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6. GEOGRAPHIC DISTRIBUTION; DISTRIBUTION PATTERN

6.1. GEOGRAPHIC DISTRIBUTION

6.1.1. Procedure and methods

To characterize the distribution of each species, over 25000 herbarium specimens were checked and more than 2000 living samples were investigated. The following 124 herbaria kindly sent material for identification of Lemnaceae species. I am most thankful to the directors and curators of these herbaria for their cooperation.

List of the consulted herbaria:

A² Arnold Arboretum, Cambridge, Massachusetts, U.S.A.
AAU² Aarhus, Denmark
AD Adelaide, South Australia, Australia
ASU Tempe, Arizona, U.S.A.
AUA Auburn, Alabama, U.S.A.
B¹ Berlin, Federal Republic of Germany
BA Buenos Aires, Museo Argentino de Ciencias Naturales
"Bernardino Rivadavia", Argentina
BAA Buenos Aires, Herb. "Gaspar Xuarez", Argentina
BAB Castelar, Buenos Aires, Argentina
BAF Buenos Aires, Herb. Museo de Botanica y Farmacologia Juan A.
Dominguez, Argentina
BM¹₃ London, Great Britain
BO³ Bogor, Indonesia
BOL Bolus Herbarium, Cape Town, South Africa
BR¹ Meise, Belgium
BRI¹ Brisbane, Queensland, Australia
BRY Provo, Utah, U.S.A.
C² Copenhagen, Denmark
CAME³ Camerino, Italy
CAL Calcutta, India
CAS San Francisco, California, U.S.A.
CM Pittsburgh, Pennsylvania, U.S.A.
COL Bogota, Colombia
COLO Boulder, Colorado, U.S.A.
CORD Cordoba, Argentina
CTES Corrientes, Argentina
DHL Louisville, Kentucky, U.S.A.
DS Dudley Herb. of Stanford, San Francisco, California, U.S.A.
DUKE Durham, North Carolina, U.S.A.
F² Field Museum, Chicago, Illinois, U.S.A.

FI¹ Firenze, Italy
FLAS Gainesville, Florida, U.S.A.
FSU Tallahassee, Florida, U.S.A.
G² Geneva, Switzerland
GA¹ Athens, Georgia, U.S.A.
GB¹ Göteborg, Sweden
GH² Gray Herb., Cambridge, Massachusetts, U.S.A.
GOET¹ Göttingen, Federal Republic of Germany
H¹ Helsinki, Finland
ID Moscow, Idaho, U.S.A.
ILL Urbana, Illinois, U.S.A.
IND Bloomington, Indiana, U.S.A.
ISC Ames, Iowa, U.S.A.
JE Jena, German Democratic Republic
JEPS Jepson Herb., Berkeley, California, U.S.A.
K¹ Kew, England, Great Britain
KASH Srinagar, Kashmir, India
KUO Kuopio, Finland
KY² Lexington, Kentucky, U.S.A.
L² Leiden, Netherlands
LA Los Angeles, California, U.S.A.
LAF^{1,3} Lafayette, Louisiana, U.S.A.
LE^{1,3} Leningrad, USSR
LIL¹ San Miguel de Tucuman, Tucuman, Argentina
LISC¹ Lisboa, Portugal
LISU¹ Lisboa, Portugal
LL Lundell Herb., Renner, Texas, U.S.A.
LP La Plata, Buenos Aires, Argentina
LSU Baton Rouge, Louisiana, U.S.A.
LY¹ Lyon, France
M¹ Munich, Federal Republic of Germany
MASS Amherst, Massachusetts, U.S.A.
MCNS Salta, Argentina
MEL Melbourne, Victoria, Australia
MERL Mendoza, Argentina
MICH² Ann Arbor, Michigan, U.S.A.
MO² St. Louis, Missouri, U.S.A.
MONTU Univ. of Montana, Missoula, U.S.A.
MPU² Montpellier, France
MU Oxford, Ohio, U.S.A.
MUHW Huntington, West Virginia, U.S.A.
MUR³ Murray, Kentucky, U.S.A.
NAN³ Nanking, China
NCSC Raleigh, North Carolina, U.S.A.
NCU Chapel Hill, North Carolina, U.S.A.
NO New Orleans, Louisiana, U.S.A.
NSW Sidney, New South Wales, Australia
NY New York City, New York, U.S.A.
OKL Norman, Oklahoma, U.S.A.
OS Columbus, Ohio, U.S.A.
OSC Corvallis, Oregon, U.S.A.
P¹ Paris, France
PAC¹ University Park, Pennsylvania, U.S.A.
PE¹ Peking, China
PENN Philadelphia, Pennsylvania, U.S.A.
PERTH Perth, Western Australia, Australia

PH	³	Philadelphia, Pennsylvania, U.S.A.
POM	³	Claremont, California, U.S.A.
PRE		Pretoria, South Africa
R	¹	Rio de Janeiro (Museo Nacional), Brazil
RB		Rio de Janeiro (Jardin Bot.), Brazil
RSA	³	Claremont, California, U.S.A.
S	¹	Stockholm, Sweden
SDC		Brookings, South Dakota, U.S.A.
SDSU		San Diego, California, U.S.A.
SGQ	³	Santiago, Chile
SI	³	San Isidro, Buenos Aires, Argentina
SING		Singapore
SMU		Dallas, Texas, U.S.A.
SP		Sao Paulo, Brazil
SRGH	¹	Salisbury, Zimbabwe
STU		Ludwigsburg, Federal Republic of Germany
TENN		Knoxville, Tennessee, U.S.A.
TEX		Austin, Texas, U.S.A.
U	¹	Utrecht, Netherlands
UARK		Fayetteville, Arkansas, U.S.A.
UC		Berkeley, California, U.S.A.
UNA		University, Alabama, U.S.A.
UPS	¹	Uppsala, Sweden
US	²	Washington, Washington DC, U.S.A.
USF		Tampa, Florida, U.S.A.
UT		Salt Lake City, Utah, U.S.A.
VALD	³	Valdiviana, Chile
VSC		Valdosta, Georgia, U.S.A.
W	¹	Vienna (Museum of Nat. Hist.), Austria
WAG		Wageningen, Netherlands
WELT		Wellington, New Zealand
WILLU		Corvallis, Oregon, U.S.A.
WS		Pullmann, Washington, U.S.A.
WTU		Seattle, Washington, U.S.A.
WU	¹	Vienna, (University), Austria
WYA		Morgantown, West Virginia, U.S.A.
Z	¹	Zürich, University, Switzerland
ZT		Zürich, Federal Institute of Technology, Zürich
ZT*		Collection of <u>Lemnaceae</u> , kept living in Zürich for some times (see LANDOLT and URBANSKA-WORYTKIEWICZ 1980), vouchers in ZT

- + herbarium of the collector
- 1 without Europe and U.S.A.
- 2 without Europe
- 3 only selected specimens

It is easy to make duplicates of one collection of Lemnaceae. Therefore I was able to recognize the same collection number in up to 20 different herbaria. On the other hand, one sample may contain up to 10 different Lemnaceae species (e.g. collections from Mexico State). On the average, a sample consisted of 2 to 3 Lemnaceae species.

Some of the labels on herbarium specimens (about 5%) could not be either deciphered or localized. Identification of the species was sometimes rather difficult due to poorly collected or incomplete material. In some cases (about 10%), it was necessary to make transparent preparations for identification. In some species groups (S. polyrrhiza, L. minor, L. perpusilla, W. oblonga, W. arrhiza), the identification was not always completely certain and had to be done according to the origin of the collection or by evaluating the few characteristics which were recognizable.

Additional data from the literature were recorded for species which are easily recognizable and also for other species if I was convinced that the respective authors had the same definition of the species as used in the present work.

The geographic distribution is represented in a different way for different geographic areas. For most countries, every known specimen is cited with approximate locality, collector and collection number (or date of collection), as well as with the herbarium symbol where it is deposited. For the following regions the presentation is different:

EUROPE: As there are so many herbarium specimens from Europe, I decided not to check all vouchers. On the other hand, the distribution of the various country floras is fairly well known. A description of the distribution therefore follows if not otherwise quoted the most recent country flora.

U.S.A. (except Alaska and Hawaii): The distribution of Lemnaceae species in U.S.A. is well documented by herbarium collections; however, the huge amount of available material would take too much room to cite within this work. Since I plan to publish a detailed distribution of the Lemnaceae species within the U.S.A. in a separate publication, I will restrict the recording of distribution to more general indications. For rare species, the counties of occurrence are listed, but without reference to the collections or literature.

TURKEY: For Turkey, a detailed record of localities for Lemnaceae species was recently given (UOTILA et al. 1984). In the present work, the localities are cited again, but without citing collections.

JAPAN: OTAKI (1974, in lit. 1978) gives detailed information on the distribution of Lemnaceae species within Japan including distribution maps. Except for the most frequently occurring species (S. polyrrhiza and L. aequinoctialis), which are distributed nearly all over the coun-

try, the prefectures in which the species occur are listed.

The geographic recording of localities was done according to fig. 6.1: 1. North America, 2. Central America, 3. Caribbean Sea, 4. South America, 5. Atlantic Ocean, 6. Europe, 7. Africa, 8. Indian Ocean, 9. Northern and Western Asia, 10. Southern and Eastern Asia, 11. Australia and New Zealand, 12. Pacific Ocean. Within each geographic area, countries are listed alphabetically. The same is true for states, provinces, districts etc. within each country. For some bigger countries (Angola, Argentina, Australia, Brazil, Canada, China, Ethiopia, Federal Republic of Germany, India, Indonesia, Japan, Mexico, New Zealand, South Africa, Sudan, Tanzania, United Kingdom, U.S.A., U.S.S.R, Zaire), the states, provinces or larger islands are listed on separate lines.

The spelling of geographic names follows "The Times Atlas of the World" (5th edition, London, 1977) as far as the localities could be determined.

6.1.2. Distribution of the family; species diversity

Fig. 6.2. contains all checked records of Lemnaceae in the world. Lemnaceae occur around the whole world except in the northernmost and southernmost regions. In desert and in very wet areas, they are extremely rare (cf. chapter 6.2). Some areas (e.g. central Brazil, central Zaire, eastern U.S.S.R.) do not show many records of Lemnaceae probably since very little botanical collecting took place.

The diversity of Lemnaceae species found within various regions of the world is quite variable, as can be seen in fig. 6.3. The map shows the number of species found within an area of about 50000 km². Of all the continents, America shows by far the biggest diversity. In general, eastern coastal areas just south or north of the tropics are the most diverse. Second in diversity are western coastal areas of the temperate zones and tropical mountain areas.

Of the four genera of Lemnaceae, three (Spirodela, Lemna, Wolffia) are distributed throughout the world. Wolffiella is restricted to America and Africa. Spirodela has its center of distribution in South America, where all three species are native. The genus Lemna shows its highest diversity in northern America and southeastern Asia. The main distribution of Wolffiella lies in the subtropical zones of America and Africa. Wolffia occurs mainly in America, southeastern Asia and Australia (table 6.1).

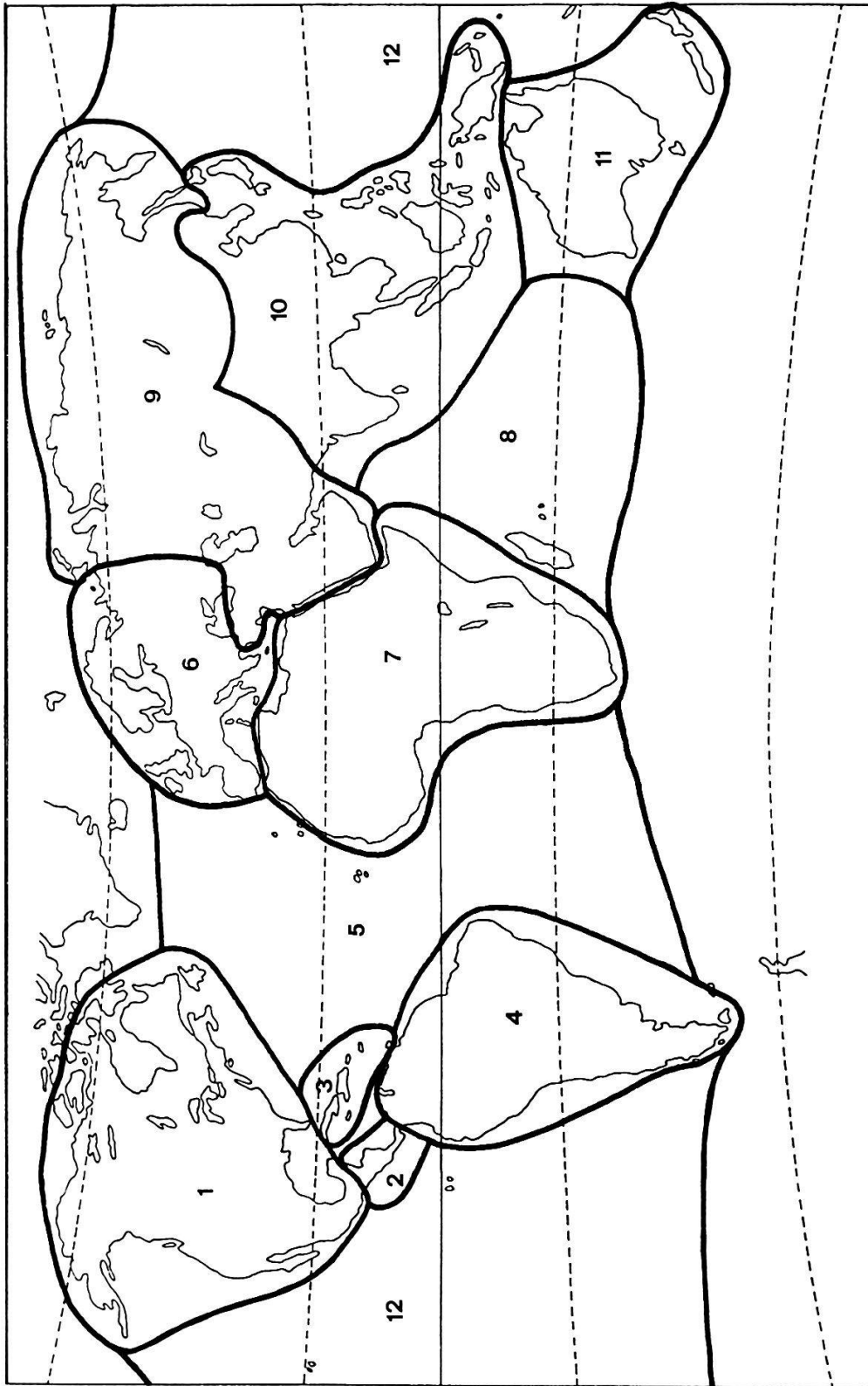


Fig. 6.1. Geographic divisions of the world
1 North America, 2 Central America, 3 Caribbean Sea, 4 South America, 5 Atlantic Ocean, 6 Europe,
7 Africa, 8 Indian Ocean, 9 Northern and Western Asia, 10 Southern and Eastern Asia,
11 Australia and New Zealand, 12 Pacific Ocean

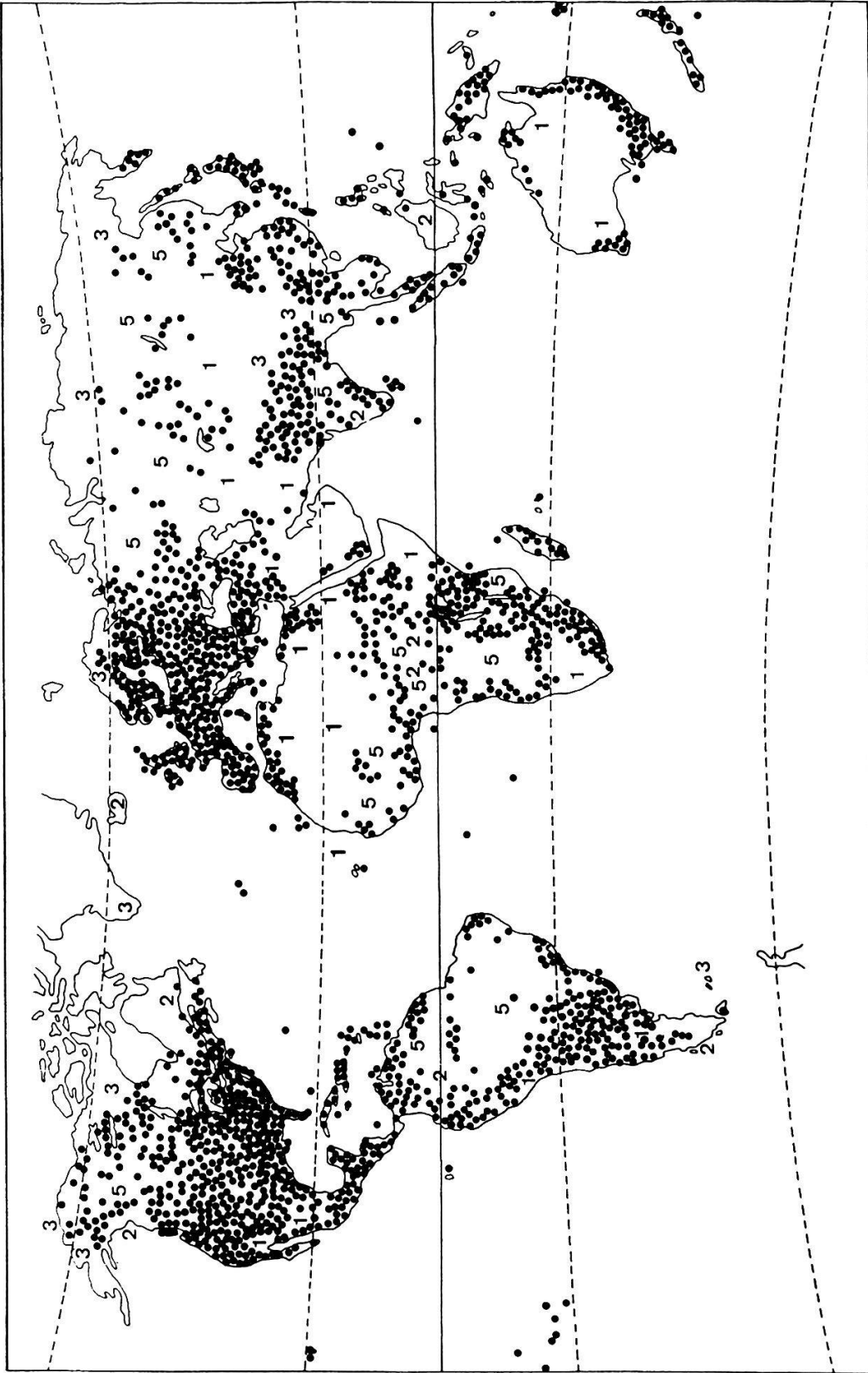


Fig. 6.2. Distribution of the family of Lemnaceae
The occurrence of Lemnaceae is lacking due to:
1 too dry, 2 too wet, 3 too cold, 5 too low density of botanical exploring

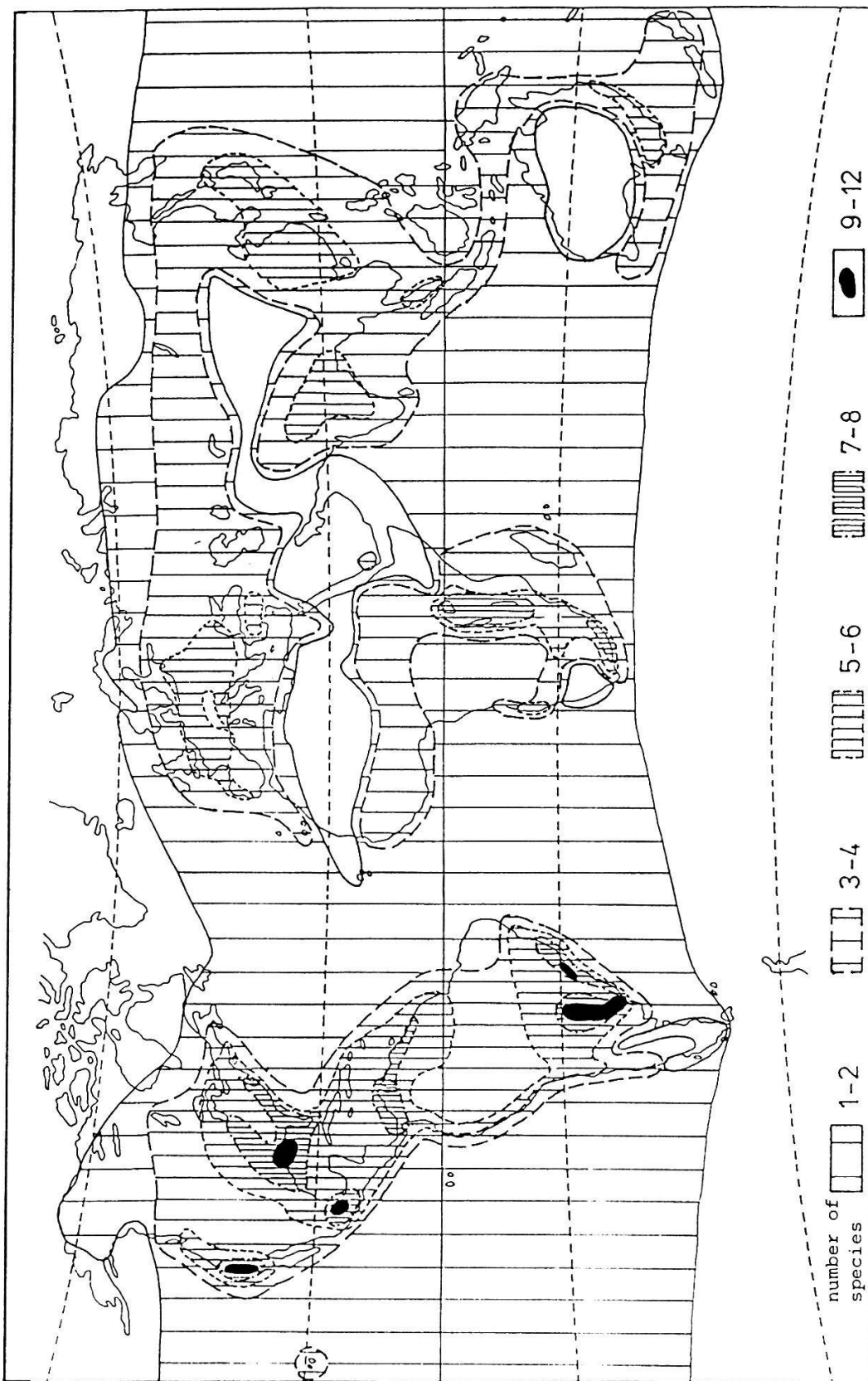


Fig. 6.3. Number of Lemnaceae species within the different regions of the world

Tab. 6.1. Number of species of each genus of the Lemnaceae within main regions of the world

- a number of persumably native species
 b number of additional species which presumably are introduced
 c total number of occurring species
 d number of endemic species

	Spirodela				Lemna				Wolffiella				Wolffia			
	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d
North America	1	1	2	-	9	-	9	2	4	-	4	1	3	1	4	1
South America	3	-	3	2	4	-	4	1	4	-	4	1	3	-	3	1

America	3	-	3	2	10	-	10	5	5	-	5	4	4	1	5	4

Europe	1	1	2	-	4	2	6	-	-	-	-	-	1	-	1	-
Africa	2	-	2	-	4	-	4	-	5	-	5	4	2	-	2	-
Northern and western Asia	1	1	2	-	4	1	5	-	-	-	-	-	1	-	1	-
Southern and eastern Asia	2	-	2	-	7	1	8	2	-	1	1	-	3	-	3	2
Australia	2	-	2	-	2	1	3	1	-	-	-	-	2	-	2	2

Old world	2	-	2	-	7	1	8	3	5	-	5	4	4	-	5	4

6.1.3. Distribution of the different species

6.1.3.1. Spirodela intermedia (fig. 6.4)

S. intermedia has its main distribution in South America from northern Argentina northwards to Venezuela.

CENTRAL AMERICA

EL SALVADOR

Dept. San Miguel: San Miguel, Laguna Jocotal (Fassett 28576: F, G, MO, US, WIS).

PANAMA

Panama City (Klötzli: ZT* 8410). DAUBS (1965) cites a further specimen from Panama which belongs to S. polyrrhiza.

CARIBBEAN SEA

PUERTO RICO

McCLURE and ALSTON (1966) investigated a clone of "S. biperforata" from Puerto Rico (Nr. 81 which corresponds to ETH Nr. 7110). This clone forms turions in culture and must be identified as S. polyrrhiza.

SOUTH AMERICA

ARGENTINA

Prov. BUENOS AIRES. Dept. Avellaneda: Isla Maciel (Burkart 1862: BAA; Giardelli 501: ZT). Dept. Baradero: Isla en Baradero, Rio Pintos (Burkart 8521: SI, ZT). Dept. Berriso: Los Talas, Canal Mena (Tur 1748: LP). Buenos Aires and vicinity: Arroyo Burgueno (Leon: ZT* 7201); Villa Ortujar (Parodi 9345: BAA); Botanic Garden (Giardelli 508: ZT; Haumann s.d.: BA, BAA); Buenos Aires (Leon: ZT* 7178; Malme 1778: UPS); Isla Martin Garcia (Cabrera 3359: LP); La Plata (Cabrera 5732: SI; Rossi: ZT* 7230); Ensenada (GIARDELLI 1939b); Parque 3 de febrero (Molfino 1175: BAF); Pilar, Rio Lujan (Cabrera 10303: SI); San Isidro (Hauman-Merck s. d.: BAA; Molfino 1258: BAF); Tordillo, Estancia La Bagatela (Giardelli 1200: SI; 1220: SI, ZT). Dept. Campana: ca. 19 km S of Campana (Landolt and Zarzycki 38/83: ZT); ca. 6 km N of Campana (Landolt and Zarzycki 41/83: ZT); ca. 7 km N of Campana (Landolt and Zarzycki 42/83: ZT); ca. 10 km N of Campana (Landolt and Zarzycki 43/83: ZT); ca. 11 km N of Campana (Landolt and Zarzycki 44/83: ZT). Dept. Castelli, Castelli, Laguna Ombu (Landolt and Zarzycki 24/83: ZT). Dept. Chascomus: Arroyo Vitel (Tur: ZT* 7920); Chascomus (Rossi 19/10/47: LIL); Lago Chascomus (Landolt and Zarzycki 31/83, 32/83: ZT); Laguna Vitel (Landolt and Zarzycki 27/83, 28/83: ZT); Manuel J. Cobo (Esta. Lezama) (Spegazzini 30/10/05: BAB). Dept. Dolores: Dolores (GIARDELLI 1939b). Dept. Grl. Conesa: Laguna Bagadela (Burkart 15671-15673: SI, ZT). Dept. Grl. Lavalle: San Clemente (Giardelli 1208, 1211: SI); Tuyuparecito (Burkart 20987: SI). Dept. Pergemino: S.A. Pena (F.C.C.A.) (Parodi 9363: BAA). Dept. San Miguel del Monte: Laguna del Monte (Landolt and Zarzycki: ZT* 8809); San Miguel del Monte (Movau 29412: BA). Dept. Zarate: Arroyo de los Jesuitas (Giardelli 552: SI, UC, ZT); Zarate (Giardelli 502: UC, ZT).

Prov. CHACO. Dept. Bermejo: Arroyo Cangüi Chico, Colonia Vélaz (Landolt

and Zarzycki 159/83: ZT; ZT* 8833); Arroyo Cangüi Chica, RN 11 (Landolt and Zarzycki 158/83: ZT); Fontana (GIARDELLI 1939b). Dept. Libertad: Ero. Guazu, N of Pt. Tirol (Landolt, Zarzycki and Eskuche (168/83: ZT); Rio Tragadero (Landolt 3/83: ZT; ZT* 8803). Dept. 1 de Mayo: Puente Nacional, Rio Guaycuru (Rojas 12059: LIL); 4 km S km 1024 RN 11, Rio Tragadero (Landolt, Zarzycki and Eskuche 163/83, 164/83, 164/83: ZT). Dept. San Fernando: Barranqueras (Meyer 16266: LIL); Resistencia, Rio Negro (Landolt, Zarzycki and Eskuche 169/83: ZT).

Prov. CORDOBA. Dept. Rio Cuarto (Stuckert 20031: CORD, G).

Prov. CORRIENTES. Dept. Capital: Arroyo Riachuelo (Christobal and Schinini 1032: CTES; Landolt, Zarzycki and Eskuche 170/83: ZT; ZT* 8838; Schinini and Miranda 1163, Schinini and Wiersema 2246c: CTES; Tur 1685: CTES, LP). Dept. Concepcion: Carombola (Pedersen: ZT* 8622); Sobre Rio Santa Lucia (Arbo 590: CTES). Dept. Mburucaya: Estacion Santa Teresa (Pedersen 2813: C, G, GH, LP, MO, S; ZT* 7702). Dept. Mercedes: Laguna Iberia (Correa et al. 5284: BAA, SI). Dept. Paso de los Libres: Laguna Iberia (Schinini et al. 7482: CTES, G, LIL). Dept. San Cosme: 1 km S of Paso de la Patria, Arroyo Pehuajo (Landolt, Zarzycki and Eskuche 180/83: ZT; ZT* 8842).

Prov. ENTRE RIOS. Dept. Capital: Concepcion del Uruguay (Lorentz 182: B, BM, G, JE, STU, UPS; 574: BG, Z; 1692: B, L, STU; 1878: CORD); Arroyo del Matadero (Lorentz 169: BAF, CORD, FI, JE, L, STU). Dept. Gualaguaychu: Embarcadero Berriso (Landolt and Zarzycke 49/83: ZT); ca. 35 km S of Ceibas (Landolt and Zarzycki 46/83: ZT); ca. 15 km S of Ceibas (Landolt and Zarzycki 47/83: ZT); Puente de los Cerros, Arroyo Nogayo (Landolt and Zarzycki 56/56: ZT); Gualaguay (Giardelli 1235: SI, ZT); Rio Gualaguay (Landolt and Zarzycki 50/83: ZT); 43 km E of Gualaguay (Landolt and Zarzycki 48/84: ZT); 5 km N of Rio Parana (Landolt and Zarzycki 45/83: ZT). Dept. La Paz: La Paz (Burkart: ZT* 7714; ZT* 8427). Dept. Tacuaras: Arroyo Ombucito (Burkart AB 21132: SI, ZT). Paranacito, Delta Parana (Burkart 7622: SI).

Prov. FORMOSA. Dept. Formosa: Fortin Esterito (GIARDELLI 1939b); Arroyo San Hilario, RN 11 (Landolt and Zarzycki 130, 131: ZT); Guazalee (Jorgensen 3373: BA, LIL; 3379: GH, MO); just N of Formosa (Landolt and Zarzycki 133/83: ZT). Dept. Laishi: Fortin Esterito (Kermes 538: BAB); Rio Salado, RN 11 (Landolt and Zarzycki 129/83, 129b/83: ZT). Dept. Pilcomayo: ca. 40 km S of Clorinda, Rcho. He-He (Landolt and Zarzycki 137/83, 137b/83: ZT; ZT* 8818); ca. 3 km S of Clorinda (Landolt and Zarzycki 142/83: ZT); Garcete Cué, RN 11 (Landolt and Zarzycki 141/83: ZT).

Prov. JUJUY. Cugaye-Banado, Rio Chico (Castillon 440-642: LIL).

Prov. MENDOZA. Dept. Tunuyan: without exact locality (Ruiz Leal 5415: LIL, MERL).

Prov. MISIONES. Loreto (Grüner 539: L, UC; cf. GIARDELLI 1939b).

Prov. NEUQUEN. Dept. Minas: Confluencia de los rios Neuquén y Varvarco (Boelcke et al. 14426: BAA).

Prov. SALTA. Dept. San Martin: Laguna del Cielo, Tartagal (Novara 3755: MCNS).

Prov. SANTA FE. Dept. Grl. Obligado: Arroyo Malabrigo (Landolt and Zarzycki 105/83, 106/83: ZT); Florencia, Rio Tapenaga (Landolt and Zarzycki 120/83: ZT); ca. 6 km W of Pt. Reconquista (Landolt and Zarzycki 108/83: ZT); ca. 6 km E of Reconquista (Landolt and Zarzycki 109/83: ZT); ca. 3 km E of Reconquista (Landolt and Zarzycki 110/83, 111/83: ZT); Reconquista (GIARDELLI 1939b); 10 km S of Villa Ocampo, Rio Amores (Landolt and Zarzycki 119/83: ZT). Dept. La Capital: Isla del Paraná (Molfino 16354: BA); Colastine (Landolt and Zarzycki 67/83: ZT); La Guardia (Landolt and Zarzycki 66/83: ZT); Rio Tindero viejo (Landolt and Zarzycki

68/83, 69/83: ZT); Santa Fé (Landolt and Zarzycki 64/83, 70/83: ZT; Molfino 4/1920: BAF). Dept. Vera: ca. 9 km E of La Gallareta (Landolt and Zarzycki 96/83: ZT); Laguna la Gallareta (Landolt and Zarzycki 98/83, 101/83: ZT); ca. 4 km N of Margarita (Landolt and Zarzycki 94/83: ZT); ca. 5 km S of Vera, Espin (Landolt and Zarzycki 102/83: ZT).
Prov. TUCUMAN. Dept. Monteras: Acherai (Venturi 6432: GH). Dept. Rio Chico: Dique Escabae (de la Sola 1080: LIL). Dept. San Miguel de Tucuman: Capital (Meyer: ZT* 7342); without exact locality (Carenzo 3448: LIL). Bosques de Santa Ana Canada (Castillon 3629a: LIL).

BOLIVIA

Dept. Santa Cruz: Santa Cruz de la Sierra (Evrard 1977: BR; Krapovickas and Schinini 31604: CTES).

BRAZIL

ACRE. Cruzeiro do Sul (Prance 12400: NY, U).

AMAZONAS. Manaus (Junk: ZT* 8312; Mitchell: ZT* 7291).

PARANA. Curitiba (Hatschbach 30626: C, NY, UC); Paranagua, Shangri-la (Hatschbach: ZT* 7708).

PERNAMBUCO. Caxanga (Ridley 29/7/1887: BM).

RIO DE JANEIRO. Rio de Janeiro (Alston 22/10/1938: BM; Glaziou 20539: C; Lutz 1355 BM, F; Perkolt 1871: STU). Sao Pedro de Aldeia (Landolt and Farney: 202-203/83: ZT; ZT* 8850).

RIO GRANDE DO SUL. Porto Alegre (Lindemann 8729: U; Reineck 24/10/1904: LY); Zuinta (Lindemann 745: S).

SANTA CATARINA. Agua Boa Riozinho, Bom Retiro (Smith 7902: R, US); Itajai (Müller 131n102: R, STU); Jaguaruna (Reitz 4459: ZT; Smith 5929: R, US, ZT); Lajes, Bacaine do Sul (Smith 12254: R, US); Tubarao (Ule 1314: STU).

SAO PAULO. Campinas (Henschen 1632: UPS); Caraguatatuba (Sucre, Burle, Freire: ZT* 7361); Salto Grande, Rio Paranapanema (Wettstein and Schiffner 7/1910: WV). Sao Paulo (Mosén 2619: S).

CHILE

Prov. Valparaiso: Vina de Mar (Zuber 9/12/1982: ZT).

COLOMBIA

Dept. Amazonas: Leticia (Hermann 11312: US). Dept. Boyaca: Labranzagrande (Amortegui 417: US); Puerto Boyaca (Espinal 1717: COL). Dept. Cordoba: Monteria (Zainum 19Bo079: US). Dept. Cundinamarca: Mosquera (Mason 13750: US). Dept. Huila: Villavieja (Smith 1243: UC). Dept. Santander: Puerto Olaya (Fassett 25363: US).

ECUADOR

Prov. Imbabura: Lago San Pablo (Camp 3254: S). Prov. Pastaza: Rio Capihuari (Ollgaard et al. 35070: AAU).

PARAGUAY

Dept. Asunción: Asunción (Balansa 2593: G); Rio Salado, Pasopé (Bordas: ZT* 7820). Dept. Central: San Bernardino, Lake Ipacaray (Schinini 7899: CTES). Dept. Chaco: Mayor Pedro Lagegenzala, Rio Timane (Schinini and Bordas 14842: CTES). Dept. Cordillera: without exact locality (Chodat 1914: G). Dept. Neembucu: Takuaros (Walter 43: FLAS).

PERU

Dept. Hunacavelica: Upper Mantara Valley (Hanght 182: US). Dept. Lima: Lima Bot. Garden (Fernandez: ZT* 7747); Laguna de Villa (Fernandez: ZT* 7746, 7797). Dept. Loreto: Inquitos (Asplund 14750: S); Yurimaguas, Rio Huallaga (Killip 27706: US).

SURINAM

Prov. Brokopondo: Brokopondo Lake (Donselaar 1004: U). Prov. Coronie: without exact locality (Cramer LBB 14877: U); Wia Wia Reservaat (Cramer 14888: U). Prov. Saramacca: Caritiba (Lindemann 4024: L); Coppenamemond

(Lindemann 5562a: U); Mokomoko (Lindemann: U). Prov. Suriname: Paramaribo (Bringht: U; Bünzli 1932: L, ZT; Florschütz 1036, 1060: BR, C, NY, U; Teunissen 12755, 12757: U; Wullschlaegel 1872: STU); Charlesburg (Teunissen: ZT* 7355); Saramacca River (Teunissen: ZT* 7357, 7359); Zypad (Cramer: ZT* 8258).

URUGUAY

Dept. Canelones: Carrasco (Archavaleta 2500: ZT; Herter 85071: B, F, G, GH, M, MO, R, S, U, UC, US, Z, ZT; Rosengurth: ZT* 7285). Dept. Montevideo: Montevideo (Archavaleta 2502: ZT; Gilbert 1337: US). Dept. San José: Barra Santa Lucia (Osten 23043: CAS, S, ZT). Without exact locality (Izaguirre: ZT* 7125).

VENEZUELA

Esto. Aragua. Llano de Calabozo (Karsten 11/1867:STU). Malariologia (Salzar 7: US). Maracay (Maas 2174, 2175: U); Maracay, Airport (Alston 6580: BM); Lago de Valencia (Alston 5682: BM).

SOUTHERN AND EASTERN ASIA

INDIA

Delhi, Botanical Garden (Maheshwari: ZT* 7450); probably introduced.

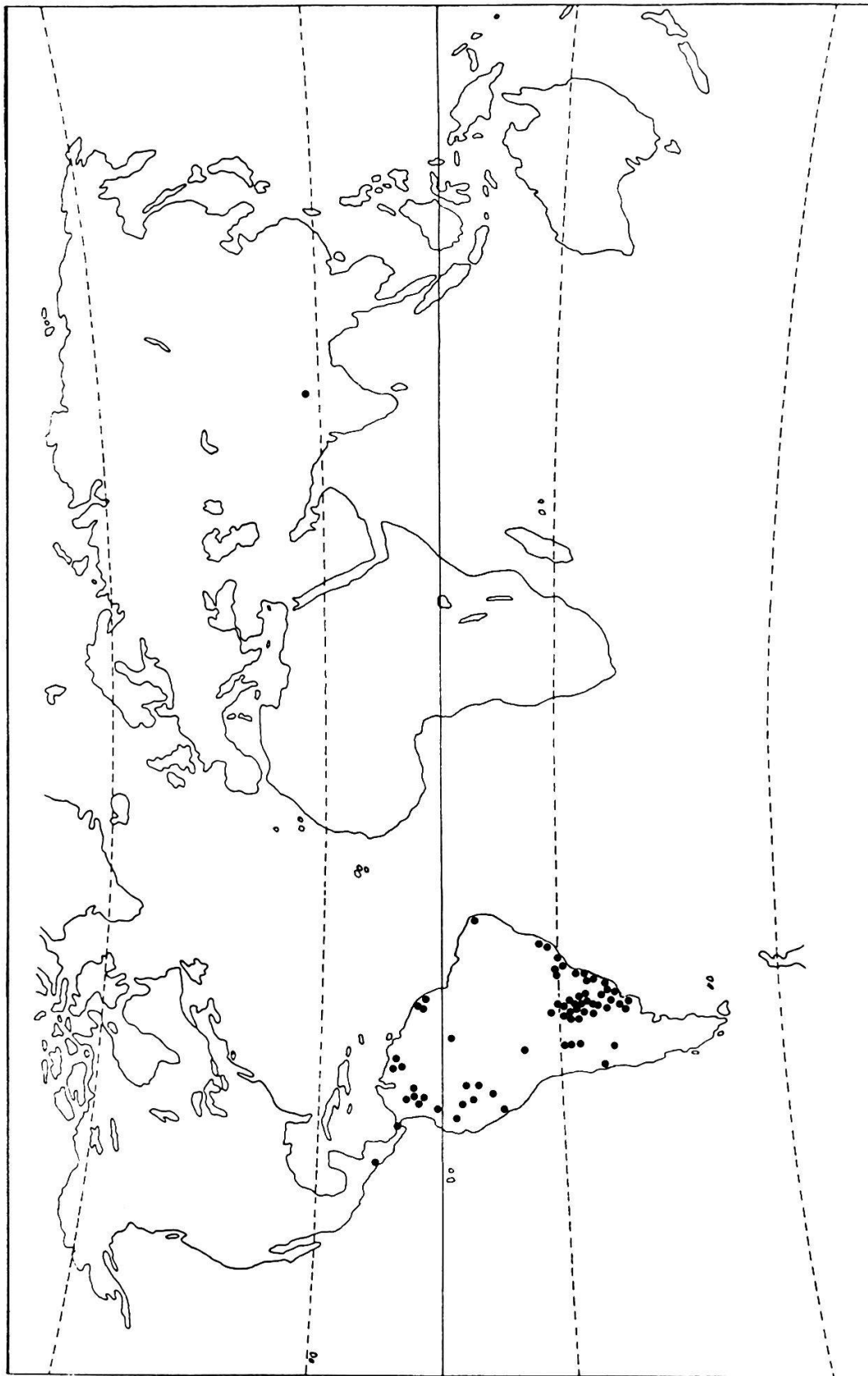


Fig. 6.4. Distribution of *Spirodela intermedia*

6.1.3.2. Spirodela polyrrhiza (fig. 6.5)

S. polyrrhiza is distributed all over the world except the eastern and southern parts of South America and some islands (e.g. New Zealand; in Australia it is rare). It reaches northwards in western and central North America 54° NL, in eastern North America 45° NL, in Scotland 57° NL, in Scandinavia 66° NL and in Siberia 55° NL.

NORTH AMERICA

CANADA

ALBERTA. Athabaska-Delta (Gillham 33/ 34: ISC). Edmonton, Sturgeon River (MOSS 1958). Rochester (Yuill 110, 111: WIS).

BRITISH COLUMBIA. Duck Lake, Creston (Ceska 1305: CESKA). Beaver Lake (Buchanan: ZT* 8298). Fort Langley (Ceska 1305: CESKA). Fraser Lake (Calder 15367: C, ID, W). Goose Lake, Chilliwak (Ceska 1165: CESKA). Hatzik Lake (Ceska 1555: CESKA). Montana Lake, Revelstoke (Calder 10898: UC). Princetown (Savile 11586: GH, US). Saanich, Swan Lake (Buchanan: ZT* 7727); Elk Lake (Baillie: ZT* 7729). Shuswap Lake (Macoun 2810: F, MO, MU, OS). Silverdale (Ceska 1556: CESKA). Tabor Lake, Prince George (Calder 14387: NY, S, WS, WTU). Vancouver Island (Calder 31980: USC); Victoria (Macoun 88278: C, GH, NY, US).

MANITOBA. Cross Lake (Scoggan 3574: C, MIN, S). Lake Stormon, S of Boissevain (Catling 84-128: +, ZT). Nelson River, Norway House (Scoggan 3096: GH). Springfield Distr., Pointe du Bois (Boivin 13268: NY), Westhawk (Ahles 71673: MASS).

NEW BRUNSWICK. French Lake, Jemseg, Gernseg, Quisibis, Upper Deep Creek (HINDS 1983).

NOVA SCOTIA. Mabou (s.coll. 1875: NY).

ONTARIO. Baptiste Creek (Staniforth; ZT* 7771). Fronterac Co., Kingston (Boyd 1897: F; Fowler 16/8/1883: MO; 26/9/1901: LY, US; 22181: WIS; Pease 23384: GH); Grass Lake (Pennell 16353: PH); Odessa, Meed Lake (Crowder: ZT* 7874); Sharbot Lake (Dore 13905: ILL, MICH). Cochrane Distr., Lillabelle Lake, Cochrane (Baldwin 5082: H, WTU). Thunderbay Distr., Lake de Mille Lacs (Baldwin 8836: H, MIN; 8928: H, MIN). Ottawa Distr., Constance Lake (Savile 3163: C, H, M, UPS). Carleton Co., Rideau River, Ottawa (Cody 21/7/1947: MO; Dore 16388: GH, US); Ottawa (Dore 26/9/1955: W; 47-1268: MO, OKL, UPS). Leeds Co., Opincori Lake (Crowder: ZT* 7857). Whitefish Lake (Garton: ZT* 8329). York Co., Ajax (Sparling: ZT* 7576); Whitby Marsh (Goepfert: ZT* 7571). Timmins (Baldwin 1952: GH). Lincoln Co., Jordan Harbour (Cody 12536: FI). Belleville (Curtis 7/1866: G; Macoun 8/1872: G). Rockton (Daubs 504: ILL). Niagara River (Daubs 506: ILL). Perth (Fowler 10/7/1881: MO, PH). Rainy River Distr., Rainy River Town (Garton 8602: MASS, MIN); Lavique (Grassel 7642: Mich). Bass Lake, Manitovlin Island (Grassel 2077: MICH). Sparrow Lake (Kirk 1312: L). Kent Co. (Mahler 5589: AAU, SMU). Waterloo Co. (Montgomery 125: GH). Toronto (Otto 49, 50: C). Kent Co., Thames River, St. Clair Lake (Soper 2300: GH). James Bay, Ekwan River (Smith 111: PH, US). Lake Erie, Pelee Island (Stuckert 5106: OS). Ottawa River, Pembroke (Umbach 10427: F, MIN, WIS). Fort William (Williamson 2384: PH). Edmonton (White 10768: ILL, MU, OS, POM, TEX). Point Pelee Nat. Park (Krüsi: ZT* 8779). Iles aux Sternes (GAUTIER 1980).

PRINCE EDWARD ISLAND. Prince Co., Lower Sea Cow Pond (Fernald 7124: C,

GH, NY, PH, WS). Queens Co., Grand Tracdie (Fernald 7101: GH).
QUEBEC. Sargents Bay, Memphremagog Lake (Churchill P 259: MO). St. Hilarion (Cayonette 73-338: G, MU, UC; 73-341: G, MU). Longueil (Dubois 10985: SMU, WTU). St. Adolphe (Hamel 18280: BR, H, SMU). Vallée du Richelieu, Ile Ste. Thérèse (Marie-Victorin 43523: C, CM, CU, UC). Lacadie, St. Jean (Raymond 150: BM, C, CAS, COLO, GB, H, L, NSW, RM, UPS, US, W, WELT, WIS). Iberville Co., Fort Lenox (Cody and Dore 6544: C, G, GH, H, SMU, UPS, W). Comté the Rimouski, Saint-Fabien (LEPAGE 1978).
SASKATCHEWAN. Green Lake (Harms 16812: GH). Prince Albert Nat. Park (Fraser 7/1939: RM; 7/1953: GH).

MEXICO

CHIAPAS. Villa Hermosa, Laguna de Catazaya (Breedlove 34928: DS).
COLIMA. Manzanillo (McVaugh 15682: MICH).
DISTR. FEDERAL. Mexico (Hahn 1868: GM, GOET, KANU, L, MO, NY, U, US; 2/1869: GOET, K, KANU, L, MEL, MO, STU, U, US; Rutten 243: U; Schaffner 1875: BM, CAS, FI, LY, M, MICH, NY, UCLA, US; Thompson 29/7/1910: KANU).
HIDALGO. Lago de Apam (Moore and Wood 4748: MICH).
JALISCO. Autlan (Wilbur 2225: MICH).
MICHOACAN. Apatzingan (Leavenworth 1476b: F); Patzcuaro (Pringle 3584: CAS, COLO, MSC, NY, SMU, UC, VT).
SONORA. Cajeme, Tesapaco (Shreve 6159: ARIZ, MICH; Wiggins 6416: DS, MICH, US); Cedros (SHREVE and WIGGINS 1964).
TABASCO. Villahermosa (Gigon: ZT* 7652).
TAMAULIPAS. Aldama, Los Yucas (Dressler 2132: GH, MICH, MO).
VERACRUZ. Orizaba (Müller 1853; 1855: NY); Coatzacoalcos (Gigon: ZT* 7657).
YUCATAN. Chichen Itza (Steere 1566: MICH).

U.S.A.

ALABAMA. Frequent.
ARIZONA. Rare: Apache Co., Mohave Co., Navajo Co.
ARKANSAS. Rather frequent.
CALIFORNIA. Frequent (except at high altitudes).
COLORADO. Rare: Larimer Co., Routt Co., Yuma Co.
CONNECTICUT. Frequent.
DELAWARE. Frequent in the North.
Distr. of COLUMBIA. Frequent.
FLORIDA. Frequent.
GEORGIA. Rare: Baldwin Co., Bibb Co., Decatur Co., Douglas Co., Early Co., Jenkins Co., McIntosh Co., Seminole Co.
IDAHO. Rare: Bear Lake Co., Bousier Co., Canyon Co., Fremont Co., Gooding Co., Kootenai Co., Shoshone Co., Twin Falls Co., Washington Co.
ILLINOIS. Frequent.
INDIANA. Frequent.
IOWA. Rather frequent.
KANSAS. Frequent.
KENTUCKY. Rather frequent, except in the East.
LOUISIANA. Frequent.
MAINE. Frequent, except in the North.
MARYLAND. Rather frequent.
MASSACHUSETTS. Frequent.
MICHIGAN. Frequent.
MINNESOTA. Frequent.
MISSISSIPPI. Rather frequent.
MISSOURI. Frequent.
MONTANA. Rare, only in the West: Flathead Co., Lake Co., Lincoln Co., Missoula Co., Ravalli Co.

NEBRASKA. Rather frequent.
NEVADA. Rare: Elko Co., Lincoln Co., Storey Co., Washoe Co.
NEW HAMPSHIRE. Rather frequent.
NEW JERSEY. Frequent.
NEW MEXICO. Rare: Dona Ana Co.
NEW YORK. Frequent.
NORTH CAROLINA. Frequent, except in the West.
NORTH DAKOTA. Rather frequent, except in the West.
OHIO. Frequent.
OKLAHOMA. Rather frequent.
OREGON. Rather frequent, except in the Northeast.
PENNSYLVANIA. Frequent, except in the Appalachians.
RHODE ISLAND. Frequent.
SOUTH CAROLINA. Frequent, except in the West.
SOUTH DAKOTA. Rather rare: Bennett Co., Brookings Co., Brule Co., Custer Co., Kingsbury Co., Lincoln Co.
TENNESSEE. Rather frequent, but only in the West.
TEXAS. Frequent, except in the far South and Northwest
UTAH. Rather rare: Cache Co., Daggett Co., Davis Co., Kane Co., Pink Co., Salt Lake Co., Sampete Co., Utah Co.
VERMONT. Frequent.
VIRGINIA. Frequent, but only in the East.
WASHINGTON. Rather frequent.
WEST VIRGINIA. Rare: Cabell Co., Grant Co., Mason Co., Pendleton Co.
WISCONSIN. Frequent.
WYOMING. Rare: Carbon Co., Niobrara Co., Teton Co.

CENTRAL AMERICA

COSTA RICA

Lagarto (Pittier and Durand/Tonduz 4800: BM, G, US, Z, ZT).

EL SALVADOR

Dept. San Miguel (Fassett 28567: F, GH, MO, WIS); Laguna Seca (Fassett 29135: WIS). Dept. La Union: Olomega (Fassett 28614: F, WIS). Dept. San Salvador: Ilopango (Fassett 28542: WIS; 28546: F, WIS; Hitchcock 23/11/1911: US). Dept. Usulután: Puento Cuscutlan (Fassett 28685: F).

GUATEMALA

Dept. Chiquimula: Chiquimula (Steyermark 30172: F). Dept. Guatemala: Sapote (Smith 1963: G, GH, M, PH, US). Dept. Jutiapa: Lake Güija (Steyermark 31831: F). Dept. Panajachel: Lake Atitlan (Fruchtenicht: ZT* 7520). Dept. Retalhuleu: Rio Samala (Steyermark 34532: F). Dept. Uxactum: Tikal (Cook and Marlin 138: US).

HONDURAS

Dept. Atlantida: Tela (Standley 56860: F, US). Dept. Olancho: Juticapa (Standley 17703: F).

NICARAGUA

Dept. Jinotega: Jinotega (Williams 27426: F). Without exact locality (Seemann 1867: BM; Wright 1853-1856: GOET, STU, US).

CARIBBEAN SEA

CUBA

Prov. Matanzas: Red Panimar (Britton 382: CM). Prov. Oriente: Bayate in Rio Jaque (Ekman 5818: S). Prov. Santa Clara: Limones, Cienfugos (Jack 6275: GH, NY), Camagüey (Rutten 405: U). Without exact locality (Wright 3723: GH, S; Wright 66: KANU).

DOMINICAN REPUBLIC

Prov. Barahona: Cachon (Fuertes 19/8/1911: BM, C, F, G, L, LE, LY, MIN,

S, U, UC, Z, ZT). Prov. Higüey: Samana, Sanchez (Lowden: ZT* 7717). Prov. La Altagracia: Miches (Lowden: ZT* 8279). Prov. San Cristobal, Arroyo Madre Vieja (Marcano: ZT* 7667). Prov. San Pedro de Macoria: Los Chicharrones (Lowden: ZT* 8332). Santo Domingo (Wright 1871: CU).

GUADELOUPE

Some indications of S. polyrrhiza have to be checked (cf. HOWARD 1979b).

HAITI

Dept. de l'Artibonite: (Ekman H8530: C, G, S, ZT), Desdunes (Lowden: ZT* 8421). Massif de la Hotte, Mirangoane (Ekman 9040: S; Eyerdam 487: WTU). Port au Prince (Ekman 3259bis: S). Rio de l'Esti (Leonard 10076: CM, UC). Dept. du Nord: Etang Romeo (Lowden: ZT* 8425), Limonade (Lowden: ZT* 8423). Dept. du Sud: Solon (Ekman H820: AAU, G, LL, S; Ekman H821: G, S, ZT).

JAMAICA

Port Henderson (Harris 10510: BM, F, NY). St. Andrew (Harris 10837: F, GH, NY, PH, U). St. Catherine Par.: Ferry River (Robertson: ZT* 7434); Fresh River (Lowden: ZT* 8633); Vaggo Head (Proctor 27613: BM, LL, U).

PUERTO RICO

Coamo (Sintenis 3188: BM, G, LE, PH, S, STU; 3189: G, GOET, LE, LY, M, S, STU); Coamo Springs (Britten 5808: NY); Garden of Eden (Britten 16022: NY). Guayamilla (Britten 1795: F, GH). Manati, Rio Curiba (Sintenis 6653: F, G, L, LE, M, NY; 6656: BM, GH, L, LE). Without exact locality (Daubs: ZT* 7110).

SOUTH AMERICA

COLOMBIA

Dept. Cordoba: Monteria (Molino 19Bo205, 206: US). Dept. Magdalena: Santa Marta (Pennell 4770: NY); Los Flores, Santa Marta (Viereck 25/12/1925: US).

ECUADOR

Prov. Esmeraldas: 25 km S of Esmeraldas (Sparre 15451, 15452: S). Prov. Guayas: Las Americas (Fagerlind 319: UPS); Milagro (Hitchcock 20251: GH, US), Rio Macul (Fagerlind 319A, 319D: S).

PERU

Dept. Lima: Lima (Seemann 857: L).

ATLANTIC OCEAN

CANARY ISLANDS

Tenerife (Burgeau 948: Z). The same collection contains L. gibba in other herbaria (BM, G, K, LE, P).

MADEIRA

HEGELMAIER (1868) refers to an indication of the species in Madeira from Léman in De Candolle (Geogr. Bot. II, 1004).

EUROPE

AUSTRIA

Rather frequent at lower altitudes of Burgenland, Lower Austria, Upper Austria and Styria. Rare in Carinthia: Ebental, Maltatal, Weissensee. Rare in Vorarlberg: Region of Lake Constance.

BELGIUM

Rather frequent, except in mountains with siliceous rocks.

BULGARIA

Rather frequent, except at higher altitudes.

CZECHOSLOVAKIA (CSSR)

Rather frequent, except at higher altitudes.

DENMARK

Rather frequent, but lacking in parts of western Jylland.

EIRE

Rather frequent, except in the Northwest and in the outermost West.

FINLAND

Rather frequent in the South; northwards scattered up to the region of Remi, 66° NL, (SAMUELSON 1934) and Pihtipudas, 63°30' NL (Rovainen 14/7/1919: KUO); distribution map by LAGERBERG (1947).

FRANCE

Rather frequent; rare in the South; lacking in Corsica and at higher altitudes.

FRG (West Germany)

Rather frequent, except in the Alps and in regions of siliceous rocks.

GDR (East Germany)

Frequent.

GREECE

Rare. Aitolia: between Angelokastron and Tricholis (HALAKSY 1908). Thessalia: Lake Lysimachia near Loutra (Koumpli-Sovantzi 1981: ZT).

HUNGARY

Frequent.

ITALY

Frequent in the plain of Po (northern Italy); otherwise rare; e.g. Toscana, Pisa (Landolt and Urbanska: ZT* 8270); Lazio, Paludi Pontine (SCOPPOLA 1982); Umbria; Sardegna.

NETHERLANDS

Frequent.

NORWAY

Rare and only in the South: regions around Oslo and Stavanger: Nordhordland (SAMUELSSON 1934); distribution map by LAGERBERG (1947).

POLAND

Frequent, except at higher altitudes.

PORTUGAL

Rare: Alentejo. Beira. Estremadura (Welwitsch 9/1846: STU). Ribatejo, Coruche (Martins: ZT* 7197).

RUMANIA

Frequent, except at higher altitudes.

SPAIN

Rare. Cataluna: Argalès; Rosello; Empuriés (CADEVAL 1933). Extremadura: Badajoz; Gévora (RIVAZ-MARTINEZ 1982).

SWEDEN

Rather frequent, but only in the South; northwards to about 60° NL, along the coast up to 63° NL; distribution map by LAGERBERG (1947).

SWITZERLAND

Rather rare, and only at lower altitudes north of the Alps.

TURKEY (European part)

UOTILA et al. (1984). Rather rare. Istanbul: Terkos Gölü; Terkos Köjü. Edirne: Elcili to Uzunköprü; Ipsala to Greek frontier.

UNITED KINGDOM

ENGLAND. Frequent, except in the North and Southwest.

NORTHERN IRELAND. Rare and only in the extreme East.

WALES. Rather rare: Anglesey; Caermarvon; Denbigh; Flint; Glamorgan; Pembroke.

USSR (European part)

According to SHISHKIN (1964) rather frequent in all parts of the country, except in Krim and in the North; northwards to about 60° NL (e.g. Sestroretsk N of Leningrad, according to STRAWINSKAYA 1984).

YUGOSLAVIA

In northern Croatia rather frequent (KRAJNCIC and DEVIDE 1982); otherwise rare, according to HAYEK (1933) in Bosnia-Herzegovina, Quadero and Serbia.

AFRICA

ALGERIA

Letouriense (Favrat 1118: ZT).

BENIN

Zagnanado, Lake Azri (Chevallier 23044: P). Récolté Dam, Cotonou, Ouémé (Eten 28: MPU).

BOTSWANA

Northern District, Khubuza (Smith 1524: SRGH); Duba Island, Okavango River (Smith 1061: SRGH); Shaile (Russell 2405: SRGH).

BURUNDI

Bujumbura, Uvira (Lewalle: ZT* 7235; Lewalle 4143, 6330: BR); Plaine de la Rusizi (Lewalle 2128: BR, K); Mutumba (Lewalle 888: BR, K).

CAMEROON

Bénoué River, Garoua (Letouzey 6712: K, P). Region West, Pendja, Nyombé (Meurillon 684: BR, P). Djouroum (Raynal 12157: P).

CHAD

Lake Yao, Wanyanga (Hutchinson 10: BM).

EGYPT

Beheira, Kafr el Dauwâr (Ibrahim: ZT* 7399; Mahdi 26/7/1970: MO, U). Cairo, Embaba (Sisi 20/8/1974: AAU). Mahallet, El Rahabein (Mahdi: ZT* 7373). Dakhla Oasis (Ascherson 22677: GOET, JE, M, STU). Alexandria (Figari: FI; Schweinfurth 58: STU; Schmid 1880: Z). Faraskur Delta (Shabetai 50: K). Montaza (Simpson 2066: K). Fayara Canal (Simpson 3962: K).

ETHIOPIA

Prov. SHOA: Shashemanne (Burger 2562: K; Meyer 8782: K, P, WAG; de Wilde 7106: BR, K, MO).

Prov. WELO: Lake Maybahr, 20 km SE Dessie (Klötzli: ZT* 8756).

GHANA

Anyaboni (Agyakwah: ZT* 7398; Hall 43105: K, P), Samreboi (Hall 2486: BR, K, S; 2489: K).

KENYA

Masai Distr.: Ambroseli Nat. Park (HEPPER 1973). Laikipia Distr.: Thompson's Fall (Sigg: ZT* 8664); Meru Nat. Park (Sigg 6/3/1981: ZT). Tana River Distr.: Tana River, Wema, 8 km NE of Garsen (Gillett and Kibuwa 19956: EA, K).

MALAWI

Northern Prov.: Rumphu, Lake Kazumi (Pawek 3354: K). Southern Prov.: Blantyre, Chilomoni Dam (Reed: ZT* 7383); Mkozi (Brummit and Patel: ZT* 7371); Lake Nyasa, Fort Johnston (Lowe 7/1946: BM); Port Herald Distr.: Jame's Lagoon (Phipps 2611: K, PRE, SRGH); Nsanje Distr.: Chiromo (Wild 7700: K, L, PRE, SRGH, USC); Zomba Distr.: Lake Chilwa (Williams 16: SRGH).

MOROCCO

Casablanca, Titmellil (Pitard 1426: K, P). Kenitra, Oued Fouarat (Maire 20/7/1921: MPU). Larache, El Guedira (Font Quer 2/3/1930: BM); 21/4/1930: B, G, MPU, S, Z.

MOZAMBIQUE

Manica e Sofala Distr.: Lucite River, between Gogoi and Dombe (Pope et al. 1225: SRGH). Maputo Distr.: Sul do Save, Inhanombe (Exell and Mendonça 570: BM, LISC, SRGH). Zambézi Distr.: Morrumbala, Rio Chire (Mendonça 2338: LISC).

NIGERIA

Prov. Anambra: Onitsha (Esh 583: K). Prov. Ogun: Ijebu Ode, Okun-Owa (McFarlane 1: K); Ogun River near Lagos to Beni road (McFarlane 2/7/1966: K); Lagos-Ikorodu (Killick 296: K).

RWANDA

Batwa Distr.: Rwaza, Chutes de la Mukungwa (de Sloover 23/2/1972: BR). Kagera (Stuhlmann 1250: STU); Parc National de la Kagera, Lac Mihindi (Troupin 14871B: BR); Lac Hago (BR).

SENEGAL

Rufisque, Sangalkam (Trochain 3234: BM, P).

SOUTH AFRICA

NATAL. Richard's Bay, Mzinkazi Lake (Venter: ZT* 7364). Tongoland, Pongala River (Wager: ZT* 7296; 59814: PRE). Zululand, Mulange Lake (Tuley 353b: PRE). Ubombo Distr., Mkuze Swamps (Ward 7493: PRE); SW Channel (Ward 7294: PRE); Kosi Bay (Strey 26/11/1967: PRE).

ORANGE FREE STATE. Vredefort, Vuol River (Obermeyer 4/1933: PRE).

SUDAN

Prov. BAHR EL GHAZAL. Meshra'er Req (Schweinfurth 1281: K, MEL, STU; 1283: STU); no exact locality (Simpson 7673: K).

TANZANIA

Prov. ARUSHA. Tengem Arca, Arusha (Beesley 2: EA); Ufiomi, Lake Basseda near Babati (Peter 44103: B). Distr. Mbulu: Lake Manyara National Park (Richards 21618: K; Greenway and Kanuri 11342: EA, K, PRE).

Prov. DODOMA. Kesese (Richards and Arasululu 28868: EA, K).

Prov. MOROGORO. Selous Distr.: Naula Camp (Vollesen 4147: EA).

Prov. TANGA. Pangani (Klötzli: ZT* 8267); Pangani River, Moshi-Tanga Road (Wingfield 545A: EA); Handeni Distr.: Segera on Pagani River (Greenway 8974: EA, K, NY); Kigoma Distr.: Ujiji (Van Meel 511: BR).

Korogwe Distr.: Maurui, Pagani River (Greenway 8715: EA, K).

Prov. WEST LAKE. Bukova Distr.: Lake Buguri, Chitara (Braun 5553: EA).

TOGO

Southern part, according to BRUNEL et al. 1984.

UGANDA

Buganda Distr.: Entebbe, Victoria Nyanza (Bagshawe 715: BM). Busoga Distr.: Kyrinye, Jinja (Lind 178: K); Lake Kifuruka (La Barbera 19: K). Mengo Distr.: Namanve Swamp, Kagwe (Eggeling 559: K). Toro Distr.: Npanga River (Bagshawe 1146: BM); Queen Elisabeth National Park, Lake George (Lock 67/115: EA); Nyamugasani (Lock 852: EA).

ZAIRE

Prov. HAUT ZAIRE. Makokoma, W shore of Lake Albert-Edouard (Bequaert 5309: BR); Yangambi (Louis 14686: ZT; 15957: BR); Ile Torfunde (Louis 14687: BR); Dungu River, Parc National de la Garamba (Troupin 679bis: BR).

Prov. KIVU. Lac Edouard (van der Beu 23: BR); Lac Kivu, Bobandana (Hendrickx 5780: BR), Lac Kivu, Kakonko (Hendrickx 4124/4125: EA, BR); Etang de Burunga (Hendrickx 5781: BR); Nyakalongo (Hendrickx 5010: BR).

Prov. SHABA. Between Kisandre and Dembo (Gillett 1532: BR); Lupepa-Kimboyi (Malaisse 7029: BR); Musokantanda, 35 km E of Kolwezi (Schmitz 3.990: BR); Bac de Kiubo, Jadotville-Sampwe road, shore of Lufira (Schmitz 2.085: BR); Moba (van Meel 1152: BR).

Prov. ZAIRE CENTRAL. Banana (Vanderyst 27937: BR). Kumpatho (Vanderyst 28/8/1908: BR).

ZAMBIA

Mpika Distr.: Mgluwe Lagoon (Aistle 5777: K, SRGH); Luanswa Valley, Jumbe (Mutimushi JMM 1675: K, SRGH). Boroma, on Zambezi R. (Menyharth 1103: WU).

ZIMBABWE

Kariba Distr.: Kariba Gorge (Smith 106D/60: SRGH). Nuanetsi Distr.: Ngezi ya matetsi (Konietzko 36: BR). Urungwe Distr.: Zambezi River, Chirundu (Whellan 25777: K).

INDIAN OCEAN

MADAGASCAR

Antsirabe (Perrier de la Bathie 7198: P). Itasy (Boiser 19700: P). Kin-kony, Majunga (Kaudern 10/1912: S), Madirovoalo (Perrier de la Bathie 288: P). Mandritsara (Decary 14432: P). Tongobory (Humbert 2709: P).

NORTHERN AND WESTERN ASIA

AFGHANISTAN

Without exact locality (Griffith 5612: K).

IRAN

Gilan: Bandar e Pahlavi (Grant 16451: MO, W; Uernakovskau 18/7/1927: LE; Wendelbo 14/7/1975: W); Lahijjan (Alexeenko 14/7/1902: LE). Mazandaran: Amol (Paq 20/8/1966: W); E of Babol (Uotila 18369, 19245: H, Z).

ISRAEL

Rare: Buteicha; Gaash (PORATH et al. 1979, 1980). POST (1933) cites two stations: Birkat Atta and Birkat Batthik which have disappeared, according to PORATH et al. (1980) probably due to water pollution.

SYRIA

Rare: Damaskus (Dingler 1874: B). Jisr esh Shughur (Pabot 18/4/1953, 20/10/1953: G).

TURKEY (Asian part)

UOTILA et al. (1984). Bingöl: Seyran. Bitlis: Mus-Tatvan. Bolu: Büyük Melen; Gölyaka. Izmir: Menemen. Kars: Arpacay. Kayseri: Lindiremeke. Ordu: Uenye. Samsun: Carsamba. Van: Bendimahi.

USSR (Asian part)

Rather rare.

AZERBAJDZHANSKAYA SSR. Lenkoran (Hohenacker: STU).

KAZAKHSKAYA SSR. Dzungaria, Lepsa (Karelin and Kosiloff 1846: G); Semipalatinsk (Kossinosky 5/7/1914: S).

ROSSIYSKAYA SFSR. Amurskaya Oblast: Arkhara River (Schipezinsky 18/7/1912: S); Blagoveshchensk (GRITSENKO and DYMINA 1976). Astrakhan Oblast: Astrakhan (De Bengé s.no.: P). Buryatskaya ASSR: Kicherbi, Muya (PAUTOVA and GALIMULIN 1980), Sukhaya (Jonkov 1/8/1911: P). Irkutskaya Oblast: Irkutsk (Raspopov: ZT* 7549). Kamchatskaya Oblast: Maschura (Komorov 1908-1909: P, S). Krasnoyarskiy Krai: Angara, Motyginno (PAUTOVA and GALIMULIN 1980); Krasnaja zvezda (Zedtwitz 6/1919: M). Omskaya Oblast: Omsk (Weckmann 7-8/1872: H). Primorskiy Krai: Vladivostok (Melvil 8/8/1926: S). Tomskaya Oblast: Tomsk (Stenberg 12/7/1898: H).

SOUTHERN AND EASTERN ASIA

BURMA

Irrawadi Valley, Pegu (Kurz 2306: STU). Rangoon (Yank 10/1929: BM). Salin Lake, Minbu (Aubert-Gage 498987: CAL)

CHINA

HEILUNGKIANG. Harbin (Skuortzow 26/6/1937: GH).

HONAN. Kioshan (Bailey 26/6/1917: BH, GH); Weng-Yang (s.coll. 3/6/1960: PE).

HOPEH. Tien-chin (Licent 751: BM, P).

HUNAN. Y-chang (Chaney 3/9/1925: UC).

HUPEH. Wuchang (Bailey 4/6/1917: BH).

KIANGSU. Nan-Ching (Chien 201: ZT; Tsu 126: UC, US; Wang 169: ZT); Nan-

Ching, Lake Sans-souci (s.coll.: ZT* 8338); Hsuan-wu-hu (Chen 20, 27: NAN); Hua-ching-Tian (s.coll. 5/6/1961: PE); Ching-chiang (Bailey 27/6/1917: BH).

KIRIN. Manchuria, T'ou menn ling (Licent 8393: BM).

KWANGTUNG. Canton (s.coll.: ZT* 8240; Merrill 10383: GH; s.coll. 26/10/1953: PE).

PEI-CHING. Pei-ching (Tang Yen-chen: ZT* 7950; Rotmaier 20075: JE).

SHANG-HAI. Shang-hai (Debeaux 1861: P; Schröter 11/11/1898: ZT); Zakau-doo (Bailey 31/5/1917: BH, GH).

SHENSI. Juan-ma-tien (Giraldi 6758: FI); Lin-kian-se (Giraldi 6759: FI); Ton-kian-su (Giraldi 6761: FI); Lin-tun-Scian (Giraldi 6764, 6765: FI); Si-ngan-fu (Giraldi 6763: FI); Shensi Central, without exact locality (Licent 2394: BM); Tciuz-Scien (Giraldi 6766: FI); Tai-pai-shan (Liou and Tsoong 2412: PE).

SZECHWAN. Nin-yuan-fu (Sam 1925: S; Smith 1846: GB, UPS); Ningyuen (Handel-Mazetti 1265: WU); Ta-kong-Shan (s.coll. 12/9/1963: PE); Hoch'uan (Hopkinson 110: S); O'mei, Wan-hsingchuan (s.coll.: A).

YUNNAN. Kun-ming (Burnand: ZT* 8652; Wang 63069: A; s.coll. 30/7/1975: PE); Hei-ling-tan (s.coll. 24/7/1957: PE); Li-chiang-Hsien (Wang 65101, 77953: A); Lung-huk (Wang 80209: A); Tong-tchouzu (Maire 2870: MICH, UC, Z); Yetshe (Handel-Mazetti 7951: GH); Yunnan-fu (Sam 1925: S; Handel-Mazetti 458: WU; Smith 1518b: UPS; Schneider 40: G, WU).

NORTHERN CHINA. Nao-gui-haize (Licent 6236: BM).

HONG-KONG

New Territories, Shatin (Lau: ZT* 7205). Railway Pass (Shiu Ying Hu 9482: US).

INDIA

ANDHRA PRADESH. Hyderabad (Narayan 3/1/1969: AD. Nidadavolu (Narayan 27/5/1968: AD). Kakinada (Narayan 3/1/1969: AD).

ASSAM. Tatin ponds (Pooni s.no.: CAL).

BIHAR. Patna (Burnand: ZT* 8442).

DELHI. Delhi (Malaisse: ZT* 7481; Usha 10/1961: AAU).

HIMACHAL PRADESH. Kangra, Kulu Valley (Koelz 4917: F, GH, MICH, UC; Koelz 4785: GH, MICH). Pathankot (Stewart 1066: BH, MO, S, UC). Yanuma (Uotila 17707: H, M, Z); Manali (Uotila 17744: H).

JAMMU and KASHMIR. Srinagar (Dössegger: ZT* 8453). 20 km W of Srinagar (Klötzli: ZT* 8675). Habak, Srinagar (Kake 3879: KASH). Gandorbai (Ludlow 8114: BM). Dal Lake (Naqshi 4964/4965: KASH); Stewart 3337: BH, MO, NY; 3348: PH; 3379: L, MICH, MO, UC). Harwan, Srinagar (Singh 3441a: KASH). Tangmang (Stewart 1222: NY, PEN).

MADHYA PRADESH. Gwalior (Maries 1890: BM). Beraghat (Koelz 18648: MICH).

MAHARASHTRA. Thama, Bassein (Billore 113747: CAL).

MANIPUR. Manipur City (Watt 7387: CAL, P).

PONDICHERRY. Pondicherry (Thanikaimoni: ZT* 7379).

PUNJAB. Dalhousie (Stewart 1894: NY, PH). Jullundur (Uotila 18233: H, Z). Amritsar (Uotila 17606: H, Z).

