Map 9, Pattern IIIa, Endemic Groups, Radiations; map 10, Pattern IIIb, Endemic Groups, Chilean.

have crossed a water gap to South America. The presence of a large number of fossil syrphids (35 genera, 75 species) in Eocene, Oligocene, and Miocene deposits from the northern continents strongly suggests that the family did not arise in the Neotropical region, since this would have required rather rapid and frequent dispersal from South America across a large water gap in the very early part of the Tertiary. Also, as will be shown below by phylogenetic evidence, *all*

endemic Neotropical milesine genera are obviously recently derived from more primitive genera in other parts of the world.

In studying zoogeographical relationships of the endemic Neotropical genera, two questions are of major interest: first, what is the location of the non-endemic group most closely related to the taxon in question (its sister-group); and second, if there is a non-endemic sister-group, in which direction did the past dispersal take place. If no non-endemic sister-group is found, then the group in question probably arose in the area where it is found. However, if a non-endemic sister-group is found, then there must have been some past dispersal. This dispersal could have been of two types: 1) the ancestor of one of the sister-groups dispersed to a new area, or 2) the ancestors of both sister-groups dispersed to new areas. In the first case, only two different areas are involved and in the second case, three. Almost all endemic Neotropical milesine genera have a strictly northern group as their nearest relative (see Table VII, VIII), strongly indicating that only two areas are involved as possible sources of the Neotropical endemic genera, South America itself and North America. The few remaining endemic Neotropical milesine genera, except for *Senogaster* and *Flukea*, are closely related to genera found throughout most of the world including the Nearctic region. Thus these few endemic genera could possibly have had their origins

Table VII. Sister-group relationships of the Chilean endemic milesine genera

Chilean Genus	Sister-group	Location of Sister-group	Status of Sister-group in Regions	
			Ethiopian	Australian
Chamesphegina	Neoascia Sphegina	Holarctic	absent	absent
Chromocheilosia	Myolepta	mainly Holarctic	absent	absent
Notiocehilosia	Callicera	mainly Holarctic	absent	absent
Valdivia and Odyneromyia*	Temnostoma	Holarctic	absent	absent
Eriophora	Criorhina	Holarctic Oriental	absent	???
Macrometopia	Xylota group	Holarctic Oriental	absent	?absent
Philippimyia	Blera	Holarctic	absent	absent
Hemixylota and Stilbosoma*	Milesia	Holarctic Oriental	absent	absent
Flukea	Doinches	Australian	absent	present

*The two genera listed have the same extralimital sister-group

Table VIII. Sister-group relationships of the Neotropical milesine radiations

Radiation	Sister-group	Location of Sister-group	Status of Sister-group in Ethiopian Region	Status of Sister-group in Australian Region
Trichopsomyia	Neocnemodon	Holarctic	absent	absent
Ornidina	Volucella	mainly Holarctic	absent	a few spp.
Nausigaster and Alipumilio	Eumerus	Megagea	present	present
Lepidomyia	Myolepta	mainly Holarctic	absent	absent
Quichuana	Mallota?	mainly Holarctic	absent	absent
Habromyia	Mallota	mainly Holarctic	absent	absent
Palpada and Lycastrirhynchus*	Eoseristalis Eristalis	mainly Holarctic	1 sp. (tenax)**	1 sp. (tenax)**
Meromacrus	Eoseristalis Eristalis	mainly Holarctic	1 sp. (tenax)**	1 sp. (tenax)**
Ceriana	???	???	???	???
Sterphus and Ceriogaster*	Chrysosomidia Hadromyia	Nearctic	absent	absent
Neplas	Chalcosyrphus	Nearctic	absent	absent

*As in Table VII. **Eristalis tenax is now cosmopolitan and was probably introduced into the Australian and Ethiopian regions by man.

on almost any continent, but the probabilities, based on the majority of the cases being of New World origin, strongly favor that these are also of Nearctic or Neotropical origin.

Only two particular cases suggest a non-New World origin of an endemic Neotropical milesine group. The monotypic genus *Senogaster* is most closely related to *Syritta*, which is *absent* from the Nearctic region but is abundant in the Ethiopian region. *Flukea* is the sister-group of *Deinches*, an Australian endemic genus. Since *Senogaster* and *Flukea* are monotypic, I would suggest, in these special cases, either wind dispersal or rafting across the oceans to explain these two exceptions to the general pattern of endemic Neotropical milesine genera (as well as all higher Diptera - see Vockeroth 1969) - having a northern sister group.

Although most endemic Neotropical milesine genera have a northern sister-group, the location of the sister-group does not indicate the direction of past dispersal unless we know which sister-group is primitive or have other information about the geographical location of the ancestral group to both sister-groups, i.e. fossils. The fact

