# The Distribution of Leafhopper Pests in Relation to Other Leafhoppers (Hemiptera; Cicadellidae)

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## Abstract

A species-level database with country-level information was used to examine the global distribution patterns across biogeographic realms and across latitudes for 13,621 leafhopper species (among 2,016 genera and subgenera) and 148 known leafhopper vectors of phytopathogens. There were only seven cosmopolitan genera: *Balclutha*, *Cicadella*, *Deltocephalus*, *Empoasca*, *Exitianus*, *Idiocerus*, and *Xestocephalus*. Cicadellid generic richness was highest in the Indomalaysian and Neotropical Realms. Deltocephaline genera peaked in the Nearctic and the typhlocybine genera peaked in the Indomalaysian Realm. The generic overlap among most biogeographic realms was low, with complementarity (distinctness) values over 90%. Geographical proximity between realms generally was directly proportional to their overlap. The Nearctic and Neotropical Realms were the least distinct, whether the Mexican fauna was classified as Nearctic, as Neotropical, or even excluded completely from the comparison. The Nearctic and Palearctic Realms were more distinct than many others, for example, the Palearctic and Afrotropical Realms. The leafhopper fauna of the Greater Antilles was most similar to that of Mexico+Central America. Cicadellid generic richness peaked in the N 0-10° interval while species richness peaked in the N 20-30° interval and exceeded 4,000 species in the N 40-50° interval. The latter richness estimate seems to be an artifact of using country-level data. The ratio of species per genus was higher in the New World than in the Old World and was higher in the N 20-60° latitude intervals, even separating data for the New and Old Worlds. This suggests that a natural phenomenon driving finer, species-level diversification may be at work on leafhoppers in the northern habitats. The ratio of known vectors to all species was used to calculate the expected number of vectors, assuming random distribution, in all biogeographic realms and latitude intervals. The seven cosmopolitan genera and the seven largest genera have fewer known vectors than expected. The Australian, Nearctic, and Palearctic Realms, where most research has been conducted, have many more known vectors than expected and this is reflected in the latitudinal pattern. The true number of vectors is therefore probably much greater than known and their agricultural importance has been vastly underestimated. An appendix listing the genera of all biogeographic realms and the Holarctic genera is provided.


Key Words. Membracoidea, biogeography, distribution, vector, phytopathogen.

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## Introduction

Leafhoppers constitute the largest family in Hemiptera, which is the fifth largest insect order. Leafhoppers are of great agricultural importance because of their ability to transmit phytopathogens occurring in phloem or xylem, although vectors of most diseases are unknown (e.g., less than 5% of the vectors of phytoplasms, a group of pathogens often transmitted by leafhoppers, are known [Robert Davis, ARS, pers. comm.]). So many leafhoppers are undescribed that we are not able to estimate with any accuracy how many exist. Most subfamilies are cosmopolitan, and this is attributable partly to dispersal, including passive drift in air currents (WELLINGTON 1945, WOLFENBARGER 1946) rather than vicariance.

Despite their importance in agriculture, the overall distribution patterns of leafhoppers and leafhopper pests are unknown. Examining the distribution of known pests and other species may enable us to predict where additional, as yet unknown pests or other species occur, or at least direct us to productive avenues for further investigation.

The most general view of species distributions up until now was provided by METCALF (1962a, 1962b, 1962c, 1962d, 1963a, 1963b, 1963c, 1963d, 1964b, 1965a, 1965b, 1966a, 1966b, 1966c, 1966d, 1967a, 1967b, 1967c, 1968a). In each section of the Catalogue of the Homoptera, Fascicle VI, METCALF cited the number of species occurring in each biogeographic region. The taxonomic and distribution data of that catalogue fascicle are available at http://www.sel.barc.usda.gov/selhome/leafhoppers/mckpaper.htm. Nevertheless, since the 1955 cut-off date of that catalogue, the number of species has almost doubled and there have been many changes in specific and generic taxonomy. LINNAVUORI (1959) discussed the endemic elements and representative genera of Deltocephalinae in subregions of the Neotropical Realm. OMAN et al. (1990) provided biogeographic regions for the nearly 2,400 genera described through 1985, with phenomonal accuracy given the absence of a species database. As we shall see, however, while they succeeded for most genera, many designations were incomplete. NIELSON (1968) provided distributions for known vectors of phytopathogens and later examined the taxonomic distribution of the species (NIELSON 1979b), but the geographical distribution has not been examined.

For the first time, it is possible to examine the global distribution patterns of Cicadellidae. These are based on an in-progress world database on the family (McKamey, in. prep.). Though still far from complete, country-level data are recorded for the majority of valid species. Some 7,699 of these have current country names based on the localities listed in the Catalogue of the Homoptera, while the remainder are from more recent literature: Coelidiinae (NIELSON 1975, 1977, 1979a, 1982); Cicadellinae (YOUNG 1968, 1977, 1986); and original descriptions of species in other subfamilies. This database also indicates the vector status of 148 valid species.

## Materials and Methods

Because of the high subjectivity inherent in higher taxa, the incomplete knowledge of most species distributions, and the existence of many undescribed species, most comparisons are limited to genus-groups (genera and subgenera). Counting subgenera also skirts disagreements regarding the most appropriate status of some taxa. To look for parallels in subsets of Cicadellidae, generic patterns within the two largest subfamilies, Deltocephalinae and Typhlocybinae (both sensu OMAN et al. 1990), were also examined. The results are based on country-level data for 13,621 valid species, of which 5,080 are Deltocephalinae and 4,348 are Tyhlocybinae, and 2,016 genera (including 739 deltocephalines and 481 typhlocybines). Unnaccounted for here, because at this point they lack country-level information in the database, are 3,765 species as well as most species described after 1992. There are also 590 genera and subgenera in the database that could not be included because at this point we have captured no country-level information for their included species.

The database shell is Biota (COLWELL 1996), a relational database well suited to the objective of this paper. Elaborate search strings can be designed, then saved for re-

loading later. The lists generated from these searches can be compared in many ways (e.g., shared records, unshared records), all within Biota, and the resultant lists can be exported (Appendix 1). For this investigation, search strings consisted of lists of countries (and in some cases regions, e.g., "Europe Central and Northern") categorized by latitude in increments of 10°, and by biogeographic realm.

The country-level nature of the data introduces some artifacts, as many countries span the limits of the 10° latitude intervals and some even span two biogeographic realms. Below I have attempted to give some measure of the influence of these artifacts.

For breakdown by latitudes, all species occurring from a country falling in an increment were counted, regardless of the species' distribution within that country. Species of countries spanning more than 10° latitude were therefore counted multiple times, i.e., counted as present in every increment in which their country occurs. Consequently, a species with a restricted distribution within a large country would be counted as present in 10° latitude bands where it does not actually occur, and the overlap between increments and richness within one or more latitude intervals would be overestimated.

Categorizing countries by biogeographic realm posed a different challenge. The countries China, Japan, Mexico, and the United States of America span two biogeographic realms, but the country-level data in the database precluded dividing the fauna of the two elements in each country. For example, although southern Florida and southern Mexico have tropical climates (and faunas), the entire United States and entire Mexico were assigned to the Nearctic Realm. Likewise, Japan and China were assigned to the Palearctic Realm. Indonesia, however, was divided in the database along biogeographic realm lines, western Indonesia pertaining to the Indomalaysian Realm and eastern to the Oceanian Realm (the division falling just east of the Philippines and Sulawesi and between Bali and Lombok Island, corresponding to Wallace's line (from MAYR 1944; Fig 1).

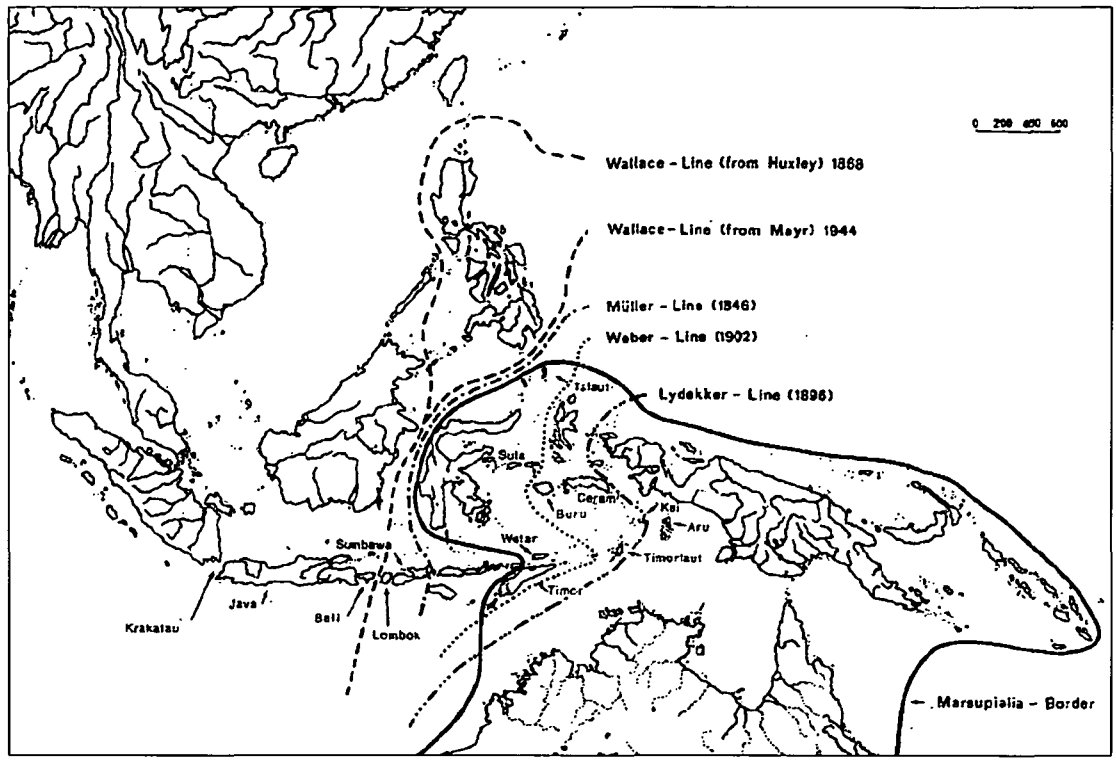


**Fig. 1**
**(after HEPPNER 1991). Various lines that have been used as limits of biogeographic realms in southeast Asia. In this paper, Wallace's line (from MAYR 1944) was used to distinguish the Indomalaysian from the Oceanian Realm.**

The biogeographic realms for the data reported below were as follows. The Afrotropical Realm (formerly known as the Ethiopian Realm) includes sub-Saharan Africa and the southwest corner of Arabia. The Australian Realm is composed of Australia and the nearby Coral Sea Islands. The Indomalaysian Realm includes India, Asia (south of Himalayas), and western Indonesia. The Palaearctic Realm includes Europe, Asia (north of the Himalayas), very northern Africa, and most of Arabia. The Nearctic Realm includes North America (including Mexico) and Greenland. The Neotropical Realm includes Central America, South America, West Indies, and the Galapagos Islands. The Oceanian Realm includes Hawaii, eastern Indonesia, Micronesia, New Guinea, New Zealand, Polynesia, and many other islands. Countries of the Oceanian Realm include: American Samoa, Ashmore &

**Table 1.**
**Cicadellid generic and specific richness, average number of species per genus, number of known vector species, and number of vectors expected by chance the biogeographic realms arranged generally by continuity. The chance probability is based on 148 known vectors for 18,386 species, or 0.008 vectors/species.**

| Realm | Gen. | Spp. | Spp./Gen. | Vector spp. | Expected by chance |
|---|---|---|---|---|---|
| Australian | 200 | 500 | 2.5 | 8 | 3 |
| Oceanian | 168 | 604 | 3.6 | 5 | 5 |
| Indomalaysian | 569 | 2380 | 4.18 | 18 | 19 |
| Afrotropical | 399 | 1378 | 3.45 | 5 | 11 |
| Palearctic | 469 | 2166 | 4.62 | 31 | 17 |
| Nearctic | 447 | 3802 | 8.51 | 97 | 30 |
| Neotropical | 730 | 4130 | 5.66 | 25 | 33 |

**Table 2.**
**Cicadellid generic complementarity (to the left of the diagonal) and the number of shared genera (to the right of the diagonal) of the biogeographic realms arranged generally by continuity. Cell values for complementarity are % C (text equation 1) and, in parentheses, total observed generic richness (Sjk).**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Australian | - | 30 | 58 | 38 | 46 | 17 | 19 |
| Oceanian | 91 (338) | - | 33 | 40 | 17 | 30 | 29 |
| Indomalaysian | 92 (711) | 95 (704) | - | 106 | 33 | 57 | 54 |
| Afrotropical | 93(561) | 92 (527 | 88 (862) | - | 102 | 38 | 41 |
| Palearctic | 93 (623) | 97 (620) | 97 (1005) | 87 (766) | - | 90 | 49 |
| Nearctic | 97 (630) | 95 (585) | 94 (959) | 96 (808) | 89 (826) | - | 199 |
| Neotropical | 98 (911) | 97 (869) | 96 (1245) | 96 (1088) | 96 (1150) | 80 (978) | - |
| | Australian | Oceanian | Indomalaysian | Afrotropical | Palearctic | Nearctic | Neotropical |
| Total genera: | 200 | 168 | 569 | 399 | 469 | 447 | 730 |

Cartier Islands, Baker Island, Clipperton Island, Cook Islands, Easter Island, Fiji, French Polynesia, Guam, Hawaii, Howland Island, Jarvis Island, Kiribati, Mariana Islands, Marshall Islands, Micronesia Federated States, Midway Islands, Nauru, New Caledonia, New Zealand, Niue, Norfolk Island, Palau, Palmyra Atoll, Papua New Guinea, Pitcairn Islands, Solomon Islands, South Georgia and Sandwich Islands, Tokelau, Tonga, Tuvalu, Vanuatu (formerly New Hebrides), Wake Island, Wallis & Futuna Islands, and Western Samoa. The richnesses and affinities of the Holarctic region (a combination of Nearctic and Palearctic Realms) and the Greater Antilles (southeastward to Dominica) also were examined.

