Mem. Inst. Oswaldo Cruz, Rio de Janeiro, Vol. *88* (2): 221-230, apr./jun. 1993

A PROGRAMME FOR COMPUTER AIDED IDENTIFICATION OF PHLEBOTOMINE SANDFLIES OF THE AMERICAS (CIPA) – PRESENTATION AND CHECK-LIST OF AMERICAN SPECIES

CIPA GROUP*

*H. BERMUDEZ (Bolivia); J. P. DEDET (Bolivia); M. DUNCAN (U.S.A.); A. L. FALCÃO (Brazil); M. D. FELICIANGELI (Venezuela); C. FERRO (Colombia); E. A. B. GALATI (Brazil); E. A. GOMEZ-LANDIRES (Ecuador); M. V. HERRERO (Costa-Rica); D. HERVAS (Bolivia); J. LEBBE (France); A. MORALES (Colombia); E. OGUSUKU (Peru); J. E. PEREZ (Peru); E. F. RANGEL (Brazil); I. A. SHERLOCK (Brazil); M. TORREZ+ (Bolivia); R. VIGNES (France); M. WOLFF (Colombia) & D. G. YOUNG (U.S.A.)

The CIPA programme is a collaborative project including two entomologists from France and seven from South and Central America countries. Its objective is the development of an expert system for computer aided identification of phlebotomine sandflies from the Americas. It also includes the formation of data bases for bibliographic, taxonomic and biogeographic data. Participant consensus on taxonomic prerequisites, standardization in bibliographic data collections and selection of descriptive variables for the final programme has been established through continuous communication among participants and annual meetings. The adopted check-list of American sandflies presented here includes 386 specific taxa, ordered into three genera and 28 sub-genera or species groups.

Key words: phlebotomine sandflies – America – computer identification – taxonomy

Phlebotomine sandflies are the vectors of several diseases of medical and veterinary importance, including leishmaniasis, bartonellosis and arboviroses. In the New-World, approximately 400 sandfly species have been described to date. Only a small percentage of those species are suspected or proven vectors of disease. Thus precise identifications of sandfly species are indispensable for epidemiological studies and disease control programs.

The data concerning American phlebotomine sandflies are numerous. The literature on this subject spans this century. Unfortunately, access to many articles is limited and available publications exist in at least four languages (English, French, Portuguese and Spanish). This situation as well as communication barriers between taxonomists has resulted in extensive heterogeneity in species descriptions, a significant accumulation of synonyms and misidentifications, and finally a failure to update much of the information available.

A concentration and standardization of the information available for American phlebotomine sandflies can best be accomplished using computer technology. Computers permit storage of large quantities of diverse information in an easily accessible and up to date form. Also a specific computer aided identification (CAI) programme might improve traditional methods of sandfly identification.

The purpose of this paper is to describe such a programme, the CAI programme for Phlebotomine sandflies of the Americas (CIPA programme) which is currently in progress.

This research was supported in part under grant no. DHR-5600-G-00-0060-00 Program Science and Technology Cooperation, Office of the Science Advisor, U.S. Agency for International Development, and by the Scientific and Technic Cooperation of the Ministry of Foreign Affairs of France.

+Corresponding author – Instituto Boliviano de Biologia de Altura, c/o Embajada de Francia, Casilla 717, La Paz (Bolivia).

Received 8 September 1992.
Accepted 2 March 1993.

CIPA PROGRAMME

The primary objective of CIPA is the development of an expert system for computer aided identification of phlebotomine sandflies from the Americas. It also includes the formation of data bases for bibliographic, taxonomic and biogeographic data.

The CIPA Programme is coordinated at the Bolivian Institute of High Altitude, La Paz, Bolivia. It was developed with the computing expertise of two French scientists and the collaboration of 15 entomologist from seven South and Central America countries.

This programme is based on a previous study carried out in French Guiana by Lebbe et al. (1988). They developed an expert system in English and French that fits on a IBM compatible computer diskette. The system is complemented by a fully illustrated text.

The CIPA Programme uses the XPER-programme (Lebbe, 1984), a generator of expert system for computer aided identification. The XPER-programme was the first expert system generator programme specifically developed for microcomputers. It is well adapted to biological data management and has already been used for several biological and medical applications, some of them accessible to the French telematic MINITEL System (Lebbe et al., 1989).

XPER-software is used to create a knowledge base which accumulates the descriptions of all Phlebotomine sandfly species reported in the participating countries, utilizing a standard-description form previously established by the CIPA Group (1991a).

Participant consensus on taxonomic prerequisites, standardization in collection of bibliographic data and selection of descriptive variables for the final program has been established through continuous communication among participants and annual meetings. The collections of bibliographic and descriptive data are realized according to standards jointly elaborated.

