

LYMNAEA VIATRIX AND LYMNAEA COLUMELLA IN THE NEOTROPICAL REGION: A DISTRIBUTIONAL OUTLINE

W. LOBATO PARAENSE

A review of lymnaeid samples collected by the author from 106 localities in Mexico, Cuba, Jamaica, Haiti, Dominican Republic, Puerto Rico, Martinique, Saint Lucia, Guatemala, Costa Rica, Panamá, Ecuador, Peru, Bolivia, Chile, Argentina, Uruguay and Brazil showed that one of them (from Ecuador) belonged to Lymnaea cousini Jousseaume, 1887, and all the others to either L. viatrix Orbigny, 1835 or L. columella Say, 1817.

The ranges of L. viatrix and L. columella overlap in Middle America, and in northern and southern South America (Venezuela-Colombia-Ecuador and northeastern Argentina-Uruguay-southernmost Brazil, respectively).

L. viatrix was the only species found in Peru west of the Andes and in Chile, and is supposed to have migrated eastward to Argentina via the Negro river basin.

The range of L. columella in South America is discontinuous. The species has been recorded from Venezuela, Colombia and Ecuador and, east of the Andes, from latitudes 15° S (central-west Brazil) to 35° S (La Plata, Argentina). Such a gap may be attributed to either introduction from the northern into the southern area, or migration along the unsampled region on the eastern side of the Andes, or extinction in the now vacant area.

No lymnaeids have been found so far in Brazil north of latitude 15° S and in the Guianas.

On searching Neotropical countries for planorbid snails, I have had the opportunity of collecting numerous samples of lymnaeids. Some of those samples were used for defining anatomically the species *Lymnaea viatrix* Orbigny, 1835 on the basis of topotypic material (Paraense, 1976).

Comparison with specimens of *Lymnaea cubensis* Pfeiffer, 1839 from a creek at Soroa, near Candelaria, about 100 km by road to the west of Havana, Cuba, showed that it is anatomically indistinguishable from *L. viatrix* (to be published).

Another species frequently recorded in the Neotropical region is *Lymnaea columella* Say, 1817, originally described from the United States. Comparing numerous samples with specimens of *L. columella* from Michigan, kindly sent by Dr. George M. Davis, it was possible to record its presence in many localities. It also could be ascertained on anatomical evidence (to be published) that *Lymnaea peregrina* Clessin, 1882 (topotypic specimens from Taquara, Brazil) is a synonym of *L. columella*.

In the present paper an account of the distribution of *L. viatrix* and *L. columella* is given. Additional observations on those and other species found in the area will be published elsewhere.

MATERIAL AND METHODS

The snails were collected from 105 localities in Mexico, Guatemala, Costa Rica, Panamá, Cuba, Jamaica, Haiti, Dominican Republic, Puerto Rico, Martinique, Saint Lucia, Ecuador, Peru, Bolivia, Chile, Argentina, Uruguay and Brazil, during the course of several collecting trips between the years 1956 and 1981. In the unmentioned continental countries (except Colombia, which I have not visited so far) and in Trinidad, Barbados, Guadeloupe, Antigua, Saint Croix and Saint Thomas I did not happen upon lymnaeids.

A variable number of specimens from each sample were preserved for anatomical study in Railliet-Henry's fluid, as described by Paraense (1981). Identification of specimens was based on the characteristics of the shell and internal organs (radula, pallial complex and genital system).

RESULTS

Table I and Fig. 1 show the distribution of the collected samples of *L. viatrix* and *L. columella*. It can be seen that the ranges of the two species overlap in Middle America, and in Uruguay and surrounding area of northeastern Argentina and southernmost Brazil.

In South America west of the Andes a single population of *L. columella* was found at Lake San Pablo, near Otavalo, Ecuador. Another species, *L. cousini* Jousseaume, 1887, was collected at its type-locality, near Chillogallo, Ecuador, and will be studied in a separate paper. Except for those two findings, the area is occupied by *L. viatrix*, which farther on to the south extends eastward to Argentina along the Negro river basin, spreads over this country up to the Bolivian boundary, but has not been recorded north of latitude 30° S in eastern Argentina and in Brazil, except for a single population that was found at Belo Horizonte (locality 96), in full range of *L. columella*. As to the latter, it is represented in my samples from 15° S (in Brazil) southward to northeastern Argentina and Uruguay.