that the sister-groups of the Neotropical endemic milesine genera are almost always found in the Nearctic region mutually supports the geological evidence that there are only two probable sources for these genera, the Nearctic or Neotropical region. The dispersal of the ancestor of either sister-group probably took place during the Tertiary Period, as indicated previously, thus allowing both sufficient time and isolation for the evolution of generic distinctiveness. The Tertiary isolation of South America, which greatly restricted faunal interchanges, would tend to cause the retention of primitive forms in the area where they arose and insure the dispersal of the derived forms across the barrier. The hypothesized nature of the selective or filtering mechanism affecting the fauna of South America, the isolating Tertiary water gap, is based on the following evolutionary observation. The fossil record indicates that higher taxa also have a definite life cycle, as species have: a new taxon comes into existence, quickly grows abundant and diverse, spreading over many niches and much land area, and then leveling off at a peak point. From this peak point in the life cycle of the taxon, one of three different things may happen: 1) the taxon may give rise to new taxa, 2) it may be replaced by another taxon and quickly go to extinction, or 3) it may persist in low numbers and in specialized niches or isolated areas. Thus it would appear that the derived groups of animals, being more numerous and widespread, have a greater probability of crossing a barrier than primitive groups which tend to be rare and restricted in range. The Tertiary ocean between South and North America was a constant barrier to syrphids: no syrphid has ever become adapted to survive in salt water. In summary, if syrphids arose in South America, then the oldest syrphids should still be there. However, if syrphids arose elsewhere, these primitive groups probably would not have been able to cross the barrier into South America and therefore they should be absent from the Neotropical region.

Table IX. Sister-group relationships of miscellaneous endemic Neotropical

Genus	Sister-group	Location of Sister-group	Status of Sister-group in Ethiopian Region	Australian Region
Cacoceria	?Temnostoma	Holarctic	absent	absent
Senogaster	Syritta	Megagea	present	absent

Knowing whether the endemic South American genera are either derived or primitive is essential for indicating the direction of past dispersal. In the determination of the phylogenetic relationship between the northern and Neotropical genera, the sister-groups *must* be dealt with individually. For our general purpose it is only necessary to study a few of the sister-group relationships since we are mainly concerned with the place of origin of the milesines. The

answer to the question of whether the milesines arose in South America or not depends only on whether the oldest extant milesine genera are restricted to the Neotropical region or not. The oldest genera will naturally be found only in the most primitive milesine tribes — Pipizini, Cheilosini, Volucellini, and Callicerini.

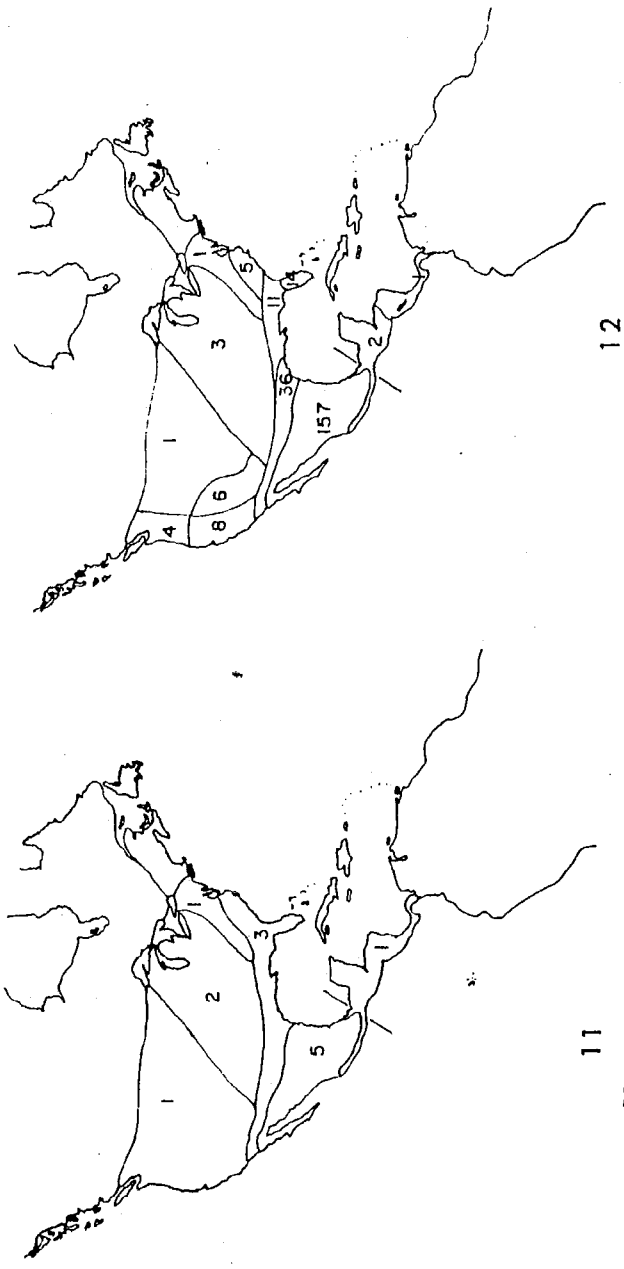
Of these tribes only two[1], Pipizini and Volucellini, have endemic Neotropical milesine genera and in both of these tribes the endemic Neotropical milesine genera are the most recently derived genera in their respective tribes as indicated in the main text. Thus absence of primitive endemic genera of the primitive milesine tribes indicates that the family did not arise in South America and that almost all endemic milesine syrphids must have crossed the Tertiary water gap from the north.

TRANSITION BETWEEN THE NEARCTIC AND NEOTROPICAL MILESINE FAUNAS

Faunal regions provide a means for categorizing the main features of distribution of existing animals. Since Sclater (1857) first proposed faunal regions to explain the distribution of birds, there has been considerable controversy about the reality and practicality of these faunal regions. The controversy stems from the lack of appreciation of two fundamental facts about faunal regions: 1) the limits of faunas do not correspond exactly to certain geographical boundaries, but they tend to merge into each other in complex zones of transition; and 2) faunal regions are only pragmatical devices, representing the *average* patterns of animal distribution and thus serving as a "standard" for comparison purposes only.