RAJASTHAN. Kota (Cook 77, 78: Z; Mehta: ZT* 8256). Bharatpur (Klötzli: ZT* 8679). Pushkar (Gopal: ZT* 8342). Abu (BLATTER and HALLBERG 1921).

SIKKIM. Purseat (Anderson 1/2/1867: CAL).

TAMIL NADU. Madras (Ihivy 124: MICH). Vellore (Ihivy 125: MICH). Coimbatore (Koelz 19881: MICH; Subramanian 3016: CAL).

UTTAR PRADESH. Lucknow (Maheshwari: ZT* 7379); Kashipur (Chand 915: L, UC, W; 917: L, MICH, UC); Amhat (Nair 14729: CAL); Dehra Dun (Parker 13/12/1925: NSW; 18/9/1927: G, NSW); Kumaun (Strachey and Winterbottom: A).

WEST BENGAL. Rajnagar (Mittra: ZT* 7212). Budge-Budge (Gosh 801: CAL). Calcutta (Kurz 3/1866: MEL, STU; Mueller: STU; Meebold 791: L).

INDONESIA

CELEBES. Tataäran (Alston 16342: BM). Tanahjampea Island (Monod 375: L). JAWA. Bandung (Zollinger 1426a: L); Bandung Palasari (Pieterse: ZT* 8364); Bengalengan (Backer 13/10/1918: BO); Cilacap (van der Brück 2826: U); Garoel (Möller 4/5/1897: S); Junghuha (Zollinger 1586: P); Malang (Zollinger 2486: L); Poeger-Watangan (Koorders 1895: BO); Priangan (Sprint 3/1928: BO); Res. Preangar (van der Brink 5963: L); Sekassor (van Steenis 17/7/1938: BO); Sempol (Backer 21/6/1918: BO; Durand 11/6/1927: BO, L; van Steenis 5/5/1940: BO; van Leeuwen 11953a: L); Sungai Kolbu (Koorders 12/8/1916: BO); Telaga Batengan (Backer 30/3/1914: BO); Tjiadadap (Backer 9/7/1917: BO).

SUMATRA. Atjeh: Sabang (van Steenis 31/12/1933: BO); Tehengong (van Steenis 28/8/1934: BO). Sumatera Barat: Taran, Payakumbuh (Meijer 5746: L). Sumatera Utara: Baliga, Tobameer (Lörzing 6416: BO, L).

WEST IRIAN. Balin River (Brass 11810: A, BRI, L); Distr. Hollandia, Lake Sentani, Cycloop Mts. (Royen and Steumer 6601: L).

JAPAN

OTAKI (1974, in lit. 1978). Frequent throughout the country; also on the Ryukyu Retto: Ishigaki Island (Fosberg 37986a: US); Okinawa, Naha (Walker et al. 8111: US), Teruma (Walker et al. 6012: MICH, UC).

KOREA

Cheju-do (Quelpart Island), Monglo (Faurie 2192: BM, P; Taquet 7/1908: G; 1936: C). Kyonggi, Sosa (Yong No Lee: ZT* 7682). Gangweon; Chungbuk; Chungnam (CHOI et al. 1973).

MALAYSIA

Perak: Bracas Dendrys (Ridley 1891: SING); Sauk (Landolt 24/84: ZT). Pinang: Sungei Buorong (Sinclair 4/11/1951: L, SING); Pinang (Chaw: ZT* 8229). Selangor: Kuala Lumpur (Abdullah: ZT* 7222; Landolt 14/81: ZT; Nasker 4429: CAL; Surkiel 4229: BM, MICH, UC; 23/2/1919: BRI, SING); between Bangi and Salak (Landolt 18/81: ZT).

NEPAL

Barampur (s.coll.: BM). Kathmandu (Manandhur: ZT* 7674; Stainton et al. 6951: A, BM, UPS; Klötzli: ZT* 8686a), Bharatpur (Klötzli: ZT* 8788).

PAKISTAN

Lahore: Lahore (Koelz 4085: F, GH, MICH, NY, UC, US; Uotila 18369: H, Z); Tangmer: Gandarabad (YUSUF and OMER, mscr., 1986). Kashmir: Punch (Schlagintveit 12575: GH). Khairpur: Rohri; Sukkur (YUSUF and OMER, mscr., 1986). Peshawar: Swat, Kalam, Marguyar, Mingora (STEWART 1972); Akpar Pura, Pang Trieth (YUSUF and OMER, mscr., 1986) Rawalpindi: Ihelum (Uotila 17601: H, Z); Sohawa pond; Hassan Abdal (YUSUF and OMER, mscr., 1986).

PAPUA NEW GUINEA

Fly River (Brass 8163: A). Morobe Distr.: Boana (Clemens 41513: MICH); Bulolo (Streimann NGF 39154: L). Sepik Distr.: Aitape (Derbyshire 7827: L); Leitre Village (Sayers NGF 19575: L); Sepik River (Herre 271: DS, NY).

PHILIPPINES

Luzon: International Rice Research Inst. (Guzman 2: L); Bayninane Inugao (Conklin 78627: A, L); Bontoc Subprov. (Vanderbergh 3319: F); Mountain Prov. (Sanros 5770: L); Prov. Cogayan (Curran 11622: C); Mt. Maqueling (Nielson 732: C).

SINGAPORE

Alexandria Road (s.coll. 36938: SING).

SRI LANKA

North Central Prov.: Polonnariwa (Fosberg 51905: US). Northern Prov.: Mannar (Jayasuriya 599: US). Sabaragamuva Prov.: Kahawalla (Hepper 4559:

L, PRE). Southern Prov.: Tissamaharama (Hepper 4742: L, PRE, US; Simpson 9928: BM). Uva Prov.: Magapala (Hepper 4712: L, PRE, US). According to HEPPER (1981) in the following districts: Puttalam; Kandy; Hambantola; Badulla; Ratmapura.

TAIWAN

Bankinsing (Faurie 992: P; 993: BM, G). Kaoshiung Co., Feng-shan (Yang: ZT* 7723). According to YANG et al. (1978): Taipei: Taipei; Peitou. Ilan: Ilan. Taoyuan: Tachi. Hsinchu: Hukon. Teitung: Is. Lanyu; Is. Luta. Nantou: Sun Moon Lake.

THAILAND

Bangkok (Kerr 21/6/1931: BM); Bang Khen (Youngboonkird: ZT* 7206); Snake Farm (Landolt-Stadler: ZT* 8357). Muang Distr., Sahm Lahn Forest (Maxwell 74-1041: AAU, L). Tam Chieng Dao, 60 km N of Chieng-mai (Sørensen et al. 1199: C).

VIETNAM

Hanoi (Chevalier 39556: P; d'Alleizette 5/1908: L). Nam Dinh (Mouret 392: P). Phuc-Nhac (Bon 13/12/1883: P). Ho Chi Minh (Saigon) (Nu-yan-Cuong 99: P).

AUSTRALIA AND NEW ZEALAND

AUSTRALIA

NEW SOUTH WALES. Sydney (Constable 49444: AD; Müller s.no.: MEL); Bega (Hindle 18/4/1969: NSW).

NORTHERN TERRITORY. W Arnhemland, Adelaide R. (Balgooy, Byrnes 1413: L, Z; 1414: Z). Darwin (Byrnes NB 663: L); Howard Springs (Henshall 1171: AD, NSW; Klötzli: ZT* 8718). Fog Dam (den Hartog 703: L). Howard River (Must 1151: BRI, L, MEL). Mataranka (Garden 27/7/1954: NSW); Roper River (Maconochie: ZT* 7551).

QUEENSLAND. Eidsvold (Bancroft 1914: BRI). Kilcoy, Kilcoy Creek (Blake 14807: BRI). Townsville, West Barrata Creek (Rood 11/1/1966: NSW).

VICTORIA. Biggara (Williamson 11/1928: MEL). Gibbsland, Thompson River (Aston 1088: MEL). Hume River (Mueller 1/1874: MEL, STU). Towang (Mueller 1/1874: MEL). Upper Murray (Williamson 6383: M).

PACIFIC OCEAN

HAWAII (U.S.A.)

Maui (Le Roy 5/8/1927: MASS, NY). Oahu: Honolulu (Degener 27/11/1926: CU, G, K, MASS, MICH, NY); Waiahole (Herbst: ZT* 7469).

LOO-CHOO ISLANDS

(Wright 325: GH, P, US).

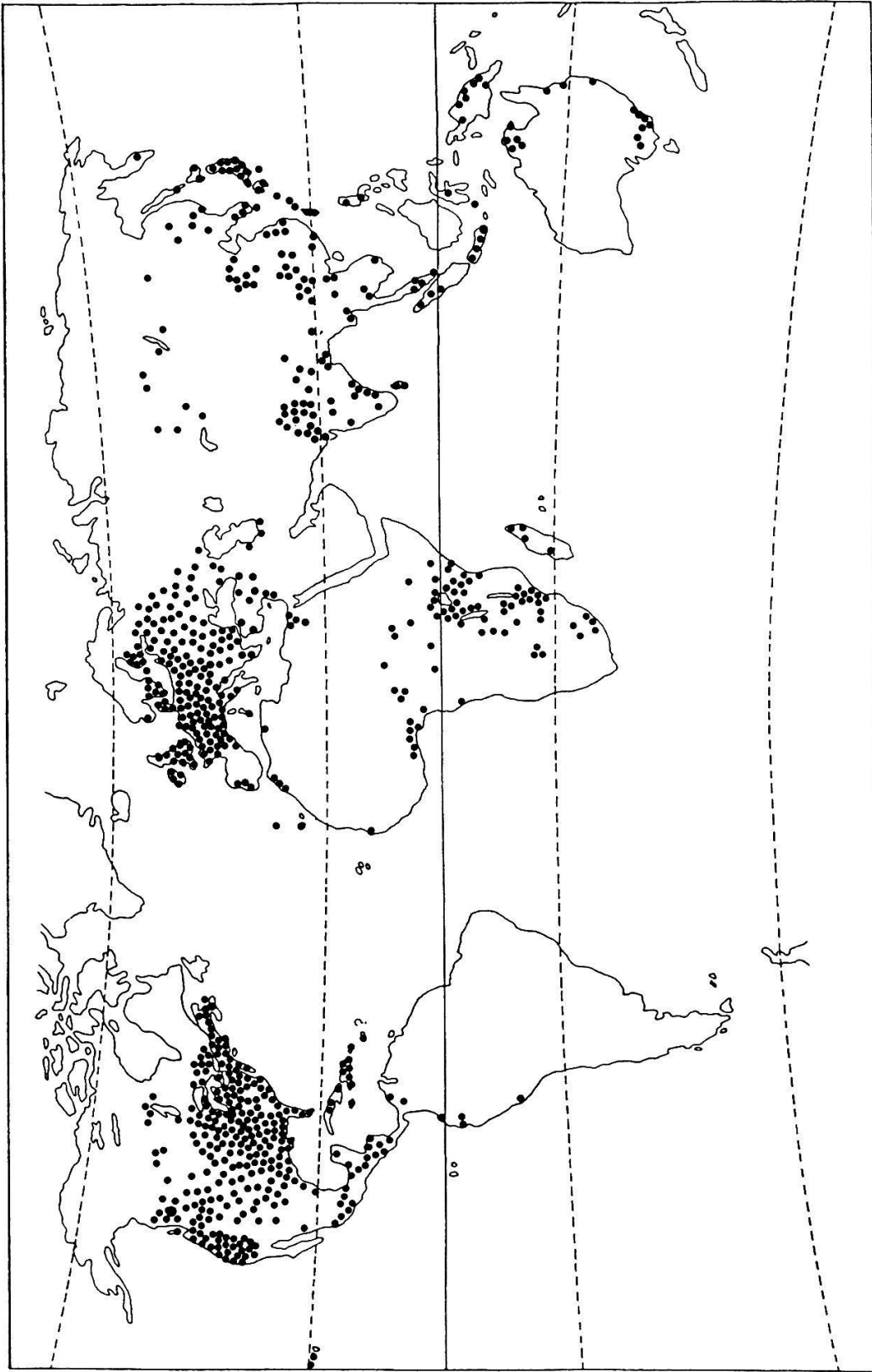


Fig. 6.5. Distribution of Spirodela polyrrhiza

6.1.3.3. Spirodela punctata (fig. 6.6)

Originally, S. punctata was distributed throughout South America, Southeast Asia and Australia. It is probably also native to South Africa. The first record is known from E. Zeiher (Uitenhage: K, STU, collected before 1850). HEGELMAIER attributed this to a mislabeling, but recently it was found several times in the same area. In the following countries, it certainly is introduced: USA, since about 1930 (SAEGER 1932); New Zealand, since 1930 (MASON 1950); Egypt, Israel and Italy (PIGNATTI 1957). It was probably also introduced in some islands of the Indian and Pacific and Atlantic Ocean.

NORTH AMERICA

U.S.A.

ALABAMA. Frequent.

ARIZONA. Rare: Coconino Co., Maricopa Co.

ARKANSAS. Rare: Pulaski Co.

CALIFORNIA. Rare: Alameda Co., Fresno Co., Madera Co., San Diego Co., Santa Clara Co., Yolo Co.

DISTRICT OF COLUMBIA. Rather frequent.

FLORIDA. Frequent.

GEORGIA. Rare, only in the South: Cook Co., Decatur Co., Early Co., Lowndes Co., Seminole Co.

ILLINOIS. Rare: Alexander Co., Bureau Co., Johnson Co., Union Co.

KENTUCKY. Rare: Ballard Co., Hickman Co.

LOUISIANA. Frequent.

MASSACHUSETTS. Rare: Middlesex Co. Probably only temporary.

MISSISSIPPI. Rare: Issaquena Co., Marion Co., Rankin Co.

MISSOURI. Rather rare: Cape Girardeau Co., Jackson Co., Perry Co., Wayne Co.

NORTH CAROLINA. Rather rare, only in the East: Columbus Co., Dare Co., Durham Co., Hyde Co., Johnston Co., Martin Co., Northampton Co., Tyrell Co., Vance Co., Wake Co.

OKLAHOMA. Rare: McCurtain Co.

OREGON. Rare: Clatsop Co.

PENNSYLVANIA. Rare: Lebanon Co., Tioga Co., Crawford Co. (WOHLER et al. 1965).

SOUTH CAROLINA. Rather rare: Berkeley Co., Charleston Co., Colleton Co., Jaspers Co., Richland Co., Union Co.

TENNESSEE. Rare: Lake Co.

TEXAS. Rather rare, only in the East: Brazos Co., Denton Co., Gregg Co., Orange Co., Rusk Co., San Patricio Co., Shelley Co.

VIRGINIA. Rare, only in the East: Charles City Co., Fairfax Co., New Kent Co., Surry Co.

SOUTH AMERICA

BRAZIL

RIO DE JANEIRO. Araruama, Iguabo Grande (Landolt and Farney 200/83: ZT); Lagao de Camorêm (Segadas-Vianna: ZT* 7253); Marico, Barra de Marico

(Landolt 193/83: ZT; Landolt and Farney 194/83: ZT; ZT* 8847); Recreio, Bandeirantes (Segadas-Vianna: ZT* 7224); Rio de Janeiro (Carauta 2474; 21/12/77: RB); Rio de Janeiro, Horto Botânico (Segadas-Vianna: ZT* 7226; Gröber: ZT* 8689); Saquaremo, SW of Sampaio Correio (Landolt and Farney 195/83: ZT); Araruama; San Pedro de Aldeia (Landolt and Farney 202/83: ZT).

SAO PAULO. Campinas (Moten 4661: S); Sao Paulo (Joly: ZT* 7111).

CHILE

Tierra del Fuego, Orange Harbor (Wilkes: DS, GH, MO, US; Spegazzini, according to GIARDELLI 1970). RAMIREZ et al. (1979) cite the species in Chile from 23° to 36° SL. But this indication is probably erroneous and may have to be referred to S. intermedia.

COLOMBIA

Dept. Guainia: San Fernando (Molina 18Va 224: COL).

GUYANA

Essequibo River (MEYER 1818, no material seen).

ATLANTIC OCEAN

CANARY ISLANDS

Tenerife, Orotova (Hauser: ZT* 7536).

EUROPE

ITALY

Lombardia, Pavia, Certosa di Pavia and Pieve del Cairo (PIGNATTI 1957). This occurrence is probably only temporary. In 1979 no plants could be found by the present author.

SWITZERLAND

Zürich, Katzenbach (Koch 1953: ZT). This occurrence was only temporary, probably from aquarium cultures.

TURKEY

Istanbul, Bot. Garden (Polar: ZT* 8868).

AFRICA

EGYPT

Cairo, Giza (Sisi: ZT* 7366).

SOUTH AFRICA

CAPE. Grahamtown (Preez: ZT* 7232). Manley Flats (Preez 25/11/1969: PRE). Stellenbosch, Jonkershoek (Kruger: ZT* 7248). Uitenhage (Zeiher, ex. herb. Ecklon: K). Cape Flats (Mauve 4618: CAP, K, PRE); Isoetes Olei (Mathews 13/1/1969: CAP).

NATAL. Ubombo, Mbazwane (Mauve: ZT* 8248; 4931: PRE); Kosy Bay (Strey and Moll 26/11/1967: PRE). Pietermaritzburg (van Staden: ZT* 7272; Ward 7609: PRE); Fosmer Upper Mlazi Estuary (Ward 7334: PRE). Tongoland, Pongola River (Wager: ZT* 7297). Richard's Bay, Ukubu Lake, Zululand (Musil 358: PRE).

TRANSVAAL. Distr. Brits: Orocodibe River (Mauve, Verdoom and Vahrmeyer 4309: PRE). 4 miles N of Pretoria (Mauve and Schieben 9603: PRE). Distr. Pretoria: Bon Accord Dam (Strey 2829: PRE). SW part of Hartbeesport Dam (de Winter 9575: PRE).

ZIMBABWE

Distr. Bulawayo: Hillside, Bulawayo (Biegel 3820: SRGH). Distr. Goromonzi: Ruwa River (Biegel 3418: BR, C, K, LISC, M, MO, PRE, SRGH, WAG; ZT* 7461). Distr. Salisbury: Hillside, Mahabuzi River (Moll 529: SRGH); Lake McIlwaine (Faulkener: ZT* 7532; Phipps 1343: K, PRE); Pelican Point (Ellis 57610: BR, K, L, LISC, PRE, S).

INDIAN OCEAN

MALDIVES

Malé Atoll (Fosberg 36906: NY, US).

MAURITIUS

Berkley Experimental Station (Guého: ZT* 7333).

NORTHERN AND WESTERN ASIA

ISRAEL

Tel Aviv, Bot. Garden (Feinbrun: ZT* 7624); Kefar Hayaroq (RIMON and GALUN 1968).

SOUTHERN AND EASTERN ASIA

CHINA

CHEKIANG. Without exact locality (Barchet: US).

FUKIEN. Kushan (Metcalf 7386: G, Z).

HONAN. Kioshan (Bailey 26/6/1917: BH).

HUPEH. Wuchang (Bailey 4/7/1917: BH).

SHANG-HAI. Shang-hai (Debeaux 1861: P).

SZECHWAN. Ho-chuan (Hopkinson 110: S); O'mai, Cheng Du (Burnand: ZT* 8651); Ta-kong-Shan (s.coll. 12/9/1963: PE).

YUNNAN. Ta-li-hsien (Wang 63471: A); Dah-Meng-lung (Wang 77953: A).

INDIA

DELHI. Delhi (Maheshwari: ZT* 7449).

MAHARASHTRA. Bombay (Wallace 5913: BM).

MANIPUR. Manipur City (Watt 7387: CAL, P).

WEST BENGAL. Sherampore (Griffith: BM, MEL; Seemann 1845: G, JE). Calcutta (Kurz 6/1865: K, MEL, U; 9/1878: K; L, MEL, STU; Mueller s.no.: STU).

INDONESIA

JAWA. Bandung (Zollinger 1426a: L; Pieterse: ZT* 8365); Tjikoga (Zollinger 1426: KANU, STU); Vipanans, Segemung (Everaarts 99: L).

SUMATRA. Medan (Landolt-Stadler: ZT* 8354).

JAPAN

OTAKI (1974, in lit. 1978).

HONSHU. Auchi; Kobe; Kyoto; Nagato (HARA 1976); Osaka; Saitama; Shiga; Shizuoka; Tokyo, Adachiku (Otaki: ZT*: 7429).

KYUSHU. Fukuoka; Kumamoto; Oita; Saga (Nakai: ZT* 8710).

SHIKOKU: Ehime.

MALAYSIA

Selangor, Kuala Lumpur (Surkiel 23/2/1919: BRI). Pahang (VAN DER PLAS 1971).

PHILIPPINES

Luzon, Prov. Cogayan (Curran 11622: C).

TAIWAN

Ilan: Ilan. Taipei: Taipei (YOUNG et al. 1978).

THAILAND

Bangkok, Bang Khen (Youngboonkird: ZT* 7208).

AUTRALIA AND NEW ZEALAND

AUSTRALIA

NEW SOUTH WALES. Albion Park (McBarron 4044: NSW). Albury, Railway line (McBarron 4624: NSW; Flynn 84466: AD, NSW). Berrima (Constable 78992: AD, NSW). Bonngriigg, Cabramatta Creek (Constable 78946: AD, NSW; Evans 24/6/1968: NSW). Bathhurst (Ingram 4/1960: NSW). Branxton (Landolt 98/81: ZT). Bulli (Sprague 18/11/1968: NSW). Bega Swamp (Hindle 18/4/1969: NSW). Kanulla to Kurnell (Johnson 564: NSW). Cambewarra Range, Browns

Mt. (Rodway 13791: NSW). Deniliquin (Leigh 84466: AD, NSW). Eastwood (Evans 84204, 94535, 94570, 94571, 94856: AD; 94534: AD, MEL). Emu Plains (Evans 44946: AD). Forbes (Clerk 8/3/1967: MEL, NSW). Forster (Salasoo 3364: NSW). Goulburn, Joppas Creek (Alister 18/4/1967: NSW). Gran Plains (Evans 4/1959: NSW). Gosford (Fletcher 1895: NSW; Sainty 23/7/1965: NSW). Grose Vale (Leigh 2/10/1955: NSW). Glenorie (Martin 17/12/1964: NSW). Griffith (Sainty 78984, 90977: AD, NSW; 4/12/1965: NSW; Evans 94622: AD). Grafton, Alumy Creek (Pastega 7/7/1970: NSW). Greenwell Point, South Coast (Rodway 12830: NSW); Gibraltar Creek, Coc's River (Rodd 28/1/1968: MEL, NSW). Hoxton Park (Salasoo 3604: NSW). Kogarah (Canfield 18/12/1899: NSW; Deane 1888: NSW). Kellyville, Hazlett Road (Evans 78983: AD, NSW); Second Pondo Creek (Child 29/9/1967: NSW). Kinchela, Macleay River (Johnson 56900: AD, NSW). Kyogle (Van 3/1959: NSW). Liverpool, George River (McBarron 11803, 11808: NSW; Constable 7008: NSW; den Hartog 1107: L); Radio Station (Coveny 605: NSW). Maitland, 5 mi NE of (Briggs and Johnson B3277a: NSW); Dalwood Area (Beck 26/4/1966: NSW). Maequarie Fields, Bunburry Curran Creek (McBarron 10747: AD, NSW). Marrandera, Murrumbidgee River (Eichler 19048: AD). Minto (Evans: ZT* 7203); Bons Bowring Creek (Evans 13/4/1968: NSW); Staleon (Constable 23/3/1961: NSW). Murrumbidgee (Sainty 7/12/1965: MEL). Murrurendi (Landolt 96/81: ZT). Newcastle, Seaham (Briggs and Johnson: ZT* 7273). Picton, Stonequarry Creek (McBarron 11998: AD, NSW). Penrith (Constable 79131: AD, NSW; Evans 6/3/1968: NSW); Erskine Park (Constable 7007: MEL, NSW). Port Kembla, Windang, South Coast (Constable 13/12/1960: NSW). Prospect (Constable 29/2/1968: NSW). Pennant Hills (Evans 21/12/1968: NSW; Vickery 6/3/1967: NSW). Pitt Town, Wiseman Ferry Road (Evans 4/3/1968: NSW). Parramata Park (Evans 6/1966: NSW). Port Jackson (Whitelegge 1886: PH, STU). Rouse Hille (Evans: ZT* 7202; s.no.: NSW). Richmond (Briggs 3/1961: NSW). Richmond River (Bundock 1895: MEL). Richmond (Mueller s.no.: MEL). Singleton (Landolt 97/81: ZT). Sydney (Constable 49442, 49443, 49444, 49445, 80737, 80766: AD; 16/2/1967: NSW; 1087: MEL; Coveny 624, 626: NSW; Dearo 2/1887: NSW; Mueller s.no.: MEL; 18/11/1886: NSW; Whitelegge 77956: AD, NSW). Bot.Garden Sydney (Coveny: ZT* 8225; Evans 90987: AD; Boorman 10/1906: BRI, MIN, NSW, POM, Z). Rossmore (Raid 12/1970: NSW). Tenterfield (Landolt 94/81: ZT). Toogabbie Creek (Constable 14/2/1949: NSW). Terara, 3 mi E of Mowra (Rodway 1551: NSW). Upper Matai River (Lee 11/2/1966, 13/5/1968: NSW). Uralla (Landolt 95/81: ZT). Waamargama (McBarron 1269: NSW). Wingham (Brown: ZT* 7799). Windsor (Potts 17/12/1968: NSW); 4,5 mi NE of Windsor (Coveny 754: NSW). Wentworth, junct. of the Darling and Murray River (Holding 1889: MEL). Yanco (Sainty 78944: AD, NSW).

QUEENSLAND. Atherton, Crater Lake (Eagon 12/6/1969: BRI, Landolt: ZT* 8721). Ayr (Landolt 66/81, 67/81: ZT). Brisbane (Blake 5277: BRI; Durrington 600: BRI; Menary 10/1954: BRI); 130 km N of Sidney (Sharp 2005: BRI); Brisbane River (Bailey s.no.: MEL; Dietrich 700: STU). Banana (Julian 13/10/1977: BRI). Burnett River (Keys 146: MEL). Bajool (Landolt 82/81: ZT). Capricorn (Bormann s.no.: MEL). Chelmer (Primerose 29/12/1905: BRI). Curtis Island (s.coll. 22/3/1962: BRI). Gatton (Marshall 3/1957: BRI); East Haldon (Blake: ZT* 7294). Gympie, Maroochie River (Bailey 1874: MEL). Goombungee (Joyer 15/5/1959: BRI). Herberton (Haldane 13/12/1900: BRI). Holm-Hill (Landolt: ZT* 8724; 73/81, 74/81: ZT). Ingham (Landolt: ZT* 8722). Kilcoy, Kilcoy Creek (Blake 14807: BRI). Kalejope (Landolt 83/81, 84/81: ZT). Kolan River (Landolt 87/81: ZT). Landsborough (Landolt: ZT* 8726). Moreton Distr. (Blake 13880: BRI; Belmont 30/10/1953: BRI). Moreton Bay (Bailey: MEL). Moreton Island (Durrington 1162: BRI). Miriam Vale (Landolt 85/81, 86/81: ZT). Moogerah Lake (Lan-

dolt 92/81, 93/81: ZT). Peachester (Pembroke 17/7/1957: BRI). Rockhampton (Mueller 1/12/1897: MEL, STU; Landolt 79/81, 81/81: ZT). Walkerton (Landolt 75/81: ZT). Warrill View (Landolt 91/81: ZT).

SOUTH AUSTRALIA. Adelaide (Symon 36878: AD). Blanchetown (Chinnock 180: AD). Berry (Eichler 12349, 12350: AD). Bonney Lake (Wehl 4/1888: MEL). Bow Hill (Eichler 17192: AD). Entrance of the Murray (Birn 9/1848: MEL). Flinders Island (Cleland 24/11/1912: NSW). Glencoe West (von Wattenwyl: ZT* 7817). Loxton (Eichler 12322: AD). Mt. Gambier, Caroline Stinkhole (von Wattenwyl: ZT* 7760). Narrung (Eichler 19738-40, 19753: AD; Williams 377, 388, 390: AD). Tasmore (Symon 11/1968: NSW). Wellington (Eichler 15680: AD). Windsor Garden (Spooner 617: AD).

TASMANIA. Kimberley (Blacke 1047/1: MEL).

VICTORIA. Benalla (Aston 16/12/1959: AD, MEL). Colac (Aston: ZT* 7232). Crambourne (Aston: ZT* 7277, 7278). Darwin River (Oldfield: STU); Echuca, Barmah (Aston: ZT* 7477); Tongala (Aston: ZT* 7479); Tullah Creek (Aston: ZT* 7478). French Island (Beaglehole 38290, 38291: MEL). Gibbsland, Sale (Aston: ZT* 7632, 7633); Lake Wellington (Aston: ZT* 7634; 1088: MEL); Wuk Wuk (Beaglehole 37647: MEL); Wuk Wuk, Boggy Creek (Beaglehole 37657: MEL); Genoa (Beaglehole 34383: MEL); Brodripp River (Melville and Wakerfield 2245: K, MEL); Orbost (Robbins ACB 9780: MEL); Tarrago River, between Longwarry and Drouin (Willis 5/2/1960: MEL). Hawkeburg (Williamson 1895: MEL). Hawkersdale (Williamson 2/1903: MEL). Gormondale, Merryman Creek (Young: ZT* 7776). Hune (Mueller 1/1874: MEL, STU). Murray River (Blacke 1047/2: MEL; Mueller s.no.: STU). Melbourne (Melville and Wakerfield 2074: K, MEL); Botany School (Chambers: ZT* 7191). Merry Creek (Morrison 20/2/1894: PERTH). Numurkah (Aston: ZT* 7603, 7606, 7607). Portland, Tyrendarra (Aston: ZT* 7260). Red Cliffs, Pumping Station on Murray River (Beaglehole 33437: MEL). Richmond (Woolles s.no.: MEL). Shepparton (Aston: ZT* 7604); Bunbartha (Aston: ZT* 7475). Terang Lake (Easten 1875: MEL; Mueller 4/1874: MEL). Towang (Mueller 1/1874: MEL). Wangaratta Twp., Ovens River (Willis 27/2/1960: MEL). Waterloo (s.coll.: MEL). Yarra Glen (Aston 2/12/1959: MEL).

WESTERN AUSTRALIA. Albany (Landolt 51/81: ZT). Bibra Lake (Landolt 44/81: ZT). Bunbury (Landolt 36/81: ZT). Gingin (Landolt 38/81, 43/81: ZT). Stratham (Landolt 46/81: ZT). Swan River (Drummond 1854: G, K, L, STU). Perth (Marchant 107, 108, 293, 23/11/1960: PERTH). Wanneroo (Keneally 10/7/1971: PERTH; Landolt 30/81, 31/81: ZT; ZT* 8716). Waroona (den Hartog 190: L). Wokalop (Landolt 45/81: ZT).

NEW ZEALAND

NORTH ISLAND. Auckland (Gurr 129847: AD, NSW, U; BANGERTER 1978). Otaki Beach (Bo 22/11/1955: WELT). Wellington (Cone 2/3/1975: WELT; Mason 538: MEL). Napier (MASON 1950). Palmerston, Awapuni (BANGERTER 1978).

SOUTH ISLAND. North Canterbury, Leithfield Beach (Mason: ZT* 7541; Mason and Urbanska: ZT* 8646).

CHATHAM ISLANDS (MOORE and EDGAR 1970).

PACIFIC OCEAN

FIDJI ISLANDS

Viti Levu, Lautoka (Greenwood 153: K). Without exact locality (Naumann 1875: STU; Seemann 656: CAL, G, GH, K, L, MEL, STU, ZT; 657: BM, G, GH, L, MEL).

NEW CALEDONIA

Balade (Vieillard 1369: L). Bouloupari, Ouameni R. (Botton: ZT* 7302). Bourail (Balansa 1367: L); Karagéré (Botton: ZT* 7322). Foawhari (Cribs 261: L). Itagap (Vieillard 1369: L). Koumac (McKee 8002: K, L, NSW). La Foa (McKee 5451: K, L). Nouméa (Baumann 5487: Z; ex herb. Bonati: ZT;

Guillaumin 9771: Z). Tchiaor (Balansa 3111: K, L, MO, Z; 3112: A, G, GH, L, MO, NY, UC, Z).

NEW HEBRIDES

Malekula (Hallé RSNH 6433: K).

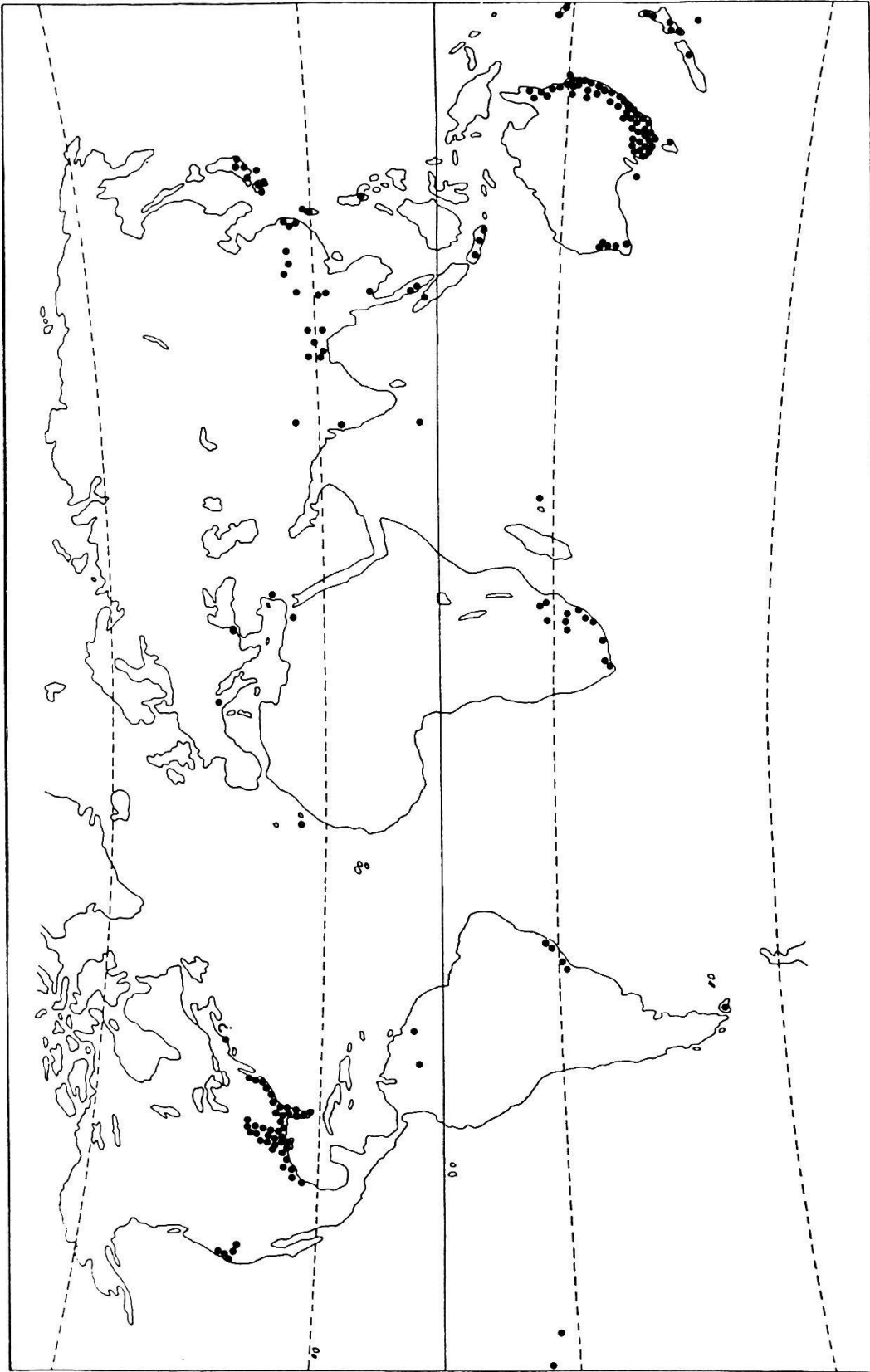


Fig. 6.6. Distribution of Spirodela punctata

6.1.3.4. Lemna gibba (fig. 6.7)

L. gibba has its main distribution in regions with mediterranean climates throughout the world except Australia; it also grows in neighbouring countries with relatively dry, mild climates and in tropical mountains. It is introduced in a few places in Japan.

NORTH AMERICA

MEXICO

BAJA CALIFORNIA NORTE. Alisito Rancho (Wiggins 3967: CAS, DS, F, G, MICH, MO, MU, NY, US); La Encantada (Thorne 14334: CAS); Rancho San José (Moran 21995: ARIZ); San Pedro Martir (Brandegge 26/5/1893: KANU; Moran 21996: ARIZ; Wiggins 16588, 16591: DS); Santa Catarina (Broder 478: DS); San Vicente (Hevley 2125b: ARIZ); Tecate (Orcutt 2/7/1884: MO); Tijuana (Orcutt 22/6/1885: MO); Topo (Orcutt 9/7/1884: MO);.

CHIHUAHUA. Chihuahua City (Rose 4942: GH, US); Samalajuca (Wright 17/4/1852: GH).

COAHUILA. Saltillo (Fassett 28399: WIS, ZT).

DISTR. FEDERAL. Mexico City (Bailey 594: BH; Barkeley 17M337, 17M341: TEX; Barkeley 36239: COL, GH, MO; Daniels 673: BH; Dreleuse 139: MO; Daubs 605: ILL; Edwards 902: F; Hahn 1865: STU; 1868: CAL, BM, FI, K, KANU, LY, MO, NY, PH, STU, US; 5/1868: KANU, L, STU; 1869: GOET, L, U; 2/1869: GOET, JE, K, KANU, L, MEL, MO, STU, U, US; Fassett 28430: MICH; Gonzales 11/2/1977: ARIZ, CAS, MO; Mears 390: TEX; Moore 85: BH; Mitastein 122: MICH; Orcutt 4067: BM, GH, US; Orterburger 16M647: TEX; Pringle 1300: GH, US; 7301: CAS, COLO, MICH, MSC, SMU, UC, US, VT; 7204: MICH, MSC, SMU, US, VT; 7300: COLO, F, GH, MICH, MSC, SMU, UC, VT; Rose 6466: U, US; 4546, 4547, 6465: US; Rzedowski 26276: DS, MICH, MSC; Rutten 243: U; Schaffner 631: BM, CAS, FI, G, GOET, ILL, L, LY, M, MICH, US, ZT; 1875: BM, CAS, FI, LY, M, MICH, NY, UCLA, US; 1876: FI; 579: MEL; Schmitz 1855: BM; Seidl: ZT* 8415; Stone 166: NY; Thompson 29/7/1910, 27/7/1910; Trelease 137: KANU; Mixquic (Pineda: ZT* 7305, ZT* 7309, ZT*7312).

DURANGO. Durango (Palmer 149: MO; 169: BM, C, G, F, GH, NY, UC, US).

GUADALAJARA. La Barca (Gigon: ZT* 7648).

GUANAJUATO. San Miguel de Allende/Queretaro (Genelle 865: DUKE, MO, USF).

HIDALGO. Lago de Apam (Moore and Wood 4748: BH, GH, MICH); Ixmiquilpan (Moore and Wood 4510: BH, GH, MICH); San Miguel (Carlson 2823: F, NY).

MEXICO. 20 km N of Mexico City (Gigon: ZT* 7647); Lago Texcoco (Cruz 134: DS, MICH); San Juan Citaltepec (Rzedowski 16589: DS, MICH); Toluca (Barkeley 612: TEX; Schnoberger 7682: MICH); Toluca (Fassett 28479: GH, MO, UC, WIS, ZT); Xochimilco (Helia Bravo: ZT* 7239, 7240, 7241); Zumpango (Fassett 28240: GH; Matuda 19719: UC; Mitastein 2: MICH, MSC).

MICHOACAN. Ciudad (McVaugh 9946: MICH); Col Miguel Hidalgo, NE of Morelia (Iltis and Cochrane 236a: WIS); Emanuelo Zapata, Lago Chapalla (Iltis and Koeppen 513: WIS, ZT); Jiquilpan (Daubs 617: ILL); Sahuayo (McVaugh 18149: MICH); Zitacuaro (Daubs 615: ILL).

OAXACA. Monte Alban (Camp 2763: DUKE, F, G, M, MICH, MSC, NY, TEX, US, W); Oaxaca (Camp 2766: DUKE, G, MICH, MO, MSC, NY, TEX, UC, US; Thompson

11/8/1910: KANU); Talatlaco (Conzatti 5227: MICH); Tehuantepec (Orcutt 4067: MO).

PUEBLA. Acatzingo (Fassett 28276: NY; 28476: F, MICH, MO, WIS, ZT); Altoseca (Arsène 6/12/1906: L); Amozoc (Barr 62-685 and Hevley 2695: ARIZ); Atoyac (Arsène 1130: US); Chimantha (Siebmann 1968: C); Hacienda Batan (Arsène 938: US); Hacienda Cristo (Arsène 1063: GH, ILL, L, LY, MO, NY, US); Mayorazgo (Arsène 930: BM, MO, US; 20/5/1907: US); Puebla (Arsène 212: LY; 906: GH, ILL, MO, US; Barkley 2442: TEX, LIL); Puebla/Cholula (Arsène 305, 893, 895: US); San Baltazar (Arsène 28/10/1907: G); Tecamachalco (SCHWABE-BRAUN and TÜXEN 1981b); Tepeaca (Fassett 28464, 28474: MO, WIS, ZT); Tezuitlan (Orcutt 4067: MICH); Zapotecic (Daubs 608: ILL).

QUERETARO. Cadereyta (Kelly 617: UC); San Pablo (Gigon: ZT* 7661).

SONORA. Fronteras (Hartmann 990: DS, GH, MICH, MO, UC, US); Hermosillo (Rose 12458: NY, US); Magdalena (Rose 15133: GH, US; 15136: US); Pitiquito (Wiggins 8230A, 8230B: DS); Rio Bavispe, Colonia Morelos (White 4415: MICH).

TAMAULIPAS. Tula (Lüönd 4/1984: ZT).

TLAXCALA. Santa Ana (Arsène 1853: GH, MO, LY, US; 5717: GH, MO, US); Tlaxcala (Nicolas 5717: MICH).

VERACRUZ. Orizaba (Müller 1853, 1855: NY).

ZACATECAS. La Bufa (Dressler 261: MO); Zacatecas (Jones 23/4/1892: POM, US).

U.S.A.

ARIZONA. Frequent.

CALIFORNIA. Frequent.

ILLINOIS. Rare: Will Co.

NEBRASKA. Rather rare: Cherry Co., Garden Co., Keith Co., Lincoln Co., Thomas Co.

NEVADA. Rare and only in the West: Churchill Co., Nye Co., Washoe Co.

NEW MEXICO. Rather rare and only in the Southwest: Catron Co., Dona Ana Co., Grant Co., Hidalgo Co.

TEXAS. Rare: Tom Green Co.

WYOMING. Rare: Teton Co. (warm spring).

CARIBBEAN SEA

HAITI

A specimen cited by DAUBS (1965) (Eyerdam 344: MO) belongs to Lemna aequinoctialis.

ST. THOMAS

(Breutel 96: G, STU). The specimen in STU is labeled "Pl.Afr.austr.", Nisky, Thomas Island. Together with L. gibba W. arrhiza is present. Contrary to the opinion of HEGELMAIER (1868) who identified the Wolffia as W. brasiliensis, I consider the origin of the collection as South Africa. The collection in G lacks the addition of "Nisky, St. Thomas Island" on the label. It is very unlikely that L. gibba can tolerate the warm waters of that climate for more than a few months.

SÃO BARTHOLO

(Erfors-Arvem 5/1792: GOET). The specimen is labeled "India occid., Sao Bartholo". Sao Bartholo is probably the same as the island of St. Barthélemy. This record is also very doubtful. Either the specimen results from a very temporary introduction, or the indication is the result of a mislabeling.

SOUTH AMERICA

ARGENTINA

Prov. BUENOS AIRES. Dept. Avellaneda: Isla Maciel (Parodi 1209: BAA); Sarandi (Giardelli 503: UC, ZT under the name of L. parodiana). Dept. Balcarce: Sa. Volcan (Crovetto 1565: BAB). Dept. Berriso: Los Talas, Canal Mena (Tur 1748: LP). Dept. Buenos Aires and vicinity: Arroyo Burgueno (Leon: ZT* 7200); Buenos Aires (Conde 91: LIL; Leon: ZT* 7179); Escuela Santa Catalina (Clos 2543: BAB); General Mondarega (Nicora 6985: BAA); La Plata (Boffa 4000; Marelli 43: SI); Lujan (Parodi 8641a: GH; Clos 3762: BAB); Mar del Plata (Hicken 14507: SI, ZT); Rio Lujan-Delta (Burkart 554: UC); Rivadaria (Balansa 21/11/1875: F); Tordilla, Estancia La Bagadela (Giardelli 1200, 1201: SI; 1220: SI, ZT); Villa Ortuzar (Parodi 9345); Villa Progesa (Burkart 14509: SI, ZT); Zebaya (Burkart 535: UC). Dept. Campana: 20 km S of Campana (Landolt and Zarzycki 37/83: ZT); 19 km S of Campana (Landolt and Zarzycki 38/83: ZT); 10 km S of Campana (Landolt and Zarzycki 39/83: ZT); between Campana and Zarate (Landolt and Zarzycki 40/83: ZT). Dept. Castelli: Castelli, Laguna Ombu (Landolt and Zarzycki 24/83: ZT); Estancia Belen (Spegazzini 1/11/04: BAB). Dept. Chascomus: Arroyo Vitel (Tur: ZT* 7922; ZT* 7922a); Laguna Adela (Landolt and Zarzycki 33/83, 43/83: ZT); Lago Chascomus (Landolt and Zarzycki 32/83: ZT); Laguna del Burro (Landolt and Zarzycki 36/83: ZT); Laguna Vitel (Landolt and Zarzycki 27-30/83: ZT). Dept. Dolores: Laguna pres de Sevigue (Landolt and Zarzycki 23/83: ZT); Dolores (Giardelli 515: UC). Dept. Ensenada: Ensenada (s. coll. 1/1888: LP). Dept. Grl. Conesa: Laguna Bagadela (Burkart 15671-15673: SI, ZT). Dept. Grl. Lavalle: San Clemente (Giardelli 1205, 1208, 1211: SI; Tur 1699: LP). Dept. Junin (Clos 175: BAB). Dept. Lanas de Zamora: Lagur Tanque (7549: BAA). Dept. Lincoln: Lincoln (Giardelli 565: SI, UC). Dept. Lobos: Lobos (Kalela 11: H). Dept. Magdalena: S of Pipinas (Landolt and Zarzycki 25/83: ZT); 10 km S of Pipinas (Landolt and Zarzycki 26/83: ZT). Dept. Mercedes: Altamira (Giardelli 551 under the name of L. disperma: L). Dept. 9 de Julio: Denneby (Pedersen 26/12/1981: ZT* 8733); Nueve de Julio (Pedersen 13159: LP). Dept. Pringles: Las Mostazas (Perrone 57.002: BA). Dept. San Miguel del Monte: Laguna del Monte (Landolt and Zarzycki 21/83, 22/83: ZT); ZT* 8813.

Prov. CATAMARCA. Sierra de Ancasti (Falds E) (Hunziker 19417: CORD).

Prov. CHACO. Dept. San Fernando: Fontana (Meyer 582: BAF, LIL).

Prov. CHUBUT. Dept. Futaleufu: Esquel (Meyer 9245: LIL).

Prov. CORDOBA. Dept. Capital: Cordoba (Kurtz 9089: R; Stuckert 20031, 4/4/1909: G); Laguna Peitiado (Hieronymus 489: F, G, L, SP, STU; 4/1877: JE, US; Kurtz 9127: CORD; 15745: CORD, LE; Stuckert 935: CORD); Quinta (Stuckert 2866, 12851: CORD); Saldan (Ariza: ZT* 7184). Dept. Colon: La Calera, Rio Primero (Landolt 15/83: ZT); La Calera (Peysegur 27778: SI). Pajas Blancas (Hunziker 8416: SI, ZT; 15759: ZT); Rio Ceballos "La Antonio" (Horseus 27/1/1941: CORD); Sierra Chica, Cabera (Stuckert 11740: CORD); Unquillo (Horseus 1/9/1918: CORD). Dept. Ischilin: Dean Funes (Landolt 13/83: ZT). Dept. Minas: Guasapampa (Kurtz 6790: BAF, CORD, STU). Dept. Pres. Roque Saenz Pena: La Cesira (Hunziker 18688: CORD); Laguna del Monte (Hunziker 13049: SI, ZT). Dept. Rio Cuarto: Gigena-Elena (Pedersen: ZT* 8655); Rio Cuarto (Kurtz 3776: CORD, SGO, STU; Stuckert 20031: CORD). Dept. Rio Primero: La Toma (Kurtz 9089: CORD); Las Saladas, Mar Chiquita (Kurtz 4756: CORD); Malpaso (Kurtz 6558/6559: BAF, CORD, NY, STU); Molino Ducas (Kurtz 15744: CORD). Dept. San Justo: Balnearia (Difulvio 12351: CORD); El Tio (Hunziker 13260: CORD, SI, ZT); Miramar (Hunziker 16906: CORD); Pozo Algarrobo (Bodenbender s.d.: BAF; Kurtz 8423, 8424: CORD, MO, R. STU); San Francisco (Hunziker and Cocucci

15759: CORD). Dept. Santa Maria: Dique José de La Quintana (Hunziker 22287: CORD). Dept. Tulumba: San José de La Dormida (Subilis 1792: CORD); Tulumba (Balegru 1534: LIL). Dept. Union: Monte Lena (Hunziker 12755: CORD, SI).

Prov. ENTRE RIOS. Dept. Capital: Concepcion del Uruguay (Lorentz 169: BAF, CORD, FI, JE, L, STU, UPS; 198: PH; 870: BM, STU). Dept. Gualeguaychu: Arroyo El Animal (Landolt and Zarzycki 51/83: ZT); 8 km W of Arroyo El Animal (Landolt and Zarzycki 52/83: ZT); 3 km W of Arroyo El Animal (Landolt and Zarzycki 53/83, 54/83: ZT); 1 km W of Arroyo El Animal (Landolt and Zarzycki 55/83: ZT); Embarcadero Berriso (Landolt and Zarzycki 49/83: ZT); 43 km E of Gualeguay (Landolt and Zarzycki 48/83: ZT); Puente de los Cerros, Arroyo Nogayo (Landolt and Zarzycki 56/83: ZT; ZT* 8814). Dept. La Paz: Morentina (Burkart and Bacigalupo 21133: SI). Dept. Victoria: Almacén, Arroyo Carballo (Landolt and Zarzycki 62/83: ZT); N of Arroyo Mananillalos (Landolt and Zarzycki 59/83, 60/83: ZT); Estancia El Besamiento (Landolt and Zarzycki 61/83: ZT); Ricon de Nogoya (Landolt and Zarzycki 57/83: ZT).

Prov. FORMOSA. Dept. Pilcomayo: ca. 12 km E of Laguna Blanca (Landolt and Zarzycki 152/83, 153/83, 153b/83, 156/83: ZT).

Prov. JUJUY. Dept. Humahuaca: Humahuaca (Venturi 8231: GH, US). Dept. Santa Barbara: El Piquete (Burkart et al. 30413: SI); Santa Barbara (Fries 371: F). Dept. Tilcara: Huacalera (Burkart et al. 30414: SI). Dept. Tumbaya: Volcan (Meyer et al. 21.145: LIL). Banfield (Guarlerie 48: LIL). Piquete (Fries 485: S).

Prov. LA RIOJA. Dept. La Rioja: La Rioja (Burkart 12283: SI). Las Canas, camino al Catadero (Hunziker 5049: CORD, LIL).

Prov. MENDOZA. Dept. Lujan de Cuyo: Lujan de Mendoza (Ruiz Leal 11551, 11552: MERL). Dept. Tunuyan: Without exact locality (Ruiz Leal 5415: LIL, MERL, ZT).

Prov. RIO NEGRO. Dept. Conesa: China Muerta (Hunziker 494: LIL). Dept. General Roca: Cervantes (Burkart 15944: SI, ZT; Giradelli 1970 lists the sample under L. parodiana). 40 km W de la poblacion de Rio Colorado (Ruiz Leal 25500: CORD). Isla Chaele Choel (Ruiz Leal 26135: CORD).

Prov. SALTA. Dept. Capital: El Jardin (Novara 2156: MCNS). Dept. Molinos: Molinos (s.coll. 1/1897: LP). Dept. Oran: Bollivion Agua Linda (Barsini 727: LIL); Tarija (Eyerdam and Butle 22854: G, GH, MO, UC). Parque Nacional El Rey (de Sloover 75/432, 75/436-437: BR; Landolt 9/83: ZT). Rio Calchaqui, El Chural (Castellanos 45816: BA). Sianbon (Lorentz and Hieronymus 1024: CORD, GOET, KANU; Meyer 23048: LIL).

Prov. SAN JUAN. Sierra del Valle Fertil, Toma de los Alvares (Hunziker 16740: CORD).

Prov. SAN LUIS. Dique Cruz de Piedra (Ruiz Leal 13128, 13129, 13130: CORD, ZT; Hunziker 9316: ZT); Dique Potrero de Funes (Hunziker 9306: CORD, SI, ZT).

Prov. SANTA CRUZ. Peito Morano, Chacra de Cabeza (Roivainen 2372: H).

Prov. SANTA FE. Dept. Capital: N of Esperanza, N of Rio Salado (Landolt and Zarzycki 75/83: ZT; ZT* 8815); ca. 12 km N of Esperanza (Landolt and Zarzycki 76/83: ZT); ca. 15 km N of Esperanza (Landolt and Zarzycki 77/83, 78/83: ZT); Rio Salado RN 4 (Landolt and Zarzycki 79/83, 80/83: ZT); Rio Salado RN 62 (Landolt and Zarzycki 82/83, 83/83, 84/83, 85/83: ZT); Santa Fé (Burkart 9073: SI, ZT. Dept. Caseros: Between Chabas and Villada (Hunziker 16584: CORD). Dept. Grl. Lopez: Santa Emilia (Hunziker 16592: CORD); Venado Tuerto (Troncoso 12045: SI, ZT). Dept. Rosario: Rosario, camino Venado Fuerto (Troncoso 5284: SI). Dept. Vera: 12 km S of Cachaqui (Landolt and Zarzycki 91/83, 92/83); ca. 9 km E of La Gallareta (Landolt and Zarzycki 96/83: ZT); Laguna La Gallareta (Landolt and Zarzycki 99/83: ZT).

Prov. SANTIAGO DEL ESTERO. Dept. Ojo de Agua: Tala Yacu (Piccinini and Hilfer 3739: BAB). Dept. Termas: Termas, Rio Hondo (Legnome et al. 19Ar068: LIL). Cado del Rio Dulce (Hunziker 7651: CORD, ZT).

Prov. TUCUMAN. Dept. Burreyacu: Marino (Peisano 820: LIL). Dept. Famaila: Rio Lules (Meyer 3349; Schreiter 4112: LIL; Venturi 2076: GH, S, SI). Dept. Rio Choco: Dique Escabae (de la Sola 1080: LIL). Dept. Tafi: Ruffreuli (Infranfes 4213: LIL); Roth s.d.: LP).

BOLIVIA

Dept. Cochamba: Cochamba (Julio II.196: US). Dept. Cordillera: Abapo, near Rio Grande (De Sloover 75/233: BR). Dept. La Paz: Ulloma (Asplund 74: S, UPS); La Paz (Beck, Ramirez 2889: VALD, ZT; Raynal 21349: P, ZT); Lake Titicaca (Collot 11; Raynal and Collot 21444: P, ZT; Liberman et al. 1986: CAME, ZT); Huatajata (Zuber: ZT* 8753); Tiwanaku (Raynal and Collot 21465: P, ZT). Dept. Larecaja: Sorata (Mandon 1457: JE, MO, STU; 1897: G, GH; 1457: MO, STU). Dept. Oruro: Sajama (Klein: ZT* 8667, 8671). Dept. Potosi: Potosi (Lüönd 8903: ZT).

BRAZIL

RIO GRANDE DO SUL. Porto Alegre (August 538: MPU); Rio Grabyba (Reineck 7/1896: BA, LY).

CHILE

Prov. Aconcagua: Los Moles (Rose 22/10/1914: US). Prov. Antofagasta: San Pedro (Barrot 3761: GH). Prov. Coquimbo: La Serena (Ramirez: ZT* 8893). Prov. Nuble: Laguna San Carlos (Navas 3341: SGO). Prov. Santiago: Blanqueado (Espinosa 3/2/1936: SGO); Maipù (Kummerow: ZT* 7261, ZT* 7262); Quebrada de Macul (Navas 1961: SGO); Santiago (Hastings 597: CU, UC, US; 598: CU, UC; Joseph 2887: US; Philippi 1/1871: SGO; 1904: BM). Prov. Tarapaca: Bofedal de Parinacota (Escobar 1961; s. coll. 2887: VALD, ZT). Prov. Valdivia: Valdivia (Philippi 1/1871: BM, SGO). Prov. Valparaiso: Limache (Garavante 346: GH); Valparaiso (Bertero 1830: BR).

COLOMBIA

Dept. Cundinamarca: Bogota (Holten 23/11/1852: AC, G, GH, MO, PH, STU; Hélier 18/8/1910: G; Triana 682bis: MO, US; s.coll. 5/1856: BM); Bosa (Aguirre 184: COL).

ECUADOR

Prov. Imbabura: Lago San Pablo (Asplund 7226: R, UPS, US; Camp 3254; Fagerlind 1325: S); Lago de Cotalo (Spruce 5064: BM, C, G, GH, GOET, LE, MO).

PARAGUAY

Dept. Boqueron: Santa Elisa (Hassler 2497a: G). Dept. Presidente Hayes: Transchaco-Rio Negro (De Sloover 75/81: BR).

PERU

Dept. Cuzco: Chincheros, Lake Piuray (King et al. 270: F, ZT); San Geronimo (Landolt-Stadler: ZT* 7611); San Pedro (Lüönd: ZT* 8901); Saylla (Iltis 1208: UC). Dept. Huambulio: Valle de Oropesa (Herrera 2081: F, US). Dept. Lima: Chancay (Eyerdam 9081: UC); Laguna de Villa (Fernandez: ZT* 7798); Boza (Cabrera 10874: LP). Dept. Puno: Lake Titicaca (Bollinger: ZT* 8445; Charpin 12741: G; Ellenberg 21/3/1957: U; Landolt-Stadler: ZT* 7613).

URUGUAY

Dept. Canelones: Carrasco (Herter 85071: B, F, G, GH, M, MO, R, RB, S, U, UC, US, Z, ZT). Dept. Montevideo: Miguelete (Herter 85483: F, G, GH, M, MO, MPU, NY, S, U, UC, US, Z, ZT); Montevideo (Archavaleta 1899: LY; Commerson s.no.: G; Herter 68131: F, GOET, M, MO, U, WIS, ZT; Osten 3399, 3565, 3614: ZT; Schwager 6: PH); Penarol (Herter 91329: GH, U, Z, ZT); Pocitos (Herter 70258: B, BH, F, G, M, MO, MSC, NY, S, U, UC, WIS, Z, ZT; 70512: B, F, G, GH, K, MO, MSC, S, SP, U, UC, Z, ZT). Dept. San

José: Without exact locality (Herter 87850: B, ZT). Dept. Trenta-y-Tres: Without exact locality (Herter 3/12/1882): RB).

ATLANTIC OCEAN

CANARY ISLANDS

Gomera: Agulo (Laegaard 71-7861: AAU). Gran Canaria: Artenara (Linguist 14/6/1954: GB); Monte (Murray 5/1894: BM, LE); Banadero (Hulten 12/1966: S); Barranco (Grau 130: C); Las Lagunetas (Schotsman: ZT* 8266); Los Balinos (Gelert 10/4/1897: C); without exact locality (Murray 14/5/1892: G; Ex. Herb. Sonder 979: MEL; Despréaux 1837: G). Tenerife: Puerto de la Cruz (Hauser: ZT* 7537); Santa Urusula, Barranco de la Cruz (Asplund 520: B, G, S); Icod (Asplund 14/4/1933: S); Val du Bufadero (Bourgeau 1845-1846: FI); Tezina (Bornmüller 2869: G, JE, LE, MO, P, STU, Z); Orotava (Pitard 683: FI, MPU, P); Santa Cruz de Tenerife (Pitard 684: G, MO, NSW); without exact locality (Bourgeau 498: BM, G, K, LE, P; Gandoger 6/1906: LY, MO).

MADEIRA

Funchal (Hansen 3/1/1969: C; Trelease 6/11/1896: MO). Machico (Lowe 23/4/1865: BM, K, LE). Magdalena (Lowe 21/5/1863: BM, LE). Ribo de Seixo (Lowe 986: G, K).

ST. HELENA

HEGELMAIER (1895) referred to a specimen collected by Mellis which, in my opinion, belongs to L. minor.

EUROPE

ALBANIA

No known record, but certainly occurring in the plain.

AUSTRIA

Rather frequent in Burgenland, Lower Austria, Upper Austria; lacking or only temporary in other regions.

BELGIUM

Rather frequent, except in the mountains of siliceous rocks.

BULGARIA

Rather rare and only in the East: Burgas, Varna.

CZECHOSLOVAKIA

Rather frequent at lower altitudes.

DENMARK

Rather frequent.

EIRE

Rather frequent.

FINLAND

Aland, otherwise rare and only temporary.

FRANCE

Frequent in the Atlantic and Mediterranean region; lacking in the Alps and Pyrénées.

FRG (West Germany)

Rather frequent at lower latitudes; lacking or rare in the southern part and in the mountains of siliceous rocks.

GDR (East Germany)

Rather frequent.

GREECE

Rather frequent at lower altitudes except on most of the islands. Known records from Macedonia, Thessalia, Aitolia, Attica, Argolis, Lesvos, Mythilene.

HUNGARY

Frequent.

ITALY

Frequent at lower altitudes.

NETHERLANDS

Frequent.

NORWAY

Only temporary (Oslo-Aker).

POLAND

Rather frequent at lower altitudes.

PORTUGAL

Rather frequent.

RUMANIA

Frequent at lower altitudes.

SPAIN

Frequent at lower altitudes, except in the North.

SWEDEN

Rather frequent in the South; northwards scattered to Gävle (LAGERBERG 1947).

SWITZERLAND

Many records, but only temporary.

TURKEY (European part)

Frequent (UOTILA et al. 1983).

UNITED KINGDOM

Frequent in the South; northwards scattered to Yorkshire.

USSR (European part)

Rather frequent in the South: Moldaviya. Southern Ukraina (included Krym: e.g. Mezin Natural National Park: USTYMENKO 1984). Southern Rossiya (e.g. Khopersk State Res., see PECHENYUK 1984). Lowlands around the Kavkaz. Otherwise rare and only temporary.

YUGOSLAVIA

Rather frequent, but only at lower altitudes.

AFRICA

ALGERIA

Mostaganem (Balansa 1851: G). Letouriense (Favrat 1118: ZT). Tilila near Aïn Sefra (Hochreutiner 296: G). Mares de Lenhadja, Bône (Letoureau: MPU). Aflou (Leiner 40lbis; Roux s.no.: MPU). Prov. Oran: Sidi-bel-Abbes (Wariouz 1/2/1873: BH, FI, G); Tafraoua (Wariouz 10/6/1868: STU). Berrouaghia (Roux 5/5/1862: MPU). Alger, Mustapha (Trabut 1874: MPU). Sfid (Wariouz 28/10/1871: G). Bouira, O. Tiaret, Tlemcen (MAIRE 1957).

EGYPT

Alexandria (Duparquet sn.: JE; Schweinfurth 15/12/1873: G, STU, Z). Beheira, Kafr el Dauwâr (Ibrahim: ZT* 7400; Mahdi 26/7/1970: MO, U). Bentra (Schweinfurth 22/12/1873: G, STU). Beiro (Sickenberger 3/1880: Z). Cairo, Garden Dokki (Saad: ZT* 7320); Giza (Sisi 1970: AAU, ZT* 7367); Sandhanhur (Mahdi: ZT* 7372); Choubrak (Figari 12/1847: FI); Abbasia (Hassib 26/7/1929: K, LE, U; 17/4/1934: CAL, G); Embaba (Sisi 20/8/1974: AAU, AD, H, LL, MO); Abu Zabal (Simpson 2099: K). Dakhla Oasis (Ascher-son 22766: GOET, JE, M, STU; 4/1876: B; Anderson 2, 3, 5: STU; Simpson 6113: K). El Fayum (Ascher-son 17/3/1876: LE, P; Anderson 4: STU; Barbey 820: G; Deflers 1242: MPU; Täckholm 21/11/1926: S; Schweinfurth 27/3/1879: GOET, STU, Z; 29/3/1879: Z; 30/3/1879: G, US; Leupi 25/8/1981: ZT). El Kharga (Meinertzhagen 3/1928: BM; Simpson 2412, 2413: K). El Merq (Simpson 282: K). Fayara Canal (Simpson 3962: K). Rosetta (Muschler 3/1906: K; Sickenberger 1880: Z). Helman near Nile (Muschler 3/1906: K). Kafr Shoukr, Niam (Mahdi: ZT* 7377). Lower Egypt (Sickenberger 9/1892: NY). Mahalett, El Rahabein (Mahdi: ZT* 7374, 7375). Menzaleh (Muschler

3/1904: K). Nazlet el Ashtar (Simpson 5259: K). Nile Delta, Zagazik (Hartmann 26/1/1911: MPU). Ramleh (Scott 3648: BM). Thonbert (Sickenberger 1880: Z).

ETHIOPIA

Prov. ERITREA. Acroun (Schweinfurth 764: BR, G, K, LE, P, STU, Z). Almeraza, Larva (Schweinfurth 1669: STU); Keren (Schweinfurth 989: STU). Anseba (Pappi 5055: EA, MO, NY, UC, US). Asmara (Schweinfurth 444: STU). Ferfer (Schweinfurth 126: Z). Halai (Schweinfurth 124: Z). Hamasen (Pappi 1228, 3228: EA). Mai-Mefales (Schweinfurth 123: Z). Saganeiti (Fiori 7/3/1909: FI; Schweinfurth 899: BR, G, K, LE, P, STU, US, Z).

Prov. SHOA. 30 km E of Addis Abeba (Klötzli: ZT* 7784); Koka Lake (Ash 577/B: EA). Mt. Zuquala (Meyer 7501: K, MO).

Prov. WELO. Lalibela (Albers 62023: TEX).

KENYA

Kajiado Distr.: Namanga River Hotel, Namanga (Greenway 8795: EA, K, PRE); Magadi Junction, Ondoni River Side (Prescott 1926: BM). Machakos Distr.: 14 Falls, Ol dan Sapuk (Verdcourt 718B: EA, MO); Chai Springs (Brown s.no.: EA); Kibwezi (Bramblett: ZT* 7127). Masai Distr.: Amboseli National Park, near Ol Tukai (Verdcourt 3107: BR, K, PRE); Taberer's New Lake (Verdcourt 3116: EA, K, L, PRE, UT). Narok Distr.: Nsampolai Valley (Greenway and Kanuri 15.457: EA, K, MO). Tvaso East Distr. (Leuthold: ZT* 7357). Tvaso West Distr.: Mzima Springs (Gilbert 4082: EA, K; Landolt: ZT* 8431). Lukenya (Agnew 8964: C, MO). Mt. Kenya, Nyeri (Leuthold: ZT* 7639).

MOROCCO

Agadir (Leuthold s.no.: ZT). Aim Chokk (Pitard 1428: K). Ain Kahla (Jahadiez 822: MPU). Asni (Greater Atlas) (Hooker 5/1871: K; Lindberg 3116: B, H). Casablanca (Mouret 1161: P). El-Chasun (Gandoger 6/1909: G, L, MO). Dar Chaoui (Pitard 142: P). Ducertem (Weiller 1: MPU). Ifni, Arksis (MATHEZ 1973). Dayet Achlef (Maire 15/8/1924: MPU). Marrakech (Braun-Blanquet 4/1921: ZT; Lindberg 2979: H, W; Maire 3/4/1921, 20/7/1926: MPU; Raphélis 4/4/1930: MPU). Melilla (Mauricia 17/3/1933: BM, MPU). Lagar (n'Bair) (Faurel 28/7/1938: MPU). Rabat (Lindberg 1723: H, K, MPU, S). Rabat-Casablanca, Qued Cherrat (Lewalle: ZT* 8384). Route de Mazagan (Gattefossé 2019: MPU). Salé (Jahadiez 32: BM, MPU, Z). Sidi Teali (Pitard 1427: K). Tanger (Pitard 209: G, P).

RWANDA

Mugusa Distr., Grafumba, Nyamashke swamp (de Sloover 1972: BR).

SOUTH AFRICA

CAPE. Grahamstone, Great Fisher River (Preez: ZT* 7219); Koonap River (Preez: ZT* 7218). Stellenbosch, Jonkershoek (Kruger: ZT* 7245); Kuilsriver (Oliver: ZT* 7249). Uitenhage Distr.: Zwartkops River (Drège 8812: LE, S; 84: G, K; Ecklon 10/1829: S); Uitenhage (Thode A1090: PRE); New Road Bridge (Mauve and Wells 52: L, PRE); December River, Coega Hills (Zeyher 512: Z; s.coll.: CAP, BM). Cape Flats, Cape Town (Ecklon 456: MO; Mauve 4620: PRE; Parker 4659: K); Isoetes Olei (Mathews 13/1/1969: CAP); Prices Valley (Marloth 8605: PRE); West London (Phillips 1219: CAP). Longstad (Ecklon 1828: S). Bird Island, between Port Elisabeth and Port Alfred (McGill 3: PRE). Port Elisabeth (Sucheland 8/1865: STU). Skiereiland Distr. (Le Roux 1/1959: PRE). 40 km from Alice to Peddie (Stirton 6217: PRE). Nieuwejaarspruit, between Garip and Caldon River (Zeyher 114.10: LE, MO, MEL, S). Without exact locality (Drège 8/1845: G, L).

NATAL. Alexanders Koek (Schlechter 5157: B, C, FI, G, LE, MEL, P, PRE, US, WU, Z). Hlabisa Distr.: Futululu (Strey 5760: K, PRE). Isipingo North Distr.: Pietermaritzburg, Fosmer Upper Mlayi Estuary (Ward 7333:

K). Without exact locality (Drège 8813: MEL).

ORANGE FREE STATE. Wesselsbron Distr.: Gelukwaarts (Mueller 1348: PRE). Vredefort Distr.: Parys, Vaal River (Obermeyer 31679: PRE). Westminster (McLean 18/1/1961: PRE). Rhenosterspruit (Mostert 664: PRE).

TRANSVAAL. Pretoria, Daspoort (Steijin: ZT* 7734); Rooiwal (Steijin: ZT* 7735). Potchefstroom, Toaibosspomit (Haynes 10/1/1968: PRE). Bon Accord Dam, 4 min N of Pretoria (Mauve and Schieben 9603: PRE). Hartebeespoort Dam (Winter 9576: PRE).

SUDAN

Hassaniya (Schmid 1875: Z).

TANZANIA

Prov. ARUSHA. Arusha Distr.: Amboseli (Klötzli: ZT* 8637); Tululuse National Park (Greenway and Kanuri 12.223: BR, EA, K, PRE); Ngorodoto Gate, Arusha National Park (Greenway and Fitzgerald 14.971: EA, K, PRE); Nurdoto National Park (Richards 21684: K, PRE); E of Mt. Meru, in Ngongongare (Richards 23320: K); Arusha National Park, Royden's Farm (Richards and Arasululu (26609: K); Arusha Town, ditch near Rail Road Lines (Wingfield 544: EA). Masai Distr.: Masailand, Arash (Greenway 9081: B, EA, K, PRE). Mbulu Distr.: Manyara National Park (Greenway and Kanuri: 11.807: BR, K); Chem Chem River, Lake Manyara (Greenway and Kirika 11.066: EA, K, PRE). Meru Distr.: Ngongongare (Peter 2616: B). Monduli Distr.: Ngorongoro Crater, northern end of Lari Forest (Greenway and Kanuri 12.583: BR, EA, K, PRE); Ngorongoro Crater, Pool (Gilbert 2678: EA); Geitokitok Springs (Verdcourt 1558: PRE). Mosuma Distr.: Moru Kopjes, Serengeti National Park (Greenway et al. 13.158: EA, K, PRE). Ufiomi Distr.: Lake Basseda near Babati (Peter 44103: B).

Prov. DODOMA. Kesese (Richards and Arasululu 28868: K).

Prov. IRINGA. Bura Lake, near Kondva-Iringa (Peter 44390, 44560: B).

Prov. MTWARA. 8 km SW of Kingupina (Vollesen 3068: EA).

Prov. SINGIDA. Singida Lake (Polhill and Paulo 2198: B, BR, K, LISC, PRE).

TUNISIA

Ain Cherichera (Rohlf's and Stecker s.no.: STU). Bab Bou Saadouse (Buxbaum and Schussnis 16/4/1924: WU). Gafsa (Pitard 508: CAL, G, MEL, NSW). Ghia Tunis, Bab Bon Sadoun (Buxbaum 16/4/1942: W). Ghia de Melassiur (Cuénod 1955: G). Sfax (Balansa 1851: P; Kralik 138: BM, FI, G, MPU, P).

UGANDA

Kizegi Distr.: Rubanda Co., Kagyezi, E of Ikumba (Lye 735: K).

ZAIRE

DAUBS (1965) cited a specimen of L. gibba ("Van Laesengonck 1875") from F which I did not see.

NORTHERN AND WESTERN ASIA

AFGHANISTAN

Prov. Badgis: Murghab (Köie 4291: C). Prov. Bamyan: 20 km W of Charikar (Uotila 18742: H). Prov. Ghazni: Ozak-Behzud (Rechinger 17971: M). Prov. Kabul: Kabul (Gilli 27/10/1950: W). Prov. Kataghan: Kunduz (RIEDL 1976). Prov. Mayar i Sharif: Balekh (Gilli 31/12/1950: W). Prov. Nuristan: Wama (Edelsberg 1170: C). Without exact locality (Griffith 5615: K, P, STU).

IRAN

Azarbaijan: Urmia (Knapp 2/7/1884: WU); Khvoy (Knapp 22/5/1884: WU). Fars: Lar-Basttak (Wendelbo 1/3/1977: W). Gilan: Bandar e Pahlavi (Mosadegh 10/1970: ZT); Astara (RIEDL 1976). Mazandaran: Ramsar, Ghassem Abbath (Landolt-Stadler: ZT* 8291); Barfurush (s.coll. 1909: B); W of Shapasand (Uotila 16006: H).

