

# Hymenoptera Parasitoid, a Suitable Biodiversity Resource for Vineyard Environmental Discrimination

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## Abstract

Vineyards host a high number of insect species and represent suitable environments to investigate the relationships among arthropod community and environmental biodiversity.

Hymenoptera Braconidae summarize many of the attributes required to a reliable group of bioindicators. Indeed, they represent a complete assemblage of a family taxon and are quite well known from a taxonomical and faunistic point of view, occupying the top of the ecological (trophic) pyramid and occurring in very diverse habitats. Braconidae subfamilies are often linked to a single host order, so directly expressing in some way, a functional role in the environment.

Here we compared the abundance and the community composition of braconid subfamilies in three differently managed vineyards for two years (2012 and 2013). In each vineyard, the community structure resulted quite similar (abundance and composition) during the first part, but significantly diverged in the second part of the research period. Non Metric Dimensional Scale and Permanova Analysis well described the population distribution. The abundance of some subfamilies, consistently with their ecology, resulted significantly related to the habitat variables considered, as showed by the Multiple Regression analysis. The adoption of insecticides seems to not influence negatively braconid populations, probably because the surrounding areas are provided with a rich local vegetation of bushes and trees, where natural enemies can find refuge. The abundance of some subfamilies that adopt an endophagous koinobiont strategy against lepidopteran larvae showed differences statistically significant in the vineyard where the mating disruption technique was adopted, in comparison with their abundance in the other two vineyards.

**Keywords:** agro-ecosystem, habitat determinants, insect population, parasitoids

## 1. Introduction

In Italy vineyards occupy a considerable part of the agricultural landscape, so that the management systems adopted on them could have a crucial influence on the natural capital of the agricultural territory and its functions, usually known as ecosystem services (ES). Among ES, conserving biodiversity is one of the main supporting services that vineyard operators must enhance. This represents a crucial point in agricultural systems, by promoting sustainability, natural balances and resilience, and offering new opportunities for recreation and tourism (Tompkins, Wratten, & Simpson, 2012). Vineyards are permanent crops that allow a long-term development of species community and are, therefore, particularly suited to host biodiversity studies (Buchs, 2003).

Research in vineyards has historically focused on arthropod pests, with the publication of about 1,000 scientific papers in the last 40 years (Vincent, Isaacs, & Bostanian, 2012) and approximately 150 species have been considered harmful to the grapevine worldwide (Bentley, Varela, & Daare, 2005). Unfortunately, researches on natural enemies diversity conducted at the habitat scale are scarce (Fraser et al., 2007) and are mostly focused on the complex of predators or parasitoids of a small number of insect pests (Altieri et al., 1993, Menalled et al., 1999).

Parasitic Hymenoptera have been estimated to represent about 20% of all insect species (Lasalle & Gauld, 1991), and about 75% of those with a parasitoid life style (Santos & Quicke, 2011), exerting a strong impact on terrestrial ecosystems and playing a crucial role in the regulation of arthropod herbivorous population (Anderson

et al., 2011; Shaw & Hochberg, 2001; Shaw, 2006).

Braconidae are one of the largest families among parasitic Hymenoptera. They occur in very diverse habitats and occupy, with few exceptions, the highest trophic levels, harboring a wide range of ecological niches (Wharton, 1993). Braconid species or morphospecies were frequently used to characterize the environmental biodiversity and, more in general, the arthropods inhabiting forests and prairies in tropical and temperate regions (Papp, 1994, Ent & Shaw, 1998; Gonzáles & Ruíz, 2000; Whitefield & Lewis, 2001; Maeto, Noerdjito, Belokobylskij, & Fukuyama, 2009; Stenbacka et al., 2010) and/or to test different silvicultural management systems (Lewis & Whitefield, 1999; Maleque et al., 2010).

In a recent study, the braconids listed in biodiversity databases were proposed as useful sources to identify evenly inventoried areas (Santos, Jones, Quicke, & Hortal, 2010). Nowadays, research dealing with species inventories does not have easy access to public or private funds and is hindered by the difficulty of finding expert taxonomists, as well as by the wide variety and high number of samples collected. The taxonomic problem can be overcome if samples are considered at a higher taxonomic level (family or subfamily instead of genus or species). In this way a great deal of labour could be saved and less taxonomic expertise would be needed (Hoback, Svatos, Spomer, & Higley, 1999; Veijalainen, Sääksjärvi, Erwin, Gomez, & Longino, 2012).

Unfortunately, the knowledge of the braconid populations and the functional role that they play as bio-indicators in cultivated crops and in the vineyards are still limited (Loni & Lucchi 2012). However, braconid subfamilies can represent a well correlated parasitoid-host association scheme, because most of them are restricted to a single host Order, and their compositional biodiversity, at the subfamily level, reflects in some way their functional role (Wharton, 1997a). The first step to link a group of bio-indicators to a particular habitat is to verify if it is representative of the habitat chosen and suited to discriminate between different habitats. In other words, it is important that it well matches specific features of the environment and reacts to any impacts or changes on it (Büchs, 2003).

The local structure and diversity of insect populations in the agro-ecosystems can be strongly affected by the structure of the landscape matrix in which they lie, depending on fragmentation, habitats size and connectivity (Tschardt et al., 2012) as well as by the mobility and dispersal ability of the studied taxa (Lévesque-Beaudin & O Wheeler, 2011; Marini, Öckinger, Battisti, & Bonmarco, 2012). For this reason we selected three vineyards in the same area, with the aim to reduce as much as possible the environmental variability. Our study covers a two-year period and deals with the braconid fauna (Hymenoptera) of three differently managed vineyards in the Province of Pisa (Tuscany, Italy).

In our experimental approach we speculated that the community description of the braconid subfamilies could represent an appropriate indicator to discriminate a vineyard agro-ecosystem, checking how the abundance and the community composition of the braconid subfamilies changed across the vineyards and over the time. In detail, we tested:

- i) The null hypothesis that braconid community, at subfamilies taxon level, shows the same level of similarity across different vineyards;
- ii) The possible contribution of each subfamily to describe spatial and temporal differences;
- iii) The suitability of habitats surrounding the sample sites and local sources to explain braconid abundance and composition;
- iv) The possible influence of the different pest management systems adopted in each vineyard on braconid subfamilies population.

## 2. Materials and Methods

### 2.1 Study Areas

The three studied vineyards were labelled as C (Conventional), MD (Mating disruption) and O (Organic), lie in the district of Crespina (Province of Pisa, Tuscany, Central Italy) between 15 and 50 meters above sea level. The vineyard size of C, MD and O is respectively 40 hectares, 30 hectares and 2 hectares. The O vineyard is small but is located in a large natural area that includes wild vegetation of trees, bushes and herbs. The areas around which the observations were carried out are under these coordinates DMS: C (43°35'47.265"N, 10°32'12.695"E); MD (43°35'42.795"N, 10°34'18.241"E) and O (43°35'5.273"N, 10°32'14.520"E). All the experimental units occur in an area of 3 kilometres in diameter, allowing to reduce the variation of topographical and weather conditions and their borderlines are at least 1 Km away from each other.

We believe this experimental design suitable to prevent overlap of braconid populations from the different areas.

In effect, as shown in some specific papers, the range of braconid flight is usually limited to the area around the release point (Langhof, Meyhöfer, Poehling, & Gathmann, 2005; Wanner, Hattendorf, Günther, & Dorn, 2007; Scarratt, Wratten & Shishehbor, 2008). In each vineyard, the control of the main insect pest, the grapevine moth *Lobesia botrana*, has been conducted in different ways in the last seven years: C continuously adopted a conventional strategy based on organophosphate insecticides, MD only pheromone mating disruption with Isonet L dispensers and O no insecticide treatments at all.

As regards the control of downy mildew and powdery mildew, seven treatments were annually adopted in the three vineyards with the following active ingredients: Dimetomorph, Cimoxamil, Mancozeb, Phosetil-Al and Sulfur in C; only Copper and Sulfur in MD and O.

All the vineyards have been planted more than 9 years ago and their agronomic characteristics (density per hectare, cultivated varieties, age of the vineyards) are similar.

## 2.2 Braconid Sampling

Braconids have been surveyed by using Malaise traps, which are considered the most appropriate devices to catch insects flying in a hypothetical layer of 0-3 m (Papp, 1994; Lewis & Whitefield, 1999; Fraser, Dytham, & Mayhew, 2007). Two Malaise traps were installed in each vineyard, one approximately in the centre and the other near one edge, at a distance of at least 60 m apart. The traps continuously worked from the end of May to the first week of October in 2012 and from half May to the first week of October in 2013. Insects were collected every two weeks obtaining eighteen samples per vineyard in 2012 and twenty in 2013. In this way we covered all the productive season of the grapevine, as well as the main flying season of the parasitoids (Fraser, Dytham, & Mayhew, 2007). We considered that the position of the two Malaise and the numerous temporal replications represented a good combination in determining the space-temporal composition of braconid community as well as in giving a measure of the within-vineyard variability (Fraser, Dytham, & Mayhew, 2008). Braconids were separated from all the other insects and stored in 70% ethanol at the Department of Agriculture, Food and Environment of Pisa University. They were grouped at the subfamily level according to Sharkey (1997) and Van Achterberg (1993).

## 2.3 Habitat Characterization

### 2.3.1 Abiotic Factors

Temperatures and rains of the two years were obtained from the database of the “Servizio Idrologico Regionale” of Tuscany, selecting the meteorological station of the locality of Cenaia, located in the study area (43°61'N, 10°54'E) (<http://www.sir.toscana.it/>).

### 2.3.2 Local Vegetation Assessment

A complex of vegetation variables were measured to describe the habitat sources. We delimited a circular transect (50 meter ray) around each trap and scored all the trees (woody species higher than 3 meters), the number of the wild, woody shrub species and the surface covered by the grapevine. In each circle a bi-monthly estimation of the surface covered by herbs was conducted by randomly throwing a square grid of 20 cm of side and by evaluating the herbs covering inside it. Thirty throws were performed in each trap site, visually choosing the zones with macroscopically different herbs occurrence. Trees, shrubs and herbs represent the main structural vegetation components, whose role was already adopted as habitat indicators in determining Ichneumonid abundance and diversity (Fraser et al., 2007). All these measures, recorded in both years, are reported in Appendix A.

## 2.4 Data Analyses

### 2.4.1 Braconid Communities Similarity

The start point of all our analyses for both the years was the raw data matrix reporting an array of rows (braconid subfamilies) and columns (all the Malaise trap samples). Usually the species-abundance distributions within ecological assemblage are strongly right skewed, being most species rare and only a few very abundant. By considering specimens at subfamily taxonomic level, we enhanced such an aspect, because it increases the differences among the subfamilies represented by a lower number of species and those represented by a higher number of species. Based on this assumption we performed a preliminary analysis of draftsman plot to visualize such right-skewed distribution and, after that, we adopted the strongest log-e transformation for all the raw data variables, so reducing the right-skewed distribution and down weighting the most represented subfamilies (Clarke & Warwick, 2001).

To visualize preliminarily differences or similarities in braconid population we adopted an ordination technique

as the Non-Metric Multidimensional Scaling (NMDS, usually shortened to MDS) and a method of Hierarchical Agglomerative Clustering, producing a configuration in two dimensions of the braconid subfamilies samples and a dendrogram respectively.

To test the null hypothesis that braconid subfamily communities showed the same level of similarity across different vineyards, we used a mixed-model nested permutational multivariate analysis of variance (Permanova), performed on a resemble matrix, based on Bray-Curtis similarity coefficient, calculated on the log-e transformed data of the original raw data matrix. We adopted as factors: vineyard (C, MD, and O), trap with two levels (c, central and p, peripheral) and time (collection dates). Vineyard and time were fixed factors, trap was considered a random factor, nested in the vineyard factor. A P value < 0.01, based on permutation method, was chosen (Anderson, Gorley, & Clarke, 2008).

The two-trap design adopted gave a measure of within-vineyards variability, which could be significantly affected by the central and peripheral location of the traps. On the other hand, such a location gives a more complete and representative assemblage of insect population, by joining two samples of complementary sites in the same experimental area (Fraser et al., 2008). For that reason we repeated both the Permanova than the MDS and Cluster analysis on a new matrix, obtained cumulating the data of each couple of traps for the years 2012 (Appendix B) and 2013 (Appendix C). In this second Permanova we adopted a two-way crossed design where only the two fixed factors, vineyard (C, MD, and O) and period with three levels (1, 2, 3), were considered. Each level of the term “period” groups three consecutive sample dates, because a preliminary observation of the MDS representation in 2012 clearly showed a cloud of samples grouping the first three dates of collection. Further, in this way, we reduced the probability to find some significant differences across the high number of dates, just as result of a stochastic event. In 2013 we collected samples of ten different dates, so that the Permanova analysis, performed adopting the term “period”, produced an unbalanced design with the levels 1 and 2, each one grouping three dates and the level 3 grouping the last four dates. We considered such data adopting sums of square called Types III, where every term in the model is fitted only after taking into account all other terms in the full model. Also in these cases a P value < 0.01 was adopted (Anderson, Gorley, & Clarke, 2008).

#### 2.4.2 Braconid Subfamilies Similarity Percentage Contribution

The evaluation of the contribution of each subfamily to the (dis)-similarity among the samples was performed by a Simper analysis (similarities percentage), which decomposes average Bray-Curtis dis-similarities into percentages from each subfamilies, both within a group or between all pairs of groups considered, listing them in decreasing order of such contributions. The analysis was conducted taking into consideration vineyard and time factors and was applied only on the resemble matrix, based on the couple-cumulated trap data, considered more representative of the braconid community assemblage (Appendices D, E, F, G) (Clarke & Warwick, 2006).

#### 2.4.3 Habitat Variables and Populations Correlation

To relate the braconid community structure to the habitat variable(s) defined in paragraph 2.3.2, we tested the null hypothesis that such variable(s) were not associated to any of the subfamilies abundance by using a distance-based linear model analysis, adopting a step-wise selection procedure and an adjusted R<sup>2</sup> selection criteria. P values for testing the null hypothesis are obtained using a permutation method. Obviously the linear model analysis adopted, by matching all the habitat variables with all the 17 subfamilies, could produce some positive (or negative) correlations, statistically significant, just as result of a stochastic event. For this reason we considered only those subfamilies that resulted significantly correlated (P < 0.05) to the same habitat variable in both years and that, at least for one year, showed a statistical significance with a P value ≤ 0.005.

All these analyses were performed by using the Primer Program v6, 2nd edition (Clarke & Warwick, 2001, 2006) and the Permanova+ for Primer (Anderson, Gorley, & Clarke, 2008).

#### 2.4.4 Subfamily Differences Among Different Management Systems

We collated the subfamily functional biodiversity among the three vineyards, by verifying the null hypothesis of no differences in the abundance of braconid subfamilies among the vineyards in the season. We adopted the Kruskal-Wallis one-way analysis of variance by ranks to test if each subfamily was statistically different in the three vineyards (Siegel & Castellan, 1998). We chose a P value < 0.05. We discussed differences among distribution of different subfamilies adopting the main guilds of braconids, based on the combination of the presumed principal hosts in the literature and on the parasitisation strategies (koinobiont or idiobiont) (Wharton, 1997a). We considered six guilds, koinobionts of Lepidoptera (KL), koinobionts of Diptera (KD), koinobionts of Coleoptera (KC), koinobionts of Aphids (KA), idiobionts of both Lepidoptera and Coleoptera (ICL) and idiobionts of Coleoptera (IC). All data were analyzed separately for each year of the study.

### 3. Results

#### 3.1 Year 2012

##### 3.1.1 Abiotic Factors

Rains occurred only at the beginning and at the end of the study period, whereas it did not rain from the half of June to the end of August. On the contrary, temperatures were within the range of the values recorded in the previous years (<http://www.sir.toscana.it>). The summer dryness strongly influenced the growth and the presence of the wild cover crops in the vineyards.

##### 3.1.2 Braconid Subfamily Community

The six Malaise traps (2 per vineyard) overall captured 8,356 individuals belonging to 17 subfamilies. Almost all the subfamilies were represented in the three vineyards except for Neonerinae, captured only in MD and C, Macrocentrinae only in C and MD and Miracinae only in O and C. The most abundant subfamilies were Microgastrinae, Aphidinae and Alysiinae, including approximately the 60% of the total specimens captured. Euphorinae, Cheloniinae and Braconinae were well represented in the collections, whereas captures of specimens belonging to the subfamilies Macrocentrinae (12), Meteorinae (4) and Neoneurinae (2), resulted singleton or doubleton in any samples. The most abundant captures were recorded in the vineyard MD (3,625 specimens), followed by C with 2,666 Braconids and O with 2,065 specimens (Table 1).

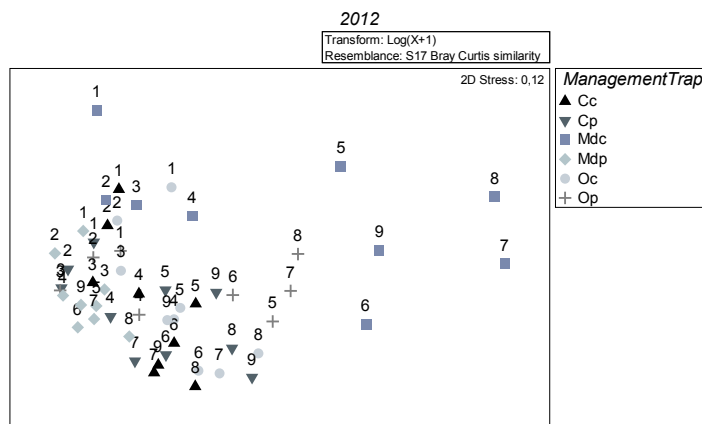
Table 1. Total captures cumulated for each vineyard and Subfamily in 2012 and 2013

Subfamily	2012				Subfamily	2013			
	C	MD	O	Total		C	MD	O	Total
<b>Agathidinae</b>	57	212	21	<b>290</b>	<b>Ag</b>	10	79	29	<b>118</b>
<b>Alysiinae</b>	221	696	226	<b>1143</b>	<b>Al</b>	189	561	99	<b>849</b>
<b>Aphidiinae</b>	444	973	356	<b>1773</b>	<b>Aph</b>	88	405	129	<b>622</b>
<b>Braconinae</b>	209	123	112	<b>444</b>	<b>Br</b>	126	48	99	<b>273</b>
<b>Cheloniinae</b>	380	77	162	<b>619</b>	<b>Ch</b>	77	31	106	<b>214</b>
<b>Doryctinae</b>	10	21	78	<b>109</b>	<b>Do</b>	4	6	18	<b>28</b>
<b>Euphorinae</b>	169	338	155	<b>662</b>	<b>Eu</b>	74	158	152	<b>384</b>
<b>Helconinae</b>	103	73	43	<b>219</b>	<b>He</b>	33	18	29	<b>80</b>
<b>Homolobinae</b>	93	27	57	<b>177</b>	<b>Hom</b>	128	38	125	<b>291</b>
<b>Hormiinae</b>	25	19	13	<b>57</b>	<b>Hor</b>	7	8	4	<b>19</b>
<b>Macrocentrinae</b>	9	3		<b>12</b>	<b>Mac</b>	13	2	7	<b>22</b>
<b>Meteorinae</b>	2	1	1	<b>4</b>	<b>Met</b>	4	4	1	<b>9</b>
<b>Microgastrinae</b>	718	842	680	<b>2240</b>	<b>Mig</b>	621	433	510	<b>1564</b>
<b>Miracinae</b>	17		24	<b>41</b>	<b>Mir</b>	3	2	1	<b>6</b>
<b>Neoneurinae</b>		2		<b>2</b>	<b>Ne</b>	1	1		<b>2</b>
<b>Opiinae</b>	96	104	50	<b>250</b>	<b>Op</b>	52	70	50	<b>172</b>
<b>Rogadinae</b>	113	114	87	<b>314</b>	<b>Ro</b>	59	35	52	<b>146</b>
<b>Total</b>	<b>2666</b>	<b>3625</b>	<b>2065</b>	<b>8356</b>	<b>Total</b>	<b>1489</b>	<b>1899</b>	<b>1411</b>	<b>4799</b>

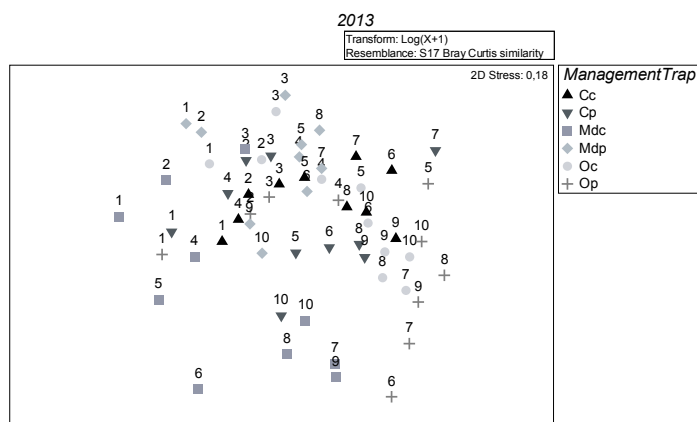
##### 3.1.3 Braconid Communities Similarity

The NMDS representation related to the assemblage of all the single trap samples showed in the upper-left part of the graphic a higher concentration of samples collected during the first weeks of the research period (Figure 1A). Such observations well matched with the results of the permanova analysis which reported strongly significant differences due to the "Time" and "Trap" factors, without significant interaction (Table 2A). The NMDS graphical representation, performed on the trap-joined data, showed a clearer situation about sample similarity. In the upper-left part there is a concentration of all the three vineyard samples, collected during the

first three dates, but in the lower and right part of the graphic there are three groups which distinctly separated the populations of the three vineyards.



