

Notes on the subfamily Bruchomyiinae (Diptera: Psychodidae)

Paul Williams

Departamento de Parasitologia, Instituto de Ciências Biológicas da Universidade Federal de Minas Gerais, Caixa Postal 2486, 30123-970 Belo Horizonte, Minas Gerais, Brasil.*

Abstract

A review is given of the subfamily Bruchomyiinae. A brief definition of the family is provided. A key is included for the identification of the genera *Bruchomyia*, *Nemapalpus* and *Eutonnoiria*. Check lists are given for the species included in each of the three genera. The check lists include reference to original descriptions, to redescrptions and to useful identification keys. The type locality of each species is cited and reference is made to subsequent redescrptions and to additional geographical records. Comments are made about the general distribution of each species. Where necessary, reference is made to synonyms.

Keywords: Diptera, Psychodidae, Bruchomyiinae, *Bruchomyia*, *Nemapalpus*, *Eutonnoiria*, Check lists, Geographical distribution.

Introduction

The subfamily Bruchomyiinae is the sister group of Phlebotominae. A brief definition of the subfamily is as follows:

Antenna usually with 14 flagellomeres, but one genus has about 30 flagellomeres and another has 100+. When referred to in descriptions, the flagellomeres bear one or two pairs of ascoids. These may be digitiform, circular, mushroom shaped, or discoidal sacs. The wings have vein R_s with the terminal branches arranged dichotomously: R_{2+3} and R_{4+5} . The proboscis of females is shorter than the longitudinal axis of the head. The females are without mandibles or, if present, they are rudimentary. The maxillae are membranous with ciliated edges and are not capable of penetrating vertebrate skin. Females have only one spermatheca. In males, the ninth abdominal segment, unlike that in Phlebotominae, does not bear a pair of lateral lobes.

The subfamily contains three genera: *Bruchomyia* Alexander, *Eutonnoiria* Alexander, and *Nemapalpus* (*Nemopalpus* of some authors) Macquart. These genera can be identified with the following key:

1. Antenna with 14 flagellomeres; vein Cu_1 short *Nemapalpus*
- . Antenna with more than 14 flagellomeres; vein Cu_1 long 2
2. Antenna with about 30 flagellomeres; ascoids discoidal; basistyle of the male with a distal tuft of setae *Bruchomyia*
- . Antenna with about 110 flagellomeres; ascoids digitiform and forked; basistyle without a distal tuft *Eutonnoiria*

Material and Methods

The few specimens of Bruchomyiinae personally examined were slide mounted in Berlese fluid. All other data were

obtained by a review of published literature. Whenever possible, photocopies were obtained of descriptions and redescrptions of species. When original descriptions and/or redescrptions were not available, reliance had to be placed on check lists and catalogues.

Genera are considered in the order given in the foregoing key. This coincides with the decreasing number of included species. The following information is given for each species: original description, followed by the name of the type locality; redescrptions of the species together with the place names of additional geographical records; reference is made to a few synonyms. Fossil bruchomyines are not included in the check lists. Names of two authors with the surname "Alexander" are referred to. When the name is followed by (J.B.) reference is being made to Dr J. Bruce Alexander; when initials are not given, the reference is to Dr C. P. Alexander.

Results

Check list of *Nemapalpus* Macquart

Nemapalpus Macquart, 1838 - In Webber & Berthelot - "Histoire Naturelle des Canaries" Volume I, Diptera: 85. Type species: *N. flavus* Macquart (the only included species). Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 260 (literature citations: 1838-1935), 260-261 (review of the genus). Duckhouse, 1973 - *Family Psychodidae*, 6A.3 (selected literature citations: 1838-1963).

acaenohybos Quate & Alexander (J. B.), 2000 - *Ann Entomol Soc Am* **93**: 190-191, Figs 15-24 (M. F.), 103 (M. in key). Type locality: Brazil: Mato Grosso, Chapada dos Guimarães (35 km ENE of Cuiabá). Distribution: Brazil: Mato Grosso, Chapada dos Guimarães.

Received 01.11.2002
Accepted 07.03.2003
Distributed 23.06.2003

* Address for correspondence: Rua Turfa 1437 Ap 201, Alto Barroca, 30430-380 Belo Horizonte, Minas Gerais, Brasil.