Currently 96 internal and external morphologic characteristics are considered in the standard sandfly description; 90 characters are listed in a previous article (CIPA Group, 1991a). The final number of variables (descriptors) included in the CAI programme will eventually exceed this number because new variables such as ratios, indices, etc. . . will also be calculated from existing variables.

TAXONOMIC REQUISITES

The sandfly taxa of the Americas were previously selected and their hicrarchical disposition adopted, according to the classification system defined by Young & Ducan (1993).

The list includes all the valid species descriptions published by December 1990. The taxa published after that date were discarded from the list, including those commonly referred in the literature under provisional names, such as "Sp. no 260", "Sp. C" or "Sp. from Três Esquinas". *Lutzomyia maracayensis* and *L. singularis,* two inadequately described species unavailable for correct subsequent identification, were not considered in the list.

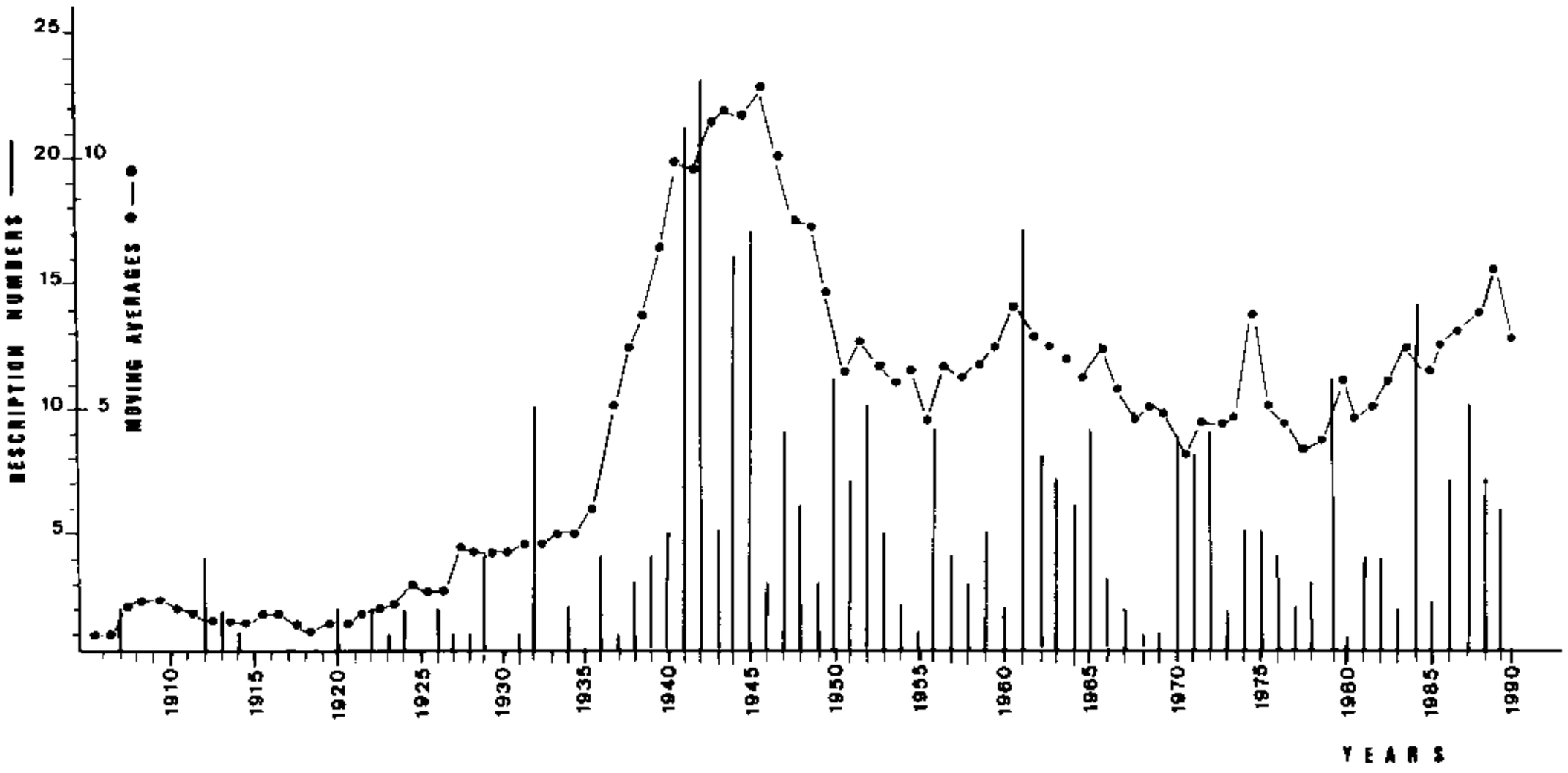
An agreement was found concerning their organization into generic and sub-generic categories. The two sub-generic categories, subgenus and species group, were maintained and considered as same rank, the last one corresponding to non definitive taxa. The "series" were suppressed. Some species of the *Lutzomyia* genus were not grouped in any sub-generic category, and fit with the heading "ungrouped species". Sub-species of the Young and Duncan classification were considered at the same rank as species taxa.