Generic faunas of biogeographic realms were compared using two measures: one of similarity, as the absolute number of shared genera, and one of difference, as the measure of complementarity (C, of COLWELL & CODDINGTON 1994). As a straightforward measure of the extent that two samples are complementary, C is the proportion of the pooled species richness ($S_{jk}$, in samples j and k) that is unique to either sample ($U_{jk}$). That is,

$$C = U_{jk}/S_{jk} \qquad (1)$$

So, for example, two samples of 75 species that each have 25 unique and 50 shared will have a complementarity of 0.5. C varies from 0, when samples are identical ($U_{jk}$=0), to 1, when the samples are completely complementary ($U_{jk}$=$S_{jk}$), and can be expressed as a percentage. Like many simple measures of overlap, C is affected strongly by sample size. For example, the comparison of two samples, one with 30 genera and the other with 100, will necessarily have at least 70 genera unique, and thus a high complementarity, even if all 30 genera of the first sample occur in the second. For this reason the total observed generic richness is reported for each comparison, as well as the actual number of genera shared between each pair of biogeographic realms.

## Results

### Biogeographic Realms

While many genera occur in multiple biogeographic realms, almost none occurred in all of them. There were only seven truly cosmopolitan genera: *Balclutha*, *Cicadella*, *Deltocephalus*, *Empoasca*, *Exitianus*, *Idiocerus*, and *Xestocephalus*, and among their 1,365 species there are only two known vectors of phytopathogens.

The generic and specific richness per biogeographic realm for Cicadellidae are given in Tab. 1 and the generic richness for Deltocephalinae and Typhlocybinae are listed on the bottom of Tables 3 and 4, respectively. For Cicadellidae overall, generic richness peaks in the Indomalaysian and Neotropical Realms, exceeding the next most generic-rich Realm (the Palearctic) by 100 and 261 genus-groups, respectively. The Realms with the most described species, however, are the Neotropical and Nearctic. The richest realms for genera of Deltocephalinae and Typhlocybinae are the Nearctic and Indomalaysian, respectively.

The generic overlaps and complementarities among the biogeographic realms are given in Tables 2-4. The most apparent pattern is that all the values are high, from 65% (Nearctic vs. Neotropical Typhlocybinae) to 98%

(Australian vs. Neotropical Cicadellidae), with the majority of values in the 90s.

For Cicadellidae overall (Tab. 2), the Indomalaysian Realm generic overlap with the Neotropical Realm is second only to the Nearctic. That surprise is not reflected in the complementarity values for the Neotropical Realm, however, which gradually decrease from the furthest to closest biogeographic realms. Likewise, geographical proximity corresponds to the complementarity values with Australian and with the Nearctic Realms. The highest generic overlaps do correspond to the lowest complementarity values, as expected for the following comparisons: between the Nearctic and Neotropical Realms, the Afrotropical and Palearctic Realms, and the Afrotropical and Indomalaysian Realms. Although the Holarctic is often treated as a biogeographic region, in leafhoppers only 90 genus-groups (Appendix 1) occur in both the Palearctic and Nearctic components, and complementarity, a measure of distinctness, is greater than the three pairs of biogeographic realms just mentioned.

The influence of Mexico on the complementarity of the Nearctic and Neotropical Realms was investigated by subtracting it from the Nearctic search string of countries and adding it to the Neotropical one. This resulted in even less overlap between the realms (172 genus-groups). The reclassification had no effect on the list of cosmopolitan genera.

The complementarity trends for Deltocephalinae (Tab. 3) resembled those for Cicadellidae regarding the importance of geographical proximity among realms and the lowest complementarity values, with three exceptions: (1) a comparison that resulted in one of the lowest distinctnes values (C of 79%) was that between the Australian and Oceanian Realms; (2) the complementarity of the Indomalaysian and Oceanian faunas was lower than that found between the Afrotropical and Palearctic; and (3) the lowest complementarity value was between the Indomalaysian and Palearctic comparison, which for all Cicadellidae had been one of the highest values.

**Table 3.**
**Deltocephaline generic complementarity (to the left of the diagonal) and the number of shared genera (to the right of the diagonal) of the biogeographic realms arranged generally by continuity. Cell values for complementarity are % *C* (text equation 1) and, in parentheses, total observed generic richness ($S_{jk}$).**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Australian | - | 11 | 14 | 14 | 15 | 7 | 6 |
| Oceanian | 79 (52) | - | 17 | 14 | 16 | 10 | 6 |
| Indomalaysian | 89 (123) | 85 (117) | - | 36 | 64 | 24 | 17 |
| Afrotropical | 89 (124) | 88 (121) | 79 (173) | - | 38 | 17 | 14 |
| Palearctic | 93 (223) | 93 (219) | 74 (245) | 86 (271) | - | 49 | 16 |
| Nearctic | 97 (260) | 96 (254) | 92 (315) | 95 (322) | 87 (390) | - | 59 |
| Neotropical | 97 (203) | 97 (200) | 94 (263) | 95 (267) | 96 (365) | 83 (351) | - |
| | Australian | Oceanian | Indomalaysian | Afrotropical | Palearctic | Nearctic | Neotropical |
| Total genera: | 33 | 30 | 104 | 105 | 205 | 234 | 176 |

The complementarity trends for Typhlocybinae (Tab. 4) also resembled those for all leafhoppers but, as for the deltocephalines, there was a strong affinity (high generic overlap and low complementarity) between the Australian and Oceanian Realms and between the Indomalaysian and Palearctic Realms

The generic richness, overlap, and complementarity of the Greater Antilles (southward to Dominica) with Mexico plus Central America and with South America is given in Tab. 5. By all measures, the Greater Antillean fauna had closer ties to the Mexico plus Central American fauna than to that of South America.

Comparing the ratio of species per genus across biogeographic realm (Tab. 1), the ratios were higher in the biogeographic realms of the New World than in those of the Old World.

**Table 4.**
**Typhlocybine generic complementarity (to the left of the diagonal) and the number of shared genera (to the right of the diagonal) of the biogeographic realms arranged generally by continuity. Cell values for complementarity are % *C* (text equation 1) and, in parentheses, total observed generic richness ($S_{jk}$).**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Australian | - | 10 | 12 | 6 | 10 | 4 | 3 |
| Oceanian | 73 (37) | - | 20 | 6 | 13 | 8 | 4 |
| Indomalaysian | 95 (245) | 92 (250) | - | 27 | 68 | 14 | 8 |
| Afrotropical | 95 (111) | 95 (124) | 91 (313) | - | 25 | 8 | 5 |
| Palearctic | 92 (123) | 90 (133) | 76 (288) | 87 (191) | - | 24 | 9 |
| Nearctic | 95 (75) | 90 (84) | 95 (288) | 95 (154) | 84 (154) | - | 31 |
| Neotropical | 96 (71) | 96 (84) | 97 (289) | 97 (152) | 95 (164) | 65 (88) | - |
| | Australian | Oceanian | Indomalaysian | Afrotropical | Palearctic | Nearctic | Neotropical |
| Total genera: | 17 | 30 | 240 | 100 | 116 | 62 | 57 |

## Latitudes

Looking from South to North, species richness of Cicadellidae (Fig. 2) first exceeded 2,000 species in the S 10-20° band, corresponding to much of Indonesia and Brazil. Generic richness peaked in the N 0-10° band, while species richness peaked in the N 20-30° band and still exceeded 4,000 species in the N 40-50° band. Species overlap also peaked in the N 40-50° band, whether measured in absolute numbers (Fig. 3) or as the proportion of the combined total species in the latitude bands being compared (Fig. 4), exceeding 80%. Species overlap also exceeded 80% in the northern and southern extremes.

The patterns for Deltocephalinae and Typhlocybinae (Fig. 5) differed from that of total Cicadellidae in that species richness did not increase markedly until further north (in the N 0-10° band for Typhlocybinae and the N 10-20° band for Deltocephalinae). Deltocephalinae richness was distinctly higher (exceeding 1,800 species) in the three bands between 20° and 50° latitude. Typhlocybine species richness was lower than that of deltocephalines in all intervals except from N 0-20° latitude. Species richness of both subfamilies peaked in the N 20-30° band, just north of the Tropic of Cancer, and no doubt contributed importantly to the same peak for overall Cicadellidae.

Comparing the ratio of species per genus across latitude (Tabs 6, 7, Fig. 6) shows that the overall pattern for Cicadellidae closely resembled that of Deltocephalinae, which made up 37% of the genera and 37% of the species of all leafhoppers tabulated for this paper. The ratios across latitude for Typhlocybinae contrasted sharply, spiking in the N 40-50° band.

| Taxon | Greater Antilles | Mexico & Central America | South America |
|---|---|---|---|
| Cicadellidae | 98 | 373 | 644 |
| Deltocephalinae | 25 | 123 | 159 |
| Typhlocybinae | 27 | 42 | 40 |

| | Complementarity | | Genera Shared | |
|---|---|---|---|---|
| Greater Antilles | Mexico & C. America | South America | Mexico & C. America | South America |
| Cicadellidae | 81 (396) | 91 (680) | 75 | 62 |
| Deltocephalinae | 84 (128) | 89 (166) | 20 | 18 |
| Typhlocybinae | 48 (44) | 67 (49) | 23 | 16 |

**Table 5: Generic richness (above) and complementarity and overlap (below) of Cicadellidae, Deltocephalinae, and Typhlocybinae faunas of the Greater Antilles (southeastward to Dominica) compared to Mexico+Central America and to South America. Cell values for complementarity are % C (text equation 1) and, in parentheses, total observed generic richness ($S_{jk}$).**

| Latitudes | Genus-groups | Species-groups | Spp./Genus | Vector spp. | Expected by chance |
|---|---|---|---|---|---|
| S 50-60 | 181 | 396 | 2.19 | 9 | 3 |
| S 40-50 | 199 | 474 | 2.38 | 10 | 4 |
| S 30-40 | 490 | 1200 | 2.45 | 18 | 10 |
| S 20-30 | 854 | 2863 | 3.35 | 19 | 23 |
| S 10-20 | 898 | 3431 | 3.82 | 17 | 27 |
| S 0-10 | 906 | 3710 | 4.09 | 12 | 30 |
| N 0-10 | 1181 | 5321 | 4.51 | 28 | 43 |
| N 10-20 | 983 | 4327 | 4.4 | 52 | 35 |
| N 20-30 | 957 | 5876 | 6.14 | 114 | 47 |
| N 30-40 | 666 | 4203 | 6.31 | 105 | 34 |
| N 40-50 | 656 | 4496 | 6.85 | 107 | 36 |
| N 50-60 | 340 | 1518 | 4.46 | 56 | 12 |
| N 60-70 | 294 | 1152 | 3.92 | 56 | 9 |
| N 70-80 | 283 | 967 | 3.42 | 52 | 8 |

**Table 6.**
**Cicadellid generic and specific richness, average number of species per genus, and number of known vector species of the 10° latitudinal bands arranged by continuity. The chance probability is based on 148 known vectors for 18,386 species, or 0.008 vectors/species.**

## Vectors of Phytopathogens

There are 148 known vectors among the 18,386 species, or about 0.008 vectors/species. This figure was used to calculate the expected number of known vectors per fauna based on random distribution. The number of known phytopathogen vectors per biogeographic realm (Tab. 1) was higher than expected by chance in the Australian, Palearctic, and Nearctic Realms, and equal to or less than the number expected by chance in the rest of the world. The number of known phytopathogen vectors per 10° latitude band (Tab. 6) was higher than expected by chance in most non-equatorial latitudes, with the highest numbers (all more than double the number expected by chance) in the N 20-50° bands.

## Discussion

As discussed in Materials and Methods, the patterns above are distorted by a number of factors because they were based on country-level data. Other factors also affect the accuracy of the results. Of foremost importance is that perhaps the majority of leafhopper species are undescribed, and the vector status of most described species is unknown. The geographic spread of the undercounts resulting from all these factors are probably far from even, being

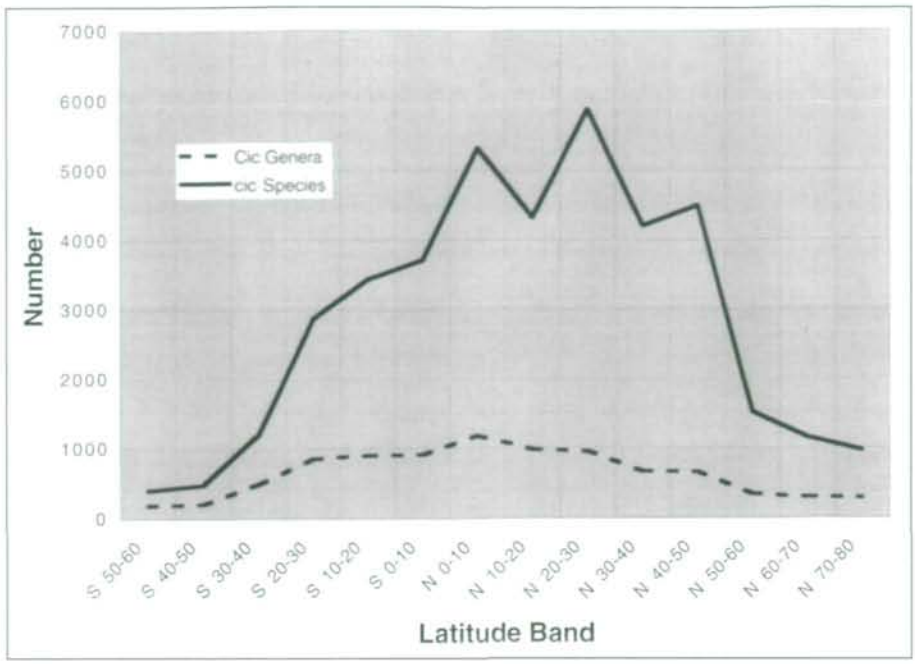


Fig. 2.
Overall generic and species richness of Cicadellidae across latitude.