DISCUSSION

Fig. 1 suggests that *L. viatrix* spread from Middle America to western South America, being apparently the only species that was able to surmount the adverse environmental conditions of the Peruvian and Chilean deserts, owing perhaps to its amphibious tendency. On its southward migration along Chile it passed the eastern Andean barrier through some waterway like that shown in Fig. 2, spreading through the Negro river corridor to Argentina, Uruguay and southernmost Brazil. Its occurrence as an isolated population in Belo Horizonte (locality 96), far north from its range, may be due either to insufficient collecting in the intervening area or to introduction perhaps by human agency.

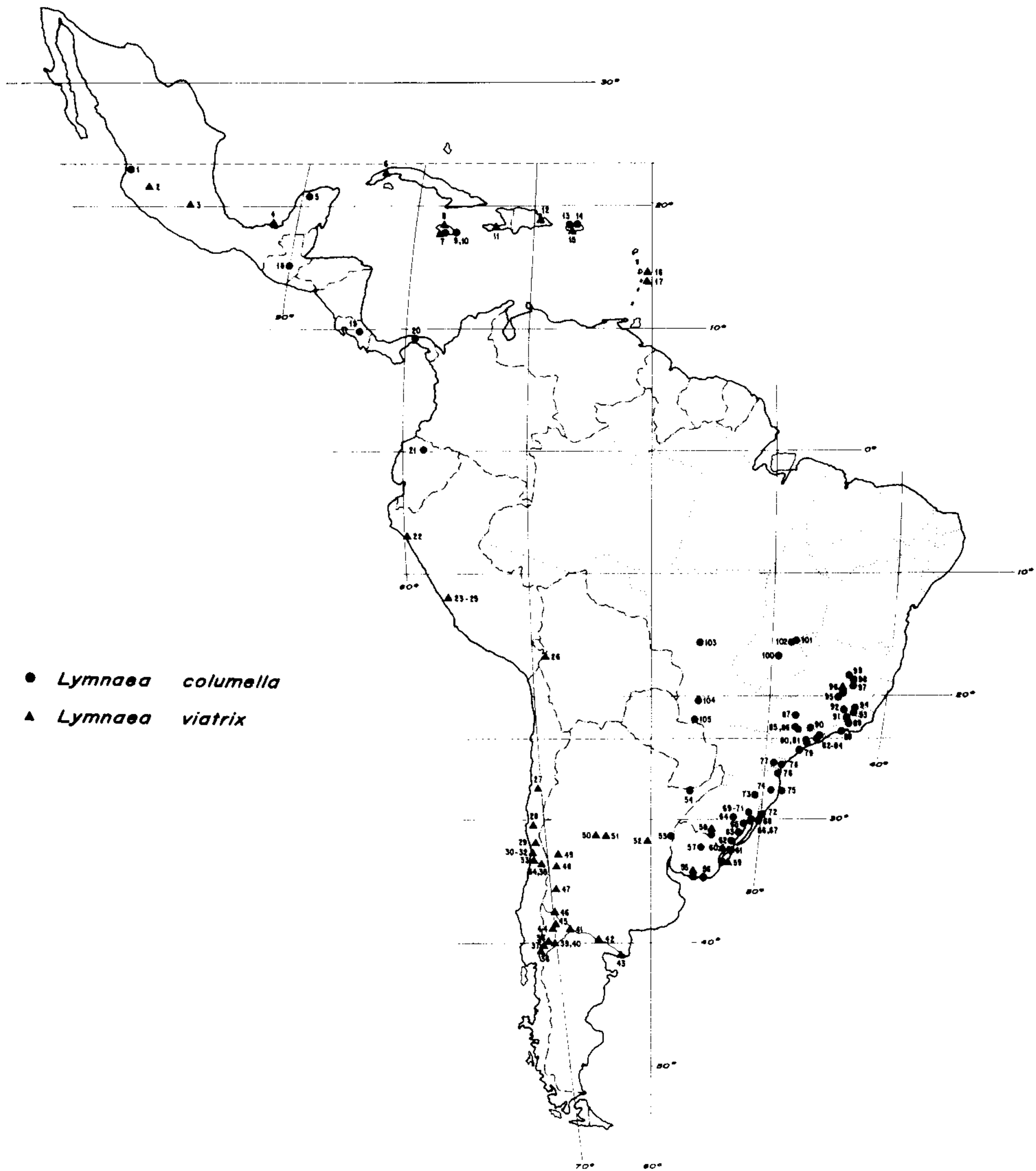


Fig. 1 – Distribution of populations of *Lymnaea viatrix* and *L. columella* examined in this study; discrimination based on characteristics of the shell and internal organs. Localities numbered as in Table I.