(A)



(B)

Figure 1. MDS representation of the similarity of single trap samples (A, 2012; B, 2013). Numbers labelling the symbols represent the progressive dates of collection, the symbols in the caption the combination of the factor vineyard: (C) Conventional, (MD) Mating disruption, (O) Organic and the factor trap position; (c) central, (p) peripheral

Table 2. Results of the mixed-model nested PERMANOVA global test (A2012, B2013)

Table 2A.

2012						
Source	df	SS	MS	Pseudo F	P	Unique (perm)
Vi	2	7630.3	3,815.1	0.89	0.5952	15
Ti	8	22883	2860.4	5.63	<b>0.0001</b>	9905
Tr(Vi)	3	12727	4242.3	8.35	<b>0.0001</b>	9929
VixTi	16	8053	503.31	0.99	0.5177	9844
Res	24	12197	508.2			
<b>Total</b>	<b>53</b>	<b>63490</b>				

Table 2B.

2013						
Source	df	SS	MS	Pseudo F	P	Unique (perm)
Vi	2	7622.2	3811.1	1.7	0.07	15
Ti	9	24639	2737.7	5.67	<b>0.0001</b>	9907
Tr(Vi)	3	6724.6	2241.6	4.64	<b>0.0001</b>	9943
VixTi	18	91060	508.89	1.054	0.37	9838
Res	27	13037	482.84			
<b>Total</b>	<b>59</b>	<b>61183</b>				

Vineyard (Vi), Time (Ti), Trap (Tr), Tr (Vi) indicates that factor Trap is nested in Vi. P values significant are in bold.

Such distribution is well underlined by superimposing also the groups resulting by the cluster analysis at the similarity level of 73% (Figures 2A and 3A). Permanova analysis confirmed the sample distribution of NMDS, showing significant differences due to the vineyard, as well as to the period factors. No significant interaction resulted between the two factors (Table 3A).

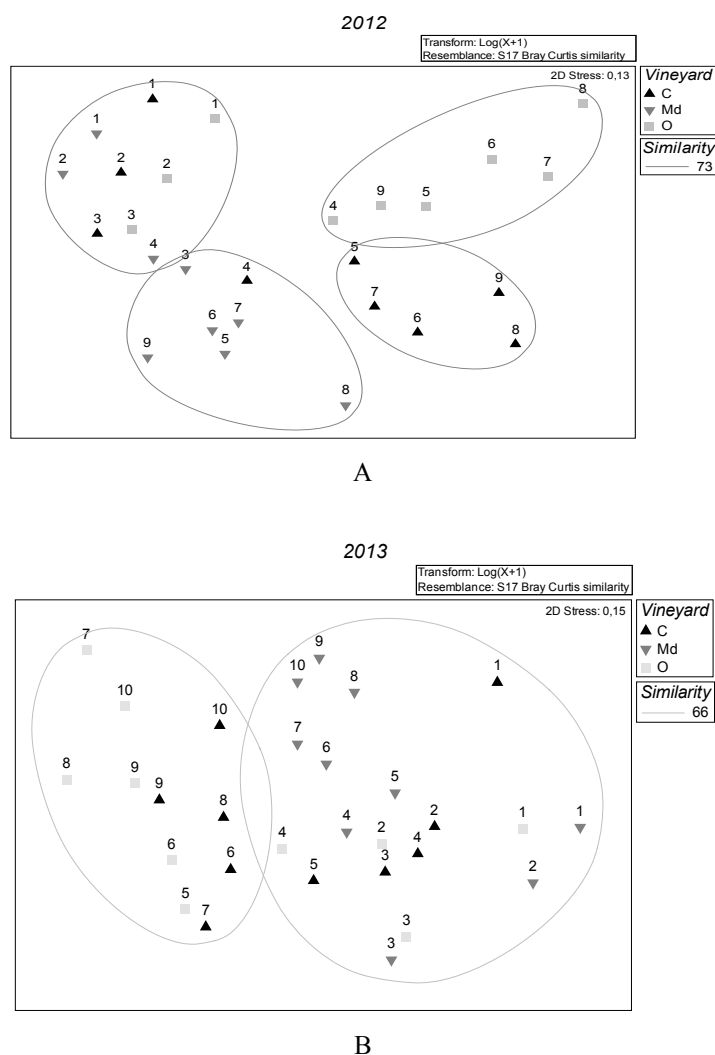


Figure 2. MDS representation of the sample similarity by pooling the captures of each couple of site traps (A, 2012; B, 2013). Different symbols represent the differently managed vineyards, (C) Conventional, (MD) Mating disruption, (O) Organic. Numbers represent the progressive dates of collection

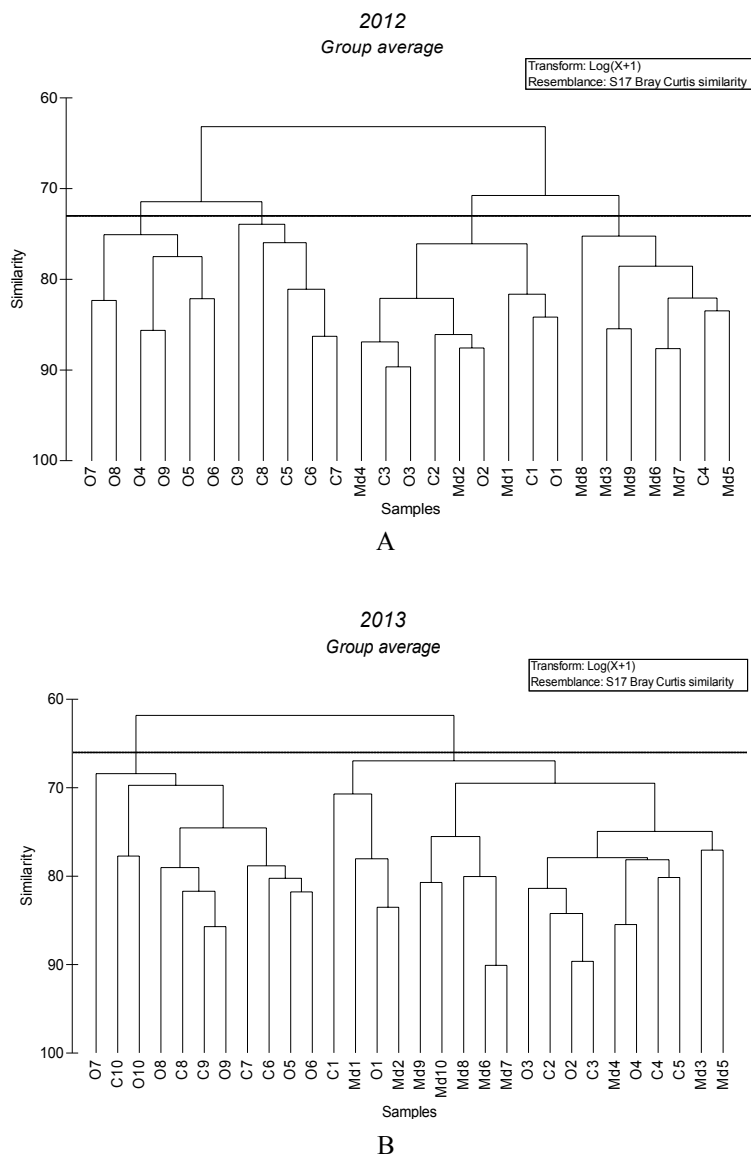


Figure 3. Cluster representation of the sample similarity by pooling the captures of each couple of site traps (A, 2012; B, 2013). (C) Conventional, (MD) Mating disruption, (O) Organic. Numbers represent the progressive dates of collection

Table 3. Results of the mixed-model PERMANOVA global test on the captures of each couple of traps pooled together (A2012, B2013)

Table 3A.

2012						
Source	df	SS	MS	Pseudo F	P (perm)	Unique perms
Vineyard	2	3196.1	1598	6.26	<b>0.0001</b>	9940
Period	2	4773.9	2386.9	9.35	<b>0.0001</b>	9933
VixPe (Interaction)	4	1187.8	296.96	1.16	0.29	9915
Res	18	4597.2	255.4			
Total	26	13755				



Table 3B.

2013						
Source	df	SS	MS	Pseudo F	P (perm)	Unique perms
Vineyard	2	2745.2	1693.2	4.648	<b>0.0001</b>	9936
Period	2	6586.8	3293.4	11.15	<b>0.0001</b>	9938
VixPe (Interaction)	4	1447.9	361.98	1.23	0.246	9917
Res	21	6201.6	295.31			
Total	29	17164				

P values significant are in bold.

Consistently the pair-wise tests of Permanova for the term “period” produced significant differences between period 1 versus periods 2 and 3, higher of that emerged by confronting the period 2 versus 3 (Table 4A).

Table 4. Results of the mixed-model PERMANOVA pair-wise test on the captures of each couple of traps pooled together, performed on the term “Vineyard”: Conventional (C), Mating disruption (MD), Organic (O) and the term period (A 2012, B 2013)

Table 4A.

2012							
Vineyard	t	P (perm)	Unique perms	Period	t	P (perm)	Unique perms
C, MD	2.18	<b>0.0012</b>	9952	1 - 2	3.16	<b>0.0005</b>	9953
C, O	2.39	<b>0.002</b>	9945	1 - 3	3.9	<b>0.0002</b>	9952
MD, O	2.89	<b>0.0003</b>	9959	2 - 3	1.69	0.03	9957

Table 4B.

2013							
Vineyard	t	P (perm)	Unique perms	Period	t	P (perm)	Unique perms
C, MD	2.24	<b>0.0004</b>	9948	1 - 2	2,79	<b>0.0007</b>	9957
C, O	1.34	0.13	9959	1 - 3	4,44	<b>0.0001</b>	9948
MD, O	2.68	<b>0.0004</b>	9942	2 - 3	2,27	<b>0.0004</b>	9941

Values significant are in bold.

### 3.1.4 Subfamilies Similarity Contribution

The average Bray-Curtis similarity across the vineyard sample groups, ranged from 70.32 (C) and 74.69 (MD). The subfamily Microgastrinae gave the main contribution to the average similarity in all the groups and the ratio of its average contribution, divided by the SD across the within-group similarity, was relatively high. It means that this subfamily is well represented and quite well distributed in all the replicates within each group. In less extent, good contributes to the typification of C are given also by Braconinae and Cheloninae. Alysinae and Agathidinae contributed in typifying MD, whereas Cheloninae, Braconinae and Doryctinae contributed at the same level for O. As regards the analysis of the dissimilarity between all pairs of the group samples, Aphidiinae and Alysinae are the most discriminating subfamilies for all the three pairs of the group samples, but some contributes were given by Euphorinae, Agathidiinae and Cheloninae in the dissimilarity between vineyard C versus MD, Doryctinae in the dissimilarity of C vs O and Agathidiinae and Doryctinae in the dissimilarity of MD vs O (Appendix D). The simper performed on the base of the time factor sample groups (1–9), gave similarity average values that resulted higher for the first weeks if confronted with values registered in the second part of the research period. Again, Microgastrinae were the subfamily that mostly typified the week factor samples, being always at the top of the list except for the first two weeks, which were headed by Aphidiinae. Values of the

average dissimilarity progressively decrease when the dates of the samples are progressively closer to each other (Appendix E).

### 3.1.5 Habitat Variables and Population Correlation

The abundance of Alysiinae, Euphorinae and Aphidiinae was significantly related to the presence of herbs. Differently, abundance of Doryctinae resulted positively correlated with trees and bushes abundance and surface covered by grapevine within the transect (Table 5).

Table 5. Results of distance-based linear model analysis, adopting a step-wise selection procedures and an adjusted R2 selection criteria. Only subfamilies that showed significant correlation with habitat variables were reported

2012					2013				
Subfamily	Habitat variables				Subfamily	Habitat variables			
	Trees abundance	Bushes abundance	Herbs surface	Grapevine Surface		Trees abundance	Bushes abundance	Herbs surface	Grapevine surface
Alysiinae		<b>P 0.019</b>	<b>P 0.001</b>	P 0.01	Alysiinae		<b>P 0.001</b>	<b>P 0.006</b>	P 0.021
Aphidiinae			P 0.001		Aphidiinae		P 0.025	P 0.09	
Doryctinae	<b>P 0.005</b>	<b>P 0.001</b>		<b>P 0.001</b>	Doryctinae	<b>P 0.037</b>	<b>P 0.022</b>		<b>P 0.022</b>
Euphorinae			<b>P 0.003</b>		Euphorinae			<b>P 0.018</b>	

P values that resulted significant in both years ( $P \leq 0.05$ ) and at least at 0.005 level in one of the years, are in bold.

### 3.1.6 Subfamily Differences Among Different Management Systems

The subfamilies Macrocentrinae, Meteorinae, Miracinae and Neonerinae were too poorly represented to allow a rational statistical approach. Among the other subfamilies, differences with statistical significance were found for Agathidiinae, Alysiinae, Cheloninae, Doryctinae, and Homolobinae.

Agathidiinae and Alysiinae were significantly more numerous in MD, Cheloninae in C, Homolobinae in A and Doryctinae in O (Table 6A).

Table 6. Results of Kruskal Wallis analysis of variance for ranks. Df = 2, N = number of cases in the combined samples. Only subfamilies with significative differences across the three vineyards are reported (A 2012, B 2013)

Table 6A.

2012					Ranks mean		
Subfamily	Guild	N	KW value	P-value	MD	C	O
Agathidiinae	KL	9	11.26	< 0.01	21.06a	11.84b	9.12b
Cheloninae	KL	9	9.45	< 0.01	8.5a	19.95b	13.56ab
Homolobinae	KL	9	8.56	< 0.02	19.45a	8.5b	14.06ab
Doryctinae	IC	9	12.71	< 0.01	10.56a	9.78a	21.67b
Alysiinae	KD	9	8.71	< 0.02	20.34a	11.34b	10.34b

Table 6B.

2013					Ranks mean		
Subfamily	Guild	N	KW value	P	MD	C	O
<b>Agathidiinae</b>	KL	9	8.96	< 0.02	21.2a	8.5b	12.28b
<b>Cheloninae</b>	KL	10	9.5	< 0.01	9.95a	16.65ab	19.97b
<b>Doryctinae</b>	IC	8	8.96	< 0.02	10.5a	8.5a	18.5b
<b>Alysiinae</b>	KD	10	15.4	< 0.001	24.05a	13.5b	8.965b

KW value was corrected on the base of the ties scores among groups. Different, not shared letters, indicate significant differences. KL = Koinobiont of Lepidoptera, IC = Idiobiont of Coleoptera, KD = Koinobiont of Diptera.

### 3.2 Year 2013

#### 3.2.1 Abiotic Factors

This year showed a more balanced distribution of the rains with only 30 days of drought from half June to half July (<http://www.sir.toscana.it>).

#### 3.2.2 Parasitoid Subfamily Communities

Malaise traps captured 4,799 adults belonging to the same 17 subfamilies of 2012. All these subfamilies were recorded in the three vineyards except for Neoneurinae, captured only in MD and C. Again, the most abundant subfamilies were Microgastrinae, Aphidinae and Alysiinae. Almost all the captures showed a drastic reduction, half number of specimens were collected in comparison with the previous year, but Homolobinae, Macrocentrinae and Meteorinae showed an increase and Neoneurinae have been captured again with only two specimens representing two singleton. As in 2012, the most abundant captures were recorded in the vineyard MD (1,899 specimens), followed by C with 1,489 and O with 1,411 specimens (Table 1).

#### 3.2.3 Braconid Communities Similarity

As in 2012, the single trap NMDS analysis grouped the first samplings in the upper-left and the last ones in the lower-right part of the graphic (Figure 1B). Such distribution is supported by Permanova main test, which found significant differences for the factors “Trap” and “Time”, without significant interaction (Table 2 B). The NMDS performed on the data of the two traps joined together showed two main grouping at the similarity level of 66%. On the left part of the figure are located all the MD samples and only those of O and C collected in the first period of the research; on the right side of the figure there are the samples of O and C collected in the second period (Figure 2B).

Permanova analysis confirmed the samples distribution of NMDS, showing significant differences due to the factor ‘vineyard’ as well as to the factor ‘period’. No significant interaction resulted between the two factors (Table 3B). The pair-wise test divided MD vineyard from C and O (Table 4B).

#### 3.2.4 Subfamilies Similarity Contribution

The average Bray-Curtis similarity across the vineyard sample group, ranged from 71.01(C) and 67.27 (O). The Microgastrinae headed the average similarity in C and O, but Alysiinae gave the main similarity contribution in MD. Further contributes in typifying C are given by Alysiinae, Braconinae and Aphidiinae.

Microgastrinae, Aphidiinae and Agathidinae contributed in typifying MD, whereas Braconinae, Cheloninae, and Alysiinae contributed for O.