ISRAEL

Golan, Birket Ram (Lipkin: ZT* 7642). Hadera, Birket Batih (Lipkin: ZT* 7641). Hurfeish (PORATH et al. 1979). Tiberias (Peyron 1/6/1884: G). Jerusalem (s.coll.: P).

JORDAN

El Azraq (Townsend 65/325: G, K).

LEBANON

Tyr (Mouterde 6777, 10402: G).

SAUDI ARABIA

Asir, Baha, 2020 m (Büttiker: ZT* 8682); Fare (22°45'N/39°47'E) (Büttiker 7/5/1985: ZT).

SYRIA

El Qanawat (Mouterde 6960: G); Es Suweidiya (Mouterde 13/4/1951: G); Jebel ed Druz (Combault 119: G, P). Hauran (Peyron 1890: G). Kuneitra (Pabot 17/5/1953: G).

TURKEY (Asian part)

(UOTILA et al. 1984). Rather frequent: Adana. Afyon. Agri. Ankara. Antakya. Antalya (Heisler s.no.: WU). Aydin. Balikesir. Bitlis. Bolu. Bursa. Canakkale. Denezli. Isparta. Izmir. Kayseri. Konya. Malatya. Muala. Mus. Natay. Sakarya. Samsun. Lesvos Island.

USSR (Asian part)

Only in the Southwest.

AZERBAYDZHANSKAYA SSR. Orjesminosmin, Isnin (Expeditio 842: LE).

GRUZINSKAYA SSR. Tbilisi (Hausknecht s.no.: JE).

ROSSIYSKAYA SFSR. Astrakhan Oblast, Astrakhan (De Bengé s.no.: P).

UZBEKSKAYA SSR. Bukhara (Paulsen 1729, 17/5/1899: C).

YEMEN

Bait Nam, Bilad Bustan (Deflers 620: P). Raisi (Radcliff 4581: K). Shibam (Hepper 5789: K, MPU).

SOUTHERN AND EASTERN ASIA

INDIA

GUJARAT. Khaira, Anand (Yogi: ZT* 7705).

JAMMU AND KASHMIR. Dal Lake (Stewart 3379: L, MICH, MO, UC). Nadapoka (Kake 3905: KASH). Padar (Stewart 2955: MICH, UC). Rampur (Stewart 12132: G, L, MO, PEN, S). Shalleng (Kake 3816: KASH). Sind Valley (Stewart 7159: NY, PH, S). Srinagar (Klötzli: ZT* 8678).

PUNJAB. Gurdaspur (Stewart 1329: MO, NY, PH).

JAPAN

HAMASHIMA (1974). OTAKI (in lit. 1978).

HONSHU. Aichi, Ama, Yatomi-cho (Hamashima: ZT* 8703). Osaka, Sakei (Umeura: ZT* 8704). Shizuoka, Fuji (CESKA 1984).

PAKISTAN

Hazara Distr.: Shogran (Parker 3405: B, GH). Punjab, Keshapur (Koelz 1625: LE, MICH); Rawalpindi (Stewart 13825: MO, UC). Swat State, Ambela Pass (Johnston 11: CAL). Karachi Div., Karachi (YUSUF and OMER, mscr., 1986). Khaipur Div., Rohri (YUSUF and OMER, mscr., 1986). Quetta Div., Quetta (YUSUF and OMER, mscr., 1986).

PHILIPPINES

The record from Blanco (cf. HEGELMAIER 1895) refers to a specimen of S. punctata (see also VAN DER PLAS 1971).

AUSTRALIA AND NEW ZEALAND

AUSTRALIA

All records from Australia refer to L. disperma.

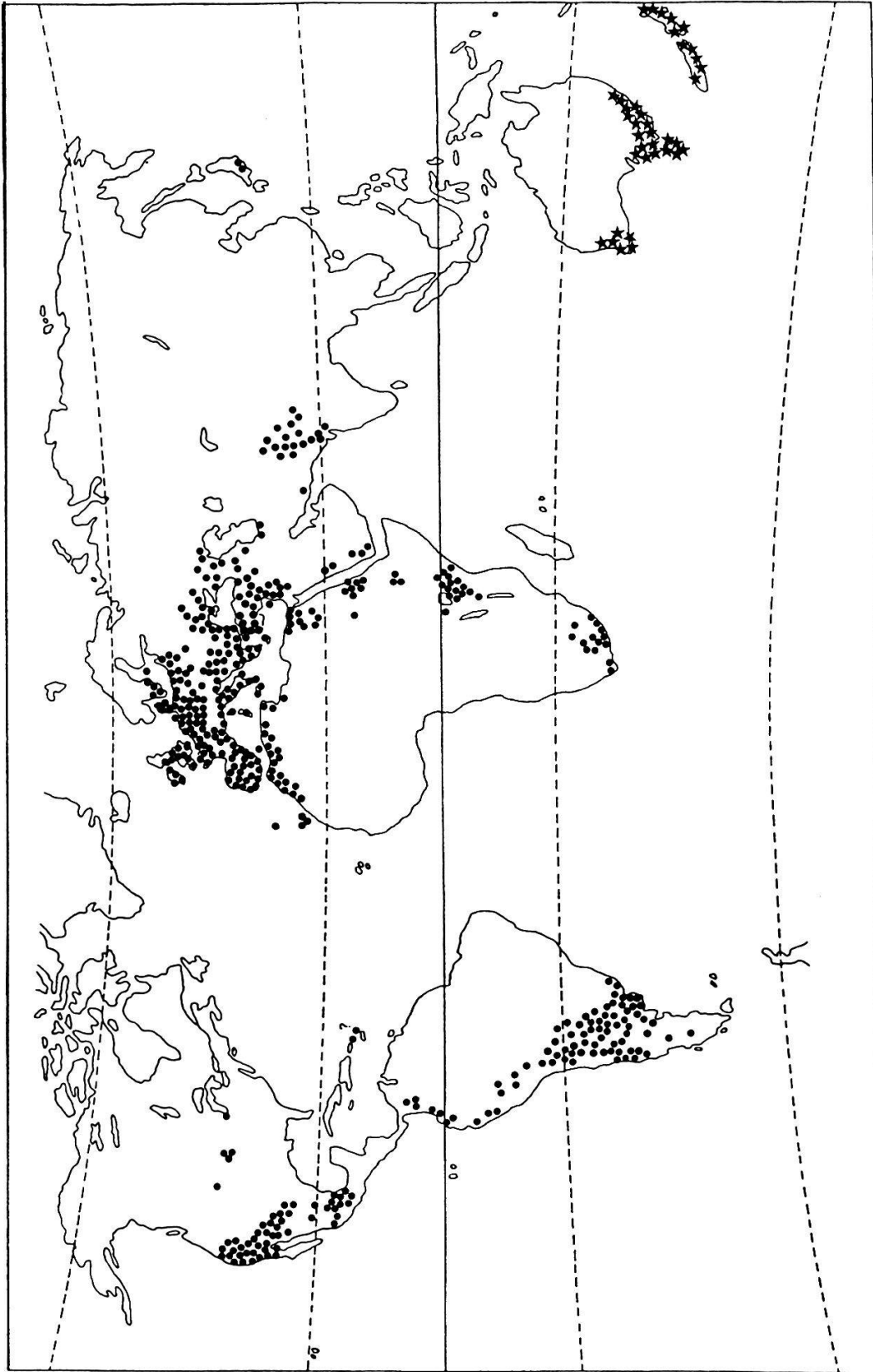


Fig. 6.7. Distribution of Lemna gibba (●) and L. disperma (★)

6.1.3.5. Lemna disperma (fig. 6.7)

L. disperma is a species endemic to Australia and New Zealand. All records from other parts of the world (e.g. America, c.f. GIARDELLI 1941, DAUBS 1965) refer to L. gibba.

AUSTRALIA AND NEW ZEALAND

AUSTRALIA

AUSTRALIAN CAPITAL TERRITORY. Canberra, Murray's Dairy (Stein: ZT* 7223).

NEW SOUTH WALES. Albury (MacBarron 4624: NSW). Dubbo (Beck 5/1960: MEL, NSW). Eastwood (Evans 95857: AD). Griffith (Sainty 78984: AD, NSW). Junit of the Darling and Murray River (Holding 1889: MEL). Lachlan River (Bennett 2: MEL). Murrumbidgee (Cunningham 5/1894: FI). Nevertire (Gray 91096: AD). Rankins Springs (Sainty 83301: AD, MEL, NSW). Singleton (Landolt: ZT* 8729). Wagga Wagga (Palmer 89350: AD). Without exact locality (Mueller 1854: LE).

SOUTH AUSTRALIA. Adelaide (Eichler 12240, 13706, 14865, 19727, 19799b: AD). Bow Hill, Murray River (Eichler 17192: AD). Comaum (Hunt 1527: AD). Flinders Island (Cleland 24/11/1912: NSW). Glencoe West (von Wattenwyl: ZT* 7818). Mt. Gambier (von Wattenwyl: ZT* 7842; Jute: MEL). Millicent (Schomburgk s.no.: AD). Narrung (Eichler 19738-40: AD; Williams 377b, 388, 390: AD). "Native Wells" (von Wattenwyl: ZT* 7816a, 7816b). Piccaninie Pond (von Wattenwyl: ZT* 7761). Port MacDonnell (Copley 1787: AD; Cornwall 152: AD); Piccaninie Blue Lake (Eichler 18147: AD). Torrens Gorge (Eichler 19795: AD). Wellington (Eichler 15680, 15682: AD; Jackson 73: AD); Lake Alexandrina (Eichler 15679: AD).

TASMANIA. George Town (ex Herb. Kew s.coll.: STU). Hobart (Eichler 16898: AD). King Island (Kibbin 11/1887: MEL; s.coll.: MEL); Lewisham (Morris: ZT* 7268, 7281); Pittswater Estate (Turnbull: ZT* 7782). Sister Island (Whinray 283: MEL). Sorell (Morris: ZT* 7269, 7301; Eichler 16863: AD). Sandy Bay (W.W.S. 202: WU). Tin Kettle Island (Whinray 1574: MEL). Woody Island (Whinray 1705: MEL). Without exact locality (Gibbs 1915: BM; Gunn 1863: C, CAL, FI, G, GH, GOET, L, LE, M, MO, P, STU, WU). VICTORIA. Allendale (Schomburgk 16/11/1882: AD). Ballarat, Lake Wendouree (Aston: ZT* 7316); Skipton (Aston: ZT* 7259; 1781: MEL). Benalla (Aston W.S. 3: MEL). Brighton (Parker 29/4/1910: MEL, S). Camperdown (Aston 1791: MEL). Colac (Meek 5/6/1962: MEL). Columa (Melville 3878: K, MEL). Dandemong (Melville 2934: K, MEL). Darby River (Audas 9/11/1908: MEL). Darwin River (Oldfield s.no.: STU). Dundas (Reader 1885; 15/9/1905: MEL). East Gibbsland, Brodrripp River, Middle Inlet (Melville 2934: K, MEL); Lake Corringe (Beaglehole 35338: MEL); Lake Victoria (Beaglehole and Barbon 37780, 37781: MEL); Metung-Swan Beach Road (Beaglehole 37665: MEL). Greelong (Wildon s.no.: MEL). Gormanale, Merriman Creek (Young: ZT* 7777). Gramians (Beaglehole and Orchard 30489B: MEL); Wannon River (Beaglehole 30597: MEL). Lake Terang (Mueller 4/1874: MEL). Lake Tyus (Lauterbach 5320: L). Landringham (Williamson 11/1910: MEL). Melbourne (Adamson 514: L; Eichler 16999: AD; Mueller 514: K; Reader 1885: MEL); Altona (Sonnenberg: ZT* 7190; s.coll. 17/2/1904: MEL); Warneet (Aston: ZT* 7276). Merri Creek (Morrison 20/2/1894: PERTH). Nelson,

Lower Glenelg River area (Beauglehole 17082: MEL). Portland (Beauglehole 17083: MEL). Quail Island, Western Port Bay (Melville and Willis 2121: K, MEL; Willis 23/10/1952: MEL). Rosebud, Mornington Peninsula (Melville and Walkerfield 2245: K, MEL). Rosedale Shire, 15 mi ESE of Sale P.O., Lake Coleman (Beauglehole 38230: MEL). Stieglitz, Brisbane Range (Willis 23/10/1955: MEL). Tyrendarra (Orchard 1990: AD). Vectis South, 10 km WSW of Horsham, Wimmera River (Copley 1822: AD). Victoria Valley, 15 km N of Dunkeld (Orchard 1975: AD). Warrambool (Williamson 3/1902: MEL). Williamstown (Morrison 30/3/1895: BRI, PERTH). Yarra Yarra (Mueller s.no.: MEL).

WESTERN AUSTRALIA. Albany (Landolt 51/81: ZT). Bibra Lake (Landolt 44/81: ZT). Dandaragan (Horker 87152: MEL). Gingin (Landolt 39-41/81: ZT). Hay River (Landolt 50/81: ZT). King River, near Albany (Darling: ZT* 7767). Lake Lefroy (Cronin 1893: STU). Pemberton (Selling 20/8/1949: S). Perth (Landolt 27/81: ZT; Marchant 23/11/1960: PERTH); 43 km N of Perth (Marchant 132: PERTH). Stratham (Landolt 46/81: ZT). Swan River (Drummond 1854: G, K, L, STU). Tow Peaples Bay (Landolt 83/81: ZT). Wanneroo (Landolt 31-33/81, 35/81: ZT; ZT* 8717).

NEW ZEALAND

NORTH ISLAND. Auckland (Case: C; Kirk 1/1865: WELT; Petrie: WELT, Z; 12/1895: WELT). Blenteren, Malborough (Reader 29/2/1880: MEL). Hutt (Bergren 1874: G, H). Otaki Beach (Bo 22/11/1955: WELT). Umarua Bay (Lauterbach 4683: L). Wairakei (Setchell 1904: L, UC). Wellington (Kirk: s.no.: GH, L). Between Hastings and Edge (Kirk 6/3/1883: WELT).

SOUTH ISLAND. Lincoln (Kirk: KANU). Malborough, Awatere Valley (Petrie 1922: WELT). Waikouaiti (Petrie 30/1/1891: WELT). Lake Wanaka (Petrie 4/12/1890: WELT).

6.1.3.6. Lemna minor (fig. 6.8)

L. minor is probably native to the cooler, rather oceanic regions of North America, Europe, Africa and western Asia. It is presumably introduced in southern Australia, where it is very localized, and in New Zealand, where today it is rather frequent and widespread. The first records from New Zealand date as far back as 1865 (Auckland: WELT) but New Zealand is so far distant from the next area with a native occurrence of L. minor (about 12000 km to northern India or California) that the indigeneity of the species in New Zealand is very unlikely. L. minor occurs northwards to about 50° NL in Canada and to about 66° NL in Scandinavia.

L. minor is often confused with other species (e.g. L. turionifera, L. disperma, L. obscura, L. japonica, L. aequinoctialis). Therefore, many indications in the literature of L. minor refer to other species.

NORTH AMERICA

CANADA

BRITISH COLUMBIA. Confluence, Palmer Creek (Buchanan: ZT* 8215). Merritt (McCabe 4487: UC). Port Haney (Macoun 62499: CU). Quamichan Lake (Melburn 26/8/1964: DUKE. Saanich, Elk Lake (Baillie: ZT* 7730). Vancouver Island, Vancouver (Stein: ZT* 7165).

NEW FOUNDLAND. SCOGGAN (1978) reports L. minor from the South. The indication might refer to L. turionifera.

ONTARIO. Bridgenorth (Giles: ZT* 8438). Bruce Peninsula (Hanes: ZT* 8328); Atwood (Remple: ZT* 8324); Grimsey (Hume: ZT* 8325); Whitefish Lake (Garton: ZT* 8330). Byron Bog (Hume: ZT* 7769). Grey Co., Shallow Lake (Catling and McKay: ZT* 7582). Lamable (Giles: ZT* 8440). Niagara Peninsula, Stinking Barn (Giles: ZT* 8434). Norfolk Co., Deer Creek (Hume: ZT* 8299). Ontario Co., Claremont (Catling, McKay: ZT* 7565); St. Catharines, Guelph (Giles: ZT* 8436); Thorold (Giles: ZT* 8435). Peel Co., Brampton (Catling, McKay: ZT* 7584). Pinery Prov. Park (Hume: ZT* 7772). Toronto, 120 km E of Toronto, Garden Hill (Landolt-Stadler: ZT* 7697). York Co., Highland Creek (Catling, McKay: ZT* 7567); Ajax (Sparling: ZT* 7575); Whitby Marsh (Goepfert: ZT* 7572). Carleton Co., Ottawa (Dore 16388: GH, US); St. Bridge, Ottawa (Dore 47-1268: MO, UPS; 37-1267: MO). Fronterac Co., Sharbot Lake (Dore 13905: ILL, MICH). Rockton (Daubs 504: ILL). Niagara River (Daubs 506: ILL). Thunder Bay Distr.: Port Arthur (Garton 1712: G). Rainy River Distr.: Rainy River Town (Garton 8602: MASS, MIN). Manitoulin Island, Wekwemikong (Grassl 2078: MICH). Sparrow Lake (Kirk 16: L). North Bay, Nippising (Marie-Victorin 45347: GB, GH). Lamark Co., Christie Lake (Soper 11466: MASS). Kent Co., Mitchell Bay (Shields 433: MO).

QUEBEC. Fort Lenox (Cody 6544: C, G, GH, H, SMU, UPS, W). Magdalen Island, Grinston (Fernald 13/8/1912: US). Rimouski Co., Bic (Fernald

967: CU, GH). Lac Brompton (Forest 16014: CM). St. Fulgence (Cayonette 73-515: G). St. Romuald (Cayonette 73-314: G). Lac Egan (Hamel and Brisson 15435: CM). Lac Willim (Hamel and Brisson 67147: COLO, VT). La Trappa (Louis-Marie 5/5/1931: UC). Longueuil, Ile Plate (Marie-Victorin 8453: GH, US). Ile Ste. Thérèse (Marie-Victorin 43523: C, CU, UC). Phillipsburg (Seymour 22733, 22823: AAU, VT). Papineau Co., Ottawa (Calder 675: MO, UPS).

SASKATCHEWAN. Saskatoon (Steves: ZT* 7123).

ILES ST. PIERRE (France)

(Arsène 143: GH).

U.S.A.

ALABAMA. Rare: Lauderdale Co., Limestone Co.; Madison Co.

ARIZONA. Rare: Cococino Co.

ARKANSAS. Rare: Fulton Co.

CALIFORNIA. Rather frequent.

CONNECTICUT. Frequent.

FLORIDA. Rare: Columbia Co., Glades Co.

IDAHO. Rare: Latah Co.

ILLINOIS. Rather frequent.

INDIANA. Rather frequent.

IOWA. Rather rare: Cedar Co., Decatur Co., Dickinson Co., Fayette Co., Guthrie Co., Johnson Co., Story Co.

KANSAS. Frequent, except in the West.

KENTUCKY. Rather frequent.

LOUISIANA. Rare: St. Tammany Par.

MAINE. Rather frequent, but only in the South.

MARYLAND. Rather frequent.

MASSACHUSETTS. Frequent.

MICHIGAN. Rather frequent.

MINNESOTA. Rather frequent.

MISSOURI. Rather frequent.

MONTANA. Rare: Flathead Co., Lake Co.

NEBRASKA. Frequent.

NEW HAMPSHIRE. Rather rare: Coos Co., Grafton Co., Hillsborough Co.

NEW JERSEY. Frequent.

NEW MEXICO. Rare: Rio Arriba Co.

NEW YORK. Frequent.

NORTH CAROLINA. Rather rare: Durham Co., Hertford Co., McDowell Co., Washington Co.

NORTH DAKOTA. Rare: Cass Co.

OHIO. Frequent.

OKLAHOMA. Rare: Adair Co., Alfalfa Co., Ottawa Co., Texas Co.

OREGON. Rather frequent, except in the Southeast.

PENNSYLVANIA. Frequent.

RHODE ISLAND. Frequent.

SOUTH DAKOTA. Rather frequent, except in the North.

TENNESSEE. Rare: Cocke Co., Greene Co., Maury Co., Stewart Co.

UTAH. Rare: Davis Co.

VERMONT. Frequent.

VIRGINIA. Rather frequent, but only in the East.

WASHINGTON. Rather frequent.

WEST VIRGINIA. Rare: Cabell Co., Mason Co., Wirt Co.

WISCONSIN. Frequent.

ATLANTIC OCEAN

ASCENSION

Middleton (Duffey 1958: K; Enden 113: K). Oreacknich Valley (Enden 113: K); Dampiers Arish (Enden 113: K).

AZORES

Terceira (Trelease 958: K, MO; Pico 27/3/1829: K). Without exact locality (Hunt 1922: K).

CANARY ISLANDS

Tenerife: Orotava (Pitard 683: FI, G, MO, NSW); Santa Cruz (Pitard 682: MPU, 684: P; Trelease 378: ILL); Tezina (Bornmüller 2869: G, JE, LE, MO, P, STU, Z; Gandoger 8/1906: MO).

MADEIRA

Funchal (Gonçalves 7/1926: GB; Persoon 6/1937: GB, H; Hansen 880: C). Magdalena (Lowe 597: G). Rio do Benito (Tutin s.no. BM). Storacarralen (Lindman 10/2/1885: S).

ST. HELENA

Without exact locality (Mellis 5/1869: K).

EUROPE

ALBANIA

Few records, e.g. 60 km NNW of Tirana (Baltisberger and Lenherr: ZT* 8744); Tepelene (Baldacci 28: WU). Probably rather frequent.

AUSTRIA

Frequent, except in the Alps where it is rare.

BELGIUM

Frequent.

BULGARIA

Frequent.

CZECHOSLOVAKIA (CSSR)

Frequent.

DENMARK

Frequent.

EIRE

Frequent.

FINLAND

Frequent, northwards to Kuusamo (66°⁰NL) (LAGERBERG 1947).

FRANCE

Frequent, except in the Alps and Pyrénées.

FRG (West Germany)

Frequent, except in the Alps and in the mountains of siliceous rocks, where it is rare.

GDR (East Germany)

Frequent.

GREECE

Frequent in the North, rare in the South and lacking on most islands, except Thasos, Lemnos, Mythilene, Kriti, Mykonos, Analysa, Ios, Keos (RECHINGER 1943).

HUNGARY

Frequent.

ITALY

Frequent, except in the Alps and in the South where it is rare.

LIECHTENSTEIN

Rather rare.

LUXEMBOURG

Rather frequent.

NETHERLANDS

Frequent.

NORWAY

Rather frequent in the Southeast, northwards scattered to Dönna (66°NL) (LAGERBERG 1947) and Meløy (66°33'NL) (ROWECK 1981); lacking in the Southwest.

POLAND

Frequent.

PORTUGAL

Frequent.

RUMANIA

Frequent.

SPAIN

Rather frequent, especially in the Northeast.

SWEDEN

Frequent in the South, northwards scattered to Amasjärvi (66°NL) (LAGERBERG 1947), Mansmyran (WISTRAND and LUNDQVIST 1977), Overtornea (66°NL) (ROWECK 1981) and Risträsk (66°30'NL) (FORSLUND and RUNDLOEF 1986).

SWITZERLAND

Frequent at low altitudes, rare in the Alps.

TURKEY (European part)

UOTILA et al. (1984). Rather frequent.

UNITED KINGDOM

Frequent, rare in the Scottish Highlands.

USSR (European part)

Frequent, especially in the West; northwards scattered to Kaninskiy Bereg (about 66-67°NL) (Andrejev 10/8/1928: LE; Mambeeb 6/1945: LE); rare in the East: Bashkirskaya ASSR: Belebey (Tangarov 18/6/1916: LE); Birsk (Korzchinsky 14/6/1886: LE). Kuybishevskaya Oblast: Burguruslan. Orenburgskaya Oblast: Graczewska (2/7/1915: LE). Tatarskaya ASSR: Kazan (Graf 320: LE; Korchinsky 31/6/1885, 31/7/1885: LE).

YUGOSLAVIA

Frequent.

AFRICA

ALGERIA

Alger (Durieu 22/6/1841: P; Gandoger 6/1879: BM, C, FI; Mayer 28/1/1889: FI). Aflou (Leiner 40lbis: MPU). Bône, Senhadja (Letoureau s.no.: MPU); Oran (HEGELMAIER 1868); Aumale (HEGELMAIER 1868). Frequent in the region of Tell (MAIRE 1957).

EGYPT

Sandanhur (Mahdi: ZT* 7376b). Wadi el Natrun (Waris 8029: K). Indications from the Lybian Desert (TÄCKHOLM 1974) probably refer to L. aequinoctialis.

ETHIOPIA

Prov. BAGEMDER. Siemen (Burnand, Klötzli: ZT* 7713); Siemen, Djinbar-Wans (Klötzli: ZT* 7753).

Prov. HARAR. Chercher Distr.: Mulata Mts. (Burger 3832: EA).

Prov. ERITREA. Ailet (Barbey 471: G, STU).

KENYA

Mount Kenya, Sirimon Track, Base Camp (Van Cotthem VC 1001: EA). The collection of Verdcourt 718B from Malachi Distr. contains L. aequinoctialis and L. gibba but not L. minor.

LIBYA

Darnah, Wadi Derna (Boulos: ZT* 7295). Ain Mara (MAIRE 1957).

MOROCCO

Larache, Boucharen (Mathez: ZT* 7650; Font Quer 21/4/1930: B, G, MPU, S, Z). Ain Kaafa (Faurel 11/7/1938: MPU). Moyen Atlas, Lake Ouiuane (Maire 23/6/1923: MPU). Agla (Bucher 31/5/1903: P). Ifni, Arksis (MATHEZ 1973).

MOZAMBIQUE

Sul do Save, Onhanombe (Exell and Mendocça 570: BM, LISC, SRGH).

RWANDA

Batwa Distr.: between Grisengi and Ruhengeri (de Sloover 5/2/1972: BR); Mukungwa Falls, Rwaza (de Sloover 23/2/1972: BR). Mugusa Distr.: Grafumba, Nyamashke (de Sloover s.no.: BR).

SOUTH AFRICA

CAPE. Grahamstown, "Rockeby Park" (Brink: ZT* 7210). Stellenbosch, Jonkershoek (Kruger: ZT* 7244); Kuilsriver (Oliver: ZT* 7250). Uitenhage Distr.: Zwartkops River (Drège 8812: LE: 8813: S); Kamachs (Long 1276: K, PRE). Tsitsikama (Krauss ex herb. Braun s.no.: FI, G, JE, MO, STU, Z; 5/1834: JE). Enon (Thode A2782: K, PRE). Cape Flats, Cape Town (Mauve 4620: PRE). Between Garip and Caledon River, Nieuwejaarspruit (Zeyer 114.10: LE, MEL, MO, S).

NATAL. Alberton (Lubke: ZT* 7789). Enseleni, Richard's Bay (Venter: ZT* 7346). Mbazwane (Mauve: ZT* 8249). Mzingazi Lake (Venter: ZT* 7363). Sordwana Bay (Botha: ZT* 8219; Raven 26124: MO; Vahrmeyer 658a: PRE, S). Umgeni (Franks 7/1913: NSW; Schlechter 3081: BM, G, K, LE, LY, NSW, S, Z). Zululand, Sordoma Swamps (Gerstner 709: PRE); Lake Mulange (Tuley 353b: PRE). Port Natal (Gueinzius 1847: G, MEL). Durban Distr.: Umklanga Rocks (Mauve 4373: PRE); Wentworth (Ward 5415: PRE); Isipingo North (Ward 5860, 5862: PRE); Pietermaritzburg (Ward 7333, 7675: PRE). Nkandla, Cubu Lake (Venter 3965: PRE). Mbazwane, 10 km S of Lake Sibayi (Ward 4931: PRE). Mkuze Swamps, Channel SW of Demezane Pan (Ward 7296: PRE). Lowermost Mkuze Swamps (Ward 7680: PRE). Hlabsia, Dukuduku Forst (Winter 8403: PRE).

TRANSVAAL. Albany Distr. (Lubke: ZT* 8389, 8391). Brits Distr.: Orocodi-be River (Mauve, Verdoom and Vahrmeyer 4309: PRE).

SUDAN

Prov. DARFUR. Jebel Marra (Lynes 3/1921: BM; Wickens 2917: K; de Wilde 5388: BR, K, WAG).

TUNISIA

Gafsa (Pitard 3/1903: ZT; 508: CAL, MEL, NSW). According to MAIRE (1957) not rare in the North.

UGANDA

Prov. Buganda: Masaka Distr.: Masaka (Denny: ZT* 7194). Prov. Kizegi: Rubanda Co., Muko (Lye and Lester 1019: EA, K, UPS); Kagyezi, E of Ikumba (Lye 735: K); Mushungero, Lake Mutanda (Thomas 2410: BM).

ZAIRE

Prov. KIVU. Parc National Albert, Kabare (Bequaert 5475: BR); Kasai Occidental, Mulungu (Hendrickx 4219: BE, EA); Luandjofu, 125 km de la route de Bukavu-Sake (Hendrickx 4916: BR); Etang de Burunga, région des lacs Mokoto (Hendrickx 5781: BR); Muhero, Mayaga (Liben 1587: BR). Nyamunyune (Hendrickx and Gilbert 5357: BR).

NORTHERN AND WESTERN ASIA

AFGHANISTAN

Prov. Kabul: Kabul (Podlech 28575: M). Prov. Maidan: Unai Pass (Podlech 12786: M); Wazir (Dieterle 780: M). Prov. Nuristan: Wama (Edelsberg 1170: C). Without exact locality (Griffith 5612: K).

IRAN

Gilan: Assalem (Wendelbo 17/7/1975: W); Asterabad (Sintenis 1361: B, BM,

G, K, LE, MO, MPU, P, STU, UPS); Bandar e Pahlavi (Mossadegh 10/1970: ZT; Uernakovskau 18/7/1927: LE); Lakidshan (Alexeenko 14/7/1902: LE); W of Rasht (Wendelbo 19/7/1975: W). Mazandaran: E of Chalus (Uotila 19330: H); E of Babol (Uotila 18369: Z); Barfurush (s.coll. 1909: B); Kalar-dasht (Termé 16/10/1971: W); Ramsar, Ghassem Abbath (Landolt-Stadler: ZT* 8292). Teheran: Teheran (Capus 4/1886: P). Fars: Dasht-e Arzham (RIEDL 1976).

IRAQ

Maydan (Wheeler W 875: K); Haruna (Gillet 3698: K). Beled near Bagdad (Pietschmann 143: WU).

ISRAEL

Hadera, Qualaath Nemrod (PORATH et al. 1979, 1980); Golan (LIPKIN 1973).

JORDAN

El Azraq (Dinsmore 11093: S).

LEBANON

Beddaoui (MOUTERDE 1966). El Beqaa, Ammiq (Elhage: ZT* 7383). Tripoli (Blanche 37: G).

SYRIA

Damaskus, Barada River (Pabot 1/1953: G). Jisr ash Shughur (Bornmüller 7/8/1893: B; Pabot 18/4/1952, 21/10/1953: G).

TURKEY (Asian part)

UOTILA et al. (1984). Rather frequent: Adabazari. Afyon. Ankara. Antalya. Artvin. Bitlis. Bolu. Burdur. Canakkale. Denizli. Erzincan (e.g. Simon: ZT* 7018). Gümüsane. Ikaría. Isparta. Istanbul. Izmir. Kastamonu, Kastamonu (Sintenis 5002: G, LD). Kocaeli. Konya. Mugla. Ordu. Paphlagonia. Rize. Sakarya. Samsun. Trabzon. Usak. Van.

USSR (Asian part)

Only in the Southwest.

AZERBAYDZHANSKAYA SSR. Lenkoran (Hohenacker s.no.: STU).

GRUZINSKAYA SSR. Abastumai (Virchon 3: STU); Tskhenis Tskali (Sommier and Levier 9/7/1890: FI). Abkhaskaya ASSR: Gagra (Radde 29: G). Adzharskaya ASSR: Batumi (Alexenco 30/5/1902: FI; Sommier and Levier 16/6/1890: MPU).

KAZAKHSKAYA SSR. Tllac-Kydyk (Schipezinsky 145: NY).

ROSSIYSKAYA SFSR. Bashirskaya ASSR: Ufa (Korzchinsky 16/6/1880: LE).

TURKMENIYA SSR. Kopet-Dag (NIKITIN and SEIFULIN 1976: the sample was not checked, it could as well belong to L. turionifera).

YEMEN

Madinat al Abit (Radcliffe 4984: K). Wadi Shalalah (Hepper 6280: K).

SOUTHERN AND EASTERN ASIA

CHINA

TIBET. Tibet occid., Kunawar (Hook and Thompson: BM, FI, G, GH, GOET, MO, M, P); Sho-Kha Dzong, Tsangpo Valley (Ludlow 4561: BM, UPS). The collections of Hooker and Thompson are labeled with Tibet occid., 7000 feet; Sikkim, 7000 feet; and Kunawar, 7000 feet. It is not quite certain whether the different labels belong to the same collections and what the exact locality is. The same collectors sent another collection (Khasia, 6000 feet) to many herbaria which contained mostly L. aequinoctialis. However, two samples (L, STU) consisted of L. minor probably due to a confusion of labels.

INDIA

HIMACHAL PRADESH. Kangra (Koelz 4785: GH, MICH; 4917: F, GH, MICH, UC). Nachar (Parker 4/6/1936: GH). Simla (Parker 2850: UC; 2856: L).

JAMMU and KASHMIR. Dal Lake (Stewart 3337: BH, MO, NY; 3379: BH). Nadapoka (Kake 3905: KASH). 20 km W of Srinagar (Klötzli: ZT* 8676). Without exact locality (Rao 755: CAL).

SIKKIM. Without exact locality (Thompson s.no.: G).

UTTAR PRADESH. Tehri (Chand 1280: L); Mussoorie (Stewart 21310: NY); Garwhal (s.coll. 10/1838: K).

NEPAL

Pulanto Dara (Polunin et al. 868: BM, UPS).

PAKISTAN

Punjab, Rawalpindi (Aitchison 538: STU). Swat State, Kulali (Rodin 5604: L, UC, US).

AUSTRALIA AND NEW ZEALAND

AUSTRALIA

All indications of L. minor from Australia refer to L. disperma except some introduced material from stations near Melbourne.

VICTORIA. Melbourne (Melville 2074: MEL); Doncaster (Sonnenberg: ZT* 7189). Stawell (Symon 80: AD).

NEW ZEALAND

NORTH ISLAND. Auckland (Kirk 1/1865: WELT; Petrie s.no.: WELT). Rotorua (Urbanska: ZT* 8620; Bergren 1874: G, H). Miramar (Kirk s.no.: WELT). Mokopeka (Meebold 4848: M). Otaki Beach (Bo 22/11/1955: WELT). Puketutu Bay (Bo 9/2/1943: WELT). Pukeroa Bay (Ogle: WELT). Waikato (Kirk s.no.: WELT). Waikaro Lake (Kirk s.no.: WELT). Waitakaruru, 80 km SE of Auckland (Klötzli: ZT* 8731). Wellington (Cone 2/3/1975: WELT; Kirk 1/1865: WELT; Petal 10/1893: L).

SOUTH ISLAND. Canterbury (s.coll.: MEL). Cape Foulwind (Adams 20/4/1978: WELT). Christchurch, Banks Peninsula (Hiesey: ZT* 7015). Dog Creek, Hammer, Amuri (Petroe 4/2/1912: WELT). Moeraki Lake (Petrie 10/1893: WELT). New Brighton (Lothian 12/1936: AD). North Canterbury, Coleridge Lake (Urbanska: ZT* 8619), Leithfield Beach (Mason: ZT* 7539, 7542; Mason, Urbanska: ZT* 8643, 8645), Sefton (Mason: ZT* 7538; Mason, Urbanska: ZT* 8644). Oamaru (s.coll. 8/1891: WELT). Point Cooper (Ex. Herb. Kew s.no.: STU). Richmond, Aniseed Valley (Michaelis: ZT* 7766).

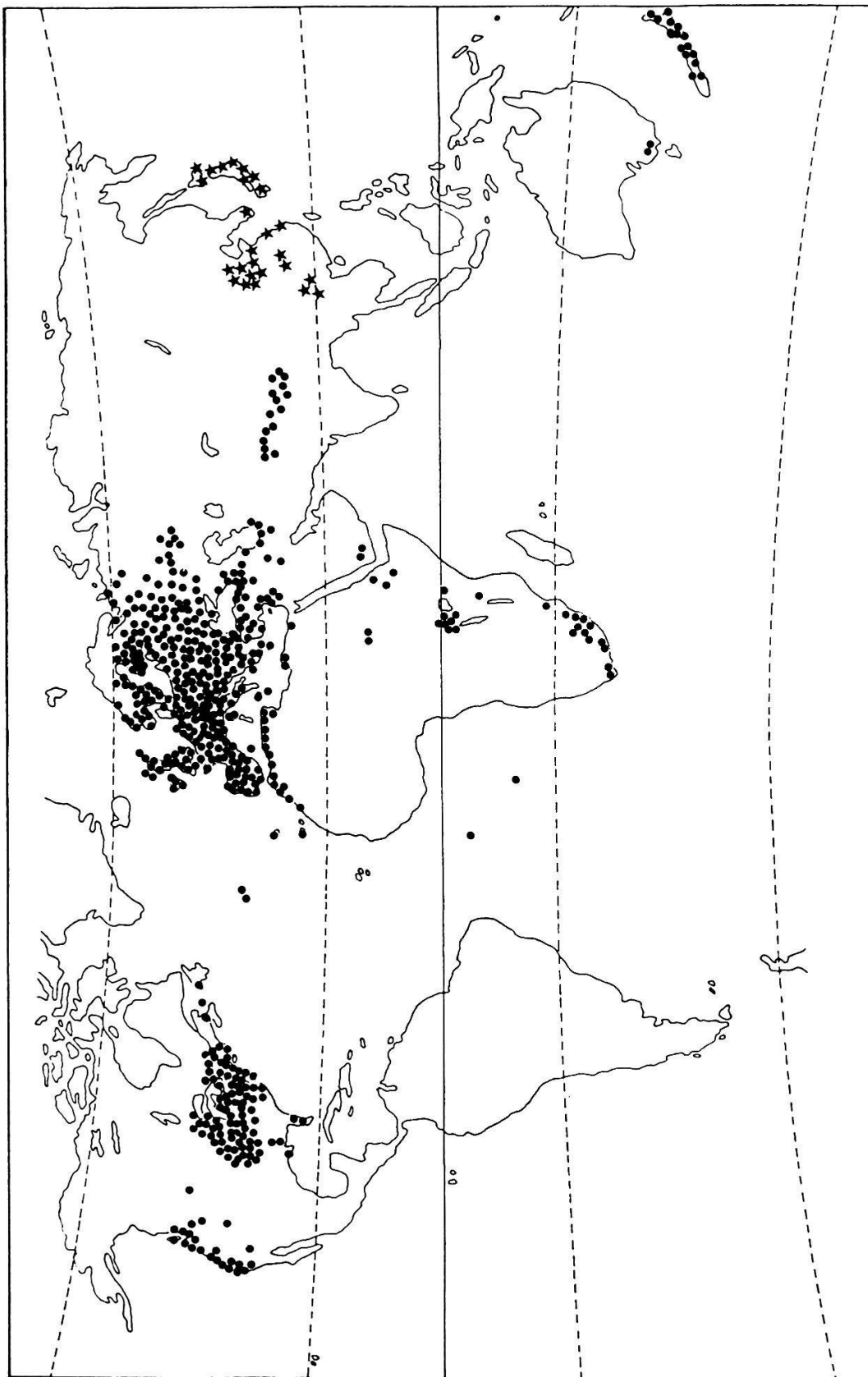


Fig. 6.8. Distribution of Lemna minor (●) and L. japonica (★)

6.1.3.7. Lemna japonica (fig. 6.8)

L. japonica is restricted to eastern Asia.

SOUTHERN AND EASTERN ASIA

CHINA

HUPEH. Shennongjia Forest, Songlon River (Sino-American Exp. 1689: ZT).
KIANGSU. Nan-ching (s.coll.: ZT* 8339; Stewart 1385: UC; Tsu 126: UC, US).

PEI-CHING. Pei-ching (Tang Yen-che: ZT* 7951; Rotmaier 20075: JE); Chou-kou-tien (Bohlin 177: S, UPS).

SHANG-HAI. Shang-hai (Debeaux 1861: P); Zaukadoo (Bailey 31/5/1917: BH, GH; 1/7/1917: BH).

SHANSI. Chien-su (Smith 6817: BM, GB); Wu t'ai-Shan (s.coll. 8/1935: PE).

SHANTUNG. Mengyin (Licent 13220: GH).

SHENSI. Fou-kian-su (Giraldi 6760: FI); In-Kia-fo (Giraldi 10/1897: FI); Juan-na-tien (Giraldi 6758: FI); Lin-tun-Scian (Giraldi 6765: FI); Pei-sfu-cel (Giraldi 6756, 6757: FI); Sin-gan-fu (Giraldi 6763: FI); Ton-ki-an-su (Giraldi 6761: FI).

SZECHWAN. Nia-yuan-fu (Smith 1845: GB, S, UPS); Ta-kong-Shan (s.coll. 12/9/1963: PE); Lu Shan (CAS).

YUNNAN. Choui-ma-ouan (Delaway 2440: P); Kun-ming (Burnand: ZT* 8653); Li-Chiang-Hsien (Wang 65101, 70466: A); Tong-tchou-zu (Maire 2870: G, MICH, UC, Z); Yunnan-fu (Sam 1925: S; Schneider 40: G; Smith 1518b, 1520: UPS; Handel-Mazzetti 187, 458: WU).

NORTHERN CHINA. Nai-gui-hai-ze (Licent 6236: BM).

JAPAN

OTAKI (1974, in lit. 1978; named as L. minor; additional records from herbarium specimens). Without exact locality (Le Boutellier's 257: PEN).

HOKKAIDO. Kushiro (Faurie 8628: G, P). Hiyama. Setana, Imachane-cho (Hasegawa: ZT* 8693).

HONSHU. Aichi. Nagoya, Nagoya University (Otaki: ZT* 7432). Hiroshima. Hyogo. Iwate, Morioka (Kobayashi: ZT* 8694). Kanagawa, Yokosuka (Sabatier 1359: P). Kyoto, Kyoto Yodo, Ikegami-cho (Beppu: ZT* 8695). Nara. Okayama, Okayama (Kadono: ZT* 8696). Osaka. Saitama. Tokyo (Sakurai 1912: H); Adachi-ku (Otaki: ZT* 7427); Tova (s.coll. 11/6/1911: S). Shizuoka. Yamazuchi, Kudamatzu (Minami: ZT* 8697).

KYUSHU. Fukuoka, Chikugo (Koga: ZT* 8698); Mizumachi-machi (Okutomi: ZT* 7182). Kumamoto.

SHIKOKU. Ehime. Kagawa.

KOREA

Prov. Kyonggi: Sosa (Yong No Lee: ZT* 7683).

6.1.3.8. Lemna ecuadoriensis (fig. 6.9)

The collections of Ecuador are the only known collections of L. ecuadoriensis.

SOUTH AMERICA

ECUADOR

Prov. Guyas: 10 km NE Guyaquil (Lüönd: ZT* 8996). Prov. Oro: Machal-Santa Rosa (Plowman 2/12/1974: F, GH, U).

6.1.3.9. Lemna obscura (fig. 6.9)

L. obscura is endemic to the southeastern part of North America. It was introduced in Hawaii.

NORTH AMERICA

MEXICO

DISTR. FEDERAL. Mexico City (Bravo 1933: ZT; Daubs 603, 604: ILL; Edwards 902: F; Hahn 2/1869: GOET, JE, KANU, L, MEL, MO, STU, U; 5/1868: KANU, L, STU; Pringle 7301: CAS, COLO, MICH, MSC, SMU, UC, US, VT; Schaffner 1875: CAS; Thompson 29/7/1910: KANU).

HIDALGO. Lago de Apam (Moore and Wood 4748: BH, GH, MICH); Ixmiquilpan (Moore and Wood 4510: BH, GH, MICH).

MEXICO. Lago de Zumpango (Fassett 28420: WIS).

PUEBLA. Tecamachalco (SCHWABE-BRAUN and TUEXEN 1981b).

U.S.A.

ALABAMA. Rather frequent.

ARKANSAS. Rather rare: Arkansas Co., Hemstead Co., Jefferson Co., Phillips Co.

DISTR. OF COLUMBIA. Rare.

FLORIDA. Frequent.

GEORGIA. Rather rare: Baldwin Co., Chatham Co., Early Co., McIntosh Co., Miller Co.

ILLINOIS. Rather frequent.

INDIANA. Rare: Delaware Co., St. Joseph Co.

IOWA. Rare: Johnson Co., Lee Co.

KANSAS. Rather frequent, except in the Northwest.

KENTUCKY. Rather rare: Carroll Co., Franklin Co., Grant Co., Henry Co., Jessamine Co., Woodford Co.

LOUISIANA. Frequent.

MARYLAND. Rare: Cecil Co.

MINNESOTA. Rare: Houston Co.

MISSISSIPPI. Rather rare: Issaquena Co., Oktibeeha Co., Wilkinson Co., Yazoo Co.

MISSOURI. Rather rare: Cape Girardeau Co., Dunklin Co., Jackson Co., Mercer Co., Mississippi Co., St. Louis Co., Scott Co.

NEBRASKA. Rather rare: Boyd Co., Colfax Co., Dodge Co., Douglas Co., Garden Co., Howard Co., Lancaster Co., Lincoln Co., Platte Co., Richardson Co., Sarpy Co., Saunders Co., Sherman Co., Webster Co.

NEW JERSEY. Rather frequent.

NEW YORK. Rare: Monroe Co., Niagara Co., Orange Co., Rockland Co.

NORTH CAROLINA. Rather frequent, but only in the East.

OHIO. Rare: Clermont Co., Franklin Co., Hamilton Co., Montgomery Co.

OKLAHOMA. Rather frequent.

PENNSYLVANIA. Rare: Bedford Co., Delaware Co., Philadelphia Co.

SOUTH CAROLINA. Rather frequent, but only in the East.

SOUTH DAKOTA. Rare: Todd Co.

TENNESSEE. Rather rare: Coffee Co., Davidson Co., Henry Co., Lake Co., Obion Co.

TEXAS. Rather frequent, except in the West.

VIRGINIA. Rather frequent, but only in the East.

WISCONSIN. Rare: Grant Co., Trempelean Co.

CARIBBEAN SEA

BAHAMAS

Cat Island (Britten 5800: NY; Correll 46144: GH, STU; 46145: BM, NY, TEX; 46165: DUKE).

PACIFIC OCEAN

HAWAII (U.S.A.)

Oahu: Pearl City (Herbst: ZT* 7325, 7471).

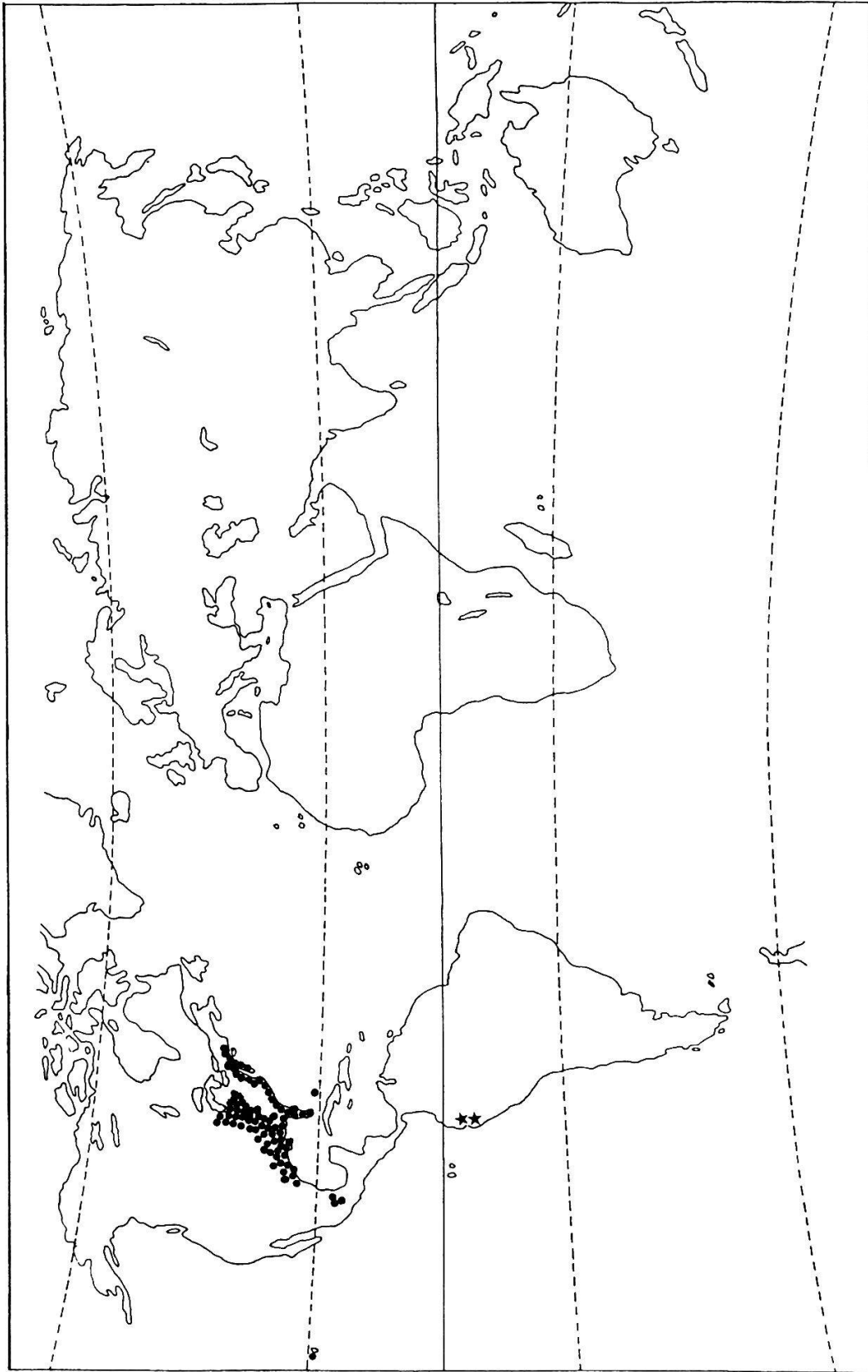


Fig. 6.9. Distribution of L. ecuadoriensis (★) and Lemna obscura (●)

6.1.3.10. Lemna turionifera (fig. 6.10)

L. turionifera is distributed mainly in North America and continental Eurasia.

NORTH AMERICA

ALASKA (U.S.A.)

Anchorage (Heller 13: CU). Edgerton, Highway 9 (Anderson 9442/43: US). Fairbanks (Argus 463: RM; Grinnell 353: CU; Spetzmond 1918: S; Smith 2129: UC; Taylor 2908: OKL); Minto Lake (Smith 1864: S, UC); Moose Lake (Smith 1893: RM, S, UC). Homer (Calder 6932: GH). Kanai Peninsula (Calder 5000: UC). Livengood, Brown Lake (Halliday 121/75: BM). Matanuska (Welsh and Moore 5993: G, MIN). Chicken, Taylor Highway (Lüönd: ZT* 8783).

CANADA

ALBERTA. Waterton Lakes National Park, Beaver Pond (Breitung 16783: F, NY). Lake La Biche (Cody 6837: GH, W; 6839: G). Fort Fitzgerald (Cody 3768: BR, COLO, MEL, MO, NDU, NSW, RM, UPS, W, WTU). Red Deer, Goetz Lake (Malte and Watson 1819: GH, UC, WTU). Vermillion Lake, Banff (Seigler 1663: TEX). Tawatinaw Lake, Rochester (Yuill 109, 110: WIS). Athabaska-Delta (Gillham 33/34: ISC). East of Smith (Hansen and Merkle 288: OSC).

BRITISH COLUMBIA. Okanagan Lake (Calder 9738: S; Newroth: ZT* 8214); Okanagan Falls (Wetherell 564: RM). Saanich, Swan Lake (Buchanan: ZT* 7728). Thrums (Buchanan: ZT* 7887). Westbank, Turtle Lake (Stein and Taylor: ZT* 7793). Chilcotin Co., Tatla Lake (Calder 20488: WS); Williams Lake (Calder 3/7/1966: W; 18301: GH, US). Fraser Lake (Calder 15367: C, ID, W). Saltspring Island (Ganges and Calder 29661: DS). Osoyoos Lake (Calder 7983: GH, UC, US). Vanderhoof (Calder 13848: C, ID, OSC, US). Tabor Lake, Prince George (Calder 14387: NY, S, WS, WTU). Puntzi Lake, Redstone (Calder 18346: WTU). Discovery Bay, Nauaime (Eastwood 9766: CAS). Fraser Valley (Holm BC 418: UPS). Joice Lake, Falkland (Hitchcock 7495: DS, GH, MO, NO, RM, UC, UCLA, WS). Lac La Hache (Hatter 120: WS, WTU). Vancouver Island, Cedar Hill (Macoun 28110: F); Victoria (Macoun 88278: C, GH, NY, US); Wellington (Macoun 88279: GH); Sooke Road (McCabe 5700: UC; Calder 31980: OSC). Shuswap Lake, Sicamour (Macoun 28103: F, MO, MU, OS). 111 Mile, Creek Cariboo Road (Murie 1307, 1308: MO). Buffalo Lake, 100-Mile House (McCabe 862: UC). Huntingdon (McCabe 3745: UC). Richardson Lake, Pender (Szcawinski 26/55: S). Fort Steele (Taylor 3970: COLO, UC). Silverdale (Ceska 1556: CESKA). Hatzik Lake (Ceska 1555: CESKA, ZT). Goose Lake (Ceska 1165: CESKA). Fort Langley (Ceska 1305: CESKA). Burns Lake (Calder 13445: WTU). Vanderhoof (Lüönd: ZT* 8791).

MANITOBA. Lake Manitoba (Löve: ZT* 6853). Diding Mountain National Park (Lüönd: ZT*8778). Westhawk (Ahles 71673: MASS). De Provencher Distr.: Kleefeld (Boivin 11739: GH, NY). MacDonald Distr.: Sanford (Boivion 9162: GH, NY). Spruce Woods Province Park (Krüsi 12/7/1983: ZT). Portage la Prairie (Dillon 6/8/1954, 172: WIS). Minnedosa (Kiel 80: WIS). Grand Trunk Pacific Railway (Macoun 76886: MO, MU; 23802: OS). Hamiota (Macoun 76888: CM, CU, GH, NY). Nelson River, Norway House (Scoggan 2813, 3096: GH). Cross Lake (Scoggan 3574: C, MIN, S). Wekusko Lake, Berry Bay

(Scoggan 6663: GH). Lake Stormon (Catling 84-128: +, ZT); Max Lake, Boissvain (Scoggan 7104: C, MIN). Churchill (SCOGGAN 1978 cited as L. minor).

NEW BRUNSWICK. Fredericton (Scoggan 15/6/1955: W). 60 km SE of Moncton, Sackville, Hog Lake (Krüsi: ZT*8745).

NEW FOUNDLAND. SCOGGAN (1978) reports L. minor from the South which might belong to L. turionifera.

NORTHWEST TERRITORIES. Mackenzie Distr.: Fort Simpson (Cody 8407: C, DS, F, LE, MICH, MIN, NY, UC, US, W). Carlton Island, James Bay (Porshild 4354: C, COLO, GH, H, US, WTU). Great Slave Lake, Mackenzie River, Yellowknife Highway (Thieret and Reich 6726, 7242, 7892: AAU, F; 6730: F, MIN, US; 8362: F, MIN, OS).

NOVA SCOTIA. Cumberland Co., Amherst (Fernald 20582: GH, PEN, PH). Kings Co., Sheffield Mills (Fernald 24/8/1902: GH); Wolfville (Steinmetz 1739: ILL); Grand Pré (Fassett 18828: F, MO, MUHW, WIS). Victoria Co., Port Bevis (Fernald 20583: GH). Ventona Co., Area Bras d'Or-Jona (Fernald 20584: CU, GH, PEN, PH). Windsor (Fowler 6/1868: G). Cape Breton, Mabou (s.coll. 1875: NY).

ONTARIO. Thunder Bay Distr.: Port Arthur (Boivin 1712: C; Curtiss 7/1866: G; Garton 2/9/1957: US, W; 1712: G, NY, RM; Bailey 1766: WTU); Lac de Mille Lacs (Baldwin 8928: H, MIN). Timmins (Baldwin 1952: GH). Cochrane Distr.: Lillabelle Lake, Cochrane (Baldwin 5082: H, WTU). Sandwich (Boot 12/9/1868: GH); St. Clair River (Gillman 28/8/1870: GH; 20/11/1870: MO). Lanark Co., Black Corners (Cody 1019: OKL). Carlston Co., Ottawa (Dore 26/9/1955, 25/9/1956: W; 47-1267: OKL). Fronterac Co., Sharbot Lake (Dore 13905: ILL, MICH); Kingston (Fowler 26/9/1901: LY, US; 22181: WIS; Pennell 16353: PH); Fronterac Park, Bear Lake (Hainault 5124: RM). Rainy River Distr.: Rainy River Town (Garton 8602: MASS, MIN; 8656: MASS, MIN). Essex Co., Pelee Island (Hawke 178: OS). Long Point, Lake Erie (Jennings 2/8/1930: CM). Bruce Peninsula (Krotkov 8824: GH, US). Belleville (Macoun 8/1872: G). Kent Co., Thames River, St. Clair Lake (Soper 2300: GH; Mahler 5589: AAU, SMU). Pembroke, Ottawa River (Umbach 10427: F, MIN, WIS). Golden Lake (Umbach 28/7/1899: F, US, WIS). Edmonton (White 10768: MIN). Point Pelee National Park (Krüsi: ZT* 8780).

PRINCE EDWARD ISLAND. Prince Co., Lower Sea Cow Pond (Fernald 7124: C, GH, NY, PH, WS).

QUEBEC. Gulf of St. Lawrence, Green Island (Abbe 10/8/1929: MIN). Longueuil (Dubois 10985: SMU). Magdalen Island (Marie-Victorin 43523: C, CM, CU, UC). Grindstone Island (Fernald 7126: UC). Montreal (Marie-Victorin 24474: GH); Saint François de Sales (Huntsman 15/8/1923: GH; Laird CI: ZT). Garillon (Jenkins 9014: FI). Ottawa River (Jenkins 8925: FLAS, ID, MSC). Ile de God (John 90284: C, H, GB, UC). Saguenay Co., Archipel Washicoutai (John 90283: GH). St. Hilarion (Cayonette 73-338: G, MU, UC). Charlevoix (Cayonette 73-341: G). Lake St. John Co., Val Galbert (Clausen 3216: BH, CU). Green Island, Kegaska (Lewis 14/8/1937: CU). Vallée du Richelieu, Ile Ste. Thérèse (Marie-Victorin 43523: C, CM, CU, UC), Weedon (Hamel 18240: BR, H, JE). Thurso (Lamarée 44-215: OSC). Fort Lennox (Cody 6544: SMU). Anticosti Island (SCOGGAN 1978 cited as L. minor).

SASKATCHEWAN. Hansen Lake Road, Big Sandy Lake (Argus 4493: RM). Cypress Hills Park (Breitung 4795: MO, RM, UPS). Moose Mountains, Kenosee Lake (Boivin 9106: GH, NY). Piapot (Bird 1182: OKLA). Val Marie (Bird 763: OKLA). Prince Albert National Park (Fraser 7/1939: RM). Little Amoyot Lake (Harms 16812: GH). Green Lake (Harms 17824: GH, RM). Turner Lake Village (Harms 18348: GH). Saskatoon (Klötzli: ZT* 7686). Indian Head (Macoun 13992b: F, MO). Cornwall Bay, Lake Athabaska (Ramp 6499: GH).

Knee Lake (SCOGGAN 1978 cited as L. minor).

YUKON TERRITORY. Mile 945 Alaska Highway, Takhim (Calder 28104: UC). Dawson, Catholic Church (Calder 3079: CAS, COLO, G, H, L, PEN, RM, S, W). Carmacks (Dawson-Whitehouse Road) (Calder and Kukkonen 28042: B, F, W). Alaska Highway, near Alaska border (Ramp 12879: GH, S). Mackintosh, Whitehorse, Mile 1022, Alaska Highway (Schofield 8180: DS).

MEXICO

BAJA CALIFORNIA NORTE. Sierra San Pedro Martir, La Grulla (Thorne 14437: KANU; 14448: ARIZ, KANU, LL, UC).

U.S.A.

ALABAMA. Rare: Jackson Co.

ARIZONA. Rather frequent, but only in the North and at higher altitudes.

CALIFORNIA. Frequent.

CONNECTICUT. Rather rare: Fairfield Co., Litchfield Co.

IDAHO. Rather frequent.

ILLINOIS. Rather frequent, except in the South.

INDIANA. Rather frequent, except in the South.

IOWA. Rather frequent.

KANSAS. Rather frequent, except in the Southeast.

KENTUCKY. Rare: Jesamine Co.

MASSACHUSETTS. Rather frequent.

MICHIGAN. Frequent.

MINNESOTA. Frequent.

MISSOURI. Rare: Clark Co., Jackson Co.

MONTANA. Frequent, except in the Southeast.

NEBRASKA. Frequent.

NEVADA. Rather frequent, but only in the North.

NEW MEXICO. Rather frequent, but only in the North and at higher altitudes.

NEW YORK. Rather frequent.

NORTH DAKOTA. Frequent.

OHIO. Frequent, except in the South.

OKLAHOMA. Rather frequent, but only in the North.

OREGON. Frequent.

PENNSYLVANIA. Rather frequent, but only in the West and in the mountains.

RHODE ISLAND. Rather rare: Washington Co.

SOUTH DAKOTA. Rather frequent.

TEXAS. Rather rare: Aransas Co., Bowie Co., Donley Co., El Paso Co., Hays Co., Hemphil Co., Kerr Co., Lipscomb Co., Oldham Co.

UTAH. Frequent.

VERMONT. Rather frequent.

WASHINGTON. Frequent.

WISCONSIN. Frequent.

WYOMING. Frequent.

EUROPE

FRG (West Germany)

Berlin (introduced: Scholz 1985: ZT* 8910). Hamburg, Haseldorfer Marsch (introduced: Heckman 1984: +, ZT* 8895; cf. HECKMAN 1984).

USSR (European part)

Bashkir ASSR: Gadityszloj, Ural River (Kraszczennikov 16/8/1931: LE).

NORTHERN AND WESTERN ASIA

MONGOLIA

Orog Nuur (Chaney 319: UC).

TURKEY

(UOTILA et al. 1984). Agri: Horosan, Tahirpass (Baytop 33533: H). Artvin: Dağlari (Davis 32524: H, K, BM). Coruh: Dağlari (Hedge and Davis 32524: BM, H, K). Bingöl: Karliova (Baytop 18366c: H). Bitlis: Kuzgunkiranpass (Baytop 31052: H); Tatvan-Resadiye (Baytop 31058: H). Erzincan: Retaliye-Imranli (Baytop 41083: H). Erzurum: Askale (Baytop 31143, 33585: H); Oltu (Baytop 41469: H). Kars: Sarikanis (Baytop ISTE 41469: H); Selim (Baytop 33505: H). Kayseri: Erciyas Dağı (Zederbauer 7/1902: WU). Konya: Beyşehir Gölü (Secmen and Leblebici 2671: H).

USSR (Asian part)

KAZAKHSKAYA SSR. Karatal River (Schipichinski 18/8/1928: S); Samarskoye (Sommier and Levier 19/7/1890: FI); Semipalatinsk (Kossinosky 5/7/1914: S).

ROSSIYSKAYA SFSR. Burytskaya ASSR: Verkhne Ubukunskaya (Odenvall 27/7/1900: H); Sukhaya (Jonkov 1/8/1911: P). Irkutskaya Oblast: Irkutsk (Fischer: LE; Raspopov: ZT* 7550). Kamchatkaya Oblast: Bannaya River (Hulten 12/9/1921: S); Karymchina River (Hulten 10/9/1921: S); Maschura (Komorov 1908/1909: P); Paratunka (Hulten 1778: GB, GH, S). Krasnoyarskiy Kray: Tunguska (Arnell 6/7/1876: UPS; 28/9/1876: S). Novosibirsk Oblast: Yarkovskiy Sowchos (Logutenko and Iksanova 23/7/1963: JE); Omskaya Oblast: Omsk (Weckmann 7-8/1872: H). Sakhalinskaya Oblast: Soriofka (Faurie 325: BM, P). Tomskaya Oblast: Tomsk (Stenberg 2/7/1898: H). Tyumenskaya Oblast: Irtysh-Ob, Samazovo (Sommier and Levier 19/7/1890: FI). Yakutskaya ASSR: Lena (Cajander 1263: H); Vilyuy River (64^oNL) Maak 1854: G).

SOUTHERN AND EASTERN ASIA

CHINA

HEILUNGKIANG. Wu-Jing (s.coll. 5/8/1956: PE).

INDIA

JAMMU AND KASHMIR. Dal Lake (Naqshi 4964, 4965: KASH).

HIMACHAL PRADESH. Manali (Uotila 17744: H).

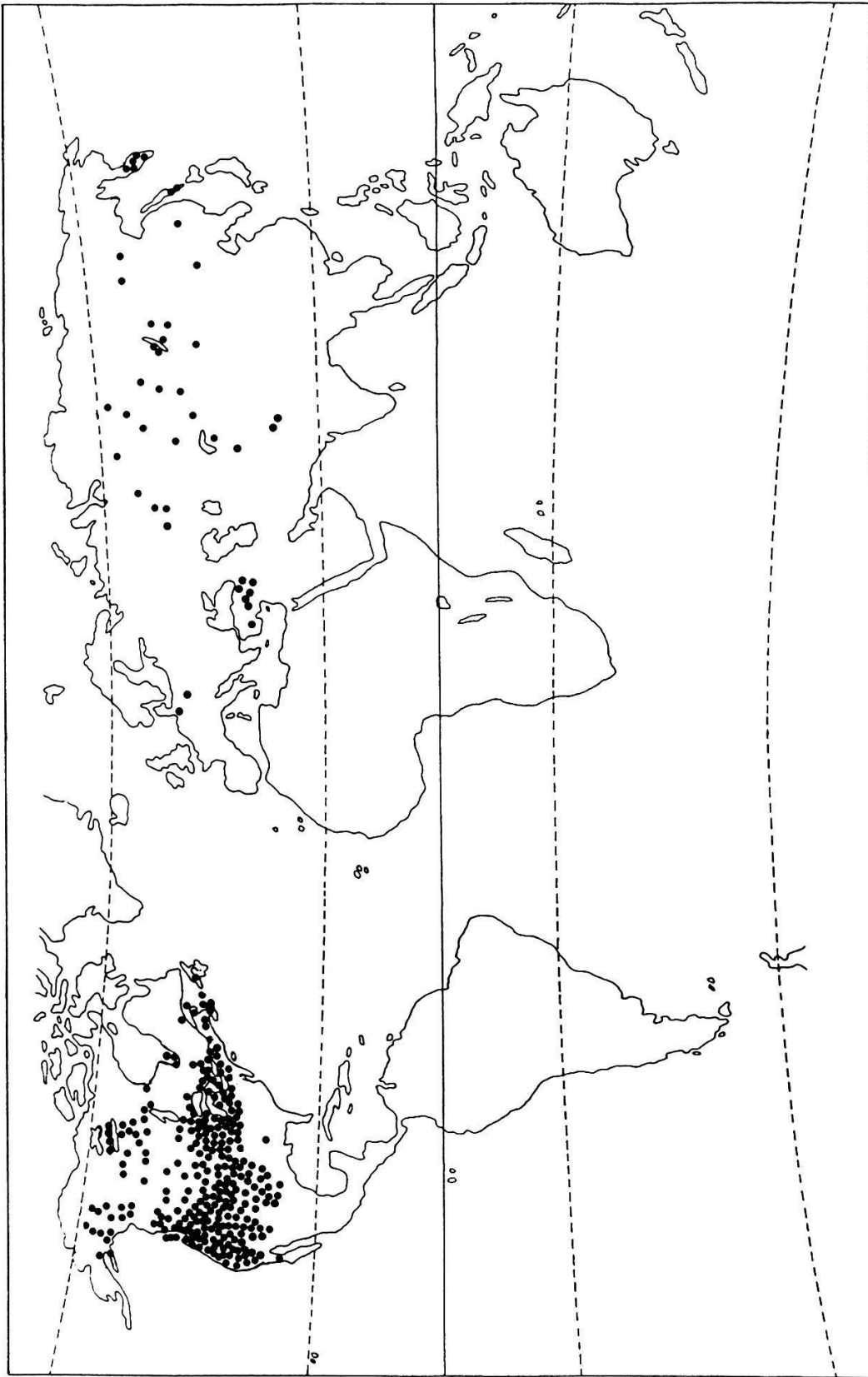


Fig. 6.10. Distribution of Lemna turionifera

6.1.3.11. Lemna trisulca (fig. 6.11)

L. trisulca grows in the cooler climatic zones throughout the world, except in South America and some islands (e.g. New Zealand). Indications from South America refer to submerged plants of L. valdiviana. The species reaches in Alaska 69°23'NL (HOLMQUIST 1971); in Siberia near Dudinska about the same latitude; in Canada, Scandinavia and northern Russia, about 68°NL.

NORTH AMERICA

ALASKA (U.S.A.)

Alaska Hwy. Mile 1292, Midway Lake (Anderson 9209: GH). Anchorage (Heller 681a: CU). Cantwell, Alaska Range (Smith 2239: S, UC). Edgerton, Hwy. 9 (Anderson 9442/43: US). Eklutna, S of Palmer (Anderson 6942: WS). Fairbanks, George Lake (Spetzmond 1075: US); Minto Lake (Smith 1864: S, UC). Gilkana, Cooper Center (Smith 2301: S, UC). Livengood, Brown Lake (Halliday 121/75: BM). Matanuska (Anderson 1379: GB, GH, LL, PH, RM; Welsh and Moore 5993: G, MIN). Noatak River (Holmquist 1934: S). Umiat (Holmen 4/8/1960: C), Colville River (Martenson 483: UPS). Upper Tanana Valley (Murray 155: COLO, VT).

CANADA

ALBERTA. Althabaska-Delta (Gillham 33/34: ISC); Egg Lake (Harper 44: US). Craigmyle Distr. (Brinkham 12/6/1922: US); Craigmyle (A.H.B. 442: WTU, VT). Stettler Distr.: Loc Battle (Brinkman 2129: US; 8326: DUKE). Fort Fitzgerald (Cody 4240: C, COLO, GB, H, M, NDU, RM, UPS, WTU). La Combe Distr. (Dixon 1052: GH; 778: RM). Beaver River, Briarville (s. coll. 3/7/1953: W). Mackenzie Basin, Wood Buffalo Park, Murdock Creek (Ramp 1995: GH, H). Tawatinaw Lake, Rochester (Yuill 110: WIS).

BRITISH COLUMBIA. Westbank, Turtle Lake (Stein, Taylor: ZT* 7794). Chilcotin Co., Tatla Lake (Calder 20488: WS). Fraser Lake (Calder 15367: C, ID, W, WTU). Anahim Lake (Calder 18585: G). Round Lake (Calder 14598: S, US, W). Vanderhoof (Calder 13848: C, ID, OSC, US). Princeton (Calder 17513: FI). Tabor Lake, Prince George (Calder 14387: NY, S, WS, WTU). Lacroix Lake, Snithers (Calder 14598, 14599: CAS, GH, UC, WS). Puntzi Lake, Redstone (Calder 18346: UC; Parmelee 18346: S). Joice Lake, Falkland (Hitchcock 7495: DS, GH, ISC, MO, NO, RM, UC, UCLA, WS, WTU). Guichon Creek (Hitchcock 7439: WTU). Paul Lake, Kamloops (Krajina 27/8/1950: GH). Vancouver Island, Victoria (Macoun 88278: C, GH, NY, US); Somas River (Macoun 13/8/1887: C, GH). Chezacut Lake (McCabe 661, 712: UC). Buffalo Lake, 100-Mile House (McCabe 862: UC). Penalau Lake (Fadden 3238: NO). Amahan Lake (Bellinger 32381: WILLU). Without exact locality (Brinkman 442: GH).

MANITOBA. MacDonald Distr.: Sanford (Boivin 9162: GH, NY). De Provender Distr.: Kleefeld (Boivin 11739: GH, NY). Riding Mts. National Park (Blohm 2/7/1968: WIS). Portage la Prairie (Dillon 35, 172, 6/8/1954: WIS). Warwporth Creek, Churchill (Gillett 2139: MO, US; 1804: C, RM, UPS, WVA). Minnedosa (Kiel 80: WIS). Williams Lake (Loomann 14540: H). Haniota (Macoun 76888: CM, CU, GH, NY). Trunk Pacific Railway (Macoun 23804: OS). Turtle Mountains (Rossbach 76: UC). York Factory (Scoggan

5987: GH). Lake Stormon (Catling 84-128: +, ZT). Max Lake, Boissevain (Scoggan 7105: C, MIN). Riverton (Scoggan 9051: MIN). Goose Creek, Churchill (Schofield 6987: COLO, DS, F, MIN, WTU). Brandon (Dore 10641: ARIZ, NDU, RM, UC, UCLA).

NEW BRUNSWICK. St. John (Scoggan 14/7/1955: W). Big Jolicure Lake, Petitcodiac, Rothesay (HINDS 1983).

NORTHWEST TERRITORIES. Aklavik (Porshild 1/9/1934: BM, S; 7305: GH, H, US). Mackenzie Distr.: Fort Simpson (Cody 8406: C, DS, F, LE, MICH, MIN, NY, UC, US, W). James Bay, Charlton Island (Porshild 4354: C, GH, H, US). Great Bear Lake, Etacho Point (Porshild 3472: C, GH; 24/8/1928: S). Great Slave Lake, Yellowknife Hwy. (Thieret and Reich 5996, 8311, 8358: AAU, F; 8371: A, F, H, MIN, S, WTU; 9275: US).

NOVA SCOTIA. Cumberland Co., Amherst (Fernald 20582: GH, PEN, PH). Inverness Co., Mabou Harbor (Smith et al. 4880: C, MU). Kings Co., Mille Brocke (Fernald 20581: CU, GH).