The Negro river, which runs between 39° and 41° S, is important as a migration route since it allows the sharing of several freshwater molluscan taxa between Chile and Argentina. Thus the families Hydrobiidae, Chilinae, Ancylidae and Sphaeriidae, found along the Negro river, are represented in both countries. Of the 13 species of Planorbidae so far recorded in Argentina (5 of the genus *Biomphalaria*, 6 of *Drepanotrema*, 1 of *Acrorbis*, 1 of *Antillorbis*), only *Biomphalaria peregrina* (see Paraense, 1966) and *Antillorbis nordestensis* are present in the river and in the two countries. The genus *Drepanotrema*, absent from Chile, has not been recorded beyond 36° S, except *D. kermatoides*, which I collected at the Choele-Choel Grande island, situated at the middle of the Negro river course, and *D. anatinum*, reported by Pilsbry (1911 : 530) from “lakes along the Rio Negro”. The family Ampullariidae, also absent from Chile, has its southernmost limit at Azul (36°45' S) in my collection. Finally the Physidae, present in Chile, are not repre-

TABLE I
Origin of examined samples of *Lymnaea viatrix* and *L. columella*

COUNTRY Locality	<i>Lymnaea viatrix</i>	<i>Lymnaea columella</i>	COUNTRY Locality	<i>Lymnaea viatrix</i>	<i>Lymnaea columella</i>
MEXICO			ARGENTINA		
1. Tepic		+	47. Bardas Blancas	+	
2. Chapala	+		48. San Carlos	+	
3. Teoloyucan	+		49. Mendoza	+	
4. Ciudad del Carmen	+		50. Salsacate	+	
5. Mérida		+	51. Córdoba	+	
CUBA			52. Paraná	+	
6. Soroa	+		53. Concordia		+
JAMAICA			54. Ituzaingó		+
7. McCooks Pen	+	+	URUGUAY		
8. Castleton	+		55. Montevideo	+	+
9. White Horses		+	56. Maldonado		+
10. Qwaw Hill		+	57. Arroyo Salsipuedes Grande		+
HAITI			BRAZIL		
11. Miragoane	+		58. Dom Pedrito, RS*	+	+
DOMINICAN REPUBLIC			59. Santa Vitória do Palmar, RS	+	+
12. Hato Mayor	+		60. Jaguarão, RS	+	
PUERTO RICO			61. Taim, RS		+
13. Sabana Seca		+	62. Capão do Leão		+
14. Río Piedras		+	63. Camaquã, RS		+
15. Caguas	+		64. Cachoeira do Sul, RS		+
MARTINIQUE			65. Guaíba, RS		+
16. Saint Pierre	+		66. Porto Alegre, RS		+
SAINT LUCIA			67. Viamão, RS		+
17. Cul de Sac river	+		68. Tramandaí, RS		+
GUATEMALA			69. Morro Reuter, RS		+
18. Purulhá		+	70. Taquara, RS		+
COSTA RICA			71. Nova Petrópolis, RS		+
19. Cartago		+	72. Araranguá, SC*		+
PANAMÁ			73. Lages, SC		+
20. Barro Colorado		+	74. Barracão, SC		+
ECUADOR			75. Florianópolis, SC		+
21. Otavalo (Lake San Pablo)		+	76. Joinville, SC		+
PERU			77. Curitiba, PR*		+
22. Pimentel	+		78. Morretes, PR		+
23. Callao	+		79. Ana Dias, SP*		+
24. Lima	+		80. São Paulo, SP		+
25. Pachacamac	+		81. Campinas, SP		+
BOLIVIA			82. São José dos Campos, SP		+
26. Guaqui (Lake Titicaca)	+		83. Caçapava, SP		+
CHILE			84. Taubaté, SP		+
27. Copiapó	+		85. Rio Claro, SP		+
28. Samo Alto	+		86. Pirassununga, SP		+
29. Salamanca	+		87. Ribeirão Preto, SP		+
30. Concón	+		88. Rio de Janeiro, RJ*		+
31. Viña del Mar	+		89. Três Rios, RJ		+
32. Valparaíso	+		90. Ouro Fino, MG*		+
33. Casablanca	+		91. Juiz de Fora, MG		+
34. Santiago	+		92. Barbacena, MG		+
35. Maipo	+		93. Ubá, MG		+
ARGENTINA			94. Viçosa, MG		+
36. Pampa Linda	+		95. Betim, MG		+
37. San Martín de los Andes	+		96. Belo Horizonte, MG	+	+
38. Catán Lil	+		97. Ferros, MG		+
39. Piedra del Águila	+		98. Sabinópolis, MG		+
40. Bajada Colorada	+		99. Diamantina, MG		+
41. Neuquén	+		100. Goiânia, GO*		+
42. Choele-Choel Grande	+		101. Formosa, GO		+
43. Viedma	+		102. Brasília, DF*		+
44. Zapala	+		103. Cuiabá, MT*		+
45. Bajada del Agrio	+		104. Aquidauana, MS*		+
46. Chos Malal	+		105. Bela Vista, MS		+