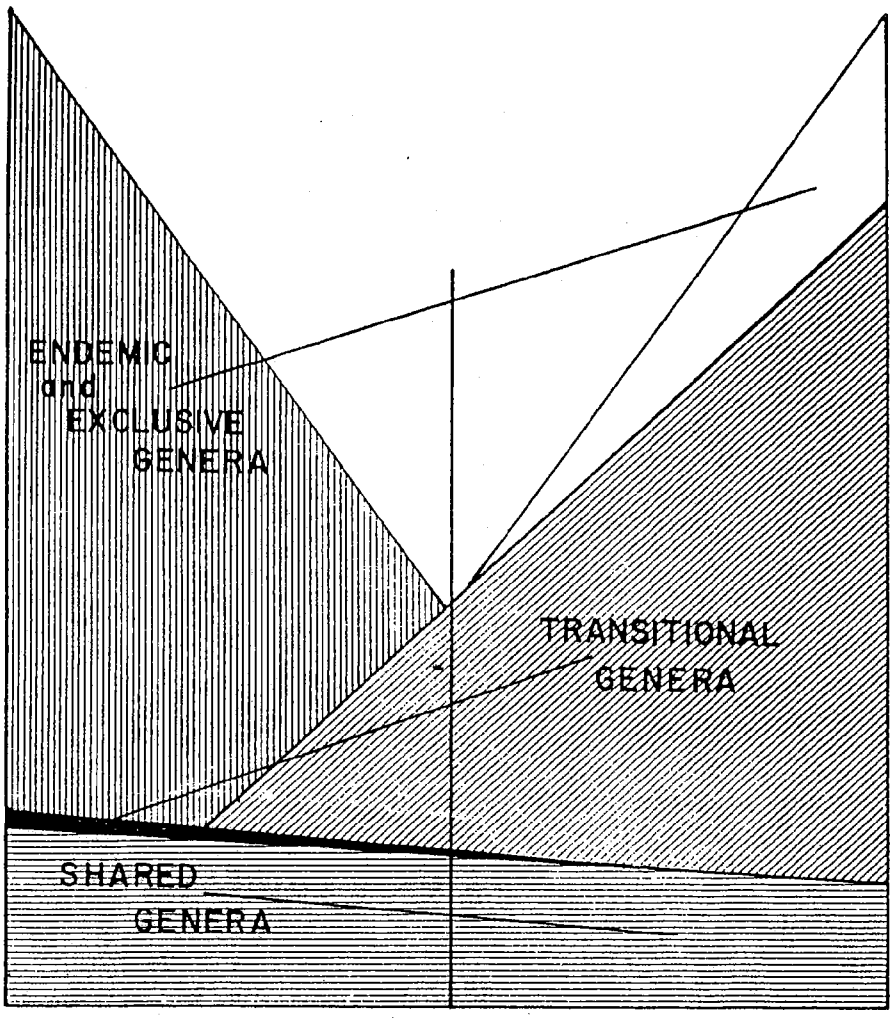
An appreciation of the above two fundamental facts concerning faunal regions leads to questions as to the nature of the transition between the Neotropical and Nearctic milesine syrphid faunas — 1) what taxa are involved in the overlap; 2) how large or small a part of the main fauna are involved in the overlap; 3) what is the relative contribution of each faunal region to the overlap; and 4) how well are the distribution patterns of the milesine syrphids categorized by the faunal regions. Faunas and the transitions between them include three types of taxa: shared taxa, transitional taxa and exclusive taxa. The *shared taxa* are those equally distributed in both regions. The *transitional taxa*, which are those taxa that are predominantly distributed in one region but with a few representatives in the other region, are the only type of taxa actually involved in the overlap between faunal regions. The *exclusive taxa* (including the endemic taxa), which are those taxa distributed in one of the regions but not the other, are not involved in the overlap but the limits of their distributions define the faunal boundaries. The boundary between two faunal regions can be defined operationally as

(1) If *Notiochellosia* is a Callicerini, which is likely, then it is the derived sister-group of *Callicera* (see above).



Map 11, Geographic distribution of the Neotropical-Nearctic transitional genera plotted with approximate isometric lines. Map 12, Geographic distribution of the transitional species of the Neotropical-Nearctic transitional genera plotted with aproximate isometric lines.

the geographical boundary that divides two faunas in such a way as to maximize the number of exclusive taxa and minimize the number of transitional taxa. The transitional taxa and the shared



6

Diagram 6, Transition between the Nearctic and Neotropical milesine faunas. The area with the horizontal lines represents the shared genera; with the diagonal lines, Neotropical transitional genera; with solid black, Nearctic transitional genera; with the vertical lines, Nearctic exclusive and endemic genera; without lines, Neotropical endemic genera.

taxa have all been marked in the list of genera in Appendix II. Diagram 6 is a modification of Darlington's diagram of faunal transition (1957:453, fig. 53), illustrating the transition between the Nearctic and Neotropical milesine faunas. The vertical axis represents the percentage, based on number of species, of each type of genera

present in the respective fauna excluding the transitional genera from the other fauna and the longitudinal axis represents the geographical relationship of the various types of taxa. From the above mentioned diagram, it can be clearly seen that the transition between the Nearctic and Neotropical milesine fauna appears to be made up of predominantly southern groups which have moved northward in direction. Only the genus *Milesia* extends slightly south of the isthmus of Tehuantepec, whereas a number of genera of Neotropical origin have extended northward across the isthmus of Tehuantepec and into Mexico and the southern United States. The transition between the Nearctic and Neotropical milesine faunas can be also illustrated by plotting the distribution of the involved genera and their species with isometric lines (see maps 11,12). In short, the isthmus of Tehuantepec is the southern limit for almost all northern taxa and thus the isthmus precisely defines the southern boundary of the Nearctic fauna. On the other hand, the isthmus is not as useful as a boundary for categorizing the Neotropical milesine syrphid fauna as for Nearctic milesines, since many predominantly South American taxa extend their range beyond the isthmus.