- antillarum* Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 270-272, Figs 16-20, 31, 37 (M.), 263 (M. in key). Type locality: Dominican Republic: Sabana de la Mar (about 34 km south of the town). Duckhouse, 1973 - *Family Psychodidae*, 6A. 3 (catalogued). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Quate & Alexander (J. B.), 2000 - *Ann Entomol Soc Am* **93**: 192 (recognition characters), 193 (M. in key). Distribution: Dominican Republic: Sabana de la Mar.
- arroyoi* de Leon, 1950 - *University of San Carlos, Guatemala, Publication* **150**: 14-16, Figs 12-18 (M. F.). Type locality: Guatemala: Mazatenango. Fairchild, 1952 - *Ann Entomol Soc Am* **93**: 261 (in check list), 263 (M. in key), 264, 266, 268 (redescription-M. F.), 268 (new geographical records). Duckhouse, 1973 - *Family Psychodidae*, 6A. 3 (catalogued). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Quate & Alexander (J. B.), 2000 - *Ann Entomol Soc Am* **93**: 187 (recognition characters), 193 (M. in key). Distribution: Guatemala: Mazatenango. Panama: Chiriqui Province: Paso Ancho, El Hato, Salo Santo, Bambito.
- australiensis* Alexander, 1928 - *Proc Linn Soc New South Wales* **53**: 293-294, Fig. 1. (F.). Type locality: Australia: ? New South Wales. Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Distribution: Australia: New South Wales. *brevinervis* Barretto & d'Andretta, 1946 - "*Livro homenagem a R. F. d'Almeida*" N°. 6: 60-62, Figs 1 - 6 (M.). Type locality: Brazil: State of São Paulo. Fairchild, 1952 : *Ann Entomol Soc Am* **45**: 261 (in check list), 263 (M. in key). Duckhouse, 1973 - *Family Psychodidae*, 6A.3 (catalogued). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Quate & Alexander (J. B.), 2000 - *Ann Entomol Soc Am* **93**: 186 (recognition characters), 192 (M. in key). Distribution: Brazil: State of São Paulo (unnamed locality).
- capensis* Edwards, 1929 - *Ann Mag Nat Hist* **3**: 422, text Fig. (M.). Type locality: South Africa: Eastern Cape Province, Pondoland, Port St John. Stuckenberg, 1962 - *Ann Nat Mus* **15**: 206 (in key), 206-211, Figs 4, 7, 10, 11, 18-22 (M, F), (new geographical records). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map) Distribution: South Africa: Eastern Cape Province, Pondoland, Port St John; Natal; Kranskop, Pietermaritzburg, Karkloof Forest, Umbilo, Durban (Stuckenberg).
- concolor* Stuckenberg, 1962 - *Ann Nat Mus* **15**: 206 (in key), 211-218, Figs 2, 6, 9, 12-15, 23-27 (M, F). Type locality: South Africa: Eastern Cape Province, Pondoland, Port St John. Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Distribution : South Africa: Eastern Cape Province, Pondoland, Port St John.
- dampfianus* Alexander, 1940 - *Rev Ent* **11**: 796 - 798, Figs 2, 4. (M). Type locality: Mexico: Chiapas, Finca Vergel. Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 263 (M in key), 272 and 274, Figs 12, 13, 21-25, 36 (F), 274 (new geographical record). Duckhouse, 1973 - *Family Psychodidae*, 6A.3 (catalogued). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Quate & Alexander (J. B.), 2000 - *Ann Entomol Soc Am* **93**: 186 (recognition characters), 192 (M. in key). Distribution : Mexico: Chiapas, Finca Vergel; Palenque (Fairchild).
- davidsoni* Stuckenberg, 1978 - Original description not seen. Cited from Duckhouse & Lewis (1980). Distribution : Namibia (unnamed locality).
- dissimilis* Barretto & d'Andretta, 1946 - "*Livro homenagem a R. F. d'Almeida*" N°. 6: 62 - 63 (F.) Type locality: Brazil: Espírito Santo, São João. Barretto, 1950 - *Pap Avulsos Zool (São Paulo)* **9**: 341-343, Figs 1-4 (M.), 343 (new geographical record). Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 261 (in check list), 263 (M in key). Duckhouse, 1973 - *Family Psychodidae*, 6A.3 (catalogued). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Quate & Alexander (J. B.), 2000 - *Ann Entomol Soc Am* **93**: 189 (recognition characters), 193 (M in key). Distribution: Brazil: Espírito Santo: São João, São Paulo: Jaraguá (Barretto).
- flavus* Macquart, 1838 - In Webber & Berthelot "*Histoire naturelle des Canaries*" Volume I, Diptera: 101-102 (M.). Type locality: Spain: Canary Islands. Duckhouse, 1973 - *Family Psychodidae*, 6A.3 (Cited as type species of *Nemopalpus*). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map), 155 and 157, Figs 2, 3 (F.), 157 and 159, Figs 4, 5 (egg), 159 (Table: comparison with some species of Phlebotominae). Distribution: Spain: Canary Islands.
- immaculatus* Freeman, 1949 - *Entomol Mon Mag* **85**: 86-87, Figs 1-3 (M.). Type locality: Brazil: Santa Catarina, Nova Teutônia. Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 261 (in check list), 263 (M. in key). Duckhouse, 1973 - *Family Psychodidae*, 6A.3 (catalogued). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Quate & Alexander (J. B.), 2000 - *Ann Entomol Soc Am* **93**: 186 (recognition characters), 192 (M. in key). Distribution: Brazil: Santa Catarina, Nova Teutônia.
- ledgeri* Stuckenberg, 1978 - Original description not seen. Cited from Duckhouse & Lewis (1980). Distribution : Namibia (unnamed locality).
- mopani* de Leon, 1950 - *University of San Carlos, Guatemala, Publication* **150**: 9-14, Figs 2, 5-11, 21 (M. F.). Type locality: Guatemala: Canchacán, Petén. Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 261 (in check list), 263-264, Figs 14, 15 and 33-35 (M. F.), 264 (new geographical record). Duckhouse, 1973 - *Family Psychodidae*, 6A.3 (catalogued). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Quate & Alexander (J. B.), 2000 - *Ann Entomol Soc Am* **93**: 192 (recognition characters), 193 (M. in key). Ibáñez-Bernal, 2001 - *Ann Entomol Soc Am* **94**: 368 (new geographical record). Kistner et al., 2001 - *Sociobiology* **37**: 238 (pupa collected in an ant colony, and male terminalia dissected out; new geographical record). Distribution: Guatemala: Canchacán, Petén, Tikal, (Kistner et al.), Mexico: Chiapas, Palenque, (Fairchild), Belize: Toledo District: Blue Creek Preserve (near Punta Gorda), (Ibáñez-Bernal).