ONTARIO. Baptiste Creek (Staniforth: ZT* 7770). Fronterac Co., Mud Lake, Odessa (Crowder: ZT* 7875); Kingston (Boyd 1897: F, GH; MacDonald 25/9/1968: COLO; Langlord 21983: WIS; Pennell 16354: PH); Perth (Fowler 10/7/1881: MO, PH); Fronterac Park (Hainault 5124: RM). Carleton Co., Ottawa (Cody and Calder 632: MO; Crillon 8/7/1933: W; Dore 26/9/1955: W; 16388: GH, US; 47-1268: MO, OKL, UPS; Jenkins 9311: ILL, MSC); Constance Lake (Savile 3163: C, H, M, UPS; Marie-Victorin 15723: UC); Ottawa (Marie-Victorin 4378: UC). James Bay, Moose River (Baldwin 1471: GH, MICH); At-tawapiskat (Fassett 25/7/1946: VT; Lepage 15783: WIS); Lake River (Lepage 16689: WIS). Kapuskasing Lake (Baldwin 6085: GH, H, WTU). Bellville (Curtiss 7/1866: G). Thunderbay Distr.: Black Sturgeon (Garton 12412: H); Black Fox Lake (Voss 12343: MICH). Rainy River Distr.: Rainy River Town (Garton 8601, 8656: MASS, MIN; 8602: MIN). Lavigne (Grassl 7636: MICH). Sandwich (Gillman 18/9/1870: MO). Casselman (Brisson 67.166: COLO). Manitoulin Island, Manitowaning (Herman 15523: US). Pinehurst Park, Galt (de Jong 15/8/1958: MSC). Waterloo Co. (Montgomery 532: GH). Toronto (Otto 49, 50: C). Pembroke (Pease 23383: GH). Gananoque (Patterson 24/7/1896: CM). Kent Co., Thames River on Lake St. Clair (Soper 2317: GH). Lanark Co., Jock River (Senn 553: OKL). James Bay, Ekwana River (Smith 111: PH, US). Essex Co., Pelee Island, Lake Erie (Stuckey 5108: OS). Jordan Harbor (Taylor 6/7/1941: SDSU). Golden Lake (Umbach 28/7/1899: F, US, WIS). Bruce Peninsula (Watson 3155: NY, US). Peel Co., Brampton (Catling, McKay: ZT* 7583). York Co., Ajax (Sparling: ZT* 7579); Witby Marsh (Goepfert: ZT* 7573). Point Pelee National Park (Krüsi: ZT* 8781).

PRINCE EDWARD ISLAND. Prince Co., Lower Sea Cow Pond (Fernald 7124: C, GH, NY, PH, WS).

QUEBEC. South River, Clarenceville (Bernard 182: MU). Sargents Bay, Lake Memphremagog (Churchill 3/8/1903: BH, GH, MO). Iberville Co., Fort Lenox (Cody and Dore 6544: C, G, GH, H, SMU, UPS, W). Chambly Co., Pont Dubuc (Dubons 195: UC). Ile de Boucherville (Desmarais 774: MICH; Rolland-Germain 136: BR; Marie-Victorin: CAS, CM, CU, F, GB, GH, M, OS, PH, RM, UC). Magdalen Island (Fernald 7122: C, GH, US; 7132: GH, WS; Marie-Victorin 9624: MIN, WS; Rousseau 35656: GH, F, PEN). Grindstone Island, Grindstone (Fernald 7123: PH). Ile Ste. Thérèse (Gervais 13/9/1960: G, MU, OSC). Rivière aux Serpents (Louis-Marie 26/5/1931: PH). La Trappe (Louis-Marie and Norbert 5/5/1931: UC). Lac Saint Louis (Louis-Marie 1/8/1955: UC). St. Mathieu, Lac St. Simon (Lepage 29/9/1937: CAS). Montreal (Marie-Victorin 25592: GH, MO, PH, US, WIS). Ile Perrot (Marie-Victorin 56412: GH). Carillon (Marie-Victorin 44216: CU). Deschenes (Malte 1015/22: MIN, OS, W). La Prairie Co., St. Lawrence River (Svenson

1012: GH). Philipsburg (Seymour 22732, 22823: VT). St. Augustin (with influence from sea water, GAUTIER 1980).

SASKATCHEWAN. De Swift Current Distr.: Coteau de Missouri (Boivin 14131: NDU, NY, RM). Lipton (Clokey 1651: UC). La Roche (Harms 17620: GH, RM). Green Lake (Harms 16813: GH, RM). Kindersley Distr.: Hoosier (Jenkins 8072: SMU, UCLA, UPS). Prince Albert (Macoun 13994: F, MU). Indian Head (Macoun 13992b: F, MO; 13993: MU; 13998: CM, OS). Cypress Hills (Macoun 26/6/1894: GH, OS). Egg Lake (Tausend 101: WIS). Phelps's Swamp (Umbach 9/1892: MIN). Without exact locality (Bourgean 1857: GH, STU, US). YUKON TERRITORY. Alaska Hwy. Mile 941, Whitehorse (Calder 28108: DS, WTU). Carmacks, Dawson-Whitehorse Road (Calder and Kukkonen: 28042: B, F, W). Old Crow Lake (Hultén 12/8/1964: S). Lake West of Lewis Lake (Porshild 11527: C, GH, S, UC, US, WTU). Lake West of Dempster Road, Mile 65 (Porshild 321: C, GH; 485: LE). Sulphur Lake, Alaska Highway, Mile 1038, Mackintosh (Schofield 8026: DS, WTU).

MEXICO

BAJA CALIFORNIA NORTE. Mision Santo Domingo (Bell and Newcomb 1373: ARIZ, BM, BR, C, CAS, COLO, CU, DS, G, GH, LL, MICH, MO, NY, PEN, PH, RM, SMU, UC, US, WAG, WTU); San Pedro Martir/La Grulla (Brandeggee 5/1893: KANU, UC; Moran 22117: ARIZ; Thorne 14448: ARIZ, KANU, LL, UC; 14437: KANU; Wiggins and Demaree 4874: C, DS, GH, MU, NY, OS, UC, US; 16589: DS)).

BAJA CALIFORNIA SUR. San José (Wiggins 9026: DS, MICH, UC, US).

DISTR. FEDERAL. Mexico (Berlandier 7: STU; Hahn 1868: BM, CAL, FI, GOET, K, KANU, MO, NY, STU, US; 2/1869: GOET, JE, K, KANU, L, MEL, MO, STU, U, US; Kasselmann 55/85: +; Rzedowski 26276: DS, MICH, MSC; Schaffner 1868: PH; 1875: CAS, G, GOET, FI, M, MEL, MICH, NY, UCLA; 1876: FI; Schmitz 1855: BM; Stone 165: NY; Thompson 27/7/1910: KANU).

U.S.A.

ARIZONA. Rare: Apache Co.

ARKANSAS. Rare: Fulton Co.

CALIFORNIA. Frequent in the North and at higher altitudes, otherwise rare.

COLORADO. Rather frequent, except in the Southeast.

CONNECTICUT. Frequent.

DELAWARE. Rare: New Castle Co.

FLORIDA. DAUBS (1965) cites a specimen from Charlotte Co. (Daubs 658: ILL) which does not contain L. trisulca. In the herbarium GH, there is a voucher from Florida (no exact locality given) containing much L. aequinoctialis with one group of L. trisulca (ex. Herb. Lowell). If L. trisulca occurs in Florida, it is only temporary since water temperatures are too high.

IDAHO. Rather frequent.

ILLINOIS. Rather frequent.

INDIANA. Frequent, except in the South.

IOWA. Rather frequent.

KANSAS. Rare: Cheyenne Co.

MAINE. Rather rare: Androscoggin Co., Aroostook Co., Waldo Co.

MASSACHUSETTS. Rather frequent.

MICHIGAN. Frequent.

MINNESOTA. Frequent.

MISSOURI. Rather rare: Buchanan Co., Clay Co., Jackson Co., Mercer Co., Oregon Co., Ripley Co., St. Louis Co., Shannon Co.

MONTANA. Rather frequent, except in the East.

NEBRASKA. Rather frequent, except in the South.

NEVADA. Rather rare: Lincoln Co., Nye Co., Storey Co., Washoe Co., White Pine Co.

NEW HAMPSHIRE. Rare: Rockingham Co., Strafford Co.
NEW JERSEY. Rather frequent.
NEW MEXICO. Rather rare: Catron Co., Dona Ana Co., Grant Co., Mora Co., Sandoval Co., Santa Fe Co., Socorro Co.
NEW YORK. Frequent.
NORTH DAKOTA. Frequent.
OHIO. Frequent.
OREGON. Rare: Klamath Co., Marion Co.
PENNSYLVANIA. Frequent, except in the Appalachians.
SOUTH DAKOTA. Rather frequent.
TENNESSEE. Rare: Lake Co.
UTAH. Rather frequent, except in the West.
VERMONT. Rather frequent, but only in the Northeast.
VIRGINIA. Rare: James City Co.
WASHINGTON. Rather frequent.
WISCONSIN. Frequent.
WYOMING. Rather frequent.

CARIBBEAN SEA

ANTIGUA

An indication of GRISEBACH (1864) is certainly erroneous.

EUROPE

AUSTRIA

Rather frequent, except in the Alps, where it is rare: Carinthia: Klagenfurth (LEUTE and MUELLER 1979); Vorarlberg: Rhine Valley.

BELGIUM

Frequent, except in the Southwest.

BULGARIA

Rather frequent.

CZECHOSLOVAKIA

Frequent.

DENMARK

Frequent.

EIRE

Frequent.

FINLAND

Frequent, except in the North: northwards along the coast to Muonio (Enwald 2/8/1903: KUO); distribution map by LOHAMMAR (1940).

FRANCE

Frequent, except in the higher mountains and in the South; lacking in Corsica.

FRG (West Germany)

Rather frequent, except in the Alps and in mountains of siliceous rocks.

GDR (East Germany)

Frequent.

GREECE

Rare and only in the North. According to HALAKSY (1904, 1908): Peloponnisos: Carithena; Messene. Sterea Ellas: Lake Copais.

HUNGARY

Frequent.

ITALY

Frequent in the North (lowland of the Po), otherwise rare: Liguria. Toscana. Latio. Campania. Sicily: Palermo (Todaro 952: MEL); Ficuzza (Todaro 1376: STU). Sardinia.

LUXEMBOURG

Rather rare.

NETHERLANDS

Frequent.

NORWAY

Frequent only around Oslo, northwards to Lake Mjösen; Trondheimsfjord; distribution map by LOHAMMAR (1940).

POLAND

Frequent.

PORTUGAL

Rather rare: Beira litoral. Estremadura. Minho.

RUMANIA

Frequent.

SPAIN

Rather rare: Andalusia. Aragon. Castillia la Nueva. Catalunja. Valencia.

SWEDEN

Frequent in the South; northwards scattered to Torne Lappmark, Karesuando, Kuttainen and Mertajärvi (ROWECK 1981); distribution map by LOHAMMAR (1940).

SWITZERLAND

Rather frequent in the North, lacking in the Alps.

TURKEY (European part)

Rare: Edirne, Enez to Ipsala (UOTILA et al. 1984).

USSR (European part)

Frequent in the North; northwards to Karelskaya ASSR and North of Archangelsk; rare in the South; lacking on the Krim peninsula.

UNITED KINGDOM

Frequent.

YUGOSLAVIA

Frequent in Slovenija, Croatia and Serbia; in other states rather rare.

AFRICA

ALGERIA

La Calle, Lac de Tonga (HEGELMAIER 1868).

ETHIOPIA

Prov. SHOA. Lake Wonchi (Gilbert et al. 3272: K).

KENYA

Central Prov.: Naivasha Distr., Rift Valley, Lake Naivasha (Leuthold: ZT* 7615; Fnis 82: C; Gaudet LN110: EA, K; Roote 27/11/1968: EA; Suttie H241/62/2: EA). Machacos Distr., Little Kiboko River, Makindu (Rayner 559: K). Prov. Masai: Kajiado Distr., Ol Tukai (Verdcourt 3975: BR, EA, K, PRE).

MOROCCO

Larache, Boucharen (Mathez: ZT* 7649). Dayet Achlef (Maire 16/8/1924: MPU; Jahadiez 530: B, C, FI, G, K, M, MPU, Z). Ain (MAIRE 1957), Lac de Quiouane (MAIRE 1957); Khala (MAIRE 1957).

RWANDA

Mugusa Distr.: Grafumba, Marais de Nyamashke (de Sloover 2/1972: BR).

TANZANIA

Prov. ARUSHA. Kilimandscharo-Meru, Lake Balbal, Duluti (Uhlig 494: EA). Ngorodoto Gate, Arusha National Park (Greenway and Fitzgerald 14.971: M, MO, PRE; 14.980: EA, K, PRE; Richards and Arasululu 27736: EA, M).

Prov. TANGA. Korogwe Distr.: Pangani R. (Greenway 8715: EA).

UGANDA

Prov. Buganda: West Mengo Distr., Makerere University Hill (Lye 3441: EA, K, UPS). Prov. Kizegi: Kabale (Denny: ZT* 7192); Lake Mutanda and Lake Bupuni (Chandler 2600: K; Christiaensen 1040: BR; Eggeling E4215: EA; Thomas 2414: BM, K; Norman 39: EA); Mushungero (Loveridge 448: A, B,

K, MO; Thomas 2410: BM); Lake Bunyonyi (Chandler and Hancock 2721a: BM; Thomas 1208: K). Prov. Toro: Lake Kanyangeye, Fort Porta 1 (La Barbera 15: K). Prov. Western Toro: Ruwenzori, Nyakasura, near Forest Portal (Taylor 2329: BM). Lake Kifuruka, volcanic crater lake (La Barbera 19: K).

ZAIRE

Prov. KIVU. Kabare (Bequaert 5377); Parc National Albert, between Molindi and Rutshuru R. (Heine 213: BR); Kibangula-Kabambare (Leonard 5760: BR); chutes de Rutshuru (Leonard 1716: BR).

INDIAN OCEAN

MAURITIUS

HEGELMAIER (1868) observed in a collection from Mauritius fronds of L. trisulca cohering to Ruppia rostellata. It is very unlikely that L. trisulca, which avoids warm waters, occurs in this island, far away from the next stations of occurrence in eastern Africa. Either there was confusion with labels or the species must have been introduced temporarily.

NORTHERN AND WESTERN ASIA

AFGHANISTAN

Prov. Faryab: Belchiragh-Meimaneh (Hedge 3797: LE, W). Prov. Ghazni: Ozak-Bedzuk (Rechinger 17971: M). Prov. Herat: Sar-i Navorak (RIEDL 1976).

IRAN

Fars: Eqlit (Koelz 14400: US); S of Haji Baba (Grey 27: GB, K, W); Shiraz (Grant 15137: MO, W; Hausknecht 5/1863: JE; Kotschny 301: BM, C, FI, G, H, LE, MO, MPU, P, STU, UPS, WAG, WU; 4/1842: FI, STU). Gilan: Astara (Fischer s.no.: LE; Hohenacker s.no.: STU); Bandar e Pahlavi (Mossadegh 10/1970: ZT; Wendelbo 14/7/1975: W); Lakidshan (Alexeenko 14/7/1902: LE). Kordestan: Chehel Chasmeh (Stapf 1/9/1885: WU). Mazandaran: N of Amol (Uotila 19283: H, M).

ISRAEL

Extinct (DAFNI and AGAMI 1976).

SYRIA

Anouar Khatib, Barada River (Pabot 51: G). W of Idlib (Pabot 51-58, 355: G). Er Roudj, Lac Baloua (MOUTERDE 1966).

TURKEY

(UOTILA et al. 1984). Rather frequent: Afyon. Agry. Ankara. Artvin. Bingöl. Bitlis. Coruh. Denizli. Erzurum. Erzincan. Isparta. Izmir. Kars. Konya. Mugla. Van.

USSR (Asian part)

Rather frequent.

AZERBAJDZHANSKAYA SSR. Astara (Hohenacker s.no.: LE, STU); Shirvanskaya Step (Kolakovsky 15/8/1930: S).

KAZAKHSKAYA SSR. Karatal River (Schipichinski 8/8/1928: S); Semipalatinginsk (Kossinosky 592: S); Ulutau (Schipichinski 182: S). Karagandinskaya Oblast: Tuzdinsk Reservoir (KORSAK and MYAKUSHKO 1980).

KIRGIZSKAYA SSR. Tyan-Shan (SHISKIN 1964).

ROSSIYSKAYA SFSR. Astrakhan Oblast: Astrakhan (De Bengé s.no.: P). Bashir ASSR: Ufa (Korzchinsky 16/6/1880: LE). Buryatskaya ASSR: Verkhne Ubukunskaya (Odenvall 27/7/1900: H); Sukhaya (Jonkov 1/8/1911: P). Irkutskaya Oblast: Irkutsk (Kusnezow 807: S); Minusinsk (Turkewitsch 752: A). Kamchatskaya Oblast: Lake Kochkovatoje (Ramensky 1908: S); Maschura (Komorov 1908-1909: P, S). Khabarowsk Kray: Nikolayevkna-Amure (HEGELMAIER 1868). Krasnoyarskiy Kray: Yenesej Dudunka (Arnell 7/8/1876: S). Novosibirsk Oblast: Jarkovskij Sowchos (Logutenko and Iksanova 23/7/

1963: JE). Omskaya Oblast: Omsk (Weckman 7-8/1872: H); Tara, Irtysh (Grano 8/1906: H). Orenburgskaya Oblast: Orenburg (s.coll.: LE). Sakhalinskaya Oblast: Vladimorovo (Faurie 329: BM, G); Alexandrovsk; Shiza, Usoro (MIYABE and KUDO 1932). Tomskaya Oblast, Tomsk (Stenberg 2/8/1880: FI). Tyumenskaya Oblast: Muzhi (Sommier and Levier 2/8/1880: FI). Yakutskaya ASSR: Lena (Cajander 1262: H).

SOUTHERN AND EASTERN ASIA

CHINA

HEILUNGKIANG. Harbin (Skuortzow 29/9/1937: GH); Sungari Valley, Talaihou (Skuortzow 10/5/1925: GH).

KIANGSU. Nan-ching (University of Nan-ching s.no.: Z; Tsu 125: UC; Wang 169: ZT); Nan-ching, Hsuan-wu-hu (Chen 20: NAN).

PEI-CHING. Yun-Ming-Yuan (s.coll. 20/11/1972: PE).

SHANSI. Kou-Toei (Licent 1981: BM, P).

SHENSI. Pei-sfu-cel-ti (Giraldi 6767: FI); Liu-hua-zae (Giraldi 6768: FI).

SINKIANG. Ta-cheng (s.coll. 10/8/1957: PE).

SZECHWAN. Nin-yuan-fu (Smith 1847: UPS). Nin-gy-hen (Handel-Mazzetti 1265: WU).

YUNNAN. Li-chiang-Hsien (Forrest 12728: BH; Wang 70492: PE); Yunnan-fu (Sam 1925: S; Schneider 40: G).

NORTHERN CHINA. Nao-gui-haize (Licent 6236: BM).

INDIA

JAMMU AND KASHMIR. Bemna (Kake 3906: KASH). Dal Lake, Srinagar (Nagshi 299: KASH) (see also ZUTSHI and KAUL 1963).

MANIPUR. Manipur City (Watt 7387: CAL, P).

WEST BENGAL. According to KURZ (1867a) frequent. Calcutta (Kurz 9/1869: L, MEL, STU; s.no.: L, LE).

INDONESIA

Reports from Aru Island, Jawa and Sumatra are probably due to erroneous determinations. VAN DER PLAS (1971) cites a specimen from Aru Island (in herb. FI) which belongs to L. aequinoctialis.

JAPAN

OTAKI (1974, in lit. 1978).

HOKKAIDO. Hakodate (Faurie 11007: G, FI); Kushiro (Otaki: ZT* 7431); Nemuro (Faurie 7408: G, P).

HONSHU. Aomori; Chiba; Fukushima; Gumma; Ibarachi; Hitachi (Masumoto 2611: AD); Iwate; Kanagawa, Mishima (Kurosawa 9/9/1928: BH); Nagano; Niigata; Saitama, Tokyo (Sakurai 1912: H; Nogasi 389: A, B, BH, BM, BR, C, CAL, F, G, GH, H, MICH, NO, NSW, NY, P, S, UC, UPS, US, W, WTU); Shizuoka; Tochigi. Nikko (Faurie 1581: G, P; Mizushima 13496: A).

SHIKOKU. Ehime.

PAKISTAN

Peshawar: Pubi (Aman Kot) (YUSUF and OMER, mscr., 1986).

PAPUA NEW GUINEA

Morobe Distr.: Kajabit Mission (Clemens 10862: A, L, MICH). From Ramu to the coast (Schlechter 14111: BR, G, L, LY, P).

PHILIPPINES

Luzon: Bayninan (Comklin 79626: A, L); Benquet Prov., Rabayan (McGregor 8782: L, NY). Mindanao: Lake Lanao (Strong 3/1907: C).

TAIWAN

Bankinsing (Faurie 990, 990bis: G; 993: BM, G). According to YANG (1978) in Ilan.

AUSTRALIA AND NEW ZEALAND

AUSTRALIA

AUSTRALIAN CAPITAL TERRITORY. Canberra, Gudgenby area (Burbidge 8179: L).

NEW SOUTH WALES. Bega Swamp (Woolles s.no.: MEL). Ebor Falls (Coveny: ZT* 8226). Griffith, Murrumbidgee Irrigation Area, Barreb Box Swamp (Sainty 4/12/1965: NSW). Gwydir River (Mueller s.no.: STU). Murrumbidgee (Cunningham 5/1894: FI).

NORTHERN TERRITORY. A specimen collected by Sonder (MEL) without precise locality is probably erroneous.

QUEENSLAND. Darling Downs near Warwick (s.coll.: MEL). Brisbane River near Ipswich (ASTON 1973). A collection from Charters Tower in the North is indicated (STANLEY 1979) but might be from a temporary station.

SOUTH AUSTRALIA. Entrance of the Murray (Birn 9/1848: MEL). Kangaroo Island, Karatha (Tepper 5/3/1886: MEL). Lake Bonney (Wehl 4/1881: MEL). Port MacDonnell (Eichler 18142: AD); 20 km E of Port MacDonnell (Copley 1811: AD); Piccaninni Ponds (Copley 1787: AD); Piccaninni Blue Lake (Eichler 18147: AD; Kraehenbuehl 925: AD). Robe (Litz 3/1889: MEL). Wellington, Lake Alexandrina (Eichler 15682: AD).

TASMANIA. Derwent (Rodway 1892: MEL). King Island (Linkora 11/6/1979: MEL; McKibbin 11/1887: MEL). Lewisham (Morris: ZT* 7282). Moonah (Carter 1881: MEL). Without exact locality (Gibbs 1915, 1925: BM; Gunn 1863: C, CAL, FI, G, GH, GOET, L, LE, M, MO, P, STU, WU).

VICTORIA. Ballarat, Lake Wendouree (Aston: ZT* 7315; 13/3/1969: MEL); Cockfiet Swamp (Aston 30/9/1959: MEL). Colac (Aston: ZT: 7331). 2 mi W of Darlington (Aston 1567: MEL). Victoria Valley, 15 km N of Dunkeld (Orchard 1975: AD). French Island (Beaglehole 38290: MEL); 8.5 mi NE of Tankenton (Beaglehole 38291: MEL). Geelong (Williamson 12/1908: LE). Grampians (Beaglehole and Orchard 30483: MEL); 2 mi WNW of Mount Cain (Beaglehole and Orchard 30489B: MEL). Hawkerdale (Williamson 2/1900; 2315: MEL). Murray River (Black 1047/2: MEL). Lake Terang (Easten 1875; Mueller 4/1874: MEL). Otway Forest (Williamson 6382: M). 1.5 mi NW of Peshurst (Aston 1537: MEL). Stony Rises, between Colac and Champertown (Aston 1792: MEL). Tyrendarra (Aston: ZT* 7258); Darlot's Creek (Orchard 1989: AD). Victoria Forest (Williamson 7/4/1927: MEL). Wilson's Prom. Nat. Park (Ducker 825: MEL).

WESTERN AUSTRALIA. According to FITZGERALD (1918) L. trisulca occurs in the Kimberley Mts. (Ord River, Dunham River, Parry Creek). These indications have to be checked. The climate of this region is very unfavourable for L. trisulca.

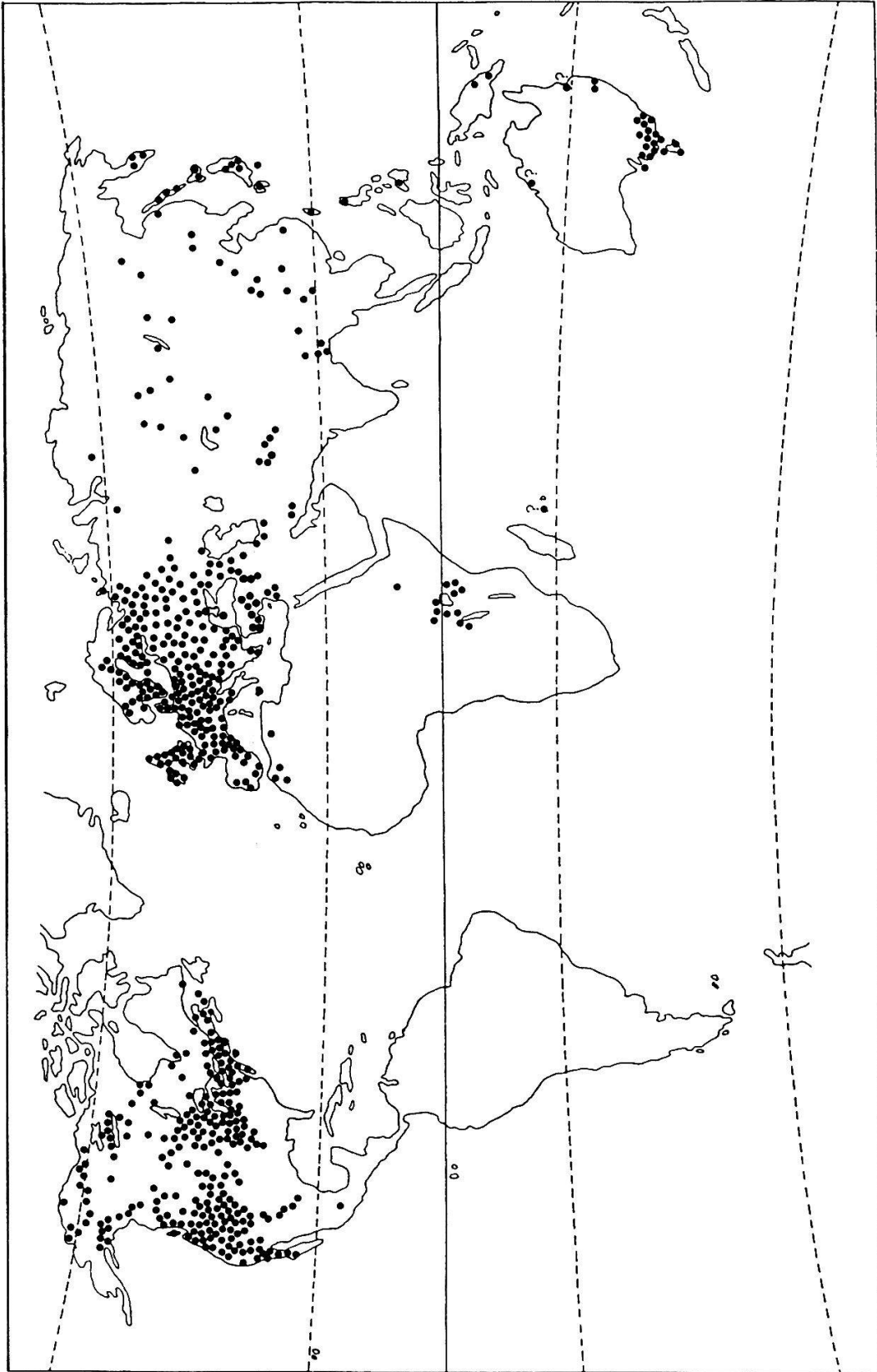


Fig. 6.11. Distribution of Lemna trisulca

6.1.3.12. Lemna perpusilla (fig. 6.12)

L. perpusilla is a species endemic to eastern and central North America. All indications from other regions have to be attributed to L. aequinoctialis.

NORTH AMERICA

CANADA

QUEBEC. Cté. Missisquoi, Venise en Québec (Bernard B76-689: MU). St. Romuald, Erchemin River (Cayonette 73-314: MU).

U.S.A.

ARKANSAS. Rare: Clark Co., Pulaski Co.

DISTR. OF COLUMBIA: Frequent

ILLINOIS. Rather frequent.

INDIANA. Rather frequent.

IOWA. Rare: Bremer Co., Decatur Co., Lyon Co.

KANSAS. Rather frequent, except in the West.

KENTUCKY. Rather rare: Ballard Co., Carrol Co., Clark Co., Henry Co., Hopkins Co., Jefferson Co., McLean Co., Oldham Co., Scott Co.

MAINE. Rare: Cumberland Co.

MARYLAND. Frequent.

MASSACHUSETTS. Frequent.

MINNESOTA. Rare: Benton Co., Nicollet Co.

MISSOURI. Rather frequent.

NEBRASKA. Rare: Hall Co., Thomas Co.

NEW JERSEY. Frequent.

NEW YORK. Rather rare: Cayuga Co., Clinton Co., Cortland Co., Oswego Co., Richmond Co., Suffolk Co., Tomkins Co.

NORTH CAROLINA. Rather rare and only in the Northeast: Currituck Co., Dare Co., Durham Co., Gates Co., Johnston Co., Orange Co., Perquimans Co.

OHIO. Rather frequent.

OKLAHOMA. Rare: Latimer Co.

PENNSYLVANIA. Rather frequent, except in the Appalachians and in the North.

RHODE ISLAND. Rather rare: Providence Co., Washington Co.

TENNESSEE. Rare: Davidson Co., Haywood Co., Maury Co., Obion Co., Stewart Co.

TEXAS. Rare: Dallas Co.

VERMONT. Rare: Chittenden Co.

VIRGINIA. Rather frequent, except in the East.

WEST VIRGINIA. Rare: Mason Co.

WISCONSIN. Rather rare: Chippowa Co., Columbia Co., Dane Co., Monroe Co., Polk Co., Richland Co., Sank Co.

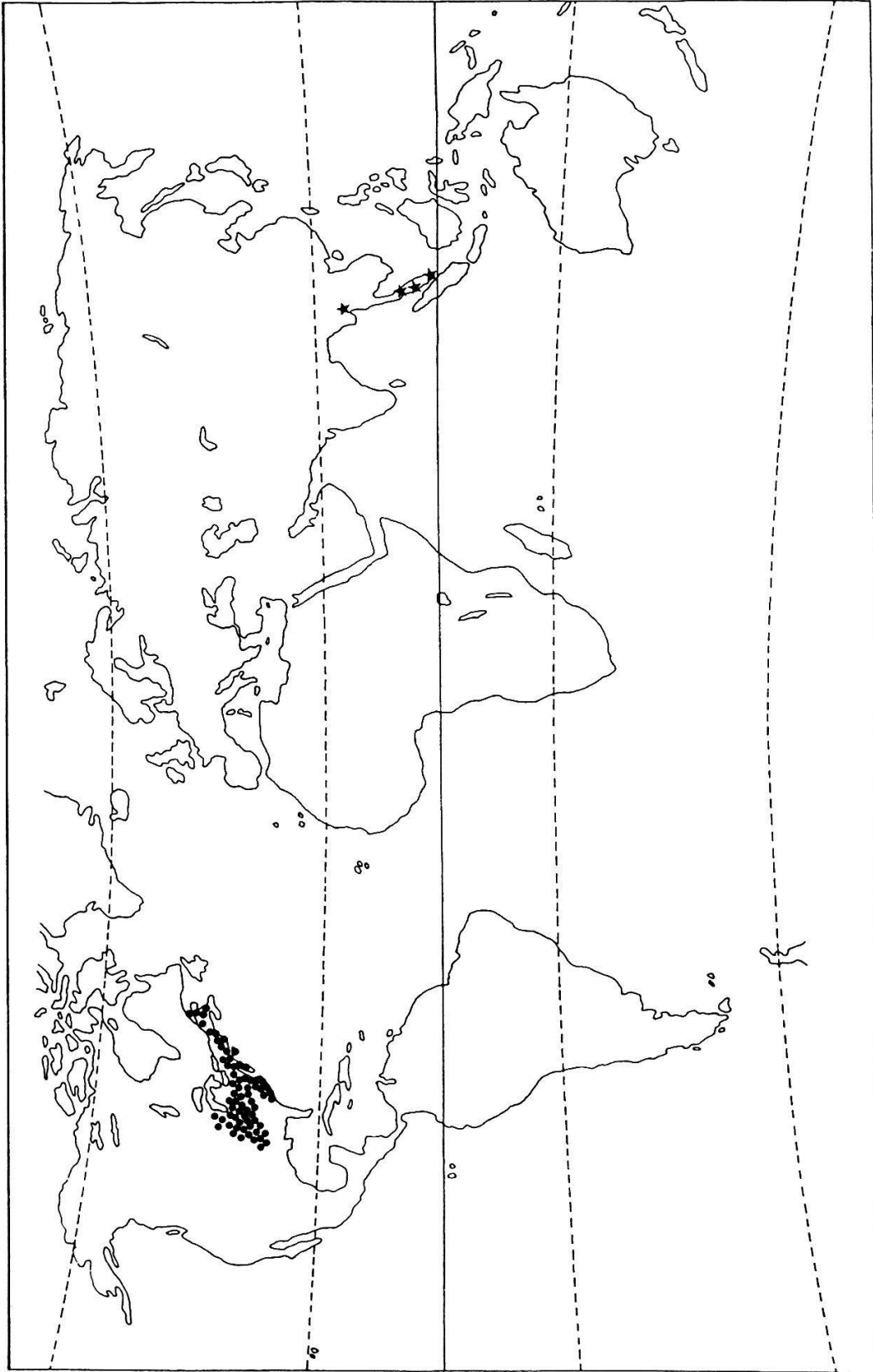


Fig. 6.12. Distribution of Lemna perpusilla (●) and L. tenera (★)

6.1.3.13. Lemna aequinoctialis (fig. 6.13)

L. aequinoctialis is distributed throughout the warmer zones of the world. With rice cultures, it was introduced into the temperate zones of many places (e.g. southern Europe, central North America, northern China, northern Japan).

NORTH AMERICA

MEXICO

BAJA CALIFORNIA SUR. Arroyo Santa Anita (Thomas 7744: DS); Miraflores (Wiggins 14742: ARIZ, TEX, WTU); Mulege (Johnston 3701: CAS); San Javier (Wiggins 519: CAS, DS); San José del Cabo (Wiggins 14712: CAS, DS, POM, UC).

CHIAPAS. Ocozocoantla (Breedlove and McClintock 23472: DS); Puerto Arista (Breedlove and Thorne 20905: DS); Tuxtla Gutierrez (Breedlove and Raven 8455: DS, MICH); Tuxtla-La Angostura (Breedlove 37367: DS).

COAHUILA. Matamoros (Rose and Russell 24226: US).

COLIMA. Manzanillo (Ferris 6125: DS; McVaugh 1633: MICH).

JALISCO. Aguascalientes (McVaugh 17048: MICH); Autlan (Wilbur 2225: MICH); Cuautitlan/Autlan de Navarro (Barr 62-802; Hevley 2811: ARIZ); Rio Primavera, Guadalajara (Kiener 18267: WIS, ZT); between El Tuito and Chamela (Lüönd 20/3/1984: ZT).

MEXICO. Cuernavaca (Fassett 28444: MO, WIS, ZT); Lake Tonatihuá (Fassett 28457: F, GH, MO).

MICHOACAN. Halfway between Jacona and Zamora, along Mexico Hwy. 15 (Iltis et al. 654: ZT).

MORELOS. Cuernavaca (Rose and Haugh 4440: US; Rose and Painter 6877: US).

NAYARIT. Acaponeta (Rose, Standley and Russell 14385: US); Ixtlan (Jones 23465: MO, UC); Mecatan (McVaugh 23578: MICH).

OAXACA. Distrito del Centro (Conzatti 4815: MICH); Oaxaca/Tula (Thompson 11/8/1910: KANU); Oaxaca (Camp 2764: WIS); Poyo de Aquibera (Conzatti 5226: MICH); Tuxtepec (Santos 3308: MICH).

QUERETARO. Tequisquinapan (Rose, Painter and Rose 9852: US).

SAN LUIS POTOSI. Without exact locality (Schaffner 634: BM, CAS, GOET, FI, M, NY).

SINALOA. Culiacan (Brandegge 6/9/1904: MICH, UC); Mazatlan (Rose, Standley and Russell 3997: US; Wright 1/1889: DS, G, MSC, UC, US); Topolobambo (Bailey 15/9/1897: US; Palmer 177: ARIZ, C, LE, MICH, US; 199: C, S).

SONORA. Colorado/Mazatlan (Wiggins 366: ARIZ, DS, GH, LL, MICH, MO, NY, UC, US); Guaymas (Bailey 273: BH); Hermosillo (Letho L 19344: ARIZ, FLAS, MSC, OS); Morelos (White 4415: MICH); Navajoa (Barr 62-559; Hevley 2567: ARIZ); Ures (Drouet 3721: GH, MO, NY, US, VT).

VERACRUZ. Catemaco (SCHWABE-BRAUN 1981); Veracruz (Gigon: ZT* 7656).

YUCATAN. Aguda (Gaumer 23234: G, ILL, LE, LL, MO, US; 3/1916: BM); Chichen, Itza (Steere 1236, 1566: MICH); Izamal (Gaumer 1437: B, BM, BR, C, CAS, DS, GH, KANU, LE, MICH, MO, PH, S, UC, US); Pocoboch (Gaumer 2393: B, BM, BR, C, CAS, DS, GH, LE, MICH, MO, S, UC, US, UPS); without exact locality (Gaumer 1438: MO, UPS).

U.S.A.

ALABAMA. Rather frequent.
ARIZONA. Rather frequent, except in the Northwest.
ARKANSAS. Rather frequent.
CALIFORNIA. Rather frequent, except in the North and at higher altitudes.
FLORIDA. Frequent.
GEORGIA. Rather frequent, but only in the South.
ILLINOIS. Rather rare: Greene Co., Lake Co., Madison Co., Menard Co., Monroe Co., St. Clair Co., Wabash Co.
IOWA. Rare: Decatur Co.
KANSAS. Rather frequent, except in the West.
KENTUCKY. Rare: Trigg Co.
LOUISIANA. Frequent.
MISSISSIPPI. Rather frequent.
MISSOURI. Rather frequent.
NEBRASKA. Rather rare: Clay Co., Douglas Co., Fillmore Co., Hamilton Co., Hayes Co., Lancaster Co., Nemaha Co., Otoe Co., Richardson Co., Seward Co., Thomas Co.
NEW MEXICO. Rare: Catron Co., Rio Arriba Co.
NORTH CAROLINA. Rather frequent, except in the West.
OKLAHOMA. Rather frequent, except in the West.
SOUTH CAROLINA. Rather frequent, except in the West.
TENNESSEE. Rather rare and only in the West: Davidson Co., Henry Co., Obion Co., Shelby Co.
TEXAS. Frequent, except in the Northwest.
VIRGINIA. Rare, only in the Southeast: Norfolk Co., Virginia Beach Co.
WISCONSIN. Rare: Grant Co., Green Co.

CENTRAL AMERICA

BELIZE

Belize (Bernoulli 12/1868: STU).

COSTA RICA

Lagarto (Pittier and Durand/Tonduz 4880: G, US, Z, ZT). Prov. Guanacaste: Rio Tempisque (BUMBY 1982)

EL SALVADOR

Dept. Ahuachapan: Ahuachapan (Standley 2528, 2537: F; 2546: UC; 20354: GH). Dept. San Miguel: Laguna Icotal (Fassett 28575: WIS); Laguna Jaguary (Fassett 28555: GH, WIS, ZT; 28558: GH, WIS; 28565: F); Laguna Seca (Fassett 29131, 29134, 29135: WIS); San Miguel (Standley 21143: GH, MO). Dept. San Salvador: Lago Ilopango (Fassett 28541: F, MO, WIS; 28542: WIS; 28543: F, MO, WIS; 28546: F, WIS); Las Cataracts, Panchimalco (Fassett 28671: F, GH, WIS, ZT); Panchimalco (Fassett 28664: WIS, ZT); San Salvador (Standley 22445: GH, S; 23157: LE). Dept. San Vicente: Apastepeque (Fassett 28347: F); Rio Lempa, Zacatecoluca (Fassett 28384: GH, WIS, ZT); Tepetitán (Standley 21438: GH). Dept. Santa Ana: Fica la Ceiba (Calderon 2265: S); Laguna de Chalchuapa, Chalchuapa (Fassett 28266: F, GH, MO, WIS, ZT); Metapan (Carlson 1045: F). Dept. Sonsonate: Armenia (Standley 23465: GH, S); Nahuizalco (Fassett 28816: F, GH, MO, WIS). Dept. Usulután: Lago San Juan, Rio Lempa (Fassett 28678: F, WIS); Lagunita Brunal, San Marcos Lempa (Fassett 29301: WIS).

GUATEMALA

Dept. Chiquimula: Chiquimula (Steyermark 30710: F); Finca San José (Steyermark 30981: F). Dept. Escuintla: Escuintla (Standley 89101: F). Dept. Izabel: Quiriga (Standley 24012, 24541: GH). Dept. Jutiapa: (Fassett 28835: GH). Dept. Petén: Sayaxché (Steyermark 46269: F). Dept.

Quetzaltenango: Quetzaltenango (Sharp 5435: GH, MO, TENN; Nelson: ZT* 7157). Dept. Quiché: Rio Blanco (Standley 62494: F). Dept. Retalhuleu: Retalhuleu (Standley 87246: F). Dept. Santa Rosa (Bernoulli 678: STU). Dept. Totomicapan: Quatro Caminos (Lüönd 2/9/1983: ZT). Dept. Uaxactum: Tikal (Lundell 15663: DUKE, LL). Dept. Zacapa: Zacapa (Standley 74260: F). Huehuetenango (Bernoulli 7/1875: GOET). Koiapa (Friederichsthal 797: STU). Without exact locality (Friederichsthal 1890: G, BR).

HONDURAS

Dept. Comayagua: Comayagua (Standley 5703: F). Dept. Morazan: Zamorano (Rodriguez 1151: F, PAC). Dept. Olancho: Juticalpa (Standley 17434: F). San Pedro Sula (Lüönd 18/9/1984: ZT).

NICARAGUA

Dept. Chontales: Juigalpa (Standley 9239, 9256: F). Dept. Granada: Lake Nicaragua (Baker 2387: UC; 2389: G, GH, KANU, L, LL, LY, MO, POM; Greenman 5769, 5771: MO; Nichols 1807: BM, GH, MO, SMU, UC, WIS, ZT). Dept. Jinotega: Esteli (Haynes 8560: AAU). Dept. Managua: Managua (Grant 1070: F). Dept. Masaya: Masaya (Dudey 55: F; Nichols 116: BM, GH, SMU). Dept. Rivas: Sapoá (Nichols 1896: BM, F, GH, MO, SMU, UC); Somoto (Lüönd 9/1984: ZT); Sodan (Orsted 1969: C).

PANAMA

Canal Zone: Juan Mina (Bartlett 16825: MO); without exact locality (Cramer 24: U; Seibert 179: GH). Prov. Chiriqui: Quebrada Velo (Woodson 240: GH). Prov. Panama: La Jagura (Bartlett 17016: DUKE, GH); Panama City-Chepo (Dodge 16723: G, U); San Antonio, Rio Juan Diaz (Klötzli: ZT* 8412).

CARIBBEAN SEA

ANTIGUA

(Russell 3251: BM, NY; Wullschlaegel 1849: M).

BARBADOS

HOWARD 1979

BONAIRE

(Wagenaar 44a: U).

CAYMAN

Gran Cayman, Georgetown (Kings 6/7/1938: BM).

CUBA

Prov. Camagüey: Camagüey (Rutten 405: U). Prov. Habana: Habana (Leon 8962: NY). Prov. Matanzas: Rio San Juan (Britton 441: CM). Prov. Oriente: Bayate (Ekman 3003: BM, F, G, S, UPS, ZT); Guantanamo (Zarzycki: ZT* 8281). Prov. Pinar del Rio: Mendoza (Shafer 10516: F); Pinar del Rio (Wright 3215: BM, GOET, MICH, S, STU). Without exact locality (Rutten 1933: U; Wright 68, 71: F; 70: KANU; 3722, 3723: GH, S; 3724: GH).

CURACAO

Santa Cruz (Horneman s.no.: C; Shafer 2993: L, NY, U; 2994: F, L, PH, U; Suringer 1885: L). St. Michiel (Suringar 1885: L). St. Thomas (Arnold 2125: US); without exact locality (Wagenaar 82a: U).

DOMINICAN REPUBLIC

Prov. Barahona: Cachon (Fuertes 19/8/1911: BM, C, F, G, L, LE, LY, MIN, S, U, UC, Z, ZT). Prov. Dajabon; Restauracion (Cicero: ZT* 7711). Distr. National: Santiago, Isa (Lowden: ZT* 8322); La Herradura (Jiménez: ZT* 8313); Guerra (Lowden: ZT* 8665). Prov. El Seibo: Horto Mayor (Lowden: ZT* 8335). Prov. la Altagracia: Bejucal (Lowden: ZT* 8275). Prov. La Estrelleta: El Llano (Lowden: ZT* 8386). Prov. Monte Cristi: Juan Gomez (Jiménez: ZT* 8255); Laguna Saladella (Lowden: ZT* 8318). Prov. Puerto Plata: Estero Hondo (Lowden: ZT* 8316; ZT* 8320); La Cienaya (Marcano, Cicero, Jiménez: ZT* 7666). Prov. San Pedro de Macoria: Guerrero (Low-

den: ZT* 8276); Los Chicarrones (Lowden: ZT* 8333); Ramon Santana (Lowden: ZT* 8278). Prov. Santiago: Santiago (Howard 9678: B, BM). Prov. Santo Domingo: Maniel de Acoa (Heine 10/1910: BR); Santo Domingo (Wright 1871: CU). Higüey (Howard 9851: B, BM, F).

GRENADA

St. George (Broadway 19/1/1905: F).

GRENADINES

Carriacou Island (Howard 10836: B, BM, FLAS, STU).

GUADELOUPE

Beaufonc (Raynal and Jérémie 21329: P, ZT; Simon: ZT* 8687). Grande Terre (Raynal and Jérémie 21318: P, ZT). Without exact locality (Horneman s.no.: C).

HAITI

Grande Cayemite, Muçon (Eyerdam 344: F, G, GA, WTU). Jérémie, Marc Franc (Bartlett 17293: UC). Dept. de l'Artibonite (Ekman H8530: C, G, S, ZT). Dept. de l'Ouest: Etang Boissier (Lowden: ZT* 8419). Dept. du Nord: Etang Romeo (Lowden: ZT* 8426). Dept. du Sud: Solon (Ekman H820: AAU, G, LL, S; H821: G, S, ZT). Port au Prince (Ekman 2359bis: S). Massif de la Hotte, Miragoana (Ekman 9040, H9986: S); Petit Tpou des Nippes (Ekman H5410: S, ZT).

JAMAICA

St. Andrew Par.: Duhaney Bridge (Lowden: ZT* 8632); St. Andrew (Harris 10837: F, GH, NY, PH, U). St. Catherine Par.: Ferry River (Harris 15/3/1900: F; Robertson: ZT* 7435); Fresh River (Lowden: ZT* 8633a); Spanish Town (Lowden: ZT* 8631); Vaggo Head (Proctor 27612: BM, LL). Clarendon Par.: Chapelton (Yuncker 17920: BM, G, S); Hoppe River Valley (Harris 9982: NY). Westmoreland Par.: Big Bridge (Proctor 27581: BM, LL).

MARIE GALANTE

Mare Locomobile (Raynal and Jérémie 21122: P, ZT); Robert (Raynal and Jérémie 21120: P, ZT); St. Louis (Raynal 19611: P; Raynal and Jérémie 21139, 21140: P, ZT).

MARTINIQUE

Mare Catiou (Raynal and Jérémie 21158: P, ZT); Mare Flambeau (Raynal and Jérémie 21172: P, ZT).

PUERTO RICO

Aguadillo (Daubs 883: ILL). Coamo (Sintenis 3188: BM, G, LE, PH, S, STU; 3189: G, GOET, LE, LY, M, S, STU;). Guanica (Britten 1795: F, GH). Juncos/Gurabo (Sintenis 2543: KANU). Manati (Sintenis 6653: F, L, LE, M; 6656: BM, GH, L, LE; Urban 6653: G, NY). Vega Baja (Britten 6765: F, G, NY; 8734: NY).

ST. BARTHELEMY

(Weigelt 1827: S).

ST. CROIX

(Fosberg 53950: GH, L, NY; Horneman s.no.: C; Howard 15297: GH; Richard s.no.: STU).

ST. MARTIN

(Boldingh 3285: L, U; Heyligers 533: U).

SAN ANDRES

(Proctor 3304: PH).

TORTOLA

(D'Arcy 498: GH; 500: FLAS).

TRINIDAD and TOBAGO

Tobago (Broadway 3103: BM, F, G, NY). Trinidad: Port of Spain (Mitchell: ZT* 7287); Milpost (Philcox 8293: K, ZT); without exact locality (Broadway 3254: BR, F, G, Z; Philcox 5/1979: K, ZT).

VIRGIN ISLANDS

Virgin Gorda (Fishlock 305: NY).

SOUTH AMERICA

ARGENTINA

Prov. CHACO. Dept. Bermejo: Arroyo Cangüi Chico (Landolt and Zarzycki 158/83: ZT); 67 km N of Resistencia, RN 11 (Landolt and Zarzycki 161/83: ZT). Dept. San Fernando: Arroyo Palameta, RN 11 (Landolt and Zarzycki 123/83: ZT); 3 km S of Colonia Benitez (Landolt, Zarzycki and Eskuche 166/83: ZT); Estancia Rio Araza (Meyer 8585: GH, LIL, S); Copernicia (ESKUCHE and ROMERO FONSECA 1982).

Prov. CHUBUT. Dept. Futaleufu: Esquel (Soriano 3422: BAB).

Prov. CORDOBA. Dept. Capital: Cordoba (Landolt 14/83: ZT). Dept. Punilla: Puente de San Roque (Kurtz 10558: CORD). Dept. Rio Primero: Las Saladas, Mar Chiquita (Kurtz 4756: CORD). Dept. San Alberto: Banado de Paja (Hunziker 22184: CORD). Dept. San Javier: Villa Dolores (Burkart 13848: SI).

Prov. CORRIENTES. Dept. Capital: A. Llamas (Verano 1908: BAB); Bridge Arroyo Riachuelo RN 12 (Landolt, Zarzycki and Eskuche 170/83: ZT); Laguna Brava (Pedersen 3989: BR, G, GH, LP, NY, S). Dept. Mburucaya: Laguna Santa Maria (Pedersen 7515: C). Dept. Saladas: Saladas (Landolt 5/83: ZT). Dept. San Cosme: E end of Laguna Rincon, RN 12 (Landolt, Zarzycki and Eskuche 178/83; 9 km S of Paso de la Patria (Landolt, Zarzycki and Eskuche 179/83: ZT).

Prov. ENTRE RIOS. Concepcion del Uruguay (Lorentz 8/1873: GOET).

Prov. FORMOSA. Dept. Formosa: Arroyo San Hilario, RN 11 (Landolt and Zarzycki 131/83; 132/83: ZT); Guazaleen (Jørgensen 3373: GH, LIL, MO). Dept. Laishi: Arroyo Lindo, RN 11 (Landolt and Zarzycki 127/83: ZT); Rio Salado, RN 11 (Landolt and Zarzycki 129/83; 129b/83: ZT). Dept. Matacos: Ing. Juarez (Castellanos 18043: LIL, ZT). Dept. Pilcomayo: ca. 40 km S of Clorinda, Rcho. He-He (Landolt and Zarzycki 137/83: ZT; ca. 3 km S of Clorinda Landolt and Zarzycki 142/83: ZT); between Primela Pinta and Laguna Blanca (Landolt and Zarzycki 149/83: ZT); ca. 12 km E of Laguna Blanca (Landolt and Zarzycki 156/83: ZT).

Prov. JUJUY. Dept. Santa Barbara: Ninalito (Meyer 8687: LIL).

Prov. LA RIOJA. Dept. Gordillo: Sierra Famatima (Kurtz 14124: CORD).

Prov. MENDOZA. Dept. Tunuyan: Las Rosas, Vista Flores (Ruiz Leal 8430: A).

Prov. SALTA. Hickmann (Pedersen: ZT* 8656); between Metan and San José (Lorentz and Hieronymus 2/1873: CORD, GOET, STU).

Prov. SANTA FE. Dept. San Justo: 2,5 km S of Gdor. Crespo (Landolt and Zarzycki 88/83: ZT). Dept. Vera: Laguna La Gallareta (Landolt and Zarzycki 99/83: ZT); ca. 9 km NE of Vera, RN 11 (Landolt and Zarzycki 103/83: ZT).

Prov. SANTIAGO DEL ESTERO. Dept. Alberdi: Campo Gallo (Barrett 3609, 3610: BAB).

Prov. TUCUMAN. Dept. Graneros: La Cocha (Meyer 3902: GH, LIL, NO). Dept. Monteros: Acheval (Castillon 1/4/1913, according to GIARDELLI 1959).

BOLIVIA

Dept. Santa Cruz: Boyuibé (Cardenas 2612: F); Fortin Ravelo (de Sloover 75/141: BR); between Boyuibé and Rio Machareti (De Sloover 75/262: BR); between Camiri and Cuevo (de Sloover 75/260: BR).

BRAZIL

ALAGOAS. Sao Jose da Coroa Grande (Lüönd: ZT* 8909).

AMAZONAS. Fortaleza (Ule 5948: G); Manaus (Albuquerque 30/7/1970: ZT); Manaus, Parna-Channel (Mitchell: ZT* 7293); Ygarapé (Rosa 31/5/1882: RB).

BAHIA. Bahia (Salzmann 1830: G, MPU); Lagoa Calderao (Luezelburg 1919: M); Queimadas (Rose 19858: US).

CEARA. Lagoa do Quixada (Luezelburg 14061: M); Maranguape (Drouet 5/8/1935: F, GH); Lima Campos (de Franca 4: US).
ESPIRITO SANTO. Linhares (Sucre 8361: RB, ZT 7608).
MARANHÃO. Alto Alegre/Barra do Corda (Eiten 10299: SP, US).
MATO GROSSO. Cuiaba (Lüönd 15/10/1985: ZT).
MINAS GERAIS. Juiz de Fora (Glaziou 3/7/1869: STU).
PARAIBA. Campina Grande (Wright 5/12/1933; 4323: GH).
PERNAMBUCO. Caxanga (Ridley 27/7/1887: BM); Esperança (Ihering 31526: SP); Olinda (Ridley 3/8/1887: BM); Recife (Mariz: ZT* 7671; Tavares 730: US); Tapera (Mariz: ZT* 8401; Pickel 3743: ZT).
RIO DE JANEIRO. Barra de Joao (Landolt and Farney 206/83; 207/83: ZT; ZT* 8852); Cabo Frio (Landolt and Farney 204/83; 205/83: ZT; Schenk 3976: STU); Cascadura (HEGELMAIER 1895); Jacarepagua, Seco Grande (Landolt 188/83: ZT); Marico-Sao Jose do Imbaicai (Landolt 191/83: ZT); Marico, Barra de Marico (Landolt 193/83: ZT); Rio de Janeiro (Carauta 2474: RB; 21/12/1977: RB; Glaziou 1869: STU; 3659; 5445: C, STU).
RIO GRANDE DO NORTE. Mossoro (Lüönd: ZT* 8908).
SANTA CATERINA. Agua Boa Riozinho, Bom Retiro (Smith 7907: R, RB).
SAO PAULO. Faz. Oroité, Imbia Paulista (Zuber: ZT* 8749).

COLOMBIA

Dept. Amazonas: Loreto Yacu, 70 km NW of Leticia (Hermann 11312: COL, GH, NY, US). Dept. Atlantico: Barranquilla (Dugand: ZT* 7469; Gutierrez and Barkley 18C005: COL, S, WIS; 18C006: COL, US); Malambo (Dugand: ZT* 7457). Dept. Bolivar: Arijna (Killip 14504: GH); Cartagena (Bailey 258: BH); Soplaviento (Killip 14609: GH, US). Dept. Cordoba: Monteria (Bristow 2/1971: COL). Dept. Magdalena: Santa Marta (Karsten s.no.: STU). Dept. Santander: Landazuri, 70 km N of Velez (Fassett 25379: US, WIS); Puerto Olaya (Fassett 25362: US).

ECUADOR

Prov. Esmeraldas: 25 km S of Esmeraldas (Sparre 15451, 15452: S). Prov. Guayas: Durand (Asplund 5794: S); Engabao (Svenson 11024: CAS, GH, NY, UC, US); Guayaquil (Anderson 76; Asplund 15348; Fagerlind 166, 167: S; Little 6578: F, NY, UC, US); Samborondon (Zuber: ZT* 8755); Guayaquil-Salinas (Hitchcock 20098: GH, US); Guayaquil-Chongon, Hazienda Santa Lucia (Asplund 5232: S); Las Americas, Rio Macul (Fagerlind 319C: S); Miagro (Hitchcock 20251: GH, US). Prov. Oro: Portoviejo, Zaruma (Hitchcock 21258: GH, US). Prov. Pastaza: Rio Capihuari (Ollgaard et al. 35070: AAU).

FRENCH GUIANA

Cayenne, Ile Royale (Oldeman: ZT* 7412); Pointe Macouria (Oldeman: ZT* 8413).

GUYANA

Demerera (Georgetown) (Cramer 5, 22: U; Hitchcock 16622: GH, US; Parker s.no.: STU; Persaud s.no.: ZT). Without exact locality (Spruner 1864: G).

PARAGUAY

Dept. Boqueron: Mariscal d'Estigarribia-Ingavi (de Sloover 75/103: BR); Parotodo (Arenas 1122: CTES); Picada Lepay, km 63 (de Sloover 75/117: S; 75/118, 75/120: BR). Dept. Caaguazu: Coronel Oviedo (Bordas 39994: ZT). Dept. Itapua: Trinidad (Osten 9165: BAF). Dept. Neembucu: Yataity (Walter 44: FLAS). Dept. Olimpo: Bahia Negro-Chaco Paraguayo (Rojas 13.755: LIL). Dept. Presidente Hayes: Transchaco-Rio Negro (de Sloover 75/81-82: BR). Dept. San Pedro: Rio Aguaray, Guazu (Krapovickas and Cristobal 34272: CTES).

PERU

Dept. Huancavelica: Huancavelica, Upper Mantara Valley (Hanght 182: US).

Dept. Ica: Ica, Las Dunas (Zuber 26/2/1983: ZT). Dept. Loreto: Isla Ca-
cao (Hermann 11313: COL, GH, US). Dept. Dumbes: Zarumilla/Agua Verdes
(Ferreyra 10608: US).

SURINAM

Prov. Brokopondo: Brokopondo Lake (Donselaar 1003, 1004: U); Wilhelminia
(Stahel 7013: U). Prov. Commewijne: Nieuw Amsterdam (Cramer 14898: U).
Prov. Coronie: Marienburg (Cramer 14918: U); Wia Wia Reservaat (Cramer
14914, 14888: U; Lanjouw 1108: U; Sterringa LBB 12505: U); without exact
locality (Cramer 14892, 14893, 14894, 14895, 14896: U). Prov. Nickerie:
Achterstraat (Cramer 2: U); van Bigi (Lindemann 3077: U). Prov. Saramac-
ca: Mokomoko-zwamp (Lindemann 5576b: U). Prov. Suriname: Paramaribo
(Cramer 14886, 14887, 14890: U; Wullschlaegel 505: BR, U); Paramaribo,
Airport (Boer 1163: A, NY, U); Paramaribo, Zypad (Cramer: ZT* 8413).
Without exact locality (Weigelt 1827: G, GOET, M, MO, PH, S, STU, WU).

VENEZUELA

Distr. Federal: Caracas (Ernst 5; 24/1/1865: STU). Esto. Aragua: Lago de
Valencia, Maracay (Alston 5682: BM; Cardénas: ZT* 7304). Esto. Azoate-
qui: La Soledad (Gines 3893: US). Esto. Barinas: Cerca de Barinas (Zuber
17/4/1986: ZT* 8925); Libertad-Rio Apure (Zuber: ZT* 8921). Esto. Falcon:
Adicora Paraguana (Tamayo 18422: BR). Esto. Guarico: Calabozo (Zuber 15/
4/1986: ZT). Esto. Lara: Agua Viva (Zuber: ZT* 8928); Barquisimeto, Car-
rizal (Tillet: ZT* 7395); El Paso (Tillet: ZT* 7396). Esto. Miranda: Cua
(Ernst 23/3/1869: STU). Esto. Monagas: Santa Barbara (Pursell 8729: NY,
PAC). Esto. Portuguesa: Piritu (Tillet: ZT* 7380). Esto. Sucre: Cumana
(Campos 0515: US). Esto. Zulia: Maracaibo (Karsten 11/1867: JE, L, MO,
STU, U).

ATLANTIC OCEAN

CANARY ISLANDS

Gomera, Los Organos (s.coll. 5/2/1866: K).

CAPE VERDE ISLANDS

S. Tiago, Antonio (Chevallier 44683: P).

EUROPE

FRANCE

Bouches du Rhône, Arles (Landolt: ZT* 7806).

FRG (West Germany)

Nordrhein-Westfalen, Bedburg (warm water inlet, only temporary; DIEK-
JOBST 1984, Diekjobst: ZT* 8746).

ITALY

(KOCH 1952, PIGNATTI 1957). Piemonte: Novara and Vercelli (Koch 51/569,
582B, 606, 627, 634, 638, 649, 690B; Landolt 108/55: ZT; Landolt and
Lüönd: ZT* 8641). Lombardia: Pavia (Koch 51/668A: ZT; Landolt and Lüönd:
ZT* 8642).

SPAIN

Huerta del Segura (RIVAS MARTINEZ 1982).

AFRICA

ALGERIA

Prov. Constantine (Cosson 3/7/1861: P).

ANGOLA

Prov. BENGUELA. Cubal (Azancot de Menezes: ZT* 7643); Lobito (Hess 51/
30: ZT).

Prov. LUANDA. Luanda Distr.: Rio Dande (Portugal Aranjó 3/1956: LISC);
Musegne de Luiz Gomes (Welwitsch 206: BM, C, STU, ZT); Bemposta (Wel-
witsch 205: BM, C, G, K, L, P, STU, ZT); Icolo e Bengo Distr.: km 11 de

la route Barraca-Zeuza (Azancot de Menezes: ZT* 7409); Lagoa de Quilunda (Welwitsch 211: BM, L, STU). Ambriz-Congo Distr.: Lagoa de Quizembo, Ambriz (Welwitsch 209: C, L).

Prov. CUANZA NORTE. Cazengo, Fazenda Maua Ambaca (Gossweiler 4979: K); Fazenda Hollanda, Pungo Andongo (Hess 50/81: ZT).

Prov. HUILA. Gambos, Chimbolebo (Azancot de Menezes 2566: LISC).

Prov. MALANJE. Malanje (Young 933: BM, SRGH).

Prov. MOCAMEDES. Porto Experimental do Caraculo (Mendes 3882: LISC). Mocamedes Distr.: Giraul (Welwitsch 18/7/1859: BM, STU).

Without exact locality (Welwitsch 207: G, K).

BENIN

Zagnanado, Lake Arzi (Chevallier 23044: P).

BOTSWANA

Northern Distr.: Nata River (Drummond 5278: K, LISC, PRE, SRGH); Shaile (Edwards 4383: PRE; Russell 2395: SRGH); Okavango Swamps, Moanachira River (Smith 581: SRGH; 585: K, PRE, SRGH); Nqamaya Island (Smith 1753: SRGH); Qeuxmno Island, Okavango (Smith 1571: SRGH); Thaoge River (Smith 1451: SRGH); Thamalakane River (Smith 879: SRGH); Letetemetso Island, Ngokha River (Smith 210: SRGH); Savuti (Wager 59847: PRE, SRGH); Nyami-land, Sepopa (Müller: ZT* 8367); Shakawe (Müller: ZT* 8369); Mochudi (Mitchison A42: K).

BURUNDI

Bujumbura, Bubanza (Lewalle: ZT* 7339); Uvira (Lewalle 6330: BR, K; ZT* 7236); Rusizi (Lewalle 2796: K; 4650: BR; Reekmans 4379: BR); airport road (Lewalle 4144: BR).

CAMEROON

Doumé-Ndingé (Letouzey 3826: P). Kousseri, Fort Fourreau (Letouzey 7075: P). Pendja Nyombe (Meurillon 684: BR, P; 685: BR). Makari (Raynal 20675: P). Maroua (de Wilde 3490: BR). Waza (de Wilde 5106: WAG).

CENTRAL AFRICAN REPUBLIC

Chari, Ndélé (Chevallier 7875: P). Oubangouï, Nyaha (Tesseront 117: P).

CHAD

Chari, Babelia (Chevallier 10222: P); Dar Banda (Chevallier 6744: G, K, L, P). Ennedi, Fada (Monod 13950, 13955: P); Gulta el Guettara (Zolofarevsky et al. 389: P). Massakori (Chevallier 10040: G, L, LY, P, Z; Raynal 12653: P). Ndjamena (Fort Lamy) (d'Alleizette 12/1922: L; de Wilde 5164: K, WAG). Tibesti, Aozou (Scholz 15: B).

CONGO

Brazzaville, Djoumouna (Hallé: ZT* 7368; 1859: P).

EGYPT

Bahr el Jebel (Simpson 7486, 7620: K). Dakhla Oasis (Ascherson 2267: GOET, JE, M, STU; 2269: K, LE, STU, WU; 10/1/1874, 17/4/1876: STU; Sickenberger 1891; 1/7/1893: Z; Simpson 6095, 6112: K). El Kharga (Schweinfurth 2/1874: STU). Ramleh (Scott 8-11/3: FI).

ETHIOPIA

Prov. HARAR. Fafan Valley (Burger 2092: K).

Prov. SHOA. Zedamba (Martelli 1870: STU); Zukwala (Meyer 7501: K, MO).

GABON

Mekambo (Hallé 342: P).

GHANA

Cape Coast (Hall 2269, 2349, 3038: K). Kumasi (Akpably: ZT* 7255; Baldwin 12466: MO). Legon (Agyakwah: ZT* 7324). Samreboi (Hall 2489: K). Takoradi (Hall 2421: K).

GUINEA

Koba (Felix 7246: K, P).

IVORY COAST

Afféry (Ake Assi: ZT* 7116). Azaguíé (Ake Assi 5953: K). Boundiali (Roberty 7015: G, Z). Mankono (Chevallier 21927: K, P). Rubino (Ake Assi 7761: K). Sassandra, Niounourou (Rham: ZT* 7338). Soubré (Leeuwenberg 4095: BR, K, L, LISC, S, WAG).

KENYA

Nairobi, Thika, Athi River (Bogdan VB263: UC; Leuthold: ZT* 8253). Tvaso West, Mzima Springs (Landolt: ZT* 8432; Slowik: ZT* 7256). Kilifi Distr.: between Mariakebuni and Maraga, 20 mi NW of Malindi (Polhill and Paulo 845: B, BR, K, PRE, S). Kwale Distr.: Taru, between Samburu and Macchinnon Road (Drummond and Hemsley 4141: K). Machakos Distr.: 14 Falls (Ol dan Sapuk) (Verdcourt 718B: EA, MO). Masai Distr.: Ol Tukai (Verdcourt 3117: BR, EA, K, PRE, UT). Mombasa Distr.: Fimboni Rabai (Hildebrandt 2309: M, STU; Taylor 1885: BM). Nyanza Distr.: Kisumu (McMahon 216: EA).

MALAWI

Northern Prov.: Rumpi Distr.: Lake Kazumi (Pawek 3354: K). Southern Prov.: Blantyre, Chilomoni Dam (Reed: ZT* 7382); Lengwe Game Reserve (Hall-Martin 3/1969; Vorster 1888: PRE); Zoma Distr.: Sandbar, Lake Chilwa (Williams 232: SRGH).

MALI

Bandiagara (Chevallier 277: P). Dialibo (Chevallier 23/1/1899: BR). Djenne (Chevallier 2/7/1899: BR, K, L). Mopti (Chevallier 2609: P). Quiquaka and Timbuktu (HEPPER 1968).

MAURETANIA

Moudjéria (Cludeau 11/1910: P).

MOZAMBIQUE

Prov. Manica e Sofola: Beira entre Maneta e Chibondo (Mendoza 4361: LISC); Macuti (Wild 5197: K, MO, SRGH). Prov. Maputo: Inhaca Island, 23 mi E of Lourenço Marques (Mogg 28066: PRE, SRGH; Noel 140: PRE); Rio Futi (Balsrinhas 1601: ZT). Prov. Tete: Magué, Dique (Wild 2582: SRGH).

NAMIBIA

Rehoboth Distr.: Langbeeb (Strey 2558: PRE); Pamela (Volk 2908: M). Windhoek Distr.: Daam Viljoen Park (Giess: ZT* 7321); Elisenheim (Giess and Merxmüller 30018: M, PRE, WAG); Goreangabdam (Giess 10899: K, M); Windhoek (Giess 3940: M). Farm Knau Dam, Otjimbingwe (Giess 13534: K, M, PRE). Otjovasandu (Le Roux 524: PRE). Owamboland, Ukualutlu (Soini 17/7/1965: H).

NIGERIA

Babana to Kubi (HEPPER 1968). Benin (Brenan 8497, 8768: BM). Bussa (Cook 522: K, Z). Ibadan, University College (Hopkins: ZT* 7130; Eijnatten 1417: WAG; Meikle 955: K). Ikorodu (Killick 297, 298: K). Jebba (Meikle 1329: K). Jjebu-Ode, Ogun (McFarlane 11/12/1966: K). Lagos (Connal 18/4/1928: BM). Shasha Forest Res. (Richards 3215: BM). Omo River (Jones 166'88: BM). Zaria City (McFarlane 10/5/1966: K, L).

RWANDA

Astrida, Buyenzi (Becquet 732bis: BR). Bugesera, Lake Kibirimi (de Sloover 12/3/1972: BR). Kagera (Stuhlmann 1250: STU). Kibundu Distr.: National Park of the Akagera, Lake Mihindi (Troupin 1471C: BR); Sabasenk Hill (Troupin 15002: BR); Rwanyerajana Hill (Troupin 6799: BR).

SAO TOME

Sao Tomé (Monod 15/8/1956: BM).

SENEGAL

Dakar (Sanokho: ZT* 8650). Dioime (Roberty 10028: G). Gorom (Bernhaut 29/9/1953: P). Koumpentoun (Trochain 3685: BM). Koun-Koun (Trochain 4899: BM, P). Richard-Toll (Hepper 3621: K). Rufisque (Bernhaut 5267: P). Kayar (Bernhaut 5062: P). Santanba (Bernhaut 4993: P).

SIERRA LEONE

Gbundapi (Adams 72: K).

SOUTH AFRICA

CAPE. Dune Bush, Kromme Bay (Acocks 21459: K, PRE). Zwartkops River, Uitenhage (Drège 4453: K, LE, MEL, P, S).

NATAL. Bella Vista Distr.: Usulu-Pongola River (Wager 59814: PRE). Isi-pingo North (Ward 7608: PRE). Ubombo Distr. (Mauve 4931: PRE); Kosi Bay (Strey 26/11/1967: PRE). Zululand, Mpangeni Lake, 5 km NW of Ngoya (Mussil 360: PRE); False Bay (Ward 2524: K, PRE). Without exact locality (Drège 1839: G).

ORANGE FREE STATE. Lincoln Farm, Bossiespruit (Edwards 3025DB: L). Zoutpansberg, Farm Zoutpan (Obermeyer 438: PRE).

TRANSVAAL. Kruger National Park, Lunpod (van der Schijff 22/4/1953: PRE); Moldave (van der Schijff 16/2/1953: PRE).

SUDAN

Prov. BAHR EL GHAZAL. Seriba Jur (Schweinfurth 1725: K, STU).

Prov. BLUE NILE. Gennar (Büttiker 52/1: ZT).

Prov. DARFUR. Marra Mts. (Dandy 38: BM; Wickens 1517, 2836: K).

Prov. EQUATORIA. Jebel Nyemati, Bahr el Hiad (Schweinfurth 1011: K, MEL, STU); Makporru (Schweinfurth/Brown 3740: GH, K, L, MEL, S, STU, WU); Nyanyane (Schweinfurth/Brown 3986: STU).

Prov. KORDOFAN. Kadugli (Bunderson 11/81: ZT). Nuba Mountains (Pfund 430: K; Wickens 783: K).

Prov. UPPER NILE. Bahr el Jebel, Lemoneli (Schweinfurth 1127: GH, K, MEL, S, STU, WU; Simpson 7620: K); Tonga (Rein 1472: K).

TANZANIA

Prov. ARUSHA. Amboseli (Klötzli: ZT* 8638); Hale Dam, Pangani Valley (Harris DSM 1541: EA). Ngorongoro Crater (Gilbert and Sharpe 2679: K); Tengem Arca (Beesley 2: EA); Tengemaree (Beesley 3: EA). Distr. Mbulu: Lake Manyara National Park, Lake Manyara (Greenway and Kanuri 11.342: EA, K, PRE; 11807: EA, BR, K, PRE). Musoma Distr.: Geitokitok, Springs about 15 mi from Ngorongoro (Verdcourt 1558: BR, EA, K, PRE).

Prov. COAST. Dar es Saalam (Peter 32711: B); University of Dar es Saalam, Kijito-Nyama stream (Wingfield 416: EA).

Prov. IRINGA. Mesengati (Greenway and Kanuri: ZT* 7341; 14.504: EA, K, MO, PRE); Ruaha National Park, Msembe (Greenway and Kanuri: ZT* 7338); Makindi Track (Richards and Arasululu 26355: K); Trikimboga Track (Greenway and Kanuri 13.953: EA; 14.461: EA, K, MO; 14.465: PRE).

Prov. KIGOMA. Ujiji (van Meel 510: BR). Mpanda Distr.: Silambula (Jefford and Newbould 2041: K).

Prov. KILIMANJARO. Moshi, Boma Ngombe (Kunderli: ZT* 7557). Takora Distr.: Nymbe (Braun 5435: EA).

Prov. MARA. Kirawera, Grumeti River (Greenway 10.796: EA, K, PRE).

Prov. MBEYA. Mbalizi, Nzovwe River (Wingfield 415: EA); Nunka, Rukwa Lake (Nicholson 185: EA); Sangu Plain, Utengule (Richards 17581: K); 8 mi SW of Galula (Wingfield 416: EA); Stream near Kiwira Spring (Wingfield 414: EA).

Prov. MOROGORO. Usagara, Kidete (Peter 32711: B).

Prov. MTWARA. 8 km SW of Kingupina (Vollesen 3068: EA).

Prov. TABORA. Mpanda Distr.: Silambula, Mahali Mts. (Jefford and Newbould 2041: K).