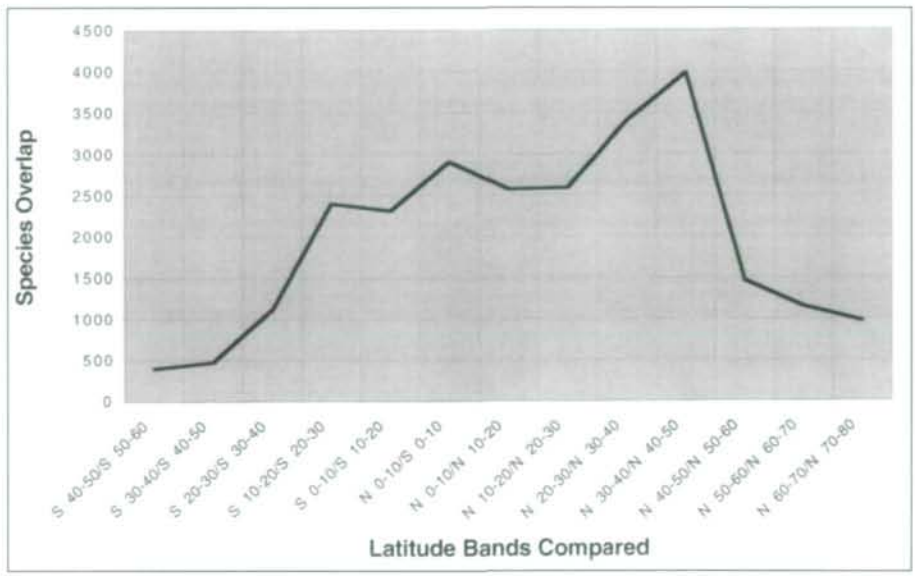


Fig. 3.
Cicadellid species overlap among adjacent latitudinal bands expressed as absolute numbers. Higher values indicate count redundancy, in many cases probably an artifact of the country-level information used to generate the data rather than reflecting the actual distribution of species.

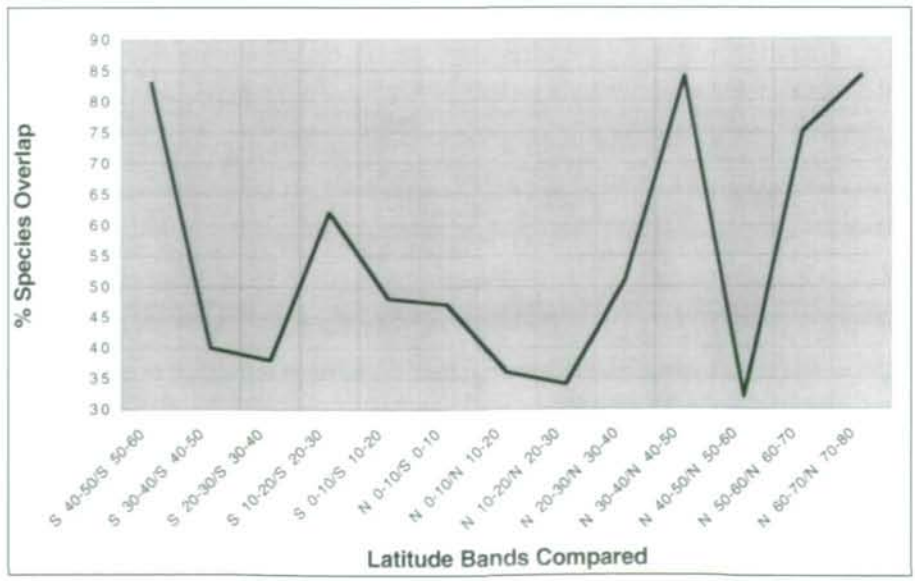


Fig. 4.
Cicadellid species overlap among adjacent latitudinal bands expressed as a percentage of the combined total species for compared latutude bands. Higher values indicate count redundancy, in many cases probably an artifact of the country-level information used to generate the data rather than reflecting the actual distribution of species.

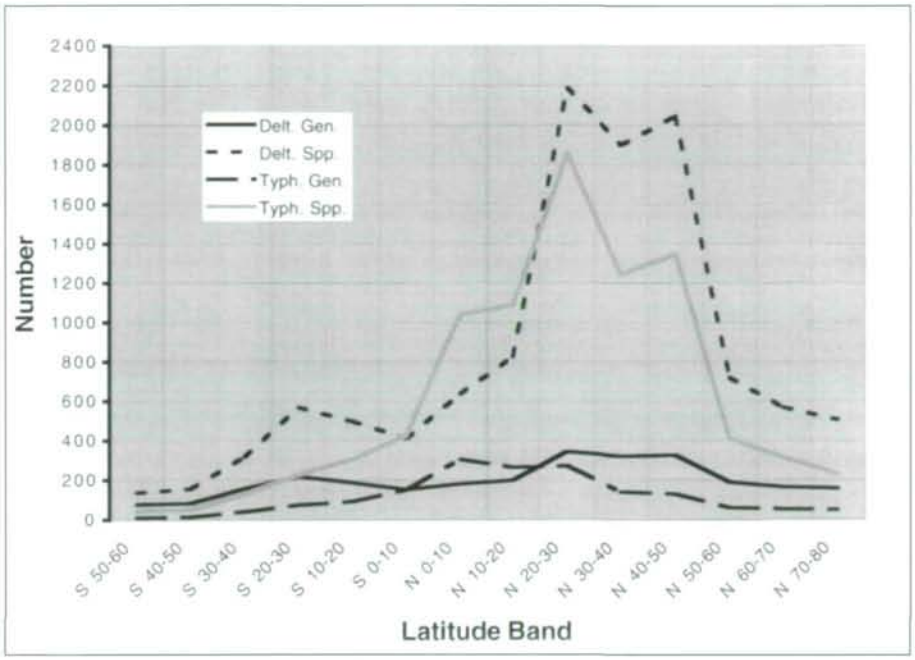


Fig. 5.
Generic and species richness of Deltocephalinae and Typhlocybinae across latitude.

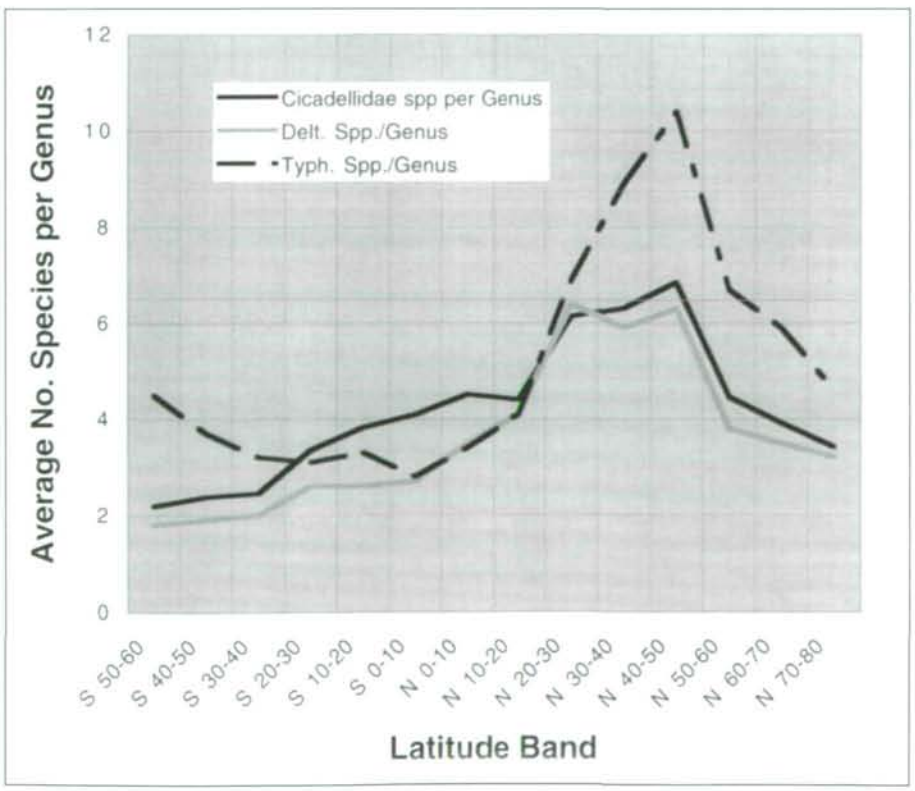


Fig. 6.
Average ratio of species per genus across latitude for Cicadellidae, Deltocephalinae, and Typhlocybinae.

concentrated in the equatorial and southern latitudes except Australia. Also, there was no account for elevation, topography, and other such variation that can drive diversification; species of known agricultural importance are likely to have more complete distribution information than other species; and despite the attempts to reduce effects of relatedness (phylogenetic effects) on patterns by looking for parallels with Cicadellidae in Deltocephalinae and Typhlocybinae, it was impossible to eliminate this artifact.

Aside from these caveats, quite a bit can be gleaned from the results.

### Biogeographic Realms

Despite the strong influence of sample size, the complementarity measure was found to be useful. In at least two instances (the Neotropical/Indomalysian comparison and the Australian/Indomalysian comparison) the generic overlap gave the surprising result that distant faunas had higher affinities than some closer faunas, but those surprises were not mirrored by the complementarity values, which supported a larger role of geographical proximity in determining degree of distinctness.

Among all the realms, the Australian and Oceanian were the least speciose and their complementarity with each other was lower than either had to any other biogeographic realm. Curiously, the Oceanian leafhopper fauna was less distinct from and shared more genera with the Nearctic than to the Palearctic in terms of overall Cicadellidae (Tab. 2), though this situation was reversed in Deltocephalinae (Tab. 3), and about equal to those two realms in Typhlocybinae (Tab. 4). Other patterns emerging from Tabs 3-5 are that most biogeographic realms have distinct generic faunas, with the highest affinities being between the Nearctic and Neotropical Realms, and between the Palearctic and both the Indomalaysan and the Afrotropical Realms. Indeed, the Palearctic fauna had more in common with that of sub-Saharan Africa than with North America, suggesting that the cold northern temperatures have been a strong barrier to dispersal. The Afrotropical deltocephaline fauna was least distinct from the Indomalaysian fauna while the latter was least distinct from the Palearctic.

Among the equatorial biogeographic realms, the Afrotropical Realm was the least speciose. While this may be an artifact of undercollecting, the finding is consistent with other organisms, from plants to mammals, birds, and Lepidoptera (HEPPNER 1991, 1998).

As expected, the Nearctic fauna, in terms of all Cicadellidae, Deltocephaline, or Typhlocybinae, had greatest affinity to the Neotropical and Palearctic faunas, and in all three cases it also shared more genera and had a lower complementarity with the Neotropical fauna. This was why Mexico was reclassified as described above. The result, that fewer genera were shared between the Nearctic and Neotropical Realms when Mexico was defined as Neotropical, can only be interpreted to mean that, overall, the Mexican leafhopper fauna has more affinity to the Neotropical fauna than to the Nearctic fauna. While unsurprising to many, LINNAVUORI (1959) struggled with this issue in his revision of Deltocephalinae and related subfamilies and decided to define the Neotropical limit as "approximately in Costa Rica". Mexico has strong elements of both faunas, and its long-term presence has allowed many genera to cross from one to the other realm: leaving Mexico entirely out of the comparison, the Nearctic and Neotropical Realms still shared 129 genera and had a complementarity of 86%, which is still lower than any other comparison in Tab. 2.

The Greater Antilles are well known for their long isolation and high rates of endemism (see LIEBHERR 1988). The high complementarity values in the Greater Antilles com-

| | Deltocephalinae | | | Typhlocybinae | | |
|---|---|---|---|---|---|---|
| Latitudes | Gen. | Spp. | Spp./Genus | Gen. | Spp. | Spp./Genus |
| S 50-60 | 77 | 137 | 1.8 | 10 | 45 | 4.5 |
| S 40-50 | 84 | 156 | 1.9 | 14 | 52 | 3.7 |
| S 30-40 | 158 | 319 | 2.0 | 40 | 129 | 3.2 |
| S 20-30 | 218 | 569 | 2.6 | 74 | 228 | 3.1 |
| S 10-20 | 188 | 498 | 2.6 | 92 | 304 | 3.3 |
| S 0-10 | 153 | 408 | 2.7 | 151 | 425 | 2.8 |
| N 0-10 | 180 | 635 | 3.5 | 304 | 1039 | 3.4 |
| N 10-20 | 199 | 824 | 4.1 | 263 | 1088 | 4.1 |
| N 20-30 | 344 | 2188 | 6.4 | 270 | 1856 | 6.9 |
| N 30-40 | 321 | 1899 | 5.9 | 140 | 1243 | 8.9 |
| N 40-50 | 326 | 2044 | 6.3 | 129 | 1347 | 10.4 |
| N 50-60 | 190 | 719 | 3.8 | 61 | 411 | 6.7 |
| N 60-70 | 164 | 566 | 3.5 | 53 | 314 | 5.9 |
| N 70-80 | 158 | 505 | 3.2 | 50 | 230 | 4.6 |

**Table 7.**
**Deltocephaline and typhlocybine generic and specific richness and average number of species per genus of the 10° latitudinal bands arranged by continuity.**

parisons (Tab. 5) bely high generic overlap between the island leafhopper genera and the western continental fauna, from 77-85% depending on the group. Thus, the high complementarity values result less from the endemism and more from the great disparity in richness between the Greater Antilles and the mainland faunas, because there were unavoidably many genera that were unshared. Still, by any measure the leafhoppers of the Greater Antilles showed greater affinity with Mexico and Central America than with South America. This finding is consistent with data from many other organisms (see LIEBHERR 1988) and is likely due to the tectonic history of the Greater Antilles as a partial bridge between North and South America in the late Cretaceus and later, in the Paleocene, having contact with the Yucatan and each other (WOODS 1989).