The choices adopted and the maintenance of the imperfections of this classification were guided by pragmatic reasons, the elaboration of a classification according to the formal taxonomic rules being expected as a final result of the programme.

CHECK-LIST OF AMERICAN SANDFLIES

The adopted check-list of American sandflies includes 386 specific taxa, ordered into 3 genera and 28 sub-genera or species groups, (CIPA Group, 1991b).

Figure shows the yearly numbers of descriptions of new sandfly taxa and the 10 year moving averages. The average of these 10 year moving averages reaches 4.57, the minimal and maximal values being respectively 0.3 and 11.4.



The yearly numbers of descriptions of new sandfly taxa and the ten year moving averages.

The first two descriptions of American sandflies were made by Coquillett in 1907 (*Flebotomus cruciatus* and *F. vexator*). During the period 1907-1935, only 41 new species were described over a period of 15 years, while no new species was described during the other 13 years.

Since 1936, 345 new descriptions were made over 53 years, one or more species being described per year. In the productive period 1941-45, 82 new species were described, 23 during 1942. This period corresponded to the works of Mangabeira and co-workers in Rio de Janeiro, Berretto and co-workers in São Paulo, and Floch and Abonnenc in French Guiana. In Panamá, Fairchild described 50 new taxa (12.9% of the total of the American species described), of which 4% were described in collaboration with Hertig. Working in Minas Gerais, Martins and co-workers described 44 new taxa (11.4% of the total).

The check-list of American sandflies is established as follow:

GENUS *BRUMPTOMYIA* França & Parrot 1921

B. avellari	(Costa Lima, 1932)
B. beaupertuyi	(Ortiz, 1954)
B. bragai	Mangabeira & Sherlock, 1961
B. brumpti	(Larrousse, 1920)
B. cardosoi	(Barreto & Coutinho, 1941)
B. cunhai	(Mangabeira, 1942)
B. devenanzii	(Ortiz & Scorza, 1963)
B. figueiredoi	Mangabeira & Sherlock, 1961
B. galindoi	(Fairchild & Hertig, 1947)
B. guimaraesi	(Coutinho & Barretto, 1941)
B. hamata	(Fairchild & Hertig, 1947)
B. leopoldoi	(Rodriguez, 1953)
B. mangabeirai	(Barreto & Coutinho, 1941)
B. nitzulescui	(Costa Lima, 1932)
B. orlandoi	Fraiha, Shaw & Lainson, 1970 Martins, Silva & Falcão, 1971
B. ortizi	(Barretto, 1947)
B. pentacantha	(Costa Lima, 1932)
B. pintoi	(Floch & Abonnenc, 1943)
B. spinosipes	(Mangabeira, 1942)
B. travassosi	(Lutz, 1922)
B. troglodytes	Mangabeira & Sherlock, 1961
B. virgensi	