As regards the analysis of the dissimilarity between all pairs of the group samples, Aphidiinae, Agathidinae, Alysiinae and Euphorinae are the most discriminating subfamilies for the pairs MD, C. Homolobinae, Euphorinae and Aphidiinae contribute in discriminating C vs O, Alysiinae, Aphidiinae, Euphorinae and Agathidiinae contributed in the dissimilarity of MD vs O (Appendix F).

The simpler performed on the base of the ‘time’ factor sample groups (1 – 10), again gave similarity average values that resulted higher for the first weeks if confronted with the second part of the year.

Alysiinae represented the most typifying subfamily with regard to the first three weeks while Microgastrinae headed the top of the list for the remaining dates.

As in 2012, the average dissimilarity values progressively decreased in 2013 when the dates of the samples were progressively closer to each other (Appendix G).

### 3.2.5 Habitat Variables and Population Correlation

The presence of herbs was significantly related to the abundance of Alisiyiinae, and Euphorinae, whereas trees and bushes abundance and surface covered by grapevine resulted positively correlated with abundance of Doryctinae (Table 5).

### 3.2.6 Subfamily Differences Among Different Vineyards

Significative differences were found for Agathidinae, Cheloninae, Doryctinae, and Microgastrinae. The number of Agathidinae and Alysinae was significantly higher in MD, Cheloninae and Doryctinae in O (Table 6B).

## 4. Discussion

A number of studies have pointed out the importance of the habitat management to maintain and/or increase agro-ecosystem biodiversity and to enhance biological control of arthropod pests (Risch, Andow, & Altieri, 1983; Sheehan, 1986; Howarth 1991; Altieri, 1999; Landis, Wratten, & Gurr, 2000; Burgio & Sommaggio, 2007; Chong, D'Alberto, Thomson, & Hoffman, 2010; Santos, Raimundo, Bento, & Pereira, 2012). Unfortunately, research on natural enemy diversity conducted at the habitat scale is scarce (Fraser, Dytham, & Mayhew, 2007) and are mostly focused on the complex of predators or parasitoids of a small number of insect pests (Altieri, Cure, & Garcia, 1993; Menalled, Marino, Gace, & Landis, 1999).

In this paper we tried to focus on a particular taxon (Braconidae), independently by the considerations of the pests.

Results of our study are consistent with the hypothesis that the braconid subfamily community represents a suitable indicator to characterize a vineyard. They summarize many of the attributes required for a reliable group of bioindicators (Büchs, 2003), showing good efficiency in discriminating different environments and giving good perspectives for further biodiversity studies.

The positioning of two Malaise traps, respectively in the central and in the marginal part of the experimental plot, allowed a more complete description of braconid populations occurring in the area. This consideration clearly emerges when the figures of each pair of traps are joined together confirming the observations of Fraser, Dytham and Mayhew (2008), which record a higher spatial variability when the collections of the single traps are analyzed separately. The use along many consecutive weeks increases trap suitability to describe the turn-over and the variation of braconid populations, as reported for Ichneumonidae (Fraser, Dytham, & Mayhew, 2007; 2008). The total number of braconids captured in 2012 (8,356) was approximately double of that obtained in 2013 (4,799), but the same subfamilies were represented in both years with about the same proportion among themselves. In our opinion such a situation describes a well-established insect community, well integrated with the surrounding environments. The fluctuation of insect populations through time and space represent a frequent phenomenon that can be influenced by many ecological factors. Though in 2013 almost all the subfamilies showed a strong numerical reduction, Homolobinae, Meteorinae and Macrocentrinae (not much represented in 2012), increased their total number. The same number of Neoneurinae was captured in both years, but with only two specimens. It is not clear if this would be connected to the unsuitability of Malaise traps to intercept adults of this subfamily or if it would depend on the peculiar biology of this subfamily, which is strictly linked to the presence of the ants, their unique hosts (Shaw, 1997).

Our braconid captures appear quite large if compared with other studies carried out in more natural ecosystems, such as a secondary broad-leaved forest ecosystem of Western Arkansas (Lewis & Whitefield 1999), an oak-sessile forest in Turkey (Papp, 1994) or a mountain old growth forest in Spain (Arnan, Bosch, Comas, Garcia, & Retana, 2011).

In both years we have registered the lowest number of captures in O, whose size is much smaller but is the most similar to a natural ecosystem. However, this is consistent with the assertion of LaSalle (1993) "... *In natural situations, parasitic Hymenoptera are often present in high species number and low population size*". The highest number of specimens was always collected in the vineyard MD, characterized by a higher abundance of a broad layer of herbs and where captures were dominated by Aphidiinae, Alisiyiinae and Microgastrinae. Consistently, such subfamilies resulted correlated to the herbs abundance (Table 6). Based on abundance and subfamily diversity, the braconid community found in C does not appear to be particularly affected by the insecticide control continuously performed in the last seven years. This situation probably reflects the richness of diverse natural habitats that the surrounding areas and landscape matrix can offer, where beneficials find refuge and perform spillover during the season, increasing the pest control services across time (Macfayden, Craze,

Polaszek, Van Achterberg, & Memmott, 2013). These data warn against assessing the biodiversity level of an agro-ecosystem only on the base of the pest management strategies adopted. Indeed, the surrounding areas, as well as the landscape matrix, can play a major role in determining the establishment of a rich and differentiated insect population in a vineyard.

The adoption of a multivariate analysis approach well describes the temporal and spatial differences among the three vineyards, and confirms the statements of Timms, Bowden, Summerville, and Buddle (2013) about the taxonomic sufficiency concept, related to the terrestrial arthropod biodiversity. In fact, the natural environmental variables can affect the community structure by replacing species whose occurrence across the sites can be due to a random event, confusing the graphical representation. The choice of considering the insects at a higher taxon level (subfamilies versus species) reduces these nuisance effects (Clarke & Warwick, 2001).

The higher similarity of the braconid populations during the first period of the research in comparison with the second period depends, in our opinion, by the specific behavior of our parasitoids and by the environmental conditions occurring in the three vineyards and in their surrounding areas. It is known that, after the emergence, an adult parasitoid spends its first days of life searching for places hosting potential hosts (the habitat host location phase) (Vinson, 1998). Then, during the season, parasitoids progressively reduce the spatial range of the searching behavior, limiting their movements to the habitats that ensure the most favorable foraging conditions (Alphen & Jerwis, 1996). We assume that the highest concentration of parasitoids occurs in the vineyards in the first part of the collection period, due to the coexistence of univoltine adult species with the first flight of multivoltine species. During the spring season, braconids could have performed an higher spillover rate through the different vineyards and the surrounding areas, all nested in the same landscape matrix, contributing in this way to reduce the differences among the three sites. In this period all the sites showed a higher similarity due to the contribution of the rains, which allowed a homogeneous development of herbs everywhere. Such observation is supported by the Simper analysis that indicates Alysiinae, Aphidiinae and Microgastrinae as the most frequent subfamilies in the first period in 2012 and in 2013 and that resulted correlated to the herbs abundance in both, or at least, in one year at 0.001 level of significance. As regards the differences of each subfamily among the three vineyards, interesting considerations emerge by focusing on their life histories and guilds. The statistically higher number of Doryctinae captured in O (Tables 6A and 6B) diverged from the trend of the total captures, that showed the lowest number of braconids in the same vineyard. But most of Doryctinae live as idiobiont ectoparasitoids of wood-boring beetle larvae and only a few live on stem boring larvae of Lepidoptera or sawfly. Presence of wood species and woody areas on the borders of the vineyards, as well as the same grapevine plants, could have represented an useful habitat for the needs of this subfamily members (Loni, Spooner, & Lucchi, 2012). This observation well matches with the results emerged by the multiple regression analysis, that found a significant correlation between Doryctinae, wood plants and grapevine abundance (Table 6). Similarly, the statistically higher population of Alysiinae in MD vineyard could be associated to its extended ruderal vegetation, which represents the main habitat resource for their host. Alysiinae live as koinobiont endoparasitoid of cyclorrhaphous Diptera, whose larvae feed on decaying substrates or on vegetal tissues as leaf or stem-mining phytophagous (Wharton, 1997b). The differences found for these subfamilies distribution clearly rely on the habitat variables, which structurally characterize the vineyards during the period of the observations. If we consider the subfamilies Braconinae, Euphorinae, Helconinae and Opiinae, even well represented in our samples, the highest values of their captures appear randomly distributed among the vineyards (Appendices B and C) and they do not result correlated to any habitat variables. Indeed, they represent various guilds and their distribution does not seem to be linked to any particular feature of the studied areas. Braconinae are mainly idiobiont ectoparasitoids of both Lepidoptera and Coleoptera (Quicke, 1997), Euphorinae are koinobiont endoparasitoid of adults Coleoptera, but also Hymenoptera, Neuroptera, Heteroptera and Psocoptera (Shaw, 1997). Helconinae are endoparasitoid of Coleoptera (Sharkey, 1997) and Opiinae are koinobiont endoparasitoid of Diptera Tephritidae and Agromyzidae (Wharton, 1997a). Different considerations could be formulated for Agathidinae, which always resulted statistically more numerous in MD vs O, whereas the number of Cheloninae always resulted statistically lower in MD compared with O and C. Both these subfamilies include koinobiont endophagous species of Lepidopteran larvae as well as Homolobinae, Macrocentrinae, Miracinae, Microgastrinae and Rogadinae. All these subfamilies, with exception of Microgastrinae and Rogadinae in 2012, resulted less numerous in MD (Table 1) even if their rank distribution among the sites did not permit to obtain differences statistically significant by Kruskal Wallis analysis (Table 7). No one of these koinobiont of Lepidoptera (KL) subfamilies were correlated to particular habitat variables, but they shared, as well as the guild, a differentiated distribution between the vineyard MD versus O and/or C.

Obviously it is not possible to attribute such differences to the presence of the synthetic pheromone of *L. botrana*

in MD vineyard. However, a rich braconid community seems to enhance the resilience of the agroecosystem by counterbalancing the reduction of KL subfamilies with the increase of another of the same guild.

In conclusion, our results corroborate braconid subfamilies as good discriminants for vineyard agro-ecosystems. In our study, environmental structural components of the vineyard seem to play a dominant role in influencing their population composition in time and space, much more than the different pest management strategies adopted for several years. This appears particularly evident if the vineyard includes and is surrounded by a natural vegetation of bushes, woods and herbs which provide shelters and supply zones, where parasitoids can perform spillover during possible disturbing events. As regards a possible influence of mating disruption technique on some subfamily distribution, our work seems to open more questions than not giving answers. How and if the synthetic pheromone dispensers of *L. botrana* installed in MD in the 2 years could have exerted an attractive or repulsive influence on some braconid subfamilies is not possible to confirm with our data, neither this was the goal of this paper.

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## Appendix

### Appendix A. Habitat variables pooled for the circular area around each trap

Vineyard samples	Vineyard surface (m <sup>2</sup> )	Trees number	Bushes number	Herbs surface (m <sup>2</sup> ) 2012	Herbs surface (m <sup>2</sup> ) 2013
C1	12500	14	28	5543	9572
MD1	14500	46	24	9220	11304
O1	6500	60	45	5120	11461
C2	12500	14	28	4492	8635
MD2	14500	46	24	8480	10990
O2	6500	60	45	4132	10205
C3	12500	14	28	3510	4710
MD3	14500	46	24	7020	8635
O3	6500	60	45	2970	10205
C4	12500	14	28	2520	3140
MD4	14500	46	24	6480	7065
O4	6500	60	45	2550	6280
C5	12500	14	28	2000	2669
MD5	14500	46	24	6020	6594
O5	6500	60	45	1490	5495
C6	12500	14	28	1490	2355
MD6	14500	46	24	6000	6280
O6	6500	60	45	1040	4710
C7	12500	14	28	1040	3140
MD7	14500	46	24	5490	7065
O7	6500	60	45	820	5495
C8	12500	14	28	1000	3925
MD8	14500	46	24	6010	7536
O8	6500	60	45	990	5809
C9	12500	14	28	1100	4710
MD9	14500	46	24	6550	7850
O9	6500	60	45	1220	6280
C10	12500	14	28	-	8635
MD10	14500	46	24	-	10362
O10	6500	60	45	-	9420

C (Conventional), MD (Mating disruption), O (Organic). Numbers represent progressive dates of samples collection. Variables “Vineyard surface”, “Trees number” and “Bushes number” are not changed through the years.

Appendix B. Captures of Braconidae subfamilies, subdivided for progressive sample dates (1-9), and vineyard C (Conventional), Md (Mating disruption), O (Organic)

2012																													
Date	1			2			3			4			5			6			7			8			9			Total	
Site	C	MD	O	C	MD	O	C	MD	O	C	MD	O	C	MD	O	C	MD	O	C	MD	O	C	MD	O	C	MD	O		
Subfamily																													
<b>Ag</b>		3			5	4	4	14	7	21	24	1	2	27	2	12	79		12	44	2	5	7		1	9	5	290	
<b>Al</b>	34	79	40	86	109	36	69	95	127	14	184	7	2	23	2	3	62	3	5	52		3	15	2	5	77	9	1143	
<b>Aph</b>	161	303	114	228	591	141	45	29	93	8	19	4	1	1	1		8		1	4						18	3	1773	
<b>Br</b>	11	5	9	21	24	16	36	21	39	28	44	13	17	9	6	23	9	6	27	5	7	15	3	4	31	3	12	444	
<b>Ch</b>	4	1	4	35	4	6	112	11	38	65	25	59	30	6	12	35	12	17	60	4	7	25	5	6	14	9	13	619	
<b>Do</b>		3	2	5	13	6	2		15		4	11	1		4			11	1	1	7				14	1		8	109
<b>Eu</b>	16	57	32	53	153	48	63	28	50	22	58	6	9	17	3	4	17	4	1	5	4	1	2	4		1	4	662	
<b>He</b>	24	9	4	41	46	25	23	2	8	3	8		5	3	3	1		3	5	1		1				4		219	
<b>Hom</b>	16	7	7	3	1	2	14	1	5	10	2	9	3		3	15	7	10	13	7	11	1	2	3	18		7	177	
<b>Hor</b>	2	2		2	3	1	12	1	5	4	1	2	1	2	3		3	1	1	2		2	4		1	1	1	57	
<b>Mac</b>	2	1		2			2						1			1			1	1						1		12	
<b>Met</b>		1					2		1																			4	
<b>Mig</b>	20	14	25	103	101	53	226	76	206	118	182	146	19	89	54	39	139	70	110	126	62	30	60	19	53	55	45	2240	
<b>Mir</b>			1													2		10	4		4	11		9				41	
<b>Ne</b>																	1			1								2	
<b>Op</b>	3	7	2	46	9	18	29	12	21	6	37	6	3	16		3	2		2	5	1	1	4	1	3	12	1	250	
<b>Ro</b>	2	3	6	7	1	4	46	8	45	17	19	9	13	14	6	14	34	6	9	17	4	3	13	3	2	5	4	314	
<b>Total</b>	295	495	246	632	1060	360	685	298	660	316	607	273	107	207	99	152	373	141	252	275	109	98	115	65	129	195	112	8356	

Appendix C. Captures of Braconidae subfamilies, subdivided for progressive sample dates (1-10), and vineyard C (Conventional), MD (Mating disruption), O (Organic)

2013																															
Date	1			2			3			4			5			6			7			8			9			10			Total
Site	C	MD	O	C	MD	O	C	MD	O	C	MD	O	C	MD	O	C	MD	O	C	MD	O	C	MD	O	C	MD	O	C	MD	O	
<b>Subfamily</b>																															
<b>Ag</b>				3	2	1	34			4	4		5	2	1	7			7	2	3	8	1	1	2	1	4	9	17	118	
<b>Al</b>	24	44	22	39	76	21	62	129	32	21	84	6	11	47	2	4	41	2	2	38	1	13	49	3	6	30	4	7	23	6	849
<b>Aph</b>	7	43	17	17	96	26	22	161	61	11	59	18	11	24	5	3	3	2	4	1	3	12	1	3		9	3		622		
<b>Br</b>	2	1	2	7	2	7	19	10	13	3	13	16	12	7	11	21	7	10	21	4	6	22	1	9	10	1	9	9	2	16	273
<b>Ch</b>			1	1		4	6	3	7	11	4	28	17	2	8	7	1	6	3	1	3	20	2	17	14	4	31	1	2	10	214
<b>Do</b>				1	1	1		1	6	1	1	3			3			1		1	2			1		1	1	1	2	28	
<b>Eu</b>	6	37	33	10	34	52	33	58	56	10	10	8	7		1	10		2	3	1	1			1	4	1	3	2	1	384	
<b>He</b>	3	1	7	5	4	2	4	2	12	3	1	1	8	3	3	5	1	3	1	1		2	4		2	1	1			80	
<b>Hom</b>	4		1	3	1	3	3				3	3	3		1	3	5	1	4	12	7	5	15	27	10	29	66	12	70	291	
<b>Hor</b>								1	1	1	2	1		1		2		2	2		1	3		1		1			19		
<b>Mac</b>	3	1	2	1		1	2		1			3		1			1	3			1					1	1		22		
<b>Met</b>		2		2				1		1		1		1														1	9		
<b>Mig</b>	17	13	15	31	21	25	36	79	41	29	49	58	29	52	73	47	58	51	71	51	61	128	48	58	168	34	71	65	28	57	1564
<b>Mir</b>	1	1		1					1																		1	1	6		
<b>Ne</b>																					1	1							2		
<b>Op</b>		5	4	15	9	11	18	29	17	4	6	8	4	10	2	4	2	1	1	6		2	1		1	3	3	2	4	172	
<b>Ro</b>	1			2		4	3	8	8	1	2	8	8	4	12	8	5	5	5	7	1	7	6	7	8	1	3	16	2	4	146
<b>Total</b>	68	148	104	135	247	159	209	515	256	96	237	164	114	155	123	102	140	87	116	126	89	211	140	110	241	90	155	186	87	189	4799

## Appendix D.

Year 2012

SIMPER - Similarity Percentages

Subfamilies contributions

*Parameters*

Resemblance: Bray Curtis similarity

Cut off for low contributions: 90,00%

***Factor Groups***

Sample    Vineyard

C1	C
C2	C
C3	C
C4	C
C5	C
C6	C
C7	C
C8	C
C9	C
MD1	MD
MD2	MD
MD3	MD
MD4	MD
MD5	MD
MD6	MD
MD7	MD
MD8	MD
MD9	MD
O1	O
O2	O
O3	O
O4	O
O5	O
O6	O
O7	O
O8	O
O9	O

*Group C*

Average similarity: 70,32

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	4,08	12,22	5,48	17,37	17,37
Ch	3,47	10,10	3,43	14,37	31,74
Br	3,13	10,09	5,08	14,35	46,09
Hom	2,20	5,92	2,08	8,42	54,51
Al	2,49	5,74	3,29	8,17	62,68
Ro	2,23	5,67	2,95	8,06	70,74
Op	1,84	4,23	3,41	6,01	76,75
Eu	2,16	3,89	1,24	5,53	82,28
He	1,83	3,30	1,30	4,69	86,97
Ag	1,49	2,87	0,97	4,08	91,04