The detailed examination of biogeographic realm composition brings forth a cautionary note regarding the biogeographic regions provided by OMAN et al. (1990) in their generic check list. For example, among deltocephalines, they reported that *Parabolocratus* and *Hecalus* are cosmopolitan genera, but the former does not occur in the Australian Realm and the latter does not occur in the Neotropical Realm. They indicate that *Deltocephalus* is Holarctic, which is indeed where most species occur, but 5-32 species occur in each of the other biogeographic realms. There are many other differences also, and even the species database is far from complete. As our knowledge of leafhoppers increases, additional genera will undoubtedly show up in biogeographic realms from which they are presently unrecorded and thus a later reassessment of the composition and overlap of the biogeographic realms is fully warranted once more data is captured. Until then, the generic lists in Appendix 1 are offerred. More up-to-date lists are available for Australia (M. Fletcher, at URL http://www.agric.nsw.gov.au/Hort/ascu/start.htm) and for many leafhopper subfamilies in the Neotropical Realm (M.A. Gaiani and P.W. Freytag, at URLhttp://cicadellidae.miza-fpolar.info.ve/).

Certainly the species of China, Japan, Mexico, and the United States of America, countries which span two biogeographic realms, could be assigned to the appropriate realm based on state or provincial distribution to get a more accurate measure of realm overlap and affinities. For example, in Mexico the transverse volcanic range north of Veracruz and Chiapas states generally marks the Nearctic-Neotropical divide.

## Latitudes

For cicadellids overall, both generic and specific richness were highest in the tropics, as expected, except for a decline in the N 10-20° band. This decline cannot be explained simply as an artifact of low species overlap (Figs. 3, 4), so perhaps it reflects a species-area relationship in that there is less land mass in that latitude in the New World (Costa Rica through mid Mexico). The lack of a decline in the more northern latitudes, however, appears to be an artifact. The presence of a few large countries (USA, Canada, and Russia) in the northern latitudes caused a high species overlap there (Figs. 3, 4). This overlap is a measure of count redundancy, an artifactual boost in richness as discussed under Materials and Methods. This count redundancy peaked in the 30-40°/40-50° comparison, at over 4,000 species (Fig. 3), representing over 80% of the combined fauna (Fig. 4). In this context, the supposed high richness from N 30-50° is not so surprising. The high species overlaps at the northern and southern extremes result from the almost identical country sets in these bands (e.g., S 40-50°: Argentina, Chile, and New Zealand; S 50-60°: Argentina, Chile, and Falkland Islands). Because the faunas are so depauperate at the extreme latitudes, however, the count redundancy did not translate into high species overlap (Fig. 3) or richness (Fig. 2).

While count redundacy partially accounts for the high values of deltocephaline and typhlocybine species and generic richness in the N 30-60° range (Fig. 5), the lower values, especially from S 20° -N 10° (Fig. 5), cannot be ignored and seem to indicate that these taxa are, indeed, more common in the North. To what extent this represents a collecting bias will be revealed only when the faunas are more completely known.

Regarding the species per genus figures (Fig. 6), it is unclear if the pattern says more about cicadellid taxonomists than about the faunas and nature of diversification. Nevertheless, the observation that all three data series are higher from 20-60° latitude suggests that there is indeed something about the nature of diversification, some latitude driven phenomenon, i.e., that the northern habitats lead to diversification more on a species level (fine differences) rather than genus level (gross differences). To investigate the typhlocybine spike in the N 40-50° band, I divided the subfamily into New World and Old World components. In the New World (1476 spp., 89 genera) the overall ratio of species to genera was 16.6; in the N 40-50° latitude band it was 16.8; in the S 20-30° band it was 3.5. In the Old World (2872 spp., 442 genera) the overall ratio was 6.5; in the N 40-50° band it was 5.1, and in the S 20-30° band it was 2.4. Clearly, the New World figures are responsible for the spike, but the more interesting observation is that in both hemispheres, the faunas of which are usually covered by different researchers, the species/genus ratio is higher at N 40-50° than at S 20-30°, corroborating the hypothesis that finer-grained diversification of leafhoppers is more common at high latitudes . Whether this putative natural phenomenon extends to the New World and Old World difference, or New World taxonomists tend to be splitters and Old World taxonomists tend to be lumpers, is a different question. Too few researchers have worked with the faunas of both hemispheres to distinguish which explanation is more plausible. It is worth remembering that faunas recieving more study tend to be split into more genera (taken to the extreme in birds in mammals) and that, if anything, this tendancy would decrease the species/genus ratio in the northern latitudes.

## Vectors of Phytopathogens

The aforementioned 0.008 vectors/species chance expectation can be used to examine if a wide distribution or a high diversification predisposes a genus to develop vectors of phytopathogens. Among the 1,365 species circumscribed among the seven aforementioned cosmopolitan genera, there are only two known vectors of phytopathogens; by chance alone, the expectation would be 11 species. There is a similar 'shortage' of known vectors among the seven largest genera, which include 2,529 species (*Empoasca*, 666 spp.; *Erythroneura*, 589 spp.; *Batracomorphus*, 356 spp.; *Gypona*, 301 spp.; *Macropsis*, 240 spp.; *Idiocerus*, 201 spp.; and *Scaphytopius*, 176 spp): 10 vectors as opposed to 20 expected by chance. The answer, then, appears to be No, although we cannot know for sure until many more vectors are discovered. For now, the only question we can answer is 'What predisposes a phytopathogen vector to be known?' and the largest factor is certainly geography. The observed vs. expected numbers of pathogen vector species by biogeographic realm (Tab. 1) and by latitude (Tab. 6) demonstrate that there are more vectors known where there is more research, i.e., in the northern latitudes of the Palearctic and Nearctic, and also in Australia. Clearly, in addition to more vectors awaiting discovery in these regions, there is a huge number of vectors closer to and south of the equator. At present, therefore, it can only be concluded that the agricultural importance of leafhoppers has been vastly underestimated.

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## Zusammenfassung

Mit Hilfe einer Art-Datenbank, die auch Angaben zur Länder-Verbreitung enthält, wurden globale Verbreitungsmuster von 13.621 Zwergzikaden-Arten (aus 2.106 Gattungen und Untergattungen) einschließlich 148 Arten, die als Überträger von Pflanzenkrankheiten bekannt sind, hinsichtlich zoogeographischer Regionen und geographischer Breiten analysiert. Nur sieben Gattungen sind kosmopolitisch verbreitet: *Balclutha*, *Cicadella*, *Deltocephalus*, *Empoasca*, *Exitianus*, *Idiocerus* und *Xestocephalus*.

Die höchsten Gattungszahlen der Cicadellidae sind in der indomalaysischen und neotropischen Region zu finden, jene der Del-

tocephalinae in der Neartis, und jene der Typhlocybinae wiederum in der indomalayischen Region. Über 90 % der Gattungen sind jeweils regionsspezifisch; der Anteil der über mehrere Regionen verbreiteten Gattungen ist relativ gering. Der Anteil gemeinsamer Gattungen ist der Entfernung der Regionen direkt proportional. Die relativ geringsten Gemeinsamkeiten zeigen Nearktis und Neotropis, unabhängig davon, ob die Gattungen Mexikos der Nearktis oder der Neotropis zugerechnet werden oder im Vergleich gänzlich unberücksichtigt bleiben. Nearktis und Paläarktis unterscheiden sich voneinander deutlicher als viele andere Regionen, z. B. Paläarktis und Afrotropis. Die Kleinzikadenfauna der Großen Antillen zeigen die größten Ähnlichkeiten mit Mexiko und Mittelamerika. Die höchste Zahl an Gattungen ist zwischen 0 und 10° nördlicher Breite zu finden, während die höchste Artenzahl zwischen 20° und 30° N zu finden ist. Mehr als 4.000 Arten sind zwischen 40° und 50° N zu finden. Dieser Wert scheint ein aus der Verwendung von Länder-Daten ableitbarer methodischer Fehler zu sein. Der mittlere Zahl der Arten pro Gattung ist in der Neuen Welt größer als in der Alten Welt. Besonders hoch ist der Wert zwischen 20° und 60° nördlicher Breite, auch bei getrennter Betrachtung von Alter und Neuer Welt. Dies könnte auf eine feinere, sich im Artniveau widerspiegelnde Diversifizierung in nördlicheren Lebensräumen zurückzuführen sein. Die Zahl bekannter Zikadenarten, die als Vektor für Phytopathogene fungieren, wurde der Gesamtartenzahl gegenübergestellt, um - bei gleichmäßiger Verteilung über zoogeographische Regionen und geographische Breiten - eine Gesamtzahl Phytopathogene übertragender Arten abschätzen zu können. Deren Anzahl ist bei den sieben kosmopolitisch verbreiteten Arten und den sieben größten Gattungen geringer als erwartet. In der australischen, nearktischen und paläarktischen Region, den am besten untersuchten Regionen, ist der Anteil der Vektoren weit höher als erwartet, was sich auch im Muster der Breitengrad-Verteilung widerspiegelt. Die wahre Zahl an Vektoren ist daher möglicherweise weit höher als bisher angenommen, und ihre (land)wirtschaftliche Bedeutung bislang noch deutlich unterschätzt. Verzeichnisse der Gattungen der zoogeographischen Regionen werden im Anhang angeführt.

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## Appendix 1. Genera and subgenera of the biogeographic realms.

### Afrotropical Realm:

*Abimwa, Acacioiassus, Acastroma, Accacidia, Aconura, Aconurella, Acopsis, Acostemana, Acostemma, Acostemmella, Acumada, Adama, Aderganna, Aethiopulopa, Afrakra, Afralebra, Afrasca, Afrascius, Africoelidia, Afridonus, Afroccidens, Afroiassus, Afroideus, Afrokana, Afrolidia, Afronirvana, Afrorubria, Afrosus, Agallia, Agalliana, Ahimia, Aladzoa, Aletta, Allophleps, Allygus, Alocoelidia, Amplicoelidia, Amplimada, Annidion, Aphrodes, Athysanus, Austroagallia, Badylessa, Balbillus, Balclutha, Bardera, Basutoia, Batracomorphus, Batracomorphus (Batracomorphus), Batracomorphus (Sudanoiassus), Beniledra, Betsileonas, Bhooria, Biadorus, Bloemia, Bonaspeia, Bordesia, Bothrogonia, Boulardus, Brasura, Brevolidia, Caffrolix, Cafixia, Camptelasmus, Capeolix, Caplopa, Capoideus, Carvaka, Castoriella, Cedarotettix, Cephalelus, Cerus, Chiasmus, Chlorita, Chlorita (Eremochlorita), Chudania, Chujophila, Chunra, Cicadella, Cicadula, Cicadulina, Circulifer, Citorus, Coelidia, Cofana, Coganoa, Coganus, Colistra, Coloborrhis, Confucius, Conlopa, Curvostylus, Dagama, Dananea, Dardania, Delopa, Deltocephalus, Demadana, Dialecticopteryx (Akotettix), Diedrocephala, Diglenita, Dikraneura, Diomma (Dilobonota), Distantia, Dlabolaiana, Doratulina, Drabescus, Draeculacephala, Drakensbergena, Drordana, Dryadomorpha, Duraturopsis, Elginus, Emadiana, Empoasca, Empoasca (Buhria), Empoasca (Empoasca), Empoasca (Marolda), Empoasca (Matsumurasca), Empoasca (Ociepa), Empoascanara, Empoascanara (Empoascanara), Epignoma, Equeefa, Eryapus, Erythroneura, Ethiocoelidia, Eupteryx, Eupteryx (Eupteryx), Euscelidella, Euscelis, Eutettix, Exitianus, Foso, Frutioidia, Frutioidia (Frutioidia), Gambialoa, Gambialoa (Gambialoa), Gambialoa (Nkasa), Gannia, Gcaleka, Glossocratus, Goniagnathus, Grammacephalus, Griveaudana, Grootonia, Gunghuyana, Gununga, Gunungidia, Habenia (Atucla), Habenia (Habenia), Hadria, Hadroca, Hangklipia, Hauptidia (Hauptidia), Hecalus, Heidinus, Helionides, Helionides (_Icaiana), Helionides (Africia), Helionides (Helionides), Helionidia, Hellerina, Hensleyella, Hikangia, Hiltus, Hishimonus, Hodoedocus, Houtbayana, Humpatagallia, Hypacostemma, Ianeira, Iassomorphus, Iassus, Idiocerus, Ifeia, Igerna, Imbecilla, Immadellana, Iseza (Iseza), Iseza (Tamaga), Iturnoria, Ivorycoasta, Jacobiasca, Jacobiella, Jafar, Jassulus, Jimara, Johanus, Jubrinia, Kadrabolina, Kaila, Kanziko, Karasekia, Kasunga, Keia, Kimbella, Kivulopa, Kolla, Kopamerra, Korana, Kosasia, Krameriata, Krisna, Krosolus, Kumba, Kutara, Lamtoana, Lautereriana, Libengaia, Lichtrea, Limassolla (Czecza), Limentinus, Lipata, Litura, Loipothea, Loka, Lualabanus, Lublinia, Lupola, Luvila, Macropsis, Macrosteles, Macugonalia, Macumada, Madagella, Madagena, Madanata, Madaura, Madessina, Madicola, Madranga, Madriscula, Madumbra, Magnentius, Mahaja, Maichewia, Malagasiella, Malasiella, Maldonadora, Malgasicola, Malgasiella, Malicia, Malissiana, Mapochia, Mascarenotettix, Mblokoa, Megalopenthimia, Megaulon, Megulopa, Mfutila, Mgenia, Mileewa, Mimotettix, Modderena, Molopopterus, Monomada, Mordania, Moskgha, Muluana, Naevus, Namibiola, Narecho, Narta, Nataretus, Naudeus, Neoaliturus, Neobassareus, Neodartellus, Neodartus, Neolimnus, Nephoris, Nephotettix, Nesocerus, Ngoma, Ngombela, Ngunga, Nkaanga, Nkonba, Nkumba, Nsanga, Nsesa, Nsimbala, Ntanga, Ntotila (Ngangula), Ntotila (Ntotila), Nzinga, Odmiella, Odomas, Odzalana, Okaundua, Olszewskia, Omiya, Opsius, Optya, Optya (Nkima), Orianajea, Orosius, Ozias, Pachodus, Pandacerus, Parabolocratalis, Parabolocratus, Paradorydium, Paralimnus, Paramelia, Paraphrodes, Paulianiana, Penthimia, Penthimidia, Penthimiola, Petalocephala, Phlepsius, Phlogothamnus, Phycotettix, Platentomus, Platyjassus, Poecilocarda, Polluxia, Pravistylus, Pretioscopus, Proekes, Prosopoxys, Protonesis, Psammotettix, Pseudobalbillus, Pseupalus, Quartauropa, Ragia, Ramakrishnania, Ratsiraka, Recilia, Renosteria, Rhinocoelidia, Rhusia, Rhusopus, Rotifunkia, Samuraba, Sapoba, Scaphoideus, Scaphoidophyes, Scaris, Selenocephalus, Selenopsis, Sichaea, Signoretia, Sochinsogonia, Srabura, Stehliksia, Stellena, Stenocalodia, Stenoledra, Stenomiella, Stenomisella, Stirellus, Strongylomma, Stymphalella, Stymphalus, Sundara, Szymczakowskia, Tafalka, Takagiana, Tamaricella, Tataka, Tetartostylus, Tettigellita, Tettigoniella, Teyasteles, Thaia (Nlunga), Thamnotettix, Thaumatopoides, Theasca, Theronella, Theronopus, Thlasia, Tialidia, Titiella, Tituria, Toropsis, Tsarata, Turitia, Typhlocyba, Tzitzikamaia, Ujna, Ulopa, Ulopella, Unitra, Vecaulis, Vilargus, Vrba, Wemba, Wiata, Wolfella, Xestocephalus, Yachandra, Yaoundea, Zadra, Zanjoneura, Zyginella.*