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GLOSSARY

Williston (1886) and Shannon (1922 and 1926) have provided brief glossaries to some of the special terms and characters used for syrphids. However, most of the terms used in syrphid systematics can be found also in Torre-Bueno (1937). Where my usage of a term differs from that in those papers, or where it may not be clear in which sense I have used a term, or where I have used a term not included in these papers, I have then listed the term below with its definition. Also, the section on characters in the first part of this revision should be consulted.

Apical cell: Apical cell is the same as cell R4+5, also called the first posterior cell (Williston).

Apical crossvein: Apical crossvein is the up-turned portion of vein m1+2, which seals off the apical cell (R4+5).

Barrette: The barrette is the upper, usually convex, portion of the meropleuron.

Character: A character is anything that *differs* among a collection of objects. Each difference is a state of the character. Thus character is a collective term, denoting a set of differences of a homologous nature. For example: color is a character; red, white and blue are states of the character color.

Derived: Derived refers to the character state that has changed the most in a dichotomy. It is the new difference that has evolved to separate one taxon from another. Hennig's term apomorphic (apo-) is synonymous.

Dichotomy: A dichotomy is the graphic representation of the divergence between any two taxa. Over a period of time, two taxa, sister-groups, diverge from a single ancestral taxon. This phenomenon can be drawn on paper as a dichotomy with one axis, ordinate, as time and the other, abscissa, as divergence.

Endemic Quotient: Endemic quotient is defined as the percentage of the total number of species of a fauna represented by the species in the endemic genera.

Facial stripes: The facial stripes is the area between the facial grooves and the eye margin.

Faunal Boundary: A faunal boundary can be defined operationally as the geographical boundary that divides two faunas in such a way as to maximize the number of exclusive taxa and minimize the number of transitional taxa (see page 197).

Primitive: Primitive refers to the character state that has remained the same or changed the least in a dichotomy. It is the condition or state closest to that of the ancestral taxon. Hennig's term plesiomorphic (plesio-) is synonymous.

Sister-group: Sister-groups are taxa, which share the same immediate ancestral group (also see dichotomy).