*Group MD*

Average similarity: 74,69

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	4,37	13,05	4,72	17,48	17,48
Al	4,14	12,02	7,75	16,09	33,56
Ag	2,78	7,20	3,11	9,64	43,20
Eu	2,88	6,29	2,05	8,42	51,62
Ro	2,32	6,02	2,13	8,06	59,68
Op	2,28	6,01	3,51	8,05	67,73
Br	2,34	5,90	4,89	7,91	75,64
Ch	2,03	5,30	2,66	7,09	82,73
Aph	2,88	5,00	1,25	6,70	89,43
Hor	1,08	2,94	3,12	3,93	93,36

*Group O*

Average similarity: 70,96

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	4,09	14,15	5,30	19,94	19,94
Ch	2,60	8,21	3,99	11,56	31,50
Br	2,40	7,83	6,79	11,03	42,53
Do	2,15	7,15	3,08	10,08	52,61
Eu	2,34	6,64	4,45	9,36	61,97
Ro	2,02	6,43	5,69	9,06	71,02
Hom	1,89	6,25	3,02	8,81	79,83
Al	2,24	4,69	1,50	6,61	86,44
Aph	1,99	2,45	0,63	3,45	89,89
Op	1,24	1,98	1,00	2,79	92,68

*Groups C & MD*

Average dissimilarity = 31,47

Species	Group C		Group MD		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Aph	1,99	2,88	4,16	1,37	13,22	13,22
Al	2,49	4,14	3,25	1,56	10,31	23,54
Eu	2,16	2,88	2,88	1,36	9,16	32,70
Ag	1,49	2,78	2,62	1,42	8,34	41,04
Ch	3,47	2,03	2,58	1,85	8,19	49,23
He	1,83	1,46	2,29	1,40	7,28	56,51
Hom	2,20	1,09	2,28	1,48	7,25	63,76
Op	1,84	2,28	1,84	1,60	5,85	69,61
Br	3,13	2,34	1,77	1,47	5,61	75,22
Ro	2,23	2,32	1,63	1,37	5,18	80,40
Mig	4,08	4,37	1,53	1,50	4,86	85,26
Do	0,55	0,70	1,30	1,15	4,13	89,38
Mir	0,58	0,00	1,07	0,63	3,39	92,77

*Groups C & O*

Average dissimilarity = 32,28

Species	Group C		Group O		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Aph	1,99	1,99	3,94	1,19	12,20	12,20
Do	0,55	2,15	3,06	1,95	9,48	21,69
Al	2,49	2,24	2,70	1,42	8,37	30,06
Eu	2,16	2,34	2,62	1,57	8,13	38,19
He	1,83	1,09	2,59	1,41	8,03	46,22
Op	1,84	1,24	2,24	1,53	6,94	53,16
Ch	3,47	2,60	2,21	1,71	6,84	60,00
Ag	1,49	0,93	2,12	1,33	6,58	66,58
Mir	0,58	0,78	1,84	0,96	5,71	72,29
Br	3,13	2,40	1,65	1,57	5,12	77,42
Ro	2,23	2,02	1,62	1,67	5,00	82,42
Mig	4,08	4,09	1,55	1,55	4,81	87,23
Hom	2,20	1,89	1,53	1,42	4,73	91,96

*Groups MD & O*

Average dissimilarity = 33,68

Species	Group MD	Group O	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Aph	2,88	1,99	4,31	1,42	12,81	12,81
Al	4,14	2,24	3,96	1,54	11,77	24,57
Ag	2,78	0,93	3,45	1,57	10,23	34,80
Do	0,70	2,15	2,93	1,70	8,69	43,50
Eu	2,88	2,34	2,62	1,55	7,77	51,27
Op	2,28	1,24	2,61	1,61	7,75	59,02
He	1,46	1,09	2,24	1,30	6,65	65,66
Hom	1,09	1,89	1,83	1,30	5,42	71,08
Ro	2,32	2,02	1,66	1,70	4,94	76,02
Ch	2,03	2,60	1,58	1,29	4,70	80,72
Mir	0,00	0,78	1,53	0,77	4,53	85,25
Mig	4,37	4,09	1,46	1,42	4,35	89,60
Br	2,34	2,40	1,42	1,53	4,21	93,81



## Appendix E.

Year 2012

SIMPER - Similarity Percentages

Subfamilies contributions

*Parameters*

Resemblance: Bray Curtis similarity

Cut off for low contributions: 90,00%

***Factor Groups***

Sample Time

C1 1

MD1 1

O1 1

C2 2

MD2 2

O2 2

C3 3

MD3 3

O3 3

C4 4

MD4 4

O4 4

C5 5

MD5 5

O5 5

C6 6

MD6 6

O6 6

C7 7

MD7 7

O7 7

C8 8

MD8 8

O8 8

C9 9

MD9 9

O9 9

*Group 1*

Average similarity: 82,45

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Aph	5,18	16,30	35,98	19,77	19,77
Al	3,88	12,11	22,88	14,69	34,46
Eu	3,46	10,25	8,12	12,43	46,89
Mig	3,00	9,49	9,08	11,50	58,40
Hom	2,33	6,98	24,17	8,47	66,86
Br	2,19	6,61	5,20	8,02	74,88
He	2,38	6,15	5,42	7,46	82,34
Ro	1,48	4,01	7,35	4,86	87,21
Op	1,52	4,00	9,22	4,85	92,06

*Group 2*

Average similarity: 86,55

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Aph	5,59	13,51	60,67	15,61	15,61
Mig	4,42	11,08	21,05	12,81	28,42
Eu	4,31	10,37	37,77	11,99	40,40
Al	4,26	10,27	11,67	11,87	52,27
He	3,62	9,02	24,18	10,42	62,69
Br	3,05	7,71	70,71	8,91	71,60
Op	3,03	6,66	6,12	7,70	79,29
Do	2,13	4,88	12,29	5,64	84,93
Ch	2,38	4,56	7,69	5,27	90,20

*Group 3*

Average similarity: 82,41

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	5,03	11,47	39,73	13,92	13,92
Al	4,55	10,79	7,83	13,09	27,01
Eu	3,82	8,74	56,18	10,61	37,62
Aph	3,92	8,73	29,72	10,59	48,21
Br	3,46	8,03	56,60	9,74	57,95
Ch	3,63	7,01	7,65	8,51	66,46
Op	3,02	6,73	55,99	8,17	74,63
Ro	3,29	6,63	4,26	8,05	82,68
Ag	2,13	4,40	4,35	5,33	88,01
He	2,16	3,52	3,10	4,28	92,29

*Group 4*

Average similarity: 79,39

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	4,99	14,35	11,35	18,07	18,07
Ch	3,85	10,54	4,47	13,28	31,35
Br	3,27	8,47	12,09	10,67	42,02
Ro	2,73	7,35	13,32	9,25	51,27
Eu	3,05	6,83	4,62	8,61	59,88
Al	3,34	6,72	10,76	8,47	68,34
Op	2,51	5,76	11,36	7,25	75,59
Aph	2,27	5,29	8,46	6,67	82,26
Hom	1,93	4,55	1,81	5,73	87,99
Ag	2,33	4,22	1,17	5,31	93,31

*Group 5*

Average similarity: 74,68

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	3,83	14,09	5,44	18,86	18,86
Ch	2,65	9,16	4,33	12,26	31,13
Ro	2,43	9,14	7,99	12,24	43,36
Br	2,38	8,70	19,58	11,64	55,01
Eu	2,19	7,07	4,01	9,46	64,47
He	1,52	5,86	14,92	7,85	72,32
Ag	1,84	4,64	14,92	6,22	78,54
Al	1,79	4,64	14,92	6,22	84,76
Hor	1,06	3,50	3,49	4,69	89,44
Aph	0,69	2,93	14,92	3,92	93,37

*Group 6*

Average similarity: 67,05

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	4,30	14,42	10,31	21,51	21,51
Ch	3,01	9,99	6,17	14,91	36,41
Hom	2,42	8,18	5,67	12,20	48,61
Ro	2,74	8,13	6,71	12,12	60,73
Br	2,48	7,66	13,36	11,42	72,15
Eu	2,04	5,99	11,16	8,94	81,09
Al	2,31	5,16	11,16	7,70	88,78
Ag	2,32	2,97	0,58	4,43	93,21

*Group 7*

Average similarity: 68,83

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	4,57	16,50	28,16	23,97	23,97
Hom	2,40	8,52	5,36	12,37	36,35
Br	2,40	7,25	5,85	10,54	46,89
Ro	2,27	6,94	9,97	10,08	56,97
Ch	2,60	6,80	4,34	9,89	66,86
Ag	2,49	5,85	2,44	8,50	75,36
Eu	1,36	3,89	1,71	5,65	81,01
Op	1,19	3,11	6,13	4,52	85,52
Do	1,16	2,65	9,45	3,86	89,38
Mir	1,07	2,19	0,58	3,19	92,57

*Group 8*

Average similarity: 67,35

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	3,51	16,15	23,91	23,97	23,97
Ch	2,33	9,50	13,75	14,10	38,07
Br	1,92	7,53	9,09	11,18	49,25
Ro	1,80	7,14	26,87	10,60	59,85
Al	1,75	6,13	10,07	9,10	68,95
Eu	1,13	4,28	3,26	6,36	75,31
Hom	1,06	4,28	3,26	6,36	81,67
Mir	1,60	4,03	0,58	5,98	87,65
Op	1,00	3,57	26,87	5,30	92,95

*Group 9*

Average similarity: 68,75

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	3,95	17,12	13,94	24,91	24,91
Ch	2,55	10,68	7,23	15,53	40,44
Al	2,82	8,60	11,40	12,51	52,95
Br	2,47	7,95	2,28	11,56	64,51
Ro	1,50	5,54	6,00	8,06	72,57
Ag	1,60	4,56	1,89	6,63	79,20
Op	1,55	4,09	2,24	5,95	85,15
Hom	1,67	3,23	0,58	4,70	89,85
Hor	0,69	3,06	15,43	4,45	94,30

*Groups 1 & 2*

Average dissimilarity = 20,51

Species	Group 1	Group 2	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Op	1,52	3,03	2,24	1,90	10,94	10,94
Mig	3,00	4,42	2,07	4,13	10,09	21,04
Do	0,83	2,13	1,93	1,74	9,39	30,43
Hom	2,33	1,06	1,89	2,60	9,20	39,63
He	2,38	3,62	1,83	1,62	8,91	48,54
Ch	1,30	2,38	1,55	1,08	7,55	56,09
Ag	0,46	1,13	1,47	1,21	7,17	63,27
Eu	3,46	4,31	1,33	1,30	6,47	69,74
Br	2,19	3,05	1,25	2,64	6,08	75,82
Aph	5,18	5,59	0,99	1,29	4,81	80,63
Ro	1,48	1,46	0,85	1,61	4,16	84,79
Al	3,88	4,26	0,84	1,32	4,09	88,87
Mac	0,60	0,37	0,84	1,15	4,07	92,95

*Groups 1 & 3*

Average dissimilarity = 26,14

Species	Group 1	Group 3	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Ch	1,30	3,63	3,19	2,57	12,19	12,19
Mig	3,00	5,03	2,83	5,16	10,82	23,01
Ag	0,46	2,13	2,48	1,73	9,49	32,51
Ro	1,48	3,29	2,48	2,24	9,49	42,00
Op	1,52	3,02	2,11	2,80	8,09	50,09
Aph	5,18	3,92	1,84	1,76	7,03	57,11
Br	2,19	3,46	1,77	3,79	6,79	63,90
Hor	0,73	1,68	1,56	1,64	5,98	69,88
Do	0,83	1,29	1,53	1,23	5,85	75,72
Hom	2,33	1,73	1,34	1,18	5,13	80,85
He	2,38	2,16	1,32	1,23	5,05	85,90
Al	3,88	4,55	1,02	1,66	3,89	89,79
Mac	0,60	0,37	0,81	1,14	3,10	92,89

*Groups 2 & 3*

Average dissimilarity = 18,49

Species	Group 2		Group 3		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Ro	1,46	3,29	2,26	1,91	12,23	12,23
Aph	5,59	3,92	2,16	1,92	11,71	23,94
He	3,62	2,16	1,96	1,40	10,57	34,51
Ch	2,38	3,63	1,86	1,58	10,06	44,58
Do	2,13	1,29	1,69	1,46	9,16	53,74
Ag	1,13	2,13	1,36	1,10	7,35	61,10
Hom	1,06	1,73	1,13	1,51	6,09	67,18
Hor	1,06	1,68	1,07	1,53	5,79	72,97
Mig	4,42	5,03	0,93	1,84	5,01	77,99
Op	3,03	3,02	0,79	1,59	4,30	82,28
Eu	4,31	3,82	0,78	1,04	4,24	86,52
Met	0,00	0,60	0,72	1,25	3,87	90,39

*Groups 1 & 4*

Average dissimilarity = 31,27

Species	Group 1		Group 4		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Aph	5,18	2,27	4,65	3,31	14,87	14,87
Ch	1,30	3,85	4,03	3,63	12,90	27,77
Mig	3,00	4,99	3,12	8,07	9,97	37,74
Ag	0,46	2,33	3,11	1,81	9,96	47,70
Al	3,88	3,34	2,29	2,78	7,31	55,01
He	2,38	1,19	2,16	1,21	6,90	61,91
Ro	1,48	2,73	1,93	2,79	6,18	68,09
Do	0,83	1,36	1,76	1,35	5,64	73,74
Br	2,19	3,27	1,63	2,00	5,22	78,96
Op	1,52	2,51	1,59	1,28	5,09	84,05
Eu	3,46	3,05	1,44	1,28	4,60	88,65
Hom	2,33	1,93	0,96	1,38	3,09	91,73

*Groups 2 & 4*

Average dissimilarity = 25,17

Species	Group 2		Group 4		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Aph	5,59	2,27	4,69	3,33	18,63	18,63
He	3,62	1,19	3,46	2,13	13,76	32,38
Ag	1,13	2,33	2,25	2,04	8,93	41,32
Al	4,26	3,34	2,23	2,03	8,85	50,17

Ch	2,38	3,85	2,20	1,65	8,74	58,91
Eu	4,31	3,05	1,91	1,27	7,57	66,48
Ro	1,46	2,73	1,75	1,92	6,95	73,44
Do	2,13	1,36	1,44	1,17	5,74	79,18
Op	3,03	2,51	1,37	1,52	5,44	84,62
Hom	1,06	1,93	1,35	1,53	5,37	89,98
Mig	4,42	4,99	0,81	1,49	3,22	93,20

*Groups 3 & 4*

Average dissimilarity = 19,53

Species	Group 3	Group 4	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Al	4,55	3,34	2,32	1,78	11,90	11,90
Aph	3,92	2,27	2,26	2,04	11,55	23,45
Do	1,29	1,36	1,73	1,23	8,87	32,31
He	2,16	1,19	1,72	1,31	8,83	41,14
Ag	2,13	2,33	1,58	1,90	8,07	49,22
Eu	3,82	3,05	1,33	1,21	6,83	56,05
Ch	3,63	3,85	1,26	1,45	6,48	62,52
Op	3,02	2,51	1,25	2,25	6,39	68,91
Hom	1,73	1,93	1,22	1,33	6,26	75,17
Ro	3,29	2,73	1,21	2,07	6,21	81,38
Hor	1,68	1,13	1,10	1,52	5,63	87,01
Met	0,60	0,00	0,75	1,25	3,85	90,86

*Groups 1 & 5*

Average dissimilarity = 34,74

Species	Group 1	Group 5	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Aph	5,18	0,69	8,39	13,26	24,15	24,15
Al	3,88	1,79	3,98	1,86	11,45	35,60
Ag	0,46	1,84	2,78	1,37	8,02	43,61
Hom	2,33	0,92	2,59	1,90	7,46	51,07
Ch	1,30	2,65	2,51	1,75	7,23	58,30
Eu	3,46	2,19	2,44	1,51	7,03	65,33
Op	1,52	1,41	1,98	1,53	5,70	71,02
Ro	1,48	2,43	1,75	1,89	5,03	76,05
He	2,38	1,52	1,67	1,31	4,81	80,86
Mig	3,00	3,83	1,66	1,57	4,78	85,64
Do	0,83	0,77	1,38	1,37	3,96	89,60
Hor	0,73	1,06	0,98	1,04	2,83	92,43

*Groups 2 & 5*

Average dissimilarity = 33,34

Species	Group 2	Group 5	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Aph	5,59	0,69	7,96	8,57	23,87	23,87
Al	4,26	1,79	4,05	2,10	12,14	36,01
Eu	4,31	2,19	3,47	2,33	10,41	46,42
He	3,62	1,52	3,40	6,89	10,19	56,61
Op	3,03	1,41	2,90	1,37	8,69	65,30
Do	2,13	0,77	2,16	1,78	6,49	71,78
Ag	1,13	1,84	1,97	1,51	5,91	77,69
Ro	1,46	2,43	1,61	1,55	4,83	82,52
CH	2,38	2,65	1,45	1,37	4,35	86,87
Mig	4,42	3,83	1,14	1,17	3,41	90,28

*Groups 3 & 5*

Average dissimilarity = 30,96

Species	Group 3	Group 5	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Aph	3,92	0,69	5,03	8,80	16,23	16,23
Al	4,55	1,79	4,41	2,31	14,24	30,47
Op	3,02	1,41	2,66	1,38	8,58	39,05
Eu	3,82	2,19	2,54	2,14	8,21	47,26
Mig	5,03	3,83	1,87	1,65	6,04	53,30
Ch	3,63	2,65	1,79	1,46	5,78	59,08
Do	1,29	0,77	1,77	1,35	5,73	64,81
Ag	2,13	1,84	1,74	1,97	5,62	70,43
Hom	1,73	0,92	1,67	1,71	5,41	75,84
Br	3,46	2,38	1,67	2,21	5,40	81,23
Ro	3,29	2,43	1,61	1,91	5,21	86,44
He	2,16	1,52	1,38	1,69	4,44	90,88

*Groups 4 & 5*

Average dissimilarity = 25,85

Species	Group 4	Group 5	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Al	3,34	1,79	3,20	1,54	12,36	12,36
Aph	2,27	0,69	2,67	3,29	10,33	22,70
Op	2,51	1,41	2,61	1,49	10,08	32,78
Ag	2,33	1,84	2,33	1,33	9,00	41,78
Ch	3,85	2,65	2,19	1,70	8,47	50,25
Mig	4,99	3,83	2,03	1,69	7,84	58,09



Hom	1,93	0,92	2,00	1,53	7,73	65,82
Do	1,36	0,77	1,97	1,30	7,64	73,46
Eu	3,05	2,19	1,96	1,51	7,58	81,04
Br	3,27	2,38	1,61	1,78	6,23	87,27
He	1,19	1,52	1,41	1,13	5,46	92,73

*Groups 1 & 6*

Average dissimilarity = 37,55

Species	Group 1	Group 6	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Aph	5,18	0,73	7,97	3,29	21,21	21,21
Ag	0,46	2,32	3,68	1,35	9,80	31,01
Al	3,88	2,31	3,29	1,63	8,76	39,77
Ch	1,30	3,01	3,03	2,65	8,06	47,83
He	2,38	0,69	2,91	1,93	7,74	55,57
Eu	3,46	2,04	2,59	1,75	6,91	62,48
Mig	3,00	4,30	2,23	2,51	5,94	68,42
Ro	1,48	2,74	2,14	1,72	5,71	74,14
Mir	0,23	1,17	2,00	1,16	5,33	79,46
Do	0,83	0,83	1,98	1,40	5,28	84,74
Op	1,52	0,83	1,36	1,06	3,62	88,36
Hor	0,73	0,69	1,11	1,36	2,95	91,32