moraesi de Leon, 1950 - *University of San Carlos, Guatemala, Publication* **150**: 17-19, Figs 19, 20 (M. F.) Type locality: Guatemala: Suchitepéquez Department, Mazatenango. Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 262 (in check list and brief description of species). Duckhouse, 1973 - *Family Psychodidae*, 6A.3 (catalogued). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Quate & Alexander (J. B.), 2000 - *Ann Entomol Soc Am* **93**: 192 (recognition characters), 193 (M in key). Distribution: Guatemala: Suchitepéquez Department, Mazatenango.

nearcticus Young, 1974 - *Fla Entomol* **57**: 109 (M.). Type locality: USA, Florida, Alachua county, Gainesville. Alexander (J. B.), 1987 - *Fla Entomol* **70**: 376 (mentioned). Mahmood & Alexander (J. B.), 1992 - *Fla Entomol* **75**: 171-178, + illustrations (immature forms). Quate & Alexander (J. B.), 2000 - *Ann Entomol Soc Am* **93**: 192 (recognition characters and new geographical record), 193 (M. in key). Distribution: USA: Florida: Gainesville, Gulf Hammond, Levy county; Bahamas: Abaco Island, Treasure Cay. [Quate & Alexander (J. B.)].

orientalis Edwards, 1928 - *J Fed Malay States Museum* **14**: 65 (F.). Type locality: Malaysia: Cameron Highlands, Gunong Berumban. [data given by Fairchild (1952)]. Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 261 (in check list). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Distribution: Malaysia: Cameron Highlands, Gunong Berumban.

pallipes Shannon & Del Ponte, 1927 - *Rev Inst Bact Dept Nac Hig* (Buenos Aires) **4**: 733-744 (F.- placed in *Bruchomyia*). Type locality: Argentina, Misiones, Iguazu Falls. Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 262 (in check list and comments on the species). Duckhouse, 1973 - *Family Psychodidae*, 6A.4 (catalogued). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Quate & Alexander (J. B.), 2000 - *Ann Entomol Soc Am* **93**: 192 (mentioned and M in key). Distribution: Argentina, Misiones, Iguazu Falls.

patriciae Alexander (J. B.), 1987 - *Fla Entomol* **70**: 377-379, Figs 1-8 (M. F.). Type locality: Colombia: Norte de Santander, Finca La Esperanza, Siravita (2.5 km East of Arbaleadas). Quate & Alexander (J. B.), 2000 - *Ann Entomol Soc Am* **93**: 190 (recognition characters), 193 (M in key). Distribution: Colombia: Norte de Santander, Siravita.

phoenimimos Quate & Alexander (J. B.), 2000 - *Ann Entomol Soc Am* **93**: 186-187, Figs 1-4 (M), 192 (M in key). Type locality: Colombia: Valle del Cauca, Alto Aquacatal, near Cali,. Distribution : Colombia: Valle del Cauca, Alto Aquacatal.

pilipes Tonnoir, 1922 - *An Soc Entomol Belg* **63**: 130-134, Figs 1-8 (M, F). Type locality: Paraguay: San Bernardino. Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 262 (in check list, with two synonyms; M in key). Duckhouse, 1973 - *Family Psychodidae*, 6A.4 (catalogued). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Quate & Alexander (J. B.), *Ann Entomol Soc Am* **93**: 186 (listed, with two synonyms; recognition characters), 192 (M in key). Distribution: Paraguay:

San Bernardino; Brazil: São Paulo, Bateia. (Barretto & d'Andretta); Rio de Janeiro: Campo Belo. (Alexander = *vexans*).

maculipennis Barretto & d'Andretta, 1946 - "Livro homenagem a R. F. d'Almeida" N°. 6: 64-66, Fig. 9 (F). Type locality :Brazil: São Paulo, Bateia. Freeman, 1949 - *Entomol Mon Mag* **85**: 87 (junior synonym of *pilipes*). Duckhouse, 1973 - *Family Psychodidae*, 6A.4 (junior synonym of *pilipes*). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map).

vexans Alexander, 1940 - *Rev Ent* **11**: 798, Fig. 5 (M). Type locality: Rio de Janeiro: Campo Belo. Freeman, 1949 - *Entomol Mon Mag* **85**: 87 (junior synonym of *pilipes*). Duckhouse, 1973 - 6A.4 (junior synonym of *pilipes*).

rondanica Quate & Alexander (J. B.), 2000 - *Ann Entomol Soc Am* **93**: 189, Figs 12-14 (M.), 193 (M. in key). Type locality: Brazil: Rondônia, 33km SE of Porto Velho. Distribution: Brazil: Rondônia, 33km SE of Porto Velho.