Prov. TANGA. Bagamoyo, Mkwaja Ranch (Klötzli: ZT* 8377, 8379); Bagamoyo (Hildebrandt 1279: BM, K, L, LE, PH, STU, WU); 3 km SE of Bagamoyo (Thulin and Nhoru 496: EA, K, UPS); Pangani (Braun 1537: EA; Klötzli: ZT* 8268); Ruovo River (Greenway and Kanuri 8974: EA, K, NY); Usambara (Holst 3441: K, LE, M, Z). Korogwe Distr.: Pangani River (Greenway 8715:

EA, K). Magunga (Peter 12708: B). Amboni (Peter 24774: B); East Usambara (Verdcourt 290/290A: EA); Useguha (Peter 8385: B).

TOGO

20 km S of Mango (Meyer 5/4/1984: ZT).

UGANDA

Prov. Sebei: East Mengo Distr., Bulemezi Co., near Kikinzi School (Lye 4413: K). Masaka Distr.: Koki Co., 3 km S of Mabira Village (Lye 6081: EA, K). Teso Distr.: Usuku Co., Bekudea (Katende and Lye K283: EA, MO). West Mengo Distr.: Busiro Co., Kisi (Lye 3949: EA, K); Bukesa near Kampala (Richardson 9/60: K). Prov. Toro: Toro Distr., Npanga River (Bagshawe 1065: BM); Queen Elizabeth National Park (Lock 67/172: EA). Forest Dept.: Bukomero Singo, Mile 53 Kampala-Hoima Road (Eggeling 558: K). Kiagwe, Namanwe Swamp (Eggeling 496: K).

ZAIRE

Prov. BANDUNDU. Dima (Vanderyst 903, 5223: BR).

Prov. EQUATEUR. Eala (Couteaux 531; Lebrun 490: BR); Lukolela (Laurent 20/4/1909: BR); Ubangi (Laurent 21/12/1903: BR). Yaminga (Laurent 9/1/1904: BR).

Prov. HAUT-ZAIRE. Nagero, Dungu River, Garamba National Park (Troupin 679ter:BR); Upemba National Park (Van Meel 05832, 07376: BR); Yangambi (Louis 14686: ZT).

Prov. KINSHASA. Bosobolo Terr., Bili Baya Road, Mondjo Swamps (Evrard 2.459: BR); Kinshasa (Gillet 8/1902: BR); Mangabaka River (Evrard 6.304: BR).

Prov. KIVU. Kabare, Albert National Park (Robyns 4062: BR, K); Katanda, Albert National Park (Lebrun 7663: BR); Ruthshuru Falls (Leonard 1717: BR).

Prov. SHABA. La Lufira, between Shiruma and Kiubo (Lebrun 10844: BR); Keyburg Station, 7 km SW of Lubumbashi (Schmitz 1.910: BR); Kinbo Bassin, Lufira, Jadotville-Sampwe Road (Schmitz 2.084: BR); Kiswishi (Malaisse 7953: BR); Lubumbashi (Malaisse: ZT* 7482); Ngaliema Terr., Isle of Mimosas (Breyne 2082: BR).

Prov. ZAIRE CENTRAL. Manyanga, N-Sabara (Stuhlmann 677: STU); Kizu (Vanderyst 26587; Wellens 414: BR); Lukunga River, Zambi (Vanderyst 17866: BR); Territory of Thysville, Sanga (Ruisseau s.no.: BR).

ZAMBIA

Northern Prov.: Luapala Distr., Lake Mweru, Mweru-Wantipa (Richards 9139: BR, K). Southern Prov.: Muckle neuk, 12 mi N of Choma (Robinson 589: K). Boroma on Zambezi River (Menyhardt 1103: WU).

ZIMBABWE

Gwanda Distr.: Zsibizini River (Pope: ZT* 7629, 716: SRGH). Kariba Distr.: Kariba Gorge (Smith 106D/60: SRGH). Nuanetsi Distr.: Malipate (Drummond 7549, 7550: BR, K, LISC, MO, PRE, SRGH); Manjinji Pan (Taylor 176: K, LISC, PRE; ZT* 7523); Merival Ranche (West 7454: SRGH); Ngezi ya matetsi (Konietzko 36: BR); Nuanetsi River (Drummond 7529: SRGH). Urungwe Distr.: Chirundu (Drummond 5354: BR, EA, K, LISC, PRE, SRGH; Whellan 25778: K, SRGH); Zambezi Valley, Kariba Gorge (Wild 4264: B, K, LISC, MO, PRE, S, SRGH). Wankie Distr.: Nenimba Springs, Wankie National Park (Rushworth 117: SRGH); Ngwashla Road, Inpan (Wild 4766, 4767: BR, K, LISC, SRGH); Wankie Game Reserve (Maar 46806: K, SRGH).

INDIAN OCEAN

COMORO ISLANDS

Johanna (Hildebrandt 1875: BM, KANU, L, LE, M, STU). Mayotte (Boivin 3093: P).

MADAGASCAR

Akaratra (Benoist 614: P). Prov. Ambovoranto: Moramanga (Humbert 945: B, P). Prov. Imerina (Hildebrandt 3520: B, BM, G, GOET, JE, L, LY, M, NSW, STU, W, WU, Z). Mandritsara (Decary 14432: P). Lake Itasy (Perrier de la Bathie 7200: P). Sakondry, Ouilahe (Perrier de la Bathie 4397: P). Prov. Tamatave (Vignier and Humbert 27/9/1912: B, P). Tananarive (d'Alleizette 606: L). Tsimbazaza (Morat: ZT* 7743). Without exact locality (Baron 2272: STU; 4320: P).

MAURITIUS

Without exact locality (s.coll.: BM).

NORTHERN AND WESTERN ASIA

AFGHANISTAN

Nuristan: Chapadarrha (RIEDL 1976).

JORDAN

El Azraq (Dinsmore 11093: G, K; Gillet 15624: K).

LEBANON

Amiq (Mouterde 2676: G, P); Tyr (MOUTERDE 1966).

SOUTHERN AND EASTERN ASIA

BURMA

Pegu, Irrawaddy Valley (Kurz 3306, 3307: STU). Rangoon (Yank 10/1929, 5/12/1929: BM).

CAMBODIA

Savu Magrurieto (Thoree 321: P).

CHINA

FUKIEN. Kushan (Metcalf 7386: G, Z); Nantai Fu-chou (Lin yu Tai 11027: MO, UC); Shaowu (Metcalf 9077: F).

HONAN. Kioshan (Bailey 26/6/1917: BH, GH); Wen-Yang (s.coll. 30/6/1960: PE).

HOPEH. Tien-chin (Licent 751: BM, P).

HUNAN. Hsien-Tien (Bailey 1/7/1917: BH); Y-chang (Chen 1880: PE).

KIANGSI. Chiang-Kang-shan (Yue 5202: NAN); Lu-shan, Kuan-yin-Chiao (Cheo 502: NAN).

KIANGSU. Nan-ching (s.coll.: ZT* 8340; Stewart 1385: UC; 7256: US).

KWANGSI. Kuei-lin (Burnand: ZT* 8654).

KWANGTUNG. Canton, Lake Sans Soucis (Acad.Sin.: ZT* 8241, ZT* 8242; Merrill 10383: GH; s.coll. 26/10/1953: PE).

SHANTUNG. Ming-Shui (Licent 6291: P); without exact locality (Wickis 1926: UC).

SHENSI. Ju-huo-Zan (Risaia 29/6/1894: FI).

SZETCHWAN. Kientschang, Tetschang (Handel-Mazzetti 1192: WU); O'mei, Wan hsing-chuan (s.coll.: A).

YUNNAN. Kung-Ming (s.coll. 30/7/1975: PE); Nan-chiao-Hsien (Wang 77021: A); Tong-tchouzu (Maire 2870: MICH); Yetsche (Handel-Mazzetti 7951: GH, WU).

NORTHERN CHINA. Nao-gui-hai-ze (Licent 6336: BM).

HONG-KONG

Deep Bay (Shiu Ying Hu 5772: US). Hong-Kong City (Bodinier 1426: P). Hung Ha Po, Taipo (Shiu Ying Hu 6117: US). New Territories, Shatin (Lau: ZT* 7204).

INDIA

ANDAMAN AND NICOBAR ISLANDS. Nicobar Islands: Katchall (Kurz 2/1875: CAL). Andaman Islands: West Coulot (Rogers 168: CAL).

ANDHRA PRADESH. Anantagin (Balakrishnan 814: CAL). Godavari (Ihivy 135, 136, 137: MICH). Warangal (Narayan 7/4/1968: AD). Hyderabad (Narayan 23/4/1968: AD). Nidadavolu (Narayan 27/5/1968: AD).

ASSAM. Palasbari (Koelz 28209: L, UC, W); Takubama, Naga (Koelz 25562: MICH). Tatin Ponds (Pooni s.no.: CAL); Lakhimpur; Meghalaya (RAO and VERMA 1976).

BIHAR. Patna (Burnand: ZT* 8443).

DELHI. Delhi (Maheshwari 23/10/1953: BM). New Delhi (Maheshwari: ZT* 7152).

GUJARAT. Kadi (Yogi: ZT* 7237, ZT* 7685). Khaira, Anand (Gadekar: ZT* 8349).

HIMACHAL PRADESH. Kangra (Koelz 4580: F, MICH, NY, US; 4786: US). Pa-thankot (Stewart 12349: BH, MO, PH).

JAMMU AND KASHMIR. Ceylan, Ruhuna Park (Schmid 10-308: G). Dal Lake (Stewart 3337, 3348: PH). Jammu (Sharma 704: KASH).

KERALA. Changanacheri (Ihivy 131: MICH). Kottor (Cook and Frey 4744: Z, ZT).

MAHARASHTRA. Bassein (Billore 113747: CAL). Poona-Pumpai (Müller 29/4/1957: ZT). Wardha (Gadekar: ZT* 8349).

MYSORE. Bandipur (Thorne 27920: GH, L).

PONDICHERRY. Pondicherry (Thanikaimoni: ZT* 7410).

PUNJAB. Amritsar (Uotila 17606: H, Z).

RAJASTHAN. Abu (Stocks s.no.: BM, STU). Bharatpur (Klötzli: ZT* 8677, ZT* 8681). Kota (Cook 76, 77: Z; Mehta: ZT* 8257). Phulod (Shetty 1833: CAL).

SIKKIM. Purseat (Anderson 1/2/1867: CAL).

TAMIL NADU. Hosur Salem (Kanoth 568: NY). Changanacheri (Ihiva 131: MICH). Coimbatore (Subramanian 3016: CAL). Madras (Ihivy 100, 101, 124, 126, 129, 138, 139: MICH; Sebastiane 5853: CAL). Madras, Sriperampadur (Nataratjan: ZT* 7300). Tanjore (Ihivy 127, 128, 130: MICH). Vellore (Ihivy 125: MICH).

UTTAR PRADESH. Agra (Maheshwari 8094: UC). Dehra Dun (Gamble 27509: L; Pant: ZT* 7242; Parker 23/9/1922: BM). Haldwani (Parker 28/12/1927: MEL, UC). Kashipur (Chand 915: L, UC, W; 917: L, MICH, UC). Kumaun (Koelz 20556: NY). Lucknow (Maheshwari: ZT* 7318). Theri Dewal (Naithani 48263: CAL).

WEST BENGAL. Calcutta (Debbarmann 635: CAL; Kurz s.no.: MEL; 9/1869: L, LE; Meebold 791: L); Chandernagore (Remy 16/3/1863: P). Howrah, Sakrail (Banerjee: ZT* 7271); Rajnagar (Mittra: ZT* 7213).

INDONESIA

ARU ISLAND. (Beccari 11790: F, L).

BALI. Bukit Djambul (Fossati: ZT* 8374).

BORNEO. Telupid (Meyer 27/7/1967: L).

CELEBES. Tanahjampea Island (Monod 375a: L). Tataären (Alston 16342: BM).

FLORES. Rana Mese (Jaag 11/6/1938: ZT).

JAWA. Bandung (Pieterse: ZT* 8363); Bangkhalan (Backer 22/2/1915: BO); Beruki, Sungai Kolbu (Backer 12/8/1916: BO); Bogor (Zollinger 1506: U); Danan moeras (van Steenis 9/8/1937: BO); Djakarta (Zollinger 10/1855: STU); Jalan Gero (Pieterse: ZT* 8362); Junghuha (Zollinger 1586: STU); Kangean, Sepandjang (Backer 23/4/1919: BO); Kedung Gede (Pieterse: ZT* 8361); Madiven, Felaga Ngebel (BO); Malang (Zollinger 2486: BM, G, MEL, P, U); Madura Burnik (Backer 8/3/1919: BO); Sampang (Backer 3/3/1915:

BO); Subang (Pieterse: ZT* 8360); Tandjong (van der Brück 2367: U); Telaga Batangan (Backer 30/3/1914: BO); Tjikoga (Zollinger 1426: KANU, ST); Tjibadak (Bakhuizen 27/9/1907: BO); Tjikampe (van Steenis 11/4/1931: BO); Tjipanas (Hochreutiner 2213: G, Z); without exact locality (Zollinger 2609: BM, BR, LE; 2691: C).

MOLUCCAS. Ambon (Beccari 11791: FI, L).

SUMATRA. Aceh, Idi (Schneider 4/7/1936: ZT). Baliga, Tobameer (Lörtzing 6416: L). Enggano (Lütjeharms 4/7/1936). Kay Aro (Alston 14262: BM, L). Kp. Oedjoeng (van Steenis 5/9/1929: BO). Lhoksukon (Frey-Wyssling 3/6/1932: ZT). Medan (Landolt-Stadler: ZT* 8355). Singalang (Bünnemeijer 2849: BO). Talang (Bünnemeijer 5611: BO, L, U).

TIMOR. Muapitine (van Steenis 9/12/1953: BM, L).

WEST IRIAN. Balin River (Brass 11810: A, BRI, L). Sukarnapura, Cycloop Mts., Sentani Lake (Royen and Steumer 6601: L); Manokwari (Vink BW8572: A, L).

JAPAN

According to OTAKI (1974, in lit. 1978) frequent throughout the country except the northern and western part of Hokkaido; also frequent on the islands of Ryukyu Retto and Okinawa (Naha, Okinawa, Teruma).

KOREA

Cheju-do (Quelpart Island), Monglo (Faurie 10/1907: BM; Taquet 60: G, OS). Central Korea, Kangnung (Lee 17/7/1972: ZT). Hamon (Taquet 30/10/1908: C, G). Seoul (In-Hye: ZT* 8913). Without exact locality (Taquet 1936: C). Guangweon; Kyeonggi; Chungbuk; Chungnam (CHOI et al. 1973).

MALAYSIA

Johor: NW of Batu Bahat (Landolt 22/81: ZT; ZT* 8715); Mersing-Endau (Landolt 8/81: ZT). Melaka: Melaka (Derry 1889: SING). Kedah: Butterworth (Landolt 30-32/84: ZT); Kapala Batas (Landolt 33/84: ZT); Quar Chempeda (Landolt 34,45/84: ZT); Kangkong (Landolt 37/84: ZT); Liman (Landolt 38/84: ZT). Negri Sembilan: Bahau (Landolt 52/84: ZT); Seremban (Landolt 64/84: ZT). Pahang: Beserah (s.coll.: SING; Landolt 9/81: ZT); Betau (Hua 1895: SING); Maran (Landolt 12/81: ZT); Pekan (Ridley 1890: SING). Perak: Ipoh (Landolt 23/84: ZT); Sauk (Landolt 25/84: ZT); Kuala Kengsar (Landolt 27/84: ZT); Semanggol (Landolt 29/84: ZT). Pinang: Pinang (Chaw: ZT* 8230; ZT* 8244); Prai (Nur 1920: BO, L, SING). Selangor: Balakong Village (Abdullah: ZT* 7221); Kapar (Landolt 12/84: ZT); Kelang (Landolt 10/84: ZT); Kuala Lumpur, Batu Caver (Fossati: ZT* 8376); Kuala Lumpur, University (Ratnasabopathy: ZT* 8394); Kuala Lumpur (Landolt 14/81, 16/81: ZT; Surkiel 4428: BR, CAL, UC; 4429: BM, CAL, MICH, UC; 23/2/1919: BO, BRI, SING); Kuala Selangor (Landolt 14/84); between Bangi and Salak (Landolt 18/81, 19/81: ZT); Tg, Karang (Landolt 18/84: ZT); Sungai Besar (Landolt 20/84: ZT); Sabak Bernam (Landolt 21/84: ZT); Serdang (Landolt 56/84: ZT); Ulu Langat (Landolt 59/84: ZT); Kajang (Landolt 62/84: ZT); Gombak (Landolt 71/84: ZT). Terrengganu: Kuala Dungan (Landolt 46/84: ZT).

NEPAL

Jumla (Polunin et al. 4980: A, BM, G, L, S, UPS). Kathmandu (Manandhar: ZT* 7675; Klötzli: ZT* 8786b). Midam, Khola (Puri 387: CAL; Stainton 5228: A, BM, UPS). Taplejung Distr., Sanghu (Nockett 5968a: BM). Trisuli (Burnand: ZT* 8444).

PAKISTAN

Hyderabad, Hyderabad to Matiari (Omer and Yusuf 1985: ZT). Khairpur, Rohri (Yusuf et al. 1967, 1972: ZT). Karachi, Karachi (Yusuf et al. 1982: ZT). Punjab, Jhelum (Uotila 17601: H, Z); Rawalpindi (Aitchison 539: MEL, STU; 572: STU).

PAPUA NEW GUINEA

Daru Island (Brass 6063: BRI). Gulf Distr.: Malalaua, near mouth of Tauri River (Schodde and Graven 4566: A, BRI, L). Morobe Distr.: Bumbu River (N.G.F. 41246: ZT); Lae (Kokori 6/4/1973: ZT); Bulolo, Manki Dioida (Horak: ZT* 7610). New Britain: Kimbe (Willis 14/8/1975: MEL); Lake Dekatana (Ball 112: ZT). Sepik Distr.: Aitape (Rogers 3041: L). Sturt Island (Brass 8112: BM, BRI, L).

PHILIPPINES

Luzon: Mt. Prov., Bayninan (Comklin 78626: A, L). Cavite Prov., Silang (Bartlett 14786: MICH); Dupax (McGregor 11317: C, P). Laguna Prov., Los Banos (Alvarez 14636: L; Robinson 17297: BM, BO, L, P); Cogayan (Curran 11622: C); Malabon (Merrill 800: G, FI, L, M, U); Manila (Merrill 131: BO, F; Robinson 9563: BO, L, LE, P); Rizal (Rotor 29/9/1957: L). Palawan Island: Uning-Uning (Olsen 74: C). Tawitawi Island: Tarawakan (Olsen 655: C).

SINGAPORE

Galang (Ridley 7: B). Loc X 28 (Laird 17/10/1955: ZT). Loc XI (Laird 14/9/1955: ZT). North Buoa Vista Road (Sidek bin Kiah: ZT* 7199). Poting Pasio (Sinclair 1948: L, P, SING). Tampine Road (Landolt 2/81: ZT, ZT* 8712). Timah Road (Ridley s.no.: SING). Upper Changi Road (Landolt 1/81: ZT); Jurong Road (Landolt 3/81: ZT); Kg. Kranji (Landolt 4/84: ZT; Maxwell 80-5: AAU); Manday Road (Landolt 24/81: ZT); Chinese Nursery (Landolt 25/81: ZT); Loyang Road (Landolt 26/81: ZT).

SRI LANKA

North Central Prov.: Anuradhapura (Sigg: ZT* 8407); Kahatagasdigilya (Davidse 8240: MO). Southern Prov.: Ruhuna National Park (Davidse 7800: MO; Schmid 10-308: G); Tissamaharama (Hepper 4748: L, PRE, US). Western Prov.: Colombo, Panumugama (Schmid: ZT* 7645). Lagoon of Negombo (Schwank 4/8/1972: ZT); Yala Park (Jakobsen 16/3/1975: C). Without exact locality (Thwaites 2739: GH, P; 2379: G, LE, P, MEL). HEPPEL (1981) cites the following districts: Anuradhapura, Maunara, Vavunya, Hambantota, Colombo.

TAIWAN

Bankinsing (Faurie 991: P; 993: BM, G). Kaohsiung Co., Feng-Shan (Yang: ZT* 7721, ZT* 7722). Koto-Syo Island (Bosu 568: UC). According to YANG et al. (1978): Taipei: Peitou. Ilan: Ilan. T'ao-yüan: Tachi. Hsin-chu: Hukon. Taitung: Lanyu Island; Luta Island.

THAILAND

Bang Khen (Youngboonkird: ZT* 7209); Bangkok (Hansen et al. 2518: C; Kerr 10/1920: BM; Sörensen et al. 2528: C; Surapat 104, 105: IND, US); Snake Farm (Landolt-Stadler: ZT* 8358). Buriram (Kerr 6/1/1924: BM). Chiang Mai (Anasarnunthorn: ZT* 7665; Hansen et al. 1199: C; Kerr 6/9/1912: BM); Tham Chieng Dac (Kerr 21/6/1931: BM; Sörensen et al. 1199: C). Ko Tao Island (Kerr 26/9/1928: BM). Muang Distr., Sahm Lahn Forest (Maxwell 74-1041: L). Phitsanulok, Tung Salaeng Luang (Larsen et al. 903: AAU, C, L, P). Sattahip, Toong Brong (Maxwell 72-334: AAU). Loi, Na Noi (Charoenphol et al. 4939: AAU).

VIETNAM

Hanoi (Chevallier 39558: P). Nam Dinh (Mouret 393: P). Phuc-Nhac (Bon 13/12/1882: P). Ho Chi Minh (Saigon) (Nu-yan-Cuong 99: P). Tu-Phap (Balansa 3794: G).

AUSTRALIA AND NEW ZEALAND

AUSTRALIA

NEW SOUTH WALES. Bega Swamp (Hindle 18/4/1969: NSW). Stephens River (Road 7/6/1874: BRI).

NORTHERN TERRITORY. West Arnhemland, Adelaide River (Balgoooy 1413, 1414: L).

QUEENSLAND. Ayr (Landolt 66/81, 69/81: ZT). Bajool (Landolt 82/81: ZT). Biloela (Everist 11/1955: BRI). Brisbane River (Dietrich 700: AD; Müller s.no.: MEL). Cairns (Eichler 20745: AD; Blake 21746: BRI). Hannaford (Pedley 407: BRI). Holm-Hill (Landolt 74/81: ZT). Ingham (Landolt: ZT* 2734). Kalejope (Landolt 83/81, 84/81: ZT). Nebo (Landolt 76/81: ZT). Landborough (Landolt: ZT* 8727). Rockhampton (Landolt 79/81, 80/81, 81/81: ZT); Müller 1/12/1869: L, MEL, STU; Dietrich 200: WU). Trinity Bay (Sayer 1886: MEL). Townville (MacFarlaw: ZT* 7737). Walkerton (Landolt 75/81: ZT).

WESTERN AUSTRALIA. Dampierland, Broome, Coulomb Pt. (Kenneally 14/9/1978: PA, ZT). Perth, Cannington (Pully 14/8/1973: L).

PACIFIC OCEAN

CAROLINE ISLANDS

Yap (according to FOSBERG and FALANRUW 1980).

FIJI ISLANDS

Ovalau Island (von Hügel 103, 106: K; Walter s.no.: MEL). Sawanikula (John 18373: K). Without exact locality (Seemann 657: G, GH, L, STU).

GALAPAGOS ISLANDS

Academy Bay (Svenson 87: CAS, GH, MO, SMU, UC). Isla Santa Cruz (Fagerlind 3176: S; Hendrickson H34: DS, GH, S; Wiggins 18655: DS). Without exact locality (Wiggins 8895A, 8895B: CAS).

HAWAII (U.S.A.)

Oahu: Honolulu (Degener 27/11/1926: G, CU, K, MICH, NY; Elmer 2/12/1903: KANU; Fosberg 27097: GB; Heller 9/5/1895: BM, JE, KANU, L, MICH, W; 2134: CU, F, G, GH, KANU, L, LE, MICH, MSC, P, PH, WELT; Hitchcock 14120: L); Manoa Valley (Herbst: ZT* 7328); Pearl City (Herbst: ZT* 7472); Waianae (Selling 3532: GB, S, ZT). Kanaio (Degener 8935: MICH, NY). Maui (Leroy 5/8/1927: MASS, NY).

LOO-CHOO ISLANDS

(Wright 324: K, US).

MARIANA ISLANDS

Saipan (Moore 911: US, cf. FOSBERG and FALANRUW 1980).

NEW CALEDONIA

Bourail (Balansa 1367: L). Tchiar (Balansa 3111: L, UC; 3112:A, G, GH, L, MO, NY, UC, Z).

TONGA ISLANDS

Tongatabu Island (Setchell 1526: BM, L; 15520, 15547: UC; 15647: GH, L, NSW, NY; 15649: G).

WESTERN SAMOA

Falavoto (Powell s.no.: MEL). Manua (Reinecke 87: L). Savaii (Reinecke 79a: G, LY, Z). Upolu Island (Reinecke 79: G, STU).

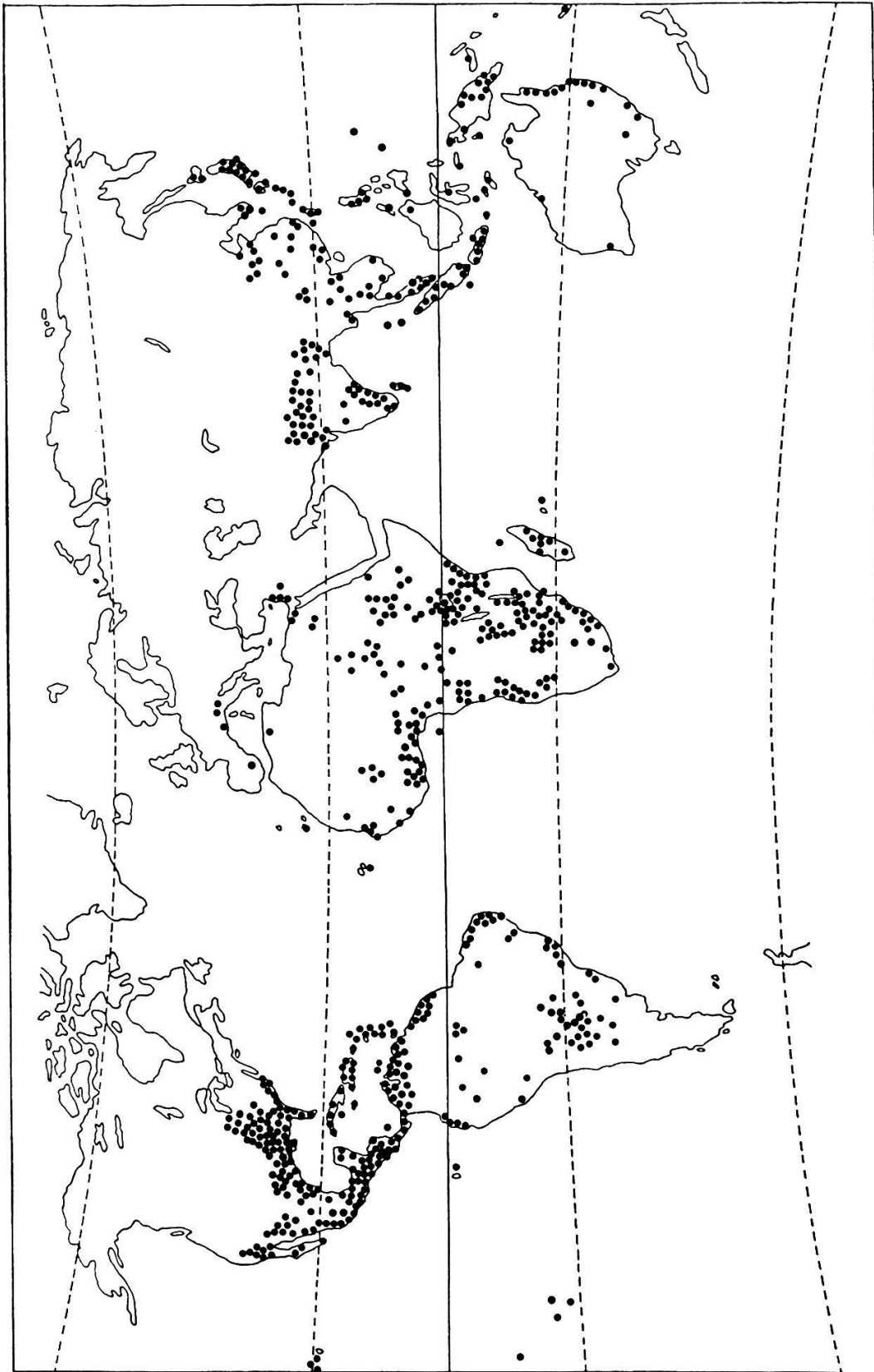


Fig. 6.13. Distribution of Lemna aquinoctialis

6.1.3.14. Lemna tenera (fig. 6.12, p. 302)

L. tenera is endemic to southeastern Asia (from Burma to Singapore), where it seems to be very rare.

SOUTHERN AND EASTERN ASIA

BURMA

Pegu, Pazwoondoung Valley (Kurz 12/1870, 2306: STU; 1/1871: K).

INDONESIA

A report from Galang Island (VAN DER PLAS 1971) is doubtful. There is probably confusion with Galang (Geylang) in Singapore.

MALAYSIA

Perak: Beruas (Ridley 3/1891: SING). Penang: Prai (Nur 1920: L, SING).

SINGAPORE

Probably now extinct due to city building. Galang (Ridley 10374: L, SING). Sarengoon (Moeller 30: GH, L, S). Tanglin (Jan 1893: SING). Telok Kuran (Ridley 10778: L; 1920: L, SING). Thong Hoe (Sinclair 13/11/1949: L, P).

6.1.3.15. Lemna valdiviana (fig. 6.14)

L. valdiviana is restricted to warm temperate, subtropical and tropical regions of America. L. valdiviana is often confused with L. minuscula.

NORTH AMERICA

MEXICO

BAJA CALIFORNIA NORTE. Ensenada (Wiggins 4751: ARIZ, C, DS, MICH, MONTU, MU, NY, UC, US).

COLIMA. Mazanillo (McVaugh 15683: MICH).

DISTR. FEDERAL. Contreras (Sharp 4415: GH, TENN). Mexico City (Hahn 5/1868: KANU, L, STU; 2/1869: GOET, JE, KANU, L, MEL, MO, STU, U; 1871, 1872: STU; Pringle 1300: G, US; 7301: CAS, COLO, MICH, MSC, SMU, UC, US, VT; Rose 6465: US; Schaffner 1875: BM, CAS, FI, G, LY, M, MEL, MICH, NY, UCLA).

MEXICO. Cuernavaca (Fassett 28457: F, GH, MO, WIS, ZT).

MICHOACAN. Ario de Rosales (Iltis and Koeppen 390: WIS, ZT); Morelia (Arsène 544: US).

TABASCO. Villahermosa (Gigon: ZT* 7653).

U.S.A.

ALABAMA. Rather frequent.

ARIZONA. Rare: Apache Co., Coconino Co., Pima Co.

ARKANSAS. Rather rare: Arkansas Co., Greene Co., Hemstead Co., Independence Co., Jefferson Co., Pope Co., Pulaski Co., Salive Co.

CALIFORNIA. Rather rare: Humboldt Co., Lake Co., Marin Co., Riverside Co., San Bernardino Co., San Diego Co., San Francisco Co., San Luis Obispo Co., San Mateo Co., Tuolumne Co.

CONNECTICUT. Rather rare: Fairfield Co., Hartford Co., Litchfield Co., New Haven Co., New London Co.

DISTR. OF COLUMBIA. Rare.

FLORIDA. Frequent.

GEORGIA. Rather rare: Catoosa Co., Chatham Co., Decatur Co., Early Co., Glynn Co., McIntosh Co., Sumter Co., Ware Co.

ILLINOIS. Rare: Cook Co., St. Clair Co., Union Co.

INDIANA. Rare: Noble Co.

KANSAS. Rare: Cherokee Co., Douglas Co.

KENTUCKY. Rare: Ballard Co.

LOUISIANA. Frequent.

MARYLAND. Rare: Cecil Co.

MASSACHUSETTS. Rather rare: Barnstable Co., Essex Co., Middlesex Co., Norfolk Co., Plymouth Co.

MICHIGAN. Rare: Kalamazoo Co.

MISSISSIPPI. Rather rare: Adams Co., Clark Co., Forrest Co., Issaquena Co., Pike Co., Wilkinson Co.

MISSOURI. Rather rare: Dunklin Co., Oregon Co., St. Louis Co., Stoddard Co., Wayne Co.

NEBRASKA. Rare: Lancaster Co.

NEW JERSEY. Rather rare: Bergen Co., Morris Co., Passaic Co., Union Co.

NEW MEXICO. Rare: Dona Ana Co.

NEW YORK. Rare: Orange Co., Suffolk Co.

NORTH CAROLINA. Rather frequent, but only in the East.

OHIO Co. Rare: Lake Co.

OKLAHOMA. Rare: McCurtain Co.

PENNSYLVANIA. Rare: Bucks Co., Northumberland Co., Philadelphia Co., Pike Co.

RHODE ISLAND. Rare: Providence Co.

SOUTH CAROLINA. Rather frequent, but only in the East.

TENNESSEE. Rather rare: Coffee Co., Greene Co., Lake Co., Lauderdale Co., Obion Co., Perry Co., Shelby Co.

TEXAS. Rather frequent, except the Northwest and the South.

VERMONT. Rare: Cheshire Co., Coos Co., Strafford Co.

VIRGINIA. Rather rare and only in the East: Lancaster Co., Norfolk Co., Southampton Co.

WEST VIRGINIA. Rare: Cabell Co., Mason Co., Pocahontas Co.

WYOMING. Rare: Teton Co. (warm spring).

CENTRAL AMERICA

COSTA RICA

Prov. Puntarenas: Rio Ceilo (Pittier and Durand 6664: BR). San Vito (Maas 1413: U).

PANAMA

Prov. Juan Mina: Rio Hondo (Bartlett 16979: GH, MO). Prov. Panama: Panama City (Klötzli: ZT* 8411).

CARIBBEAN SEA

BERMUDA

(Brown 46: F, PH; 1175: BM, F, NY, PH; Collins 115: GH; 173: F, GH; Flynn 102: VT; Harschberger 21/6/1905: STU; Moose 3021: CAS, F, GH; Rendle 793, 794: BM; Setchell 1/7/1921: UC; Vanatta 15/2/1910: PH).

CUBA

Prov. Pinar del Rio: Catalina (Ekman 11456: S, ZT).

DOMINICAN REPUBLIC

Prov. Independencia: La Salsa (Lowden: ZT* 8375). Prov. Monte Cristi: Laguna Saladilla (Lowden: ZT* 8314). Prov. Samana: Sanchez (Lowden: ZT* 7718). Prov. San Christobal: Arroyo Madre Vieja (Marcano: ZT* 7668).

GUADELOUPE

Etang Cocoyer (Raynal 20234: P); without exact locality (Herminier s.no.: STU).

HAITI

Dept. de l'Arbonite: Desdunes (Lowden: ZT* 8420). Dept. du Nord: Etang Romeo (Lowden: ZT* 8424).

JAMAICA

Manchester Par.: Alligator Hole River (Lowden: ZT* 8634; see also PROC-TOR 1982).

PUERTO RICO

San Juan (Heoran 10/1909: GH).

TRINIDAD AND TOBAGO

St. Augustine (Kalloo: ZT* 7329). Trinidad, Centeno (Philcox 8407: K, ZT).

SOUTH AMERICA

ARGENTINA

Prov. BUENOS AIRES. Dept. Castelli: Castelli, Laguna Ombu (Landolt and Zarzycki 24/83: ZT). Dept. Chascomus: Laguna Las Barrancas (Spegazzini 1/11/04: BAB); Laguna Vitel (Landolt and Zarzycki 30/83: ZT). Dept. Zarate: Arroyo de los Jesuitas (Giardelli 502: SI, UC, ZT).

Prov. CHACO. Dept Bermejo: Colonia Vélaz, Arroyo Cangüi Chico (Landolt

and Zarzycki 159/83: ZT; ZT* 8834); 7 km E of Esperanza, RN 11 (Landolt and Zarzycki 160/83: ZT). Dept. Libertad: Rio Tragadero (Landolt 3/83: ZT; ZT* 8806). Dept. San Fernando: 32 km S of Resistencia (Landolt and Zarzycki 124/83: ZT); RN 16, 3 km W junction RN 11 (Landolt, Zarzycki and Eskuche 167/83: ZT; ZT* 8836); Rio Parana (ESKUCHE and ROMERO FONSECA 1982).

Prov. CORDOBA. Dept. San Alberto: Mina Clarero (Pedersen: ZT* 8414).

Prov. CORRIENTES. Dept. Capital: Arroyo Riachuelo (Schinini and Maranda 1165: CTES); Riachuelo (ESKUCHE and ROMERO FONSECA 1982). Dept. Concepcion: Carambola (Pedersen: ZT* 8621). Dept. Empedrado: Estancia La Yela (Pedersen 12924: CTES). Dept. Mburucaya: Estancia Santa Maria (Pedersen: ZT* 7703; ZT* 7709); Rio de Oro, Las Selvas (Schulz 100216: ZT). Dept. San Cosme: RN 12, ca. 2 km E Canal 14 (Landolt, Zarzycki and Eskuche 175/83: ZT; ZT* 8839); NR 12, ca. 2,5 km E Canal 14 (Landolt, Zarzycki and Eskuche 176/83: ZT); Laguna Rincon (Landolt, Zarzycki and Eskuche 177/83: ZT); E of Laguna Rincon, RN 12 (Landolt, Zarzycki and Eskuche 178/83: ZT); 9 km S of Paso de la Patria (Landolt, Zarzycki and Eskuche 179/83: ZT); 1 km S of Paso de la Patria, Arroyo Pehuajo (Landolt, Zarzycki and Eskuche 180/83: ZT; ZT* 8843). Dept. San Luis de Palmar: Paso Horqueta (Pedersen 12923: CTES; ZT* 8658).

Prov. ENTRE RIOS. Dept. Capital: Concepcion (Lorentz 12/1878). Dept. Gualeguaychu: ca. 35 km S of Ceibas (Landolt and Zarzycki 46/83: ZT); 43 km E of Gualeguay (Landolt and Zarzycki 48/83: ZT); Embarcadero Berrioso (Landolt and Zarzycki 49/83: ZT); Rio Gualeguay, Gualeguay (Landolt and Zarzycki 50/83: ZT); 3 km W of Arroyo El Animal (Landolt and Zarzycki 54/83: ZT). Dept. La Paz: La Paz (Burkart: ZT* 7715).

Prov. FORMOSA. Dept. Formosa: just N of Formosa (Landolt and Zarzycki 133/83: ZT); 30 km N of Formosa, RN 11 (Landolt and Zarzycki 135/83: ZT); 5 km S of Canada Doce (Landolt and Zarzycki 136/83: ZT); Guazalee (Jorgensen 3373: GH, LIL, MO). Dept. Pilcomayo: 20 km W of Clorinda RN 86 (Landolt and Zarzycki 144/83: ZT; ZT* 8821); ca. 22 km W of Clorinda, S of Palmo Salo (Landolt and Zarzycki 145/83: ZT; ZT* 8824); 22 km W of Clorinda, S of Palmo Salo (Landolt and Zarzycki 146/83: ZT; ZT* 8827); 40 km W of Clorinda, Lag Naick-Neck (Landolt and Zarzycki 147/83: ZT; ZT* 8829); Laguna Blanca (Landolt and Zarzycki 148/83: ZT); between Primela Pinta and Laguna Blanca (Landolt and Zarzycki 149/83: ZT; ZT* 8831); ca. 5 km NE of Primela Pinta (Landolt and Zarzycki 150/83: ZT); ca. 2 km N of Primela Pinta (Landolt and Zarzycki 151/83: ZT); ca. 12 km E of Laguna Blanca (Landolt and Zarzycki 152/83, 153/83, 153b/83, 156/83; Landolt 154/83, 155/83: ZT).

Prov. JUJUY. Dept. Oran: Bella Vista (Lorentz 554: BAF, KANU).

Prov. MENDOZA. Dept. Malagrüe: Cayou del Beoro (Wilczek 11: G); La Junta (Wilczek 5: G).

Prov. MISIONES. Loreto (Giardelli 538: UC).

Prov. SALTA. Dept. Rosario de Lerma: Campo Quijano, Las Lomitas (Novara 1309: MCNS). Dept. San Martin: Laguna de Cielo (Novara 3755: MCNS).

Prov. SANTA FE. Dept. Grl. Obligado: Arroyo Malabrigo, RN 11 (Landolt and Zarzycki 105/83: ZT); ca. 6 km W of Pt. Reconquista (Landolt and Zarzycki 108/83: ZT); ca. 6 km E of Reconquista (Landolt and Zarzycki 109/83: ZT); ca. 3 km E of Reconquista (Landolt and Zarzycki 110/83, 111/83: ZT); ca. 2 km S of Arroyo Ceibal, Arroyo Las Garzas (Landolt and Zarzycki 117/83, 118/83: ZT); Florencia, Rio Tapenaga (Landolt and Zarzycki 120/83: ZT). Dept. La Capital: Rio Salado, RN 62 (Landolt and Zarzycki 84/83: ZT). Dept. Vera: Arroyo Malabrigo, RN 42 (Landolt and Zarzycki 114/82: ZT); Laguna La Gallareta (Landolt and Zarzycki 98/83: ZT). GIARDELLI (1970) cites L. valdiviana also from Chubut, Neuquén and Santa

Cruz; the few specimens I saw from these regions belong to L. minuscula.

BOLIVIA

Dept. La Paz: Lake Titicaca (Raynal and Collot 21433: P, ZT); Huatajata (Zuber: ZT* 8754); San Jorga (Buchtien 8845: US); San Pedro; Huarina; Tokerino; Guapi (Lieberman, Pedrotti and Venanzoni 1986: CAME, ZT). Dept. Omasuya: Achocache (Mandon 1535: STU). Dept. Oruro: Lake Poopo (Raynal 21401: P, ZT). Dept. Santa Cruz: Santa Cruz de la Sierra (Evrard 1977: BR).

BRAZIL

AMAZONAS. Manaus, Rio Negro (Mitchell: ZT* 7288); Lake Salado (Junk: ZT* 8312b).

MINAS GERAIS. Contendor (s.coll.: STU).

PARA. Santarem (Ginzberger 10/7/1927: F, L, W, WU); Belem (Kuhlmann 30575: SP).

RIO DE JANEIRO. Barra de São Joao (Landolt and Farney 206/83: ZT); Grula da Imprensa (Segadas-Vianna: ZT* 7252); Horto Botanico (Segadas-Vianna: ZT* 7227); Ilha dos Flores (Castilha 9/8/1919: BAF); Itatiaia (Sormus 23/9/1974: SP); Leblon (Landolt 190/83: ZT); Praia de São Conrado, Ave. Niemeyer (Landolt 189/83: ZT; ZT* 8845); Recreio Bandeirantes (Segadas-Vianna: ZT* 7254); Rio de Janeiro (Drade 10465: R; Glaziou 20539: C; Perkolt 1871: STU); San Pedro do Aldeira, Km 108 (Landolt and Farney 202/83: ZT; ZT* 8851).

RIO GRANDE DO SUL. Itapua (Valls and Lindeman 9519: CTES, U); Pelotas (Sacco: ZT* 7996, ZT* 7998); Porto Alegre (August 538: MPU); Rio Grabyba (Reineck 7/1896: LY); Rio Grande (Lindeman 743: S).

SANTA CATARINA. Fazenda da Laranja (Reitz and Klein 7/1891: B, BR, G, L, M, S, US, Z; Smith 7891: F, UC); Itajai (Müller 1869: KANU, R, STU); Jaguaruna (Reitz 5931: R, ZT; 4.461B: ZT; Smith 5929: R, US, ZT); Mafra (Smith 10607: R); Rio Irani (Smith 8987: R, US).

SAO PAULO. Campinas (Moten 4661: S); Candern (Usteri 12/5/1905: ZT); Caraguatatuba (Sucre, Burle: ZT* 7362); Lapa (Usteri 164: ZT); Salto Grande (Wettstein and Schiffner 7/1901: WU); S. Ana, Tieté (Wettstein and Schiffner 7/1901: WU); Sao Paulo (Usteri 27/2/1905: ZT; Wettstein and Schiffner 8/1901: WU).

CHILE

Prov. Cautin: Temuco (Ramirez: ZT* 8685).

Prov. Valdivia: Tembladerilla (Philippi 1862: G, LIL, MO, S, SGO, STU).

COLOMBIA

Dept. Cundinamarca: Bogota, Represa de Tominé (Fernandez-Pérez: ZT* 7186).

ECUADOR

Prov. Chimborazo: Huigra (Hitchcock 20393: S, US). Prov. Guayas: 10 km NE Guayaquil (Lüönd: ZT* 8897). Prov. Zamora-Chinchipec: Loja-Zamora (Sparre 18967: S).

PARAGUAY

Dept. Asunción: Asunción, Horto Botanico (Bordas: ZT* 8236).

PERU

Dept. Cuzco: San Pedro (Lüönd: ZT* 8902). Dept. Puno: Puno, Lake Titicaca (Bolliger: ZT* 8446; Landolt-Stadler: ZT* 7614). Dept. San Martin: Caceres (Schunke 3191: F).

SURINAM

Prov. Coronie (Cramer LBB 14877: U). Prov. Marowijne: Perika River (Donselaar 3491: US). Prov. Saramaca: Mokomoko-zwamp (Lindemann 5576b: U); Coppename-mond (Lindemann 5562a: U). Prov. Suriname (Cramer 14924: U); Paramaribo (Cramer 14905; Lindemann 6628, 6636: U); Charlesburg (Teunissen: ZT* 7356).

URUGUAY

Dept. Canelones: Carrasco (Archaveleta 2501: ZT); Carrasco, Airport (Rosenburgh: ZT* 7284). Dept. Montevideo: Miguelete (Herter 85483: F, G, GH, M, MO, MPU, NY, S, U, UC, US, Z, ZT); Montevideo (Archaveleta 2502: ZT; Herter 1302: RB). Dept. San José: Barra Santa Lucia (Osten 23043: CAS, S, ZT; Osten 32044: CAS, ZT). Dept. Treinta-y-Tres: Without exact locality (Herter 88885: B, F, G, GH, M, MO, NY, U, UC, US, Z, ZT).

VENEZUELA

Distr. Federal: Silla de Caracas (Ernst 1895: STU). Esto. Carabobo: Moron (Tillet: ZT* 7408). Esto. Yaracuy: Marin (Tillet: ZT* 7465).

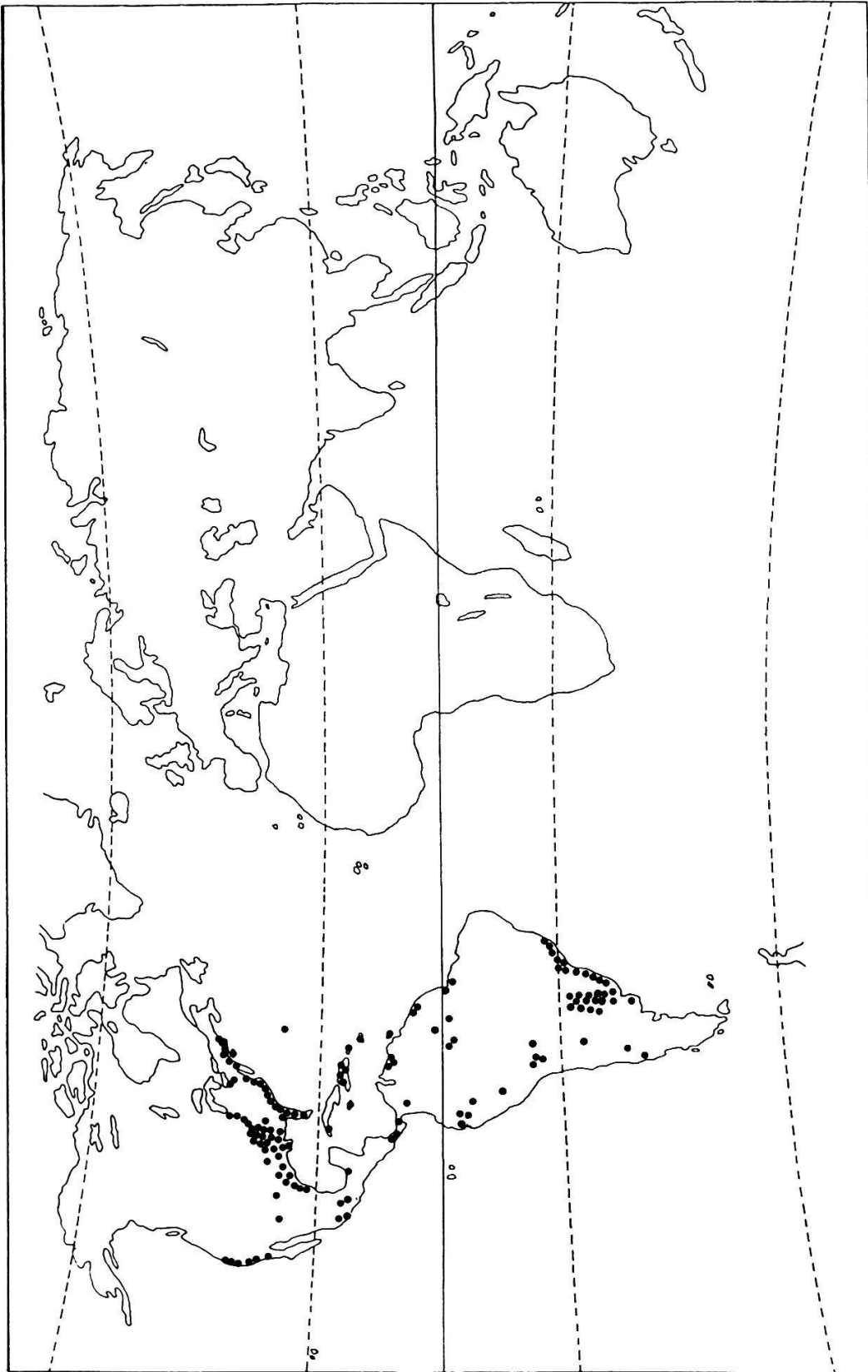


Fig. 6.14. Distribution of Lemna valdiviana

6.1.3.16. Lemna minuscula (fig. 6.15)

L. minuscula is distributed throughout the temperate zones and in the mountains of America. Recently it was introduced to Europe and Japan. It is often confused with L. valdiviana.

NORTH AMERICA

MEXICO

BAJA CALIFORNIA NORTE. San José (Moran 21995: ARIZ); San Pedro Martir (Moran 21996: ARIZ; Thorne 14437: KANU; Wiggins 16576A: DS, OS; 16591: DS); San Vicente (Hevley 2125b ARIZ).

BAJA CALIFORNIA SUR. Santiago (Bailey 191: BH).

CHIHUAHUA. Cusarare (Bye 4321: COLO).

COAHUILA. Parras (Henrickson 6192: ILL); Saltillo (Fassett 28399: F, GH, MO, WIS, ZT).

DISTR. FEDERAL. Mexico City (Hahn 1868: CAL, BM, FI, K, KANU, L, MEL, MO, PH, STU, U; 1869: GOET, L, U; 2/1869: GOET, JE, K, KANU, L, MEL, MO, STU, U, US; Pringle 1300: GH, US; 7300: COLO, F, GH, MICH, MSC, SMU, UC, VT; 7301: CAS, COLO, MICH, MSC, SMU, UC, US, VT; 7302: GH, MICH; Rossi 25: M; Rose 6466: U, US; 4546/47: US; Rutten 243: U; Schaffner 631: BM, CAS, FI, G, GOET, ILL, L, LY, M, MICH, US, ZT; 1875: BM, CAS, FI, G, LY, M, MEL, MICH, NY, UCLA, US; 1876: FI; Thompson 29/7/1910: KANU, LP).

MEXICO. Toluca (Barkley 612: TEX).

MICHOACAN. Morelia (Arsène 544: US).

PUEBLA. Hacienda Cristo (Arsène 1063: GH, ILL, L, LY, MO, NY, US); San Baltasar (Arsène 24/10/1907: LY; 1207: US).

SONORA. Pitichito (according to SHREVE and WIGGINS 1964).

U.S.A.

ALABAMA. Rare: Houston Co.

ARIZONA. Rather frequent.

ARKANSAS. Rare: Clark Co., Greene Co., Phillips Co., Pope Co.

CALIFORNIA. Frequent.

FLORIDA. Rare: Jackson Co., Leon Co.

GEORGIA. Rare: Catoosa Co., Jenkins Co.

ILLINOIS. Rare: Johnson Co.

INDIANA. Rather rare: Allen Co., Cass Co., Fountain Co., Marshall Co., Noble Co., Sullivan Co.

KANSAS. Rare: Douglas Co., Kiowa Co., Meade Co.

LOUISIANA. Rather frequent.

MISSOURI. Rather rare: Dent Co., Dunklin Co., Oregon Co., Ripley Co., Wayne Co.

NEBRASKA. Rather rare: Cherry Co., Garden Co., Keith Co., Thomas Co.

NEVADA. Rather rare: Clark Co., Lincoln Co., Nye Co., Storey Co., Washoe Co.

NEW MEXICO. Rather rare: Lincoln Co., Sandoval Co., Santa Fe Co., Socorro Co.

OKLAHOMA. Rare: Johnston Co., McCurtain Co.

OREGON. Rare: Malheur Co.

TEXAS. Rather rare: Bowie Co., Brazoria Co., Calhoun Co., Colorado Co., Dallas Co., Hays Co., Hamphill Co., Jeff Davis Co., Kerr Co., Marion

Co., Menard Co., San Saba Co., Smith Co.
UTAH. Rather rare: Cache Co., Pinte Co., Salt Lake Co., Summit Co., Utah Co., Washington Co.
WASHINGTON. Rare: Asotin Co.
WEST VIRGINIA. Rare: Hardy Co.
WYOMING. Rare: Johnson Co., Teton Co., Yellowstone Nat. Park Co.

CENTRAL AMERICA

GUATEMALA

Dept. Atitlan: Atitlan (Bernoulli 6/1870: GOET; 1870: STU; Bowes 12/7/1966: BH). Dept. Chimaltenango: Chocoyos (Norvell: ZT* 6717). Dept. Quetzaltenango: Sija (Sharp 5435: TENN). Dept. Tononicapan: Salvachan (Standley 84493: F). Without exact locality (Kellermann 6069: SMU).

CARIBBEAN SEA

GUADELOUPE

Grande Terre (Raynal and Jérémie 21318: P, ZT).

JAMAICA

PROCTOR (1982) collected a specimen in St. Andrew Par., St. Andrew.

SOUTH AMERICA

ARGENTINA

Prov. BUENOS AIRES. Dept. Azul: Without exact locality (Osten 2660, 3999: ZT). Dept. Balcará, Ao. Crespo (Grandona and Darson 6360: BAA). Dept. Baradero: Isla en Baradero, Rio Pintos (Burkart 8521: SI, ZT). Dept. Berriso: Los Borrachos (Tur 1739, 1741: LP). Dept. Buenos Aires and vicinity: Buenos Aires (Krapovickas: 2879a: F); Buenos Aires, Jardino Botanico (Giardelli 508: ZT; Leon ZT* 7180; Nicora 6985: BAA); Isla Martin Garcia (Cabrera 3359: LP); La Plata Cabrera 5732: SI; Spegazzini 25/7/1898: CORD); Ortuzar (Parodi 11893, 11894: ZT); Parque 3 de Febrero (Krapovickas 2879: H; Molfino 1175: BAF); San Isidoro (Molfino 1258: BAF); Tordillo, Estancia La Bagatela (Giardelli 1200, 1201: SI, 1220: SI, ZT); Vacurutu (Malme 1778). Dept. Campana: 10 km S of Campana (Landolt and Zarzycki 39/83: ZT); ca. 6 km N of Campana (Landolt and Zarzycki 41/83: ZT); ca. 7 km N of Campana (Landolt and Zarzycki 42/83: ZT); ca. 10 km N of Campana Landolt and Zarzycki 43/83: ZT); ca. 11 km N of Campana (Landolt and Zarzycki 44/83: ZT). Dept. Castelli: Castelli, Laguna Ombu (Landolt and Zarzycki 24/83: ZT). Dept. Chascomus: Arroyo Vitel (Tur: ZT* 7921; Verona: ZT* 7228); Lago Chascomus (Landolt and Zarzycki 32/83: ZT); Laguna Adela (Landolt and Zarzycki 33/83, 34/83: ZT); Laguna Burro (Landolt and Zarzycki 36/83: ZT); Laguna Vitel (Landolt and Zarzycki 27/83, 28/83, 29/83, 30/83: ZT). Dept. Cnl. Pringles: Las Mostazas (Perrone 57.002: BA). Dept. Dolores: Dolores (Giardelli 515: UC); Laguna pres de Sevigüe (Landolt and Zarzycki 23/83: ZT). Dept. Ensenada: Punta Lara (Cabrera 1492: LP). Dept. Grl. Conesa: Laguna Bagadela (Burkart 15671, 15672: SI, ZT). Dept. Grl. Lavalle: San Clemente (Giardelli 1205, 1208, 1211: SI; Tur 1699, 1700: LP). Dept. Lobos: Lobos (Kalela 11: H). Dept. Magdalena: S of Pipinas (Landolt and Zarzycki 25/83: ZT); 10 km S of Pipinas (Landolt and Zarzycki 26/83: ZT). Dept. 9 de Julio: Denneby (Pedersen ZT* 8734); Nueve de Julio (Pedersen 13259: LP). Dept. San Miguel del Monte: Laguna del Monte (Landolt and Zarzycki 22/83: ZT; ZT* 8810); San Miguel del Monte (Movau 29412: BA). Dept. Tornquist: Sierra de la Ventana (Lorentz 75: CORD, GH, H, LE, S, STU, UPS).
Prov. CATAMARCA. Ojos de Salado (Grau 15/1/1974: LIL).
Prov. CHACO. Dept. Bermejo: Arroyo Cangüi Chico (Landolt and Zarzycki 157/83: ZT); Colonia Vélaz (Landolt and Zarzycki 159/83: ZT); Puerto Vé-

laz (Meyer 17.206: LIL). Dept. Gr1. Donovan: without exact locality (Schinini 22833: CTES); Lapachito (Landolt 6/83: ZT); Estancia Dos Tranqueras (Schinini 22833: CTES). Dept. Libertad: Ero. Guazu, N of Pt. Tirol (Landolt, Zarzycki and Eskuche 168/83: ZT); Rio Tragadero (Landolt 3/83: ZT; ZT* 8804). Dept. 1^o de Mayo (ESKUCHE and ROMERO FONSECA 1982); 4 km S km 1024, RN 11, Rio Tragadero (Landolt, Zarzycki and Eskuche 163/83, 164/83, 165/83: ZT). 25 de Mayo: Machagdi (Landolt 7/83: ZT). Dept. San Fernando: 32 km S of Resistencia (Landolt and Zarzycki 124/83, 125/83: ZT); 3 km S of Colonia Benitez (Landolt, Zarzycki and Eskuche 166/83: ZT); RN 16, 3 km W junction RN 11 (Landolt, Zarzycki and Eskuche 167/83: ZT; ZT* 8835); Rio Negro, Resistencia (Landolt, Zarzycki and Eskuche 169/83: ZT).

Prov. CHUBUT. Dept. Futaleufu: Esquel (Kühnemann 37238: BA; Meyer 9246: LIL). Dept. Rio Senguerr: Rio Mayo, Mallin Grondona 3535: BAA, BAB). Dept. Telsen: Laguna Cona (Rossow 225: BAB).

Prov. CORDOBA. Dept. Capital: without exact locality (ESKUCHE and ROMERO FONSECA 1982); Altos Oeste (Stuckert 2823: CORD); Cordoba (Kurtz 6558: NY, R, STU; Stuckert 20031: G); La Plaza San Martin (Subils 8/5/1973: SI, ZT); Laguna Peitiados (Atnerst 2824: MO; Kurtz 6537: MO, SGO, STU; 6991: BAF, CORD, MO, R, STU; 7008: CORD; Stuckert 935: CORD; 2828: KANU, MO); Laguna Sofre (Stuckert 12845: CORD); Quinta (Stuckert 2866, 12851: CORD); Parque Sarmiento (Ariza 2692: CORD). Dept. Colon: Falda este cerca de Colanchanza (Hunziker 10275: CORD, SI); Mal Paso (Kurtz 6558, 6559: CORD); Sierra Chica, Cabera (Stuckert 11740: CORD). Dept. Ischilin: Dean Funes (Landolt 13/83: ZT). Dept. Minas: Guasapampa (Kurtz 6790: BAF, CORD, STU). Dept. Punilla: Copina, Sierra Grande (Hunziker 12917: SI, ZT; Leal 20032: CORD); Laguna San Roque (Hunziker 6063: LIL, SI, ZT); Puerto de Tanti (Kurtz 4447: CORD). Dept. Rio Cuarto: Rio Cuarto (Kurtz 3776: CORD, SGO, STU). Dept. Rio Primero: Malpaso (Kurtz 6559: BAF, NY, STU). Dept. San Alberto: Laguna Mina Clavero (Stuckert 10800: CORD). Dept. San Cosme (ESKUCHE and ROMERO FONSECA 1982). Dept. San Justo: Sierra Achala (Hunziker 15974: CORD). Dept. San Luis de Palmar (ESKUCHE and ROMERO FONSECA 1982). Dept. Santa Maria: Cerro Blanco (Hunziker 2619: CORD; 9973: SI); Sierra Brada (Subils 20/10/83: CORD).

Prov. CORRIENTES. Dept. Capital: Arroyo Riachuelo (Christobal and Schinini 1032: CTES; Schinini and Wiersema 2246: CTES; Tur 1685: CTES, LP); RN 12, Bridge Arroyo Riachuelo (Landolt, Zarzycki and Eskuche 170/83: ZT); RN 12, ca 200 m E Bridge Arroyo Riachuelo (Landolt, Zarzycki and Eskuche 171/83: ZT); ca. 2 km E of Corrientes, RN 5 (Landolt, Zarzycki and Eskuche 174/83: ZT). Dept. Concepcion: Sobre Rio Santa Lucia (Arbo 590: CTES). Dept. Empedrado: Estancia La Yela (Pedersen 12924: CTES; ZT* 8662). Dept. Mburucaya: Estacion Santa Teresa (Pedersen 2813: C, G, GH, LP, MO, S, U, US). Dept. Saladas (Landolt 5/83: ZT). Dept. San Cosme: RN 12; en el limite con el Dept. Itati (Krapovickas et al. 37548: CTES); RN 12, ca. 2 km E Canal No. 14 (Landolt, Zarzycki and Eskuche 176/83: ZT); 9 km S of Paso de la Patria (Landolt, Zarzycki and Eskuche 179/83: ZT); 11 km S of Paso de la Patria (Landolt, Zarzycki and Eskuche 182/83: ZT). Dept. San Luis de Palmar: Laguna Alfonso (Tur 1684: BAA, CTES, LP); Paso Horqueta (Pedersen 129a23: CTES; ZT* 8659); San Luis de Palmar (Quarin and Tressens 1453: CTES).

Prov. ENTRE RIOS. Dept. Capital: Concepcion del Uruguay (Lorentz 12/1878: STU). Dept. Gualaguaychu: Embarcadero Berriso (Landolt and Zarzycki 49/83: ZT); ca. 35 km S of Ceibas (Landolt and Zarzycki 46/83: ZT); ca. 15 km S of Ceibas (Landolt and Zarzycki 47/83: ZT); Puente de los Cerros, Arroyo Nogayo (Landolt and Zarzycki 56/83: ZT); 5 km N of Rio Parana (Landolt and Zarzycki 45/83: ZT); 43 km E of Gualaguay (Landolt

and Zarzycki 48/83: ZT); Rio Gualeguay, Gualeguay (Landolt and Zarzycki 50/83: ZT); 3 km W of Arroyo El Animal (Landolt and Zarzycki 53/83: ZT); 54/83: ZT). Paranacito, Delta del Paraná (Burkart 7622: SI). Dept. La Paz: Morentina (Burkart 21133, Bacigalupo: SI). Dept. Tacuaras: Arroyo Ombucito (Burkart 21132: SI, ZT). Dept. Victoria: Victoria, Laguna (Landolt and Zarzycki 58/83: ZT).

Prov. FORMOSA. Dept. Formosa: Arroyo San Hilario, RN 11 (Landolt and Zarzycki 130/83: ZT); just N of Formosa (Landolt and Zarzycki 133/83: ZT); 15 km N of Formosa, RN 11 (Landolt and Zarzycki 134/83: ZT); 30 km N of Formosa, RN 11 (Landolt and Zarzycki 135/83: ZT); Guazalee (Jorgensen 3373: BA, LIL). Dept. Laishi: Rio Salado, RN 11 (Landolt and Zarzycki 129/83, 129b/83: ZT). Dept. Pilcomayo: ca. 40 km S of Clorinda, Rcho. He-He (Landolt and Zarzycki 137/83, 137b/83: ZT; ZT* 8819); ca. 20 km S of Clorinda, Rcho. Negro (Landolt and Zarzycki 139/83: ZT); ca. 7 km SE of Clorinda, Rio Paraguay (Landolt and Zarzycki 140/83, 140b/83, 140c/83: ZT); Garcete Cué, RN 11 (Landolt and Zarzycki 141/83: ZT); 40 km W of Clorinda, Laguna Naick-Neck (Landolt and Zarzycki 147/83: ZT); ca. 12 km E of Laguna Blanca (Landolt and Zarzycki 153/83, 153b/83, 156/83: ZT).

Prov. JUJUY. Dept. Capital: Jujuy (Eyerdam and Butle 22416: BM, G, GH, MO, UC). Dept. Santa Barbara: Luinta, Laguna de la Brea (Fries 208: S). Prov. LA RIOJA. Los Hornillos (Hieronymus and Niederlein 6/3/1899: CORD).

Prov. MENDOZA. Dept. Las Heras: Cuenéga de Yalguaray (Kurtz 9492: BAF, CORD, MO). Dept. San Carlos: Cayou del Beoro (Wilczek 11: G); Las Rosas-Vista (Ruiz Leal 8430: ZT); Valle Rio Atuel (Wilczel 5: G); Zuebrada del Paso de La Cruz de Piedra (Ruiz Leal 6800: LIL, MERL, ZT). Dept. Tunuyan: Puerto del Manzano (Ruiz Leal 2381: MERL; 5415, 5416: LIL, MERL).

Prov. NEUQUEN. Dept. Catan-Lil: Arroyo Tayén-gégu, Rio Collon (Kurtz 6401: BAF, CORD, KANU, STU). Dept. Minas: Confluencia de los Rios Neuquén y Varvarco (Boelcke et al. 14426: BAA). Dept. Picunches: Arroyo La Buitrera (Nicora 7462: SI, ZT). Dept. Zapala: Zapala (Giardelli 965: UC); without exact locality (Deseole 2179: LIL).

Prov. RIO NEGRO. Dept. Conesa: Conesa, Rio Negro (Crespo and Calieres 2645: BAB). Cervantes F.C.S. (Burkart 15944: SI, ZT). Dept. Grl. Roca: Camino a Paso Cordoba (Baa 11604: BAA). Dept. San Carlos de Bariloche: San Carlos de Bariloche (Landolt 18/83, 19/83: ZT; ZT* 8808). General Roca (Pedersen: ZT* 8739).

Prov. SALTA. Dept. Caldera: Campo Alegre (Novara 3487: SI, ZT). Parque National El Rey (Landolt 8/83: ZT). Salta (Landolt 12/83: ZT). Dept. Oran: Tarija (Eyerdam and Butle 22854: G, GH, MO, UC). Sianbon, Sierra de Tucuman (Lorentz and Hieronymus 1024: CORD, GOET, KANU). San Antonio de los Cobras (Fries 717: S). Gran Chaco (Lorentz 577: CORD, GOET); Bella Vista (Lorentz and Hieronymus 8/6/1873: CORD, GOET, MO, NY, STU); Dragones (Lorentz 8/1873: B, STU). Laguna del Palmar (Lorentz and Hieronymus 554: BAF, CORD, MO). Dept. San Martin: Tartagal (Novara 3755: MCNS).

Prov. SANTA CRUZ. Rio Fenix, Lake Buenos Aires (Skottsberg 667: BA, S, SGO, UPS; 669: S).

Prov. SANTA FE. Dept. Grl. Obligado: Arroyo Malabrigo, RN 11 (Landolt and Zarzycki 105/83: ZT); between Reconquista and Pt. Reconquista (Landolt and Zarzycki 107/83: ZT); ca. 6 km W of Reconquista (Landolt and Zarzycki 109/83: ZT); ca. 3 km E of Reconquista (Landolt and Zarzycki 110/83, 111/83: ZT); 2 km S of Guadalupe Norte (Landolt and Zarzycki 115/83: ZT); ca. 2 km S of Arroyo Ceibal, Arroyo Las Garzas (Landolt and Zarzycki 118/83: ZT); 10 km S of Villa Ocampo, Rio Amores (Landolt and

Zarzycki 119/83: ZT); Florencia, Rio Tapenaga (Landolt and Zarzycki 120/83: ZT). Dept. La Capital: Santa Fé (Burkart 9074: SI; Landolt and Zarzycki 70/83: ZT; Molfino 4/1920: BAF). Isla del Parana (Molfino 16354: BA). Santa Fé (Landolt, Zarzycki 64/83: ZT); La Guardia (Landolt and Zarzycki 66/83: ZT); Colastine (Landolt and Zarzycki 67/83: ZT); Rio Tiradero viejo (Landolt and Zarzycki 69/83: ZT); Santa Fé, Rio Salado (Landolt and Zarzycki 72/83: ZT); N of Esperanza, N of Rio Salado (Landolt and Zarzycki 75/83: ZT); ca. 12 km N of Esperanza (Landolt and Zarzycki 76/83: ZT); ca. 15 km N of Esperanza (Landolt and Zarzycki 77/83, 78/83: ZT); Rio Salado, RN 62 Landolt and Zarzycki 82/83, 83/83, 48/83, 85/83: ZT); W of Emilia (Landolt and Zarzycki 86/83: ZT). Dept. Vera: ca. 190 km N of Santa Fé, RN 11 (Landolt and Zarzycki 90/83: ZT); 2 km S of Calchaqui (Landolt and Zarzycki 93/83: ZT); ca. 4 km N of Margarita (Landolt and Zarzycki 94/83: ZT); ca. 5 km N of Margarita (Landolt and Zarzycki 95/83: ZT); ca. 9 km E of La Gallareta (Landolt and Zarzycki 96/83: ZT); Laguna La Gallareta (Landolt and Zarzycki 101/83: ZT); ca. 5 km S of Vera, Espin (Landolt and Zarzycki 102/83: ZT); ca. 9 km NE of Vera, RN 11 (Landolt and Zarzycki 103/83: ZT); Arroyo El Tobo, RN 11 (Landolt and Zarzycki 104/83: ZT); Arroyo Malbrigo, RN 42 (Landolt and Zarzycki 112/83, 114/83: ZT).

Prov. SANTIAGO DEL ESTERO. Cado del Rio Dulce (Hunziker 7651: CORD, ZT). Prov. TUCUMAN. Dept. Jasmilla: Lagunas de Rio Lules (Schreiter 4112: LIL). Dept. Tafi: Valle de Tafi (Palacio et al. 19Ar116: LIL). Quebrado de los Sosas (Meyer: ZT* 7369). Valle de los Sosas (Skottsberg 18/10/1948: GB).

BOLIVIA

Dept. Cochabamba (Thompson 1891: KANU). Dept. Oruro: Sajama (Klein: ZT* 8669, ZT* 8672); Lake Poopo (Raynal 21402: P, ZT). Dept. La Paz: Lake Titicaca (Raynal and Collot 21433, 21444: P, ZT; Asplund 87, 628: S, UPS); Huarina; Puerto Perez; San Pedro, Tokeriri (Lieberman, Pedrotti and Venanzoni 1986: CAME, ZT). Dept. Potosi: Potosi (Lüönd 8904: ZT). Dept. Sorata: Sorata (Mandon 1457: JE, MO, STU; 1897: G, GH, GOET).

BRAZIL

MINAS GERAIS. Caldas (Regnell 1120: UPS).

RIO GRANDE DO SUL. Nuovo Württemberg (Bornmüller 502: B, G, JE, U; 541: G, GH, JE, M, U, Z, ZT); Pelotas (Sacco 1108: F); Porto Alegre (Fontoura 1897: GOET; Lindeman 1231: U; Valls and Lindeman 9519: CTES, U); Rambo 59213: B, S); Rio Grabyba (Reineck 7/1896: LY; Reineck and Cermak 1897: BA, BM, G, JE, M, LY, S, UC, WU, Z, ZT); Sao Leopoldo (Herter 95843: G, MO, U, Z); Serra dos Tafi (Lindeman 773: S); Silveira Martius (Lindeman 1231: S).

SANTA CATARINA. Agua Boa Riozinho, Bom Retiro (Smith and Klein 7907: RB; Mafra (Smith 10607: US); Lajes, Bacaine do Sul (Smith 11254: R, US); Santa Catarina Island (Müller 6/1870: STU); Tubarao (Ule 1314: L).

SAO PAULO. Campinas (Henschen 1633: UPS).

CHILE

Prov. Aconcagua: Zapallar (Behn 1/2/1912: UC; 2887: ZT). Prov. Antofagasta: Inacaliri (Philippi 2/1885: SGO); San Pedro (Barrot 3761: GH). Prov. Atacama: Vallenar (Johnston 6012: F, GH, S, US). Prov. Concepcion: Desembocadura, Rio Bio-Bio (Godoy 2893: VALD, ZT); Pileta, Universidad de Concepcion (Godoy 2894, 2896: VALD, ZT). Prov. Coquimbo: Est Frai Jorge (Skottsberg 871: GB, S); La Serena (Ramirez: ZT* 8894). Prov. Curico: Laguna de Torca (San Martin 1948, 2892: VALD, ZT). Prov. O'Higgins: Estero de la Angostura (Castillo 3/1897: SGO, STU). Prov. Osorno: Puente Pilmaiquen (Ramirez 868: VALD, ZT). Prov. Santiago: Cajou del Maipo (Navas 1961: SGO); Cartagena (Ramirez 19/11/1984: VALD, ZT); Que-

brada de Macul (Navas 1961: SGO); Santiago (Hastings 597: CU, UC, US; 598: CU, UC; Philippi 5/1857: BM, GOET, LE, S, SGO, STU, UPS; 5/1859: G). Prov. Tarapaca: Bofedal de Parinacota (s. coll. 2288: VALD, ZT); Humirpa (Poelmann 23/12/1897: SGO, STU). Prov. Temuco: Camino a Imperial (Hauenstein 2895: VALD, ZT). Prov. Valdivia: Pantano de la Universidad Tecnica (Godoy 1183, 2890: VALD, ZT); Rapaco (Delgado 2891: VALD, ZT); Valdivia (Philippi 1/1871: SGO; Ramirez ZT* 8686). Prov. Valparaiso: Algarrobo (Kausel 4196: H); Casablanca, Lo Orozco (Kausel 4295: H); Lima-che (Weisser: ZT* 7726); Vina del Mar (Sparre 11206: S).