*Groups 2 & 6*

Average dissimilarity = 38,97

Species	Group 2	Group 6	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Aph	5,59	0,73	7,59	3,40	19,49	19,49
He	3,62	0,69	4,47	6,18	11,46	30,95
Eu	4,31	2,04	3,56	2,53	9,12	40,07
Op	3,03	0,83	3,43	2,28	8,81	48,88
Al	4,26	2,31	3,29	1,62	8,44	57,32
Ag	1,13	2,32	2,91	1,61	7,48	64,80
Do	2,13	0,83	2,38	1,79	6,12	70,92
Hom	1,06	2,42	2,12	2,93	5,45	76,36
Ro	1,46	2,74	1,97	1,57	5,05	81,42
Mir	0,00	1,17	1,89	1,11	4,84	86,26
Ch	2,38	3,01	1,59	1,69	4,07	90,33

*Groups 3 & 6*

Average dissimilarity = 32,97

Species	Group 3	Group 6	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Aph	3,92	0,73	4,81	2,49	14,60	14,60
Al	4,55	2,31	3,48	1,53	10,56	25,15
Op	3,02	0,83	3,25	2,91	9,87	35,03
Eu	3,82	2,04	2,67	2,42	8,09	43,12
Ag	2,13	2,32	2,42	1,64	7,34	50,46
He	2,16	0,69	2,14	1,77	6,49	56,94
Do	1,29	0,83	1,94	1,12	5,89	62,84
Mir	0,00	1,17	1,82	1,09	5,53	68,37
Hor	1,68	0,69	1,64	1,46	4,98	73,35
Br	3,46	2,48	1,47	1,75	4,47	77,82
Hom	1,73	2,42	1,44	1,13	4,38	82,20
Ro	3,29	2,74	1,44	1,48	4,36	86,56
Ch	3,63	3,01	1,38	1,44	4,20	90,76

*Groups 4 & 6*

Average dissimilarity = 27,15

Species	Group 4	Group 6	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Ag	2,33	2,32	2,99	1,44	11,00	11,00
Al	3,34	2,31	2,91	1,58	10,71	21,72
Aph	2,27	0,73	2,79	1,64	10,26	31,98
Op	2,51	0,83	2,73	1,66	10,05	42,03
Do	1,36	0,83	2,13	1,11	7,85	49,88
Mir	0,00	1,17	2,02	1,10	7,46	57,33
Eu	3,05	2,04	1,98	1,48	7,28	64,61
He	1,19	0,69	1,54	1,42	5,68	70,29
Ch	3,85	3,01	1,51	1,75	5,57	75,86
Br	3,27	2,48	1,48	1,68	5,45	81,31
Mig	4,99	4,30	1,23	1,40	4,55	85,85
Hor	1,13	0,69	1,11	1,27	4,09	89,95
Ro	2,73	2,74	1,04	1,70	3,83	93,78

*Groups 5 & 6*

Average dissimilarity = 28,09

Species	Group 5		Group 6		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Ag	1,84	2,32	3,66	1,82	13,04	13,04
Hom	0,92	2,42	2,94	2,08	10,46	23,49
Al	1,79	2,31	2,48	1,17	8,82	32,32
Mir	0,00	1,17	2,45	1,10	8,72	41,04
Do	0,77	0,83	2,22	1,29	7,89	48,92
Op	1,41	0,83	2,21	1,22	7,87	56,79
Aph	0,69	0,73	1,86	2,94	6,63	63,42
He	1,52	0,69	1,57	1,38	5,58	69,00
Mig	3,83	4,30	1,49	1,44	5,29	74,29
Eu	2,19	2,04	1,42	1,40	5,05	79,34
Ch	2,65	3,01	1,34	1,36	4,76	84,10
Ro	2,43	2,74	1,21	1,21	4,31	88,41
Hor	1,06	0,69	1,18	1,19	4,21	92,62

*Groups 1 & 7*

Average dissimilarity = 37,48

Species	Group 1		Group 7		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Aph	5,18	0,77	8,01	3,91	21,36	21,36
Al	3,88	1,92	3,99	1,25	10,66	32,01
Eu	3,46	1,36	3,73	3,12	9,95	41,96
Ag	0,46	2,49	3,64	1,77	9,72	51,68
He	2,38	0,83	2,94	1,49	7,83	59,51
Mig	3,00	4,57	2,74	5,75	7,32	66,83
Ch	1,30	2,60	2,25	1,10	6,00	72,84
Mir	0,23	1,07	1,83	1,48	4,89	77,72
Do	0,83	1,16	1,52	1,38	4,05	81,77
Ro	1,48	2,27	1,49	1,70	3,97	85,74
Br	2,19	2,40	1,07	1,42	2,86	88,60
Op	1,52	1,19	1,04	1,32	2,78	91,38

*Groups 2 & 7*

Average dissimilarity = 38,36

Species	Group 2		Group 7		Contrib%	Cum. %
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Aph	5,59	0,77	7,62	4,02	19,86	19,86
Eu	4,31	1,36	4,59	4,24	11,95	31,82
He	3,62	0,83	4,43	2,80	11,55	43,37
Al	4,26	1,92	3,94	1,35	10,28	53,65
Op	3,03	1,19	2,92	2,09	7,61	61,26
Ag	1,13	2,49	2,45	1,62	6,38	67,64
Hom	1,06	2,40	2,12	3,18	5,52	73,16
Mir	0,00	1,07	1,74	1,32	4,53	77,69
Ch	2,38	2,60	1,63	1,13	4,26	81,95
Do	2,13	1,16	1,60	1,74	4,17	86,12
Ro	1,46	2,27	1,38	1,37	3,60	89,72
Br	3,05	2,40	1,32	1,86	3,44	93,16

*Groups 3 & 7*

Average dissimilarity = 34,33

Species	Group 3		Group 7		Contrib%	Cum. %
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Aph	3,92	0,77	4,80	3,14	13,99	13,99
Al	4,55	1,92	4,17	1,36	12,15	26,13
Eu	3,82	1,36	3,65	5,10	10,64	36,77
Op	3,02	1,19	2,76	2,84	8,03	44,81
He	2,16	0,83	2,21	1,57	6,43	51,24
Ch	3,63	2,60	2,18	1,63	6,36	57,60
Ro	3,29	2,27	1,77	1,62	5,17	62,76
Do	1,29	1,16	1,74	1,42	5,06	67,82
Hor	1,68	0,60	1,72	1,45	5,02	72,85
Br	3,46	2,40	1,68	1,74	4,90	77,74
Mir	0,00	1,07	1,68	1,30	4,88	82,63
Ag	2,13	2,49	1,62	1,61	4,73	87,36
Hom	1,73	2,40	1,43	1,13	4,17	91,53

*Groups 4 & 7*

Average dissimilarity = 27,72

Species	Group 4		Group 7		Contrib%	Cum. %
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Al	3,34	1,92	3,57	1,41	12,88	12,88
Eu	3,05	1,36	2,70	1,75	9,73	22,61
Aph	2,27	0,77	2,53	1,58	9,11	31,72

Ch	3,85	2,60	2,47	1,42	8,91	40,63
Ag	2,33	2,49	2,28	1,33	8,21	48,85
Op	2,51	1,19	2,17	1,41	7,83	56,68
Mir	0,00	1,07	1,86	1,30	6,72	63,40
Do	1,36	1,16	1,84	1,56	6,63	70,04
Br	3,27	2,40	1,69	1,67	6,11	76,15
He	1,19	0,83	1,67	1,32	6,04	82,18
Hor	1,13	0,60	1,11	1,10	4,02	86,20
Ro	2,73	2,27	1,03	1,13	3,72	89,92
Hom	1,93	2,40	0,93	1,10	3,34	93,27

*Groups 5 & 7*

Average dissimilarity = 28,28

Species	Group 5	Group 7	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Al	1,79	1,92	3,30	1,57	11,67	11,67
Hom	0,92	2,40	2,95	2,13	10,42	22,08
Ag	1,84	2,49	2,57	1,20	9,07	31,16
Mir	0,00	1,07	2,26	1,31	7,98	39,14
Op	1,41	1,19	2,21	1,67	7,82	46,96
Ch	2,65	2,60	2,08	1,58	7,35	54,31
Eu	2,19	1,36	1,88	1,66	6,65	60,96
He	1,52	0,83	1,86	1,33	6,58	67,55
Do	0,77	1,16	1,66	1,16	5,88	73,42
Mig	3,83	4,57	1,61	1,32	5,68	79,10
Br	2,38	2,40	1,26	1,42	4,47	83,57
Hor	1,06	0,60	1,21	1,06	4,27	87,84
Ro	2,43	2,27	1,15	1,39	4,05	91,89

*Groups 6 & 7*

Average dissimilarity = 25,68

Species	Group 6	Group 7	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Ag	2,32	2,49	3,36	1,42	13,10	13,10
Al	2,31	1,92	3,27	1,32	12,74	25,83
Do	0,83	1,16	2,34	1,59	9,13	34,97
Ch	3,01	2,60	2,16	2,31	8,42	43,39
Mir	1,17	1,07	1,95	1,48	7,61	51,00
Aph	0,73	0,77	1,79	1,24	6,98	57,98
Ro	2,74	2,27	1,51	1,37	5,89	63,87
He	0,69	0,83	1,43	1,25	5,57	69,43
Eu	2,04	1,36	1,32	1,07	5,14	74,58

Op	0,83	1,19	1,31	1,31	5,08	79,66
Br	2,48	2,40	1,26	1,21	4,92	84,58
Hor	0,69	0,60	1,10	1,22	4,28	88,86
Mig	4,30	4,57	1,03	1,48	4,00	92,87

*Groups 1 & 8*

Average dissimilarity = 44,38

Species	Group 1	Group 8	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Aph	5,18	0,00	10,51	21,19	23,69	23,69
Eu	3,46	1,13	4,70	3,94	10,59	34,27
He	2,38	0,23	4,36	2,71	9,82	44,10
Al	3,88	1,75	4,33	2,47	9,76	53,86
Mir	0,23	1,60	3,10	1,50	6,98	60,84
Hom	2,33	1,06	2,58	2,66	5,81	66,65
Do	0,83	0,90	2,42	1,39	5,45	72,10
Ag	0,46	1,29	2,30	1,29	5,19	77,29
Ch	1,30	2,33	2,04	1,27	4,60	81,90
Op	1,52	1,00	1,38	1,71	3,10	85,00
Hor	0,73	0,90	1,35	1,09	3,05	88,05
Br	2,19	1,92	1,34	1,98	3,02	91,07

*Groups 2 & 8*

Average dissimilarity = 44,83

Species	Group 2	Group 8	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Aph	5,59	0,00	9,75	10,61	21,76	21,76
He	3,62	0,23	5,91	8,09	13,18	34,94
Eu	4,31	1,13	5,52	5,22	12,32	47,26
Al	4,26	1,75	4,37	2,76	9,74	57,00
Op	3,03	1,00	3,55	2,56	7,92	64,92
Mir	0,00	1,60	2,81	1,33	6,27	71,19
Do	2,13	0,90	2,79	1,91	6,22	77,41
Br	3,05	1,92	1,97	1,70	4,39	81,80
Mig	4,42	3,51	1,62	1,75	3,62	85,42
Ag	1,13	1,29	1,59	1,05	3,55	88,97
Ch	2,38	2,33	1,41	1,10	3,14	92,12

*Groups 3 & 8*

Average dissimilarity = 43,50

Species	Group 3	Group 8	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Aph	3,92	0,00	6,55	10,74	15,06	15,06
Al	4,55	1,75	4,75	2,99	10,92	25,98
Eu	3,82	1,13	4,45	7,44	10,23	36,21
Op	3,02	1,00	3,35	3,97	7,69	43,90
He	2,16	0,23	3,09	2,31	7,11	51,01
Mir	0,00	1,60	2,71	1,30	6,22	57,24
Br	3,46	1,92	2,56	2,27	5,87	63,11
Ro	3,29	1,80	2,55	2,08	5,87	68,98
Mig	5,03	3,51	2,48	2,32	5,69	74,67
Ch	3,63	2,33	2,35	1,73	5,40	80,08
Do	1,29	0,90	2,22	1,07	5,11	85,19
Hor	1,68	0,90	1,76	1,55	4,04	89,23
Ag	2,13	1,29	1,76	0,98	4,04	93,27

*Groups 4 & 8*

Average dissimilarity = 37,29

Species	Group 4	Group 8	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Aph	2,27	0,00	4,19	5,76	11,23	11,23
Eu	3,05	1,13	3,46	2,19	9,28	20,51
Al	3,34	1,75	3,14	1,34	8,41	28,92
Mir	0,00	1,60	3,03	1,32	8,14	37,06
Ag	2,33	1,29	2,97	1,80	7,97	45,03
Ch	3,85	2,33	2,93	1,73	7,87	52,90
Mig	4,99	3,51	2,80	2,71	7,50	60,39
Op	2,51	1,00	2,75	1,76	7,37	67,76
Do	1,36	0,90	2,58	1,18	6,93	74,68
Br	3,27	1,92	2,54	1,93	6,80	81,49
He	1,19	0,23	1,99	1,41	5,34	86,83
Ro	2,73	1,80	1,87	1,82	5,00	91,83

*Groups 5 & 8*

Average dissimilarity = 31,40

Species	Group 5	Group 8	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Mir	0,00	1,60	3,74	1,33	11,92	11,92
He	1,52	0,23	3,01	3,06	9,60	21,51
Ag	1,84	1,29	2,98	1,69	9,49	31,00

Do	0,77	0,90	2,76	1,30	8,78	39,79
Op	1,41	1,00	2,57	1,71	8,18	47,97
Eu	2,19	1,13	2,48	1,75	7,91	55,88
Al	1,79	1,75	2,07	1,05	6,58	62,46
Ro	2,43	1,80	1,81	1,53	5,76	68,22
Ch	2,65	2,33	1,78	1,29	5,67	73,90
Br	2,38	1,92	1,73	1,69	5,50	79,39
Aph	0,69	0,00	1,61	14,04	5,14	84,53
Mig	3,83	3,51	1,59	1,36	5,05	89,58
Hor	1,06	0,90	1,45	1,30	4,63	94,22

*Groups 6 & 8*

Average dissimilarity = 31,22

Species	Group 6		Group 8		Contrib%	Cum. %
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Ag	2,32	1,29	3,96	1,47	12,69	12,69
Hom	2,42	1,06	2,96	2,97	9,49	22,18
Do	0,83	0,90	2,62	0,88	8,41	30,59
Mir	1,17	1,60	2,61	1,24	8,36	38,95
Al	2,31	1,75	2,39	1,07	7,67	46,61
Ro	2,74	1,80	2,28	1,63	7,31	53,93
Ch	3,01	2,33	2,01	1,67	6,45	60,38
Mig	4,30	3,51	1,86	1,54	5,96	66,34
Eu	2,04	1,13	1,84	1,29	5,89	72,23
Br	2,48	1,92	1,83	1,56	5,86	78,10
Hor	0,69	0,90	1,60	1,33	5,12	83,22
Op	0,83	1,00	1,46	1,54	4,67	87,89
Aph	0,73	0,00	1,42	0,67	4,54	92,44

*Groups 7 & 8*

Average dissimilarity = 31,72

Species	Group 7		Group 8		Contrib%	Cum. %
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Al	1,92	1,75	3,47	1,63	10,93	10,93
Ag	2,49	1,29	3,39	1,55	10,69	21,62
Hom	2,40	1,06	2,97	3,18	9,37	30,99
Do	1,16	0,90	2,91	1,64	9,17	40,16
Mir	1,07	1,60	2,70	1,62	8,52	48,68
Mig	4,57	3,51	2,27	1,84	7,17	55,85
Ch	2,60	2,33	2,15	1,22	6,78	62,63
Br	2,40	1,92	1,84	1,52	5,81	68,44
Ro	2,27	1,80	1,65	1,51	5,20	73,64



Hor	0,60	0,90	1,58	1,20	4,99	78,63
He	0,83	0,23	1,58	1,08	4,97	83,60
Aph	0,77	0,00	1,56	1,10	4,91	88,51
Eu	1,36	1,13	1,14	1,28	3,60	92,11

*Groups 1 & 9*

Average dissimilarity = 35,49

Species	Group 1	Group 9	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Aph	5,18	1,44	7,22	2,53	20,34	20,34
Eu	3,46	0,77	5,16	2,90	14,55	34,89
He	2,38	0,54	3,55	1,68	10,01	44,90
Al	3,88	2,82	2,70	1,71	7,60	52,49
Ag	0,46	1,60	2,44	1,75	6,89	59,38
Ch	1,30	2,55	2,36	2,65	6,66	66,04
Hom	2,33	1,67	1,98	1,06	5,59	71,63
Mig	3,00	3,95	1,79	4,15	5,03	76,66
Do	0,83	0,96	1,76	1,52	4,96	81,63
Br	2,19	2,47	1,58	1,59	4,44	86,07
Op	1,52	1,55	1,37	1,47	3,85	89,92
Mac	0,60	0,23	1,00	1,14	2,80	92,73

*Groups 2 & 9*

Average dissimilarity = 34,78

Species	Group 2	Group 9	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Aph	5,59	1,44	6,92	2,69	19,90	19,90
Eu	4,31	0,77	5,87	3,69	16,89	36,79
He	3,62	0,54	5,12	3,41	14,72	51,51
Al	4,26	2,82	2,70	1,56	7,76	59,27
Op	3,03	1,55	2,56	1,63	7,36	66,63
Hom	1,06	1,67	2,21	2,32	6,37	73,00
Do	2,13	0,96	2,15	1,61	6,19	79,19
Ag	1,13	1,60	1,48	1,30	4,26	83,45
Ch	2,38	2,55	1,41	3,38	4,07	87,52
Br	3,05	2,47	1,38	1,43	3,97	91,49

*Groups 3 & 9*

Average dissimilarity = 32,68

Species	Group 3	Group 9	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Eu	3,82	0,77	4,84	3,77	14,82	14,82
Aph	3,92	1,44	3,98	1,74	12,18	27,00
Al	4,55	2,82	2,88	1,44	8,81	35,81
Ro	3,29	1,50	2,74	2,22	8,39	44,20
He	2,16	0,54	2,68	1,87	8,21	52,42
Op	3,02	1,55	2,31	1,69	7,08	59,49
Hom	1,73	1,67	2,00	1,39	6,13	65,62
Do	1,29	0,96	1,91	1,29	5,85	71,47
Ch	3,63	2,55	1,71	1,40	5,24	76,72
Br	3,46	2,47	1,65	1,36	5,05	81,76
Mig	5,03	3,95	1,65	2,35	5,04	86,80
Hor	1,68	0,69	1,45	1,23	4,43	91,23