stenygros Quate & Alexander (J. B.), 2000 - *Ann Entomol Soc Am* **93**: 187 - 189, Figs 5-11, (M. F.), 193 (M. in key). Type locality: Brazil: Pará: Serra Cachorro (395km NW of Manaus - 0°59'43"S, 57°7'9"W). Distribution: Brazil: Pará, Serra Cachorro.

sziladyi Tonnoir, 1940 - *6th Int Congr Entomol Madrid 1935*: 206-208, Figs 1, 3, 4 (M.). Type locality: Costa Rica: Suiza de Turrialba. Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 262 (in check list), 263 (M. in key), 268 & 270, Figs 26-28 (M. F.), 268 (new geographical record). Duckhouse, 1973 - *Family Psychodidae*, 6A.4 (catalogued). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Quate & Alexander (J. B.) 2000 - *Ann Entomol Soc Am* **93**: 191 (recognition characters), 193 (M. in key). Distribution: Costa Rica: Suiza de Turrialba; Panama, Bocas del Toro Province. (Fairchild).

torrealbai Ortiz & Scorza, 1963 - *Acta Biol Venezuela* **3**: 357, Figs 18-27 (M.), 258 (M. in key). Type locality: Venezuela: Aragua State, Rancho Grande. Quate & Alexander (J. B.) 2000 - *Ann Entomol Soc Am* **93**: 191 (recognition characters), 193 (M. in key). Distribution: Venezuela: Aragua State, Rancho Grande.

transvaalensis Stuckenberg, 1962 - *Ann Nat Mus* **15**: 206 (in key), 211, Figs 1, 3, 5, 8, 16, 17 (M, F). Type locality: South Africa: Eastern Transvaal, Pilgrims Rest District, Mariepskop. Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Distribution: South Africa: Eastern Transvaal, Pilgrims Rest District, Mariepskop.

unicolor Edwards 1933 - *J Fed Malay States Museum* **17**: 257 (F.). Type locality: Brunei: Lumu Luma, slopes of Mount Kinabalu. Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 261 (in check list). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Distribution: Brunei: Lumu Luma, Mount Kinabalu. *vietnamensis* Quate, 1962 - *Pacific Insects* **4**:

8, Fig. 1 a-b (F). Type locality: Viet Nam: Dalat. Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Distribution: Viet Nam: Dalat.

yucateensis Vargas & Díaz Nájera, 1958 - *Rev Inst Salubr Enferm Trop* **18**: 1-11, (M.). Type locality: Mexico: Yucatan Peninsula. Quate & Alexander (J. B.), 2000 - *Ann Entomol Soc Am* **93**: 186 (recognition characters), 192 (M in key). Distribution: Mexico: Yucatan Peninsula.

zelandiae Alexander, 1921 - *Ins Int Mens* **9**: 158, Fig. 1 (sex not stated). Type locality: New Zealand. Tonnoir, 1940 - *6th Int Congr Entomol Madrid 1935*: 203-213, + Figs (M, F). Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 261 (in check list). Léger et al., 1993 - *Ann Parasitol Hum Comp* **68**: 155 (distribution, in map). Distribution: various unnamed localities in North and South New Zealand (Fairchild).

Comments. The check list shows that 29 extant species of *Nemopalpus* have been described. Two other species have fallen in synonymy (Freeman, 1949) and, as synonyms, both were cited by Fairchild (1952), who also referred to two fossil species that are not included in the foregoing check list. Both fossils were found in Baltic Amber, dated about 120 million years ago. They were described under the generic name of *Palaesycorax* [Meunier (1905); Edwards (1921) - cited by Fairchild (1952)].

On a worldwide basis, Fairchild (1952) listed 17 species of *Nemopalpus* with 11 in the New World. The catalogue of Duckhouse (1973), which deals with Psychodidae in the Americas south of USA, also refers to 11 species in this genus.

Since 1973, several new species of *Nemopalpus* have been described, but their numbers are small.

Of the Old World species listed herein, the type species (*flavus*) occurs in a northern subtropical climate, two species (*orientalis* and *unicolor*) are north tropical species, and seven species of the Old World occur in southern temperate conditions, either in Australasia or the non-tropical part of Africa.

In the New World, one species (*nearcticus*) occurs in the Nearctic Region and, with a range of 27 - 28°N, lives in a northern subtropical area. All other species of *Nemopalpus* recorded in the Americas occur in the Neotropical Region. Indeed, the two most southerly species (*brevinervis* and *pilipes*) occur at 23 - 24°S, which coincides with the Tropic of Capricorn.

H. Kistner collected larvae and a pupa of *Nematocera* from an ant colony in Guatemala. The material was sent to Dr R. H. L. Disney, who dissected out the posterior end of the pupa and revealed the external genitalia of a male fly. The dissected pupa was slide mounted in Berleze fluid and sent to PW. Specific identification was based on the redescription of the species and the figures in Fairchild (1952). A similar larva was collected in Ecuador, also in an ant colony. This is best identified only as a larva of Bruchomyiinae. The association of bruchomyiines with two ant colonies suggests that such habitats should be routinely examined to obtain adult and immature forms of the subfamily.