COLOMBIA

Dept. Boyaca: Sogamoso y Vado Hondo (Cleef 9503: COL, ZT). Dept. Cundinamarca: Bogota (Hélier 18/8/1910: G; Holten 23/11/1852: AC, G, GH, MO, PH, STU).

ECUADOR

Prov. Chimborazo: Huigra (Hitchcock 20401: GH, NY, US; Rose 22264: GH, NY, US); Huataxi (Reichenbach 8/1859: STU). Prov. Imbabura: Lago San Pablo (Camp 3254: S; Fagerlind 1325: S). Prov. Pichincha: Quito (Holmgren 947: S, ZT); Tandapi (Maas 2894: U).

PARAGUAY

Dept. Boquerón: Picada Lepay, km 63 (de Sloover 75/117, 75/118, 75/120: BR); Rio Verde (Herter 85158: ZT). Dept. La Cordillera: Escalada (Osten 9165: ZT); San Bernardino (Osten 9163: G, S, ZT); Ypacaray (Hassler 11805a: G). Dept. Paraguari: Ao. Minas, Park National Ybycui (Gonzales and Arzamendia 3: CTES).

PERU

Dept. Cajamarca: Cajamarca (Ugent 5501: WIS, ZT). Dept. Cuzco: Cuzco (Maldonado 14: F); San Geronimo (Landolt-Stadler: ZT* 7612); Saylla (Iltis 1208: US; 1206, 1207: WIS, ZT); Urubamba, Chincheros, Lake Puiray (King et al. 270: F, ZT). Dept. Huambulo: Valle de Oropesa (Herrera 2081: F, US). Dept. Huanuco: La Molia (Asplund 13640: S); Llata (MacBride 2269: BM, F, G, S, US). Dept. Junin: about 23 km NW of la Oroya (Dillon and Turner 1364: F, ZT). Dept. Libertad: Trujillo (Killip 21510: NA). Dept. Lima: Boza (Cabrera 10874: LP); San Bartolomé, Rimac Valley (Trapido 6/7/1946: CU). Dept. Loreto: Arica (Lechter 1864: G, GOET, STU). Dept. Moquegua: Tarata (Webenbauer 7476: F).

URUGUAY

Dept. Canelones: Carrasco (Herter 85071: B, F, G, GH, M, MO, R, S, U, UC, US, Z, ZT). Dept. Florida: Zimote (Rosengurth B 1682: F, US). Dept. Montevideo: Miguelete (Herter 85483: F, G, GH); Montevideo (Gilbert 1337: US; Herter 79980: ZT); Pocitos (Herter 6/1925: GOET, ZT; 70266: B, ZT; 70512: B, F, G, GH, K, MO, MSC, S, U, UC, Z, ZT; 76816: BH, G, M, MO, MSC, S, Z). Dept. San José: Barra Santa Lucia (Osten 23043: CAS, S, Z; 23044: CAS, ZT). Dept. Treinta-y-Tres: Without exact locality (Herter 3/12/1882: RB; 88885: B, F, G, GH, M, MO, NY, U, UC, US, Z, ZT).

VENEZUELA

Distr. Federal: Caracas, Quebrada Teneria (Ernst 4/4/1869: STU). Esto. Aragua: Maracay, Airport (Alston 5680: MB). Esto. Merida: Misinta (Pittier 18423: BR); Mucuchies (Pittier 12918: G, M, PH, US).

EUROPE

BELGIUM

Strépy-Bracquegnies (Havrenne and Bruynseds 24/8/1983: BR, ZT; LAWALREE 1984).

FRANCE

Bas-Rhin: Dalhunden (GEISSERT et al. 1985); Moder River and Sauer River near Rhine River (Lüönd 1980: ZT). Gironde: Bordeaux (Retz 29794/1950:

SMU, WTU; Simon: ZT* 8406). Haut-Rhin: Blotzheim (Lüönd 1980: ZT); Kunheim (Lüönd 1980: ZT); Lepuix-Neuf (Lüönd 1980: ZT); St. Louis-la-Chaussée (Lüönd 1979: ZT). Landes: Seignosse (Dussossois 20/8/1983: +); Tarnos (Dussossois 5/7/1976: ZT). Pyrénées-Atlantiques: Bayonne (Vivant 4/4/1977: ZT); Biarritz, Lac Marion (Jovet: ZT* 7724; JOVET and JOVET 1966).

FRG (West Germany)

BADEN-WÜRTTEMBERG. Bärensee; Berghäuser Altrhein; Phillipsburger Altrhein (KANDELER 1973, 1979; Lüönd 1980: ZT); Rastatt; Taubergiessen (Landolt 1983: ZT); Pfinzkanal; Waghäusel (Lüönd 1980: ZT); Markt (Masini 5/4/1979: +).

NORDRHEIN-WESTFALEN. Bedburg (Diekjobst: ZT* 8748; DIEKJOBST 1983). Coesfeld, Dülmen (RAABE 1984).

HUNGARY

Szarvas, Körös (Gigon 5/8/1984: ZT* 8872c).

SWITZERLAND

Aargau: Klingnau (Grossmann: ZT* 8370); Koblenz (Lüönd 1979: ZT). Jura: Vedlincourt (Lüönd 1981: ZT). Fribourg: Gletterens (Perfetta 1979: G). Schwyz: Vierwaldstättersee near Küssnacht (LACHAVANNE et al. 1984). St. Gallen: Altenrhein (Hegi: ZT* 8385). Vaud: Yverdon, Champ Pittet (Landolt: ZT* 8769); Auvernier (Paroz 1982: ZT).

UNITED KINGDOM

LESLIE and WALTERS 1983. Cambridgeshire. Essex. Flintshire. Hertshire. Huntshire. E. Kent. W. Kent. Middlesex. Surrey, E. Sussex, W. Sussex.

U.S.S.R. (European part)

UKRAINA. Regions of the low Danube and Dnjester (DUBYNA and PROTOPOPOVA 1983).

SOUTHERN AND EASTERN ASIA

JAPAN

OTAKI (1974, in lit. 1978) named as L. valdiviana.

HONSHU. Aichi. Kyoto. Nara. Osaka. Saitama. Shiga. Shizuoka.

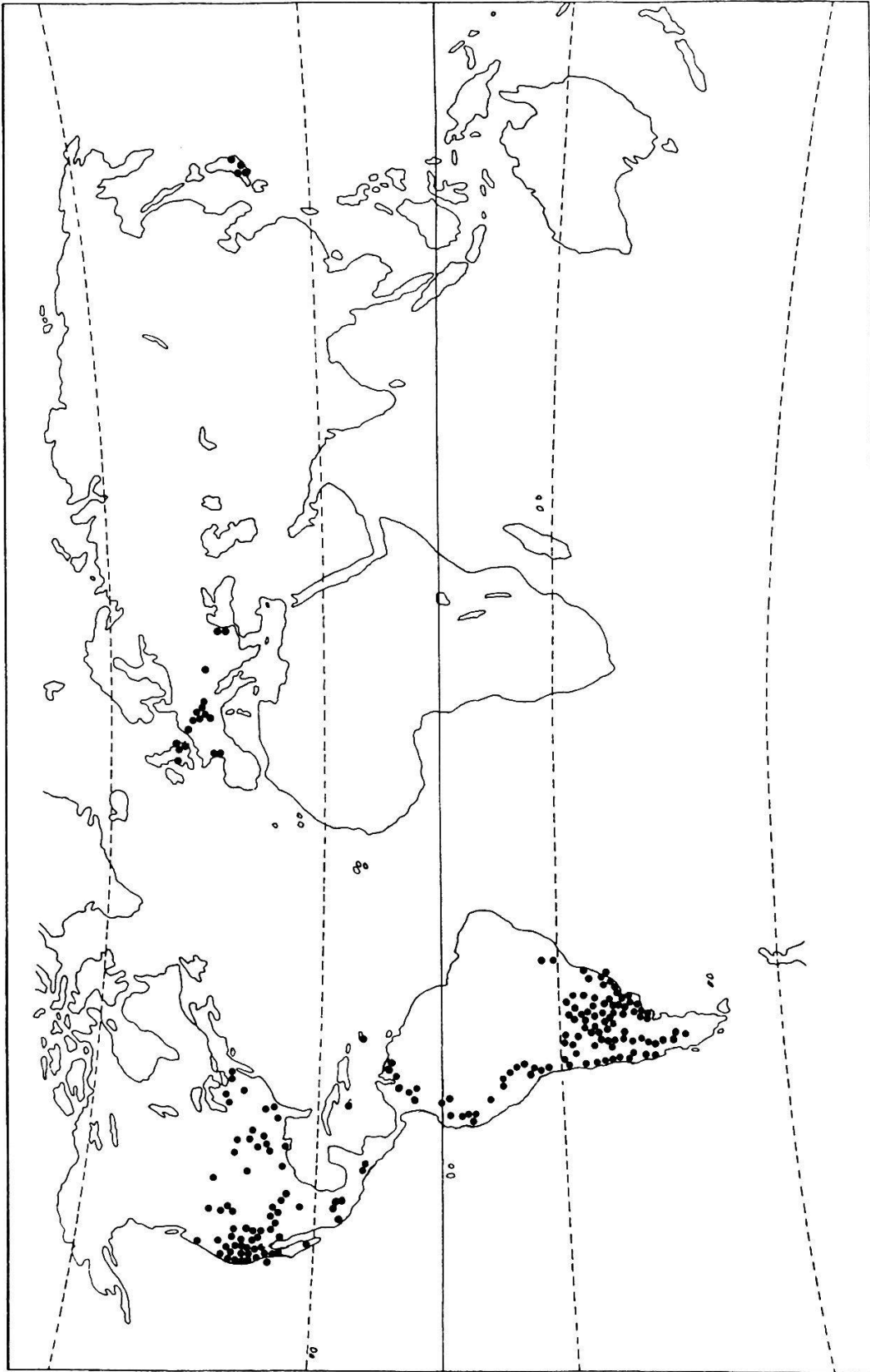


Fig. 6.15. Distribution of Lemna minuscula

6.1.3.17. Wolffiella hyalina (fig. 6.16)

W. hyalina is endemic to the drier regions of Africa. It is introduced in India.

AFRICA

CHAD

Chari, Babelia (Chevallier 10222: P). Ennedi, Fada (Monod 13949: L, P; 13950: P). Massakori (Chevallier 10040: G, L, LY, P, Z). Ndjamena (Fort Lamy) (de Wilde 5164: K, WAG).

EGYPT

Bentra (Schweinfurth 22/12/1873: G, STU). Between Cairo and Suez (Frauenfeld 1855: STU). Cairo (Abdullah 26/10/1970: ZT; Ehrenberg s.no.: GH, STU; Figari 10/12/1861: FI; Schweinfurth 1490: BM, KANU, STU). Damiette (Schweinfurth 27/7/1873: STU). El Fayum (Täckholm 21/11/1926: S). Embaba (Sisi 20/8/1974: AAU, AD, H, LL, MO). Giza, Kirdasa (Sisi: ZT* 7278a). Gurune (Ehrenberg s.no.: MO, STU). Kafr Shoukr (Mahdi: ZT* 7378). Mahallet, El Qubba (Mahdi: ZT* 7376, ZT* 7376a). Menzaleh (Schweinfurth 3/7/1887: Z). Qualyup (Ascherson 4/4/1880: C, G, GOET, STU, Z; Sickenberger 4/3/1880: Z). Nagrik (Täckholm 3/11/1967: AD). Nazlet el Ashtar (Simpson 5259: K). Roda Island (Kotschy 4/5/1855: BM, LE, MEL, P, S, UPS; Schweinfurth 6/1/1874: FI, STU, WU; 24/1/1874: FI; Sickenberger 1890: MICH, U, WAG, Z; 1891: G). Without exact locality (Delile 877: BM, MPU, P).

KENYA

Prov. Arusha: Masai Distr., Amboseli, Taberer's New Lake, near Ol Tukai (Verdcourt 3116: EA, K, L, PRE, UT; 3117: BR, EA, K, PRE, UT).

MALAWI

Southern Prov.: Zomba Distr., Lake Chilwa (Müller 1694: K, SRGH; ZT* 7426); Kachulu Harbor (Williams 231: SRGH).

MALI

Bamba (Chevallier 13808bis: P). Djenné (Chevallier 2/7/1899: BR, K, L; 1143: L, P). Timbuktu (JOVET-AST 1968).

NIGERIA

Zaria City (McFarlane 10/5/1966: K, L).

SUDAN

Prov. DARFUR. Surudji Distr.: Jebel Berkin (Pfund 6: STU).

Prov. KORDOFAN. Bara (Pfund 4/6/1875: K).

TANZANIA

Prov. ARUSHA. Amboseli (Klötzli: ZT* 8640). Arusha Distr.: Hale Dam, Pangani River (Harris DSM 1541: EA); Kiniandia Lake, Ngurdoto National Park (Greenway and Kanuri 12483: BR, EA, K, PRE); Ngorongoro Crater (Gilbert 2678: EA; 2679: EA, K). Monduli Distr.: Lake Magadi, W side of Ngorongoro Crater (Greenway and Kanuri 12.538: BR, EA, K, PRE). Mbulu Distr.: Lake Manyara (Greenway and Kanuri 11.807: PRE; Kundaeli: ZT* 7555). Mile 14.2 from the Main Gate Lake Manyara National Park (Greenway and Kanuri 11.807: EA).

Prov. DODOMA. Between Isanga and Mlejeou (Polhill and Paulo 2123: BR, K). Ufiomi, Lake Basseba near Babati (Peter 44103: B).

Prov. IRINGA. Mesangati (Greenway and Kanuri 14.504: EA, K, MO, PRE).

Prov. MTWARA. Ugogo, Ngangora (Stuhlmann 385: STU); about 8 km SW of Kingupina (Vollesen 3068: EA).

Prov. SINGIDA. Lake Singida (Polhill and Paulo 2198: B, BR, K, LISC, PRE).

Prov. TANGA. Hadeni Distr.: Segera, Pangani (Ruvo) River (Greenway 8974: EA, K, NY).

UGANDA

Prov. Buganda: East Mengo Distr., Bulemezi Co., near Kakinzi School (Lye 4413: K). Prov. Toro: near Lake Edward, Mweya Lodge, Elisabeth National Park (Gaudet 28/9/1971: EA; Lock 67/114, 68/46: EA).

ZAIRE

Prov. KIVU. Kabare, Lake Albert Edouard (Bequaert 5474: BR); Katanda, Albert National Park (Lebrun 7695: BR).

ZAMBIA

Northern Prov.: Tabwe Distr., Lake Mweru, Mweru-Wantipa (Richards 9139: BR, K).

SOUTHERN AND EASTERN ASIA

INDIA

ANDHRA PRADESH. RAMAYYA and RAJAGOPAL (1975). Hyderabad (Nayaran 3/1/1969: AD).

6.1.3.18. Wolffiella repanda (fig. 6.16)

W. repanda is restricted to a few localities in Southwestern Africa.

AFRICA

ANGOLA

Prov. MOCAMEDES. About 23 km E of Chapeu Armado, near road to San Nicolau (Kers 3611: LISC, PRE, S).

Prov. LUANDA. Luanda, near Bemposta (Welwitsch 205: BM, C, G, K, L, P, STU, ZT).

BOTSWANA

Northern Distr.: Ngamaga Island (Smith 1735: SRGH).

6.1.3.19. Wolffiella rotunda (fig. 6.16)

W. rotunda is only known from one locality in Zimbabwe.

AFRICA

ZIMBABWE

Urungwe Distr.: Zambezi Valley, Kariba Gorge (Wild 4264: B, K, LISC, MO, PRE, S, SRGH).

6.1.3.20. Wolffiella neotropica (fig. 6.16)

W. neotropica is a species endemic to tropical South America.

SOUTH AMERICA

BRAZIL

AMAZONAS. Neptunia, Rio Negro (Mitchell: ZT* 7290).

ESPIRITO SANTO. Linhares (Sucre 8361: RB, ZT* 7609).

PARA. Belem (Kuhlmann 30575: SP, ZT).

RIO DE JANEIRO. Cabo Frio (Sucre: ZT* 7279). Marico, Barra do Marico (Landolt and Farney 194/83: ZT; ZT* 8848); Rio de Janeiro (Segadas-Viana: ZT* 7225).; Saquarema, Lagao de Jacarepia (Landolt and Farney 198/83, 199/83: ZT; ZT* 8849).

SURINAM

Prov. Suriname: Paramaribo (Cramer 14903: U). Without exact locality (Cramer 14924: U).

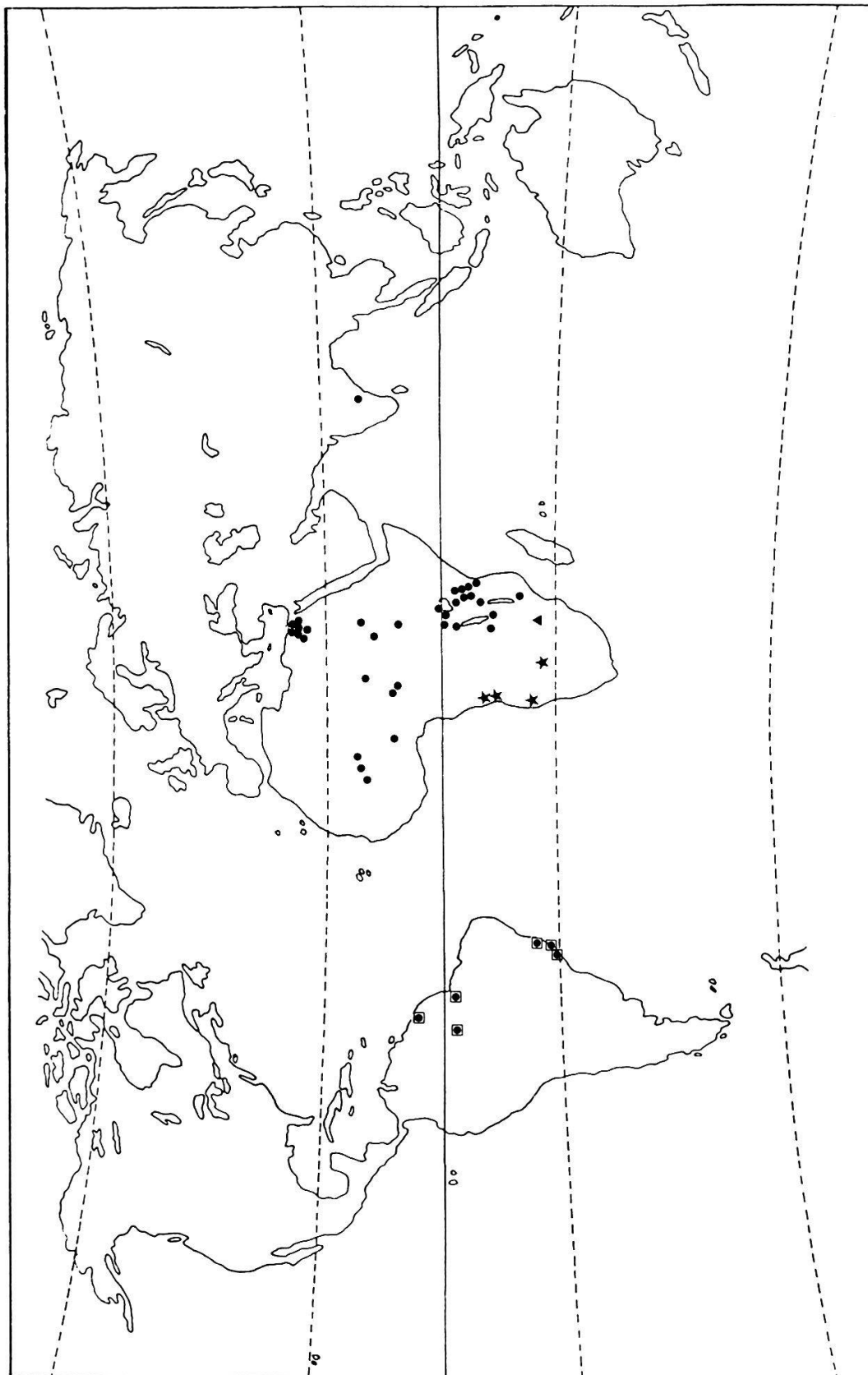


Fig. 6.16. Distribution of Wolffiella hyalina (●), W. repanda (★), W. rotunda (▲) and W. neotropica (■)

6.1.3.21. Wolffiella Welwitschii (fig. 6.17)

W. Welwitschii grows within the tropics of America and Africa.

NORTH AMERICA

MEXICO

CHIAPAS. Rio San Pedro, El Brillante (Breedlove 38371: DS).

TABASCO. Villa Hermosa-Merida, Bajadas Grandes, Laguna de Catazaja (Breedlove 34928: DS).

CENTRAL AMERICA

COSTA RICA

Prov. Guanacaste: Rio Cañas (BUMBY 1982).

EL SALVADOR

Dept. La Libertad: Laguna de Zapotitan (Fassett 29336: WIS, ZT). Dept.

San Miguel: Lake Jaguay (Fassett 28558: F, WIS).

GUATEMALA

Dept. Jutiapa: Lago Güija (Steiermark 31831: F; according to DAUBS 1965).

CARIBBEAN SEA

CUBA

Without exact locality (Wright 70: KANU; 3215: BM, GOET, MICH, S, STU; 3726: GH).

DOMINICAN REPUBLIC

Prov. Altagracia: Miches (Lowden: ZT* 8280). Prov. Barahona: Cachon (Fuertes 1161: BM, C, F, G, L, LE, LY, MIN, S, U, UC, Z, ZT). Haina (Liogier 21208: NY). Higüey (Howard 9851: B, BM, FI). Prov. Monte Cristi: Laguna Saladilla (Lowden: ZT* 8315). National Distr.: Guerra (Lowden ZT* 8666); Laguna de Cuenca (Jiménez: ZT* 8254): Prov. Santiago (Ekman 16516: S, ZT).

GUADELOUPE

Grande-Terre: Mare Caybo, 2.5 km SW of Moule (Proctor 19945: ZT; Raynal and Jérémie 21315: P, ZT).

HAITI

Dept. de l'Artibonite: Petite Rivière de l'Artibonite (Ekman H 8530: C, G, S, ZT). Desdunes, Bois Gérard (Lowden 3782: ZT). Lake Miragoane (Ekman 9040: S; Eyerdam 487: F, WTU). Rio de l'Esti (Leonard 10076: UC). Dept. du Nord: Etang Romeo (Lowden 3802: ZT).

JAMAICA

St. Catherine Par.: Charlton, Ewarton (Proctor 37943: ZT); Vaggo Head (Ekman 9040: S). St. Elisabeth Par.: Black River (PROCTOR 1982).

MARIE GALANTE

St. Louis (Raynal and Jérémie 21137: P, ZT).

St. CROIX

(Richard s.no.: STU).

SOUTH AMERICA

BRAZIL

CEARA. Maranguape, Kagado (Drouet 2203: F).

COLOMBIA

Dept. Atlantico: Barranquilla (Dugand: ZT* 7468). Dept. Cordoba: Monteria (Bristow 2/1971: COL). Dept. Huila: Villa Vieja (Smith 1243: UC).

ECUADOR

Prov. Guayas: Guayaquil-Salinas (Hitchcock 20098: GH, US); Milagro (Hitchcock 20251: GH, US).

FRENCH GUIANA

Kourou, Crique Macouria (Rogués 20178: P, ZT). Tonate, Crique du Trésor (Rogués 20052: P, ZT).

GUYANA

Demerara (Georgetown) (Bailey 3/1924: BH; Hitchcock 16622: GH, US; Jenman 9/1889: K, L).

SURINAM

Prov. Coronie: Tolness (Cramer 14892: U). Prov. Nickerie: van Bigi (Lindemann 3076: U). Prov. Suriname: Paramaribo (Cramer 14886, 14891: U); Zypad (Cramer: ZT* 8259).

VENEZUELA

Distr. Federal: Caracas (Ernst 19/4/1896: FI, H, STU; 8/1870: K; Gollmer 3/1854: GOET, H). Esto. Barinas: Libertad-Rio Apuro (Zuber: ZT* 8922); cerca de Barinas (Zuber: ZT* 8926).

AFRICA

ANGOLA

Prov. BENGUELA. Cubal (Azancot de Menezes: ZT* 7644).

Prov. LUANDA. Distr. Ambriz: Quizembo (Welwitsch 209: BM, C, G, H, K, L, STU); without exact locality (Welwitsch 207: G, K).

BOTSWANA

Northern Distr.: Linyanti River, Shaile (Russell 2394: SRGH); Nyamiland, Sepopa (Müller: ZT* 8368); Okavango River, Duba Island (Smith 1061: SRGH); Okavango Swamps (Smith 585: K, PRE, SRGH).

CHAD

Chari: Ninga (Fotius 1267: G, P).

GHANA

Cape Coast, Akotokyir (Hall 3036: K, S).

KENYA

Central Prov.: Lake Naivasha (Gaudet LN 110: EA, K, ZT). Kajiado Distr.: Ol Tukai (Verdcourt 3975: EA).

MALAWI

Southern Prov.: Lengwe Game Reserve (Hall-Martin 3/1969: PRE); Kasupe Distr., Sandbar between Lake Chilwa and Lake Chiuta (Williams 180: SRG).

MALI

Bani Plaine, Mopti (MONOD 1949). Soye, Sofora (Monod 2/12/1945: BR).

MOZAMBIQUE

Maputo Prov.: Inhaca Island, 23 mi E of Lourenço Marques (Mogg 28066: PRE, SRGH).

NIGERIA

Prov. Benin: Okomu Forest Reserve (Brenan 8788: B, BM K). Prov. Ijebu-Obode: Okun Owa, Ogun (McFarlane 11/12/1966: K).

RWANDA

Prov. Kagera: Akagera National Park, Lake Mihindi (Troupin 14871A: BR).

SENEGAL

Dakar, Lake Ouörouai (MONOD 1949). Gorom (Bernhaut 29/9/1953: P). Santanba, Néma (Bernhaut 4993: P). Between St. Louis and Richard Toll (Kassermann 2/1984: ZT).

SOUTH AFRICA

NATAL. Mbazwane, Ubombo (Mauve 4931: PRE; ZT* 8252). Mkuze Swamps,

Ndlankaya Pan (Ward 7297: PRE; 7496: K). Sordwana Bay, Ubombo (Botha: ZT* 8222; Raven 26121, 26123: MO; Vahrmeyer 658b: PRE, S).

SUDAN

Prov. BAHR EL GHAZAL. Meshra'er Req (Schweinfurth 1281: K, MEL, STU; 1283: STU).

TOGO

Southern part (according to BRUNEL et al. 1984).

TANZANIA

Prov. ARUSHA. Ngorodoto Gate, Arusha National Park (Greenway and Fitzgerald 14.971: EA, K, PRE).

Prov. TANGA. Korogwe Distr.: Maurui, Pangani River (Greenway 8715: EA, K).

UGANDA

Prov. Buganda: Entebbe, Victoria Nyanza (Bagshawe 753: BM, L). Prov. Kizegi: Rubanda Co., near Muko School (Lye 1021: K, UPS). Prov. Toro: Queen Elisabeth National Park, 3100 ft (Lock 67/172: EA).

ZAIRE

Prov. KIVU. Burunga Pond near Mokoto Lakes (Hendrickx 5781: BR).

ZAMBIA

Mporokoso Distr.: Lagoon at Chiengi (Whellan 1393: SRGH).

ZIMBABWE

Wankie Distr.: Ngame River (Garley 29022: SRGH).

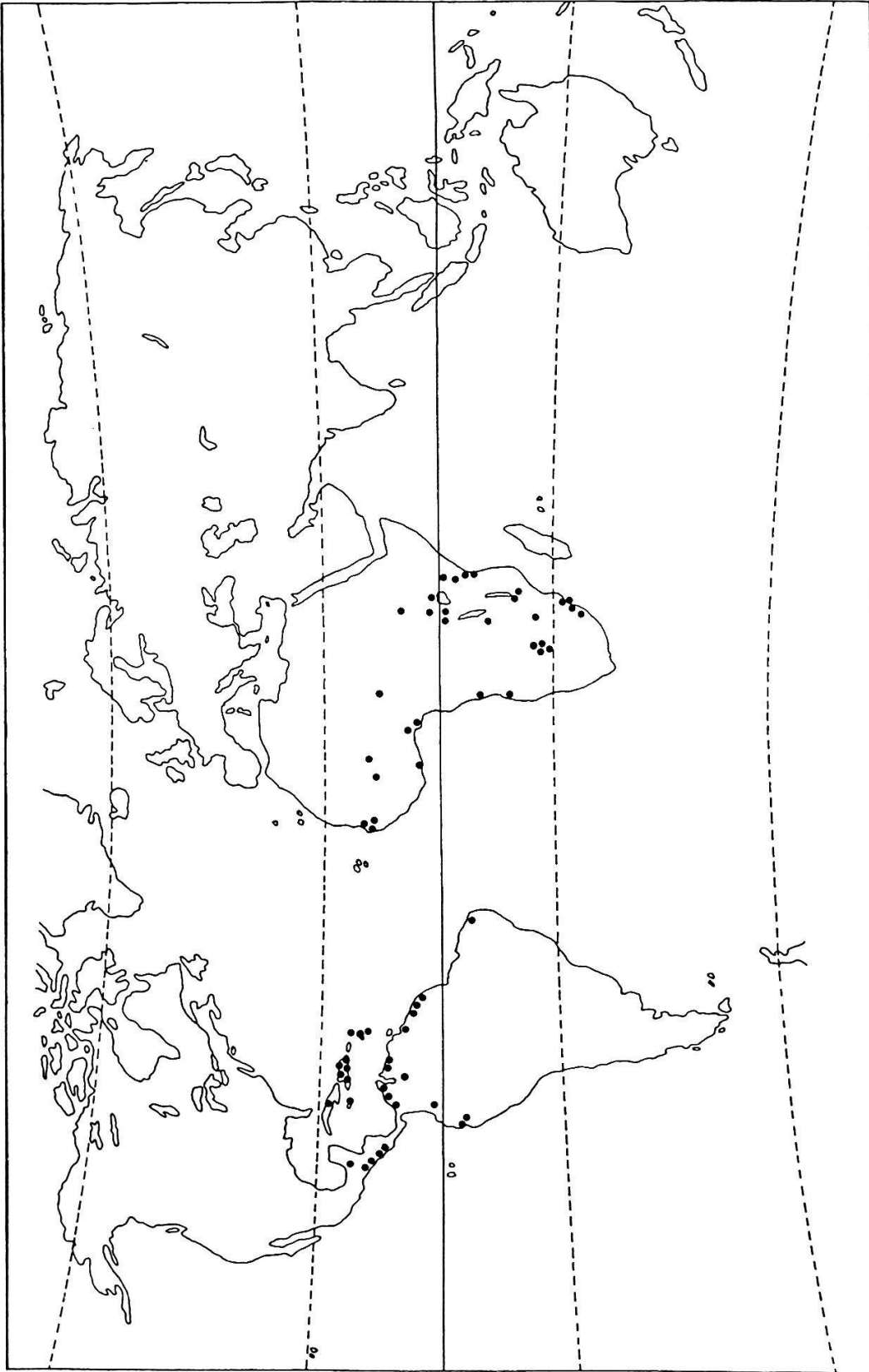


Fig. 6.17. Distribution of Wolffiella Welwitschii

6.1.3.22. Wolffiella lingulata (fig. 6.18)

W. lingulata is a species endemic to warmer regions of America.

NORTH AMERICA

MEXICO

DISTR. FEDERAL. Mexico City (Daubs 603, 604, 605: ILL; Hahn 1868: BM, CAL, FI, GOET, K, KANU, LY, MO, NY, PH, STU, US; 5/1868: KANU, L, STU; 1869: GOET, L, U; 2/1869: GOET, JE, K, KANU, L, MEL, MO, STU, U, US; Kasselmann 55/85: +, ZT; Pringle 7300: COLO, F, GH, MICH, MSC, SMU, UC; 7301: CAS, COLO, MICH, MSC, SMU, UC, US, VT; Rose 4546, 4547: US; Rutten 234: U; Schaffner 631: BM, CAS, FI, G, GOET, ILL, L, LY, M, MICH, US, ZT; 1875: BM, CAS, FI, G, LY, M, MEL, MICH, NY, UCLA; 1876: FI; Thompson 29/7/1910: KANU).

MEXICO. San Juan Citaltepec (Rzedowski 16589: DS, MICH; 16590: MICH).

TABASCO. Villahermosa (Gigon: ZT* 7655); Villahermosa-Merida, Bajadas Grandes, Laguna di Catazaja (Breedlove 34928: DS).

TAMAULIPAS. Aldama, Las Yucas (Dressler 2132: GH, MICH, MO; 2133: GH, MO).

VERACRUZ. Coatzacoalcos (Gigon: ZT* 7658).

U.S.A.

CALIFORNIA. Rather rare: Fresno Co., Kern Co., Los Angeles Co., Merced Co., Monterey Co., Orange Co., San Bernardino Co., San Francisco Co., San Joaquin Co., San Luis Obispo Co., San Mateo Co., Santa Barbara Co., Santa Clara Co., Santa Cruz Co.

FLORIDA. Rare: Glades Co.

LOUISIANA. Rather rare: Cameron Par., Iberia Par., Jefferson Par., Plaquemines Par., St. Bernard Par., Vermillion Par.

TEXAS. Rare: Brazoria Co., Refugio Co.

CENTRAL AMERICA

PANAMA

Canal Zone: Gamboa (Cramer 24: U). Prov. Juan Mina: Chagres River (Bartlett and Lasser 16506: DUKE, GH, MO, VT).

CARIBBEAN SEA

CUBA

Without exact locality (Wright 3215: G).

GUADELOUPE

Grande Terre (Raynal 20235: P; Raynal and Jérémie 21087, 21088, 21315, 21316, 21318: P, ZT); (cf. JEREMIE and RAYNAL-ROQUES 1981). Without exact locality (Herninier: STU).

MARIE-GALANTE

St. Louis (Raynal and Jérémie 21137, 21138, 21139, 21140: P, ZT); (cf. JEREMIE and RAYNAL-ROQUES 1981).

TRINIDAD AND TOBAGO

Trinidad: Milpost (Hilcox 8411: K, ZT); St. Augustine (Kalloo: ZT* 7330); Debé (Broadway 8074: S).

SOUTH AMERICA

ARGENTINA

Prov. BUENOS AIRES. Dept. Campana: ca. 11 km N of Campana (Landolt and Zarzycki 44/83: ZT). Vacurutu (Malme 1778: S, UPS).

Prov. CHACO. Dept. Bermejo: Colonia Vélaz, Arroyo Cangüi Chico (Landolt and Zarzycki 159/83: ZT); Isla del Cerrito (ESKUCHE and ROMERO FONSECA 1982). Dept. Grl. Donovan: Estancia Dos Tranqueras (Schinini 22672: CTES; 22729: CTES). Dept. Libertad: Ero. Guazú, N of Pt. Tirol (Landolt, Zarzycki and Eskuche 168/83: ZT); Rio Tragadero (Landolt: ZT* 8806). Dept. 1^o de Mayo: 4 km S km 1024 RN 11, Rio Tragadero (Landolt, Zarzycki and Eskuche 163/83, 164/83, 165/83: ZT). Selva Riparia (ESKUCHE and ROMERO FONSECA 1982). Dept. 25 de Mayo: Machagüi (Landolt 7/83: ZT). Dept. San Fernando: El Paraisal, RN 11 (Landolt and Zarzycki 121/83: ZT); 32 km S of Resistencia (Landolt and Zarzycki 124/83: ZT); 3 km S of Colonia Benitez (Landolt, Zarzycki and Eskuche 166/83: ZT); RN 16, 3 km W junction RN 11 (Landolt, Zarzycki and Eskuche 167/83: ZT); Rio Negro, Resistencia (Landolt, Zarzycki and Eskuche 169/83: ZT); Rio Paraná (ESKUCHE and ROMERO FONSECA 1982).

Prov. CORRIENTES. Dept. Capital: RN 5, without exact locality (Tur 1682: CTES); Arroyo Riachuelo (Schinini and Miranda 1163: CTES); RN 12, Bridge Arroyo Riachuelo (Landolt, Zarzycki and Eskuche 170/83: ZT); RN 12, ca. 200 m E Bridge Arroyo Riachuelo (Landolt, Zarzycki and Eskuche 171/83: ZT); RN 5, ca. 2 km E of Corrientes (Landolt, Zarzycki and Eskuche 173/83: ZT); RN 5, ca. 1 km W of Laguna Brava (Landolt, Zarzycki and Eskuche 174/83: ZT). Empedrado: Estancia La Yela (Pedersen 12924: CTES; ZT* 8664). Dept. Mburucuyá: Estancia Santa Maria (Pedersen 7514: C); Estacion Santa Teresa (Pedersen: ZT* 7725). Dept. Saladas: Saladas (Landolt 5/83: ZT). Dept. San Cosme: San Cosme, 40 km E of Corrientes (Lüönd and Bruckner: ZT* 8742); RN 12, ca. 2 km E Canal 14 (Landolt, Zarzycki and Eskuche 175/83, 176/83: ZT; ZT* 8841); RN 12, Laguna Rincon (Landolt, Zarzycki and Eskuche 178/83: ZT); 1 km S of Paso de la Patria, Arroyo Pehajo (Landolt, Zarzycki and Eskuche 180/83: ZT); 11 km S of Paso de la Patria (Landolt, Zarzycki and Eskuche 181/83, 182/83: ZT). Dept. San Luis del Palmar: Paso Horqueta (Pedersen 12923: CTES; ZT* 8661); San Luis del Palmar (ESKUCHE and ROMERO FONSECA 1982).

Prov. ENTRE RIOS. Dept. Capital: Concepcion del Uruguay (Lorentz 1878: CORD).

Prov. FORMOSA. Dept. Formosa: just N of Formosa (Landolt and Zarzycki 133/83: ZT); RN 11, 15 km N of Formosa (Landolt and Zarzycki 135/83: ZT); RN 11, 5 km S of Canada Doce (Landolt and Zarzycki 136/83: ZT). Dept. Laishi. Pt. Vélaz, Rio Bermejo (Landolt and Zarzycki 126/83: ZT); 4 km N of Arroyo Lindo (Landolt and Zarzycki 128/83: ZT); RN 11, Rio Salado (Landolt and Zarzycki 129/83, 129b/83: ZT). Dept. Pilcomayo: ca. 40 km S of Clorinda, Rcho. He-He (Landolt and Zarzycki 137/83, 137b/83: ZT); ca. 20 km S of Clorinda, Rcho. Negro (Landolt and Zarzycki 139/83: ZT); ca. 7 km SE of Clorinda, Rio Paraguay (Landolt and Zarzycki 140/83: ZT); RN 11, Garcete Cué (Landolt and Zarzycki 141/83: ZT); Clorinda (Landolt and Zarzycki 143/83: ZT); RN 86, 20 km W of Clorinda (Landolt and Zarzycki 144/83: ZT; ZT* 8822); RN 86, ca. 22 km of Clorinda (Landolt and Zarzycki 145/83: ZT; ZT* 8825); ca. 5 km NE of Primela Pinta (Landolt and Zarzycki 150/83: ZT); ca. 2 km N of Primela Pinta (Landolt and Zarzycki 151/83: ZT); ca. 12 km E of Laguna Blanca (Landolt and Zarzycki 153/83, 153b/83, 156/83, Landolt 154/83: ZT).

Prov. SANTA FE. Dept. Grl. Obligado: RN 11, Arroyo Malabrigo (Landolt and Zarzycki 105/83: ZT); between Reconquista and Pt. Reconquista (Landolt and Zarzycki 107/83: ZT); ca. 6 km W of Pt. Reconquista (Landolt

and Zarzycki 108/83: ZT); ca. 6 km E of Reconquista (Landolt and Zarzycki 109/83: ZT); ca. 3 km E of Reconquista (Landolt and Zarzycki 110/83, 111/83: ZT); 8 km N of Las Garzas (Landolt and Zarzycki 116/83: ZT); ca. 2 km S of Arroyo Ceibal, Arroyo Las Garzas (Landolt and Zarzycki 118/83: ZT); 10 km S of Villa Ocampo, Rio Amores (Landolt and Zarzycki 119/83: ZT); Florencia, Rio Tapenaga (Landolt and Zarzycki 120/83: ZT). Dept. La Capital: Santa Fé (Landolt and Zarzycki 64/83, 70/83: ZT); La Guardia (Landolt and Zarzycki 66/83: ZT); Rio Salado, Santa Fé (Landolt and Zarzycki 72/83: ZT); N of Esperanza, N of Rio Salado (Landolt and Zarzycki 75/83: ZT; ZT* 8817); ca. 15 km N of Esperanza (Landolt and Zarzycki 77/83, 78/83: ZT); RN 62, Rio Salado (Landolt and Zarzycki 82/83, 83/83, 84/83, 85/83: ZT). Dept. Vera: ca. 9 km E of La Gallareta (Landolt and Zarzycki 96/83: ZT); Laguna La Gallareta (Landolt and Zarzycki 101/83: ZT); ca. 5 km S of Vera, Espin (Landolt and Zarzycki 102/83: ZT); ca. 9 km NE of Vera, RN 11 (Landolt and Zarzycki 103/83: ZT); Arroyo El Tobo, RN 11 (Landolt and Zarzycki 104/83: ZT); Arroyo Malabrigo, RN 42 (Landolt and Zarzycki 112/83, 114/83: ZT).

BOLIVIA

Dept. Santa Cruz: Santa Cruz de la Sierra (Evrard 1977: BR).

BRAZIL

AMAZONAS. Manaus (Albuquerque 30/7/1970: ZT); Parana Canal (Mitchell: ZT 7292). Rio Negro (Mitchell: ZT* 7289).

PARA. Belem (Kuhlmann 30575: S, SP); Santarem (Ginzberger 10/7/1927: F, L, W, WU).

RIO DE JANEIRO. Rio de Janeiro, Cabo Frio (Sucre and Santos 6479: RB).

COLOMBIA

Dept. Cordoba: Monteria (Bristow 2/1971: COL; Zainun 19Bo079: US).

ECUADOR

Prov. Guayas: 10 km NE of Guayaquil (Lüönd: ZT 8998).

FRENCH GUIANA

Cayenne (Raynal and Jérémie 21265: P, ZT).

PARAGUAY

Dept. Asunción: Asunción, Horto Botanico (Bordas: ZT* 8237, ZT* 8238).

Dept. Chaco: Mayor Lagerenza, Rio Timane (Schinini and Bordas 14843: CTES). Dept. La Cordillera: Escalada (Osten 9165: ZT); San Bernardino (Osten 9163, 9164: G, S, ZT).

SURINAM

Prov. Coronie: Tolness (Cramer 14892: U). Prov. Saramacca: Mokokoko-Swamp (Lindemann 5576b: U); Saramacca River (Teunissen: ZT* 7360). Prov. Suriname: Paramaribo (Grauer 14891, 14900: U). Without exact locality (Cramer 14924: U).

URUGUAY

Dept. Montevideo: Pocitos (Herter 6/1924: GOET, ZT; 76816: BH, G, M, MO, MSC, S, Z).

VENEZUELA

Distr. Federal: Caracas (Gollmer 3/1854: GOET, H). Esto. Aragua: Maracay, Lago de Valencia (Alston 5682: BM; Maas 2175: U); Maracay (Maas 2174: U). Esto. Barinas: Cerca de Barinas (Zuber: ZT* 8927); Libertad Rio Apure (Zuber: ZT* 8923). Esto. Yaracuy: Marin (Tillet: ZT* 7464).

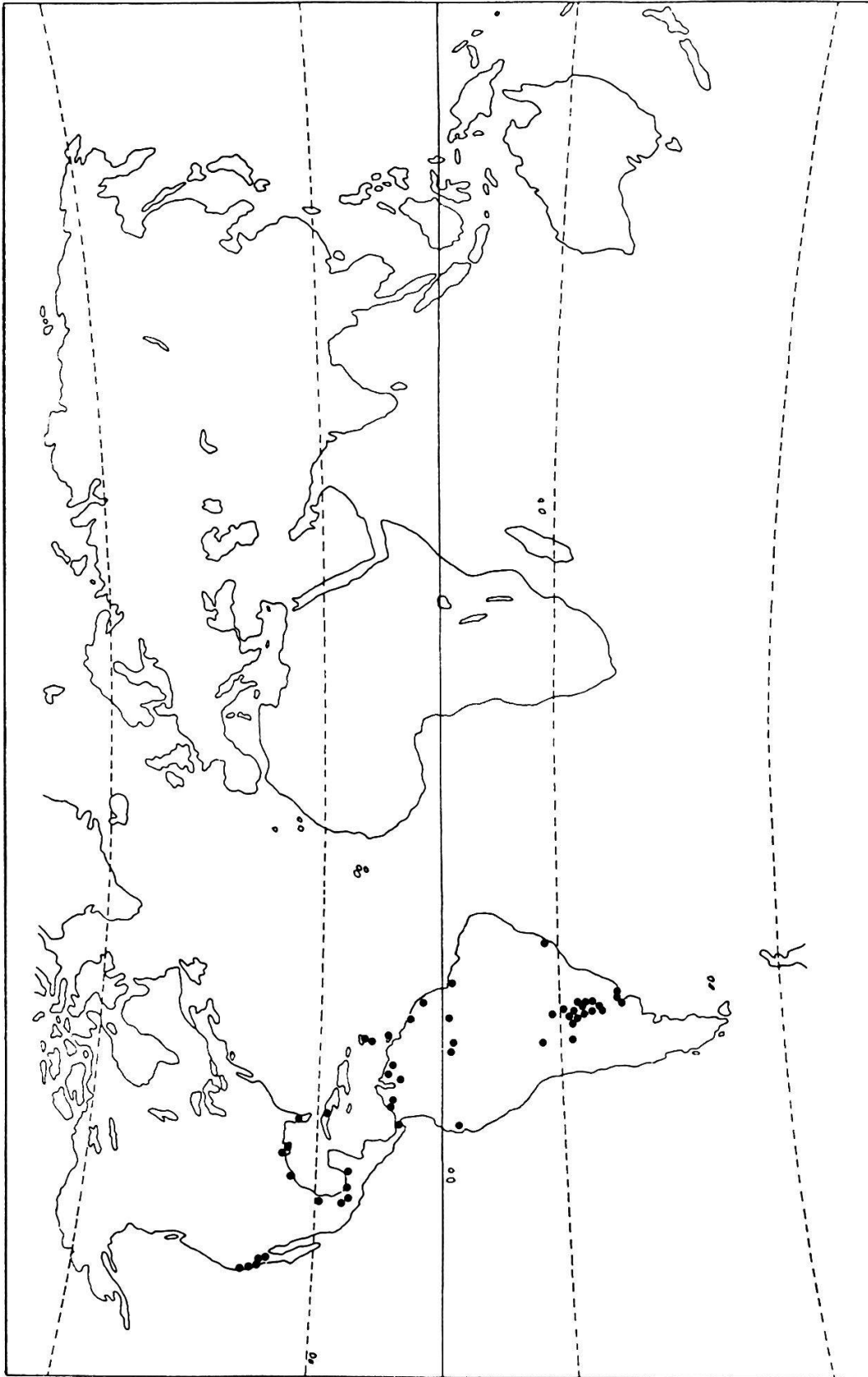


Fig. 6.18. Distribution of Wolffiella lingulata

6.1.3.23. Wolffiella oblonga (fig. 6.19)

W. oblonga is a species endemic to mostly warm, temperate regions of America.

NORTH AMERICA

MEXICO

DISTR. FEDERAL. Mexico City (Barkley 17M341: TEX; Daubs 603, 604: ILL; Edwards 902: F; Hahn 1868: BM, CAL, FI, GOET, K, KANU, LY, MO, NY, PH, STU, US; 5/1868: KANU, L, STU; 1869: GOET, L, U; 2/1869: GOET, JE, K, KANU, L, MEL, MO, STU, U, US; Pringle 1300: GH, US; 7300: COLO, F, GH, MICH, MSC, SMU, UC, VT; 7301: CAS, MICH, MSC, SMU, UC, US, VT; Rose 4546, 4547: US; Schaffner 631: BM, CAS, FI, G, GOET, ILL, L, LY, M, MICH, US, ZT; 1875: BM, CAS, FI, G, LY, M, MEL, MICH, NY, UCLA; Thompson 29/7/1910: KANU).

MEXICO. San Juan Citaltepec (Rzedowski 16589: DS, MICH); Toluca (Barkley 612: TEX; Hendrickson and Milstead 34a-81: ASU).

U.S.A.

CALIFORNIA. Rather rare: Fresno Co., Marin Co., Merced Co., Monterey Co., Orange Co., San Bernardino Co., San Francisco Co., San Joaquin Co., San Luis Obispo Co., San Mateo Co., Santa Barbara Co., Santa Clara Co., Santa Cruz Co.

FLORIDA. Rather rare: Atachua Co., Citrus Co., Collier Co., Glades Co., Palm Beach Co., Polk Co., Wakulla Co.

LOUISIANA. Rather frequent, except in the North.

TEXAS. Rare: Brazoria Co., Hidalgo Co., Matagorda Co.

CENTRAL AMERICA

PANAMA

Juan Mina: Rio Hondo (Bartlett 16979: GH, MO).

CARIBBEAN SEA

CUBA

Prov. Pinar del Rio (Wright 3215: BM, G, GOET, MICH, S, STU).

SOUTH AMERICA

ARGENTINA

Prov. BUENOS AIRES. Dept. Baradero: Isla en Baradero, Rio Pintos (Burkart 8521: SI, ZT). Dept. Berriso: Los Borrachos (Tur 1739: LP; 1741: LP); Los Talas, Canal Mena (Tur 1748: LP); La Balandra (Tur 1751: LP). Dept. Buenos Aires and vicinity: Arroyo Burgueno (Leon: ZT* 7201a); Buenos Aires, Botanic Garden (Giardelli 508: ZT; Hauman s.d.: BAA); General Mondareaga (Nicora 6985: BAA); Isla Martin Garcia (Cabrera 3359: LP; Pastore 4/1935: UC); Parque 3 de Febrero (Krapovickas 2879a: CTES); La Plata (Spegazzini 25/7/1898: CORD); Tordillo, Estancia La Bagatela (Giardelli 1201: SI; 1220: SI, ZT); Zarate (Giardelli 502: UC, ZT). Vacurutu (Malme 1778: S); Villa Ortuzar (Parodi 11893, 11894). Dept. Campana: ca. 11 km N of Campana (Landolt and Zarzycki 44/83: ZT). Dept. Castelli: Castelli, Laguna Ombu (Landolt and Zarzycki 24/83: ZT). Dept. Chascomus: Laguna Barrancas (Spegazzini 1/11/04: BAB); Manuel J. Cobo (Est. Lesema) (Spegazzini 30/10/04: BAB); Lago Chascomus (Landolt and Zarzycki 32/83:

ZT); Arroyo Vitel (Tur: ZT* 7923); Laguna Vitel (Landolt and Zarzycki 27/83: ZT; 29/83, 30/83: ZT). Dept. Cnl. Pringles: Las Mostazas (Perrone 57.002: BA). Dept. Dolores: Dolores (Giardelli 514: K); Laguna pres de Sevigue (Landolt and Zarzycki 23/83: ZT). Dept. Grl. Conesa: Laguna Bagadela (Burkart 15671-15673: SI, ZT). Dept. Grl. Lavalle: San Clemente (Tur 1700: LP). Dept. Lobos: Lobos, Roque Perez (Kalela 11: H). Dept. 9 de Julio: Dennehy (Pedersen 13161: CTES; ZT* 8735); Nueve de Julio (Pedersen 13159: LP). Dept. San Miguel del Monte: Laguna del Monte (Landolt and Zarzycki 21/83, 22/83: ZT; ZT* 8813); San Miguel del Monte (Movau 29412: BA). Prov. CHACO. Dept. Grl. Donovan: Estancia Dos Tranqueras (Schinini 22672, 22729: CTES). Dept. 1 de Mayo: Colonia Benitez (Schulz 7589: ZT). Dept. 25 de Mayo: Machagdi (Landolt 7/83: ZT). Dept. San Fernando: 32 km S of Resistencia (Landolt and Zarzycki 124/83: ZT); RN 16, 3 km W junction RN 11 (Landolt, Zarzycki and Eskuche 167/83: ZT; ZT* 8837).

Prov. CHUBUT. Dept. Futaleufu: Esquel (Soriano 3422: BAB). The locality has very cold winters for W. oblonga. Possibly it is a temporary introduction or the species grows in locally warmer waters.

Prov. CORDOBA. Cordoba (Kurtz 9089: CORD, R, STU); Altos Oeste (Stuckert 2823: CORD); Laguna Peitiado (Atnerst 2824: MO; Hieronymus 489: F, G, L, SP, STU; 4/1877: F, G, JE, L, LE, US; Kurtz 6537: CORD, MO, SGO, STU; 6991: BAF, CORD, MO, R, STU; 7008: CORD; Lorentz 8/1873: GOET; Stuckert 9/5/1897, 935: CORD; 2828: KANU, MO); Laguna Sofre (Stuckert 12845: CORD); Puerto del Paraiso (Kurtz 9127: CORD); Quinta (Stuckert 2866, 2868: CORD; 12851: G, CORD). Dept. Colon: Sierra Chica, Cabera (Stuckert 11740: CORD); Villa Allende (Di Fulvio 6: CORD). Dept. Minas: Guasapampa (Kurtz 6790: BAF, CORD, STU). Dept. Rio Primero: La Toma (Kurtz 9089; 18/4/1896: CORD).

Prov. CORRIENTES. Dept. Capital: Arroyo Riachuelo (Schinini and Miranda 1165: CTES). Dept. Empedrado: Estancia La Yela (Pedersen 12924: CTES; ZT* 8662). Dept. Goya: Colonia Carolina (Schinini et al. 19088: CTES). Dept. Mercedes: Laguna Iberia, San Dionisio (Correa et al. 5284: BAA, SI, ZT). Dept. San Cosme: RN 12, en el limite con el Dept. Itati (Krapovickas et al. 37548: CTES); RN 12, ca. 2 km E Canal 14 (Landolt, Zarzycki and Eskuche 175/83, 176/83: ZT; ZT* 8840); Laguna Rincon, RN 12 (Landolt, Zarzycki and Eskuche 177/83: ZT); E-end Laguna Rincon, RN 12 (Landolt, Zarzycki and Eskuche 178/83: ZT); 9 km S of Paso de la Patria (Landolt, Zarzycki and Eskuche 179/83: ZT); 1 km S of Paso de la Patria, Arroyo Pehuajo (Landolt, Zarzycki and Eskuche 180/83: ZT; ZT* 8844). Dept. San Luis de Palmar: Paso Horqueta (Pedersen: ZT* 8659).

Prov. ENTRE RIOS. Dept. Capital: Concepcion del Uruguay (Lorentz 182: B, BM, CORD, G, JE, STU, UPS, Z; 1878: CORD; 12/1878: STU). Dept. Gualaguaychu: Embarcadero Berriso (Landolt and Zarzycki 49/83: ZT); ca. 35 km S of Ceibas (Landolt and Zarzycki 46/83: ZT); 3 km W of Arroyo El Animal (Landolt and Zarzycki 54/83: ZT); 43 km E of Gualaguay (Landolt and Zarzycki 48/83: ZT); Gualaguay, Rio Gualaguay (Landolt and Zarzycki 50/83: ZT).

Prov. FORMOSA. Just N of Formosa (Landolt and Zarzycki 133/83: ZT); 15 km N of Formosa, RN 11 (Landolt and Zarzycki 134/83: ZT); 30 km N of Formosa, RN 11 (Landolt and Zarzycki 135/83: ZT); 5 km S of Canada Doce (Landolt and Zarzycki 136/83: ZT). Dept. Pilcomayo: Clorinda (Landolt and Zarzycki 143/83: ZT); 20 km W of Clorinda, RN 86 (Landolt and Zarzycki 144/83: ZT; ZT* 8823); ca. 22 km W of Clorinda, RN 86 (Landolt and Zarzycki 145/83: ZT; ZT* 8826); 22 km W of Clorinda, S of Palmo Salo (Landolt and Zarzycki 146/83: ZT; ZT* 8828); 40 km W of Clorinda, Laguna Naick-Neck (Landolt and Zarzycki 147/83: ZT; ZT* 8830); between Primela

Pinta and Laguna Blanca (Landolt and Zarzycki 149/83: ZT; ZT* 8832); ca. 5 km NE of Primela Pinta (Landolt and Zarzycki 150/83: ZT); ca. 12 km E of Laguna Blanca (Landolt and Zarzycki 152/83, 153/83 ZT; Landolt 154/83, 155/83: ZT).

Prov. JUJUY. Laguna del Palmar (Lorentz and Hieronymus 554: BAF, CORD, GOET, KANU, MO, NY).

Prov. MISIONES. Jabebiri (Giardelli 537: UC).

Prov. RIO NEGRO. General Roca (Pedersen: ZT* 8740).

Prov. SALTA. Sianbon, Sierra de Tucuman (Lorentz and Hieronymus 1024: CORD, GOET, KANU); Gran Chaco, Bella Vista (Lorentz 577: GOET; Lorentz and Hieronymus 8/6/1873: CORD, NY, STU); Parque National El Rey (de Sloover 75/436-437: ZT; Eskuche: ZT 8751). Dragores (Lorentz 8/1873: B, STU).

Prov. SANTA FE. Dept. Grl. Obligado: Arroyo Malabrigo (Landolt and Zarzycki 105/83: ZT); 8 km N of Las Garzas (Landolt and Zarzycki 116/83: ZT); ca. 2 km S of Arroyo Ceibal, Arroyo Las Garzas (Landolt and Zarzycki 117/83, 118/83: ZT); Florencia, Rio Tapenaga (Landolt and Zarzycki 120/83: ZT). Dept. La Capital: Colastine (Landolt and Zarzycki 67/83: ZT); Santa Fé (Landolt and Zarzycki 64/83, 70/83: ZT); La Guardia (Landolt and Zarzycki 66/83: ZT); Rio Tindero Viejo (Landolt and Zarzycki 68/83: ZT); Rio Salado, Santa Fé (Landolt and Zarzycki 72/83: ZT); N of Esperanza, N of Rio Salado (Landolt and Zarzycki 75/83: ZT; ZT* 8816); ca. 12 km N of Esperanza (Landolt and Zarzycki 76/83: ZT); ca. 15 km N of Esperanza (Landolt and Zarzycki 77/83, 78/83: ZT); Rio Salado, RN 62 (Landolt and Zarzycki 82/83, 83/83, 84/83, 85/83: ZT). Dept. Vera: ca. 190 km N of Santa Fé, RN 11 (Landolt and Zarzycki 90/83: ZT); ca. 4 km N of Margarita (Landolt and Zarzycki 94/83: ZT); ca. 5 km N of Margarita (Landolt and Zarzycki 95/83: ZT); ca. 9 km E of La Gallareta (Landolt and Zarzycki 96/83: ZT); Laguna La Gallareta (Landolt and Zarzycki 98/83, 99/83, 101/83: ZT); ca. 5 km S of Vera, Espin (Landolt and Zarzycki 102/38: ZT); Arroyo El Tobo, RN 11 (Landolt and Zarzycki 104/83: ZT); Arroyo Malabrigo, RN 42 (Landolt and Zarzycki 112/83, 114/83: ZT).

Prov. TUCUMAN. Dept. Famaila: Rio Lules (Venturi 2076: GH, S, SI, ZT). Dept. Jasmilla: Rio Lules (Schreiter 4112: LIL). Dept. San Miguel del Tucuman: Capital (Meyer: ZT* 8662). Dept. Tafi: Valle de Tafi (Roth s.no.: LP).

BOLIVIA

Dept. Cochabamba: Cochabamba (Thompson 1891: KANU). Dept. Oruro: Sajama (Klein: ZT* 8670). Dept. Santa Cruz: Santa Cruz de la Sierra (Evrard 1977: BR).

BRAZIL

AMAZONAS. 100 km W of Manaus, Lake Salado (Junk: ZT* 8312).

PARA. Monte Alegre (Kuhlmann 840: SP).

RIO DE JANEIRO. Rio de Janeiro (Glaziou 20539: C).

RIO GRANDE DO SUL. Itapua (Lindeman and Valls 9519: CTES, U); Pelotas (Sacco: ZT* 7997); Porto Alegre, Rio Piquiri (Lindeman 8729: U); Rio Grabyba (Reineck 7/1896: LY); Rio Grande (Lindeman 743: S).

SANTA CATARINA. Jaguaruna (Reitz 5931: R, ZT; Smith 5929: R, US, ZT); Tubarao (Ule 1314: L).

SAO PAULO. Campinas (Henschen 1633: UPS; Moten 4661: S); Sao Paulo (Joly: ZT* 7142).

CHILE

Prov. Santiago: Santiago (Hastings 597: CU, UC, US; 598: CU, UC; Philippi 5/1857: BM, G, GOET, K, L, LE, MEL, MO, S, SGO, STU UPS, ZT).

ECUADOR

Prov. Imbabura: Lago San Pablo (Camp 3254: S; Fagerlind 1325: S).

PARAGUAY

Dept. Asunción: Asunción, Horto Botanico (Bordas: ZT* 8237; Bordas: ZT* 8238). Dept. Chaco: Mayor Pablo Lagerenza, Rio Timane (Schinini and Bordas 14343: CTES). Dept. La Cordillera: Escalada (Osten 9165: ZT); San Bernardino (Osten 9164: G, S, ZT).

PERU

Prov. Cuzco: Dept. Cuzco (Maldonado 14a: F). Dept. Libertad, Trujillo (Killip 21510: NY).

URUGUAY

Dept. Canelones: Carrasco (Archavaleta 3/1877, 2501: ZT; Herter 85071: B, F, G, GH, M, MO, R, S, U, UC, US, Z, ZT). Dept. Florida: Zimote (Rosenburgh B 1682: F, US). Dept. Montevideo: Miguelete (Herter 85483: F, G, GH, M, MO, MPU, NY, S, U, UC, US, Z, ZT); Montevideo (Archavaleta 2502, 2503: ZT; Gilbert 1337: US; Herter 1302: RB; 68131: F, GOET, M, MO, U, ZT); Pocitos (Herter 6/1924: GOET, ZT; 70258: WIS, ZT; 70266: B, ZT; 70512: B, F, G, GH, K, MO, MSC, S, U, UC, Z, ZT; 71352: B; 76816: BH, G, M, MO, MSC, S, Z). Dept. San José: Barra Santa Lucia (Osten 23043: CAS, S, ZT). Dept. Treinta-y-Tres: Without exact locality (Herter 88885: B, F, G, GH, M, MO, NY, U, UC, US, Z, ZT).

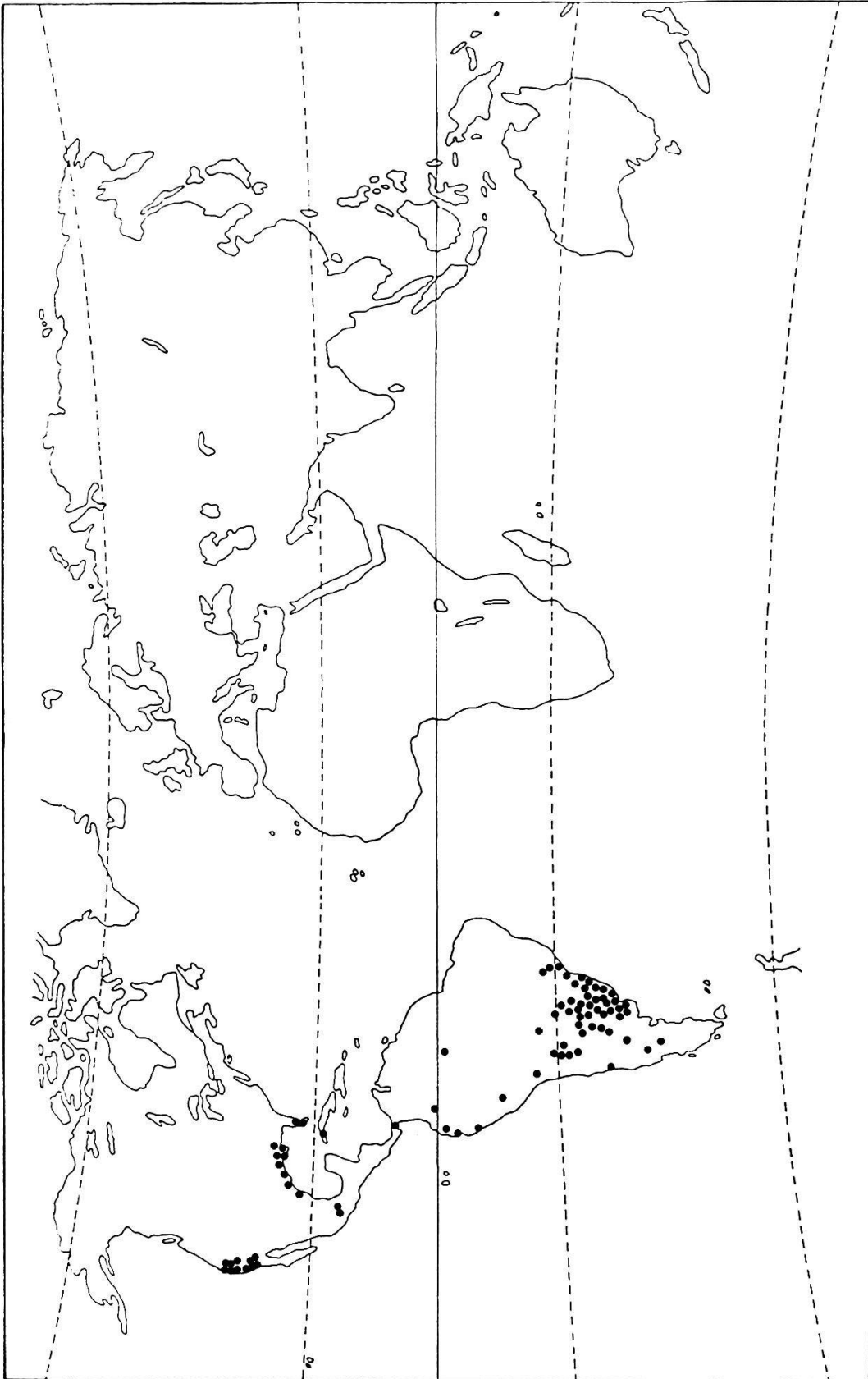


Fig. 6.19. Distribution of Wolffiella oblonga

6.1.3.24. Wolffiella gladiata (fig. 6.20)

W. gladiata is restricted to southern North America.

NORTH AMERICA

MEXICO

DISTR. FEDERAL. Mexico City (Bravo 1933: ZT; Bailey 594: BH; Daubs 603, 604: ILL; Edwards 902: F; Hahn 1868: BM, CAL, FI, GOET, K, KANU, LY, MO, PH, STU, US; 5/1868: KANU, L, STU; 2/1869: GOET, JE, K, KANU, L, MEL, MO, STU, U, US; Pringle 1300: GH, US; 7301: CAS, COLO, MICH, MSC, SMU, UC, US, VT; Rose 4546, 4547: US; 6466: U, US; Schaffner 1875: BM, CAS, FI, G, LY, M, MEL, MICH, NY, UCLA).

U.S.A.

ALABAMA. Rather rare: Covington Co., Geneva Co., Greene Co., Lowndes Co., Montgomery Co., Washington Co., Wilcox Co.

ARKANSAS. Rare: Arkansas Co., Greene Co., Hemstead Co., Jefferson Co.

DELAWARE. Rather rare: Kent Co., New Castle Co.

DISTR. OF COLUMBIA. Rare.

FLORIDA. Rather frequent.

GEORGIA. Rather rare: Chatham Co., Decatur Co., Early Co., Echols Co., Jenkins Co., Lowndes Co., McIntosh Co., Miller Co., Thomas Co.

ILLINOIS. Rather rare: Alexander Co., Cook Co., Jackson Co., Menard Co., Monroe Co., St. Clair Co., Union Co., Wabash Co.

INDIANA. Rare: Marshall Co., Warren Co.

LOUISIANA. Rather frequent.

MASSACHUSETTS. Rare: Middlesex Co., Plymouth Co. (BLAKE 1938).

MISSISSIPPI. Rather rare: Forrest Co., Issaquena Co., Leflore Co., Noxubee Co.

MISSOURI. Rare: Dunklin Co., Mississippi Co.

NEW JERSEY. Rare: Passaic Co. (EDWARDS 1932).

NORTH CAROLINA. Rather frequent, but only in the East.

OHIO. Rather rare: Fairfield Co., Hamilton Co., Lake Co., Licking Co., Perry Co., Portage Co., Summit Co.

OKLAHOMA. Rare: McCurtain Co.

PENNSYLVANIA. Rare: Crawford Co.

SOUTH CAROLINA. Rather frequent, but only in the East.

TENNESSEE. Rare: Lake Co.

TEXAS. Rather rare: Bowie Co., Colorado Co., Falls Co., Harrison Co., Hays Co., Henderson Co., Marion Co., Matagorda Co., Orange Co., Travis Co.

VIRGINIA. Rather frequent, but only in the East.

WASHINGTON. Rare: Pierce Co.

6.1.3.25. Wolffiella denticulata (fig. 6.20)

W. denticulata is endemic to southern Africa.

AFRICA

MOZAMBIQUE

Sul do Save, Inhanombe (Exell and Mendoça 570: BM, LISC, SRGH).

SOUTH AFRICA

CAPE. Tsitsikama (Krauss ex herb. Braun: FI, G, JE, MO, SZU, Z).

NATAL. Ubombo Distr.: Mbazwane (Maue 4931: PRE; ZT* 8251); Sordwana Bay (Botha: ZT* 8221; Raven 26121: MO; Vahrmeyer 658a: PRE, S); Zululand (Maue ZT* 7454). Eshowe Distr.: Jan Garland (Gillissen 9/1962: PRE). Durban (Mason 20/9/1909: K).

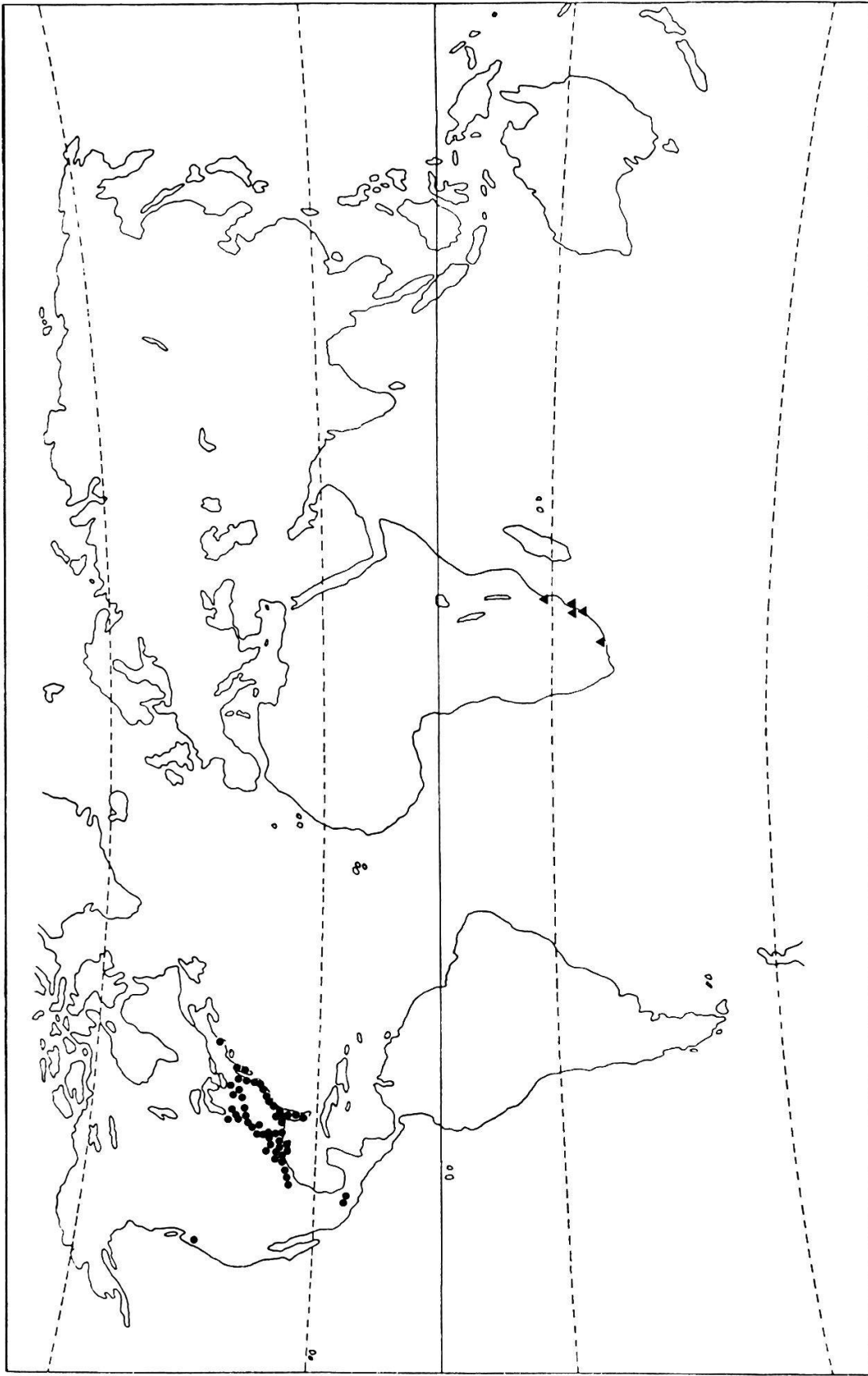


Fig. 6.20. Distribution of Wolffiella gladiata (●) and W. denticulata (▲)

6.1.3.26. Wolffia microscopica (fig. 6.21)

W. microscopica is restricted to India and Pakistan. Records from Japan and Taiwan (MIKI 1934) refer to W. globosa.

SOUTHERN AND EASTERN ASIA

INDIA

ANDHRA PRADESH. Godavari, Dowlaiswaram (Ihivy 135, 136, 137: MICH). Nidadavolu (Narayan 27/5/1968: AD).

DELHI. Delhi (Maheshwari 23/10/1953: BM). Najafgarh (Maheshwari: ZT* 8359).

GUJARAT. Kadi (Yogi: ZT* 7238).

HARYANA. Sohna (VENKATARAMAN et al. 1970).

TAMIL NADU. Thanjavur (Tanjore) (Ihivy 127, 130: MICH).