**Australian Realm:**

*Alocephalus, Alodeltocephalus, Aloeurymela, Aloipo, Aloplemmeles, Alotartessella, Alotartessus, Alseis, Amrasca, Anacornutipo, Anacotis, Anemochrea, Anemolua, Aneono, Arawa, Australoscopus, Austroagallia, Austroagalloides, Austroasca, Austrocerus, Austrolopa, Austrotartessus, Bakeriana, Balclutha, Balocerus, Balocha, Batracomorphus, Borditartessus, Brunotartessus, Carvaka, Cephalelus, Cestius, Chiasmus, Chinaella, Cicadella, Cicadulina, Circulifer, Citripo, Coelidia, Cofana, Conogonia, Cornutipo, Dayus, Deltocephalus, Dikraneura, Distantessus, Doratulina, Dremuela, Dryadomorpha, Dunioa, Dziwneono, Ectopiocephalus, Edwardsiana, Empoasca, Empoascanara, Empoascanara (Empoascanara), Epipsychidion, Erythroneura, Euacanthella, Euleimonios, Euronirvanella, Eurymela, Eurymelella, Eurymelessa, Eurymelita, Eurymeloides, Eurymelops, Eurypella, Exitianiellus, Exitianus, Giffardia, Hackeriana, Hadria, Haranga, Hecalocratus, Hecalus, Helochara, Hishimonus, Hodoedocus, Homa, Homalogoniella, Hortensia, Iassus, Idiocerella, Idiocerus, Immadellana, Inghamia, Ipelloides, Ipo, Ipocerus, Ipoella, Ipoides, Ipolo, Iposa, Ishidaella, Jacobiella, Jukaruka, Kahaono, Kahavalu, Katipo, Krisna, Kyphocotis, Kyphoctella, Lasioscopus, Ledra, Ledracotis, Ledraprora, Ledrella, Ledromorpha, Ledropsella, Ledropsis, Limotettix, Linacephalus, Lonatura, Loralia, Macroceps, Macroceratogonia, Macropsella, Macropsis, Malipo, Mapochiella, Microlopa, Mitelloides, Musgraviella, Myrmecophryne, Myrmecoscopus, Nanipoides, Neodartus, Neotartessus, Neovulturnus, Nephotettix, Nesoclutha, Newmaniana, Nirvana, Nirvanguina, Notocephalius, Occinirvana, Occiplanocephalus, Ophiuchus, Opio, Orosius, Paracephaleus, Paradorydium, Paralimnus, Pascoepus, Pauripo, Pauroeurymela, Pedionis, Pediopsis, Pedioscopus, Pettya, Philotartessus, Pingellus, Platyeurymela, Platyledra, Platyscopus, Plexitartessus, Pogonoscopus, Porcorhinus, Procephaleus, Protartessus, Putoniessa, Recilia, Relipo, Reuplemmeles, Reuteriella, Rhotidoides, Rhotidus, Rosopaella, Rubria, Smicrocotis, Sophonia, Soracte, Soractellus, Spanotartessus, Stenalsella, Stenipo, Stenocotis, Stenopsoides, Stenoscopus, Tartessella, Tartessoides, Tartessus, Taslopa, Tenuitartessus, Thamnophryne, Tharra, Thaumatoscopus, Thymbris, Tolasella, Toropsis, Tortor, Trocnada, Tumocerus, Uloprora, Vulturnus, Woodella, Xestocephalus, Zaletta, Zygina (Hypericiella).*

**Indomalaysian Realm:**

*Abrabra, Accacidia, Aconura, Aconurella, Acostemma, Adarrus (Adarrus), Aeternus, Agallia, Agnesiella (Agnesiella), Agnesiella (Draberiella), Agrica, Aguriahana, Ahmedra, Aidola, Aisa, Ajika, Albicostella, Alebra, Alebroides, Alishania, Allophleps, Almunisna, Alnetoidia, Alnetoidia (Alnella), Alnetoidia (Alnetoidia), Alobaldia, Amalfia, Ambara, Amblyscarta, Amrasca, Amrasca (Quartasca), Amritodus, Amurta, Anacofana, Anagonalia, Anaka, Anatkina, Andrabia, Angusticella, Anufrievia, Apheliona, Apheliona (Apheliona), Aphrodes, Apulia, Arboridia, Arboridia (Arboridia), Arboridia (Arborifera), Arbosiria, Aroonra, Asepodiva, Asialebra, Assina, Assiringia, Athysanopsis, Athysanus, Atkinsoniella, Austroagallia, Austroasca, Aylala, Ayubiana, Baaora, Baguoidea, Baileyus, Bakera, Bakshia, Balacha, Balala, Balanda, Balbillus, Balclutha, Baleja, Balocha, Banus, Barinaga, Batracomorphus, Beirneola, Bhandara, Bharagonalia, Bharata, Bhatasca, Bhatia, Bhooria, Bolanusoides, Bornatka, Borulla, Bothrogonia, Britimnathista, Buloria, Bundera, Busonia, Busoniomimus, Caknesia, Calodia, Capcoana, Carinata, Carvaka, Cassianeura, Catenocola, Cenedaeus, Cerkira, Cestius, Changwhania, Chatura, Chiasmus, Chikava, Chlorita, Chlorita (Eremochlorita), Chlorotettix, Chudania, Chunra, Cicadella, Cicadula, Cicadulina, Circulifer, Clinogonalia, Coelidia, Cofana, Coganoa, Colladonus, Coloana, Confucius, Conogonia, Conoguinula, Coroticus, Crispina, Cuanta, Cubnara, Cuerna, Cunedda, Daimachus, Dapitana, Davmata, Dayus, Deltocephalus, Destinia, Dialecticopteryx (Akotettix), Dikraneura, Diomma, Diomma (Diomma), Diplocolenus (Diplocolenus), Diplocolenus (Verdanus), Divus, Doda, Doratulina, Dorycnia, Drabescus, Draeculacephala, Dryadomorpha, Dryodurgades, Durgades, Dussana, Dusuna, Edwardsiana, Elbelus, Eleazara, Elymana, Empoasca, Empoasca (Distantasca), Empoasca (Empoasca), Empoasca (Endeia), Empoasca (Livasca), Empoasca (Matsumurasca), Empoasca (Sabourasca), Empoascanara, Empoascanara (Bza), Empoascanara (Empoascanara), Empoascanara (Kanguza), Eogypona, Epiclinata, Erragonalia, Eryascara, Erythria, Erythroneura, Eupelix, Eupteryx, Eupteryx (Stacla), Eurhadina (Eurhadina), Eurhadina (Singhardina), Euscelis, Eutettix, Evacanthus, Exitianus, Ezrana, Faiga, Farynala, Frutioidia, Frutioidia (Dworakowskellina), Funkikonia, Fusiplata, Futa-*

*sujinus, Galboa, Gambialoa, Gessius, Gindara, Gladkara, Glossocratus, Goifa, Golwala (Golwala), Golwala (Samruadkita), Goniagnathus, Goska, Grammacephalus, Gratba, Gredzinskiya, Guheswaria, Gunghuyana, Gunhilda, Gununga, Gurawa, Hajra, Handianus (Usuironus), Hangapa, Haranga, Hatigoria, Hecalus, Heliona, Helionides, Helionides (Naracia), Helionidia, Hemisudra, Hengchunia, Henschia, Hiratettix, Hishimonus, Hodoedocus, Homa, Hylica, Iassus, Idioceriinus, Idioceroides, Idiocerus, Idiodonus, Idioscopus, Ifuaria, Ifugoa, Igerna, Immadellana, Indokutara, Iniesta, Ipocerus, Iposcopus, Isaca, Ishidaella, Jacobiasca, Jacobiella, Jakarellus, Jamitettix, Japanagallia, Jassonirvana, Jenolidia, Jilinga, Jotwa, Juliaca, Kabakra, Kadrabia, Kalasha, Kalkiana, Kamaza, Kana, Kapsa, Karachiota, Karoseefa, Kaukania, Kepulana, Kerygma, Kikuchiella, Kirkaldykra, Knightipsis, Kolla, Koperta, Kotabala, Kotwaria, Krisna, Kronos, Kufajka, Kunasia, Kusala, Kutara, Kybos, Labrangia, Laburrus (Laburrus), Lampridius, Lankama, Lankasca, Latalus, Lectotypella, Ledeira, Ledra, Ledroides, Ledropsis, Leofa, Lichtrea, Limassolla, Limentinus, Limotettix (Limotettix), Linnavuoriana (Sharmana), Lisciasta, Litura, Lodiana, Lowata, Luvanda, Luzoniana, Macropsis, Macropsis (Macropsidius), Macrosteles, Magnentius, Mahalana, Mahellus, Mahmoodia, Maiestas, Mainda, Makilingia, Malichus, Mandera, Matsumurama, Matsumurana, Matsumuratettix, Matsumurella, Matsumurina, Maximianus, Megabyzus, Meketia, Meremra, Mesadorus, Mesargus, Mesoparopia, Mesotettix, Metalimnus, Metascarta, Michalowskiya, Michalowskiya (Burunra), Michalowskiya (Michalowskiya), Midoria, Mileewa, Mimiya, Mimotettix, Mitjaevia, Mizeria, Mohunia, Monobazus, Moonia, Motaga, Motschulskyia, Motschulskyia (Motschulskyia), Mukaria, Musbrnoia, Myittana, Nababia, Nacolus, Nakula, Namiocerus, Namsangia, Nanatka, Nandara, Naratettix, Ndokia, Nehela, Neoaliturus, Neodartus, Neotituria, Nesoclutha, Nesophrosyne, Neurotettix, Niedoida, Nikkotettix, Nimabanana, Nirvana, Nitta, Omanella, Omanesia, Omaranus, Omiya, Oncopsis, Oncopsis (Parasitades), Oneratulus, Oniella, Onukia, Onukiades, Onukigallia, Ootacamundus, Opamata, Ophiuchus, Optya, Orientalebra, Orientus, Orosius, Ossuaria, Otbatara, Pachitea, Pachymetopius, Pagaronia, Pandacerus, Parabolocratus, Parabolopona, Paracyba, Paradorydium, Paraidioscopus, Paralaevicephalus, Paralimnoidella, Paralimnus, Parallygus, Paramesodes, Parapetalocephala, Parasudra, Paratkina, Parohinka, Paromenia, Pasara, Pedionis, Pedioscopus, Peitouellus, Penthimia, Petalocephala, Petalocephaloides, Philipposcopus, Phlepsius, Phlogotettix, Pisachoides, Pitadava, Placidus, Platfusa, Platycyba, Platymetopius, Platyretus, Poecilocarda, Poecilioscarta, Polisanella, Poochara, Pradama, Prasutagus, Preta, Proskura, Pruthiorosius, Psammotettix, Pseudosudra, Pseupalus, Pugla, Pygotettix, Pythamus, Pythonirvana, Qadria, Raabeina, Radhades, Ramania, Ranbara, Randhawa, Ratburella, Ratjalia, Rawania, Recilia, Recilia (Inazuma), Recilia (Togacephalus), Rengatella, Resimaguina, Rhutelorbus, Riyavaroa, Roxasella, Rufitidia, Sabimamorpha, Sajda, Salka, Sanatana, Sandanella, Sannella, Satsumanus, Savitara, Scaphoideus, Scaphotettix, Scopogonalia, Scoposcartula, Seasogonia, Seriana, Shaddai, Shamala (Mahmoba), Shamala (Shamala), Signoretia, Sikkimasca, Singapora, Sirosoma, Smita, Smyga, Sobrala, Sochinsogonia, Sombakidia, Sophonia, Sorhoanus (Sorhoanus), Speudotettix, Sphinctogonia, Stenatkina, Stenotortor, Stirellus, Stragania, Stylolidia, Stymphalus, Subhimalus, Sudra, Sundara, Symphypyga, Szara, Szuletaia, Taharana, Takagiella, Takagioma, Takama, Tamaricella, Tambila, Tambocerus, Tartessops, Tartessus, Tautoneura, Tautoneura (Tautoneura), Tengatka, Tenompoella, Thagria, Thaia, Thaia (Niema), Thaia (Nlunga), Thaia (Thaia), Thaiora, Thamnotettix, Tharra, Thaumatoscopus, Tituria, Toba, Togaricrania, Traiguma, Trifida, Trocnadella, Tuzinka, Typhlocyba, Typhlocyba (Empoa), Ujna, Ulopa, Urmila, Urvana, Usharia, Uzeldikra, Uzelina, Vangama, Varicopsella, Varsha, Vatana, Velu, Vermara, Vikabara, Viridomarus, Vulturnus, Wagneriala, Wagneriunia, Wanritettix, Watara, Welmaya, Wiata, Witera, Wolvletta, Xerophloea, Xestocephalus, Yamatotettix, Yangida, Yanocephalus, Yeia, Ziczacella, Zielona, Znana, Zorka, Zygina, Zygina (Hypericiella), Zyginella, Zyginopsis.*