*Abbreviations of Brazilian states: DF: Distrito Federal, GO: Goiás, MG: Minas Gerais, MS: Mato Grosso do Sul, MT: Mato Grosso, PR: Paraná, RJ: Rio de Janeiro, RS: Rio Grande do Sul, SC: Santa Catarina, SP: São Paulo.

sented in my samples beyond 35°S, but Orbigny (1837 : 342) refers to *Physa rivalis* "not far from the Negro river".

The relative poorness in species of the freshwater molluscan fauna of Chile as compared with that of the neighboring countries, also evident in other animal groups,

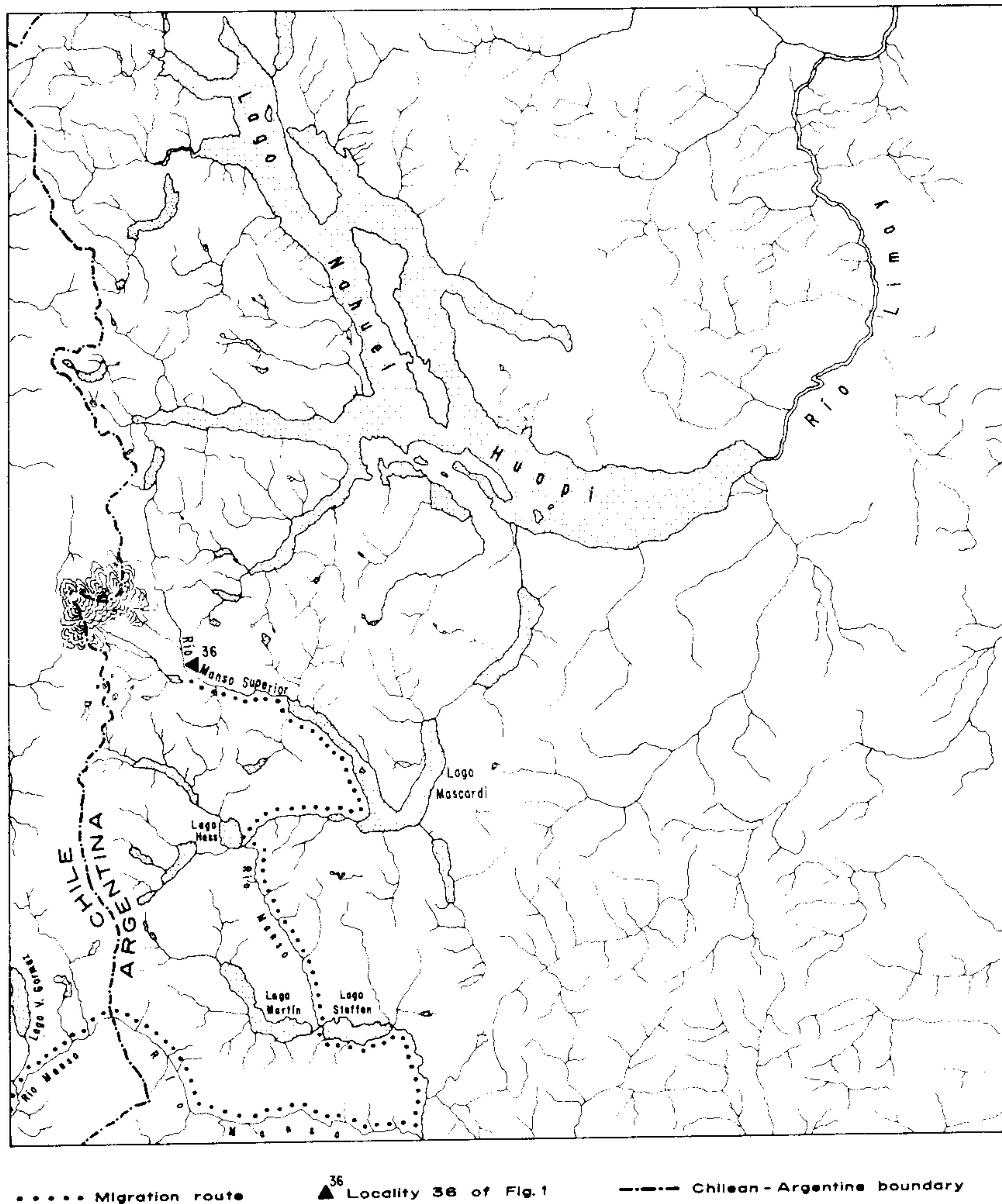


Fig. 2 – Practicable migration route between Chile and Argentina. The Manso river (lower left), common to both countries, is connected with the Manso Superior (lower middle left) at the headwaters of the Limay, a tributary of the Negro river.

results from the isolation of that country by efficient barriers – the western ocean, the northern desert and the eastern cordillera. Under such conditions the Negro river basin is one of the few channels of freshwater faunal interchange (Fig. 2). Other connections of this kind are small river basins that gather waters from Argentine sources and drain westward into Chile, as for instance those more to the south, from 43° S (Futaleufú river pass) to 49° S (San Martín-O'Higgins lake), including the basins of the Buenos Aires-General Carrera lake (46° S) connected with the Pueyrredón-Cochrane lake (47° S), and the Chubut river (Argentina) and Palena river (Chile) connection through the Hualjaina or Tecka river (about 43° S, 70° W).

In South America, outside the range outlined in Fig. 1, *L. viatrix* was recorded on conchological grounds from a number of Argentine localities: Patagones, Buenos Aires (Buenos Aires province), Estacada, Ciénaga de las Cerrajas, Uspallata (Mendoza province)

