

## NEW DATA ON THE ZOOGEOGRAPHY OF PALEARCTIC COCCOIDEA (HOMOPTERA)

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### ABSTRACT

An analysis of zoogeographical data for the Coccoidea of the Palearctic region showed that the largest number of local species was found in the Far-Eastern (639) and Mediterranean subregions. Half of the genera (190) were restricted to one subregion, while 45 were restricted to two subregions. The genera restricted to one subregion contained 293 species, with a further 150 species in the genera shared by only two subregions. There was a clear similarity between the Euro-Siberian, Irano-Turanian and Mediterranean subregions. The number of species in one square kilometre was highest in the Far-Eastern and Mediterranean subregions, whereas Euro-Siberian and Mediterranean plants had a greater richness of scale insect species than plants in the Far-Eastern and Irano-Turanian subregions. The zoogeographical connections in different scale insect families were different and this calls for further studies.

KEY WORDS: Homoptera, Coccoidea, zoogeography, Palearctic region, subregions.

### INTRODUCTION

The zoogeographical distribution pattern of the Coccoidea of the Palearctic region and its subregions was studied by Kozar and Drozdjak (1987). The study was based on the species richness within all the families of the Coccoidea and reviewed the literature. Since then Ben-Dov (1990) has studied the zoogeographical affinities of the mealybugs of the Middle East.

The present paper considers the numbers of local genera and species and relates them to different levels of zoogeographical units (Cox and Moore, 1985; Medvedev, 1985).

### MATERIAL AND METHODS

The analyses were based on Kozar and Walter's (1985) checklist, and the subregions used were those suggested in the map of Emelyanov (1974), whereas the data for the distribution of the species and genera were taken from the Palearctic Catalogue of Coccoidea (F. Kozar, in prep.). The connections between subregions were analysed by Venn diagrams, and the degree of endemism (which, based on our present knowledge, is far from complete) was calculated using the method of Cox and Moore (1985). The similarity between subregions was assessed and classified by the modified cluster method of Sneath and Sokal, as used by Szecsi and Dobrovolszky (1984).

## RESULTS

The Palearctic region contains 1,938 species in 391 genera from 19 families of Coccoidea. Of these genera, 101 are cosmopolitan and 100 are distributed through several subregions. Based on the current incomplete data, "local" genera appear to be distributed as follows: 17 in the Euro-Siberian, 24 in the Irano-Turanian, 51 in the Mediterranean and 98 in the Far-Eastern subregion. Thus almost half of the genera (48.6%) are local (restricted to one subregion) and most of them are monotypic, suggesting that the region and the subregions have an old, well-differentiated endemism at both the generic and the species level (Fig. 1). Further analyses concerning the distribution of genera between two subregions suggest that the number of shared