APPENDIX I. Character survey of the milesine tribes

Genera	Character states																				
	1	2	3	4	5	6a	6b	6c	7	8	9	10	11	12	13	14	15a	15b	16	17	18	19	20
Tribe Pipizini																							
Pipiza	–	–	–	+	–	–	–	–	+	–	–	+	–	–	–	+	–	–	–	–	–	+	+
Trichopsomyia	–	–	–	+	–	–	–	+	+	–	–	+	–	–	–	+	–	–	–	–	–	+	+
Neoenamodon	–	–	–	+	–	–	–	–	+	–	–	+	–	–	–	+	–	–	–	–	–	+	+
Pipizella	–	–	–	+	–	–	–	–	+	–	–	+	–	+	–	+	–	–	–	–	–	+	+
Heryngia	–	–	–	+	–	–	–	–	+	–	–	+	–	+	–	+	–	–	–	–	–	+	+
Tribe Cheilosini																							
Subtribe Cheilosina	+	v	v	–	–	–	–	+	–	–	–	+	–	–	–	+	–	+	–	–	–	+	+
Cheilosia	+	+	+	–	–	–	–	+	–	–	–	+	–	–	–	+	–	+	–	–	–	+	+
Hiatomyia	+	+	+	–	–	–	–	+	+	–	–	+	–	–	–	+	–	+	–	–	–	+	+
Portevinia	+	–	+	–	–	–	–	+	–	–	–	+	–	–	–	+	–	+	–	–	–	+	+
Ferdinandea	+	+	+	–	–	+	+	+	–	–	–	v	–	–	–	+	–	+	–	–	–	+	+
Rhingia																							
Subtribe Pelecocerating	v	+	v	+	v	–	–	+	–	–	–	+	–	–	–	+	–	v	–	–	–	+	+
Chamaesyphus	+	+	+	+	+	–	–	+	–	–	–	+	–	–	–	+	–	+	–	–	–	+	+
Pelecocera																							
Tribe Volucellini																							
Subtribe Volucellina	+	–	–	–	+	–	–	+	–	–	+	–	–	+	–	+	–	+	–	+	–	–	+
Volucella	+	–	–	–	+	v	v	+	–	–	+	–	–	+	–	+	–	+	–	–	–	–	+
Graptomyza																							
Subtribe Ornidina	+	–	–	–	+	–	–	+	–	–	–	–	–	+	–	+	–	+	–	+	–	+	+
Tachinosyrphus	+	–	–	–	+	–	–	+	–	–	+	–	–	+	–	+	–	+	–	+	–	+	+
Ornidia	+	–	–	–	v	–	–	+	v	–	+	–	–	+	–	+	–	+	–	v	–	+	+
Copestylum																							
Tribe Calliceratini																							
Calliocera	+	–	–	–	–	–	–	+	+	v	–	v	–	–	–	+	–	+	–	–	–	+	+
Notiochailosia	+	–	–	–	–	–	–	+	+	–	–	–	–	–	–	+	–	+	–	–	–	+	+
Tribe Sericomyini																							
Aretophilia	+	+	+	–	–	–	–	+	+	–	+	+	+	–	v	+	–	+	–	–	–	+	+
Sericomyia	+	+	+	–	–	–	–	+	+	–	+	+	+	–	–	+	–	+	–	–	–	+	+
Pyritis	+	–	–	–	–	–	–	+	+	–	+	+	+	–	–	+	–	+	–	–	–	+	+
Pseudovolucella	+	+	+	–	–	–	–	+	+	–	+	+	+	–	–	+	–	+	–	–	–	+	+
Tapetomyia	+	+	+	–	–	–	–	+	+	–	+	+	+	–	–	+	–	+	–	–	–	+	+
Tribe Spheginobacchini																							
Spheginobaccha	+	+	+	–	+	–	–	+	+	+	–	+	–	–	–	+	–	–	–	–	–	+	+
Tribe Psarini																							
Psarus	+	+	+	+	–	–	–	+	+	+	–	+	+	+	–	+	–	–	–	–	–	+	+
Tribe Chrysogasterini																							
Subtribe Spheginina	+	+	+	+	+	+	+	+	–	+	–	+	–	+	–	+	–	+	–	–	–	+	+
Sphegina	+	+	+	+	+	+	+	+	–	+	–	+	–	+	–	+	–	+	–	–	–	+	+
Neoascia	+	+	+	+	+	+	+	+	–	+	–	+	–	–	–	+	–	+	+	–	–	+	+
Chamaesphegina																							
Subtribe Chrysogasterina	+	+	+	+	+	+	+	+	+	+	v	+	–	–	–	+	–	+	–	–	–	+	+
Brachyopa	+	+	+	+	+	–	+	+	+	+	–	+	–	–	–	+	–	+	v	–	–	+	+
Chrysogaster	+	+	–	+	+	–	+	+	+	+	–	+	–	+	–	+	–	+	v	–	–	+	+
Orthonevra	+	–	+	+	–	–	+	+	–	+	–	+	–	–	–	+	–	+	–	–	–	+	+
Chromocheilosia	+	+	–	+	+	–	–	+	+	+	–	–	–	–	–	+	–	+	–	–	–	+	+
Lepidomyia	+	+	+	v	+	–	+	+	+	+	–	v	v	–	–	+	–	+	+	–	–	+	+
Myolepta																							
Tribe Eumerini	+	–	–	+	+	–	–	+	+	+	–	+	–	–	–	+	+	+	+	–	–	–	+
Nausigaster	+	–	–	–	+	+	+	+	+	+	–	+	–	+	–	+	+	+	+	–	–	–	+
Alipumilio	+	–	–	–	+	+	+	+	+	+	–	+	v	+	–	+	+	+	+	–	–	–	+
Eumerus	+	–	–	–	v	+	+	+	+	+	–	+	+	+	+	+	+	+	+	–	+	–	+
Merodon	+	–	–	–	–	+	+	+	+	+	–	+	+	+	+	+	+	+	+	–	–	–	+
Azpeytia	+	–	–	–	–	+	+	+	+	+	–	+	–	–	–	+	+	+	+	–	–	–	+
Pailota																							
Tribe Cerioidini	+	+	–	–	+	–	–	+	+	+	–	+	+	–	v	–	–	+	–	–	–	–	+
Ceriana																							