Kistner et al (2001) also recorded some other associations between Diptera and ant colonies.

Fairchild (1952) considered *Nemopalpus* to have a mainly tropical distribution. This is true of the New World species but the Old World species are predominantly temperate in distribution.

Considering only the species of the Neotropical Region, no *Nemopalpus* have been reported from Bolivia, Caribbean Islands, Chile, ?Ecuador, El Salvador, French Guiana, Guyana, Honduras, Nicaragua, Peru, Surinam, Uruguay.

Check list of *Bruchomyia* Alexander

Bruchomyia Alexander, 1920 - *Ann Entomol Soc Am* **13**: 402 - 405. Type species: *B. argentina* Alexander (by original description). Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 274 (literature citations : 1920-1946).

almeidai Barretto & d'Andretta, 1946 - "Livro homenagen a R. F. d'Almeida" N°. 6: 68-71, Figs 10-13 (F.). Type locality : Brazil: São Paulo: Franca. Barretto, 1950 - *Pap Avulsos Zool (São Paulo)* **9**: 343 - 346, Figs 9-13 (M.). Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 276 (in check list). Duckhouse, 1973 - *Family Psychodidae*, 6A.2 (catalogued). Distribution: Brazil: São Paulo: Franca, Jaraguá (Barretto).

argentina Alexander, 1920 - *Ann Entomol Soc Am* **13**: 405, Figs 1-9 (M.). Type locality: Argentina: Cordoba Province: La Granja, Altigracia. Tonnoir, 1940 - *6th Congr Internat Ent Madrid, 1935*: 212, Figs 5E, 7A, B (M.). Satchell, 1953 - *Proc R Entomol Soc Lond Ser A* **28**: 1-12, Figs 1-14 (egg, fourth larval instar, pupa). Duckhouse, 1973 - *Family Psychodidae*, 6A.2 (catalogued). Distribution : Argentina: Cordoba Province: La Granja, Altigracia, Tucumán Province, Tucumán - laboratory reared (Satchell).

brasiliensis Alexander, 1940 - *Rev Ent* **11**: 795-796, Figs 1, 3. (M.). Type locality: Brazil: Ceará, Crato. Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 276 (in check list). Duckhouse, 1973 - *Family Psychodidae*, 6A.2 (catalogued). Distribution: Brazil: Ceará, Crato.

fusca Barretto, 1950 - *Pap Avulsos Zool (São Paulo)* **9**: 348-350, Figs 6-9 (M.). Type locality: Brazil: São Paulo, Serra da Cantareira. Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 276 (in check list and new geographical record), Figs 40-42, 46-52 (M. F.). Duckhouse, 1973 - *Family Psychodidae*, 6A. 2 (catalogued). Distribution: Brazil: São Paulo, Serra da Cantareira; Rio de Janeiro, Boa Vista (Fairchild); Minas Gerais, Rio Acima (present paper).

peruviana Alexander, 1929 - *Proc US Natl Mus* **75**: 6 (M.). Type locality: Peru: Chanchamayo, Colonia Perené. Fairchild 1952 - *Ann Entomol Soc Am* **45**: 276 (in check list). Duckhouse, 1973 - *Family Psychodidae*, 6A.2 (catalogued). Distribution: Peru: Chanchamayo, Colonia Perené.

plumanni Alexander, 1944 - *Rev Ent* **15**: 313-315, Figs 1, 2. (M.). Type locality: Brazil: Santa Catarina,, Nova Teutônia. Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 276 (in check list). Duckhouse, 1973 - *Family Psychodidae*, 6A.3 (catalogued). Distribution: Brazil: Santa Catarina, Nova Teutônia.

shannoni Alexander, 1929 - *Proc US Natl Mus* **75**: 4-6, Figs 1, 2. (M. F.). Type locality: Peru: Lima, Verrugas Cañon. Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 276 (in check list), 279, Figs 42-44 (M., F.), 279 (new geographical record). Duckhouse, 1973 - *Family Psychodidae*, 6A.3 (catalogued). Distribution: Peru: Lima, Verrugas Canyon, Rimac Valley, (near Lima), Sucre and Turnamesa (Fairchild).

unicolor Barretto, 1950 - *Pap Avulsos Zool (São Paulo)* **9**: 348-348, Figs 14-16 (M.). Type locality: Brazil: São Paulo, Jaraguá. Fairchild, 1952 - *Ann Entomol Soc Am* **45**: 276 (in check list). Duckhouse, 1973 - *Family Psychodidae*, 6A.3 (catalogued). Distribution: Brazil: São Paulo, Jaraguá.

Comments. Fairchild (1952) and Duckhouse (1973) listed eight species of *Bruchomyia*. No new species has been described for more than 50 years.

Bruchomyia is an American genus, with a geographical range from the tropics to the south temperate region. Six species have been recorded in Brazil, mostly in the southern part of the country but one in Ceará, a semi-arid State in north eastern Brazil and subject to periodic droughts. The Peruvian species occurs at a relatively low altitude for that country, and in a tropical climate.