*Groups 4 & 9*

Average dissimilarity = 28,45

Species	Group 4	Group 9	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Eu	3,05	0,77	3,97	2,09	13,95	13,95
Al	3,34	2,82	2,47	1,25	8,67	22,62
Ag	2,33	1,60	2,35	1,65	8,26	30,88
Ch	3,85	2,55	2,35	2,46	8,26	39,14
Aph	2,27	1,44	2,31	1,38	8,11	47,25
Ro	2,73	1,50	2,17	2,75	7,62	54,88
Op	2,51	1,55	2,12	1,63	7,47	62,35
Do	1,36	0,96	2,12	1,29	7,44	69,78
Hom	1,93	1,67	2,01	1,38	7,05	76,84
Mig	4,99	3,95	1,85	5,59	6,49	83,33
He	1,19	0,54	1,83	1,21	6,44	89,77
Br	3,27	2,47	1,71	1,33	6,01	95,78

*Groups 5 & 9*

Average dissimilarity = 28,70

Species	Group 5	Group 9	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Al	1,79	2,82	3,26	1,55	11,36	11,36
Eu	2,19	0,77	3,17	1,69	11,05	22,41
Hom	0,92	1,67	2,99	1,62	10,41	32,82
Aph	0,69	1,44	2,56	1,67	8,93	41,75

Op	1,41	1,55	2,49	1,38	8,67	50,42
He	1,52	0,54	2,40	1,56	8,36	58,78
Ag	1,84	1,60	2,31	1,58	8,05	66,84
Ro	2,43	1,50	2,01	1,88	7,01	73,85
Do	0,77	0,96	1,96	1,29	6,82	80,66
Br	2,38	2,47	1,81	1,65	6,31	86,97
Ch	2,65	2,55	1,16	1,58	4,05	91,02

*Groups 6 & 9*

Average dissimilarity = 30,43

Species	Group 6	Group 9	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Ag	2,32	1,60	3,54	1,75	11,63	11,63
Al	2,31	2,82	2,87	1,32	9,44	21,07
Aph	0,73	1,44	2,74	1,20	9,00	30,08
Eu	2,04	0,77	2,53	1,36	8,30	38,38
Mir	1,17	0,00	2,50	1,10	8,22	46,60
Ro	2,74	1,50	2,44	1,71	8,02	54,62
Do	0,83	0,96	2,36	1,15	7,75	62,38
Hom	2,42	1,67	2,16	1,08	7,09	69,47
Op	0,83	1,55	1,95	1,21	6,41	75,88
Br	2,48	2,47	1,75	1,54	5,76	81,64
He	0,69	0,54	1,58	1,27	5,19	86,83
Ch	3,01	2,55	1,05	1,19	3,45	90,28

*Groups 7 & 9*

Average dissimilarity = 28,93

Species	Group 7	Group 9	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Al	1,92	2,82	3,73	1,24	12,88	12,88
Ag	2,49	1,60	2,65	1,48	9,17	22,06
Aph	0,77	1,44	2,52	1,24	8,72	30,78
Mir	1,07	0,00	2,31	1,31	7,97	38,75
Hom	2,40	1,67	2,19	1,10	7,55	46,30
Ch	2,60	2,55	1,97	2,18	6,82	53,13
Br	2,40	2,47	1,90	1,50	6,56	59,68
Do	1,16	0,96	1,85	1,10	6,39	66,08
He	0,83	0,54	1,70	1,13	5,89	71,96
Eu	1,36	0,77	1,70	1,15	5,86	77,83
Ro	2,27	1,50	1,60	1,42	5,54	83,37
Op	1,19	1,55	1,58	1,25	5,47	88,84
Mig	4,57	3,95	1,21	2,01	4,18	93,02

*Groups 8 & 9*

Average dissimilarity = 32,43

Species	Group 8		Group 9		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Mir	1,60	0,00	3,83	1,33	11,81	11,81
Aph	0,00	1,44	3,27	1,15	10,09	21,90
Al	1,75	2,82	3,22	1,39	9,93	31,83
Hom	1,06	1,67	3,19	2,28	9,84	41,67
Do	0,90	0,96	2,94	1,19	9,07	50,74
Br	1,92	2,47	2,34	1,23	7,20	57,95
Ag	1,29	1,60	2,23	1,19	6,88	64,83
Op	1,00	1,55	1,87	1,18	5,75	70,58
Eu	1,13	0,77	1,68	1,22	5,18	75,76
Ch	2,33	2,55	1,65	3,33	5,08	80,84
Hor	0,90	0,69	1,60	2,98	4,94	85,77
He	0,23	0,54	1,40	0,92	4,31	90,09

## Appendix F.

Year 2013

SIMPER - Similarity Percentages

Subfamilies contributions

*Parameters*

Resemblance: Bray Curtis similarity

Cut off for low contributions: 90,00%

***Factor Groups***

Sample	Vineyard
C1	C
C2	C
C3	C
C4	C
C5	C
C6	C
C7	C
C8	C
C9	C
C10	C
MD1	MD
MD2	MD
MD3	MD
MD4	MD
MD5	MD
MD6	MD
MD7	MD
MD8	MD
MD9	MD
MD10	MD
O1	O
O2	O
O3	O
O4	O
O5	O
O6	O
O7	O
O8	O
O9	O
O10	O

*Group C*

Average similarity: 71,01

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	3,91	15,31	7,37	21,56	21,56
Al	2,60	8,80	3,06	12,40	33,96
Br	2,41	8,64	3,14	12,17	46,13
Aph	2,05	6,94	2,69	9,78	55,91
Ro	1,72	5,61	2,27	7,90	63,80
Eu	1,69	4,98	2,00	7,01	70,82
Ch	1,76	4,88	1,31	6,87	77,69
He	1,31	4,16	1,68	5,86	83,55
Hom	1,70	4,14	1,41	5,83	89,38
Op	1,44	3,85	1,51	5,42	94,79

*Group MD*

Average similarity: 70,76

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Al	3,93	15,77	9,90	22,28	22,28
Mig	3,68	14,70	6,42	20,77	43,05
Aph	2,82	8,00	1,89	11,30	54,35
Ag	1,81	5,57	1,76	7,87	62,22
Eu	2,02	4,84	1,09	6,84	69,06
Op	1,67	4,58	1,52	6,47	75,54
Br	1,51	4,51	2,48	6,38	81,91
Ro	1,25	3,25	1,12	4,59	86,51
Hom	1,18	2,81	0,81	3,97	90,47

*Group O*

Average similarity: 65,27

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	3,92	16,62	4,11	25,46	25,46
Br	2,35	9,10	3,84	13,94	39,40
Ch	2,19	7,50	2,56	11,48	50,88
Al	1,97	6,03	2,73	9,24	60,12
Ro	1,65	5,22	1,59	8,00	68,12
Hom	1,92	4,75	0,95	7,28	75,40
Op	1,40	3,28	1,15	5,03	80,43
Aph	1,61	2,74	0,65	4,20	84,62
Eu	1,58	2,50	0,64	3,83	88,45
Do	0,90	2,32	1,15	3,55	92,00

*Groups C & MD*

Average dissimilarity = 32,48

Species	Group C	Group MD	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Aph	2,05	2,82	3,17	1,53	9,77	9,77
Ag	0,51	1,81	3,07	1,72	9,46	19,23
Al	2,60	3,93	3,07	1,55	9,45	28,68
Eu	1,69	2,02	2,97	1,51	9,14	37,83
Hom	1,70	1,18	2,73	1,25	8,42	46,24
Ch	1,76	1,11	2,56	1,44	7,89	54,14
Br	2,41	1,51	2,51	1,44	7,73	61,87
Op	1,44	1,67	2,27	1,42	6,99	68,86
Ro	1,72	1,25	1,99	1,28	6,13	74,99
He	1,31	0,92	1,54	1,38	4,73	79,72
Mig	3,91	3,68	1,52	1,30	4,68	84,40
Mac	0,66	0,14	1,41	1,12	4,33	88,74
Hor	0,46	0,43	1,16	1,21	3,58	92,32

*Groups C & O*

Average dissimilarity = 32,02

Species	Group C	Group O	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Hom	1,70	1,92	3,45	1,33	10,78	10,78
Eu	1,69	1,58	3,41	1,55	10,64	21,42
Aph	2,05	1,61	3,37	1,69	10,51	31,93
Al	2,60	1,97	2,70	1,34	8,44	40,37
Ch	1,76	2,19	2,48	1,30	7,75	48,12
Op	1,44	1,40	2,27	1,31	7,10	55,21
He	1,31	0,99	1,99	1,39	6,21	61,42
Ro	1,72	1,65	1,86	1,23	5,81	67,23
Ag	0,51	0,92	1,81	1,17	5,65	72,88
Br	2,41	2,35	1,61	1,25	5,01	77,89
Do	0,28	0,90	1,59	1,37	4,95	82,85
Mig	3,91	3,92	1,57	1,40	4,90	87,75
Mac	0,66	0,46	1,35	1,22	4,20	91,95

*Groups MD & O*

Average dissimilarity = 36,71

Species	Group MD	Group O	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Al	3,93	1,97	4,49	1,74	12,22	12,22
Aph	2,82	1,61	4,47	1,47	12,17	24,39

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Eu	2,02	1,58	3,92	1,42	10,67	35,07
Hom	1,18	1,92	3,29	1,29	8,97	44,03
Ch	1,11	2,19	2,90	1,43	7,89	51,92
Ag	1,81	0,92	2,75	1,64	7,49	59,41
Op	1,67	1,40	2,41	1,35	6,58	65,99
Br	1,51	2,35	2,28	1,47	6,21	72,20
Ro	1,25	1,65	2,08	1,28	5,66	77,86
He	0,92	0,99	1,75	1,35	4,77	82,63
Do	0,39	0,90	1,51	1,32	4,10	86,73
Mig	3,68	3,92	1,34	1,22	3,66	90,39



## Appendix G.

Year 2013

SIMPER - Similarity Percentages

Subfamilies contributions

*Parameters*

Resemblance: Bray Curtis similarity

Cut off for low contributions: 90,00%

***Factor Groups***

Sample	Time
C1	1
MD1	1
O1	1
C2	2
MD2	2
O2	2
C3	3
MD3	3
O3	3
C4	4
MD4	4
O4	4
C5	5
MD5	5
O5	5
C6	6
MD6	6
O6	6
C7	7
MD7	7
O7	7
C8	8
MD8	8
O8	8
C9	9
MD9	9
O9	9
C10	10
MD10	10
O10	10

*Group 1*

Average similarity: 73,86

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Al	3,40	16,55	17,63	22,41	22,41
Mig	2,77	13,93	12,30	18,86	41,27
Eu	3,04	12,66	3,21	17,15	58,42
Aph	2,92	12,10	6,89	16,39	74,81
He	1,39	4,86	2,07	6,57	81,38
Br	0,96	4,33	3,00	5,87	87,25
Mac	1,06	4,33	3,00	5,87	93,11

*Group 2*

Average similarity: 80,09

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Al	3,75	13,69	8,50	17,10	17,10
Mig	3,27	12,73	52,22	15,90	33,00
Aph	3,59	12,26	9,63	15,31	48,31
Eu	3,31	11,30	3,83	14,11	62,42
Op	2,52	9,56	112,81	11,93	74,36
Br	1,75	5,70	2,91	7,12	81,48
He	1,50	5,16	3,73	6,45	87,92
Hom	1,16	3,69	2,64	4,61	92,53

*Group 3*

Average similarity: 80,65

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Al	4,17	11,77	8,79	14,59	14,59
Eu	3,89	11,71	23,50	14,53	29,12
Mig	3,91	11,57	30,77	14,35	43,47
Aph	4,12	10,93	8,39	13,56	57,03
Op	3,08	9,22	19,77	11,43	68,46
Br	2,76	8,15	6,41	10,10	78,56
Ch	1,94	5,83	47,03	7,23	85,80
Ro	1,93	5,21	4,27	6,46	92,26

*Group 4*

Average similarity: 79,94

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	3,80	13,69	125,60	17,12	17,12
Aph	3,17	10,10	70,60	12,64	29,76
Al	3,16	9,04	2,93	11,31	41,07
Ch	2,69	8,98	16,34	11,23	52,30

Eu	2,33	8,73	8,33	10,92	63,23
Br	2,39	6,79	3,27	8,50	71,72
Op	1,92	6,59	39,68	8,24	79,96
Do	1,06	3,14	5,29	3,93	83,89
Ro	1,36	3,14	5,29	3,93	87,82
He	0,92	2,67	11,98	3,34	91,15

*Group 5*

Average similarity: 70,76

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	3,95	15,81	6,95	22,34	22,34
Br	2,38	9,71	9,86	13,72	36,07
Aph	2,50	8,84	6,14	12,49	48,56
Ro	2,12	7,91	5,63	11,18	59,74
Al	2,48	6,77	2,11	9,57	69,30
Ch	2,06	6,40	2,39	9,05	78,35
He	1,66	6,09	19,54	8,60	86,95
Op	1,70	5,54	5,09	7,83	94,78

*Group 6*

Average similarity: 73,39

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	3,97	19,61	15,96	26,72	26,72
Br	2,52	11,03	6,83	15,03	41,76
Ro	1,93	9,02	15,81	12,28	54,04
Al	2,15	6,33	5,59	8,63	62,67
Aph	1,29	5,98	10,98	8,15	70,82
Ch	1,57	5,73	1,40	7,81	78,63
He	1,29	4,73	2,01	6,44	85,07
Hom	1,29	4,64	2,34	6,32	91,39

*Group 7*

Average similarity: 64,92

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	4,14	22,03	7,25	33,93	33,93
Br	2,22	9,44	4,70	14,54	48,47
Ro	1,52	5,56	2,03	8,56	57,03
Hom	1,62	5,45	1,86	8,39	65,42
Ch	1,16	5,16	1,88	7,95	73,37
Al	1,82	4,43	5,46	6,83	80,20
Eu	1,06	4,43	5,46	6,83	87,03
Ag	1,06	2,00	0,58	3,08	90,12

*Group 8*

Average similarity: 69,34

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	4,30	18,62	8,84	26,86	26,86
Ro	2,11	9,32	8,78	13,45	40,30
Hom	2,21	8,85	7,07	12,76	53,06
Al	2,65	8,23	3,43	11,87	64,93
Ch	2,34	7,98	1,59	11,51	76,44
Br	2,04	5,80	1,30	8,36	84,80
Ag	1,43	4,21	3,10	6,07	90,87

*Group 9*

Average similarity: 73,56

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	4,35	18,33	19,06	24,91	24,91
Hom	3,24	13,09	6,87	17,80	42,72
Ch	2,71	10,51	7,82	14,29	57,00
Al	2,33	8,31	6,81	11,30	68,30
Br	1,80	5,73	1,46	7,79	76,09
Ro	1,43	4,37	2,80	5,94	82,03
Ag	0,83	3,34	14,68	4,54	86,57
Eu	1,00	3,34	14,68	4,54	91,11

*Group 10*

Average similarity: 73,82

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mig	3,93	15,23	18,25	20,64	20,64
Hom	3,88	13,08	4,11	17,73	38,36
Al	2,40	8,39	9,53	11,37	49,73
Ag	2,27	7,77	4,01	10,53	60,26
Br	2,08	6,17	2,63	8,36	68,62
Ro	1,85	5,28	6,56	7,15	75,77
Op	1,36	4,99	15,91	6,77	82,54
Eu	1,06	3,52	2,93	4,77	87,31
Ch	1,40	3,50	3,20	4,74	92,05

*Groups 1 & 2*

Average dissimilarity = 24,40

Species	Group 1		Group 2		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Op	1,13	2,52	3,22	1,49	13,18	13,18
Aph	2,92	3,59	2,31	1,20	9,46	22,64

Eu	3,04	3,31	1,88	1,11	7,69	30,33
Ro	0,23	0,90	1,83	1,42	7,49	37,82
Br	0,96	1,75	1,74	1,52	7,11	44,93
Do	0,00	0,69	1,58	15,18	6,47	51,41
Hom	0,77	1,16	1,54	1,46	6,31	57,72
Ch	0,23	0,77	1,53	1,11	6,29	64,01
Mac	1,06	0,46	1,42	1,22	5,82	69,83
Met	0,37	0,46	1,31	0,91	5,35	75,18
Ag	0,46	0,37	1,30	0,91	5,31	80,49
He	1,39	1,50	1,26	1,76	5,18	85,67
Al	3,40	3,75	1,19	1,12	4,88	90,55

*Groups 1 & 3*

Average dissimilarity = 33,09

Species	Group 1	Group 3	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Op	1,13	3,08	3,87	2,05	11,70	11,70
Br	0,96	2,76	3,56	4,62	10,75	22,45
Ch	0,23	1,94	3,36	4,68	10,15	32,60
Ro	0,23	1,93	3,29	3,69	9,93	42,53
Ag	0,46	1,42	2,70	1,05	8,17	50,70
Aph	2,92	4,12	2,62	1,48	7,92	58,62
Mig	2,77	3,91	2,22	3,68	6,70	65,32
Eu	3,04	3,89	1,76	1,02	5,31	70,62
Do	0,00	0,88	1,70	1,01	5,13	75,75
Al	3,40	4,17	1,63	1,52	4,94	80,69
Hom	0,77	0,46	1,53	1,20	4,62	85,31
He	1,39	1,76	1,48	1,46	4,46	89,77
Mac	1,06	0,60	1,07	1,20	3,23	93,00

*Groups 2 & 3*

Average dissimilarity = 20,86

Species	Group 2	Group 3	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Ag	0,37	1,42	2,39	0,99	11,45	11,45
Ch	0,77	1,94	2,12	1,59	10,14	21,59
Ro	0,90	1,93	1,93	1,40	9,25	30,84
Br	1,75	2,76	1,85	1,65	8,85	39,68
Aph	3,59	4,12	1,72	1,41	8,25	47,93
Hom	1,16	0,46	1,47	1,53	7,05	54,98
Al	3,75	4,17	1,21	1,48	5,80	60,78
Eu	3,31	3,89	1,20	1,08	5,76	66,55

Do	0,69	0,88	1,17	1,22	5,63	72,17
Mig	3,27	3,91	1,12	1,69	5,37	77,54
He	1,50	1,76	0,99	1,20	4,76	82,31
Op	2,52	3,08	0,99	1,79	4,75	87,05
Met	0,46	0,23	0,94	0,92	4,52	91,57

*Groups 1 & 4*

Average dissimilarity = 34,82

Species	Group 1	Group 4	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Ch	0,23	2,69	5,41	4,49	15,53	15,53
Br	0,96	2,39	3,01	1,90	8,64	24,17
Ro	0,23	1,36	2,39	1,50	6,87	31,04
Mac	1,06	0,00	2,38	2,96	6,83	37,87
Do	0,00	1,06	2,30	4,57	6,61	44,48
Mig	2,77	3,80	2,23	4,12	6,42	50,89
Eu	3,04	2,33	2,10	2,27	6,03	56,92
Ag	0,46	1,07	1,99	1,18	5,70	62,62
Al	3,40	3,16	1,98	1,68	5,69	68,32
Op	1,13	1,92	1,86	0,95	5,35	73,67
Aph	2,92	3,17	1,82	1,35	5,23	78,89
Hor	0,00	0,83	1,82	4,92	5,22	84,12
Hom	0,77	0,92	1,71	1,25	4,90	89,01
He	1,39	0,92	1,35	1,18	3,87	92,88