Genera	Character states																				
	1	2	3	4	5	6a	6b	6c	7	8	9	10	11	12	13	14	15a	15b	16	17	18	19	20
Tribe Eristalini																							
Subtribe Helophilina																							
Quichuana	+	-	-	-	+	-	-	+	+	+	-	+	+	-	+	+	-	+	-	-	+	+	+
Polydontomyia	+	+	-	-	v	-	-	+	+	+	-	+	+	-	+	+	-	+	-	-	+	+	+
Anemosyrphus	+	+	-	-	v	-	-	+	+	+	-	+	+	-	+	+	-	+	-	-	+	+	+
Arctosyrphus	+	+	-	-	+	-	-	+	+	+	-	+	+	-	+	+	-	+	-	-	+	+	+
Mallota	+	v	-	-	v	-	-	+	+	+	-	+	+	-	+	+	-	+	-	-	+	+	+
Helophilus	+	+	-	-	-	-	-	+	+	+	-	+	+	-	+	+	-	+	-	-	+	+	+
Lunomyia	+	+	-	-	+	-	-	+	+	+	-	+	+	-	+	+	-	+	-	-	+	+	+
Parhelophilus	+	+	-	-	+	-	-	+	+	+	-	+	+	-	+	+	-	+	-	-	+	+	+
Anasimyia	+	+	-	-	+	-	-	+	+	+	-	+	+	-	+	+	-	+	-	-	+	+	+
Eurmyia	+	+	-	-	+	-	-	+	+	+	-	+	+	-	+	+	-	+	-	-	+	+	+
Dolichogyna	+	+	-	-	v	-	-	+	+	+	-	+	+	-	+	+	-	+	-	-	+	+	+
Nabromyia	+	+	-	-	+	-	-	+	+	+	-	+	+	-	+	+	-	+	-	-	+	+	+
Orthoprosopa	+	+	-	-	+	-	-	+	+	+	-	+	+	-	+	+	-	+	+	-	+	+	+
Myiatropa	+	-	-	-	v	-	-	+	+	+	-	+	+	-	+	+	-	+	-	-	+	+	+
Neasembrius	+	+	-	-	+	-	-	+	+	+	-	v	+	-	+	+	-	+	-	-	+	+	+
Subtribe Eristalina																							
Megaspis	+	+	-	-	v	-	-	+	+	+	v	-	+	-	+	+	-	+	v	+	+	+	+
Solenaspis	+	+	-	-	-	-	-	+	+	+	-	+	+	-	+	+	-	+	+	+	+	+	+
Simioides	+	+	-	-	v	-	-	+	+	+	+	-	+	-	+	+	-	+	-	+	+	+	+
Keda	+	+	-	-	+	-	-	+	+	+	-	+	+	-	+	+	-	+	-	+	+	+	+
Xenzoon	+	+	-	-	+	-	-	+	+	+	-	+	-	-	+	+	-	+	-	+	+	+	+
Meromacrus	+	+	-	-	+	-	-	+	+	+	-	+	+	-	+	+	-	+	-	+	+	+	+
Eristalis	+	-	-	-	v	-	-	+	+	+	+	+	+	-	+	+	-	+	-	+	+	+	+
Eoseristalis	+	-	-	-	v	-	-	+	+	+	v	+	+	-	+	+	-	+	-	+	+	+	+
Eristalinus	+	-	-	-	+	-	-	+	+	+	-	+	+	-	+	+	-	+	-	+	+	+	+
Eristalodes	+	-	-	-	v	-	-	+	+	+	-	-	+	-	+	+	-	+	-	+	+	+	+
Lathyrophthalmus	+	+	-	-	+	-	-	+	+	+	-	+	+	-	+	+	-	+	-	+	+	+	+
Palpada	+	+	-	-	v	-	-	+	+	+	-	-	+	-	+	+	-	+	-	+	+	+	+
Lycastrirhychus	+	+	-	-	v	-	-	+	+	+	-	-	+	-	+	+	-	+	-	+	+	+	+
Axona	+	+	+	-	+	-	-	+	+	+	-	+	+	-	+	+	-	+	-	+	+	+	+
Dissoptera	+	+	-	-	+	+	+	+	+	+	-	+	-	-	+	+	-	+	-	+	+	+	+
Tribe Milesini																							
Criorhina Group																							
Criorhina	+	+	v	-	v	-	-	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Flukea	+	+	+	-	-	-	+	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Aneriophora	+	+	+	-	-	-	-	+	+	+	-	+	+	-	-	+	-	+	+	-	-	+	+
Merapioidus	+	+	+	-	+	-	-	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Deinaches	+	+	+	-	-	-	-	+	+	+	-	+	+	-	-	+	-	+	+	-	-	+	+
Spheocomyia	+	+	+	-	-	-	-	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Caliprobola	+	+	+	+	+	-	-	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Paratropidia	+	+	+	-	-	+	+	+	+	+	-	+	+	-	-	+	-	+	+	-	-	+	+
Blera Group																							
Blera	+	+	+	+	v	v	v	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Somula	+	+	+	+	-	-	-	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Lejota	+	+	+	+	v	v	+	+	+	+	-	+	-	-	-	+	-	+	+	-	-	+	+
Philippimyia	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	+	-	+	+	-	-	+	+
Temnostoma Group																							
Temnostoma	+	+	+	v	-	-	+	+	+	+	-	+	+	-	-	+	-	+	-	-	-	v	+
Takaomyia	+	+	+	-	-	+	+	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Valdivia	+	+	+	+	-	-	+	+	+	+	-	+	-	-	-	+	-	+	-	-	-	+	+
Odyneromyia	+	+	+	+	-	-	-	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Tuechnemis	+	+	+	-	+	-	+	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Pterallastes	+	+	+	+	-	-	+	+	+	+	-	+	+	-	v	+	-	+	-	-	-	+	+
Tropidia Group																							
Tropidia	+	+	+	-	v	-	v	+	+	+	-	+	+	-	-	+	-	+	+	-	-	+	+
Senogaster	+	+	+	-	+	+	+	+	+	+	-	+	+	-	-	+	-	+	+	-	-	+	+
Syritta	+	+	+	-	+	+	+	+	+	+	-	+	+	-	-	+	-	+	+	-	-	+	+
Nepenthosyrphus	+	+	v	-	+	-	-	+	+	+	-	+	+	-	-	+	-	+	+	-	-	+	+
Xylota Group																							
Xylota	+	+	+	+	+	+	+	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Xylotomimia	+	+	+	-	-	+	+	+	+	+	-	+	+	-	-	+	-	+	+	-	-	+	+
Chalcosyrphus	+	+	+	-	-	+	+	+	+	+	-	+	-	-	-	+	-	+	+	-	-	+	+
Crioprora	+	+	+	+	+	-	+	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Brachypalpus	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Chrysosomidia	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Neplas	+	+	+	-	-	+	+	+	+	+	-	+	+	-	-	+	-	+	+	-	-	+	+
Sterphus	+	+	+	+	-	-	-	+	+	+	-	+	+	-	-	+	-	+	v	-	-	+	+
Coriogaster	+	+	+	+	+	-	-	+	+	+	-	+	+	-	-	+	-	+	v	-	-	+	+
Macrometopia	+	-	v	+	-	-	-	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Hadromyia	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Fecota	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	+	-	+	-	-	-	+	+
Milesia Group																							
Milesia	+	+	v	-	-	+	+	+	+	+	-	+	+	-	-	+	-	+	+	+	-	v	+
Hemixylota	+	+	+	+	-	+	+	+	+	+	-	+	-	-	-	+	-	+	+	-	-	+	+
Korchinia	+	+	+	+	-	-	+	+	+	+	-	+	+	-	+	+	-	+	+	-	-	+	+
Spilomyia	+	+	+	-	+	v	+	+	+	+	-	+	+	-	-	+	-	+	v	-	-	-	+
Stilbosoma	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	+	-	+	+	-	-	+	+
Syrittosyrphus	+	+	+	-	-	+	+	+	+	+	-	+	+	-	+	+	-	+	+	-	-	+	+
Hardimyia	+	+	-	-	-	+	+	+	+	+	-	-	-	-	-	+	-	+	+	-	-	-	+
Pseudozetterstedtia	+	+	+	+	-	+	+	+	+	+	-	+	+	-	+	+	-	+	-	-	-	+	+
Palumbia	+	+	+	+	-	+	+	+	+	+	-	+	+	-	+	+	-	+	+	+	-	+	+