Personal experience of *Bruchomyia* is limited to examination of three specimens, two males and one female. The two males were obtained using a miniature light trap set in a dog's kennel (see Fig. 1 in dos Santos et al, 1991) at Rio Acima, State of Minas Gerais, Brazil. The kennel (with the watch dog removed while the light trap was operating) was one of several collecting sites at Rio Acima, where light traps were used weekly for about 18 months. On the first night of collecting, in December, 1985, two insects were obtained that resembled very small and unusually hairy Culicidae. These were identified as *B. fusca* on the basis of the redescription and Figures of Fairchild (1952).

Thereafter, all light trap collections at Rio Acima were scrutinized for additional specimens but none were obtained. A colleague caught a female *Bruchomyia* at Santa Barbara, situated in a valley adjacent to Rio Acima. This specimen was preserved in ethyl alcohol for an unknown length of time and did not clear well after being slide mounted. The specimen could not be identified specifically. The poorly defined spermatheca is similar to that shown by Fairchild (1952) for *B. shannoni* and by Léger et al. (1993) for *N. flavus*.

It is generally considered to be inadvisable to preserve phlebotomine sand flies in ethyl alcohol and, from experience with a single specimen, it is suggested that alcohol should be avoided for the preservation of female *Bruchomyiinae*.

Check list of *Eutonnoiria* Alexander

Eutonnoiria Alexander, 1940 - *Rev Entomol* **11**: 794 (generic characteristics), 795 (in key). Type species: *Bruchomyia edwardsi* Tonnoir, 1939 (by original designation).

edwardsi (Tonnoir, 1939) - *British Museum (Natural History), Ruwenzori Expedition 1934-5*, **1** (4) - *Psychodidae*: 36 (in list of African *Bruchomyiinae*), 38-39, Figs 1-7 (M). Type locality: Uganda: Mobuku Valley (7,300 feet above sea level). Fairchild,

1952 - *Ann Entomol Soc Am* **45**: 278 (comment on numerous flagellomeres). Duckhouse & Lewis, 1980 - In R. J. Crosskey [ed.] "*Catalogue of the Diptera of the Afrotropical Region*". British Museum (Natural History), London - *Family Psychodidae*: 94 (catalogued). Distribution: Uganda: Mobuku Valley.

Comment. Tonnoir (1939, page 37) considered the number of flagellomeres to be insufficient to separate *edwardsi* from the other three species of *Bruchomyia* that were known at the time. Alexander (1940, page 794) disagreed with this view and proposed the generic name of *Eutonnoiria*. Only one species is known.

Discussion

Brief reference has already been made to two fossils of *Nemopalpus*. Both were found in Baltic amber and dated to the Lower Cretaceous, about 120 million years ago. Where the fossils were recovered probably had a warmer climate than the corresponding geographical area of today. The paucity of fossil material throws no light on the present distribution of *Bruchomyiinae*. *Nemopalpus* is most abundant in the Americas, but not restricted there. *Bruchomyia* is limited to South America and *Eutonnoiria* is known from a single locality in tropical Africa.

The fossil records of Phlebotominae are only a little better than those of *Bruchomyiinae*. Fossil sand flies were reviewed by Lewis (1982) and more recently by Léger & Depaquit (2002). Because only one fossil phlebotomine has been described recently (Brazil & Andrade Filho, 2002), there is no point in repeating information previously published. As with *Bruchomyiinae*, the fossil records of Phlebotominae do nothing to explain the modern geographical distribution of the subfamily.

Carte 1 in Leger et al.(1993) shows the distribution of *Nemopalpus* at that date and Fig. 4 (map) in Léger & Depaquit (2002), considered together, provide a satisfactory means of comparing the distributions of phlebotomines and bruchomyiines. In both the Old and New Worlds, sand flies extend from 40°-50° N to 40°-50° S. The southern limit of phlebotomines in the New World has not been extended by the discovery of an unnamed species from Argentinean Patagonia (Muzón et al, 2002). It is obvious from the cited map that sand flies enjoy a wider and more diverse distribution than do bruchomyiines.

Based on experience of collecting Phlebotominae in Mexico, Panama, Caribbean Islands, Peru and Brazil, Fairchild (1952) suggested that bruchomyiines might be found by carefully searching dark and humid places such as hollow trees, the buttressed roots of large trees and rock crevices. Animal shelters might also harbour *Bruchomyiinae* (Stuckenberg, 1978). In American tropical rain forest, sand flies can be collected in considerable numbers from tree buttresses, animal burrows and caves. From personal experience in Belize over a period of 6 - 7 years, no bruchomyiines were encountered in these habitats.

Since the publication of Fairchild (1952), only 10 species of *Bruchomyiinae* (all *Nemopalpus*) have been described. All these descriptions have appeared since the publication of the

catalogue by Duckhouse (1973). Further evidence on the infrequency with which bruchomyiines are collected is provided by the following facts: 12 species of *Nemopalpus*, six of *Bruchomyia* and the single species of *Eutonnoiria* are all known only from their type localities. One cannot escape from concluding that the subfamily Bruchomyiinae constitutes a group of very rare Diptera.