*Groups 2 & 4*

Average dissimilarity = 24,48

Species	Group 2	Group 4	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Ch	0,77	2,69	3,81	2,18	15,57	15,57
Al	3,75	3,16	2,05	1,42	8,39	23,95
Eu	3,31	2,33	1,93	1,39	7,90	31,85
Br	1,75	2,39	1,84	1,73	7,52	39,37
Ag	0,37	1,07	1,83	1,35	7,46	46,83
Aph	3,59	3,17	1,78	1,20	7,27	54,10
Ro	0,90	1,36	1,72	1,36	7,03	61,14
Hor	0,00	0,83	1,63	4,83	6,64	67,78
He	1,50	0,92	1,24	1,89	5,05	72,83
Met	0,46	0,46	1,22	1,53	5,00	77,82
Op	2,52	1,92	1,22	1,69	4,97	82,80
Hom	1,16	0,92	1,14	0,93	4,66	87,45
Mig	3,27	3,80	1,05	1,72	4,28	91,74

*Groups 3 & 4*

Average dissimilarity = 23,51

Species	Group 3	Group 4	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Eu	3,89	2,33	2,69	6,61	11,45	11,45
Ag	1,42	1,07	2,50	1,41	10,63	22,08
Al	4,17	3,16	2,21	1,51	9,38	31,46
Op	3,08	1,92	2,04	2,96	8,67	40,13
Aph	4,12	3,17	2,01	1,35	8,55	48,69
He	1,76	0,92	1,54	1,44	6,56	55,24
Ro	1,93	1,36	1,44	1,44	6,14	61,38
Do	0,88	1,06	1,35	1,69	5,76	67,14
Hom	0,46	0,92	1,31	1,04	5,56	72,71
Ch	1,94	2,69	1,28	1,49	5,46	78,16
Br	2,76	2,39	1,24	1,08	5,29	83,45
Mac	0,60	0,00	1,08	1,21	4,58	88,02
Hor	0,23	0,83	1,03	1,51	4,39	92,42

*Groups 1 & 5*

Average dissimilarity = 39,18

Species	Group 1	Group 5	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Eu	3,04	0,69	5,67	1,87	14,48	14,48
Ro	0,23	2,12	4,48	3,55	11,44	25,92
Ch	0,23	2,06	4,32	2,23	11,03	36,95
Br	0,96	2,38	3,34	5,39	8,53	45,48
Al	3,40	2,48	2,97	1,36	7,57	53,05
Mig	2,77	3,95	2,85	2,31	7,27	60,32
Op	1,13	1,70	2,15	1,14	5,50	65,82
Ag	0,46	0,96	2,12	1,20	5,40	71,22
Aph	2,92	2,50	1,98	1,44	5,05	76,27
Hom	0,77	0,46	1,86	1,15	4,75	81,02
Mac	1,06	0,69	1,41	1,21	3,61	84,63
Mir	0,60	0,00	1,41	1,27	3,60	88,24
He	1,39	1,66	1,33	1,26	3,40	91,64

*Groups 2 & 5*

Average dissimilarity = 31,16

Species	Group 2	Group 5	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Eu	3,31	0,69	5,60	2,00	17,98	17,98
Al	3,75	2,48	3,12	1,29	10,01	27,98

Ch	0,77	2,06	2,98	1,60	9,57	37,55
Ro	0,90	2,12	2,64	1,39	8,48	46,03
Aph	3,59	2,50	2,52	1,24	8,09	54,12
Hom	1,16	0,46	1,81	1,50	5,81	59,93
Ag	0,37	0,96	1,81	1,15	5,80	65,73
Op	2,52	1,70	1,77	1,45	5,68	71,40
Mig	3,27	3,95	1,50	1,41	4,83	76,23
Do	0,69	0,46	1,46	16,30	4,69	80,92
Br	1,75	2,38	1,35	1,11	4,34	85,26
Met	0,46	0,23	1,13	0,94	3,61	88,87
Mac	0,46	0,69	1,12	1,15	3,60	92,48

*Groups 3 & 5*

Average dissimilarity = 27,68

Species	Group 3		Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Eu	3,89	0,69	5,93	2,83	21,42	21,42
Al	4,17	2,48	3,26	1,43	11,77	33,19
Aph	4,12	2,50	2,96	1,66	10,70	43,88
Ag	1,42	0,96	2,57	1,39	9,30	53,18
Op	3,08	1,70	2,53	2,22	9,13	62,31
Do	0,88	0,46	1,61	1,19	5,82	68,13
Ch	1,94	2,06	1,25	2,03	4,51	72,64
Hom	0,46	0,46	1,14	0,84	4,13	76,77
He	1,76	1,66	1,10	1,43	3,97	80,75
Mac	0,60	0,69	1,07	1,28	3,85	84,60
Ro	1,93	2,12	0,87	1,15	3,14	87,74
Mig	3,91	3,95	0,87	1,50	3,14	90,87

*Groups 4 & 5*

Average dissimilarity = 24,67

Species	Group 4		Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Eu	2,33	0,69	3,46	1,52	14,01	14,01
Al	3,16	2,48	2,88	1,45	11,66	25,67
Ro	1,36	2,12	2,00	1,43	8,09	33,76
Aph	3,17	2,50	1,83	1,31	7,40	41,16
Ch	2,69	2,06	1,76	1,28	7,15	48,31
Ag	1,07	0,96	1,72	1,16	6,99	55,30
Do	1,06	0,46	1,65	1,87	6,68	61,98
Hom	0,92	0,46	1,56	1,05	6,32	68,30
He	0,92	1,66	1,43	1,44	5,78	74,07



Br	2,39	2,38	1,42	1,60	5,75	79,82
Mac	0,00	0,69	1,40	1,18	5,66	85,48
Op	1,92	1,70	1,11	1,54	4,49	89,97
Mig	3,80	3,95	0,93	1,17	3,78	93,75

*Groups 1 & 6*

Average dissimilarity = 42,03

Species	Group 1	Group 6	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Eu	3,04	1,03	5,43	1,78	12,93	12,93
Ro	0,23	1,93	4,31	4,68	10,25	23,18
Aph	2,92	1,29	4,10	2,29	9,76	32,93
Br	0,96	2,52	3,99	3,15	9,50	42,43
Al	3,40	2,15	3,91	1,62	9,31	51,74
Ch	0,23	1,57	3,51	1,73	8,35	60,10
Mig	2,77	3,97	3,05	13,80	7,26	67,36
Ag	0,46	0,92	2,30	1,20	5,47	72,82
Mac	1,06	0,23	2,12	1,77	5,04	77,86
Op	1,13	1,13	1,97	1,47	4,68	82,54
Hom	0,77	1,29	1,96	1,32	4,67	87,20
Mir	0,60	0,00	1,52	1,27	3,61	90,81

*Groups 2 & 6*

Average dissimilarity = 33,85

Species	Group 2	Group 6	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Aph	3,59	1,29	5,24	2,52	15,50	15,50
Eu	3,31	1,03	5,23	1,70	15,45	30,95
Al	3,75	2,15	4,02	1,46	11,87	42,82
Op	2,52	1,13	3,12	2,95	9,21	52,03
Ro	0,90	1,93	2,37	1,31	7,01	59,04
Ch	0,77	1,57	2,34	1,32	6,92	65,96
Ag	0,37	0,92	1,95	1,17	5,76	71,72
Br	1,75	2,52	1,79	1,12	5,30	77,02
Mig	3,27	3,97	1,57	3,40	4,64	81,65
He	1,50	1,29	1,03	1,35	3,04	84,69
Hom	1,16	1,29	1,02	1,09	3,03	87,72
Met	0,46	0,00	1,01	0,67	3,00	90,72

*Groups 3 & 6*

Average dissimilarity = 32,36

Species	Group 3		Group 6		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Eu	3,89	1,03	5,62	2,44	17,37	17,37
Aph	4,12	1,29	5,44	3,75	16,81	34,18
Al	4,17	2,15	4,10	1,63	12,66	46,84
Op	3,08	1,13	3,79	4,05	11,70	58,54
Ag	1,42	0,92	2,68	1,16	8,27	66,81
Hom	0,46	1,29	1,89	1,57	5,83	72,64
Do	0,88	0,23	1,54	1,05	4,76	77,40
He	1,76	1,29	1,39	1,36	4,30	81,70
Mac	0,60	0,23	1,03	1,16	3,19	84,89
Ch	1,94	1,57	0,93	0,89	2,86	87,75
Br	2,76	2,52	0,89	1,42	2,75	90,51

*Groups 4 & 6*

Average dissimilarity = 28,20

Species	Group 4		Group 6		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Aph	3,17	1,29	4,06	2,84	14,38	14,38
Al	3,16	2,15	3,43	1,50	12,16	26,54
Eu	2,33	1,03	3,04	1,28	10,80	37,34
Ch	2,69	1,57	2,34	1,43	8,30	45,64
Ag	1,07	0,92	2,12	1,39	7,52	53,15
Ro	1,36	1,93	1,84	1,69	6,53	59,68
Do	1,06	0,23	1,74	1,94	6,17	65,85
Op	1,92	1,13	1,69	1,64	6,00	71,84
Br	2,39	2,52	1,64	1,33	5,80	77,64
Hom	0,92	1,29	1,58	1,05	5,59	83,23
Hor	0,83	0,37	1,42	1,91	5,05	88,28
He	0,92	1,29	1,13	1,21	3,99	92,27

*Groups 5 & 6*

Average dissimilarity = 25,19

Species	Group 5		Group 6		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Al	2,48	2,15	3,09	1,22	12,26	12,26
Aph	2,50	1,29	2,84	1,84	11,26	23,52
Eu	0,69	1,03	2,54	1,13	10,07	33,59
Hom	0,46	1,29	2,37	1,49	9,40	42,99
Ag	0,96	0,92	2,20	1,40	8,72	51,71

Ch	2,06	1,57	2,04	1,49	8,11	59,81
Op	1,70	1,13	1,62	1,18	6,44	66,25
Mac	0,69	0,23	1,40	1,19	5,57	71,82
Do	0,46	0,23	1,31	0,94	5,19	77,01
He	1,66	1,29	1,23	1,26	4,87	81,88
Hor	0,46	0,37	1,21	1,45	4,81	86,69
Ro	2,12	1,93	0,97	1,48	3,86	90,55

*Groups 1 & 7*

Average dissimilarity = 47,50

Species	Group 1	Group 7	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Aph	2,92	0,77	5,74	2,02	12,08	12,08
Eu	3,04	1,06	5,25	2,21	11,05	23,13
Al	3,40	1,82	4,97	1,53	10,46	33,59
Mig	2,77	4,14	3,68	5,65	7,75	41,35
Br	0,96	2,22	3,33	1,84	7,02	48,37
Ro	0,23	1,52	3,27	1,95	6,88	55,25
Hom	0,77	1,62	2,88	1,22	6,06	61,30
He	1,39	0,46	2,56	1,28	5,40	66,70
Op	1,13	0,88	2,55	1,28	5,36	72,06
Ag	0,46	1,06	2,54	1,26	5,34	77,40
Ch	0,23	1,16	2,53	1,76	5,33	82,74
Mac	1,06	0,46	2,20	1,58	4,63	87,37
Hor	0,00	0,73	1,84	1,33	3,88	91,25

*Groups 2 & 7*

Average dissimilarity = 40,51

Species	Group 2	Group 7	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Aph	3,59	0,77	6,71	2,25	16,57	16,57
Eu	3,31	1,06	5,30	2,62	13,09	29,66
Al	3,75	1,82	4,96	1,43	12,24	41,89
Op	2,52	0,88	3,95	1,71	9,74	51,63
He	1,50	0,46	2,49	1,93	6,14	57,77
Ag	0,37	1,06	2,14	1,18	5,28	63,05
Ro	0,90	1,52	2,14	1,43	5,27	68,32
Mig	3,27	4,14	2,06	3,15	5,09	73,41
Hom	1,16	1,62	1,89	1,18	4,68	78,09
Br	1,75	2,22	1,72	1,21	4,24	82,33
Ch	0,77	1,16	1,66	1,30	4,11	86,44
Hor	0,00	0,73	1,62	1,33	4,01	90,44

*Groups 3 & 7*

Average dissimilarity = 40,29

Species	Group 3	Group 7	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Aph	4,12	0,77	6,70	3,04	16,62	16,62
Eu	3,89	1,06	5,70	5,43	14,14	30,77
Al	4,17	1,82	4,92	1,59	12,21	42,97
Op	3,08	0,88	4,50	2,22	11,18	54,15
Ag	1,42	1,06	2,85	1,38	7,07	61,23
Hom	0,46	1,62	2,66	1,50	6,60	67,83
He	1,76	0,46	2,66	1,68	6,60	74,42
Do	0,88	0,60	1,56	1,26	3,87	78,30
Br	2,76	2,22	1,54	1,67	3,81	82,11
Ch	1,94	1,16	1,53	2,49	3,80	85,90
Ro	1,93	1,52	1,35	1,20	3,35	89,26
Mac	0,60	0,46	1,34	1,35	3,33	92,59

*Groups 4 & 7*

Average dissimilarity = 33,29

Species	Group 4	Group 7	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Aph	3,17	0,77	5,44	2,33	16,33	16,33
Al	3,16	1,82	4,28	1,56	12,86	29,18
Ch	2,69	1,16	3,38	3,05	10,15	39,34
Eu	2,33	1,06	2,95	2,84	8,85	48,19
Op	1,92	0,88	2,62	1,38	7,86	56,05
Hom	0,92	1,62	2,45	1,16	7,35	63,40
Ag	1,07	1,06	2,10	1,31	6,32	69,71
Br	2,39	2,22	1,87	1,42	5,61	75,32
Ro	1,36	1,52	1,73	1,35	5,19	80,51
Do	1,06	0,60	1,21	1,23	3,65	84,16
He	0,92	0,46	1,17	0,88	3,51	87,66
Hor	0,83	0,73	1,08	1,29	3,25	90,91

*Groups 5 & 7*

Average dissimilarity = 33,81

Species	Group 5	Group 7	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Aph	2,50	0,77	4,28	1,70	12,65	12,65
Al	2,48	1,82	3,68	1,22	10,89	23,55
Hom	0,46	1,62	3,34	1,39	9,88	33,43
He	1,66	0,46	2,93	2,12	8,68	42,10

Op	1,70	0,88	2,74	1,42	8,10	50,21
Eu	0,69	1,06	2,53	3,68	7,49	57,70
Ch	2,06	1,16	2,45	1,69	7,23	64,93
Ag	0,96	1,06	2,12	1,27	6,27	71,20
Ro	2,12	1,52	1,92	1,15	5,69	76,89
Mac	0,69	0,46	1,68	1,18	4,96	81,85
Do	0,46	0,60	1,63	1,30	4,83	86,68
Br	2,38	2,22	1,52	2,47	4,51	91,19

*Groups 6 & 7*

Average dissimilarity = 27,04

Species	Group 6		Group 7		Contrib%	Cum. %
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Al	2,15	1,82	3,49	1,14	12,91	12,91
Ag	0,92	1,06	2,52	1,30	9,31	22,22
Eu	1,03	1,06	2,38	1,72	8,79	31,01
He	1,29	0,46	2,29	1,31	8,46	39,47
Op	1,13	0,88	2,12	1,49	7,84	47,31
Hom	1,29	1,62	2,10	1,23	7,78	55,09
Aph	1,29	0,77	2,00	1,45	7,40	62,49
Ch	1,57	1,16	1,90	1,98	7,04	69,53
Br	2,52	2,22	1,78	1,46	6,60	76,13
Hor	0,37	0,73	1,58	1,05	5,84	81,97
Ro	1,93	1,52	1,50	0,91	5,56	87,53
Mac	0,23	0,46	1,42	0,96	5,24	92,77

*Groups 1 & 8*

Average dissimilarity = 48,78

Species	Group 1		Group 8		Contrib%	Cum. %
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Eu	3,04	0,23	6,92	3,05	14,19	14,19
Ch	0,23	2,34	5,27	2,01	10,81	25,00
Ro	0,23	2,11	4,64	4,31	9,52	34,52
Aph	2,92	1,32	4,34	1,35	8,90	43,42
Mig	2,77	4,30	3,73	4,31	7,64	51,06
Hom	0,77	2,21	3,59	1,67	7,36	58,42
Br	0,96	2,04	3,07	1,60	6,30	64,72
Al	3,40	2,65	2,85	1,30	5,83	70,56
Ag	0,46	1,43	2,75	1,57	5,64	76,20
Op	1,13	0,60	2,31	1,53	4,74	80,95
Mac	1,06	0,23	2,14	1,63	4,38	85,33
He	1,39	0,90	2,13	1,22	4,38	89,70

Hor	0,00	0,69	1,62	1,12	3,33	93,03
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*Groups 2 & 8*

Average dissimilarity = 42,75

Species	Group 2	Group 8	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Eu	3,31	0,23	6,76	3,35	15,82	15,82
Aph	3,59	1,32	5,16	1,47	12,06	27,88
Op	2,52	0,60	4,27	2,85	9,98	37,86
Ch	0,77	2,34	3,76	1,62	8,78	46,64
Al	3,75	2,65	3,00	1,23	7,02	53,66
Ro	0,90	2,11	2,72	1,50	6,36	60,02
Ag	0,37	1,43	2,48	1,66	5,80	65,82
Hom	1,16	2,21	2,41	1,61	5,63	71,44
Mig	3,27	4,30	2,21	2,41	5,17	76,61
Br	1,75	2,04	2,13	1,65	4,98	81,60
He	1,50	0,90	1,65	1,00	3,85	85,45
Do	0,69	0,00	1,51	9,81	3,54	88,99
Hor	0,00	0,69	1,44	1,13	3,37	92,36

*Groups 3 & 8*

Average dissimilarity = 38,90

Species	Group 3	Group 8	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Eu	3,89	0,23	6,95	6,18	17,87	17,87
Aph	4,12	1,32	5,34	1,88	13,73	31,60
Op	3,08	0,60	4,76	3,55	12,22	43,82
Hom	0,46	2,21	3,32	2,05	8,53	52,35
Al	4,17	2,65	3,14	1,36	8,06	60,41
Ag	1,42	1,43	2,64	1,58	6,78	67,19
He	1,76	0,90	1,91	1,10	4,91	72,10
Ch	1,94	2,34	1,83	5,02	4,71	76,80
Br	2,76	2,04	1,82	1,11	4,69	81,49
Do	0,88	0,00	1,63	1,01	4,20	85,70
Hor	0,23	0,69	1,14	1,13	2,94	88,64
Mig	3,91	4,30	1,03	1,50	2,64	91,28

*Groups 4 & 8*

Average dissimilarity = 33,35

Species	Group 4	Group 8	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Eu	2,33	0,23	4,52	3,82	13,56	13,56
Aph	3,17	1,32	4,04	1,36	12,13	25,68
Hom	0,92	2,21	2,92	1,33	8,77	34,45
Op	1,92	0,60	2,85	2,13	8,55	43,00
Al	3,16	2,65	2,77	1,37	8,31	51,30
Br	2,39	2,04	2,21	1,37	6,63	57,93
Do	1,06	0,00	2,21	4,28	6,62	64,55
Ro	1,36	2,11	1,94	1,37	5,82	70,36
Ag	1,07	1,43	1,90	1,31	5,69	76,06
Ch	2,69	2,34	1,87	1,58	5,61	81,67
He	0,92	0,90	1,44	1,45	4,33	85,99
Mig	3,80	4,30	1,16	1,14	3,49	89,48
Hor	0,83	0,69	1,12	1,33	3,36	92,84