## Nearctic Realm:

*Acinopterus, Acrogonia, Acuera (Acuera), Acuera (Parcana), Acunasus, Acuponana, Acusana, Adarrus (Errastunus), Aflexia, Agallia, Agalliana, Agalliopsis, Agalliopsis (Agallaria), Agalliopsis (Agalliopsis), Agalliota, Agrosoma, Aguriahana, Alapus, Alconeura, Alconeura (Alconeura), Alconeura (Hyloidea), Alebra, Aligia, Alladanus, Allogonia, Allonolla, Allygianus, Allygiella, Allygus, Amahuaka, Amblydisca, Amblyscarta, Amblysel-*

*lus*, *Amphigonalia*, *Amplicephalus*, *Amplicephalus* (*Amplicephalus*), *Ankosus*, *Aphrodes*, *Aplanus*, *Aplanusiella*, *Apogonalia*, *Arboridia*, *Arboridia* (*Erythridula*), *Artucephalus*, *Arundanus*, *Ascius*, *Atanus*, *Athysanella*, *Athysanella* (*Amphipyga*), *Athysanella* (*Athysanella*), *Athysanella* (*Brachydella*), *Athysanella* (*Gladionura*), *Athysanella* (*Pectinapyga*), *Athysanella* (*Pedumella*), *Athysanus*, *Attenuipyga*, *Auridius*, *Balclutha*, *Baldulus*, *Ballana* (*Laterana*), *Ballana* (*Viriosana*), *Bandara*, *Bandara* (*Bandarana*), *Bardana*, *Barela*, *Bathysmatophorus*, *Bonneyana*, *Boreotettix*, *Brenda*, *Brunerella*, *Cahya*, *Caladonus*, *Calanana*, *Caldwelliola*, *Calonia*, *Campecha*, *Cantura*, *Carsonus*, *Cazenus*, *Ceratagallia*, *Ceratagallia* (*Aceratagallia*), *Ceratagallia* (*Ceratagallia*), *Cetexa*, *Chlorita*, *Chlorita* (*Chlorita*), *Chlorogonalia*, *Chloronana*, *Chlorotettix*, *Chlorotettix* (*Chacotettix*), *Chlorotettix* (*Chlorotettix*), *Cicadella*, *Cicadula*, *Ciminius*, *Circulifer*, *Cochlorhinus*, *Cocoelidia*, *Coelella*, *Coelidiana*, *Colladonus*, *Commellus*, *Conversana*, *Cosmotettix*, *Cosmotettix* (*Cosmotettix*), *Costamia*, *Costanana*, *Coulinus*, *Cozadanus*, *Crassana* (*Crassana*), *Crassana* (*Macrasana*), *Cribrus*, *Crumbana*, *Cuerna*, *Cuitlana*, *Curtara*, *Curtara* (*Curtara*), *Curtara* (*Curtarana*), *Curtara* (*Mysticana*), *Cyrtodisca*, *Dalbulus*, *Daltonia*, *Dampfiana*, *Danbara*, *Davisonia*, *Decua*, *Deltanus*, *Deltazotus*, *Deltella*, *Deltocephalus*, *Deltorhynchus*, *Destria*, *Devolana*, *Diceratalebra*, *Dicyphonia*, *Diedrocephala*, *Diestostemma*, *Dikraneura*, *Dikraneura* (*Delongia*), *Dikraneura* (*Dikraneura*), *Dikrella*, *Dikrella* (*Dikrella*), *Dikrella* (*Readionia*), *Dilobopterus*, *Diplocolenus* (*Diplocolenus*), *Diplocolenus* (*Verdanus*), *Dixianus*, *Doleranus*, *Doratura*, *Dorycara*, *Dorydiella*, *Draeculacephala*, *Draeculacephala* (*Carneocephala*), *Dragonana*, *Drionia*, *Driotura*, *Edwardsiana*, *Egidemia*, *Elymana*, *Empoasca*, *Empoasca* (*Empoasca*), *Empoasca* (*Hebata*), *Endria*, *Errhomus*, *Erythrogonia*, *Erythroneura*, *Erythroneura* (*Erasmoneura*), *Erythroneura* (*Eratoneura*), *Erythroneura* (*Erythroneura*), *Eulonus*, *Eupterella*, *Eupteryx*, *Eupteryx* (*Eupteryx*), *Euragallia*, *Eusama*, *Euscelidius*, *Euscelis*, *Eusora*, *Eutettix*, *Eutettix* (*Guadlera*), *Evacanthus*, *Excavanus*, *Excultanus*, *Exitianus*, *Extrusanus*, *Fibragallia*, *Fieberiella*, *Fitchana*, *Flexamia*, *Flexarida*, *Floridonus*, *Forcipata*, *Frequenamia*, *Freytagana*, *Fridonus*, *Frigartus*, *Friscanus*, *Fusigonalia*, *Gargaropsis*, *Gillettiella*, *Giprus*, *Gloridonus*, *Gorgonalia*, *Graminella*, *Graphocephala*, *Graphocraerus*, *Graphogonalia*, *Gypona*, *Gypona* (*Gypona*), *Gypona* (*Marganalana*), *Gypona* (*Obtusana*), *Gyponana* (*Clovana*), *Gyponana* (*Gyponana*), *Gyponana* (*Sternana*), *Habralebra*, *Haldorus* (*Eohaldorus*), *Hamana*, *Harasupia*, *Hardya*, *Hebecephalus*, *Hebexa*, *Hecalapona* (*Hecalapona*), *Hecalus*, *Hecullus*, *Helochara*, *Henribautia*, *Hesium*, *Homalodisca*, *Huleria*, *Hymetta*, *Idiocerus*, *Idiocerus* (*Populicerus*), *Idiodonus*, *Idona*, *Ilagia*, *Isogonalia*, *Janastana*, *Japananus*, *Jikradia*, *Jiutepeca*, *Joruma*, *Joruma* (*Joruma*), *Joruma* (*Jorumidia*), *Juliaca*, *Kalimorpha*, *Kansendria*, *Kidrella*, *Kinonia*, *Knullana*, *Koebelia*, *Kunzeana*, *Kunzella*, *Kyboasca*, *Kybos*, *Ladoffa*, *Laevicephalus*, *Lareba*, *Latalus*, *Ledra* (see note under Holarctic), *Licontinia*, *Limbanus*, *Limotettix*, *Limotettix* (*Dryola*), *Limotettix* (*Limotettix*), *Limotettix* (*Neodrylix*), *Limotettix* (*Ophiolix*), *Limotettix* (*Scleroracus*), *Lonatura*, *Loreta* (*Loreta*), *Lycioides*, *Lystridea*, *Macropsis*, *Macrosteles*, *Macugonalia*, *Macunolla*, *Macustus*, *Manzutus*, *Mareja*, *Marganana* (*Marganana*), *Mcateeana*, *Memnonia*, *Mendozellus*, *Menosoma*, *Mesamia*, *Mexara*, *Mexicananus*, *Mexolidia*, *Mocuellus*, *Mocuellus* (*Mocuellus*), *Molomea*, *Momoria*, *Naltaca*, *Negosiana*, *Neocoelidia*, *Neocoelidiana*, *Neodonus*, *Neohecalus*, *Nesophrosyne* (*Nesophrosyne*), *Nesophrosyne* (*Nesoreias*), *Nesophryne*, *Nigridonus*, *Nionia*, *Norvellina*, *Notus*, *Notus* (*Curta*), *Notus* (*Notus*), *Nurenus*, *Ollarianus*, *Omanana*, *Omanolidia*, *Oncometopia* (*Oncometopia*), *Oncometopia* (*Similitopia*), *Oncopsis*, *Opsius*, *Oragua*, *Orientus*, *Orocastus*, *Orocastus* (*Cabrulus*), *Osbornellus*, *Osbornellus* (*Sorbonellus*), *Ossiannilssonola*, *Pachyopsis*, *Pagaronia*, *Paluda*, *Parabahita*, *Parabolocratus*, *Parallaxis*, *Paraphlepsius*, *Paraphlepsius* (*Gamarex*), *Paraphlepsius* (*Paraphlepsius*), *Paraphlepsius* (*Paraphysius*), *Paraphlepsius* (*Sabix*), *Paraphlepsius* (*Strephonius*), *Paraulacizes*, *Paromenia*, *Pasadenus*, *Pasaremus*, *Pazu*, *Peconus*, *Pediopsoides* (*Nanopsis*), *Pendarus*, *Pendarus* (*Remadosus*), *Penehuleria*, *Penestragania*, *Penthimia*, *Phera*, *Phlepsanus*, *Pilosana*, *Pinumius*, *Planicephalus*, *Plesiommata*, *Plummerella*, *Poeciloscarta*, *Polana* (*Bohemanella*), *Polana* (*Largulara*), *Polana* (*Nihilana*), *Polana* (*Polana*), *Polyamia*, *Ponana*, *Ponana* (*Bulbana*), *Ponana* (*Ponana*), *Ponanella*, *Prairiana*, *Premanus*, *Prescottia*, *Proranus*, *Protalebra*, *Protalebrella*, *Psammotettix*, *Pseudaligia*, *Pseudometopia*, *Pseudophera*, *Pseutettix*, *Renonus*, *Reticopsis*, *Retusanus*, *Reventazonia*, *Rhabdotalebra*, *Ribautiana*, *Rosenus*, *Rugosana*, *Sanctanus*, *Sanctanus* (*Cruciatanus*), *Sanctanus* (*Sanctanus*), *Sanuca*, *Scaphoideus*, *Sca-*

*phoideus (Latenus), Scaphoideus (Lonenus), Scaphoideus (Scaphoideus), Scaphytopius, Scaphytopius (Cloanthanus), Scaphytopius (Convelinus), Scaphytopius (Scaphytopius), Scaris, Scinda, Secopennis, Sibovia, Sisimitalia, Sobara, Solanasca, Soleatus, Sonronius, Sorhoanus, Spangbergiella, Spartopyge, Spathanus, Spinulana, Stenometopiellus, Stephanolla, Stirellus, Stoneana, Stragania, Streptanus, Telusus, Tenuarus, Tenucephalus, Tenuisanus, Tettigoniella, Texananus, Texananus (Aridanus), Texananus (Iowanus), Texananus (Texananus), Thamnotettix, Thatuna, Tiaja, Tideltellus, Tinobregmus, Tlagonalia, Tropicanus, Tropicanus (Cabimanus), Tropicanus (Tropicanus), Trypanalebra, Twiningia, Tylozygus, Typhlocyba, Typhlocyba (Anomia), Typhlocyba (Empoa), Typhlocybella, Unerus (Unerus), Unoka, Usanus, Xerophloea, Xestocephalus, Xyphon, Yunga, Zabrosa, Zelenius, Zonocyba, Zygina.*

