in all the size classes. (From Herrmann 1972).

gington (1972) found an overall infection rate of 5.1% in *Goniobasis floridensis* Reeve from the Wekiva River, Florida. Davis (1958) examined *Physa propinqua* Tryon and *Stagnicola palustris nuttalliana* (Lea) from the Columbia Basin, Washington, and found an incidence of infection of 1.5% and 5.5% respectively. Bourns (1963) showed an infection rate of 48.3% in *Lymnaea stagnalis appressa* Say from Ontario.

In other studies, snails were first examined for emerging cercariae and then crushed and dissected to determine the presence of immature cercariae (Rankin 1939, Goodman 1951, Hunter and Birkenholz 1961, Farley 1967). Studies employing these techniques should not be compared to the present study since the results obtained yield different incidence of infection data. For example, Goodman (1951) found an overall infection of 9.3% from *Physa gyrina* by isolation and 37% positive after

crushing. Similarly, Davis (1958) found 1.5% *P. propinqua* and 5.5% *L. palustris* positive after isolation, but increased his estimate of the respective overall prevalence of infection to 7.8% and 39.6% after crushing.

Effect of age

Figure 5 shows the diameter of the snails that were positive for emerging cercariae. According to the study conducted by Herrmann (1972), *H. anceps* greater than 9 mm in diameter were producing eggs (see Figure 7). Since few individuals with a smaller diameter produce eggs it seems feasible to consider individuals in this range as adults. No smaller individuals were positive for emerging cercariae. The observation that no juvenile snails were found to be infected is in agreement with other reports in the literature (Ewers 1964, Farley 1967). Differences in the susceptibi-

lity of adult and juvenile snails to infection may be due to a natural immunity possessed by the juvenile portion of the population (Ewers 1964).

Environmental effects

Figure 5 compares the monthly shedding pattern by cercarial groups to the water temperature and pH. Cercarial emergence peaks seem to be limited to a pH range of approximately 6.5-9.5 and no emergence takes place below pH 3 or above pH 11 (Smyth 1966). The data collected during this study show no correlation between pH and emergence peaks. However, fluctuations in pH may have been within the optimum range for the species involved. Undoubtedly, such environmental parameters as pH, rainfall, flooding, oxygen concentration and light intensity have important effects on cercarial emergence. However, at the present time their exact influences are not known (Hunter and Wigington 1972).

Environmental temperature and density of the snail population are probably the two most important factors in determining the presence of cercarial emergence peaks (Hunter and Wigington 1972). The effect of temperature on cercarial emergence has been examined for some species. In *Fasciola hepatica* emergence will not occur below 10°C while in *Cotylophoron cotylophorum* peaks are produced between 30-35°C and no emergence will occur below 24°C and above 35°C (Smyth 1966). Generally, cercarial emergence peaks reach their lowest incidence during the winter months. Active stages found at this time are immature sporocysts and rediae whose development has been slowed down due to the low temperatures (Probert 1966). The development of the rediae of *F. hepatica* has been shown to be inhibited from late autumn

until spring when water temperatures are below 10°C. Maximum emergence occurs in the late summer when water temperatures are highest. Spring emergence peaks are probably due to the maturation of overwintering stages as the temperature rises (Probert 1966).

Figure 5 compares the monthly shedding pattern of each species with the water temperature. The cercariae of *C. bulboglossa* peaked in the early spring and did not appear again later in the year. Previous mention has been made to the often occasional and accidental nature of furcocercous cercariae. From the data shown in Figure 5 it can be concluded that those emerging in June may have overwintered in surviving adult snails to be released when higher temperatures favored development. An alternative explanation is that the incidence of infection for this species remained so low in this population that it was undetected in later collections.

The situation for *P. parva* is an entirely different one. Figure 5 shows a shedding pattern with an early spring rise and the greatest emergence during the summer months when temperatures and numbers of susceptible snails are highest. Although the definitive host for this species is present throughout the year, any eggs that may have been released during the winter months would have been arrested in development because of the colder temperatures. Herrmann's (1972) data suggest that the density of the snails decreases during the winter months. These factors coupled with the fact that no infected snails were found in May leads to the conclusion that winter infections of *P. parva*, if present, are the results of miracidia that penetrated earlier in the year and are populations with extremely low density.

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REVIEW

KEEN, A. Myra and COAN, Eugene (1973) Marine molluscan genera of western North America. An illustrated key. -- Second edition. Stanford University Press, Stanford, Calif. vi, 208 p. Illustrated, \$8.75

In general, malacologists recognize the usefulness of keys for the identification of species but they are also almost unanimous in agreeing that keys are highly difficult to construct. When keys are attempted, systematists seek the aid of willing guinea pigs to try out their keys--generally students in zoology--and when they present the finished product to a waiting world, they hope their keys will work and not be outdated too soon by the description of new species and genera.

The first edition of the key reviewed here appeared 11 years ago and has drawn very little criticism and much praise from all who have used it. The only reason for a new edition is the correction of a few errors and the incorporation of new material. For this addition to the aids available to the taxonomist the authors have earned the thanks and praise of all systematists who attempt to identify the numerous, varied, and beautiful marine Mollusca of the West Coast.

Aurèle La Rocque