UTTAR PRADESH. Agra (Maheshwari 8094: G, UC). Dehra Dun (Parker 23/9/1922: BM).

PAKISTAN

Punjab: Rawalpindi, Fatehjang (Futeh Jang) (Aitchinson 539: MEL, STU).

6.1.3.27. Wolffia elongata (fig. 6.21)

W. elongata is a species endemic to northern South America.

CARIBBEAN SEA

CURACAO

(Suringar 1885: L).

SOUTH AMERICA

COLUMBIA

Dept. Atlantico: Barranquilla (Guttierrez 18C 005/6: COL, S, WIS). Dept. Bolivar: Arjona (Killip 14504: GH). Dept. Cordoba: Monteria (Molino 19Bo205: US).

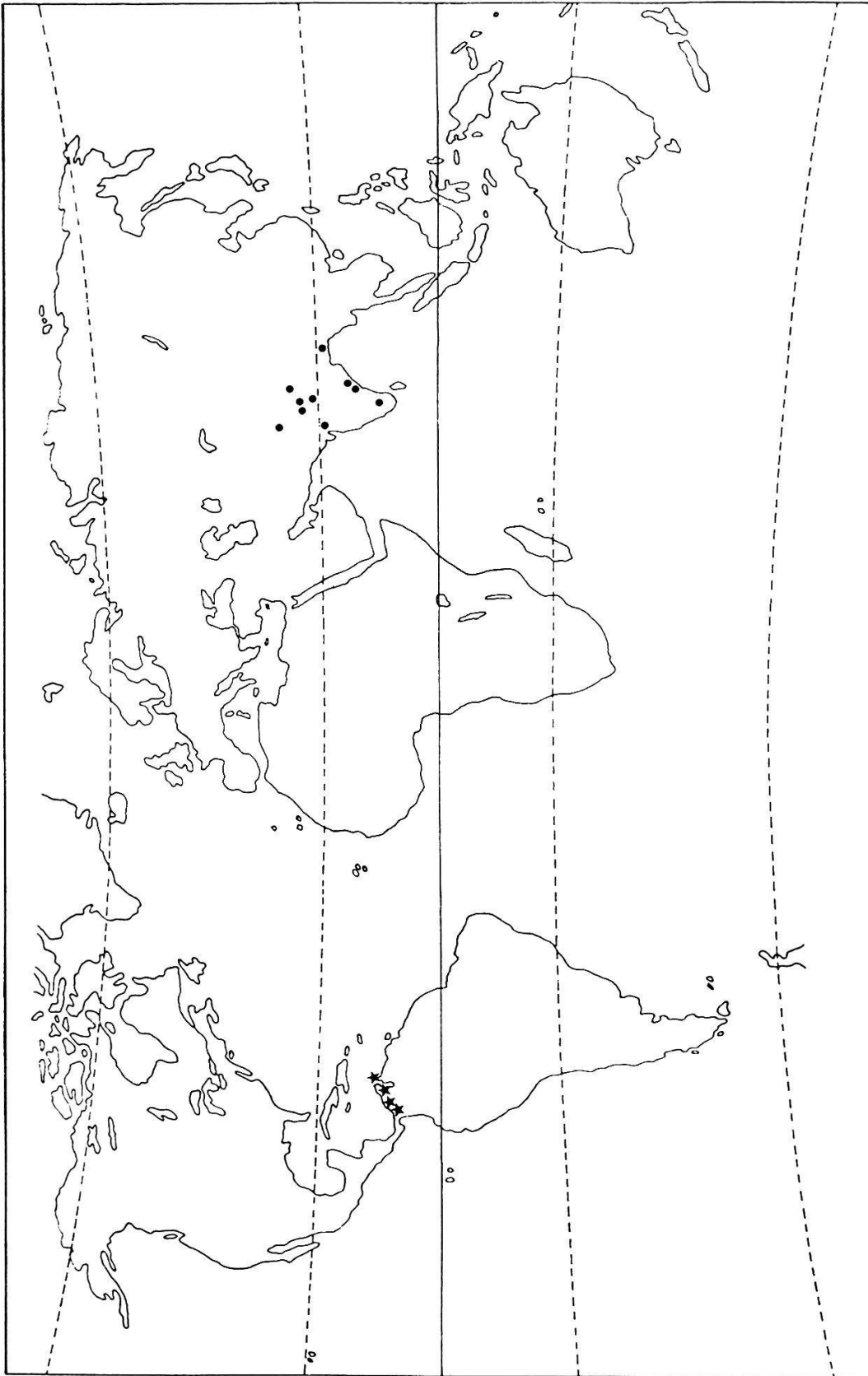


Fig. 6.21. Distribution of *W. microscopica* (●) and *Wolffia elongata* (★)

6.1.3.28. Wolffia brasiliensis (fig. 6.22)

W. brasiliensis is distributed throughout America, except the cooler regions. Samples from Kashmir (KAK et al. 1978) under the name of W. papulifera were checked by the author and identified as W. arrhiza.

NORTH AMERICA

MEXICO

CAMPECHE. Souther part (CAMP 1933).

CHIAPAS. Ocozocoantla (Breedlove 23472: DS); San Cristobal las Casas (Breedlove 8319: DS, F, MICH).

DISTR. FEDERAL. Mexico City (Barkley 17M337: TEX; 36239: COL, GH, MO; Bravo 1933: ZT; Hahn 1868: BM, CAL, FI, GOET, K, KANU, LY, MO, NY, PH, STU, US; 2/1869: GOET, JE, KANU, L, MEL, MO, STU, U; 1871, 1872: STU; Orterbuerger 16M647: TEX; Pineda 1003: MICH; Pringle 1300: GH, US; 7300: COLO, F, GH, MICH, MSC, SMU, UC, VT; 7301: CAS, COLO, MICH, MSC, SMU, UC, US, VT; Thompson 29/7/1910: KANU); Mixquic (Pineda: ZT* 7306a, 7311, 7314).

HIDALGO. 110 km N of Mexico (Gigon: ZT* 7663).

MEXICO. Cerro de Guadalupe (Pringle 11/10/1902: CAS, COLO, MICH, MSC, SMU, UC, US, VT).

MICHOACAN. Apatzingan (Leavenworth 1476b: F); Quiroga (Clark: ZT* 7499, ZT* 7500).

OAXACA. Oaxaca (Camp 2763: DUKE, F, G, M, MICH, MO, MSC, NY, TEX, UC, US, W); Talatlaco (Conzatti 5227: MICH).

PUEBLA. Alteseca (Arsène 6/12/1906: L); Hacienda Cristo (Arsène 1063: GH, ILL, L, LY, MO, NY, US); Puebla (Arsène 906: GH, ILL, MO, US); Tepeaca (Fassett 28464: MO, WIS, ZT).

SAN LUIS POTOSI. 27 km SW of San Luis Potosi (Kasselmann 54/85: +, ZT).

TAMAULIPAS. Aldama, Las Yuncas (Dressler 2367: MO).

YUCATAN. Chichen Itza (Steere 1566: MICH).

U.S.A.

ALABAMA. Frequent.

ARKANSAS. Rather rare: Arkansas Co., Carroll Co., Clark Co., Hemstead Co., Newton Co., Pulaski Co., Union Co.

CONNECTICUT. Rare: Fairfield Co.

FLORIDA. Rather frequent, except in the South.

GEORGIA. Rather rare: Bibb Co., Decatur Co., Early Co., Echols Co., Lowndes Co., McIntosh Co.

ILLINOIS. Rather frequent, especially in the South.

INDIANA. Rather rare: Gibson Co., Knox Co., La Porte Co. (HESS 1986), Posey Co.

KANSAS. Rare: Barber Co., Cherokee Co., Linn Co.

KENTUCKY. Rather rare: Bracken Co., Fayette Co., Henderson Co., Henry Co., Kenton Co., Logan Co., Madison Co., Meade Co.

LOUISIANA. Frequent.

MARYLAND. Rare: Calvert Co., Montgomery Co.

MASSACHUSETTS. Rather rare: Hampden Co., Hampshire Co., Middlesex Co.

MICHIGAN. Rather rare: Berrien Co. (HESS 1986).

MISSISSIPPI. Rather rare: Forrest Co., Issaquena Co., Noxubee Co., Rankin Co.

MISSOURI. Rather frequent, especially in the South.
NEW JERSEY. Rather rare: Mercer Co., Morris Co., Salem Co.
NEW YORK. Rare: Rockland Co (FOCHT 1972).
NORTH CAROLINA. Rather frequent, but only in the East.
OHIO. Rather frequent.
OKLAHOMA. Rare: Choctaw CO., McCurtain Co., Ottawa Co.
PENNSYLVANIA. Rather rare: Bedford Co., Bucks Co., Chester Co., Crawford Co., Lebanon Co., Sullivan Co., Tioga Co.
SOUTH CAROLINA. Rare: Darlington Co., Richland Co.
TENNESSEE. Rather rare: Davidson Co., Henry Co., Lake Co., Marshall Co., Montgomery Co., Obion Co.
TEXAS. Rather frequent, except in the West.
VIRGINIA. Rather frequent, but only in the East.
WEST VIRGINIA. Rare: Cabell Co., Mason Co. (BRUMFIELD et al. 1982).
WISCONSIN. Rare: Winnebago Co.

CENTRAL AMERICA

EL SALVADOR

Dept. Ahuachapan: Laguna de Moran (Fassett 29360: WIS; Hustedt 3/4/1953: WIS).

GUATEMALA

Dept. Atitlan: Lake Atitlan (Bernoulli 1/1870: STU).

CARIBBEAN SEA

CUBA

Santiago de los Vegas (Baker 29/7/1904: POM).

DOMINICAN REPUBLIC

Prov. Dajabon: Restauracion (Cicero: ZT* 7710). Prov. El Seibo: Hato Mayor (Lowden: ZT* 8334); Llano Costera (Ekman 1214F: S, ZT); Seibo (Lowden: ZT* 8277). Prov. Monte Cristi: Laguna Saladilla (Lowden: ZT* 8319); Prov. Puerto Plata (Lowden: ZT* 8317); Estero Hondo (Lowden: ZT* 8321); Punta Rucia (Lowden: ZT* 8323); Sabaneta de Jasica (Lowden: ZT* 7843).

HAITI

Dept. de l'Artibonite: Desdunes, Bois Gerard (Lowden 3782: ZT). Dept. du Nord: Etang Romeo (Lowden: ZT* 8422). Massif de la Hotte, Petit Trou des Nippes (Ekman H5410: S, ZT).

JAMAICA

Clarendon Par.: Chapelton (Yuncker 17920: BM, G, S). St. Andrew Par.: St. Andrew (Harris 10837: F, GH, NY, PH, U). St. Anne Par.: Reynolds Mine (Proctor 8657: GH; Wullschlaegel s.no.: STU). St. Catherine Par.: Giddy Hall (Proctor 33777: GH); Ewarton (Proctor 15189: GH); Vaggo Head (Proctor 15188: BM, F; 27613: LL, U). St. Elizabeth Par.: Goshen (Proctor 27549: BM, L, LL, U). Mondeville (Andrews 7/1932: BM).

MARTINIQUE

Mare Catiou (Raynal and Jérémie 21157, 21158: P, ZT); Mare Flambeau (Raynal and Jérémie: 21171, 21172: P, ZT).

ST. THOMAS

The specimen of Breutel cited by HEGELMAIER (1868) was identified by the present author as W. arrhiza; it probably originated from South Africa (see under L. gibba).

SOUTH AMERICA

ARGENTINA

Prov. BUENOS AIRES. Dept. Bolivas: Pirovano (Pedersen 26.10.81: ZT); Hudson (GIARDELLI 1939b). Dept. Buenos Aires and vicinity: La Plata (Spegazzini 10278: CORD); Buenos Aires, Botanic Garden (Burkart 6700: ZT); Partido 9 de Julio (Pedersen: ZT* 8736). Dept. Campana: ca. 10 km N of Campana (Landolt and Zarzycki 43/83: ZT); ca. 11 km N of Campana (Landolt and Zarzycki 44/83: ZT). Dept. Castelli: Castelli, Laguna Ombu (Landolt and Zarzycki 24/83: ZT). Dept. Chascomus: Arroyo Vitel (Tur: ZT* 7925); Lago Chascomus (Landolt and Zarzycki 31/83, 32/83: ZT); Laguna Vitel (Landolt and Zarzycki 27/83, 29/83, 30/83: ZT). Dept. Dolores: Laguna near Sevinge (Landolt and Zarzycki 23/83: ZT). Dept. San Miguel del Monte: Laguna del Monte (Landolt and Zarzycki 21/83, 22/83: ZT; ZT* 8811).

Prov. CHACO. Dept. Bermejo: 7 km E of Esperanza, RN 11 (Landolt and Zarzycki 160/83: ZT). Dept. Gr1. Donuvan: Fontana (GIARDELLI 1939b). Lapachito (Landolt 6/83: ZT). Dept. 9 de Julio: Dennehy (Pedersen ZT* 8737). Dept. 1 de Mayo: Colonia Benitez (Schulz 7589: ZT). Dept. San Fernando, Rio Parana (ESKUCHE and ROMERO FONSECA 1982).

Prov. CORDOBA. Dept. Capital: Ciudad Universitaria (Hunziker 18915: CORD) (GIARDELLI 1972).

Prov. CORRIENTES. Dept. Capital: Riachuelo (ESKUCHE and ROMERO FONSECA 1982); ca. 2 km E of Corrientes (Landolt, Zarzycki and Eskuche 173/83: ZT); ca. 1 km W of Laguna Brava, RN 5 (Landolt, Zarzycki and Eskuche 174/83: ZT). Dept. Concepcion: Carambola (Pedersen 12401: CTES; ZT* 8621a). Dept. Goya: Colonia Carolina (Schinini et al. 19088: CTES). Dept. Gr1. Paz: Lomas de Vallejos (Tur 1687: CTES). Dept. Mburucaya: Esta. Santa Teresa (Pedersen 3115: BR, C, G, K, LP, MO, S, US). Dept. San Cosme: San Cosme (Tressens and Christbal 1367: CTES); ca. 2 km E Canal 14, RN 12 (Landolt, Zarzycki and Eskuche 175/83, 176/83: ZT); Laguna Rincon, RN 12 (Landolt, Zarzycki and Eskuche 177/83: ZT); E-end Laguna Rincon, RN 12 (Landolt, Zarzycki and Eskuche 178/83); 9 km S of Paso de la Patria (Landolt, Zarzycki and Eskuche 179/83: ZT); 11 km S of Paso de la Patria (Landolt, Zarzycki and Eskuche 182/82: ZT); 40 km E of Corrientes (Lüönd and Brucker: ZT* 8743) (GIARDELLI 1939b). Dept. San Luis de Palmar: Paso Horqueta (Pedersen: ZT* 8657); San Luis (ESKUCHE and ROMERO FONSECA 1982).

Prov. ENTRE RIOS. Dept. Gualaguaychu: ca. 35 km S of Ceibas (Landolt and Zarzycki 46/83: ZT); 43 km E of Gualaguay (Landolt and Zarzycki 48/83: ZT); 3 km W of Arroyo Animal (Landolt and Zarzycki 54/83: ZT); 1 km W of Arroyo Animal (Landolt and Zarzycki 55/83: ZT). Dept. Victoria: N of Arroyo Mananillalos (Landolt and Zarzycki 59/83, 60/83: ZT).

Prov. FORMOSA. Dept. Matacos (Cartellanos 18043: LIL, ZT); Ing. Juarez (Castellanos 118043: LIL, ZT). Dept. Pilcomayo: ca. 12 km E of Laguna Blanca (Landolt and Zarzycki 152/83, Landolt 154/83: ZT).

Prov. JUJUY. Dept. Capital: Laguna de Jala (Jones et al. 10423: BAA).

Prov. SALTA. Dragores (Lorentz 8/1873: STU). Gran Chaco, Bella Vista (Lorentz and Hieronymus 8/6/1873: CORD, NY, STU).

Prov. SANTA FE. Dept. La Capital: N of Esperanza, N of Rio Salado (Landolt and Zarzycki 75/83: ZT); ca. 15 km N of Esperanza (Landolt and Zarzycki 77/83: ZT). Dept. Vera: ca. 9 km NE of Vera, RN 11 (Landolt and Zarzycki 103/83: ZT).

BOLIVIA

Dept. Santa Cruz: Boyuibe (Cardenas 2612: F); between Boyuibe and Rio Machareti (de Sloover 75/262: BR).

BRAZIL

MATTO GROSSO. Villa Maria (Weddel 7/1845: K, L, STU).

PARA. Monte Alegre (Kuhlmann 920: SP).

PARANA. San José dos Pinhais (Hatschbach 31077: BH, C, CU, S, UC; ZT* 7712).

RIO DE JANEIRO. Copacabana (Glaziou 8/6/1872: STU; Schenk 2453: STU); Jarazapagua (HEGELMAIER 1895: STU).

RIO GRANDE DO SUL. Irai (Lüönd: ZT* 8906); Porto Alegre (Valls and Lindeman 9519: CTES, U); Quinta (Lindeman 741: S).

SANTA CATARINA. Santa Catarina Island, Itajahy (Müller 6/1870: STU).

SAO PAULO. Campinas (Moten 4661: S).

COLOMBIA

Dept. Cundinamarca: Bogota (Héliier 18/8/1910: G). Dept. Magdalena: Santa Marta (Pennell 4770: NY).

ECUADOR

Prov. Guayas: Guayaquil (Fagerlind 166, 167: S).

PARAGUAY

Dept. Alto Parana: 15 km W of Ciudad Presidente Stroessner (Lüönd: ZT* 8907). Dept. Boqueron: A 415 km of Villa Hayes, between Filadelfia and Mariscal (de Sloover 75/96bis: BR); Picada Lepay, km 63 (de Sloover 75/117, 75/118, 75/120: BR).

SURINAM

Prov. Saramacca: Mokokoko-zwamp (Lindemann 5576b: U).

URUGUAY

Dept. Montevideo: Pocitos (Herter 6/1942: GOET, ZT; 70512: B, F, G, GH, K, MO, MSC, S, U, UC, Z, ZT).

VENEZUELA

Esto. Aragua: Maracay (Carenas: ZT* 7303). Esto. Barinas: Cerca de Barinas (Zuber 17/4/1986: ZT); Libertad-Rio Apure (Zuber: ZT* 8924). Esto. Carabobo: El Aislado, Lago de Valencia (Alston 5696: A, BM, L, LL, U). Esto. Guarico: Calabozo (Zuber: ZT* 8919). Esto. Lara: Agua Viva (Zuber: ZT* 8929); Quibor (Tillet: ZT* 7397, 7455); Terrepaima (Tillet: ZT* 7556). Esto. Merida: Las Menzas (Tillet: ZT* 7581). Esto. Portuguesa: Siporo (Tillet: ZT* 7466). Esto. Trujillo: Valera (Goebel 11/1890: STU).

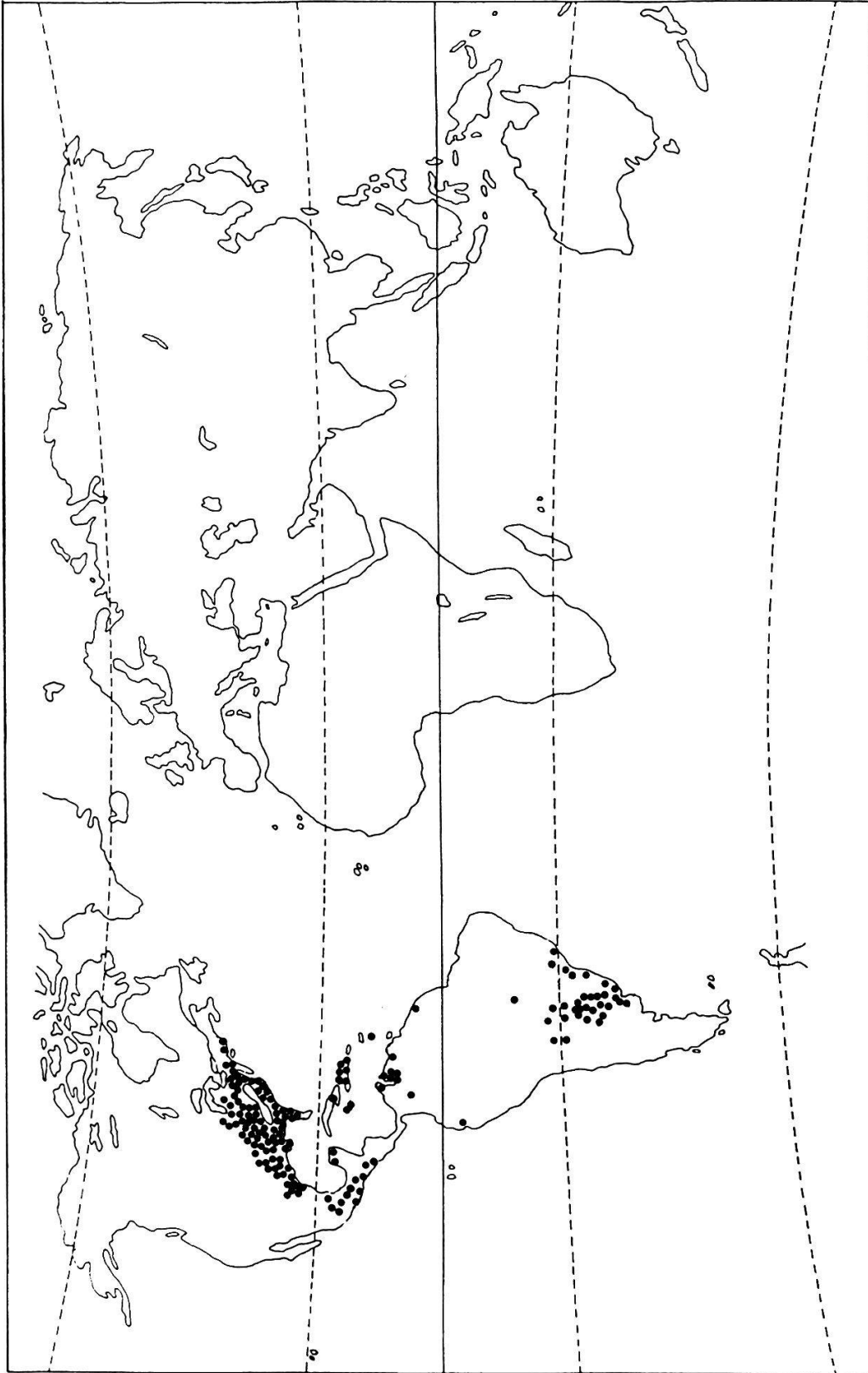


Fig. 6.22. Distribution of Wolffia brasiliensis

6.1.3.29. Wolffia borealis (fig. 6.23)

W. borealis is endemic to central North America.

NORTH AMERICA

CANADA

BRITISH COLUMBIA. (CESKA and CESKA 1979). Duck Lake, Creston (Ceska 742: CESKA). Mission, Silverdale (Ceska 1556: CESKA). Hatzik Lake, Hatzik (Ceska 1555: CESKA). Chilliwack, Goose Lake (Ceska 1165: CESKA). Agassiz, Maria Slough (Ceska 1679: CESKA). Fort Langley, Sellers Avelangley (Ceska 1305: CESKA).

ONTARIO. (DORE 1957). Baptiste Creek (Staniforth: ZT* 7788). Fronterac Co.: Odessa, Mud Lake (Crowder: ZT* 7877). Peel Co.: Brampton (Catling and McKay: ZT* 7585). York Co.: Ajax, Le Vay's Marsh (Sparling: ZT* 7577); Highland Creek (Catling and McKay: ZT* 7566); 20 km E of Toronto, Garden Hill (Landolt-Stadler: ZT* 7698). Carleton Co.: Ottawa (Dore 16388: GH, US; 47-1268: MO, OKL, UPS; 47-1267: MO, OKL); Constance Lake (Savile 3163: C, H, M, UPS); Manotick (Cody 32183: +, ZT). Lincoln Co.: Jordan Harbor (Cody 12536: FI). Hastings Co., Bannockburn (Dore 17552: OS). Leeds Co.: Singleton Lake, Lyndhurst (Dore 16980: OS). Russell Co.: Riceland (Dore 17455: OS); Payne (Gillman 1869: MO). Kent Co.: Thames River, St. Clair Lake (Soper 2300: GH).

QUEBEC. According to DORE (1957) and SCOGGAN (1978), all indications from Quebec are erroneous (confusion with W. columbiana). But CAYONETTE et al. (1983) mention some new localities: Comté de Gatineau, canton de Hull. Comté de Missisquoi: Philipsburg. Comté de Pontiac, Allumette Township.

U.S.A.

CALIFORNIA. Rare: Mendocino Co., San Diego Co., Shasta Co. (ARMSTRONG and THORNE 1984; ARMSTRONG 1985).

COLORADO. Rare: Yuma Co.

CONNECTICUT. Rare: Fairfield Co., Litchfield Co.

IDAHO. Rare: Washington Co.

ILLINOIS. Rather frequent.

INDIANA. Rather frequent.

IOWA. Rare: Dickinson Co., Johnson Co.

KANSAS. Rather rare: Atchinson Co., Dickinson Co., Edwards Co., Ellsworth Co., Lincoln Co., Ottawa Co., Pratt Co., Rocks Co., Sheridan Co., Smith Co., Stafford Co.

KENTUCKY. Rather rare: Bracken Co., Fayette Co., Henderson Co., Jefferson Co., Kenton Co., Meade Co.

MASSACHUSETTS. Rare: Berkshire Co., Hampshire Co., Middlesex Co.

MICHIGAN. Rather frequent, except the Northwest.

MINNESOTA. Rather frequent, except the North.

MISSOURI. Rare: Phelps Co., St. Louis Co., Texas Co.

NEBRASKA. Rather rare: Boyd Co., Buffalo Co., Cass Co., Cherry Co., Custer Co., Dodge Co., Dundy Co., Grant Co., Howard Co., Lincoln Co., Otoe Co., Saunders Co., Valley Co.

NEW HAMPSHIRE. Rare: Hillsborough Co.

NEW YORK. Rather frequent, especially in the Northwest.

OHIO. Rather frequent, especially in the North.

OREGON. Rare: Lane Co.
PENNSYLVANIA. Rather rare: Bedford Co., Crawford Co., Erie Co., Lawrence Co., Lebanon Co., Northhampton Co, Tioga Co.
SOUTH DAKOTA. Rare: Todd Co.
TENNESSEE. Rare: Davidson Co.
UTAH. Rare: Cache Co., Morgan Co., Weber Co.
VERMONT. Rare: Addison Co., Grand Isle Co.
VIRGINIA. The indication of FERNALD (1941) refers to W. brasiliensis.
WISCONSIN. Rather frequent.

6.1.3.30. Wolffia australiana (fig. 6.23)

W. australiana is endemic to southern Australia and New Zealand.

AUSTRALIA AND NEW ZEALAND

NEW SOUTH WALES. Greenwell Point, South Coast (Rodway 12830: NSW). Mill Park, The Oaks (Constable 24/2/1966: MEL). Singleton (Landolt: ZT* 8730). Sydney, Cosula (Coveny 624: NSW); Orange Distr. (s.coll. 17/4/1969: NSW).

SOUTH AUSTRALIA. Glencoe West (von Wattenwyl: ZT* 7819). Mt. Gambier (Jute s.no.: MEL). Mount Lofty Range, Torrens Gorge (Eichler 19048: AD; ZT* 7733). Harrison's Creek, 21 km WNW of Mannum (Eichler 12241: AD). Narrung (Eichler 19734, 19738-40: AD).

TASMANIA. Lewisham (Morris: ZT* 7267, ZT* 7280). Pittswater Estate (Turnbull: ZT* 7783).

VICTORIA. Ballarat (Aston 1782, 30/9/1959: MEL); Lake Wendouree (Aston: ZT* 7317). Camperdown (Mueller 3/1875: MEL). East Gibbsland, Lake Wellington (Aston: ZT* 7635); Mitchell River, Wuk Wuk (Beauglehole 37657: MEL); Sale (Aston: ZT* 7631). Fallett, Green Lagoon (Reader 15/3/1908: MEL). Hawkesdale (Williamson 1900, 1903, 2315: MEL; 1904: MEL, S); Kerang (Aston 1636: MEL). Melbourne (Willis 25/6/1942: MEL); Botany School (Chambers: ZT* 7211); Crambourne (Aston: ZT* 7275). Mount Emu (Mueller 25/2/1874: BRI, FI, JE, MEL, STU). Mount Gellibrand (Mueller 3/1875: MEL). Nelson (Beauglehole 17085: MEL). Portland (Beauglehole 17084: MEL). Penshurst (Williamson 12/1908: LE). Rosebud, Mornington Peninsula (Melville 2245: K, MEL; 2246: MEL). Shepparton (Aston: ZT* 7605).

NEW ZEALAND

NORTH ISLAND. Wellington (Mason 538: MEL). Manawatu River southwards to Wellington (MASON 1950).

SOUTH ISLAND. North Canterbury, Leithfield Beach (Mason: ZT* 7540, ZT* 7543; Mason and Urbanska: ZT* 8647, ZT* 8648).

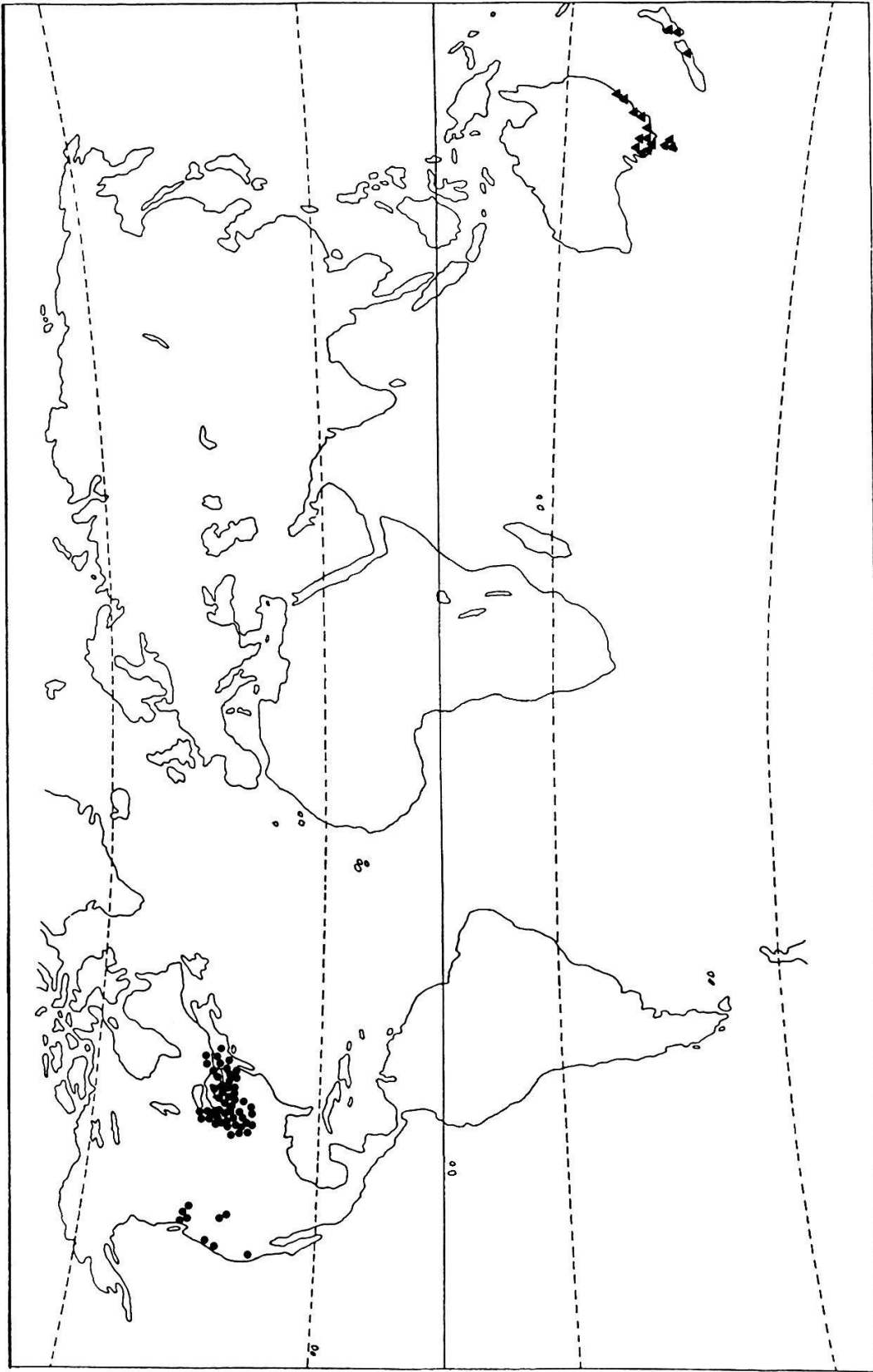


Fig. 6.23. Distribution of Wolffia borealis (●) and W. australiana (▲)

6.1.3.31. Wolffia angusta (fig. 6.24, p. 370)

W. angusta is restricted to Australia and southeastern Asia.

SOUTHERN AND EASTERN ASIA

INDIA

RAJASTHAN. Kota (Cook and Frey 4584: Z, ZT).

WEST BENGAL. Calcutta, Royal Botanic Garden (Nashar 28/7/1949: CAL).

MALAYSIA

Malacca: Malacca (Derry 8/1889: SING). Selangor: between Bangi and Salak (Landolt 18/81: ZT, ZT* 8714); Gombak (Landolt 71/84: ZT); Serdang (Landolt 56/84: ZT).

PAKISTAN

Karachi (Hussain 10/1/1985: ZT; ZT* 8917). Hyderabad: National Highway on way to Matiari (YUSUF and OMER, mscr., 1986).

SINGAPORE

Kranji area (Maxwell 80-4: AAU). Potong Pasir, Serangoon Road (Sinclair 1948: L, P, SING). Singapore (Holten 37919: L). Tampine Road (Landolt 2/81: ZT, ZT* 8713).

SRI LANKA

Southern Prov.: Tongalla-Beliatta (Kasselmann 1/1985: ZT).

AUSTRALIA AND NEW ZEALAND

AUSTRALIA

NEW SOUTH WALES. Camden (Constable 78991: AD, NSW). Eastwood (Evans 94571: AD). Glenorie (Martin 17/12/1964: NSW). Gosford (Fletcher 1895: NSW). Griffith (Sainty 78984: AD, NSW). Kellyville (Evans 78983: AD). Kogarah (Canfield 18/12/1899: NSW). Nowra (Rodway 1551: NSW). Newcastle, Seaham (Briggs, Johnson: ZT* 7274). Penrith (Constable 7007: MEL, NSW). Portland (Woolles s.no.: MEL). Yanco (Sainty 78944: AD, NSW).

NORTHERN TERRITORY. Keep River Area (Henshall 1148: MEL). Kapalga Study Area, E of Darwin (Craven 4504: ZT).

QUEENSLAND. Booyal (Burrey 12/1958: BRI). Brisbane (Bailey s.no.: L; Blake 5293: BRI). Burnett River (Keys 146: MEL). Chelmer (Primrose 29/12/1905: BRI). Gatton (Marshall 3/1957: BRI). Holm-Hill (Landolt: ZT* 8725). Landsborough (Landolt: ZT* 8728).

SOUTH AUSTRALIA. Mount Lofty Range, Torrens Gorge (Eichler 19078, 19794, 19800: AD). Narrung (Eichler 19734, 19737-40; William 388, 390: AD). Wellington (Eichler 15679: AD).

VICTORIA. Allendale (Schomburgk 16/11/1882: AD). Camperdown (Mueller 3/1874: MEL). Columa (Melville 3878: K, MEL). Echuca, Tongala (Aston: ZT* 7480). Horsham (Copley 1822: AD). Lake Terang (Mueller 4/1874: MEL). Melbourne (Eichler 16999: AD). Shepparton, Bunbartha (Aston: ZT* 7476). Williamstown (Morrison 30/4/1895: BRI, PERTH).

WESTERN AUSTRALIA. Pemberton (Selling 20/8/1949: S). Oobagooma, Round Hill (den Hartog 9/1967: AD). (DEN HARTOG and VAN DER PLAS 1972 under the name of W. globosa).

6.1.3.32. Wolffia arrhiza (fig. 6.24)

W. arrhiza is distributed in Europe, Africa, Western Asia, and in Rio de Janeiro, Brazil, from where it has been reported since 1872. Indications of North America (e.g. LOOMAN 1983, MASON 1957), eastern Asia and Australia refer to W. columbiana, W. globosa and W. australiana, respectively. A sample from St. Thomas Island (Caribbean Sea) (Breutel 96: STU) mixed with L. gibba originates probably from South Africa.

SOUTH AMERICA

BRAZIL

RIO DE JANEIRO. Barra de Sao Joao, about 9 km N of Tamoios (Landolt and Farney 206/83: ZT, ZT* 8853; Botafogo (Carauta 2806: RB); Rio de Janeiro (Glaziou 3267: STU).

EUROPE

AUSTRIA

Rare: Lower Austria, Hohenaus (KANDELER 1979).

BELGIUM

Rather rare and only in Vlaanderen and Brabant.

BULGARIA

Rare: Burgas, Sozopol (STOIANOFF and STEFANOFF 1924).

CZECHOSLOVAKIA

(HUSAK and OTAHELOVA 1982). Slovakia: Izkovce; Nové Zmlay; Oborim; Somotor; Topol'cany. Moravia: Boskovice; Podyji.

FRANCE

Rather rare: According to ROUY (1912) in the following departments: Bouche-du-Rhône; Cher; Côte-d'Or; Deux-Sèvres; Eure, Finistère; Gironde; Ile-et-Vilaine; Landes; Loire-et-Cher; Loire-Inférieure; Loiret; Maine-et-Loire; Manche; Morbihan; Nièvre; Nord; Orne; Pas-de-Calais; Puy-de-Dôme; Seine; Seine-Inférieure; Seine-et-Marne; Yonne. A record from Corsica (Calvi) is erroneous due to a wrong identification of L. minor (Soleirol s.no.: STU).

FRG (West Germany)

Rather rare.

BADEN-WUERTTEMBERG. Extinct, earlier records from Ravensburg.

BREMEN. Bremen Blockland (CORDES 1980, KUESEL 1955).

HESSEN. Steinheim (MALENDE 1957); Dreieichenheim; Hoja (KANDELER 1979; now extinct: DIEKJOBST 1983).

NIEDERSACHSEN. Wendelland, Dannenberg (KANDELER 1979, Tüxen: ZT* 7014, ZT* 8217); Maujahn (HORST 1978, SCHWABE-BRAUN and TUEXEN 1981b); Ostfriesland (WEBER-OLDECOP 1973).

NORDRHEIN-WESTFALEN. Geldern; Moers (KANDELER 1979); Lingen, Mehringer Altarm (STELZIG and BERNING 1984); Krefeld (WOIKE 1968); Lübbeck; Rees-Emmerich (RUNGE 1979); Vosswinkel (extinct: DIEKJOBST 1983).

SCHLESWIG-HOLSTEIN. Curauer Moor and Malkendorfer Moor (HAERTEL 1972).

GRD (East Germany)

Rather rare (KANDELER 1979). Brandenburg (FISCHER 1957); Britz; Dallgow; Drewitz; Eberswalde; Fürstenberg/O. Mecklenburg; Hartmannsdorf (JAE-

GER 1965); Lehnin; Lichtengrade; Marquardt; Michendorf; Potsdam-Sanssouci; Rahnsdorf; Sachsen-Anhalt; Schildow; Spreewald (JENTSCH 1979); Zierow near Wismar; Ziesar; Leipzig.

HUNGARY

Rare: According to FINTHA (1979). Sorokar. Szarvas, Szatmar Bereg. For region of Tisza see LAKATOS (1978).

ITALY

Rather rare. Campania: Caserta (Landolt and Engetschwiler: ZT* 7678). Emilia: Modena (Mori 1892-99: BH, KUO, VT). Lazio: Paludi Pontini. Liguria. Lombardia. Piemonte: Asti (ABBA 1976); Torinese. Sicilia: Catania. Toscana: Pisa, San Rossore (e.g. Landolt and Urbanska: ZT* 8272); Asciano, Lucca, Pontetto, Firenze (HEGELMAIER 1868). Venezia.

NETHERLANDS

Rather frequent.

POLAND

Rather rare and only at low altitudes. Komin, Kazimiersk Biskupi; Kolo; Przybylova (KANDELER 1979, KORDAKOW 1970); Jarnice, Bielwa, Kotun (PODPIELKOWSKI 1967); Chelmno (KEPCZYNSKI and FABISZAK 1974). Wysocyzna Siedlecka (KORDUS-WALANKIEWICZ 1978).

PORTUGAL

Rare: Beira; Estremadura; Ribateio, e.g. Corruche (Martins: ZT* 7187), Montalvo (Martins: ZT* 7198).

RUMANIA

Rather rare. Bihor; Timis; Bucuresti; Ilfov; Tulcea; Bacan.

SPAIN

Rare. Aranjuez, Madrid, Rio Tajo, Badajoz, Rio Rivilla, Retuerta, Ciudad Real, Rio Bullaque (RIVAS-MARTINEZ 1982).

UNITED KINGDOM

Rather rare, lacking in the North and in Northern Ireland.

ENGLAND. Kent; Middlesex; Somerset; S. Essex; S. Wilts; Surrey; Sussex.

WALES. Glamorgan.

USSR (European part)

Rather rare.

ROSSIYA S.F.S.R. Kaliningrad. Voronesh Oblast: Khoper State Reserve (PECHENYUK 1982).

UKRAINA S.S.R. CHORNA (1978): Kiew; Gelmyazow; Aleksandriva; Kremenchug; Volchansk; Zdonetskoe; Shurovo; Lugansk. Chernovtsy (Topa 6/8/1928: NSW).

YUGOSLAVIA

Rare and only in the North. Croatia: Stupna; Novo Selo; Sunja; Krapje; Brodice; Delekovec; Lubrega (KRAJNCIC and DEVIDE 1982); Zagreb (DEVIDE 1956; Bedalova: ZT* 7421); Istra, Linski Canal (Jovet: ZT* 7699); Kvarneric, Veglia, Campi (Tommasini 16/5/1865: STU); Rijeka (FINTHA 1979). Serbija: Backa, Pancevo (DEVIDE 1956). Slovenia: Pentanjei (KANDELER 1979); Velika Potana (KRAJNCIC 1976).

AFRICA

ALGERIA

Prov. Constantine: Bône, Senhadja (Cosson 3/7/1861: P; Letoureau s.no.: MPU).

ANGOLA

Prov. HUILA. Huila-Humpata (Johnston 9/1883: K).

Prov. LUANDA. Boarra do Dande Distr.: Dande River near Bombo (Welwitsch 9/1858: BM, G, K), Icolo e Bengo Distr.: Lagoa de Quilunda (Welwitsch 211: BM, K, L, ST, U). Kuanda, Viana (Azancot de Menezes 3464: BM, K, LISC, PRE; ZT* 7452).

BOTSWANA

Northern Distr.: Chobe, Kachikau, Shale (Edwards 4382: PRE). Ngamiland, Ngokha Island, Okavango Swamps (Smith 1071B: SRGH); Taogke River (Smith 1451: SRGH). Savuti (Wager 59847: SRGH).

BURUNDI

Bubanza (Reekmans 4377: BR).

GHANA

Accra, Weiija (Hall 2369: K). Cape Coast, Akotobayir (Hall 2379: K). Kade (Agyakwah: ZT* 7323). Kumasi (Baldwin 12466: MO). Mankessin (Hall 2368: K). Oduponkpehe (HEPPER 1968).

IVORY COAST

Afféry (Assi: ZT* 7217). Azaguié (Assi 10195: K; ZT* 7215). Odienné (HEPPER 1968).

KENYA

Prov. Arusha: Nyanza Distr., Kisumu (McMahon 215: EA); Masai Distr., Amboseli near Ol Tukai (Verdcourt 3107: BR, K, PRE; 3116: EA, K, L, PRE, UT; 3117: BR, EA, K, PRE, UT). Prov. Central: Naivasha Distr., Lake Naivasha (Otieno 14851: EA). Great Rift Valley, Ologesaile (Leuthold: ZT* 8618). Lukenya (Agnew 8964: C, MO).

MOROCCO

Dayas de la Forêt de Mamora (MAIRE 1957). La Guédira (Fon Quer 18/3/1930: B, BM, G, S, Z); Larache, Merfa Rhedira (Mathez: ZT 7651).

MOZAMBIQUE

Sul do Save, Inhanombe (Exell and Mendoça 570: BM, LISC, SRGH).

NIGERIA

Prov. Benin: Okomu Forest Reserve (Brenan 8596: B, BM, K; 8788: B). Prov. Oyo: Ibadan (Brenan 8954: K, P; Klay FH 22732: K). Lagos (Killick 288: K). Yaba (HEPPER 1968).

RWANDA

Mugusa Distr.: Grafumba, Nyamashke (de Sloover 1972: BR). Lake Tshohoha (Liben 766: BR).

SENEGAL

Dakar (Sanokho: ZT* 8649); Sangalkam (Vivant 221(4): P). Rufisque (Bernhaut 671: P). Hann (HEPPER 1968).

SOUTH AFRICA

CAPE. Grahamstown, Great Fish River (Preez: ZT* 7219a); Manly Flats (Preez 25/11/1969: PRE). Stellenbosch, Jonkerhoek (Kruger: ZT* 7246; ZT* 7247; Schoor 1/7/1968: PRE); Kruijsriver (Oliver: ZT* 7251). Zwartskops River, Port Elizabeth (Gaillamod 7303: MO). Cape Flats, Isoetes Olei (Mathews 13/1/1969: CAP); Cape Town (Mauve 4620: PRE); Princes Valley (Marloth 8605: PRE); West London (Phillips 1219: CAP). Skireiland Distr. (Le Roux 1/1959: PRE).

NATAL. Enseleni (Venter: ZT* 7347). Ubombo Distr.: Mbazwane (Mauve 4931: PRE; ZT* 8250); Sordwana Bay (Botha: ZT* 8220; Raven 26122: MO; Vahrmeyer 658b: PRE, S); Kosi Bay (Strey 26/11/1967: PRE). Mzingazi Lake (Venter: ZT* 7365). Port Shepstone (Strey 7438: PRE; ZT* 7265). Umgeni (Franks 7/1912: NSW). Midmar Dam at Umgeni River (Musil 182: K, PRE). Clairmont (Schlechter 3138: BM, G, K, LE, LY, NSW, PRE, S, Z). Ndlozi Peninsula, St. Lucia Park (Ward 7700: K, PRE). Durban Distr.: Isipingo (Ward 5856: PRE).

TRANSVAAL. Albany Distr.: Peddie Farm (Lubke: ZT* 8390). Johannesburg (Lubke: ZT* 7790). Pretoria (Whitton 18/8/1947: PRE); Rooiwal (Steijn: ZT* 7736); 4 mi N of Pretoria (Mauve and Schieben 9603: PRE). Delmas Distr. (Grous 10/10/1958: PRE).

TANZANIA

Prov. ARUSHA. Arusha Distr.: Amboseli (Klötzli: ZT* 8639); Lake Kinian-

dia, Ngurdoto National Park (Greenway and Kanuri 12.483: BR, EA, K, PRE). Ufiomi, Lake Basseda near Babati (Peter 44103: B); Arusha National Park, near Mathee (Vesey-Fitzgerald 6416: EA); between 10 and 20 mi N of Babati (Wingfield 418: EA).

Prov. IRINGA. Ruaha National Park, Makundi Track (Richards and Arusululu 26355: K).

Prov. MBEYA. About 8 mi SW of Galula (Wingfield 416: EA); Lake Rukwa, Nunka (Nicholson 185: EA).

Prov. SINGIDA. Lake Singida (Polhill and Paulo 2198: B, BR, K. LISC, PRE).

Prov. TANGA. Tanga Distr.: East Usambara, Ngua (Verdcourt 290/290A: EA, PRE); Amani (Greenway 4624: EA, K, L, PRE). Handeni Distr.: Segera on Pangani (Ruvo) River (Greenway 8974: EA, K, NY).

TOGO

20 km S of Mango (Meyer 5/4/1984: ZT).

UGANDA

Prov. Buganda: Ankole Distr., Masaka-Mbarara (Lock: 67/156: EA, K; ZT* 7193). Prov. Kizegi: Rubanda Co., near Muko School (Lye 1020: K).

INDIAN OCEAN

MADAGASCAR

Prov. Imerina (Hildebrandt 3520: B, BM, G, GOET, JE, LE, LY, M, NSW, STU, W, WU, Z).

NORTHERN AND WESTERN ASIA

IRAN

Rare. Gilan: Astara (RIEDL 1976).

ISRAEL

Birkat Pattish (POST 1933; now extinct: PORATH et al. 1980). Golan (LIPKIN 1973).

SOUTHERN AND EASTERN ASIA

INDIA

JAMMU and KASHMIR. Srinagar, Dalgab (Kake 3236, 3262: KASH).

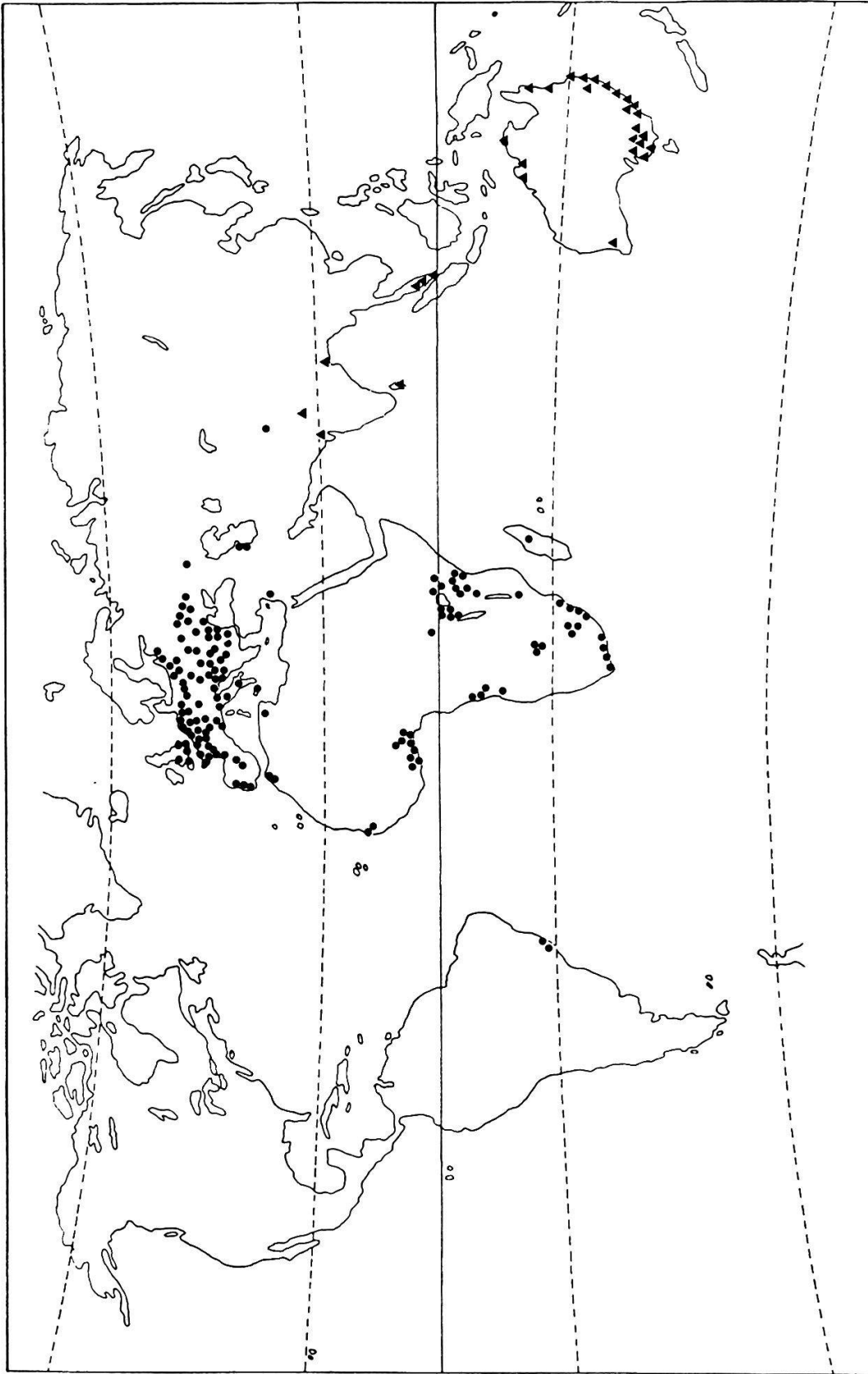


Fig. 6.24. Distribution of *Wolffia angusta* (▲) and *W. arrhiza* (●)

6.1.3.33. Wolffia columbiana (fig. 6.25)

W. columbiana grows throughout America, except in the coolest regions. Samples from Kashmir (KAK et al. 1978) belong to W. arrhiza.

NORTH AMERICA

CANADA

MANITOBA. Lake Stormon, 26 km S of Boissevain (Catling 28-128: +, ZT). Riding Mountain national Park (CODY 1980).
ONTARIO. (DORE 1957). Baptiste Creek (Staniforth: ZT* 7787). Essex Co.: Pelee Island, Fox Pond (Roberts 1564: OS). Point Pelee National Park (Krüsi: ZT* 8782). Fronterac Co.: Odessa, Mud Lake (Crowder: ZT* 7876); Kingston (Fowler 26/9/1901: LY, US; 22181: WIS, Pease 23384: GH); Shabot Lake (Dore 13905: ILL, MICH). Guelph (Giles: ZT* 8437). Ontario Co.: Claremont (Catling and McKay: ZT* 7564). Peel Co.: Brampton (Catling and MacKay: ZT* 7586). Peterborough, Bridgenorth (Giles: ZT* 8439). York Co.: Ajax, Le Vay's Marsh (Sparling: ZT* 7578); Higland Creek (Catling and MacKay: ZT* 7568); Witby Marsh (Goepfert: ZT* 7574). Carleton Co., Ottawa (Dore 16388: GH, US; 47-1267: MO, OKL; 47-1268: MO, OKL, UPS); Constance Lake (Savile 3163: C, H, M, UPS); Manotick (Cody 32183: +, ZT). Kent Co.: Mitchell Bay (Shields 433: MO); Sandwich (Boot 12/9/1868: GH; Gillman 28/8/1870: GH, MO); Thames River, St. Clair Lake (Soper 2300: GH). Hastings Co.: Bannockburn (Dore 17552: OS). Leeds Co.: Singleton Lake, Lyndhurst (Dore 16890: OS). Lincoln Co.: Jordan Harbor (Cody 12536: FI). Russel Co.: Payne (Gillman 1869: MO); Riceland (Dore 17455: OS).

QUEBEC. (DORE 1957). Cté. de Gatineau: Hull (CAYONETTE et al. 1983). Cté. de Missisquoi: Fort Lenox (Cody 6544: C, G, GH, H, SMU, US, UPS, W); Philipsburg (Seymour 22823: AAU, VT); Venise en Québec (Bernard B76-689: MU). Cté. de Pontiac, Allumette Township (CAYONETTE et al. 1983).

SASKATCHEVAN. Pierceland; Debden; Red Cross (named as W. arrhiza: LOOMAN 1983).

MEXICO

DISTR. FEDERAL. Atzalpotzalco (Thompson 29/7/1910: KANU, LP). Mexico City (Bravo 1933: ZT; Barkley 17M337: TEX; 36239: COL, GH, MO; Hahn 1868: BM, CAL, FI, GOET, K, KANU, LY, MO, NY PH, STU, US; 5/1868: KANU, L, STU; 1869: GOET, L, U; 2/1869: GOET, JE, KANU L, MEL, MO, STU, U; Kasselmann 55/85: +, ZT); Pringle 1300: GH, US; 7300: F, GH, MICH, MSC, SMU, UC, VT; 7301: CAS, MICH, MSC, SMU, UC, US, VT; 7302: GH, MICH; 7304: MICH, MSC, STU, US, VT; Rose 4924: US; Rossi 25: M; Rutten 243: U; Schaffner 631: BM, CAS, FI, G, GOET, ILL, L, LY, M, MICH, US, ZT; 1875: BM, CAS, FI, G, LY, M, MEL, MICH, NY, UCLA; 1876: FI). Mixquic (Pineda: ZT* 7306, ZT* 7310, ZT* 7313).

HILDALGO. 110 km N of Mexico City (Gigon: ZT* 7662).

OAXACA. Oaxaca (Camp 2763: DUKE, F, G, M, MICH, MO, MSC, NY, TEX, UC, US, W); Talatlaco (Conzatti 5227: MICH).

PUEBLA. Alteseca (Arsène 6/12/1906: L); Amozoc (Barr 62-685: ARIZ; Hevley 2695: ARIZ); Hacienda Cristo (Arsène 1063: GH, ILL, L, LY, MO, NY, US); Puebla (Arsène 906: GH, ILL, MO, US; 212: LY; 28/10/1907: G); Tepeaca (Fassett 18464: MO, WIS, ZT; 28474: MO, WIS, ZT).

QUERETARO. Cadereyta (Kelly 617: UC).
SINALOA. Mazatlan (Rose et al. 13996: US).
TABASCO. Villahermosa (Gigon: ZT* 7654).
TAMAULIPAS. Tula (Lüönd 4/1984: ZT).
YUCATAN. Buena Vista (Gaumer 590: F); Chichen Itza (Steere 1566: MICH);
without exact locality (Gaumer 570: C, CAS, F, MICH, MO; 1895: BM, G,
GH, US).

U.S.A.

ALABAMA. Rather frequent.
ARKANSAS. Rather frequent.
CALIFORNIA. (ARMSTRONG and THORNE 1984, ARMSTRONG 1985). Rare: Fresno
Co., San Diego Co., San Luis Obispo Co., Stanislaus Co.
COLORADO. Rare: Yuma Co.
CONNECTICUT. Rather frequent.
DELAWARE. Rather rare: New Castle Co.
DISTR. OF COLUMBIA. Rather frequent.
FLORIDA. Rather frequent.
GEORGIA. Rather rare: Baldwin Co., Bib Co., Early Co., Echols Co., Jack-
son Co., Lowndes CO., McIntosh Co.
ILLINOIS. Frequent.
INDIANA. Frequent.
IOWA. Rather rare: Dickinson Co., Guthrie Co., Johnson Co., Linn Co.,
Louisa Co., Palo Alto Co.
KANSAS. Rather frequent.
KENTUCKY. Rather frequent, especially in the North.
LOUISIANA. Frequent.
MAINE. Rare: Cumberland Co.
MARYLAND. Rather rare: Allegany Co., Calvert Co., Cecil Co., Montgomery
Co.
MASSACHUSETTS. Rather frequent (BURK et al. 1976).
MICHIGAN. Rather frequent.
MINNESOTA. Rather frequent.
MISSISSIPPI. Rather rare: Adams Co., Issaquena Co., Pike Co., Rankin Co.
MISSOURI. Rather frequent.
NEBRASKA. Rather frequent.
NEW HAMPSHIRE. Rather rare: Hillsborough Co., Rockingham Co. (e.g. COLT
et al. 1971), Strafford Co.
NEW JERSEY. Rather frequent.
NEW YORK. Rather frequent.
NORTH CAROLINA. Rather frequent, but only in the East.
NORTH DAKOTA. Rare: Pembina Co., Ransom Co., Richland Co.
OHIO. Frequent.
OKLAHOMA. Rare: Choctaw Co., McCurtain Co.
OREGON. Rare: Lane Co., Linn Co.
PENNSYLVANIA. Frequent, except in the Appalachians.
SOUTH DAKOTA. Rare: Bennett Co., Gregory Co., Todd Co.
TENNESSEE. Rare: Davidson Co., Lake Co.
TEXAS. Rather frequent, except in the West.
VERMONT. Rather rare: Chittenden Co., Rutland Co.
VIRGINIA. Rather rare: James City Co., New Kent Co., Northampton Co.,
Surry Co.
WEST VIRGINIA. Rare: Cabell Co., Mason Co.
WISCONSIN. Frequent.

CENTRAL AMERICA

EL SALVADOR

Dept. Ahuachapan: Laguna de Moran (Fassett 29360: WIS). Dept. San Miguel: Lake Jaguay (Fassett 28558: F, GH, WIS); La Seca (Fassett 29131: WIS).

GUATEMALA

Dept. Amatitlan: Moran (Kellermann 6630: F, US).

HONDURAS

San Pedro Sula (Lüönd 19/7/1984: ZT).

CARIBBEAN SEA

CURACAO

Santa Cruz (Shafer 2993: L, LY, U; 2994: F, L, PH, U), St. Michiel (Suringar 1885: L).

SOUTH AMERICA

ARGENTINA

Prov. BUENOS AIRES. Dept. Berriso: Los Borrachos (Tur 1739: LP); La Bandra (Tur 1751: LP). Dept. Buenos Aires and vicinity: Buenos Aires, Botanic Garden (Burkart 6700; Giardelli 508: ZT); Capital Federal, Villa Ortuzar (Parodi 9345: BAA; 11893: ZT); La Plata and vicinity (Rossi: ZT* 7231). Dept. Chascomus: Arroyo Vitel (Tur: ZT* 7924; Verona: ZT* 7229); Lago Chascomus (Landolt and Zarzycki 32/83: ZT); Laguna de Lezama (s. coll. 1904: LP); Laguna Vitel (Landolt and Zarzycki 27/83, 29/83, 30/83: ZT). Dept. Dolores: Laguna pres de Sevigue (Landolt and Zarzycki 23/83: ZT). Dept. 9 de Julio: Dennehy (Pedersen ZT* 8736; ZT* 8737); Nueve de Julio (Pedersen 13162: LP). Dept. San Miguel del Monte: Laguna del Monte (Landolt and Zarzycki 21/83, 22/83: ZT; ZT* 8812).

Prov. CHACO. Dept. Bermejo: 7 km E of La Esperanza RN 11 (Landolt and Zarzycki 160/83: ZT); 67 km N of Resistencia, RN 11 (Landolt and Zarzycki 162/83: ZT). Dept. Grl. Donuvan: Estancia Dos Tranqueres, La Verde (Schinini 22672: CTES); Lapachito (Landolt 6/83: ZT). Dept. Libertad: Ero. Guazu, N of Pt. Tirol (Landolt, Zarzycki and Eskuche 168/83: ZT). Dept. 1 de Mayo: 4 km S km 1024 RN 11, Rio Tragadero (Landolt, Zarzycki and Eskuche 163/83, 164/83, 165/83: ZT); Selva Riparia (ESKUCHE and ROMERO FONSECA 1982). Dept. San Fernando: 3 km S of Colonia Benitez (Landolt, Zarzycki and Eskuche 166/83: ZT); Resistencia, Rio Negro (Landolt, Zarzycki and Eskuche 169/83: ZT); Rio Paraná (ESKUCHE and ROMERO FONSECA 1982).

Prov. CORDOBA. Dept. Capital: Laguna Peitiado (Hieronymus 477: F, G, L, LE, US; 489: F, G, L, SP, STU; Kurtz a7008: CORD; a9089: R, STU; Lorentz 8/1873: GOET); Parque Sarmiento (Ariza 8341: CORD). Dept. San Javier: Villa Dolores (Burkart 13848: SI, ZT). Dept. San Justo: Pozo Algorrobo (Bodenbender s.d.: BAF; Kurtz 8424: MO, R; 8423: CORD, MO, R, STU); Quinta (Stuckert 12851: G).

Prov. CORRIENTES. Dept. Capital: Riachuela (ESKUCHE and ROMERO FONSECA 1982); Rotondo Av. Independencia RN 12 and RN 5 (Landolt, Zarzycki and Eskuche 172/83: ZT). Dept. Goya: Colonia Carolina (Schinini 19088: CTES).

Prov. ENTRE RIOS. Dept. Capital: Concepcion del Uruguay (Lorentz 8/1873: GOET; 1692: B, KANU, L, LY, MO, STU; 182: B, BM, CORD, G, JE, STU, UPS; 574: Z; 10/1878: BM, CORD, F, FI, L, LE, STU, UPS, Z). Dept. Gualeguaychu: ca. 35 km S of Ceibas (Landolt and Zarzycki 46/83: ZT); 3 km W of Arroyo El Animal (Landolt and Zarzycki 53/83: ZT). Dept. La Paz: La Paz (Burkart: ZT* 7716). Dept. Victoria: Rincon de Nogoya (Landolt and Zarzycki 57/83: ZT); Victoria, Laguna (Landolt and Zarzycki 58/83: ZT); N

of Arroyo Mananillalos 59/83, 60/83: ZT); Almacén Arroyo Carballo (Landolt and Zarzycki 62/83: ZT).

Prov. FORMOSA. Dept. Formosa: just N of Formosa (Landolt and Zarzycki 133/83: ZT). Dept. Laishi: Rio Salado, RN 11 (Landolt and Zarzycki 129/83, 129b/83: ZT). Dept. Pilcomayo: ca. 40 km S of Clorinda, Rcho. He-He (Landolt and Zarzycki 137/83, 137b/83: ZT; ZT* 8820); ca. 20 km S of Clorinda, Rcho. Negro (Landolt and Zarzycki 139/83: ZT); ca. 7 km SE of Clorinda, Rio Paraguay (Landolt and Zarzycki 140/83: ZT); Carcete Cué, RN 11 (Landolt and Zarzycki 141/83: ZT); 40 km W of Clorinda, Laguna Naick-Neck (Landolt and Zarzycki 147/83: ZT); between Primela Pinta and Laguna Blanca (Landolt and Zarzycki 149/83: ZT); ca. 5 km NE of Primela Pinta (Landolt and Zarzycki 150/83: ZT); ca. 2 km of Primela Pinta (Landolt and Zarzycki 151/83: ZT); ca. 12 km E of Laguna Blanca (Landolt and Zarzycki 152/83, 156/83; Landolt 154/83: ZT).

Prov. LA RIOJA. Las Canas, Camino al Catadero (Hunziker 5049: CORD, GH LIL).

Prov. SALTA. Between Metan and San José (Lorentz and Hieronymus 2/1873: CORD, STU). Dept. Rosario de Lerma: Las Lomitas, Campo Quijano (Novara 1309: MCNS).

Prov. SANTA FE. Dept. Grl. Lopez: Santa Emilia (Hunziker 16592: CORD). Dept. Grl. Obligado: between Reconquista and Pt. Reconquista (Landolt and Zarzycki 107/83: ZT); ca. 6 km W of Pt. Reconquista (Landolt and Zarzycki 108/83: ZT); ca. 6 km E of Reconquista (Landolt and Zarzycki 109/83: ZT); ca. 3 km E of Reconquista (Landolt and Zarzycki 110/83, 111/83: ZT); Florencia, Rio Tapenaga (Landolt and Zarzycki 120/83: ZT). Dept. La Capital: Santa Fé, Rio Salado (Landolt and Zarzycki 72/83: ZT); N of Esperanza, N of Rio Salado (Landolt and Zarzycki 75/83: ZT); ca. 15 km N of Esperanza (Landolt and Zarzycki 77/83, 78/83: ZT); Rio Salado, RN 4 (Landolt and Zarzycki 79/83: ZT); Rio Salado, RN 62 (Landolt and Zarzycki 82/83, 83/83, 84/83, 85/83: ZT). Dept. Vera: ca. 4 km N of Margarita (Landolt and Zarzycki 94/83: ZT); ca. 5 km N of Margarita (Landolt and Zarzycki 95/83: ZT); ca. 9 km E of La Gallerta (Landolt and Zarzycki 96/83: ZT); ca. 5 km S of Vera, Espin (Landolt and Zarzycki 102/83: ZT); ca. 9 km NE of Vera, RN 11 (Landolt and Zarzycki 103/83: ZT).

Prov. TUCUMAN. Dept. Tafi: Dique Sali (Lillo 4702: LIL); Valle de Tafi (Roth s.d.: LP).

BOLIVIA

Dept. Santa Cruz: Santa Cruz de la Sierra (Evrard 1977: BR); between Boyuibe and Rio Machareti (de Sloover 75/262: BR).

BRAZIL

CEARA. Lagoa de Quixada (Luetzelburg 14061: M).

PERNAMBUCO. Olinda (Ridley 3/8/1887: BM).

RIO GRANDE DO SUL. Itapua (Lindemann and Valls 9519: CTES, U); Rio Grabyba (Reineck 7/1896: LY).

COLOMBIA

Dept. Atlantico: Barranquilla (Dugand: ZT* 7467; Gutierrez 18C 005: WIS; 18C 006: COL, US); Malambo (Dugand: ZT* 7458). Dept. Bolivar: Arjona (Killip 14504: GH); Soplaviento (Killip 14609: GH, US). Dept. Cordoba: Monteria (Bristow 2/1971: COL; Molino 19Bo 205, 19 Bo 206: US). Dept. Cundinamarca: Bogota (Héliier 18/8/1910: G). Dept. Magdalena: Santa Marta (Karsten: STU).

ECUADOR

Prov. Esmeraldas: Esmeraldas, Hacienda Timbre (Sparre 15451, 15452: S).

Prov. Guayas: Guayaquil (Anderson 76: S; Asplund 15348, 15349: S; Fagerlind 166, 167: S; Little 6578: NY).

PARAGUAY

Dept. Boquerón: Rio Negro (de Sloover 75/81-82: BR); A 415 km of Villa Hayes, between Filadelfia and Mariscal (de Sloover 75/96bis: BR); Picada Lepay, km 63 (de Sloover 75/117, 75/118, 75/120: BR).

URUGUAY

Dept. Canelones: Carrasco (Rosengurth: ZT* 7286). Dept. Montevideo: Montevideo (Herter 68131: F, GOET, M, MO, U, WIS, ZT); Pocitos (Herter 6/1924: GOET, ZT; 70512: B, F, G, GH, K, MO, MSC, S, U, UC, Z, ZT). Dept. Treinta-y-Tres: Without exact locality (Herter 3/12/1982: RB).

VENEZUELA

Esto. Aragua: Maracay (Maas 2174: U); Airport (Alston 5680: BM); Lago de Valencia (Maas 2175: U). Esto. Carabobo: El Aislado, Lago de Valencia (Alston 5696: A, BM, L, LL, U, WIS). Esto. Guarico: Calabozo (Zuber: ZT* 8920). Esto. Lara: Agua Viva (Zuber: ZT* 8930); Quibor (Tillet: ZT* 7456); Esto. Yaracuy: Marin (Tillet: ZT* 7463).

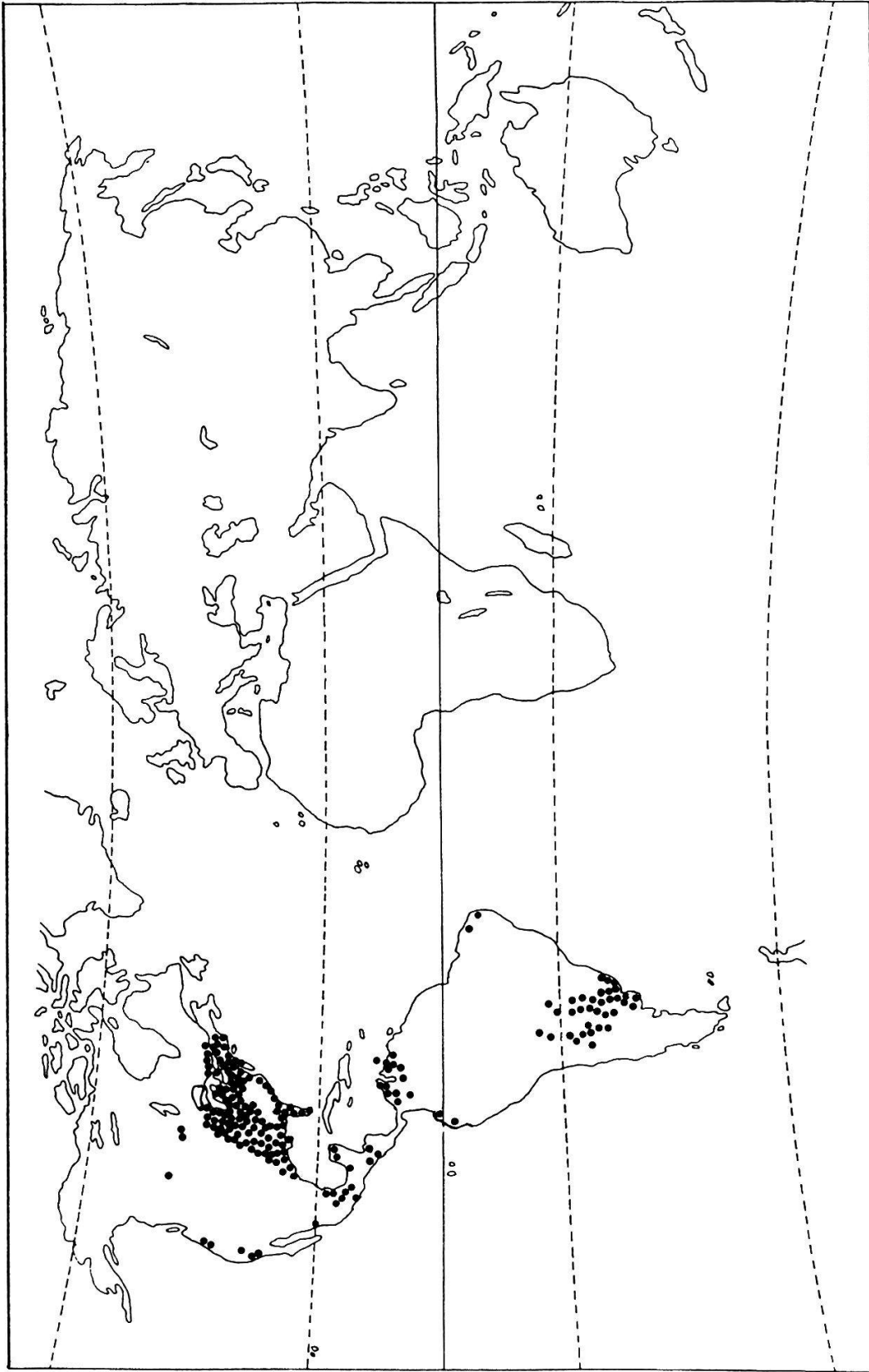


Fig. 6.25. Distribution of Wolffia columbiana

6.1.3.34. Wolffia globosa (fig. 6.26)

W. globosa is native to Africa and eastern Asia. In California and Florida it is probably introduced.

NORTH AMERICA

U.S.A.

CALIFORNIA. (ARMSTRONG 1984, 1985, ARMSTRONG and THORNE 1984). Rare: Fresno Co., San Diego Co., Riverside Co., San Joaquin Co., Stanislaus Co.

FLORIDA. Rare: Pinellas Co.

AFRICA

ANGOLA

Prov. MOCAMEDES. Mocamedes, Dois Irmaos, Serra da Providencia (Mendes 3948: LISC). Libongo Distr.: Libongo Mts. (Welwitsch 212: BM, L, STU).