GENUS *WARILEYA* Hertig, 1948

*Sub-genus *WARILEYA* Hertig, 1948	
W. fourgassiensis	Le Pont & Desjeux, 1984

W. nigrosaccula	Fairchild & Hertig, 1951
W. phlebotomanica	Hertig, 1948
W. rotundipennis	Fairchild & Hertig, 1951
W. yungasi	Velasco & Trapido, 1974
*Sub-genus HERTIGIA Fairchild, 1949	
W. hertigi	(Fairchild, 1949)
GENUS *LUTZOMYIA* França, 1924	
**ARAGAOI* Group Theodor, 1965	
L. abunaensis	Martins, Falcão & Silva, 1965
L. aragaoi	(Costa Lima, 1932)
L. berrettoi barrettoi	(Mangabeira, 1942)
L. barrettoi majuscula	Young, 1979
L. brasiliensis	(Costa Lima, 1932)
L. carpenteri	(Fairchild & Hertig, 1953)
L. coutinhoi	(Mangabeira, 1942)
L. inflata	(Floch & Abonnenc, 1944)
L. pascalei	(Coutinho & Barretto, 1940)
L. runoides	(Fairchild & Hertig, 1953)
L. texana	(Dampf, 1938)
**BAITYI* Group Theodor, 1965	
L. baityi	(Damasceno, Causey & Arouck, 1945)
L. gorbitzi	(Blancas, 1960)
L. moucheti	Pajot & Le Pont, 1978
*Sub-genus *COROMYIA* Barretto, 1962	
(Cf. *VESPERTILIONIS* Group Theodor, 1965)	
L. aquilonia	(Fairchild & Harwood, 1961)
L. beltrani	(Vargas & Nájera, 1951)
L. deleoni	(Fairchild & Hertig, 1947)
L. disneyi	Williams, 1987
L. isovespertilionis	(Fairchild & Hertig, 1958)
L. steatopyga	(Fairchild & Hertig, 1958)
L. vesicifera	(Fairchild & Hertig, 1947)
L. vespertilionis	(Fairchild & Hertig, 1947)
L. viriosa	(Fairchild & Hertig, 1958)
L. zeledoni	Young & Murillo, 1984
*Sub-genus *DAMPFOMYIA* Addis, 1945	
L. anthophora	(Addis, 1945)
L. atulapai	(Léon, 1971)
L. dodgei	(Vargas & Nájera, 1953)
L. insolita	(Fairchild & Hertig, 1956)
L. permira	(Fairchild & Hertig, 1956)
L. rosabali	(Fairchild & Hertig, 1956)
**DELPOZOI* Group Lewis et al., 1977	
L. delpozoi	(Vargas & Nájera, 1953)
L. inusitata	(Fairchild & Hertig, 1961)
L. piedraferroi	Léon, 1971
**DREISBACHI* Group Lewis et al., 1977	
L. aclydifera	Fairchild & Hertig, 1952
L. dreisbachi	(Causey & Damasceno, 1945)
L. hermanlenti	Martins, Silva & Falcão, 1970
L. ruparupa	Martins, Llanos & Silva, 1976
*Sub-genus *EVANDROMYIA* Mangabeira, 1941	
L. begonae	(Ortiz & Torrez, 1975)
L. bourrouli	(Barretto & Coutinho, 1941)
L. brachyphalla	(Mangabeira, 1941)
L. cerqueirai	(Causey & Damasceno, 1945)
L. infraspinosa	(Mangabeira, 1941)
L. inpai	Young & Arias, 1977
L. monstruosa	(Floch & Abonnenc, 1944)
L. pinottii	(Damasceno & Arouck, 1956)
L. teratodes	Martins, Falcão & Silva, 1964

*Sub-genus *HELCOCYRTOMYIA* Barretto, 1962	
(Cf. *VEXATOR* Group Theodor, 1965)	
L. apache	Young & Perkins, 1984
L. ayacuchensis	Cáceres & Galati, 1988
L. blancasi	Galati & Cáceres, 1990
L. botella	(Fairchild & Hertig, 1961)
L. caballeroi	Blancas, Cáceres & Galati, 1989
L. ceferinoi	(Ortiz & Alvarez, 1963)
L. cirrita	Young & Porter, 1974
L. erwindonaldoi	(Ortiz, 1978)
L. hartmanni	(Fairchild & Hertig, 1957)
L. imperatrix	(Alexander, 1944)
L. larensis	Arredondo, 1987
L. noguchii	(Shannon, 1929)
L. oppidana	(Dampf, 1944)
L. osornoi	(Ristorcelli & Van Ty, 1941)
L. peruensis	(Shannon, 1929)
L. pescei	(Hertig, 1943)
L. sanguinaria	(Fairchild & Hertig, 1957)
L. scorzai	(Ortiz, 1965)
L. stewarti	(Mangabeira & Galindo, 1944)
L. strictivilla	Young, 1979
L. tejadai	Galati & Cáceres, 1990
L. tortura	Young & Rogers, 1984
L. valderramai	Cazorla, 1988
L. vargasi	(Fairchild & Hertig, 1961)
L. vexator	(Coquillett, 1907)
L. vindicator	(Dampf, 1944)
**LANEI* Group Theodor, 1965	
L. digitata	(Damasceno & Arouck, 1950)
L. lanei	(Barretto & Coutinho, 1941)
L. pelloni	(Sherlock & Alencar, 1959)
*Sub-genus *LUTZOMYIA* França, 1924	
L. alencari	Martins, Souza & Falcão, 1962
L. amarali	(Barretto & Coutinho, 1940)
L. araracuarensis	Morales & Minter, 1981
L. battistinii	(Hertig, 1943)
L. bicornuta	(Blancas & Herrer, 1960)
L. bifoliata	Osorno, Morales, Osorno & Hoyos, 1970
L. caligata	Martins, Falcão & Silva, 1965
L. carvalhoi	(Damasceno, Causey & Arouck, 1945)
L. castroi	(Barretto & Coutinho, 1941)
L. cavernicola	(Costa Lima, 1932)
L. cipoensis	Martins, Falcão & Silva, 1964
L. cruciata	(Coquillett, 1907)
L. cruzi	(Mangabeira, 1938)
L. diabolica	(Hall, 1936)
L. dispar	Martins & Silva, 1963
L. evangelistai	Martins & Fraiha, 1971
L. flabellata	Martins & Silva, 1964
L. forattinii	Galati, Rego, Nuñes & Teruya, 1985
L. gaminarai	(Cordero, Vogelsang & Cossio, 1928)
L. gasparviannai	Martins, Godoy & Silva, 1962
L. gomezi	(Nitzulescu, 1931)
L. ischyracantha	Martins, Falcão & Silva, 1962
L. ischnacantha	Martins, Souza & Falcão, 1962
L. lichyi	(Floch & Abonnenc, 1950)
L. longipalpis	(Lutz & Neiva, 1912)
L. marinkellei	Young, 1979
L. renei	(Martins, Falcão & Silva, 1957)
L. sherlocki	Martins, Silva & Falcão, 1971
L. souzalopesi	Martins, Silva & Falcão, 1970
L. spathotrichia	Martins, Falcão & Silva, 1963