*Groups 5 & 8*

Average dissimilarity = 29,88

Species	Group 5	Group 8	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Hom	0,46	2,21	4,12	1,86	13,79	13,79
Aph	2,50	1,32	3,26	1,22	10,91	24,70
Al	2,48	2,65	2,84	1,20	9,51	34,21
Op	1,70	0,60	2,60	1,37	8,70	42,90
Ch	2,06	2,34	2,11	1,18	7,05	49,95
He	1,66	0,90	2,02	1,14	6,75	56,71
Ag	0,96	1,43	1,98	1,52	6,62	63,33
Br	2,38	2,04	1,95	1,35	6,53	69,86
Eu	0,69	0,23	1,66	0,85	5,57	75,43
Mac	0,69	0,23	1,39	1,13	4,64	80,07
Mig	3,95	4,30	1,25	1,51	4,17	84,23
Hor	0,46	0,69	1,23	1,17	4,13	88,37
Do	0,46	0,00	1,10	0,66	3,67	92,04

*Groups 6 & 8*

Average dissimilarity = 26,41

Species	Group 6	Group 8	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Al	2,15	2,65	3,17	1,27	11,99	11,99
Ch	1,57	2,34	2,84	1,92	10,75	22,74

Ag	0,92	1,43	2,34	1,33	8,88	31,62
Hom	1,29	2,21	2,32	1,31	8,77	40,39
Aph	1,29	1,32	2,26	1,42	8,56	48,96
Eu	1,03	0,23	2,24	0,97	8,49	57,45
Br	2,52	2,04	2,23	1,19	8,44	65,89
He	1,29	0,90	1,87	1,16	7,10	72,99
Op	1,13	0,60	1,60	1,12	6,08	79,06
Hor	0,37	0,69	1,58	1,17	5,97	85,03
Ne	0,00	0,46	1,05	1,33	3,99	89,03
Mig	3,97	4,30	0,89	1,04	3,37	92,40

*Groups 7 & 8*

Average dissimilarity = 31,20

Species	Group 7		Group 8		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Al	1,82	2,65	3,95	1,40	12,65	12,65
Ch	1,16	2,34	3,33	1,68	10,68	23,32
Aph	0,77	1,32	2,80	1,27	8,98	32,31
Br	2,22	2,04	2,52	1,57	8,08	40,39
Ag	1,06	1,43	2,30	1,44	7,37	47,76
Hom	1,62	2,21	2,23	1,31	7,13	54,89
Eu	1,06	0,23	2,10	1,81	6,74	61,63
Op	0,88	0,60	1,90	1,22	6,09	67,72
He	0,46	0,90	1,88	1,49	6,02	73,74
Ro	1,52	2,11	1,71	0,93	5,49	79,23
Hor	0,73	0,69	1,62	1,23	5,18	84,41
Do	0,60	0,00	1,56	1,15	5,02	89,42
Mac	0,46	0,23	1,33	0,89	4,28	93,70

*Groups 1 & 9*

Average dissimilarity = 46,49

Species	Group 1		Group 9		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Ch	0,23	2,71	6,14	3,61	13,20	13,20
Hom	0,77	3,24	6,04	2,97	12,99	26,19
Aph	2,92	0,69	5,43	2,64	11,68	37,87
Eu	3,04	1,00	4,96	2,37	10,66	48,53
Mig	2,77	4,35	3,85	2,58	8,29	56,82
Ro	0,23	1,43	2,87	1,72	6,17	62,99
Al	3,40	2,33	2,84	1,69	6,10	69,09
Br	0,96	1,80	2,46	1,82	5,29	74,38
Op	1,13	0,69	2,26	1,37	4,86	79,24



Mac	1,06	0,23	2,12	1,69	4,57	83,81
Ag	0,46	0,83	1,87	2,50	4,03	87,84
He	1,39	0,83	1,64	1,22	3,54	91,37

*Groups 2 & 9*

Average dissimilarity = 39,82

Species	Group 2		Group 9		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Aph	3,59	0,69	6,40	2,79	16,07	16,07
Eu	3,31	1,00	5,05	2,89	12,69	28,76
Hom	1,16	3,24	4,57	2,81	11,47	40,24
Ch	0,77	2,71	4,28	1,97	10,75	50,99
Op	2,52	0,69	4,07	2,57	10,22	61,21
Al	3,75	2,33	3,20	1,63	8,03	69,24
Mig	3,27	4,35	2,31	1,58	5,81	75,04
Ro	0,90	1,43	1,92	1,37	4,83	79,88
Br	1,75	1,80	1,69	1,35	4,25	84,13
He	1,50	0,83	1,51	1,75	3,79	87,92
Ag	0,37	0,83	1,44	1,68	3,62	91,54

*Groups 3 & 9*

Average dissimilarity = 39,17

Species	Group 3		Group 9		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Aph	4,12	0,69	6,45	4,01	16,46	16,46
Eu	3,89	1,00	5,48	7,77	13,99	30,45
Hom	0,46	3,24	5,22	3,33	13,33	43,78
Op	3,08	0,69	4,60	3,29	11,73	55,51
Al	4,17	2,33	3,44	1,88	8,77	64,29
Ag	1,42	0,83	2,27	1,08	5,79	70,08
Br	2,76	1,80	1,94	1,05	4,95	75,03
He	1,76	0,83	1,81	1,38	4,61	79,64
Ch	1,94	2,71	1,50	1,25	3,82	83,46
Do	0,88	0,46	1,40	1,06	3,58	87,03
Ro	1,93	1,43	1,33	1,14	3,40	90,43

*Groups 4 & 9*

Average dissimilarity = 31,53

Species	Group 4		Group 9		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Aph	3,17	0,69	5,21	3,09	16,51	16,51
Hom	0,92	3,24	5,04	2,14	15,99	32,50

Eu	2,33	1,00	2,83	2,96	8,97	41,47
Op	1,92	0,69	2,64	1,78	8,38	49,85
Al	3,16	2,33	2,61	1,37	8,28	58,14
Br	2,39	1,80	2,21	1,41	7,02	65,16
Ag	1,07	0,83	1,72	3,33	5,44	70,60
Mig	3,80	4,35	1,58	1,38	5,03	75,62
Ro	1,36	1,43	1,57	1,22	4,97	80,59
Ch	2,69	2,71	1,42	1,45	4,51	85,10
Hor	0,83	0,23	1,29	1,50	4,09	89,19
Do	1,06	0,46	1,27	1,26	4,04	93,23

*Groups 5 & 9*

Average dissimilarity = 33,31

Species	Group 5		Group 9		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Hom	0,46	3,24	6,39	2,89	19,18	19,18
Aph	2,50	0,69	4,09	2,16	12,27	31,45
Al	2,48	2,33	2,76	1,46	8,30	39,75
Op	1,70	0,69	2,52	1,39	7,57	47,31
Eu	0,69	1,00	2,38	2,04	7,15	54,46
Ch	2,06	2,71	2,18	1,37	6,56	61,02
Ro	2,12	1,43	1,98	1,27	5,94	66,96
He	1,66	0,83	1,89	1,92	5,67	72,62
Br	2,38	1,80	1,70	0,90	5,09	77,71
Mig	3,95	4,35	1,62	1,47	4,87	82,58
Ag	0,96	0,83	1,56	1,81	4,67	87,25
Do	0,46	0,46	1,42	1,35	4,27	91,52

*Groups 6 & 9*

Average dissimilarity = 27,21

Species	Group 6		Group 9		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Hom	1,29	3,24	4,72	2,56	17,33	17,33
Al	2,15	2,33	2,80	1,20	10,30	27,63
Ch	1,57	2,71	2,74	1,36	10,08	37,71
Eu	1,03	1,00	2,23	1,38	8,20	45,91
Br	2,52	1,80	2,19	0,97	8,06	53,96
Ag	0,92	0,83	1,81	1,45	6,66	60,62
Ro	1,93	1,43	1,74	1,33	6,41	67,03
Op	1,13	0,69	1,67	1,25	6,13	73,17
Mig	3,97	4,35	1,58	1,78	5,82	78,99
Aph	1,29	0,69	1,58	1,25	5,80	84,79

He	1,29	0,83	1,39	1,31	5,12	89,92
Hor	0,37	0,23	1,05	0,93	3,85	93,77

*Groups 7 & 9*

Average dissimilarity = 29,41

Species	Group 7	Group 9	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Hom	1,62	3,24	4,08	1,78	13,89	13,89
Ch	1,16	2,71	3,86	2,31	13,11	27,00
Al	1,82	2,33	3,69	1,44	12,54	39,54
Br	2,22	1,80	2,43	1,37	8,28	47,82
Op	0,88	0,69	2,02	1,25	6,88	54,70
Ag	1,06	0,83	1,92	1,76	6,52	61,22
Aph	0,77	0,69	1,81	1,17	6,14	67,36
Ro	1,52	1,43	1,80	1,26	6,13	73,49
Hor	0,73	0,23	1,63	1,36	5,55	79,04
Mig	4,14	4,35	1,52	1,69	5,16	84,20
Mac	0,46	0,23	1,37	0,92	4,64	88,84
Do	0,60	0,46	1,19	1,06	4,06	92,90

*Groups 8 & 9*

Average dissimilarity = 26,55

Species	Group 8	Group 9	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Al	2,65	2,33	2,68	1,37	10,11	10,11
Aph	1,32	0,69	2,56	1,31	9,63	19,74
Hom	2,21	3,24	2,54	1,86	9,58	29,32
Br	2,04	1,80	2,37	1,10	8,91	38,23
Ch	2,34	2,71	2,21	1,41	8,31	46,54
Eu	0,23	1,00	1,95	1,23	7,34	53,88
Ro	2,11	1,43	1,92	1,23	7,22	61,10
Ag	1,43	0,83	1,58	1,21	5,94	67,04
Mig	4,30	4,35	1,56	1,62	5,87	72,91
He	0,90	0,83	1,54	1,77	5,82	78,73
Hor	0,69	0,23	1,44	1,11	5,41	84,14
Op	0,60	0,69	1,41	1,18	5,29	89,43
Do	0,00	0,46	1,06	1,32	3,99	93,42

*Groups 1 & 10*

Average dissimilarity = 45,36

Species	Group 1	Group 10	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				

Hom	0,77	3,88	7,03	3,04	15,49	15,49
Eu	3,04	1,06	4,53	2,39	9,98	25,47
Ag	0,46	2,27	4,25	1,99	9,37	34,84
Aph	2,92	1,23	3,94	1,60	8,69	43,53
Ro	0,23	1,85	3,67	2,04	8,08	51,61
He	1,39	0,00	3,25	2,25	7,17	58,78
Ch	0,23	1,40	2,67	1,46	5,88	64,66
Mig	2,77	3,93	2,62	3,14	5,79	70,45
Br	0,96	2,08	2,46	1,44	5,43	75,88
Al	3,40	2,40	2,22	1,58	4,89	80,77
Do	0,00	0,83	1,91	4,98	4,21	84,98
Mac	1,06	0,23	1,90	1,81	4,20	89,18
Met	0,37	0,65	1,72	0,94	3,79	92,97

*Groups 2 & 10*

Average dissimilarity = 38,31

Species	Group 2	Group 10	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Hom	1,16	3,88	5,54	2,75	14,45	14,45
Aph	3,59	1,23	4,90	1,85	12,80	27,25
Eu	3,31	1,06	4,65	2,93	12,14	39,39
Ag	0,37	2,27	3,96	2,38	10,33	49,72
He	1,50	0,00	3,12	4,27	8,13	57,85
Al	3,75	2,40	2,76	1,76	7,20	65,05
Op	2,52	1,36	2,41	3,32	6,28	71,33
Ro	0,90	1,85	2,20	1,14	5,75	77,08
Ch	0,77	1,40	1,95	1,33	5,09	82,17
Met	0,46	0,65	1,61	0,93	4,21	86,38
Br	1,75	2,08	1,57	1,36	4,10	90,48

*Groups 3 & 10*

Average dissimilarity = 38,75

Species	Group 3	Group 10	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Hom	0,46	3,88	6,04	3,30	15,59	15,59
Aph	4,12	1,23	5,14	2,42	13,26	28,86
Eu	3,89	1,06	5,10	8,45	13,16	42,02
He	1,76	0,00	3,20	2,67	8,25	50,27
Al	4,17	2,40	3,13	2,32	8,08	58,35
Op	3,08	1,36	3,11	4,61	8,04	66,38
Ag	1,42	2,27	3,10	2,45	8,01	74,39
Ch	1,94	1,40	1,54	2,43	3,97	78,36

Br	2,76	2,08	1,49	1,03	3,84	82,21
Ro	1,93	1,85	1,33	1,73	3,44	85,65
Do	0,88	0,83	1,27	1,43	3,29	88,94
Met	0,23	0,65	1,26	0,88	3,25	92,19

*Groups 4 & 10*

Average dissimilarity = 31,99

Species	Group 4	Group 10	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Hom	0,92	3,88	5,95	2,31	18,61	18,61
Aph	3,17	1,23	3,82	1,69	11,95	30,56
Ch	2,69	1,40	2,65	1,53	8,29	38,86
Eu	2,33	1,06	2,57	3,82	8,03	46,89
Ag	1,07	2,27	2,53	1,15	7,90	54,80
Al	3,16	2,40	2,13	1,25	6,66	61,45
He	0,92	0,00	1,92	2,11	6,01	67,46
Ro	1,36	1,85	1,83	1,28	5,71	73,17
Br	2,39	2,08	1,80	1,29	5,62	78,79
Met	0,46	0,65	1,59	1,39	4,98	83,77
Hor	0,83	0,23	1,20	1,50	3,77	87,54
Op	1,92	1,36	1,11	1,61	3,46	91,00

*Groups 5 & 10*

Average dissimilarity = 34,84

Species	Group 5	Group 10	Av.Diss	Diss/SD	Contrib%	Cum.%
	Av.Abund	Av.Abund				
Hom	0,46	3,88	7,28	2,98	20,88	20,88
He	1,66	0,00	3,54	4,71	10,16	31,05
Aph	2,50	1,23	2,93	1,41	8,41	39,45
Ag	0,96	2,27	2,84	1,59	8,15	47,60
Al	2,48	2,40	2,42	1,62	6,95	54,55
Eu	0,69	1,06	2,26	3,35	6,49	61,04
Ch	2,06	1,40	2,13	1,32	6,11	67,15
Ro	2,12	1,85	1,65	1,48	4,73	71,88
Do	0,46	0,83	1,58	3,35	4,53	76,41
Met	0,23	0,65	1,50	0,91	4,31	80,72
Br	2,38	2,08	1,47	1,18	4,21	84,93
Mac	0,69	0,23	1,28	1,19	3,69	88,62
Op	1,70	1,36	1,13	1,10	3,23	91,85

*Groups 6 & 10*

Average dissimilarity = 31,22

Species	Group 6	Group 10	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Hom	1,29	3,88	5,78	2,60	18,51	18,51
Ag	0,92	2,27	3,39	1,54	10,86	29,37
He	1,29	0,00	3,00	2,50	9,61	38,98
Al	2,15	2,40	2,67	1,66	8,54	47,52
Eu	1,03	1,06	2,11	1,80	6,76	54,28
Ch	1,57	1,40	1,88	1,53	6,02	60,31
Br	2,52	2,08	1,82	1,14	5,83	66,14
Aph	1,29	1,23	1,76	1,47	5,64	71,78
Ro	1,93	1,85	1,60	1,91	5,12	76,90
Met	0,00	0,65	1,40	0,67	4,47	81,37
Do	0,23	0,83	1,32	1,54	4,24	85,61
Mir	0,00	0,46	1,01	1,33	3,24	88,84
Hor	0,37	0,23	0,98	0,94	3,15	92,00

*Groups 7 & 10*

Average dissimilarity = 30,87

Species	Group 7	Group 10	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Hom	1,62	3,88	5,12	1,86	16,60	16,60
Al	1,82	2,40	3,48	1,86	11,28	27,88
Ag	1,06	2,27	3,15	1,46	10,20	38,08
Aph	0,77	1,23	2,45	1,31	7,93	46,01
Op	0,88	1,36	2,13	1,84	6,90	52,91
Ro	1,52	1,85	2,03	1,42	6,58	59,49
Br	2,22	2,08	2,03	1,50	6,57	66,06
Ch	1,16	1,40	1,56	1,47	5,06	71,12
Hor	0,73	0,23	1,52	1,37	4,92	76,04
Met	0,00	0,65	1,44	0,66	4,68	80,71
Mac	0,46	0,23	1,30	0,98	4,20	84,92
He	0,46	0,00	1,05	1,32	3,39	88,31
Mir	0,00	0,46	1,05	1,32	3,39	91,70

*Groups 8 & 10*

Average dissimilarity = 31,33

Species	Group 8	Group 10	Av.Diss	Diss/SD	Contrib%	Cum. %
	Av.Abund	Av.Abund				
Hom	2,21	3,88	3,62	1,84	11,55	11,55
Ch	2,34	1,40	2,78	1,37	8,88	20,43

Aph	1,32	1,23	2,49	1,19	7,94	28,37
Al	2,65	2,40	2,35	1,58	7,49	35,86
Ag	1,43	2,27	2,22	1,33	7,08	42,94
Br	2,04	2,08	2,22	1,31	7,08	50,03
He	0,90	0,00	1,91	1,24	6,09	56,11
Eu	0,23	1,06	1,91	1,70	6,08	62,20
Do	0,00	0,83	1,83	4,59	5,84	68,03
Op	0,60	1,36	1,77	1,34	5,65	73,68
Ro	2,11	1,85	1,70	2,17	5,43	79,11
Met	0,00	0,65	1,36	0,66	4,33	83,44
Hor	0,69	0,23	1,34	1,12	4,29	87,72
Mig	4,30	3,93	1,20	1,19	3,83	91,56

### Groups 9 & 10

Average dissimilarity = 27,51

Species	Group 9		Group 10		Contrib%	Cum.%
	Av.Abund	Av.Abund	Av.Diss	Diss/SD		
Ag	0,83	2,27	3,21	2,62	11,68	11,68
Ch	2,71	1,40	3,18	1,70	11,54	23,22
Hom	3,24	3,88	2,51	1,59	9,13	32,36
Aph	0,69	1,23	2,21	1,35	8,02	40,38
Br	1,80	2,08	1,98	1,16	7,19	47,57
Ro	1,43	1,85	1,94	1,35	7,06	54,63
He	0,83	0,00	1,85	4,58	6,74	61,36
Al	2,33	2,40	1,76	1,17	6,40	67,77
Op	0,69	1,36	1,69	1,29	6,15	73,91
Mig	4,35	3,93	1,60	1,33	5,82	79,74
Met	0,00	0,65	1,37	0,67	4,98	84,71
Mir	0,00	0,46	0,99	1,33	3,60	88,32
Eu	1,00	1,06	0,98	1,39	3,56	91,87

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