KENYA

Kwale Distr.: near Taru, between Samburu and Macknon Road (Drummond and Hensley 4164: B, BM, BR, G, K, LISC, PRE, S, W). Masai Distr.: Amboseli, near Ol Tukai (Verdcourt 3107: EA).

SOUTH AFRICA

CAPE. Grahamstown (Preez: ZT* 7233). Zwartkops River, Uitenhage (Mauve and Wells 52: L, PRE); without exact locality (Drège 8/1845: L).

NATAL. Port Shepstone (Strey 7438: PRE).

TRANSVAAL. Pretoria Distr.: Bon Accord Dam (Strey 2829: PRE); Onderstepoort, Pretoria (Stejin 6/4/1943: CAP). Hoggeveld, Standarton (Rehmann 6777: BM, K, L, Z, ZT).

TANZANIA

Prov. COAST. Dar-es-Salaam (Hildebrandt 1236: BM, G, GOET, K, KANU, L, LE, M, STU, W).

Prov. IRINGA. Mesangati (Greenway and Kanuri 14.504: EA, K, MO, PRE; ZT* 7340).

Prov. MTWARA. ca. 8 km SW of Kingupina (Vollesen 3068: EA).

Prov. TANGA. Bagamoyo, Mkwaja Ranch (Klötzli: ZT* 8378).

ZIMBABWE

Nuanetsi Distr.: Manjinji Pan (Taylor 176: K, LISC, PRE; ZT* 7524); Malipate (Drummond 7549, 7550: BR, K, LISC, MO, PRE, SRGH); Merrivale Ranch (West 7454: SRGH). Wankie Distr.: Ngwashla Road, Inpan (Wild 4766, 4767: BR, K, LISC, SRGH).

SOUTHERN AND EASTERN ASIA

BURMA

Pegu, Irrawaddi Valley (Kurz 3307: STU).

CHINA

FUKIEN. Nantai, Fu-chou (Lin yu Tai 11027: MO, UC).

HONAN. Kioshan (Bailey 26/6/1917: BH, GH).

HUPEH. Wuchang (Bailey 4/7/1917: BH).

KIANGSU. Nan-ching, Lake Sanssouci (s.coll.: ZT* 8341).

KWANGTUNG. Canton (Acad.Sin.: ZT* 8243; Merrill 10381: GH; Weigolt 7/7/1918: WU).

SHANG-HAI. Shang-hai (Debeaux 1861: P).

HONG-KONG

Hung Ha Po, Taipo (Shiu Ying Hu 6117: US). New Territories, Shatin (Lau: ZT* 7234).

INDIA

ANDHRA PRADESH. Warangal (Narayan 7/4/1968: AD). Hyderabad (Narayan 3/1/1969: AD). Nidadavolu (Narayan 27/5/1968: AD).

ASSAM. Chotapooni (HEGELMAIER 1868).

DELHI. Delhi (Maheshwari 4/11/1955: BM; ZT* 7128, ZT* 7451, ZT* 7460).

GUJARAT. Kadi (Yogi: ZT* 7684, ZT* 7700). Khaira (Yogi: ZT* 7706).

MADHYA PRADESH. Gwalior (Ihivy 132: MICH).

PONDICHERY. Pondicherry (Thanikaimoni: ZT* 7370, ZT* 7411).

RAJASTHAN. Pushkar, Ajem (Gopal: ZT* 8343).

TAMIL NADU. Vellore (Ihivy 125: MICH); Tanjore (Ihivy 127, 128: MICH); Madras (Ihivy 138, 139: MICH).

UTTAR PRADESH. Agra (GUPTA 1935 named as W. arrhiza); Dehra Dun (Pant: ZT* 7243; Parker 11/10/1927: L); Lucknow (Maheshwari: ZT* 7319).

WEST BENGAL. (According to KURZ 1867 frequent in Bengal). Howrah, Sak-rail (Banerjee: ZT* 7270). Rajnagar (Mitra: ZT* 7214). Calcutta (Kurz s.no.: MEL, STU).

INDONESIA

FLORES. Rana Mese (Jaag 11/6/1938: ZT).

JAWA. Kangean Island, Sepandjang (Backer 23/4/1919: BO); Surabaja, Pasuruan (HEGELMAIER 1895; this material was not checked by the present author, there is a possibility that it might be W. angusta).

SUMATRA. Medan (Landolt-Stadler: ZT* 8356).

JAPAN

(OTAKI 1974, in lit. 1978).

HONSHU. Aichi; Chiba; Hyogo; Osaka; Okayama; Saitama; Shiga; Shizuoka; Wakayama.

KYUSHU. Fukuoka; Kumamoto.

SHIKOKU. Ehime,

MALAYSIA

Pinang: Pinang (Chaw: ZT* 8245). Selangor: Kuala Lumpur (Landolt 57/84: ZT; Naskar 4428: CAL; Surkiel 4428: BR, UC; 4429: BM, CAL, MICH, UC; 23/2/1919: BRI, SING); Kuala Selangor (Landolt 14/84, 16/84: ZT).

NEPAL

Bharatpur (Klötzli: ZT* 8789).

PAKISTAN

Punjab: Peshawar, Swati (Suhail 274: L); Rawalpindi (Stewart 1497: PH). Karachi: Karachi.

PHILIPPINES

Luzon: Manila (Merrill 131: BM, CAL, L, MO, NSW, P; Robinson 9563: C; van Marlens s.no.: STU); Pangana, Calumpit (Merrill 9/1905: BO); Rizal, Malabor (Mendoza: ZT* 7659); Victoneta Park (Mendoza: ZT* 7623).

SINGAPORE

Potong Pasir, Serangoon Road (Sinclair 1948: L, P, SING); Tanglin (Jan 1893: SING).

SRI LANKA

Central Prov.: Matale Distr.: Pelbendiyama (HEPPER 1981). North Central Prov.: Anuradhapura (Hosiaislouma 12/1/1972: H); Dambulla (Hepper 4667: US). Yala Park (Jacobsen 16/3/1975: C). Colombo Distr.: Madampilya (HEPPER 1981). Western Prov.: Colombo (s.coll. 1881: BM); Panumugama (Schmid: ZT* 7646).

TAIWAN

Taipei (YANG et al. 1978).

THAILAND

Bangkok (Hillman: ZT* 8441; Kwanymen: ZT* 8218); Bang Khen (Youndboon-
kird: ZT* 7207). Chiang Mai (Anusarnunthorn: ZT* 7664). Nakhon Ratchasi-
ma (Surapat 343: IND).

VIETNAM

Pagodas (Mouret 391: P). Phuc-Nhac (Bon 13/12/1882: P).

PACIFIC OCEAN

HAWAII (U.S.A.)

Oahu: Pearl City (Herbst: ZT* 7470).

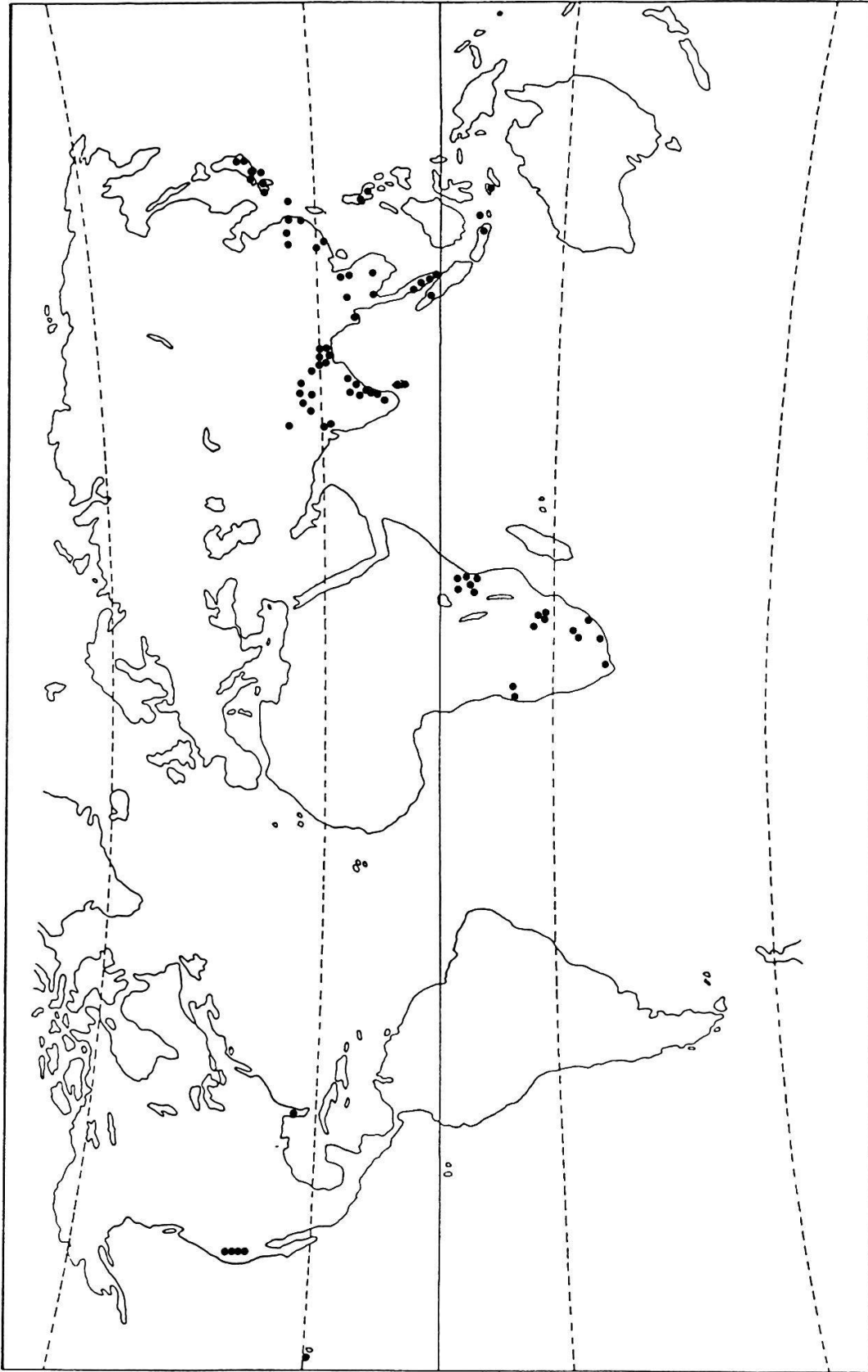


Fig. 6.26. Distribution of Wolffia globosa

6.2. ALTITUDINAL DISTRIBUTION

The altitudinal distribution is not an independent characteristic of the different species. It is correlated with the general climatic conditions. Lemnaceae reach the highest altitudes in the southern subtropical Andes of South America between about 15° and 22° Southern Latitude (up to 4450 m) Other high localities of Lemnaceae occur in the Southern Rocky Mountains of North America (45°-35° NL, up to 3750 m), in the mountains of Yunnan, China (c. 25° NL, up to 3000 m), in the Western Himalayas (27°-35° NL, up to 2900 m) and in the tropical mountains of Africa (Ethiopia, Kenya 6°-15° NL, up to 3450 m) and of America (Guatemala, Colombia, Ecuador between 15° NL and 15° SL, up to 3000 m). Some of the highest recorded localities in the Andes and in the Rocky Mountains refer to localities with warm springs.

It is interesting to note that species with a relatively oceanic distribution (L. gibba, L. minuscula, W. oblonga) reach the highest altitudes in the southern Andes (figs. 6.28, 6.32, 6.33). Apparently they are relatively well adapted to a subtropical mountain climate, with generally cool but not extreme temperatures. The highest stations of more continental species (S. polyrrhiza, L. trisulca) can be found in the more continental areas of the central Rocky Mountains and southern China (figs. 6.27, 6.30).

The different species have the following altitudinal distribution (see table 6.2)

Spirodela

S. intermedia

The area of S. intermedia extends from 13° NL (El Salvador) to 36° SL (Buenos Aires). It reaches altitudes of 2700 m in the tropics.

S. polyrrhiza

The area lies between 54° NL in America, 55° NL in Siberia and, exceptionally 66° NL in Europe, 37° SL in Australia, 30° SL in Africa. In South America it is restricted to the Northwest (southwards to about 10° SL). The highest localities of S. polyrrhiza were found in southern China at about 2900 m altitude (fig. 6.27).

Table 6.2. The highest known localities of some Lemnaceae species

<u>S. intermedia</u>	2250 m Colombia, Mosquera (Mason 13750:UC)	5°	NL
	<u>2700 m</u> Ecuador, Imbabura (Camp 3254:S)	0°	
	1000 m Brazil, Santa Catarina (Smith and Klein 7902:R,US)	28°	SL
<u>S. polyrrhiza</u>	1920 m U.S.A., Wyoming (Porter and Porter 8860:UPS)	44°	NL
	1980 m U.S.A., Colorado (Landolt and Urbanska 8197:ZT)	40°	NL
	2400 m U.S.A., California (Hall and Babcock 4311:JEP,UC)	40°	NL
	1800 m India, Kashmir (Stewart 1222:NY,PH)	34°	NL
	<u>2900 m</u> Yunnan (Maire 2870:G,MICH,UC,Z)	24°	NL
	2500 m Mexico, Hildago (Moore and Wood 4748:MICH)	20°	NL
	2000 m Ethiopia, Shoa (de Wilde 7106:BR,K,MO)	10°	NL
	2300 m Kenya, Laikipia (Sigg 8684:ZT)	0°	
	950 m U.S.A., Arizona (Blumer 1975:ARIZ)	36°	NL
<u>S. punctata</u>	<u>2400 m</u> China, Yunnan (Wang 63471:GH)	24°	NL
	1500 m Zimbabwe, Moll 529:SRGH)	18°	SL
	1410 m South Africa, Transvaal (Mauve et al. 4309:PRE)	25°	SL
	1900 m U.S.A., Wyoming (Forwood 14/8/1882:GH)	44°	
	1650 m U.S.A., Nevada (Lindsdale and Lindsdale 647A:CAS)	39°	NL
<u>L. gibba</u>	1650 m Turkey, Agri (Uotila 19549:H)	30°	NL
	2800 m Afghanistan, Chazni (Rechinger 6/7/1962:M)	33°	NL
	2500 m Mexico, Queretaro (Quenelle and Fleming 1865:DUKE)	21°	NL
	2500 m Mexico, Hidalgo (Moore and Wood 4748: BH,GH)	20°	NL
	2580 m Mexico, Toluca (Fassett 28479:MO)	19°	NL
	2600 m Ethiopia, Eritrea (Schweinfurth 124:Z)	15°	NL
	2600 m Yemen (Hepper 5789:K)	15°	NL
	2650 m Colombia, Bogota (Iriano 682bis:BM,MO, US)	5°	NL
	2700 m Ecuador, Imbabura (Asplund 6/8/1920:S, UPS)	0°	
	2400 m Kenya, Narok (Greenway and Kanuri 14457: EA,K,MO)	1°	SL
	3500 m Peru, Sicuani (Lüönd 8901:ZT)	14°	SL
	3800 m Peru, Titicaca (Landolt-Stadler 7613: ZT)	16°	SL
	4100 m Bolivia, Sorata (Mandon 1497:GH,STU)	16°	SL
	4300 m Bolivia, Oruru (Klein 8667:ZT)	18°	SL
	4000 m Bolivia, Potosi (Lüönd 8903:ZT)	19°	SL
	4392 m Chile, Tarapaca (Escobar 1961:VALD,ZT)	20°	SL
	<u>4450 m</u> Chile, Tarapaca (Univ.Concepc. 2288: VALD,ZT)	20°	SL
3000 m Argentina, Jujuy (Venturi 8231:GH,US)	23°	SL	
1800 m South Africa, Transvaal (Haynes 10/1/1968:PRE)	26°	SL	
2750 m Chile, Atacama (Jonston 6012:GH,S,US)	28°	SL	
800 m Argentina, Chubut (Meyer 9245:LIL)	43°	SL	

Table 6.2 (continued)

<u>L. obscura</u>	2500 m Mexico, Hidalgo (Moore and Wood 4748: BH,GH,MICH)	20°	NL
<u>L. japonica</u>	800 m China, Shansi (Smith 6817:BM,GH)	38°	NL
	1650 m China, Szechwan (Smith 1845:GB,S,UPS)	30°	NL
	2900 m China, Yunnan (Maire 2870:G,MICH,UC,Z)	24°	NL
<u>L. minor</u>	2000 m Switzerland, Wallis (BECHERER 1956)	47°	NL
	1250 m U.S.A., Utah (Buchanan 7844:ZT)	41°	NL
	1800 m Turkey, Kayseri (Zederbauer 26/2/1902: WU)	39°	NL
	2900 m Afghanistan, Maidan (Dieterle 780:M)	35°	NL
	2940 m China, Tibet (Ludlow et al. 4561:BM, UPS)	29°	NL
	3000 m Nepal (Bolumi 868:BM,UPS)	29°	NL
	2500 m Yemen (Hepper 6280:K)	15°	NL
	2460 m Sudan, Jebel Marra (Lynes 3/1921:BM)	13°	NL
	3470 m Ethiopia, Simien (Klötzli 7753:ZT)	13°	NL
	3450 m Mt. Kenya (Van Cotthem 1001:EA)	0°	
	2300 m Rwanda (de Sloover 5/2/1972:BR)	2°	SL
<u>L. turionifera</u>	1275 m Canada, Alberta (Breitung 16783:NY)	49°	NL
	2700 m U.S.A., Wyoming (Porter and Porter 8851:CAS,MIN,TEX,UPS)	44°	NL
	2350 m Turkey, Coruh (Davis and Hedge 32524: BM,H,K)	41°	NL
	2850 m U.S.A., Utah (Maguire 19164:CU)	39°	NL
	3750 m U.S.A., Colorado (Bessey 10/7/1895:NY)	39°	NL
	2200 m Turkey, Kayseri (Zederbauer 7/1902:WU)	39°	NL
<u>L. trisulca</u>	2200 m U.S.A., Montana (Whitman 395:USFS)	46°	NL
	2700 m U.S.A., Wyoming (Porter and Porter 7925:CAS,UC)	44°	NL
	2700 m U.S.A., Wyoming (Porter and Porter 10331:CAS)	42°	NL
	2300 m Turkey, Coruh (Davis and Hedge 32524bis:BM)	41°	NL
	2850 m U.S.A., Colorado (Herman 5473:CAS,PH)	39°	N
	2610 m U.S.A., California (Howell 25879:G)	36°	NL
	2800 m Afghanistan, Ghazni (Rechinger 6/7/ 1962:M)	33°	NL
	3000 m China, Yunnan (Forrest 12728:BH)	25°	NL
	2800 m Ethiopia, Shoa (Gilbert et al. 3272:K)	8°	NL
	1950 m Uganda, Kizegi (Thomas 1208:K)	1°	SL
<u>L. aequinoctialis</u>	1260 m U.S.A., Arizona (Kearney and Peebles 14486:CAS)	31°	NL
	2280 m Nepal (Polunin et al. 4980:BM,G,UPS)	29°	NL
	2800 m China, Yunnan (Maire 2870:MICH)	24°	NL
	2940 m Guatemala, Quetzaltenango (Sharp 4535: GH,MIS)	15°	NL
<u>L. valdiviana</u>	2020 m U.S.A., California (Hall 7544:JEP,UC)	34°	NL
	2610 m Mexico, Contreras (Sharp 4415:GH)	19°	NL
	3500 m Peru, Cuzco, San Pedro (Lüönd 8902:ZT)	14°	SL
	3800 m Peru, Titicaca (Landolt-Stadler 7614: ZT; Bolliger 8446:ZT)	17°	SL
	2700 m Argentina, Mendoza (Wilczek 11:G)	33°	SL

Table 6.2 (continued)

<u>L. minuscula</u>	2550 m U.S.A., Wyoming (Tweedy:NY)	44°	NL	
	2250 m U.S.A., Nevada (Archer 6588:UC)	39°	NL	
	2200 m Mexico, Mexico (mult.herb.)	19°	NL	
	3100 m Guatemala, Totonicapan (Standley 84492:F)	15°	NL	
	3300 m Colombia, Boyaca (Cleef 9503:COL)	6°	NL	
	2930 m Ecuador, Pichincha (Holgren 947:S,ZT)	0°	NL	
	4100 m Bolivia, Sorata (Mandon 1497:GH,GOET)	16°	SL	
	3900 m Peru, Tarata (Webenbauer 7476:F)	17°	SL	
	4300 m Bolivia, Oruro (Klein 8669:ZT)	18°	SL	
	4000 m Bolivia, Potoni (Lüönd 8904:ZT)	19°	SL	
	<u>4450 m Chile, Tarapaca (Univ.Concepc. 2288: VALD,ZT)</u>	20°	SL	
	3350 m Argentina, Salta (Fries 717:S)	24°	SL	
	2750 m Chile, Atacama (Johnston 6012:F,GH, S,US)	28°	SL	
	2600 m Argentina, Mendoza (Kurtz 9492:BAF, CORD)	33°	SL	
	800 m Argentina, Chubut (Meyer 9246:LIL)	43°	SL	
	<u>W. hyalina</u>	1620 m Tanzania, Monduli (Greenway ad Kanuri 12538: BR,EA,K,PRE)	3°	SL
	1515 m Tanzania, Singida (Polhill and Paulo 2198:L,PRE)	6°	SL	
	1050 m Zambia, Tabwe (Richards 9139:BR)	9°	SL	
	<u>W. Welwitschii</u>	1890 m Kenya, Naivasha (Gaudet LN 110:EA)	1°	SL
	2000 m Uganda, Kizegi (Lye 1021:K,UPS)	1°	SL	
<u>W. lingulata</u>	2250 m Mexico, Mexico (mult.herb.)	19°		
<u>W. oblonga</u>	2250 m Mexico, Mexico (mult.herb.)	19°	NL	
	2700 m Ecuador, Imbabura (Fagerlind 1325:S)	0°		
	3400 m Peru, Cuzco (Maldonado 14a:F)	14°	SL	
	4300 m Bolivia, Oruro (Klein 8670: ZT)	18°	SL	
	550 m Chile, Santiago (mult.herb.)	35°	SL	
<u>W. gladiata</u>	2250 m Mexico, Mexico (mult.herb.)	19°	NL	
<u>W. brasiliensis</u>	2250 m Mexico, Mexico (Pineda 1003:MICH)	19°	NL	
	2290 m Mexico, Puebla (Fassett 28464:MO)	19°	NL	
	2600 m Colombia, Bogota (Héliier 18/8/1910:G)	5°	NL	
<u>W. borealis</u>	1130 m U.S.A., Nebraska (Kiener 29638:WIS)	42°	NL	
	<u>1350 m U.S.A., Utah (Maguire 13182:CU,F,GH, MICHJ,MO,WS)</u>	41°	NL	
	1000 m U.S.A., California (Armstrong 1219:ZT)	41°	NL	
<u>W. arrhiza</u>	1600 m India, Kashmir (Kake 3236,6262:KASH)	34°	NL	
	1860 m Kenya, Naivasha (Otieno 14852:EA)	1°	SL	
	2000 m Uganda, Kizegi (Lye 1020:K)	1°	SL	
	1650 m Tanzania, Singida (Polhill and Paulo 2198:K)	6°	SL	
<u>W. columbiana</u>	1130 m U.S.A., Nebraska (Kiener 20638:WIS9)	42°	NL	
	2250 m Mexico, Puebla (Fassett 28474:MO)	19°	NL	
	2600 m Colombia, Bogota (Héliier 18/8/1910:G)	5°	NL	
<u>W. globosa</u>	<u>1350 m Nepal (Klötzli 8789:ZT)</u>	28°	NL	
	900 m Tanzania, Usambara (Greenway 4624:K)	5°	SL	

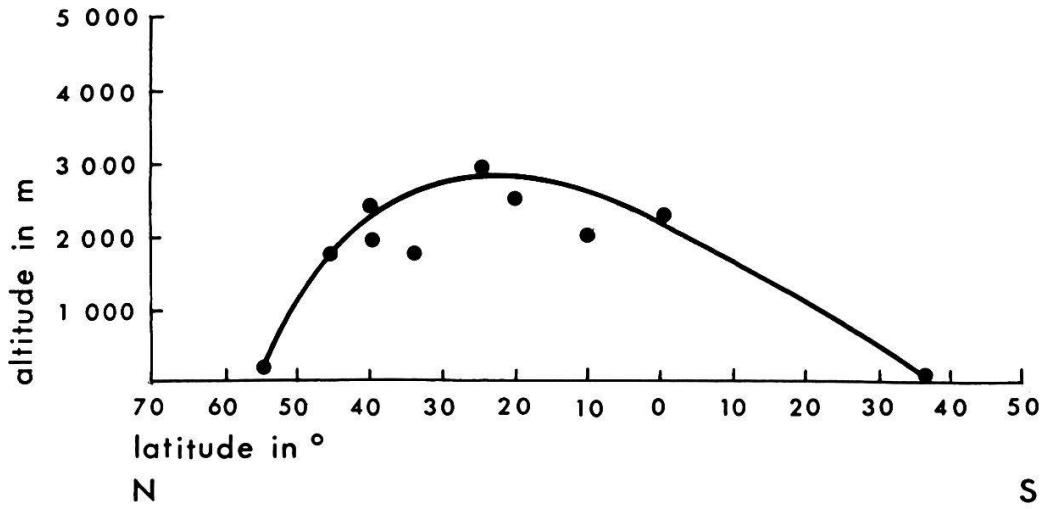


Fig. 6.27. Highest known stations of Spirodela polyrrhiza in relation to the latitude

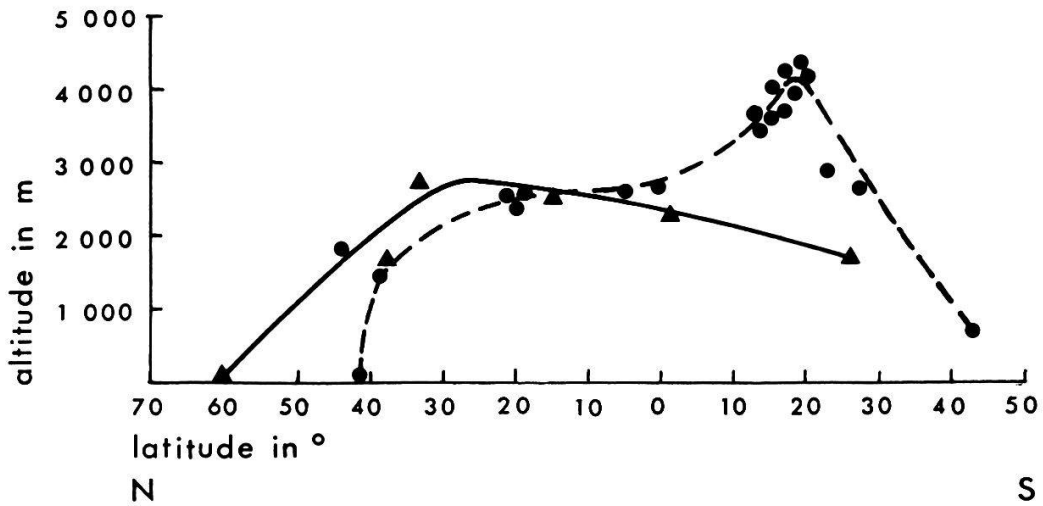


Fig. 6.28. Highest known stations of Lemna gibba in America (●), and Eurasia and Africa (▲) in relation to the latitude. The northernmost station in America refers to a warm spring.

S. punctata

In South America S. punctata was found at 55° SL; in North America it is introduced and reaches 40°-43° NL in southern Oregon, Illinois and Pennsylvania. The highest known locality is 2400 m in southern China.

Lemna

L. gibba

The area of L. gibba extends northwards in North America to 44° NL in Wyoming (warm spring), in Europe (Sweden) up to 60° NL, and reaches southwards in America to 43° SL in Chubut and in Africa to 35° SL in the Cape. Together with L. minuscula it is found at the highest altitudes (above 4000 m) of all Lemnaceae (oceanic climates) (see fig. 6.28).

L. disperma

The area of L. disperma is restricted to the region of southern Australia and New Zealand between 27° and 47° SL. L. disperma is distributed only in the lowlands.

L. minor

The northern limit of L. minor is at about 50° NL in Canada and 66°30' NL in Europe (Scandinavia), the southern limit touches 35° SL in Africa and 45° SL in New Zealand. The highest localities (more than 3400 m) occur in tropical Africa (see fig. 6.29).

L. japonica

L. japonica is distributed in eastern Asia between 24° and 45° NL. It reaches 2900 m in China.

L. ecuadoriensis

The two localities are situated in the lowlands just South of the equator.

L. obscura

The area lies in North America between 10° and 42° NL. The highest known locality is 2500 m in Hidalgo, Mexico.

L. turionifera

L. turionifera is distributed in North America and Asia between 65° and 31° NL. In Colorado it reaches 3750 m (probably in a warm spring).

L. trisulca

In America L. trisulca is distributed between 19° and 69° NL, in the eastern hemisphere between 68° NL in Siberia and 37° SL in Australia. It reaches its highest point in southern China (3000 m) (see fig. 6.30).

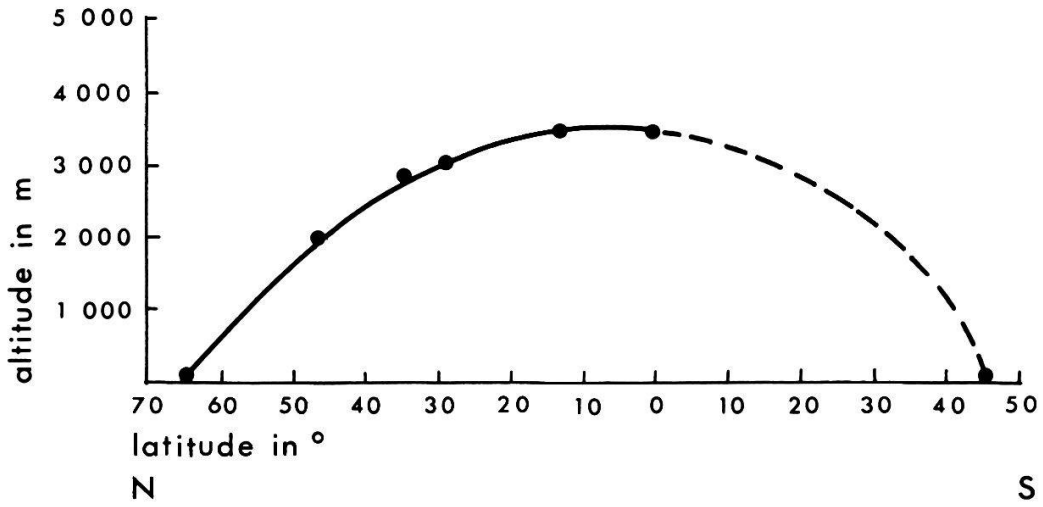


Fig. 6.29. Highest known stations of Lemna minor in relation to the latitude

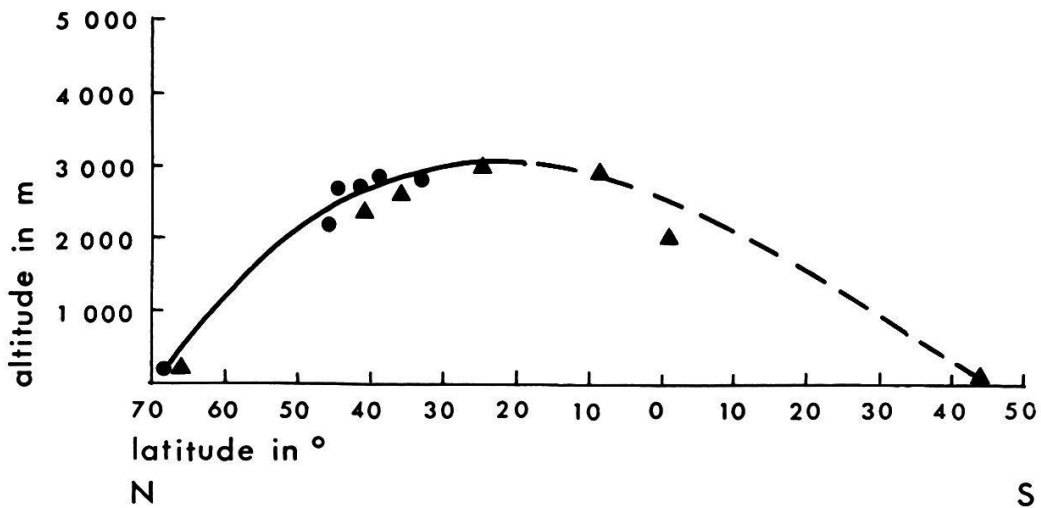


Fig. 6.30. Highest known stations of Lemna trisulca in America (●) and in Eurasia, Africa and Australia (▲) in relation to the latitude

L. perpusilla

L. perpusilla is restricted to an area between 35° and 45° NL and to lower altitudes.

L. aequinoctialis

The northern limit of L. aequinoctialis reaches 45° NL in America, Europe, and Japan. The southern limit lies between 30° and 35° SL. It reaches 2940 m in Guatemala (see fig. 6.31).

L. tenera

L. tenera is a tropical lowland species and occurs between 2° and 17° NL.

L. valdiviana

L. valdiviana is distributed between 43° NL (Massachusetts) and 40° SL (Valdivia). The highest known occurrence is at about 3800 m in Peru.

L. minuscula

L. minuscula occurs between 46° NL (Washington) and 46° SL (Patagonia). It climbs far above 4000 m in the southern Andes (fig. 6.32).

Wolffiella

W. hyalina

W. hyalina is distributed from 31° NL (Egypt) to 9° SL (Zambia). In Tanzania it reaches 1620 m.

W. repanda

W. repanda is restricted to a small area between 9° SL (Angola) and 20° SL (Botswana) and does not occur at higher altitudes.

W. rotunda

The only known locality lies at 16° SL and at 450 m altitude.

W. Welwitschii

W. Welwitschii is a tropical species between 23° NL (Cuba) and 5° SL (Brazil, Ceara) in America and 15° NL (Mali) and 28° SL (Natal) in Africa. It grows up to 2000 m in Uganda.

W. neotropica

W. neotropica is a tropical species of America between 6° NL (Surinam) and 23° SL (Rio de Janeiro) and is known only from lower altitudes.

W. lingulata

W. lingulata is distributed in America between 38° NL (California) and 35° SL (Buenos Aires). The highest locality is known from Mexico (2250 m).

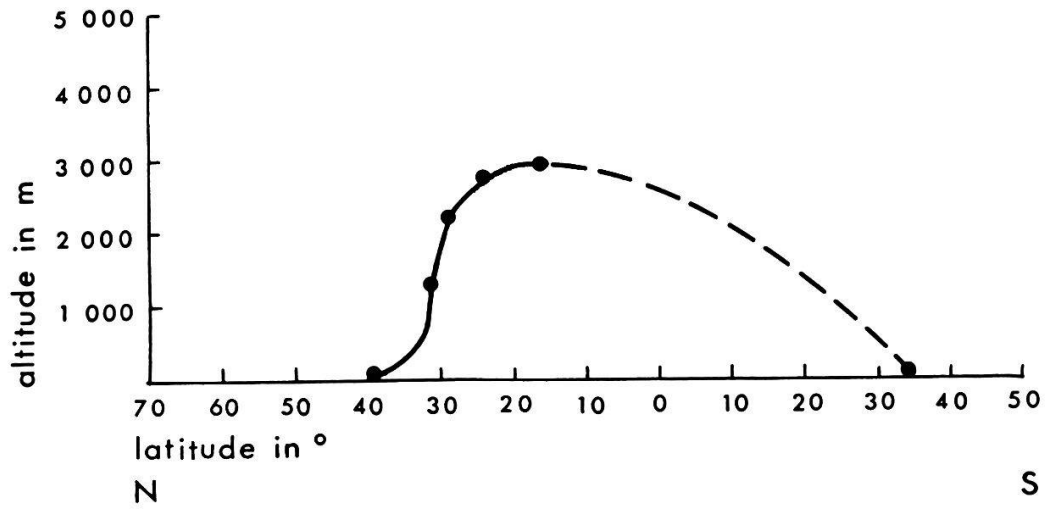


Fig. 6.31. Highest known stations of Lemna aequinoctialis in relation to the latitude

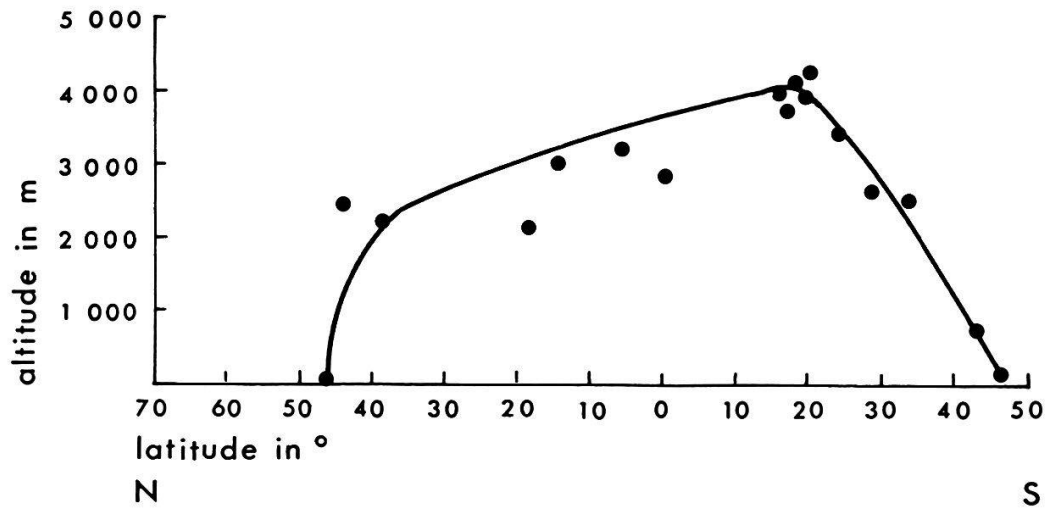


Fig. 6.32. Highest known stations of Lemna minuscula in relation to the latitude
The two points which are located above the curve refer to warm springs.

W. oblonga

The northern limit is at 38° NL in California, the southern one at 39° in Rio Negro, Argentina. W. oblonga was found at an altitude of 4300 m in Peru in a warm spring (fig. 6.33).

W. gladiata

W. gladiata occurs in North America between 10° NL (Mexico) and 47° NL (Washington). It reaches 2250 m in Mexico; in the USA it is distributed only in the lowlands.

W. denticulata

W. denticulata is a lowland species of southern Africa between 24° SL (Mozambique) and 34° SL (Cape).

Wolffia

W. microscopica

W. microscopica is distributed in India between 33° NL (Punjab) and 10° SL (Tamil Nadu) mainly in lower altitudes.

W. elongata

The tropical lowland species occurs between 9° NL (Columbia) and 12° NL (Curaçao).

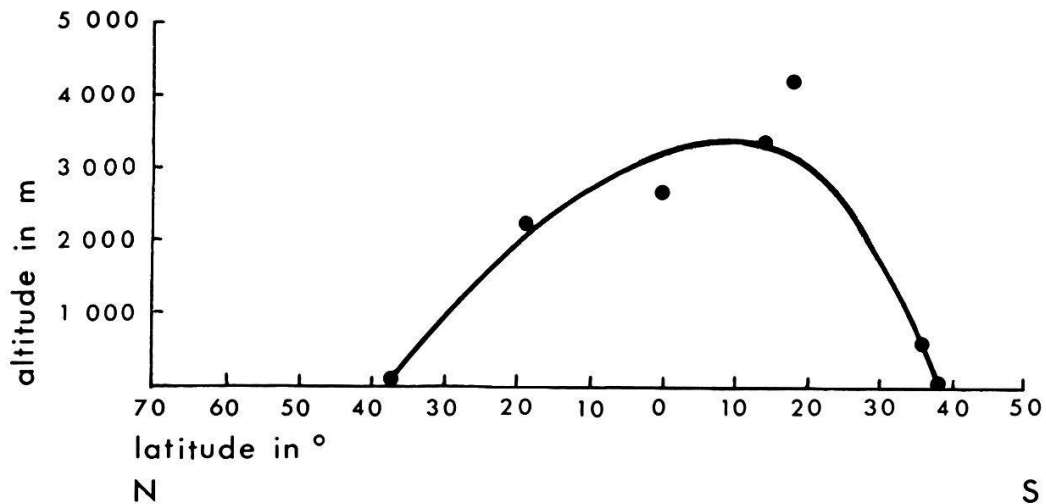


Fig. 6.33. Highest known stations of Wolfffiella oblonga in relation to the latitude

W. brasiliensis

W. brasiliensis has its northern limit at 43° NL (Wisconsin) and its southern limit at 37° SL (Buenos Aires). It reaches 2600 m in Colombia.

W. borealis

W. borealis is limited between 33° (California) and 50° NL (British Columbia). In Utah it can be found at 1350 m.

W. australiana

W. australiana grows between 30° SL (New South Wales) and 44° SL (New Zealand). It is not known from higher altitudes.

W. angusta

W. angusta can be found between 25° NL (Karachi) and 38° SL (Victoria). It is a species of the lowlands.

W. arrhiza

The northern limit of W. arrhiza is at 54° NL in Poland, the southernmost limit is at 34° SL in the Cape. The highest known locality is in eastern Africa at 2050 m.

W. columbiana

W. columbiana is distributed between 49° NL in Manitoba and 37° SL in Buenos Aires. It reaches 2600 m in Colombia.

W. globosa

W. globosa occurs between 38° NL (Japan, California) and 34° SL (Cape). The highest known locality (1350 m) is in Nepal.

6.3. RELATIONSHIP BETWEEN ECOLOGICAL DEMANDS, CLIMATIC FACTORS, AND GEOGRAPHIC DISTRIBUTION

The relationship between the occurrence of some Lemnaceae and climatic factors was pointed out by LANDOLT (1981, 1982a, 1984b). A survey for all species is given in table 6.3. The data in the table are only taken from experience and are not physiologically established. Many of the indications may coincide with other more important factors and are therefore of no decisive value. In addition, numerous complex local factors which are partly influenced by the macroclimatic factors play a role.

6.3.1. Local factors interfering with the general distribution

One must distinguish between factors which prevent the species from growing in a region where the general climatic conditions would allow the species to exist, and those which enable the species to grow in a region otherwise unfavourable.

6.3.1.1. Local factors which prevent the occurrence of a species

- **Permeable soils** preventing the formation of suitable waters
- **Heavy winds** drive the Lemnaceae fronds on to the shore where they dry out
- **Fish and/or fowl** feeding on duckweeds and so preventing them from establishment
- **Soils unusually poor in nutrients** due to a poor substratum (sand, granite, turf etc.) or due to great age
- **High pollution** of the water (sewage, pesticides, heavy metals)
- **Higher or lower temperature** of the water than normal for the climate due to external influences (warm or cool springs, warm inlet, origin of the water from another climate region)
- **Difference in nutrient composition** compared with normal waters of the region due to alien influences (mineral springs, origin of the water from another climatic region)
- **Low light intensity** due to shade in regions with dense forests
- **High competition** by other water plants.

Table 6.3. Ecological limits of Lemnaceae distribution

- 1 minimum number of days with mean temperature above 10°C
 2 lowest mean temperature of the 3 coolest months in °C
 3 lowest absolute minimum temperature in °C
 4 lowest mean temperature of the 3 warmest months in °C
 5 highest mean temperature of the 3 warmest months in °C

6 aridity factor of Martonne =
$$\frac{\text{annual precipitation in cm}}{\text{mean annual temperature in } ^\circ\text{C}+10}$$

	1	2	3	4	5	6
Lemnaceae	50	-40	<-40	10	>28	1-8
Spirodela	110	-40	<-40	10	>28	2-8
Lemna	50	-40	<-40	10	>28	1-8
Wolffiella	170	- 1	-20	16	>28	2-8
Wolffia	140	- 8	-20	16	>28	2-8
<i>S. intermedia</i>	260	+ 8	-10	20	>28	3-8
<i>S. polyrrhiza</i>	110	-40	<-40	16	>28	2-8
<i>S. punctata</i>	200	+ 1	-10	10	28	3-8
<i>L. gibba</i>	50	- 1	-20	10	26	1-4
<i>L. disperma</i>	170	+ 1	-10	12	24	2-4
<i>L. minor</i>	50	-15	-30	10	24	3-8
<i>L. japonica</i>	140	- 1	-20	18	26	3-8
<i>L. ecuadoriensis</i>	365	+18	>0	25	>28	2-4
<i>L. obscura</i>	170	- 1	-20	18	26	3-6
<i>L. turionifera</i>	80	-40	<-40	12	26	2-6
<i>L. trisulca</i>	50	-40	<-40	10	22	1-6
<i>L. perpusilla</i>	140	- 8	-30	18	24	3-6
<i>L. aequinoctialis</i>	170	+8(-8)	-20	20	>28	1-8
<i>L. tenera</i>	365	+18	>0	25	>28	5-8
<i>L. valdiviana</i>	170	- 1	-20	12	>28	4-8
<i>L. minuscula</i>	170	- 1	-20	16	26	2-6
<i>W. hyalina</i>	365	+13	>0	25	>28	1-3
<i>W. repanda</i>	365	+18	>0	25	>28	1-3
<i>W. rotunda</i>	365	+18	>0	25	>28	1-3
<i>W. neotropica</i>	365	+18	>0	25	>28	5-8
<i>W. Welwitschii</i>	365	+18	>0	25	>28	2-5
<i>W. lingulata</i>	260	+ 8	- 8	25	>28	2-8
<i>W. oblonga</i>	260	+ 8	-10	18	28	2-4
<i>W. gladiata</i>	170	- 1	-20	18	26	3-6
<i>W. denticulata</i>	365	+13	>0	18	24	3-6
<i>W. microscopica</i>	365	+13	>0	25	>28	2-4
<i>W. elongata</i>	365	+18	>0	25	>28	2-4
<i>W. brasiliensis</i>	170	- 1	-20	22	28	2-5
<i>W. borealis</i>	140	- 8	-20	18	22	3-6
<i>W. australiana</i>	200	+ 8	-10	18	22	3-6
<i>W. angusta</i>	260	+ 8	- 5	22	>28	3-8
<i>W. arrhiza</i>	140	- 8	-20	18	28	2-5
<i>W. columbiana</i>	140	- 8	-20	18	28	2-5
<i>W. globosa</i>	200	+ 1	-20	22	>28	3-8

6.3.1.2. Local factors promoting the establishment of Lemnaceae

- **Occasional distribution** by birds enabling Lemnaceae to grow temporarily in regions where they cannot stand the unfavourable seasons (very often it is difficult to decide from herbarium specimens if a species is indigenous or only growing temporarily).
- **Pollution** of the water allowing Lemnaceae to grow in waters of humid regions where otherwise the nutrient content would not be sufficient
- **Temperature of the water higher or lower than normal** enabling the species to grow in cooler or warmer regions (warm or cool springs, warm inlet, warmer or cooler water from regions with different climate)
- **Higher or lower nutrient content** than would correspond to water of the general climate (river water coming from drier or moister regions)
- **Creation of artificial water** by man (e.g. fish ponds, water reservoirs, irrigation ditches, paddy fields)

6.3.1.3. Some examples of interfering local factors

It is known that in the Rocky Mountains and in the Andes, the species grow at much higher altitudes than is to be expected because warm springs occur (see chapter 6.2).

In the Piedmont of North and South Carolina (LANDOLT 1981) as well as in some tropical regions the soils are very old and poor in nutrients. Waters are much more oligotroph than would be expected from the amount of precipitation. Therefore, Lemnaceae are very rare in these regions. A similar observation was made by JACOBS (1947) on the distribution of Lemnaceae in a granite area in Minnesota.

The water of the Nile in lower Egypt and the water of the Okovango in Botswana are much lower in mineral content than the local waters which are too concentrated for many species of Lemnaceae. In the overflow of these rivers several species of Lemnaceae can be found which otherwise are not present in the region.

In Switzerland the climate is too humid for L. gibba. Today the species is only found occasionally introduced by birds but cannot survive for long. Earlier, before the sewage waters was canalised, the species grew in ditches around the villages.

DIEKJOBST (1984) found L. aequinoctialis temporarily in a warm inlet in Nordrhein-Westfalen, FRG, in a region which is too cool for this species.

temperatures (e.g. L. trisulca, L. turionifera, S. polyrrhiza). Species with a high minimum growth temperature (e.g. S. polyrrhiza, W. arrhiza) require a relatively long period with temperatures over 10°C , whereas species with low minimum growth temperatures (e.g. L. minor, L. gibba, L. trisulca) perform well within a shorter period (50 days) of temperatures over 10°C . It can be assumed that waters can reach temperatures several degrees higher than the monthly mean. This is true, at least temporarily, in regions with high solar radiation. Very few places with oceanic climate may have Lemnaceae even if the mean temperature does not quite reach 10°C but stays above 0°C during the whole year (e.g. S. punctata at the southern tip of South America or L. gibba at high altitudes in the subtropical Andes. The northern limit of the distribution of Lemnaceae follows rather exactly the line of 50 days with a mean temperature above 10°C (LANDOLT 1982a,b). This limit is somewhat to the south of the northern tree line. In two regions (Iceland, eastern Canada) the limit of Lemnaceae occurrence is further south due to the relatively high precipitation (cf. chapter 6.3.2.5).

6.3.2.2. Limiting minimum temperatures

The absolute minimum temperatures are important for species which are sensitive to freezing and have not the possibility to avoid the cold by sinking to the bottom of the water. It can be shown that W. oblonga does not grow in regions with lower absolute minimum temperatures than -10°C even if the average winter temperatures are 10°C or more. A similar limit is the absolute minimum temperature of -8°C for W. lingulata and the absolute minimum temperature of 0°C for W. Welwitschii. It is probable that other tropical species (L. tenera, W. rotunda, W. denticulata, W. neotropica, W. microscopica, W. hyalina, W. repanda, W. elongata) have similar minimum limits.

The limits of too cool regions may be determined by

- temperature tolerance of fronds
- possibility of sinking to warmer layers of water during cool seasons.

The mean temperature of the three coolest months is taken as a measure of the limits of the species against too cool regions. Lemnaceae can be found in regions with winters down to -40°C mean temperature. It is assumed that for some species the winter temperatures are not limiting provided that all other factors are favourable. The limiting winter tem-

peratures for each species are summarized in table 6.5.

S. polyrrhiza and L. turionifera can stand the cold because they form turions which sink to the bottom of the water. The submersed L. trisulca has also the same possibility of avoiding the cold. On the other hand, L. minor is not able to form true turions. Some buds sink together with wilting fronds to deeper layers of water. But the chance of surviving is probably much smaller for these little buds without special starch accumulation than for the true turions. The limiting temperature is therefore -15°C .

Table 6.5. Temperature limits of the three coolest months for Lemnaceae species
 All species not mentioned do not grow in regions with lower average monthly temperature than 18°C

temperature ($^{\circ}\text{C}$)	-40	-15	-8	-1	+1	+8	+13	+18
L. trisulca	_____							
L. turionifera	_____							
S. polyrrhiza	_____							
L. minor	_____							
L. perpusilla	_____							
W. borealis	_____							
W. arrhiza	_____							
W. columbiana	_____							
L. gibba	_____							
L. japonica	_____							
L. minuscula	_____							
L. valdiviana	_____							
W. gladiata	_____							
W. brasiliensis	_____							
L. obscura	_____							
L. disperma	_____							
W. globosa	_____							
S. punctata	_____							
W. australiana	_____							
L. aequinoctialis	_____							
W. angusta	_____							
W. oblonga	_____							
W. lingulata	_____							
S. intermedia	_____							
W. denticulata	_____							
W. hyalina	_____							
W. repanda	_____							
W. rotunda	_____							
W. microscopica	_____							

The three Wolffia species W. columbiana, W. arrhiza, and W. borealis are able to form turions of which it is known that they are more sensitive to deep temperatures than those of S. polyrrhiza (see chapter 2.5.1). The same is probably true for the seeds of L. perpusilla. They are not found in regions with deeper winter temperatures than -8°C . The -1°C limit is found in moderately cold tolerant species which do not form true turions or seeds (e.g. L. gibba, L. japonica, L. minuscula, L. valdiviana, L. obscura). The fronds of L. aequinoctialis are rather sensitive to the cold (limit: $+8^{\circ}\text{C}$). In regions where it overwinters as seeds (U.S.A., Southern Europe, Japan) or as turions (Japan) the limits shift to the -8°C line. W. brasiliensis which forms turions and W. gladiata which grows submerged are probably very sensitive to the cold that they cannot exist in regions with colder winters than -1°C . The other species are still more sensitive and cannot be found in regions with deeper winter temperatures than $+1^{\circ}\text{C}$ (S. punctata, L. disperma, W. australiana, W. globosa) or $+8^{\circ}\text{C}$ (W. oblonga, W. lingulata, S. intermedia, W. angusta) or even $+13^{\circ}\text{C}$ (W. denticulata, W. hyalina, W. rotunda, W. repanda, W. microscopica). The true tropic species (L. tenera, L. ecuadoriensis, W. Welwitschii, W. neotropica, W. elongata) do not normally grow in regions with mean temperatures below 18°C .

6.3.2.3. Limiting maximum temperatures

It is known that some species (e.g. L. trisulca) are not able to grow at temperatures above $26-34^{\circ}\text{C}$ for any length of time (LANDOLT 1957). It is therefore not surprising that some species are limited in nature by high mean temperatures. As a measure, the mean temperature of the three warmest months is taken. The temperature of the water is usually higher than the temperature at the air, due to the solar radiation; also the temperature of the air might well be much higher in some years than the average. Therefore, limiting temperature of the three warmest months is well below the limiting physiological longterm temperature. For L. trisulca, 22°C is the climatically limiting temperature, under cultural conditions it can stand up to $26-30^{\circ}\text{C}$ for longer periods depending on the clone. Species with climatic limits of 26°C or lower are mainly distributed in temperate regions. A survey of the limiting temperatures of the three warmest months is given in table 6.6.

Table 6.6. Temperature limits of the three warmest months for Lemnaceae species

All species not mentioned are able to grow at mean temperatures above 28°C

temperature °C	22	24	26	28
L. trisulca	_____			
W. borealis	_____			
W. australiana	_____			
L. minor	_____	_____		
L. perpusilla	_____	_____		
L. disperma	_____	_____		
W. denticulata	_____	_____		
L. gibba	_____	_____	_____	
L. turionifera	_____	_____	_____	
L. minuscula	_____	_____	_____	
L. obscura	_____	_____	_____	
L. japonica	_____	_____	_____	
W. gladiata	_____	_____	_____	
S. punctata	_____	_____	_____	_____
W. arrhiza	_____	_____	_____	_____
W. columbiana	_____	_____	_____	_____
W. brasiliensis	_____	_____	_____	_____
W. oblonga	_____	_____	_____	_____

6.3.2.4. Limiting low temperatures of the three warmest months

(table 6.7)

Some of the species of Lemnaceae do not occur in regions with too cool temperatures even if all other factors are favourable. As a rule, the lowest mean summer temperature for Lemnaceae is about 8°C (S. punctata, L. gibba, L. trisulca, L. minor). At least 12°C is required by L. turionifera, L. disperma and L. valdiviana. S. polyrrhiza and L. minuscula need 16°C mean summer temperature. 18°C is necessary for L. obscura, L. perpusilla, L. japonica, W. oblonga, W. gladiata, W. denticulata, W. borealis, W. australiana, W. arrhiza, W. columbiana. Still higher temperatures are required for S. intermedia, L. aequinoctialis (20°C), W. brasiliensis, W. angusta, W. globosa (22°C) and L. tenera, L. ecuadoriensis, W. hyalina, W. repanda, W. rotunda, W. neotropica, W. Welwitschii, W. lingulata, W. microscopica, W. elongata, (24°C).

Table 6.7. Lowest mean temperature of the three warmest months needed for Lemnaceae species
 All species not mentioned require temperatures of at least 24°C

temperature °C	10	12	16	18	20	22
S. punctata	_____					
L. gibba	_____					
L. minor	_____					
L. trisulca	_____					
L. turionifera	_____	_____				
L. disperma	_____	_____				
L. valdiviana	_____	_____				
S. polyrrhiza	_____	_____	_____			
L. minuscula	_____	_____	_____			
L. obscura	_____	_____	_____	_____		
L. perpusilla	_____	_____	_____	_____		
L. japonica	_____	_____	_____	_____		
W. oblonga	_____	_____	_____	_____		
W. gladiata	_____	_____	_____	_____		
W. denticulata	_____	_____	_____	_____		
W. borealis	_____	_____	_____	_____		
W. australiana	_____	_____	_____	_____		
W. arrhiza	_____	_____	_____	_____		
W. columbiana	_____	_____	_____	_____		
L. aequinoctialis	_____	_____	_____	_____	_____	
S. intermedia	_____	_____	_____	_____	_____	
W. brasiliensis	_____	_____	_____	_____	_____	_____
W. angusta	_____	_____	_____	_____	_____	_____
W. globosa	_____	_____	_____	_____	_____	_____

6.3.2.5. Limiting amount of precipitation

The precipitation has an influence on the mineral composition of the water of a region. The lower the amount of precipitation at the same temperature the higher the concentration of soluble ions of the water. At higher temperatures the amount of precipitation must be greater than at lower temperatures to cause the same effect due to greater evaporation. The aridity factor of Martonne takes this differences into account and is therefore used here as a measure of mean mineral concentration of the water. The aridity factor (i) is calculated by the amount of annual precipitation in cm (N) divided by the mean annual temperature in °C (T)

In regions with an aridity factor below 1, waters are only temporary or too concentrated for the existence of Lemnaceae. Rare cases of occurrence of Lemnaceae in such zones are due to water supply from more humid regions (irrigations). On the other hand, there are also regions with too much precipitation for growth of Lemnaceae as this results in too oligotrophic waters. Lemnaceae are lacking in regions with an aridity factor of Martonne higher than 8: e.g. Borneo, southwest coast of India, coast of Cameroun, southwestern Norway, northeastern Canada, coastal area of northwestern Canada and Alaska, southern Chile and many mountain regions.

The different species show different reactions to the precipitation regime (table 6.8). There are species with wide tolerances (L. aequinoctialis, S. polyrrhiza) and endemic species with a very narrow distribution (e.g. W. microscopica, W. neotropica, L. tenera).

The most favourable climate for the growth of Lemnaceae is in regions with an aridity factor between 3 and 4. Only six species have been found mostly outside this range.

6.3.3. Distribution within the climate zones

The distribution of the species of Lemnaceae shows a concentration of species in some climate zones of the world (fig. 6.3, p. 236). Figure 6.34 presents an arrangement of the climate zones of the world according to WALTER et al. (1975) and to WALTER and BRECKLE (1983). In table 6.9, the occurrence of the species within each climate zone is shown. A distinct center can be seen in the climate zone V, secondary centers in the climate zones II and VI.

The neighbouring transition zones are also relatively rich in species. There are some differences between the genera. Whereas Spirodela and Wolffia show a similar pattern as the family, Lemna has its own center in climate zone VI and Wolffiella in zone II.

From table 6.3, it is evident that each species makes different demands on the climate and that it is nearly impossible to make characteristic groups of species.

Table 6.9. Occurrence of Lemnaceae species within climate zones (explanations see fig. 6.34)
 xx frequent occurrence, x occasional occurrence (rare occurrences are not considered)

-- climatic centers of distribution

Climate zones	I		I- II		I- III		I- IV		II		II- III		II- IV		III- IV		IV- V		IV- VI		IV- VII		V- VI		V- VII		VI- VII		VI- VIII		VII- VIII		VIII- IX			
	x	xx	x	xx	x	xx	x	xx	x	xx	x	xx	x	xx	x	xx	x	xx	x	xx	x	xx	x	xx	x	xx	x	xx	x	xx	x	xx				
S. intermedia	x		x		x		x																													
S. polyrhiza	x		x		x		x																													
S. punctata	x		x		x		x																													
L. gibba																																				
L. disperma																																				
L. minor																																				
L. japonica																																				
L. ecuadoriensis																																				
L. obscura																																				
L. turionifera																																				
L. trisulca																																				
L. perpusilla																																				
L. aequinoctialis																																				
L. tenera																																				
L. valdiviana																																				
L. minuscula																																				
W. hyalina																																				
W. repanda																																				
W. rotunda																																				
W. neotropica																																				
W. Melwitschii																																				
W. Lingulata																																				
W. oblonga																																				
W. gladiata																																				
W. denticulata																																				
W. microscopica																																				
W. elongata																																				
W. brasiliensis																																				
W. borealis																																				
W. australiana																																				
W. angusta																																				
W. arrhiza																																				
W. columbiana																																				
W. globosa																																				
Total of "x"	2	3	4	4	3	2	5	0	2	2	2	1	1	1	6	3	3	3	2	1	1	1	1	2	2	3	3	2	1	0	1	0	1	0		
Spirodela	5	4	1	4	4	1	3	0	3	7	6	3	10	6	9	9	3	11	4	6	2	4	2	4	5	2	2	2	4	5	2	2	0	2	0	
Lemna	3	3	0	2	9	5	7	0	1	2	2	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Wolffella	3	4	4	2	7	2	7	0	0	1	0	0	0	0	11	5	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Wolffia																																				
Lemnaceae	13	14	9	12	23	10	22	0	6	12	10	7	4	33	18	8	19	5	7	3	4	6	2	2	6	2	4	6	2	4	6	2	0	2	0	

Fig. 6.34 (page 405). Climate zones according to WALTER et al. (1975) and WALTER and BRECKLE (1983) (published with the kind permission of Prof. Dr. H. Walter)

The numbers represent the following climate zones:

- I Equatorial zone
High temperatures ($>20^{\circ}\text{C}$) and high precipitation (>100 mm per month) throughout the year. Tropical rain forests.
- II Tropical zone of summer rains
Warm to hot summers with high precipitation, and cooler dry winters; no frosts. Tropical deciduous forests or savannas.
- III Subtropical dry zone
Great temperature variation during the day and during the year; occasionally slight frosts; annual precipitation <200 mm. Deserts.
- IV Mediterranean zone
Warm dry summers, mild humid winters; slight frosts possible. Sclerophyllous forests.
- V Warm temperate zone
Warm humid summers, mild winters; slight frosts possible. Laurel forests.
- VI Typical temperate zone
Warm summers, cool winters (with frosts); moderately humid throughout the year. Summer green deciduous forests.
- VII Temperate dry zone
Continental conditions with great temperature variations, warm summers, cold winters. Steppes or deserts.
- VIII Cool temperate zone
Cool humid summers, long cold winters. Boreal coniferous forests.
- IX Polar zone
Cool summers ($<10^{\circ}\text{C}$) and very long cold winters. Tundras.

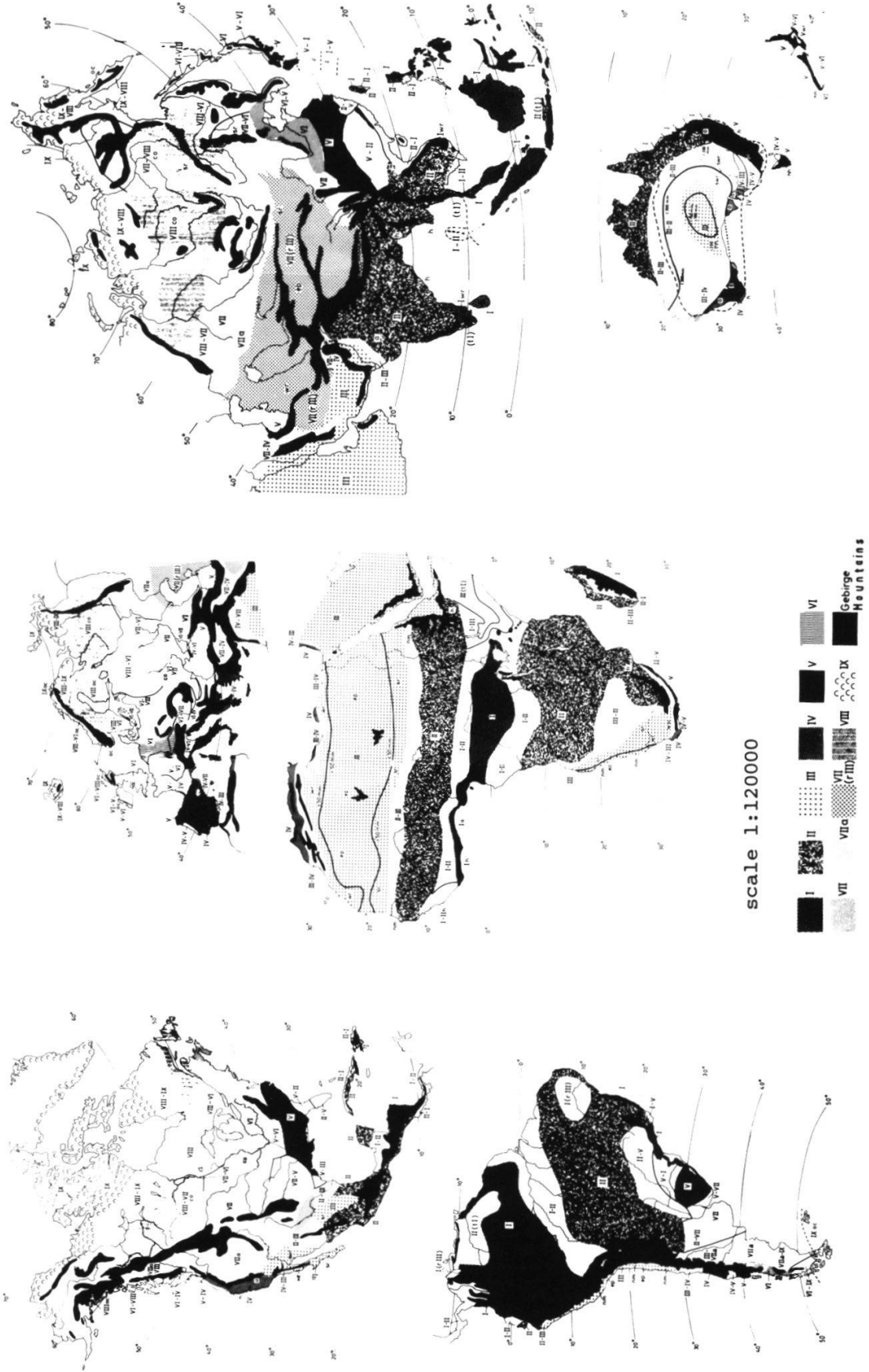


Fig. 6.34. Climate zones of the world (for further information see p. 404)

6.4. DISPERSAL AND THREAT BY MAN

As pointed out in chapter 5.5.1, some of the Lemnaceae species which were called pioneer species are easily distributed by man (e.g. in aquacultures, piscicultures). On the other hand, follower species such as L. trisulca, W. neotropica, W. lingulata, W. oblonga, W. gladiata, W. denticulata, are rarely distributed by man. They have difficulty establishing themselves in a new place under different conditions.

For the following species, it is known, that they have expanded due to dispersal by man.

Spirodela punctata (fig. 6.35)

The original distribution of the species is uncertain. We know of early records from southeastern Asia and Australia. The first preserved collection from South America dates back to 1838 (Wilke's collection from Orange Harbor). The earliest description of the species was made by MEYER in 1818 from a lost collection from Essequibo River (Guyana). Since then, S. punctata was never found in that region. Therefore, it is possible that the material of Meyer consisted of small fronds of S. intermedia which is widespread in South America. A second station from northern South America (San Fernando, Colombia) is only represented by a single group. Today, the species is frequent in the regions of Sao Paulo and Rio de Janeiro. The first collection dates back to 1876 (MOTEN 4661). All the other collections were not made before 1960. In South Africa there is also one single old collection (Zeiher, before 1850), though the species is widespread today. For Zimbabwe, the first record is 1956 (Ellis 57610). Recently (1970), the species has also been found in Egypt (Sisi ZT* 7366). In North America, the species is very widespread today in the southern States and completely naturalized. The first known occurrence was observed in 1930 (SAEGER 1934). Further introductions were to Japan (MIKI 1934), New Zealand (LANCASTER 1930, MASON 1950, BANGERTER 1978), Israel (RIMON and GALUN 1968a), Canary Islands (Hauser 1971: ZT* 7536), Northern Italy (PIGNATTI 1957; probably extinct again).

S. punctata is one of the most common aquarium plants and therefore easily distributed.

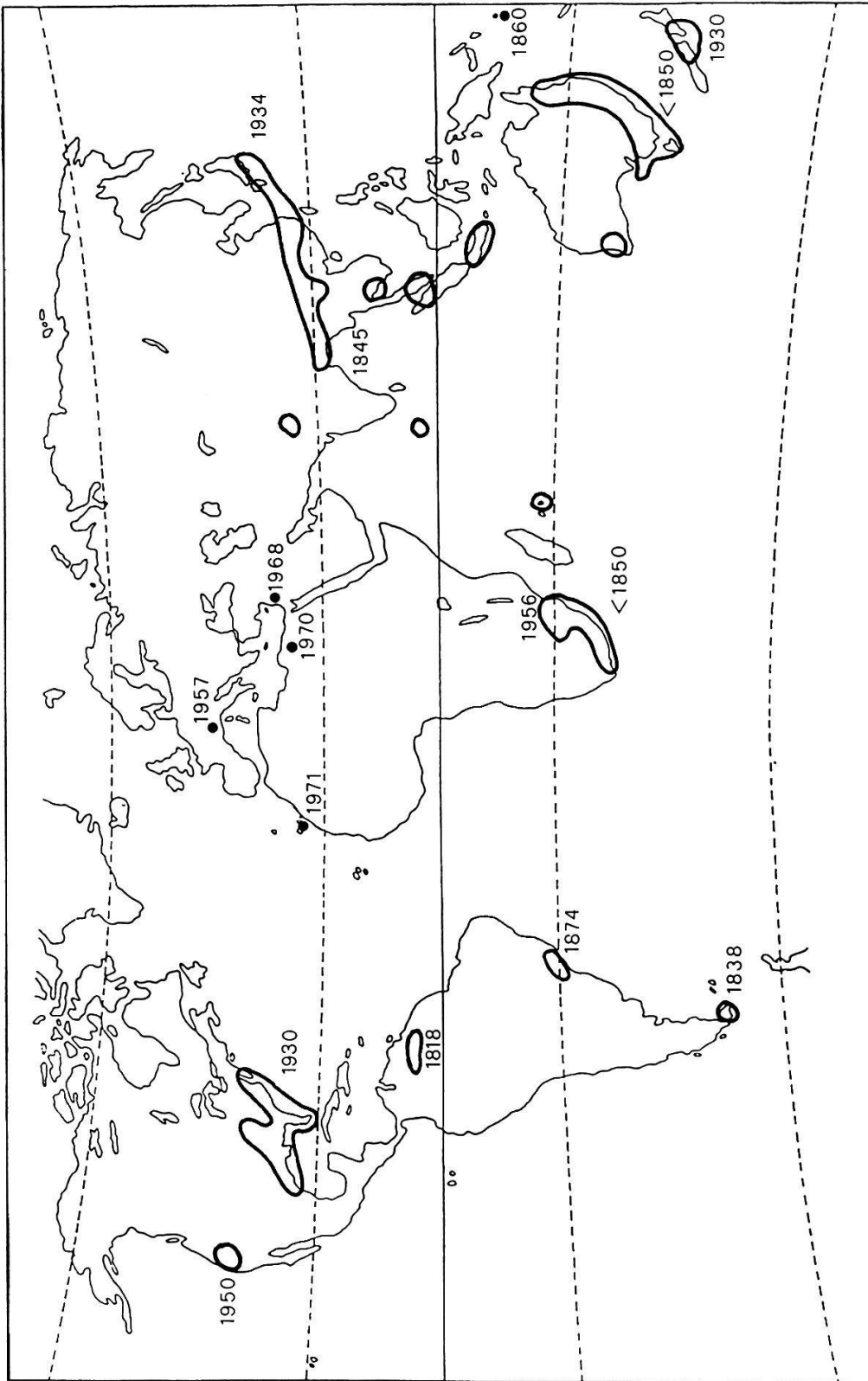


Fig. 6.35. Distribution of *Spirodela punctata* with the year of the first record. It is supposed that at least localities which have been detected after 1900 for the first time do not belong to the original distribution.

Lemna gibba

The only known stations which are far from the natural distribution area lie in the eastern central part of Honshu, Japan.

Lemna minor

Outside the original distribution, the species can be found in New Zealand where it is quite naturalized, and in the region of Melbourne, Australia. Though the first known record from New Zealand dates back to 1865 (Kirk from Auckland) the species must have been introduced since the next natural occurrence of L. minor is more than 10,000 km away (Himalayas, California). In some of the southern Atlantic Islands (Ascension, St. Helena), the species may have been introduced, too.

Lemna obscura

The only occurrence of L. obscura outside the southeastern part of North America is in Hawaii, where the species was first observed in 1970 (Herbst ZT* 7225).

Lemna turionifera

Recent introductions of L. turionifera to Hamburg and to Berlin, FRG, were observed by HEECKMANN (1984) and SCHOLZ (in lit. 1985), respectively.

Lemna aequinoctialis

The original distribution of L. aequinoctialis is pantropical. The species followed the rice culture far northwards (e.g. to northern Japan, southern Europe). As a frequent aquarium plant, it is easily distributed and may be found temporarily also in cooler countries (e.g. in Nordrhein-Westfalen, FRG, by DIEKJOBST 1984).

Lemna minuscula

L. minuscula is an excellent example of a recent introduction to Europe and Japan by man and of a fast expansion. In Europe, it has spread out and naturalized from southwestern France where it was found for the first time in 1965 (JOVET and JOVET 1966, 1967). It was observed in 1968 in Baden, FRG (KANDELER 1973), in 1975 in Switzerland and in Alsace, eastern France (LANDOLT 1979), in 1977 in England (LANDOLT 1979, LESLIE and WALTERS 1983), in 1982 in Nordrhein-Westfalen, FRG (DIEKJOBST

1983b), in 1983 in Belgium (LAWALREE 1984), and in the Ukraina, USSR (DUBYNA and PROTOPOPOVA 1983), in 1984 in Hungary (ZT* 8872c).

It is expected that L. minuscula will be distributed throughout the whole of western, central and southern Europe within the next ten years.

Wolffiella hyalina

Some recent records of this African species from central India (RAMAYYA and RAJAGOPAL 1975) probably concern an introduction.

Wolffia borealis

ARMSTRONG (1982) reports the introduction of W. borealis into southern California.

Wolffia globosa

The original distribution of W. globosa seems to be in southeastern Asia and Africa. The occurrence of the species in Hawaii (Herbst 1970: ZT* 7470) and North America, California (Nobs and Smith 1949: AD, ARIZ, CAS, CU, DS, RM, WIS, WS, WTU; MASON 1957) and Florida (Armstrong 1983: ARMSTRONG 1985), is most probably not native.