**MIGONEI* Group Theodor, 1965	
L. andersoni	Le Pont & Desjeux, 1988
L. baculus	Martins, Falcão & Silva, 1965
L. bahiensis	(Mangabeira & Sherlock, 1961)
L. callipyga	Martins & Silva, 1965
L. cortelezzii	(Bréthes, 1923)
L. corumbaensis	Galati, Nuñes, Oshiro & Rego, 1989
L. costalimai	(Mangabeira, 1942)
L. carmelinoi	Ryan, Fraiha, Lainson & Shaw, 1986
L. dubitans	(Sherlock, 1962)
L. edwardsi	(Mangabeira, 1941)
L. evandroi	(Costa Lima & Antunes, 1936)
L. firmatoi	(Barretto, Martins & Pellegrino, 1956)
L. gruta	Ryan, 1986
L. lenti	(Mangabeira, 1938)
L. migonei	(França, 1920)
L. pacae	(Foch & Abonnenc, 1943)
L. petropolitana	Martins & Silva, 1968
L. sallesi	(Galvão & Coutinho, 1939)
L. sericea	(Floch & Abonnenc, 1944)
L. termitophila	Martins, Falcão & Silva, 1964
L. tupynambai	(Mangabeira, 1942)
L. walkeri	(Newstead, 1914)
L. williamsi	(Damasceno, Causey & Arouck, 1945)
L. xerophila	Young, Brenner & Wargo, 1983
*Sub-genus *MICROPYGOMYIA* Barretto, 1962 (*CAYENNENSIS* Group Theodor, 1965)	
L. atroclavata	(Knab, 1913)
L. californica	(Fairchild & Hertig, 1957)
L. cayennensis braci	Lewis, 1967
L. cayennensis cayennensis	(Floch & Abonnenc, 1941)
L. cayennensis hispaniolae	(Fairchild & Trapido, 1950)
L. cayennensis jamaicensis	(Fairchild & Trapido, 1950)
L. cayennensis maciasi	(Fairchild & Hertig, 1948)
L. cayennensis puertoricensis	(Fairchild & Hertig, 1948)
L. cayennensis viequesensis	(Fairchild & Hertig, 1948)
L. chiapanensis	(Dampf, 1947)
L. cubensis	(Fairchild & Trapido, 1950)
L. ctenidophora	(Fairchild & Hertig, 1948)
L. duppyorum	(Fairchild & Trapido, 1950)
L. durani	(Vargas & Nájera, 1952)
L. farilli	(Vargas & Nájera, 1959)
L. hardisoni	(Vargas & Nájera, 1952)
L. lewisi	Feliciangeli, Ordoñez & Fernandez, 1984
L. minasensis	(Mangabeira, 1942)
L. micropyga	(Mangabeira, 1942)
L. oliveirai	Martins, Falcão & Silva, 1970
L. quadrispinosa	(Floch & Chassignet, 1947)
L. schreiberi	Martins, Falcão & Silva, 1975
L. venezuelensis	(Floch & Abonnenc, 1948)
L. yencanensis	(Ortiz, 1965)
L. wirthi	(Vargas & Najera, 1951)
*Sub-genus *NYSSOMYIA* Barretto, 1962	
L. anduzei	(Rozeboom, 1942)
L. antunesi	(Coutinho, 1939)
L. bibinae	Léger & Abonnenc, 1988
L. edentula	(León, 1971)
L. flaviscutellata	(Mangabeira, 1942)
L. hernandezi	(Ortiz, 1965)
L. inornata	Martins, Falcão & Silva, 1965
L. intermedia	(Lutz & Neiva, 1912)
L. olmeca bicolor	(Fairchild & Theodor, 1971)
L. olmeca nociva	Young & Arias, 1982
L. olmeca olmeca	(Vargas & Nájera, 1959)