## Neotropical Realm:

*Abana, Abrela, Absheta, Acinopterus, Acrobelus, Acrocampsa, Acrogonia, Acrulogonia, Acuera, Acuera (Acuera), Acuera (Parcana), Acuera (Tortusana), Acuponana, Acusana, Adiaerotoma, Aequcephalus, Agallia, Agalliana, Agalliopsis, Agalliopsis (Agallaria), Agalliopsis (Agalliopsis), Agalliota, Agelina, Aglenita, Agrosoma, Aguahua, Aguana, Aguatala, Agudus, Alaca, Alahana, Alapona, Albera, Alconeura, Alconeura (Alconeura), Alconeura (Hyloidea), Alebra, Alebranus, Aligia, Allogonia, Amahuaka, Ambigonalia, Amblydisca, Amblyscarta, Amblyscartidia, Amblysellus, Amphigonalia, Amplicephalus, Amplicephalus (Amplicephalus), Amplicephalus (Nanctasus), Amylidia, Anacrocampsa, Anacuerna, Ancudana, Andanus, Angubahita, Angubahita (Mairana), Angucephala, Antoniellus, Aphanalebra, Aphrodes, Apogonalia, Apophydia, Apulia, Arapona, Aricanus, Arrugada, Articoelidia, Aspilodora, Atanus, Athysanus, Aulacizes, Aurogonalia, Backhoffella, Bahapona, Bahita, Balacha, Balclutha, Baleja, Balera, Baluba, Bandara, Bandara (Bandarana), Bandaromimus, Barbatana, Barbinolla, Barela, Barodecus, Baroma, Bascarrhinus, Batracomorphus, Beamerana, Begonalia, Beirneola, Benala, Benibahita, Bergallia, Bergolix, Biadorus, Biza, Bolarga, Bolidiana, Bolivaia, Boliviela, Bolotheta, Bonamus, Borogonalia, Brasa, Brasilanus, Brasilanus (Mascoitanus), Brasopsis, Brazosa, Brevicapitorus, Brincadorus, Brunerella, Bubacua, Bucephalogonia, Buritia, Bythonia, Cahya, Caldwelliola, Calliscarta, Calodicia, Camaija, Caphodellus, Caphodus, Caragonalia, Caranavia, Cardioscarta, Carelmapu, Cariancha, Caribovia, Carinolidia, Caruya, Catagonalia, Catorthorrhinus, Cephalogonalia, Ceratagallia (Ceratagallia), Ceratagallia (Ceratagallia), Cerrillus, Chaparea, Chichahua, Chilelana, Chilella, Chilenana, Chinaia, Chinchinota, Chlorogonalia, Chloronana, Chlorotettix, Chlorotettix (Chacotettix), Chlorotettix (Chlorotettix), Chonosina, Chromagallia, Chunroides, Cibra, Cicadella, Cicadulina, Cicciana, Ciccus, Ciminius, Cinerogonalia, Circulifer, Citorus, Clinonana, Clinonella, Clydacha, Clypeolidia, Cochanga, Codilia, Coelana, Coelidia, Coelidiana, Coelindroma, Coelogypona, Colladonus, Columbonirvana, Comanopa, Conala, Conbalia, Copididonus, Corilidia, Coronigonalia, Coronigoniella, Cortona, Corupiana, Costanana, Crassinolanus, Crepluvia, Crinolidia, Crinorus, Crossogonalia, Cruziella, Cubrasa, Cuerna, Cuitlana, Culumana, Cumbrenanus, Curtara, Curtara (Ardasoma), Curtara (Curtara), Curtara (Curtarana), Curtara (Lataba), Curtara (Mysticana), Curtara (Remarana), Curtara (Retusana), Curtara (Sinchora), Cyclogonia, Cyrtodisca, Dalbulus, Daltonia, Daridna, Dariena, Dasmeusa, Dayoungia, Dechacona, Declivara, Deltocephalus, Deltocoelidia, Deltolidia, Depanana, Depanisca, Derogonia, Derriblocera, Desamera, Deselvana, Desertana, Diceratalebra, Dichrophleps, Dicodia, Dicolecia, Dictyodisca, Diedrocephala, Diestostemma, Dikraneura, Dikrella (Dikrella), Dikrella (Readionia), Dikrellidia, Dilobopterus, Discocephalana, Docalidia, Doleranus, Dolyobius, Donidea, Donleva, Doradana, Draeculacephala, Dumorpha, Ectypus, Edwardsiana, Egenus, Egidemia, Ehagua, Elabra, Eldarbala, Elrabonia, Empoasca, Empoasca (Empoasca), Endoxoneura, Eovulturnops, Erabla, Erythrogonia, Erythroneura (Erythroneura), Eualebra, Eupteryx, Euragallia, Euscelis, Eusceloidia, Eutettix, Evansiola, Evansolidia, Exitianus, Exogonia, Exolidia, Faltala, Ferrariana, Fibragallia, Fieberiella, Fistulidia, Flexana, Folicana, Fonsecaiulus, Frequenamia, Fuminana, Fusanus, Fusigonalia, Gabrita, Garapita (Chlamydopita), Garapita (Garapita), Garlica, Gehundra, Geitogonalia, Genatra, Gicrantus, Gillonella, Goblinaja, Godoyana, Gracilidia, Graminella, Graphocephala, Graphogonalia, Grunchia, Gypona, Gypona (Carnoseta), Gypona (Elevanosa), Gypona (Gypona), Gypona (Marganalana), Gypona (Obtusana), Gypona (Paragypona), Gyponana, Gyponana*

(Gyponana), Gyponana (Pandara), Gyponana (Spinanella), Gyponana (Zerana), Habralebra, Hadralebra, Hadria, Haldorus, Haldorus (Eohaldorus), Haldorus (Haldorus), Haldorus (Parahaldorus), Hamolidia, Hanshumba, Harasupia, Hastalidia, Hecalapona, Hecalapona (Carapona), Hecalapona (Hecalapona), Hecalapona (Nulapona), Hecaloidia, Hegira, Helochara, Helocharina, Hespenedra, Hodoedocus, Homalodisca, Homoscarta, Hortensia, Huachia, Huancabamba, Hybla, Hyogonia, Iassus, Icaia, Ichthyobelus, Idiocerus, Idiodonus, Idionannus, Idona, Igerna, Inoclapis, Inuyana, Iragua, Isogonalia, Jakrama, Jalorpa, Janastiana, Jassolidia, Jassopronus, Jassosqualus, Jawigia, Jikradia, Joruma, Joruma (Joruma), Joruma (Jorumidia), Jozima, Juliaca, Julipopa, Kalimorpha, Kanorba, Kapateira, Kogigonalia, Kolla, Korsigianus, Kramerana, Kramerolidia, Kravilidius, Krisna, Krocobella, Krocodona, Krocozzota, Kunzeana, Kunzella, Labocurtidia, Ladoffa, Laevilidia, Lajolla, Laneola, Larsenolidia, Latusagallia, Lautereria, Lawsonellus, Lebaja, Licolidia, Licontinia, Lissoscarta, Lodia, Lojanus, Lojata, Lorellana, Loreta, Loreta (Bahitella), Loreta (Loreta), Luheria, Macrosteles, Macugonalia, Macunolla, Maranata, Marcapatiana, Mareba, Mareja, Marganana (Declivana), Maricaona, Medlerola, Megabahita, Megacoelidia, Megagallia, Megalidia, Mendozellus, Menosoma, Mesadorus, Mesamia, Mesogonia, Metacephalus, Metascarta, Miarogonalia, Microgoniella, Mimodorus (Megadorus), Mimodorus (Mimodorus), Mocoa, Molomea, Momoria, Mucrometopia, Myerslopia, Nannogonalia, Napo, Nedangia, Neiva, Nelidina, Neobala, Neocoelidia, Neocoelidiana, Neocrassana, Neodeltocephalus, Neodikrella, Neojoruma, Neomesus, Neonirvana, Neophlepsius (Neophlepsius), Neophlepsius (Nesolanus), Neopsis, Nesothamnus, Nielsonia, Nionia, Noritonus, Nudulidia, Nullamia, Nullana, Ochrostacta, Oeogonalia, Ohausia, Ollarianus, Omagua, Omanolidia, Omegalebra, Onblavia, Oncometopia, Oncometopia (Oncometopia), Oncometopia (Similitopia), Oncopsis, Onega, Onura, Opsius, Oragua, Orechona, Orsalebra, Ortega, Osbornellus, Osbornellus (Nereius), Osbornellus (Osbornellus), Osbornellus (Sorbonellus), Osbornulus, Pachitea, Pachyopsis, Pachytettix, Palingonalia, Pamplona, Pamplonoidea, Panolidia, Parabahita, Paracarinolidia, Paracatua, Paracrocampsa, Paraganus, Paragonalia, Paralebra, Paralidia, Parallaxis, Parandanus, Paraphlepsius, Paraphlepsius (Gamarex), Paratanus, Paraterulia, Parathona, Paratubana, Paraulacizes, Parinaeota, Paromenia, Paulomanus, Pawiloma, Peayanus, Pegogonia, Peltocheirus, Penestragania, Penthimia, Penthimiola, Pentoffia, Perspinolidia, Perubahita, Perubala, Perugrampta, Perulidia, Phera, Phereurhinus, Phlepsobahita, Picchuia, Picchusteles, Piezauchenia, Pilosana, Planicephalus, Planolidia, Plapigella, Platygonia, Platyhynna, Platymetopius, Platypona, Plerogonalia, Plesiommata, Poeciloscarta, Polana, Polana (Angusana), Polana (Bohemanella), Polana (Bulbusana), Polana (Declivella), Polana (Largulara), Polana (Nihilana), Polana (Parvulana), Polana (Polana), Polana (Polanana), Polana (Polanella), Polana (Striapona), Polana (Validapona), Polyamia, Ponana, Ponana (Lataponana), Ponana (Neoponana), Ponana (Peranoa), Ponana (Ponana), Ponana (Proxaponana), Ponanella, Portanus, Prairiana, Procama, Procandea, Proconia, Proconobola, Proconopera, Proconosama, Propetes, Proranus, Protalebra, Protalebrella, Proxima, Pseudalaca, Pseudometopia, Pseudophera, Psibala, Punahuana, Pygmaelidia, Quaziptus, Quichira, Rabela, Racinolidia, Ramosulus, Raphirhinus, Regalana, Relaba, Reticana, Reventazonia, Rhabdotalebra, Rhobala, Rhogosana, Rhopalogonia, Rikana, Rineda, Rotigonalia, Rugosana, Ruppeliana, Saavedra, Sailerana, Salvina, Sanctanus, Sandersellus, Sanestebania, Sanluisia, Sapingia, Saranella, Sarascarta, Scaphoidula, Scaphytopius, Scaphytopius (Cloanthanus), Scaphytopius (Convelinus), Scaphytopius (Fundarus), Scaphytopius (Protranus), Scaphytopius (Scaphytopius), Scapidonus, Scaris, Scaroidana, Schildola, Schistogonalia, Scopogonalia, Scoposcartula, Segonalia, Selenopsis, Selvitsa, Serpa, Serratus, Serridonus, Sibovia, Sincholata, Sinchonoa, Sisimitalia, Solanasca, Sonesimia, Soosiulus, Sordana, Spangbergiella, Spanigorlus, Spathifer, Sphaeropogonia, Spinolidia, Splonia, Sprundigia, Stalolidia, Stehlikiana, Stenolidia, Stephanolla, Stictoscarta, Stirellus, Stragania, Strictogonia, Suarezia, Subrasaca, Sulcana, Syncharina, Synogonia, Tacora, Tahuampa, Tahura, Tantogonalia, Tantulidia, Tapajosa, Taperinha, Teleogonia, Teletusa, Tenuacia, Tenuacia (Rubacea), Tenucephalus, Terulia, Tettigoniella, Tettisama, Tettiselva, Texananus, Texananus (Iowanus), Texananus (Texananus), Thamnotettix, Tichocoelidia, Tingolix, Tingopyx, Tinocripus, Tinteromus, Tipuana, Tlagonalia, Toldoanus, Torresabela, Tortigonalia, Tozzita, Trachygonalia, Tretogonia, Trichogonia, Triquetolidia, Tropicanus, Tropicanus (Tropicanus), Trypanalebra, Tuberana, Tubiga, Tumupasa, Tungurahuala, Tylo-

*zygus, Typhlocyba, Typhlocybella, Unerus, Unerus (Unerus), Uperogonalia, Vernobia, Versigonalia, Vidanoana, Villosana, Virganana, Webaskola, Willeiana, Woldana, Xedreota, Xenocoelidia, Xenogonalia, Xerophloea, Xestocephalus, Xiqilliba, Xyphon, Yochlia, Yotala, Youngolidia, Yunga, Yungasia, Yuraca, Zabrosa, Zaruma, Zonana, Zygina, Zyzzogeton.*

## Oceanian Realm:

*Aaka, Aconura, Agallia, Agalliopsis, Aguriahana, Alebroides, Amberbakia, Ambigonalia, Amrasca, Arahura, Arawa, Archeguina, Arragsia, Ateloguina, Athysanus, Austroasca, Balclutha, Batracomorphus, Baya, Bharata, Bhatia, Bolanusoides, Borduria, Bothrogonia, Breviguina, Calodia, Calotartessus, Carchariacephalus, Carvaka, Castanoguina, Cestius, Chlorita, Chunra, Cicadella, Cicadulina (Idyia), Coelidia, Cofana, Colliguina, Conogonia, Dayus, Deltocephalus, Dialecticopteryx, Diomma, Diomma (Bunyipia), Drabescus, Draeculacephala, Dryadomorpha, Duatartessus, Dunioa, Edwardsiana, Eldama, Empoasca, Empoascanara, Empoascanara (Empoascanara), Erythrogonia, Erythroneura, Eurymeloides, Eutettix, Evacanthus, Exitianus, Flavitartessus, Garguina, Graptoguina, Guineotetta, Gurawa, Haranthus, Harmata, Hecaloidella, Hecalus, Heteroguina, Hishimonus, Horouta, Hybrasil, Iassus, Idiocerus, Idioscopus, Ifugoa, Ipoides, Ishidaella, Jacobiella, Kapsa, Katipo, Kirkaldiella, Kolla, Koperta, Kutara, Kybos, Lamia, Latiguina, Latusagallia, Limassolla, Limotettix, Maguangua, Matatua, Melanguina, Mileewa, Milotartessus, Moluccasia, Moruloguina, Myerslopia, Mysolis, Namsangia, Navaia, Neotharra, Nephotettix, Nesoclutha, Nesolina, Nirvana, Nirvanoides, Nitidoguina, Notocephalius, Novolopa, Novothymbris, Nubelloides, Oceanopona, Opsianus, Orosius, Pactana, Paguinapua, Parabolocratus, Paracephaleus, Paradorydium, Parohinka, Pedioscopus, Pelaguina, Penestragania, Penthimia, Petalocephala, Philotartessus, Phytotartessus, Platyretus, Poeciloscarta, Preta, Pythonirvana, Recilia, Resimaguina, Roguina, Ronjpelana, Sarpestus, Satsumanus, Scaphetus, Scaphoideus, Seasogonia, Selenomorphus, Selvitsa, Sibovia, Solanasca, Sophonia, Stirellus, Tahara, Taharana, Tartessops, Tartessus, Teloguina, Thagria, Thalattoscopus, Tharra, Trachyguina, Triviotartessus, Tuguinana, Unguinana, Vulturnus, Wakaya, Wiloatma, Xestocephalus, Zelopsis, Zinga, Zygina.*