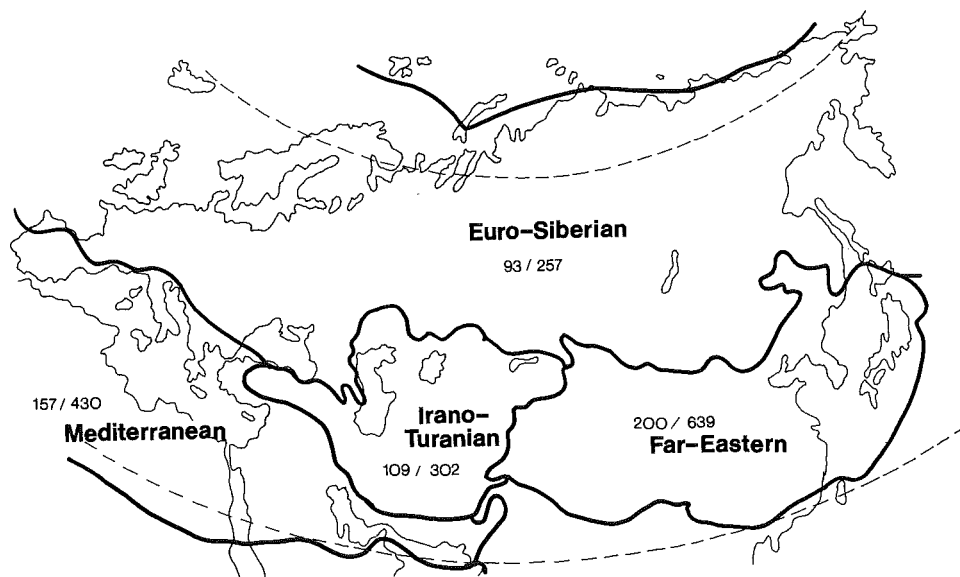


Fig. 1. Total number of the genera of Coccoidea in subregions of the Palearctic region and number of species restricted to each subregion.

genera fluctuated from 5 to 15. The largest number of shared genera (15) was found in the Mediterranean and Irano-Turanian subregions, suggesting a close phylogenetic similarity between these two areas. In addition the number of genera connecting the Euro-Siberian subregion to the other subregions was also 15 (Fig. 2). The number of species in the local genera restricted to one subregion was highest in the Far Eastern and Mediterranean subregions, while the number of species in genera shared by any two subregions was greatest between the Mediterranean and Irano-Turanian subregions (Fig. 3). An analysis of the similarity between the local genera in different families showed that the greatest similarity was between the Euro-Siberian and Irano-Turanian subregions (Fig. 4), while a similar analysis based on the number of species in different families suggested an approximately equal degree of similarity between the Mediterranean, Irano-Turanian and Euro-Siberian subregions (Fig. 5). Wider analyses, including all genera and species in the different families, suggested that the

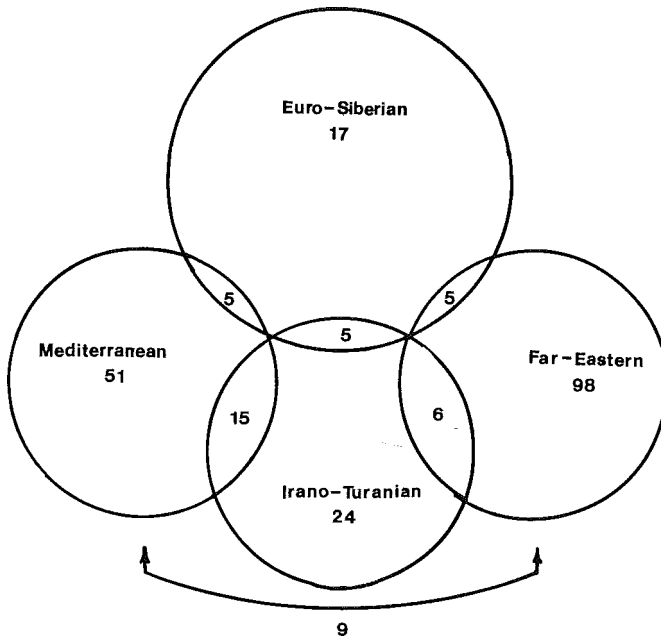


Fig. 2. Number of local and shared genera of Coccoidea in the subregions of the Palearctic region.

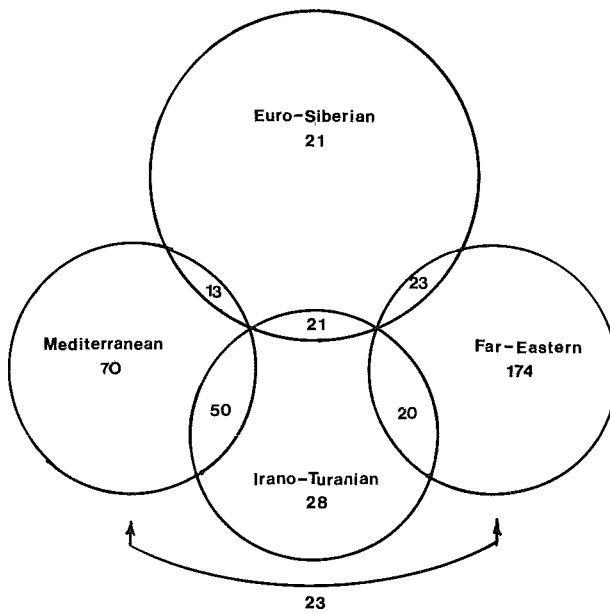


Fig. 3. Number of species in the local and shared genera of Coccoidea in the subregions of the Palearctic region.