L. olmeca reducta	Feliciangeli, Ramirez, Perez & Ramirez, 1988
L. richardwardi	Ready & Fraiha, 1981
L. shawi	Fraiha, Ward & Ready, 1981
L. sylvicola	(Floch & Abonnenc, 1944)
L. trapidoi	(Fairchild & Hertig, 1952)
L. umbratilis	Ward & Fraiha, 1977
L. waltoni	Arias, Freitas & Barrett, 1984
L. whitmani	(Antunes & Coutinho, 1939)
L. ylephiletor	(Fairchild & Hertig, 1952)
L. yuilli yuilli	Young & Porter, 1972
L. yuilli pajoti	Abonnenc, Léger & Fauran, 1979

**OSWALDOI* Group Theodor, 1965

L. alphabetica	(Fonseca, 1936)
L. appendiculata	Martins, Falcão & Silva, 1961
L. breviducta	(Barretto, 1950)
L. borgmeieri	Martins, Falcão & Silva, 1972
L. capixaba	Dias, Falcão, Silva & Martins, 1987
L. fonsecai	(Costa Lima, 1932)
L. ferreirana	(Barretto, Martins & Pellegrino, 1956)
L. goiana	Martins, Falcão & Silva, 1962
L. longipennis	(Barretto, 1946)
L. machupicchu	Martins, Llanos & Silva, 1975
L. oswaldoi	(Mangabeira, 1942)
L. paterna	(Quate, 1963)
L. peresi	(Mangabeira, 1942)
L. pratti	(Vargas & Nájera, 1951)
L. pusilla	Dias, Martins, Falcão & Silva, 1986
L. quechua	Martins, Llanos & Silva, 1975
L. quinquefer	(Dyar, 1929)
L. ramirezi	Martins, Falcão, Silva & Miranda, 1982
L. rorotaensis	(Floch & Abonnenc, 1944)
L. saccai	Feliciangeli, Ramirez-Perez & Ramirez, 1989
L. trinidadensis	(Newstead, 1922)
L. zikani	(Barretto, 1950)

**PILOSA* Group Theodor, 1965

L. chassigneti	(Floch & Abonnenc, 1944)
L. mangabeirana	Martins, Falcão & Silva, 1963
L. pilosa	(Damasceno & Causey, 1944)

*Sub-genus *PINTOMYIA* Costa Lima, 1932

L. damascenoi	(Mangabeira, 1941)
L. fischeri	(Pinto, 1926)
L. gibsoni	(Pifano & Ortiz, 1972)
L. pessoai	(Coutinho & Barretto, 1940)

*Sub-genus *PRESSATIA* Mangabeira, 1942

L. calcarata	Martins & Silva, 1964
L. camposi	Rodriguez, 1952
L. choti	(Floch & Abonnenc, 1941)
L. dysponeta	(Fairchild & Hertig, 1952)
L. equatorialis	(Mangabeira, 1942)
L. triacantha	(Mangabeira, 1942)
L. trispinosa	(Mangabeira, 1942)

*Sub-genus *PSATHYROMYIA* Barretto, 1962
(= *SHANNONI* Group Theodor, 1965)

L. abonnenci	(Floch & Chassignet, 1947)
L. campbelli	(Damasceno, Causey & Arouck, 1945)
L. cratifer	(Fairchild & Hertig, 1961)
L. cuzquena	Martins, Llanos & Silva, 1975
L. dasymera	(Fairchild & Hertig, 1961)
L. dendrophyla	(Mangabeira, 1942)
L. guatemalensis	Porter & Young, 1986
L. lutziana	(Costa Lima, 1932)
L. pestanai	(Barretto & Coutinho, 1941)