Williams (1993) considered that the subfamily Phlebotominae, as known today, is the result of a successful evolutionary experiment. The success of the group might well be related to adult feeding habits. Sand flies have complete Dipteran mouthparts that are elongate. This enables the female fly to pierce vertebrate skin and to suck up blood, so obtaining proteins and amino acids. The elongate mouthparts of both sexes permits them to suck up nectar, to pierce plants and to exploit the by-products of other insects (such as honeydew) as sources of carbohydrates.

It should not be considered that extant Bruchomyiinae provide evidence of a failed evolutionary experiment. Their more limited distribution and the rarity of their capture may be related to the shortness of the mouthparts. The feeding habits of adult bruchomyiines are unknown and it has been suggested that they may not feed as adults. There may be difficulty in obtaining proteins, amino acids and carbohydrates, and this could limit their flight range. It should be overlooked, however, that Bruchomyiinae could have an evolutionary history at least as long as that of Phlebotominae, and living bruchomyiines represent an enduring evolutionary line.

Acknowledgements

I am most grateful to Dr Paul D. Ready, Department of Entomology, The Natural History Museum, London, who provided a photocopy of a paper I could not obtain in Brazil and for sending me a copy of a list of references that I needed to consult. I am also grateful to Professeur Nicole Léger, formerly of *La Faculté de Pharmacie de Reims*, for sending a photocopy of another paper that was unobtainable in Brazil and for giving me useful information. I must express my thanks to the staff of the library at *Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais*, especially Ana Paula Martins de Oliveira, for their patience in dealing with my many questions and requests for material from other universities.

References

- Alexander, C. P. 1920. A new subfamily of Tanyderid flies (Diptera). **Annals of the Entomological Society of America**, **13**: 402-406 + Plate XXXII.
- Alexander, C. P. 1921. Two undescribed Tipuloid flies from New Zealand. **Insector Inscitiae Menstruus**, **9**: 157-159.
- Alexander, C. P. 1928. The Australasian species of the genus *Nemopalpus* (Psychodidae, Diptera). **Proceedings of the Linnean Society of New South Wales**, **53**: 291-294.
- Alexander, C. P. 1929. A revision of the American two-winged flies of the Psychodid subfamily Bruchomyiinae. **Proceedings of the United States National Museum**, **75**: 1-9.
- Alexander, C. P. 1940. Further observations on the Psychodid subfamily Bruchomyiinae (Diptera). **Revista de Entomologia**, **11**: 793-799.
- Alexander, C. P. 1944. Two undescribed species of Psychodid Diptera from tropical America. **Revista de Entomologia**, **15**: 313-317.
- Alexander, J. B. 1987. A new species of *Nemopalpus* (Diptera: Psychodidae, Bruchomyiinae) from northeastern Colombia. **Florida Entomologist**, **70**: 376-381.
- Barretto, M. P. 1950. Contribuição para o estudo dos Bruchomyiinae brasileiros, com as descrições de duas novas espécies (Diptera, Psychodidae). **Papéis Avulsos do Departamento de Zoologia, Secretaria da Agricultura, São Paulo, Brasil**, **9**: 341-350.
- Barretto, M. P. & d'Andretta, M. A. V. 1946. Observações sobre subfamília *Bruchomyiinae* Alexander, 1920 com a descrição de quatro novas espécies (Diptera: Psychodidae). "*Livro Homenagem Romualdo Ferreira d'Almeida*", São Paulo: 55-75.
- Brazil, R. P. & Andrade Filho, J. D. 2002. Description of *Pintomyia (Pifanomyia) falcaorum* sp. n. (Diptera: Psychodidae: Phlebotominae) a fossil sand fly from Dominican Amber. **Memórias do Instituto Oswaldo Cruz**, **97**: 501-503.
- Duckhouse, D. A. 1973. A catalogue of the Diptera of the Americas south of the United States. 6A : Family Psychodidae, subfamilies Bruchomyiinae, Trichomyiinae, Sycoracinae and Psychodinae. **Museu de Zoologia, Universidade de São Paulo**: 29 pages.
- Duckhouse, D. A. & Lewis, D. J. 1980. Family Psychodidae: 95-105. In R. J. Crosskey [ed.], Catalogue of the Diptera of the Afrotropical region. **British Museum (Natural History), London**.
- Edwards, F. W. 1921. A note on the subfamily Bruchomyiinae (Diptera, Nematocera). **Annals and Magazine of Natural History**, **7**: 437-439.
- Edwards, F. W. 1929. The genus *Nemopalpus* in South Africa (Diptera, Psychodidae). **Annals and Magazine of Natural History**, **3**: 421-423.
- Fairchild, G. B. 1952. Notes on *Bruchomyia* and *Nemopalpus* (Diptera, Psychodidae). **Annals of the Entomological Society of America**, **45**: 259-280.
- Freeman, P. 1949. A key to the South American species of *Nemopalpus* (Dipt., Psychodidae) with the description of a new species. **Entomologist's Monthly Magazine**, **85**: 85-88.
- Ibáñez-Bernal, S. 2001. Notes on the Psychodidae (Diptera) of Belize : subfamilies Bruchomyiinae and Phlebotominae. **Annals of the Entomological Society of America**, **94**: 367-385.
- Kistner, D. H., Disney, R. H. L. & Williams, P. 2001. Larval and pupal Bruchomyiinae (Diptera, Phlebotomidae) from army ant colonies (Hymenoptera, Formicidae). **Sociobiology**, **37**: 237-238.
- Léger, N. & Depaquit, J. 2002. Systématique et biogéographie des phlébotomes (Diptera: Psychodidae). **Annales de la Société Entomologique de France**, (n. s.), **38**: 163-175.