by Strobel (1874 : 40); Quequén, Sierra Curamalal, Arroyo del Azul, Rosas, Atalaya, Ensenada (Buenos Aires province), Las Higueras, Cerro el Nevado, San Rafael (Mendoza province), Trapiche, Los Chorrillos (San Luis province), Saldán, Cabana, Arroyo Macha, Cerro Colorado, Arroyo San Francisco, Arroyo Tulumba (Córdoba province), Olta, Aguada de Olta (La Rioja province), San Pedro, Est. "Golgota" (Salta province), Termas de Palmer, Las Lajitas, Río Alisos, Manantiales del Río Chico, Ciudad de Jujuy (Jujuy province) by Castellanos & Landoni (1981 : 70); Chico river, southern Patagonia, by Pilsbry (1911 : 525). Other records from South America are: Asunción, Paraguay (Martens, 1895 : 34), Ureña, Colombia (Brumpt et al, 1940 : 563, as *L. cubensis*), Caracas, Venezuela (Martens, 1899 : 378, as *L. cubensis*), Caracas and Maracay, Venezuela (Lutz, 1928 : 80, as *L. cubensis*), Mendoza, Venezuela (Morales & Pino, 1981 : 39, as *L. cubensis*).

The species *L. diaphana* King, 1830 from Cape San Gregorio on the strait of Magellan, whose shell closely resembles that of *L. viatrix*, may prove a senior synonym of the latter.

Hubendick (1951 : 140, Figs. 257, 268, 324) shows three specimens from Nova Teutônia, Brazil, as examples of *L. viatrix*. The figured shells are different from those of specimens from the localities mentioned by Orbigny (1841 : 430), and figured by this author and by Paraense (1976). Moreover, the prostate of *L. viatrix* shows an inward fold which is missing in the Nova Teutônia specimens (compare Paraense's Fig. 11 with Hubendick's Fig. 257, PR).