L. punctigeniculata	(Floch & Abonnenc, 1944)
L. scaffi	(Damasceno & Arouck, 1956)
L. shannoni	(Dyar, 1929)
L. soccula	(Fairchild & Hertig, 1961)
L. souzacastroi	(Damasceno & Causey, 1944)
L. tanyopsis	Young & Perkins, 1984
L. undulata	(Fairchild & Hertig, 1950)
L. volcanensis	(Fairchild & Hertig, 1950)
*Sub-genus *PSYCHODOPYGUS* Mangabeira, 1941	
L. amazonensis	(Root, 1934)
L. arthuri	(Fonseca, 1936)
L. ayrozai	(Barretto & Coutinho, 1940)
L. bernalei	Osorno, Morales & Osorno, 1967
L. bispinosa	(Fairchild & Hertig, 1951)
L. carrerai carrerai	(Barretto, 1946)
L. carrerai thula	Young, 1979
L. chagasi	(Costa Lima, 1941)
L. claustrei	Abonnenc, Léger & Fauran, 1979
L. complexa	(Mangabeira, 1941)
L. corossoniensis	Le Pont & Pajot, 1978
L. davisi	(Root, 1934)
L. dorlinsis	(Le Pont & Desjeux, 1982)
L. fairchildi	Barretto, 1966
L. fairtigi	Martins, 1970
L. geniculata	(Mangabeira, 1941)
L. guyanensis	(Floch & Abonnenc, 1941)
L. hirsuta hirsuta	(Mangabeira, 1942)
L. hirsuta nicaraguensis	(Fairchild & Hertig, 1961)
L. killicki	Feliciangeli, Ramírez-Pérez & Ramírez, 1988
L. lainsoni	(Fraiha & Ward, 1974)
L. leonidasdeanei	(Fraiha, Ryan, Ward, Lainson & Shaw, 1986)
L. llanosmartinsi	(Fraiha & Ward, 1980)
L. lloydi	(Antunes, 1937)
L. matosi	(Barretto & Zago, 1956)
L. nocticola	Young, 1973
L. panamensis	(Shannon, 1926)
L. paraensis	(Costa Lima, 1941)
L. parimaensis	(Ortiz & Alvarez, 1972)
L. recurva	Young, 1973
L. squamiventris squamiventris	(Lutz & Neiva, 1912)
L. squamiventris maripaensis	(Floch & Abonnenc, 1946)
L. wellcomei	(Fraiha, Shaw & Lainson, 1971)
L. yucumensis	(Le Pont, Caillard, Tibayrenc & Desjeux, 1986)
**RUPICOLA* Group Lewis et al., 1977	
L. correalimai	Martins, Coutinho & Luz, 1970
L. rupicola	Martins, Godoy & Silva, 1962
**SAULENSIS* Group Lewis et al., 1977	
L. saulensis	(Floch & Abonnenc, 1944)
L. wilsoni	(Damasceno & Causey, 1945)
*Sub-genus *SCIOPEMYIA* Barretto, 1962	
L. fluviatilis	(Floch & Abonnenc, 1944)
L. microps	(Mangabeira, 1942)
L. nematoducta	Young & Arias, 1984
L. pennyi	Arias & Freitas, 1981
L. preclara	Young & Arias, 1984
L. servulolimai	(Damasceno & Causey, 1945)
L. sordellii	(Shannon & Del Ponte, 1927)
*Sub-genus *TRICHOPHOROMYIA* Barretto, 1962	
L. acostai	(Llanos, 1966)
L. auraensis	(Mangabeira, 1942)
L. beniensis	Le Pont & Desjeux, 1987
L. bettinii	Feliciangeli, Ramírez-Pérez & Ramírez, 1988