- Léger, N., Pesson, B., Ferté, H., Gijon-Botella, H. & Morilla-Marquez, F., 1993. Redescription de la femelle et description de l'oeuf de *Nemopalpus flavus* Macquary, 1838 (Bruchomyiinae, Psychodidae, Diptera). Affinités avec les phlébotomes. **Annales de Parasitologie Humaine et Comparée**, **68**: 154-160.
- de Leon, J. R. 1950. Tres nuevas especies de *Nemopalpus* de Guatemala. **University of San Carlos, Publication No. 150**: 3-29.
- Lewis, D. J. 1982. A taxonomic review of the genus *Phlebotomus* (Diptera: Psychodidae). **Bulletin of the British Museum (Natural History). (Entomological series)**, **45**: 121-209.
- Macquart, M. 1838. Diptera. In P. B. Webber & S. Berthelot [eds], "*Histoire naturelle des Canaries*" **2, Part 3, Entomology I**: 101-102.
- Mahmood, F. & Alexander, J. B. 1992. Immature stages of *Nemopalpus nearcticus* (Diptera : Psychodidae). **Florida Entomologist**, **75**: 171-178.
- Meunier, F. 1905. Monographie des Psychodidae de l'ambre de la Baltique. **Annali Museum Nationales Hungarici**, **3**: 235-255.
- Muzón, J., Spinelli, G. R., Salomon, O. D. & Rossi, G. 2002. A first record of Phlebotominae from Argentinean Patagonia (Diptera: Psychodidae: Phlebotominae). **Memórias do Instituto Oswaldo Cruz**, **97**: 797-798.
- Ortiz, I. & Scorza J. V. 1963. Notas biológicas y taxonomicas sobre algunos Phlebotominae (Diptera, Psychodidae) de Rancho Grande, Venezuela. **Acta Biologica Venezuelica**, **3**: 341-361.
- Quate, L. W. 1962. A review of the Indo-Chinese Phlebotominae (Diptera: Psychodidae). **Pacific Insects**, **4**: 251-267.
- Quate, L. W. & Alexander, J. B. 2000. Synopsis of the New World *Nemopalpus* (Diptera, Psychodidae, Bruchomyiinae) with description of four new species. **Annals of the Entomological Society of America**, **93**: 185-193.
- dos Santos, M. C. Williams, P. & Ferreira, M. 1991. Changes in sex ratio during attempts to establish a laboratory colony of *Lutzmyia longipalpis* (Diptera: Psychodidae). **Parassitologia**, **33** (suppl. 1): 169-176.
- Satchell, G. H. 1953. On the early stages of *Bruchomyia argentina* Alexander (Diptera: Psychodidae). **Proceedings of the Royal Entomological of London (Series A)**, **28**: 1-12.
- Shannon, R. C. & del Ponte, E. 1927. Cuatro notas sobre especies nuevas de dipteros nematóceros hematófagos o no, de la República Argentina. (Tercera nota). **Revista de Instituto de Bacteriologia do Departamento Nacional da Higiene**, **4**: 733-734.
- Stuckenberg, B. R. 1962. The South African species of *Nemopalpus* (Diptera: Psychodidae). **Annals of the Natal Museum**, **15**: 201-218.
- Stuckenberg, B. R. 1978. Two new species of *Nemopalpus* (Diptera: Psychodidae) found in rock hyrax abodes in South West Africa. **Annals of the Natal Museum**, **23**: 367-374.
- Tonnoir, A. L. 1922. Notes sur le genre *Nemopalpus* (Dipt. Psychodidae) et description d'une espèce nouvelle. **Annals de la Société Entomologique Belgique**, **60**: 125-136.
- Tonnoir, A. L. 1939. Psychodidae. **Ruwenzori Expedition 1934-5, 1 (4)**: 35-39 and 80.
- Tonnoir, A. L. 1940. Sur un remarquable organe sexuel secondaire chez certains mâles du genre *Nemopalpus* Macq. avec description d'une espèce nouvelle et d'une autre peu connue. **6 Congreso Internacional Entomologia, Madrid 1935**: 203-213.
- Vargas, L. & Díaz Nájera, A. 1958. *Nemopalpus yucatanensis* n. sp. (Diptera, Psychodidae). **Revista del Instituto de Salubridad y Enfermedades Tropicales**, **18**: 1-11.
- Williams, P. 1993. Relationships of Phlebotomine sand flies (Diptera). **Memórias do Instituto Oswaldo Cruz**, **88**: 177-183.
- Young, D. G. 1974. Bruchomyiinae in North America with a description of *Nemopalpus nearcticus* n. sp. (Diptera : Psychodidae). **Florida Entomologist**, **57**: 109-113.

Dedication

This paper is in memory of Dr Laurence W. Quate who studied Psychodidae in many parts of the world throughout the second half of the 20th century and into the beginning of the 21st century.