L. columella was identified on anatomical basis in several South American localities not listed in Table I. Scott (1953 : 403, Fig. 3) studied specimens from San Javier (Misiones province) and Aguapey river (Corrientes province), northeast Argentina. Her description and figure of the prostate – "a rosette-like folded tube which stands out as an ivory skein against the smooth wall of the albumen gland" – evidently refer to the oviduct. Additional Argentine localities, mentioned by Castellanos & Landoni (1981 : 66), are Posadas (Misiones province) and La Plata (Buenos Aires province). In other South American countries *L. columella* was recognized by examination of the shell and internal organs at Americana, Atibaia (Ueta, 1977 : 217) and Piquete (Ueta, 1980 : 230), in São Paulo state, Brazil; Villarrica, Paraguay (Hubendick, 1951 : 140); a number of localities in the Departments of Valle, Cauca, Nariño and Meta, Colombia (Malek & Cogswell, 1980 : 112-113); and Maracay, Venezuela (Malek & Chroschiechowski, 1964 : 55).

The wide gap in the geographic range of *L. columella* in South America east of the Andes may be due to one of the following reasons: (a) introduction from northern into southern latitudes with subsequent spreading on the south; (b) migration southward along the eastern side of the Andes through Colombia, Peru and Bolivia, where the species may be found if properly sought (Malek & Cogswell [1980] found it on the eastern face of the Colombian Andes at Villavicencio); (c) former distribution over a continuous geographic range and subsequent extinction in the now vacant area, to be verified by paleontological investigation.

There are no records of lymnaeids in Brazil north of latitude 15° S, and also in the Guianas. This fact seems to reflect a real situation, seeing that a good deal of collecting has been done in the area by workers of domestic and foreign institutions.

RESUMO

A revisão de amostras de limneídeos coletados pelo autor em 106 localidades no México, Cuba, Jamaica, Haiti, República Dominicana, Porto Rico, Martipica, Santa Lúcia, Guatemala, Costa Rica, Panamá, Equador, Peru, Bolívia, Chile, Argentina, Uruguai e Brasil mostrou que uma delas (do Equador) pertenciam a *Lymnaea cousini* Jousseaume, 1887, e que todas as outras pertenciam a *L. viatrix* Orbigny, 1835 ou a *L. columella* Say, 1817.

As distribuições da *L. viatrix* e da *L. columella* sobrepõem-se na Meso-América e na América do Sul setentrional (Venezuela-Colômbia-Ecuador) e meridional (nordeste da Argentina-Uruguai-extremo sul do Brasil).

A *L. viatrix* foi a única espécie encontrada no Peru, a oeste dos Andes, e no Chile, parecendo ter migrado na direção leste para a Argentina através da bacia do rio Negro.

A distribuição de *L. columella* na América do Sul é descontínua. Tem sido encontrada na Venezuela, Colômbia e Ecuador e, a leste dos Andes, entre as latitudes 15° S (Centro-Oeste do Brasil) e 35° S (La Plata, Argentina). Esse hiato na distribuição pode ser atribuído à introdução da espécie do norte para o sul, ou à migração ao longo da faixa não estudada no lado leste dos Andes, ou à extinção na área atualmente vaga.

Até agora não foi registrada a presença de limneídeos no Brasil ao norte da latitude 15° S e nas Guianas.

ACKNOWLEDGMENTS

The material on which this paper is based was collected during the course of several trips supported by the Pan American Health Organization, Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Serviço Especial de Saúde Pública, Instituto Nacional de Endemias Rurais, Instituto Oswaldo Cruz, and Consejo Nacional de Investigaciones Científicas y Técnicas of Argentina.