L. brachipyga	(Mangabeira, 1942)
L. castanheirai	(Damasceno, Causey & Arouck, 1945)
L. cellulana	Young, 1979
L. dunhami	(Causey & Damasceno, 1945)
L. eurypyga	Martins, Falcão & Silva, 1963
L. flochi	(Abonnenc & Chassignet, 1948)
L. howardi	Young, 1979
L. incasica	(Llanos, 1966)
L. ininii	(Floch & Abonnenc, 1943)
L. lopesi	(Damasceno, Causey & Arouck 1945)
L. loretonensis	(Llanos, 1964)
L. meirai	(Causey & Damasceno, 1945)
L. melloi	(Causey & Damasceno, 1945)
L. napoensi	Young & Rogers, 1984
L. octavioi	(Vargas, 1949)
L. omagua	Martins, Llanos & Silva, 1976
L. readyi	Ryan, 1986
L. reburra	(Fairchild & Hertig, 1961)
L. rostrans	(Summers, 1912)
L. ruii	Arias & Young, 1982
L. saltuosa	Young, 1979
L. ubiquitalis	(Mangabeira, 1942)
L. viannamartinsi	(Sherlock & Guitton, 1970)
L. wilkersoni	Young & Rogers, 1984
*Sub-genus *TRICHOPYGOMYIA* Barretto, 1962	
(= *LONGISPINUS* Group Theodor, 1965)	
L. conviti	Ramírez-Pérez, Martins & Ramírez, 1976
L. dasypodogeton	(Castro, 1939)
L. elegans	Martins, Llanos & Silva, 1976
L. ferroae	Young & Morales, 1987
L. gantieri	Le Pont & Desjeux, 1987
L. longispina	(Mangabeira 1942)
L. martinezi	Young & Morales, 1987
L. pinna	Feliciangeli, Ramírez-Pérez & Ramirez, 1989
L. ratcliffei	Arias, Ready & Freitas, 1983
L. rondonensis	martins, Falcão & Silva, 1965
L. trichopyga	(Floch & Abonnenc, 1945)
L. triramula	(Fairchild & Hertig, 1952)
L. wagleyi	(Causey & Damasceno, 1945)
L. witoto	Young & Morales, 1987
**VERRUCARUM* Group Theodor, 1965	
(= Sub-Genus *PIFANOMYIA* Ortiz & Scorza, 1963)	
L. amilcari	Arredondo, 1984
L. andina	Osorno, Osorno & Morales, 1972
L. aulari	Feliciangeli, Ordoñez & Manzanilla, 1984
L. christophei	(Fairchild & Trapido, 1950)
L. columbiana	(Ristorcelli & Van Ty, 1941)
L. disiuncta	Morales, Osorno & Osorno, 1974
L. evansi	(Nunez-Tovar, 1924)
L. longiflocosa	Osorno, Morales, Osorno & Hoyos, 1970
L. moralesi	Young, 1979
L. nevesi	(Damasceno & Arouck, 1956)
L. nuneztovari	(Ortiz, 1954)
L. odax	(Fairchild & Hertig, 1961)
L. oresbia	(Fairchild & Hertig, 1961)
L. orestes	(Fairchild & Trapido, 1950)
L. ottolinai	(Ortiz & Scorza, 1963)
L. ovallesi	(Ortiz, 1952)
L. quasitownsendi	Osorno, Osorno & Morales, 1972
L. sauroida	Osorno, Morales & Osorno, 1972
L. serrana	(Damasceno & Arouck, 1949)
L. spinicrassa	Morales, Osorno, Osorno & Hoyos, 1969
L. townsendi	(Ortiz, 1959)
L. verrucarum	(Townsend, 1913)
L. youngi	Feliciangeli & Murillo, 1987

*Sub-genus *VIANNAMYIA* Mangabeira, 1941	
L. caprina	Osorno, Morales & Osorno, 1972
L. fariasi	(Damasceno, Causey & Arouck, 1945)
L. furcata	(Mangabeira, 1941)
L. tuberculata	(Mangabeira, 1941)
*Ungrouped species:	
L. acanthopharynx	Martins, Falcão & Silva, 1962
L. boliviana	Velasco & Trapido, 1974
L. brisolai	Le Pont & Desjeux, 1987
L. bursiformis	(Floch & Abonnenc, 1944)
L. ignacioi	Young, 1972
L. misionensis	(Castro, 1959)
L. monticola	(Costa Lima, 1932)
L. oligodonta	Young, Perez & Romero, 1985
L. pia	(Fairchild & Hertig, 1961)
L. ponsi	Perruolo, 1984
L. rangeliana	(Ortiz, 1952)
L. samueli	(Deane, 1955)
L. torrealbai	Martins, Fernandez & Falcão, 1979

COMPUTER AIDED IDENTIFICATION

Once achieved, the knowledge-base will allow the generation of documents, including automatically generated keys, lists and descriptions in natural language, and the CAI software. The final documents will be published in the four following languages: English, French, Portuguese and Spanish.

The identification process consists of progressively describing the specimen, by selecting successive descriptors, according to a completely free order, and attributing to them the corresponding modality (state). The expert system permanently compare the descriptions to the data contained in the knowledge base and assign the specimen when possible to a particular category.

When the descriptors provided are sufficient, the programme supplies the name of the species to which the specimen corresponds. Should the description of the specimen prove incompatible with all the species included in the knowledge-base, a function allow the programme to seek out the species with greatest number of common characters.

The multiple advantages of CAI determination strategy, in comparison with classical dichotomous keys, have been discussed in detail by Lebbe et al. (1989), and include multiple access, selection of the most discriminating morphological characters, display of eliminated species, review of already entered responses. Possibility of correcting makes for a flexible system.

The adoption of the same descriptive characteristics for all species and according to the same terminology permit comparisons between taxa or groups, in order to calculate distances between taxa descriptions for numerical taxonomy studies. Such an accumulation of easily comparable data will constitute the basis for a convenient ordering of this medically important group of insects.

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