## Palearctic Realm:

*Acacioiassus, Accacidia, Acharis, Achrus, Aconura, Aconurella, Acrobelus, Adarrus, Adarrus (Adarrus), Adarrus (Belaunus), Adarrus (Errastunus), Adelungia, Agallia, Aglena, Agnesiella, Agnesiella (Agnesiella), Aguriahana, Aindrahamia, Albicostella, Alebra, Alebroides, Alishania, Allygidius, Allygidius (Dicrallygus), Allygus, Allygus (Allygus), Alnetoidia, Alnetoidia (Alnella), Alnetoidia (Alnetoidia), Alobaldia, Amblytelinus, Amimenus, Amritodus, Anaceratagallia, Anatkina, Anoplotettix, Anoscopus, Anoterostemma, Anufrievia, Apheliona, Apheliona (Sujitettix), Aphrodes, Araldus, Arboridia (Arboridia), Arocephalus (Ariellus), Arocephalus (Arocephalus), Arthaldeus, Artianus, Asialebra, Asianidia, Assiuta, Athysanopsis, Athysanus, Atkinsoniella, Austroagallia, Austroasca, Baguoidea, Baileyus, Balacha, Balala, Balcanocerus, Balclutha, Baleja, Balocha, Bambusana, Banus, Bathysmatophorus, Batracomorphus, Batracomorphus (Batracomorphus), Beirneola, Bergevina, Bhatia, Bilusius, Bobacella, Bordesia, Bothrogonia, Brachylope, Brachypterona, Bugraia, Bundera, Byphlocyta, Calodia, Canariotettix, Carchariacephalus, Carvaka, Cazenus, Cechenotettix, Cephalius, Cestius, Changwhania, Chiasmus, Chlorita, Chlorita (Artemisiella), Chlorita (Asymmetrasca), Chlorita (Chlorita), Chlorita (Eremochlorita), Chloropelix, Chudania, Cicadella, Cicadula, Cicadulella, Cicadulina, Circulifer, Ciudadrea, Clavena, Coelestinus, Coelidia, Cofana, Colladonus, Coloana, Coloborrhis, Colobotettix, Concavifer, Condylotes, Confucius, Coryphaelus, Cosmotettix, Cosmotettix (Agapelus), Cosmotettix (Airosus), Cosmotettix (Cosmotettix), Ctenurella, Cunedda, Cyrta, Dalus, Dayus, Deltocephalus, Dialecticopteryx (Akotettix), Dikraneura, Dikraneura (Dikraneura), Diomma (Diomma), Diplocolenus, Diplocolenus (Diplocolenus), Diplocolenus (Erdianus), Diplocolenus (Verdanus), Distantia, Docotettix, Doliotettix, Doratulina, Doratura, Doraturopsis, Dorycephalus, Drabescoides, Drabescus, Dudanus, Durgades, Dussana, Ebarrius, Ederranus, Edwardsiana, Elphnesopius, Elymana, Emadiana, Emelyanogramma, Emelyanoviana, Empoasca, Empoasca (Distantasca), Empoasca (Empoasca), Empoasca (Matsumurasca), Empoasca (Okubasca), Empoascanara, Empoascanara (Empoascanara), Enantiocephalus, Epiacanthus, Epicephalius, Epiclinata, Eremophlepsius, Ericotettix, Errhomenus, Erythria, Erythroneura, Erythro-*

*neura* (*Erythroneura*), *Eupelix*, *Eupteryx*, *Eupteryx* (*Eupteryx*), *Eurhadina*, *Eurhadina* (*Eurhadina*), *Eurhadina* (*Singhardina*), *Euscelidius*, *Euscelis*, *Evacanthus*, *Exitianus*, *Fagocyba*, *Falcitettix*, *Favintiga*, *Fieberiella*, *Forcipata*, *Frutioidia* (*Dworakowskellina*), *Frutioidia* (*Frutioidia*), *Funkikonia*, *Futasujinus*, *Gehundra*, *Glossocratus*, *Goldeus*, *Goniagnathus*, *Grammacephalus*, *Granulus*, *Graphocephala*, *Graphocraerus*, *Grypotes*, *Gunungidia*, *Gypona*, *Habrostis*, *Handianus*, *Handianus* (*Dlabolia*), *Handianus* (*Usuironus*), *Hardya*, *Hardya* (*Eohardya*), *Hardya* (*Hardya*), *Hardya* (*Mimohardya*), *Hatigoria*, *Hauptidia*, *Hauptidia* (*Hauptidia*), *Hauptidia* (*Melicharidia*), *Hebecephalus*, *Hecalus*, *Heliona*, *Helionides*, *Helionidia*, *Henschia*, *Hephathus*, *Hesium*, *Hiratettix*, *Hishimonus*, *Homa*, *Iassomorphus*, *Iassus*, *Iberia*, *Idiocerus*, *Idiocerus* (*Metidiocerus*), *Idiocerus* (*Populicerus*), *Idiodonus*, *Idioscopus*, *Igerna*, *Igutettix*, *Imbecilla*, *Ishidaella*, *Ishiharella*, *Jacobiasca*, *Japanagallia*, *Japananus*, *Jilijapa*, *Jubrinia*, *Kaszabinus*, *Kazachstanicus*, *Kolla*, *Krisna*, *Kropka*, *Kurotsuyanus*, *Kyboasca*, *Kybos*, *Laburrus* (*Esolanus*), *Laburrus* (*Laburrus*), *Lamprotettix*, *Latalus*, *Lectotypella*, *Ledra*, *Ledromorpha*, *Ledropsis*, *Liguropia*, *Limassolla*, *Limotettix*, *Limotettix* (*Limotettix*), *Limotettix* (*Ophiolix*), *Limotettix* (*Scleroracus*), *Lindbergina*, *Lindbergina* (*Youngiada*), *Linnavuoriana* (*Linnavuoriana*), *Lodiana*, *Lublinia*, *Macropsis*, *Macropsis* (*Macropsidius*), *Macrosteles*, *Macustus*, *Masiripius*, *Matsumurella*, *Matsumurina*, *Megipocerus*, *Megophthalmus*, *Megulopa*, *Melicharella*, *Melillaia*, *Melliola*, *Mendrausus*, *Mendreus*, *Mesagallia*, *Mesoparopia*, *Metalimnus*, *Metapocirtus*, *Micantulina*, *Michalowskiya*, *Midoria*, *Mileewa*, *Mimallygus*, *Mimotettix*, *Miraldus*, *Mocuellus*, *Mocuellus* (*Erzaleus*), *Mocuellus* (*Mocuellus*), *Mocydia*, *Mocydiopsis*, *Mongolojassus*, *Monobazus*, *Moonia*, *Motschulskyia* (*Togaritettix*), *Mukaria*, *Nacolus*, *Nakaharanus*, *Nanosius*, *Naratettix*, *Nehela*, *Neoaliturus*, *Neodartus*, *Neolimnus*, *Neotituria*, *Nephotettix*, *Nesoclutha*, *Nicolaus*, *Nikkotettix*, *Nirvana*, *Notus*, *Notus* (*Notus*), *Oncopsis*, *Oniella*, *Oniroxis*, *Onukia*, *Onukigallia*, *Ophionotum*, *Opsius*, *Optya* (*Nkima*), *Orientus*, *Orosius*, *Osbornellus*, *Osbornellus* (*Mavromoustaca*), *Oxytettigella*, *Pagaronia*, *Paluda* (*Rhopalopyx*), *Pantallus*, *Parabolocratus*, *Parabolopona*, *Paracyba*, *Paradorydium*, *Paradorydium* (*Semenovium*), *Paralaevicephalus*, *Paralimnus*, *Paramacroceps*, *Paramesodes*, *Parameses*, *Parapetalocephala*, *Parapotes*, *Paratyphlocyba*, *Paropulopa*, *Parunculus*, *Pediopsoides*, *Pediopsoides* (*Sispocnis*), *Penthimia*, *Penthimiola*, *Perotettix*, *Petalocephala*, *Petalocephaloides*, *Peyerimhoffiola*, *Philaia*, *Phlepsius*, *Phlogotettix*, *Phycotettix*, *Pinumius*, *Pithyotettix*, *Placotettix*, *Planaphrodes*, *Platycyba*, *Platymetopius*, *Platyproctus*, *Pleargus*, *Poliona*, *Praganus*, *Proceps*, *Psammotettix*, *Psegmatus*, *Pseudocephalelus*, *Pseudolausulus*, *Pseudophlepsius*, *Pseudosubhimalus*, *Pteropyx*, *Raunothus*, *Recilia*, *Recilia* (*Inazuma*), *Recilia* (*Togacephalus*), *Rengatella*, *Rhytidodus*, *Rhytistylus*, *Ribautiana*, *Rosenus*, *Sacapome*, *Sagatus*, *Salka*, *Sardius*, *Satsumanus*, *Savanicus*, *Scaphoideus*, *Schizandrasca*, *Selenocephalus*, *Sempia*, *Seriana*, *Shaddai*, *Signoretia*, *Singapora*, *Sonronius*, *Sorhoanus*, *Sorhoanus* (*Rhoananus*), *Sorhoanus* (*Sorhoanus*), *Sotanus*, *Speudotettix*, *Splonia*, *Stegelytra*, *Stenometopiellus*, *Stictocoris*, *Stirellus*, *Stragania*, *Streptanus*, *Streptopyx*, *Stroggylocephalus*, *Stymphalus*, *Sulamicerus*, *Sundara*, *Symphypyga*, *Synophropsis*, *Taharana*, *Takagiella*, *Tamaricella*, *Tartessus*, *Taurotettix*, *Tautoneura*, *Tautoneura* (*Havelia*), *Tengirhinus*, *Tetartostylus*, *Thagria*, *Thaia*, *Thaia* (*Thaia*), *Thamnotettix*, *Thamnotettix* (*Loepotettix*), *Thanomahia*, *Thlasia*, *Tituria*, *Togaricrania*, *Trocnadella*, *Turrutus*, *Typhlocyba*, *Typhlocyba* (*Anomia*), *Typhlocyba* (*Empoa*), *Typhlocyba* (*Ficocyba*), *Ulopa*, *Ulopella*, *Uzeldikra*, *Wadkufia*, *Wagneriala*, *Warodia*, *Wutingia*, *Xerophloea*, *Xestocephalus*, *Yamatotettix*, *Yanocephalus*, *Ziczacella*, *Zonocyba*, *Zorka*, *Zygina*, *Zygina* (*Flammigeroidia*), *Zygina* (*Hypericiella*), *Zyginella*, *Zyginidia*, *Zyginidia* (*Anatolidia*).

## Holarctic (genus-groups found in both the Nearctic and Palearctic realms), by subfamily:

AGALLIINAE: *Agallia*; APHRODINAE: *Aphrodes*; CICADELLINAE: *Bathysmatophorus*, *Cicadella*, *Evacanthus*, *Graphocephala*, *Pagaronia*; DELTOCEPHALINAE: *Adarrus* (*Errastunus*), *Allygus*, *Athysanus*, *Balclutha*, *Cazenus*, *Cicadula*, *Circulifer*, *Colladonus*, *Cosmotettix*, *Cosmotettix* (*Cosmotettix*), *Deltocephalus*, *Diplocolenus* (*Diplocolenus*), *Diplocolenus* (*Verdanus*), *Doratura*, *Elymana*, *Euscelidius*, *Euscelis*, *Exitianus*, *Fieberiella*, *Graphocraerus*, *Hardya*, *Hebecephalus*, *Hecalus*, *Hesium*, *Idiodonus*, *Japananus*, *Latalus*, *Limotettix*, *Limotettix* (*Limotettix*), *Limotettix* (*Ophiolix*), *Limotettix* (*Scleroracus*), *Macrosteles*, *Macustus*, *Mocuellus*, *Mocuellus* (*Mocuellus*),

*Opsius*, *Orientus*, *Osbornellus*, *Parabolocratus*, *Pinumius*, *Psammotettix*, *Rosenus*, *Scaphoideus*, *Sonronius*, *Sorhoanus*, *Stenometopiellus*, *Stirellus*, *Streptanus*, *Thamnotettix*; GYPONINAE: *Gypona*; IASSINAE: *Stragania*; IDIOCERINAE: *Idiocerus*, *Idiocerus* (*Populicerus*); LEDRINAE: *Ledra* (a doubtful record of *L. aurita* listed by METCALF), *Xerophloea*; MACROPSINAE: *Macropsis*, *Oncopsis*; PENTHIMIINAE: *Penthimia*; TYPHLOCYBINAE: *Aguriahana*, *Alebra*, *Chlorita*, *Chlorita* (*Chlorita*), *Dikraneura*, *Dikraneura* (*Dikraneura*), *Edwardsiana*, *Empoasca*, *Empoasca* (*Empoasca*), *Erythroneura*, *Erythroneura* (*Erythroneura*), *Eupteryx*, *Eupteryx* (*Eupteryx*), *Forcipata*, *Kyboasca*, *Kybos*, *Notus*, *Notus* (*Notus*), *Ribautiana*, *Typhlocyba*, *Typhlocyba* (*Anomia*), *Typhlocyba* (*Empoa*), *Zonocyba*, *Zygina*; XESTOCEPHALINAE: *Xestocephalus*.

Notes:

Errors in a small number of Neotropical species distributions within the database were discovered since the analysis above, and had resulted in erroneous generic records in the analysis. Although inflating the generic overlap (Tab. 2) of the Neotropical Realm with other realms, most notably with the Indomalaysian Realm (14 of the 54 shared genera), these errors probably had little other affect on the results but are worth noting here for accuracy for the Appendix. Erroneous Afrotropical records: *Diedrocephala*, *Draeculacephala*, *Hadria*, *Macugonalia*. Erroneous Australian records: *Hadria*, *Helochara*, *Homalogoniella*, *Hortensia*. Erroneous Indomalaysian records: *Amalfia*, *Amblyscarta*, *Apulia*, *Balacha*, *Baleja*, *Beirneola*, *Draeculacephala*, *Juliaca*, *Metascarta*, *Pachitea*, *Paromenia*, *Poeciloscarta*, *Scopogonalia*, *Scoposcartula*. Erroneous Neotropical omissions: *Amalfia*, *Homalogoniella*. Erroneous Oceanian records: *Draeculacephala*, *Poeciloscarta*, *Selvitsa*, *Sibovia*. Erroneous Palearctic records: *Balacha*, *Baleja*, *Beirneola*.

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