REFERENCES

- BRUMPT, E.; VELASQUEZ, J; UCROZ, H. & BRUMPT, L.C., 1940. Découverte de l'hôte intermédiaire, *Limnaea bogotensis* Pilsbry, de la grande douve, *Fasciola hepatica*, en Colombie. *Ann. Parasitol.*, 17 (6) :563-579.
- CASTELLANOS, Z.A. & LANDONI, N.A., 1981. La familia Lymnaeidae Rafinesque, 1815 en la Argentina, p. 55-82. In R.A. Ringuelet (ed.), Fauna de agua dulce de la República Argentina, 15 (3). Gráf. Gral. Belgrano, Buenos Aires.
- CLESSIN, S., 1882. Neue Arten. *Malakozool. Blät.* (Neue Folge), 5 :187-193.
- HUBENDICK, B., 1951. Recent Lymnaeidae: their variation, morphology, taxonomy, nomenclature, and distribution. *Kungl. Svenska Vetensk. Hand.*, 3 (1) :1-223.
- JOUSSEAUME, F., 1887. Mollusques nouveaux de la République de l'Équateur. *Bull. Soc. Zool. France*, 12 :164-186.
- KING, P.P., 1830. Description of the Cirrhipeda, Conchifera and Mollusca, in a collection formed by the Officers of H.M.S. Adventure and Beagle employed between the years 1826 and 1830 in surveying the southern coasts of South America, including the straits of Magalhaens and the coast of Tierra del Fuego. *Zool J.*, 5, Art. 47 :332-349.
- LUTZ, A., 1928. Moluscos de agua dulce recogidos y observados en Venezuela, p. 75-84. In Estudios de zoología y parasitología venezolanas. 133 p., Rio de Janeiro.
- MALEK, E.A. & CHROSCIECHOWSKI, P., 1964. *Limnaea (Pseudosuccinea) columella* from Venezuela, and notes on the distribution of *Pseudosuccinea*. *Nautilus*, 78 (2) :54-56.
- MALEK, E. & COGSWELL, F.B., 1980. *Limnaea (Pseudosuccinea) columella* in Colombia. *Nautilus*, 94 (3) :112-114.

- MARTENS, E., 1895. Mollusken von Paraguay. *Sitz.-Ber. Ges. Naturf. Fr. Berlin*, 3 :33-35.
- MARTENS, E., 1890-1901. Land and freshwater mollusca. xxviii + 706 p. *In Biologia Centrali-Americana*. Taylor & Francis, London.
- MORALES, G. A. & PINO, L. A., 1981. *Lymnaea cubensis* Pfeiffer, 1839, hospedador intermediário de *F. hepatica* en la zona alta de Los Andes trujillanos, Venezuela. *Bol. Direc. Malariol. San. Ambiental*, 21 (1) :39.
- ORBIGNY, A., 1835. Synopsis terrestrium et fluviatilium molluscorum, in suo per Americam meridionalem itinere, ab A. D'Orbigny, collectorum. *Mag. Zool.*, 5, Classe 5 (61-62) :1-44.
- ORBIGNY, A., 1835-1846. Voyage dans l'Amérique méridionale. Mollusques, 5 (3). P. Bertrand, Paris.
- PARAENSE, W. L., 1966. The synonymy and distribution of *Biomphalaria peregrina* in the Neotropical region. *Rev. Brasil. Biol.*, 26 (3) :269-296.
- PARAENSE, W. L., 1976. *Lymnaea viatrix*: a study of topotypic specimens. *Rev. Brasil. Biol.*, 36 (2) :419-428.
- PARAENSE, W. L., 1981. *Biomphalaria occidentalis* sp. n. from South America (Mollusca Basommatophora Pulmonata). *Mem. Inst. Oswaldo Cruz*, 76 (2) :199-211.
- PFEIFFER, L., 1839. Bericht über die Ergebnisse meiner Reise nach Cuba im Winter 1838-1839. *Arch. Naturg.*, 5 (1) :346-358.
- PILSBRY, H. A., 1911. Non-marine mollusca of Patagonia, p. 513-687. *In* W. B. Scott (ed.), Reports of the Princeton University Expeditions to Patagonia, 1896-1899, 3 (5). E. Schweizerbart'sche Verlagshandlung, Stuttgart.
- SAY, T., 1817. Description of seven species of American fresh water and land shells, not noticed in the systems. *J. Acad. Nat. Sci. Philadelphia*, 1 (1) :13-18.
- SCOTT, M. I. H., 1953. Sobre Limnaeidae argentinos. *Physis*, 20 (59) :401-408.
- STROBEL, P., 1874. Materiali per una malacostatica di terra e di acqua dolce dell'Argentina meridionale. lxxx + 79 p. Tip. Nistri, Pisa.
- UETA, M., 1977. Variações anatômicas em *Lymnaea columella* (Mollusca, Gastropoda). *Rev. Soc. Brasil. Med. Trop.*, 11 (6) :217-237.
- UETA, M., 1980. Ocorrência de infecção natural de *Fasciola hepatica* Linnaeus, 1758 em *Lymnaea columella* Say, 1817 no vale do Paraíba, SP, Brasil. *Rev. Saúde Públ.*, 14 (2) :230-233.