CHARACTERS USED IN APPENDIX I

1. Oral margin medially notched (+), not notched, evenly rounded (—).
2. Eyes bare (+), pilose (—).
3. Face bare (+), pilose at least on sides (—).
4. Metasterna bare (+), pilose (—).
5. Subscutellar fringe absent (+), present (—).

6a. Face concave (+), otherwise (—).
b. Face concave in female at least (+), otherwise (—).
c. Face tuberculate in both sexes or concave (+), otherwise (—).

7. Thoracic bristles absent (+), present (—).
8. Hind femur with ventral spines (+), without (—).
9. Arista plumose (+), bare (—).
10. Metathoracic spiracular pile patch absent (+), present (—).
11. Anterior crossvein distinctly at or beyond middle of discal cell (+), before middle of discal cell (—).
12. Apical crossvein perpendicular or recessive (+), directed outward (—).
13. Third vein strongly looped into apical cell (+), straight (—).
14. Antenna with arista (+), with terminal style (—).

15a. 1st abdominal spiracle free and 1st abdominal sternite reduced (+), otherwise (—).
b. 1st abdominal spiracle embedded in meta-epimeron or 1st abdominal sternite reduced (+), 1st abdominal spiracle free and 1st abdominal sternite unmodifield (—).

16. Scutellum with distinct apical emarginate rim (+), without such a rim (—).
17. Marginal cell petiolate (+), open at wing margin (—).
18. Hind femur with a basal setal patch (+), without such a patch (—).
19. Anterior portion of meso-anepisternum bare (+), pilose (—).
20. Male with four pregenital segments (+), with five pregenital segments (—).

Note: v means variable or intermediate.

APPENDIX II

Neotropical milesine genera

Pipizini
- Pipiza (s)
- *Trichopsomyia

Cheilosini
- Cheilosina
  - Rhingia (s)

Callicerini
- *Notiocheilosia

Volucellini
- Ornidina
  - Copestylum (t)
  - *Ornidia
  - *Tachinosyrphus

Chrysogasterini
- Spheginina
  - *Chamaesphegina
- Chrysogasterina
  - Orthonevra (s)
  - Myolepta (s)
  - Lepidomyia (t)
  - *Chromocheilosia

Eumerini
- Nausigaster (t)
- *Alipumilio

Cerioidini
- Ceriana (s)

Eristalini
- Helophilina
  - *Dolichogyna
  - *Quichuana
  - *Habromyia
  - Mallota
- Eristalina
  - Eristalis (introduced)
  - Eoseristalis (s)
  - Palpada (t)
  - Meromacrus (t)
  - *Lycastrirhynchus

Milesini
- *Neplas
- *Ceriogaster
- *Sterphus
- *Macrometopia
- *Cacoceria
- *Valdivia
- *Odyneromyia
- *Aneriophora
- *Flukea
- *Phillippimyia
- *Senogaster
- Syritta (introduced)
- Tropidia
- *Nemixylota
- *Stilbosoma
- Milesia (t)
- Spilomyia (s)

Nearctic milesine genera

Pipizini
- Pipiza (s)
- Heryngia
- Parapenium
- Neocnemodon

Cheilosini
- Cheilosina
  - Cheilosia
  - Cartosyrphus
  - Hiatomyia
  - Rhingia (s)
  - Ferdinandea
- Pelecocerina
  - Pelecocera
  - Chamaesyrphus

Callicerini
- Callicera

Volucellini
- Volucellina
  - Volucella
- Ornidina
  - Copestylum (t)

Chrysogasterini
- Spheginina
  - Sphegina
  - Neoascia
- Chrysogasterina
  - Chrysogaster
  - *Chrysosyrphus
  - Orthonevra (s)
  - Myolepta (s)
  - Lepidomyia (t)
  - Brachyopa

Sericomyini
- Sericomyia
- Arctophila
- *Pyritis
- *Tapetomyia

Eumerini
- Nausigaster (t)
- Eumerus (introduced)
- Merodon (introduced)
- Psilota

Cerioidini
- Ceriana (s)

Eristalini
- Helophilina
  - Helophilus
  - Anasimyia
  - Parhelophilus
  - Eurimyia
  - *Lunomyia
  - *Asemosyrphus
  - *Polydontomyia
  - Mallota (s)
- Eristalina
  - Meromacrus (t)
  - Eoseristalis (s)
  - Eristalis
  - Palpada (t)

Milesini
- Xylota
- Xylotominia
- Brachypalpus
- *Chrysosomidia
- *Teuchocnemis
- Syritta (introduced)
- Tropidia
- *Pterallastes
- *Hadromyia
- *Crioprora
- Pocota
- Blera
- *Somula
- Criorhina
- *Merapioidus
- Sphecomyia
- Spilomyia (s)
- Temnostoma
- Lejota
- Milesia (t)
- *Cynorhinella
- *Chalcosyrphus

Palearctic milesine genera

Pipizini
- Pipiza
- Heryngia
- Parapenium
- Triglyphus
- Neocnemodon
- Pipizella

Cheilosini
- Cheilosina
  - Cheilosia
  - Cartosyrphus
  - Hiatomyia
  - Rhingia
- Cheilosina
  - Ferdinandea
  - *Psarocheilosia
  - *Portevinia
- Pelecocerina
  - Pelecocera
  - Chamaesyrphus
  - *Ischyroptera
  - *Macropelecocera

Callicerini
- Callicera

Volucellini
- Volucellina
  - Volucella
  - Graptomyza

Chrysogasterini
- Spheginina
  - Sphegina
  - Neoascia
- Chrysogasterina
  - *Helleniola
  - Myolepta
  - Orthonevra
  - Chrysogaster
  - *Lejogaster
  - Brachyopa

Sericomyiini
- Sericomyia
- Arctophila
- Pararctophila
- Pseudovolucella

Eumerini
- *Platynochaetus
- Merodon
- Eumerus
- Psilota

?????
- *Psarus

Cerioidini
- Ceriana

Eristalini
- Helophilina
  - Helophilus
  - Anasimyia
  - Parohelophilus
  - *Lejops
  - Eurimyia
  - Mesembrius
  - *Myiatropa
  - Arctosyrphus
  - Mallota
- Eristalina
  - Eristalis
  - Eoseristalis
  - Simioides
  - *Pleaskeola

Milesini
- Xylota
- Xylotomina
- Brachypalpus
- *Macrozelima
- Syritta
- Tropidia
- *Rhinotropidia
- Pocota
- Blera
- *Matsumyia
- *Calliprobola
- Criorhina
- Sphecomyia
- Spilomyia
- Korinchia
- Milesia
- Temnostoma
- Takaomyia
- Lejota
- *Palumbia

Oriental milesine genera

Pipizini
- Pipiza
- Pipizella

Cheilosini
- Cheilosina
  - Cheilosia
  - Ferdinandea
  - Rhingia
- Pelecocerina
  - Chamaesyrphus

Callicerini
- Callicera

Volucellini
- Volucellina
  - Volucella
  - Graptomyza

Chrysogasterini
- Spheginina
  - Sphegina
- Chrysogasterina
  - Myolepta
  - Chrysogaster

Spheginobacchini
- Spheginobaccha

Sericomyiini
- Sericomyia
- Pararctophila
- Pseudovolucella

Eumerini
- Eumerus
- Merodon
- Psilota
- *Azpeytia

Cerioidini
- Ceriana

Eristalini
- Helophilina
  - Helophilus
  - Eurimyia
  - Mesembrius
  - Mallota
  - *Klossia
  - *Catacores
- Eristalina
  - *Solenaspis
  - *Digulia
  - *Keda
  - Eristalis
  - Phytomia
  - Dissoptera
  - Axona

Milesini
- Xylota
- Brachypalpus
- Syritta
- Blera
- Milesia
- Temnostoma
- Takaomyia
- Korinchia
- *Nepenthosyrphus
- *Lycastris
- *Cheiroxylota
- Criorhina
- Spilomyia

Ethiopian milesine genera

Cheilosini
Cheilosina
Rhingia

Volucellini
Volucellina
Graptomyza

Chrysogasterini
Chrysogasterina
Orthonevra
Chrysogaster

Spheginobacchini
Spheginobaccha

Eumerini
Eumerus
Merodon

Cerioidini
Ceriana

Eristalini
Helophilina
Eurmyia
Mallota
Mesembrius
*Chasmomma

Eristalini
Eristalina
Eristalis
Phytomia
Simioides
*Senaspis
*Meromacroides

Milesini
Xylota?
Syritta
Tropidia?
*Syrittosyrphus
*Pogonosyrphus

Australian milesine genera

Pipizini
*Emmyia
Triglyphus?

Volucellini
Volucellina
Graptomyza

Chrysogasterini
Chrysogasterina
*Cyphipelta
*Eocheilosia
*Coeloprosopa
*Plesia
*Hemilampra

Eumerini
Psilota
Eumerus

Cerioidini
Ceriana

Eristalini
Helophilina
Helophilus?
*Pilinascia
Mesembrius
*Orthoprosopa
Eristalina
Eristalis

Dissoptera
Axona
*Xenzoon

Milesini
Syritta
Xylota?
Criorhina?
*Deinches
*Paratropidia
*Malometaternum
*Hardimyia

Symbols used in Appendix II

(s) = shared genera
(t) = transitional genera
* = endemic genera

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(Tribes, genera and subgenera; synonyms in italics)