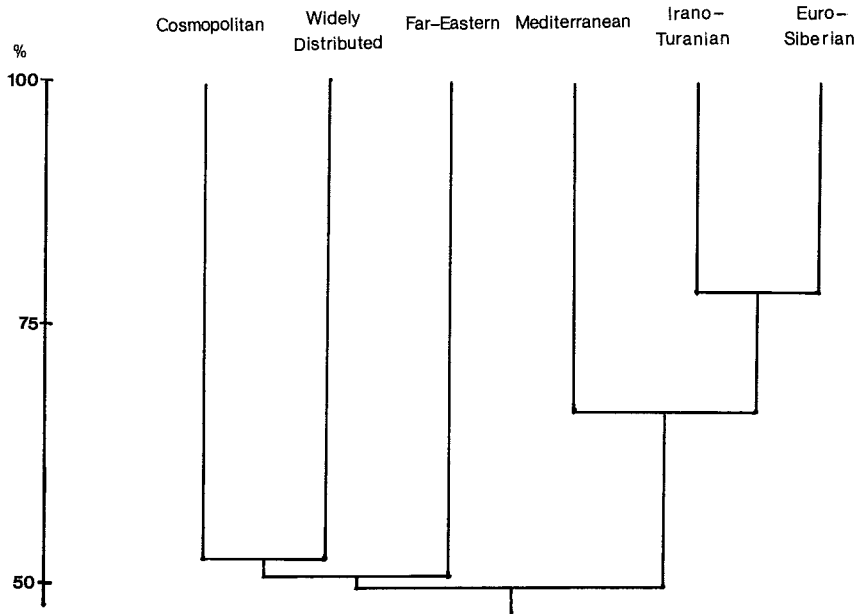


Fig. 4. Similarity of local genera in different families of Coccoidea in the subregions of the Palearctic region.

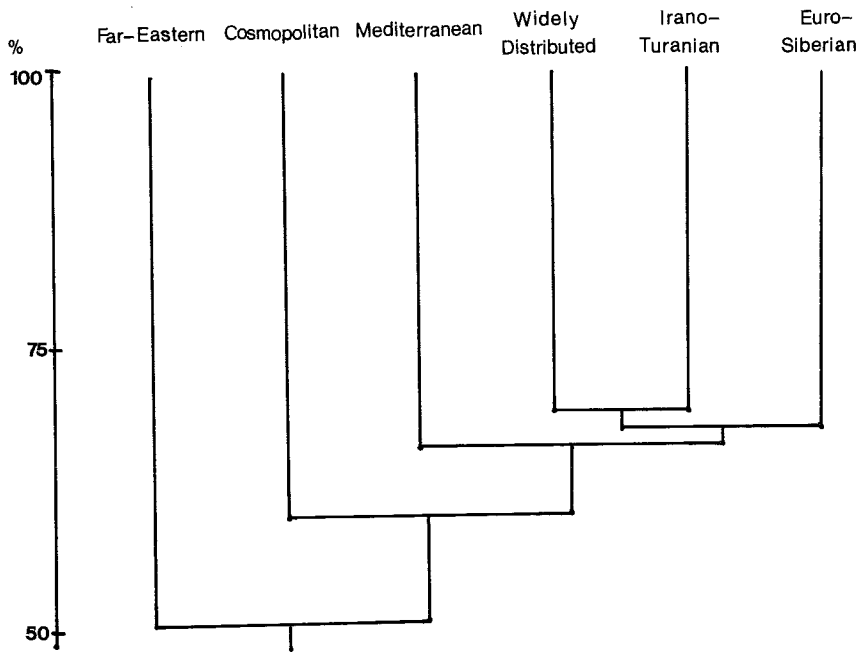


Fig. 5. Similarity of the species number in local genera in different families of Coccoidea in the subregions of the Palearctic region.

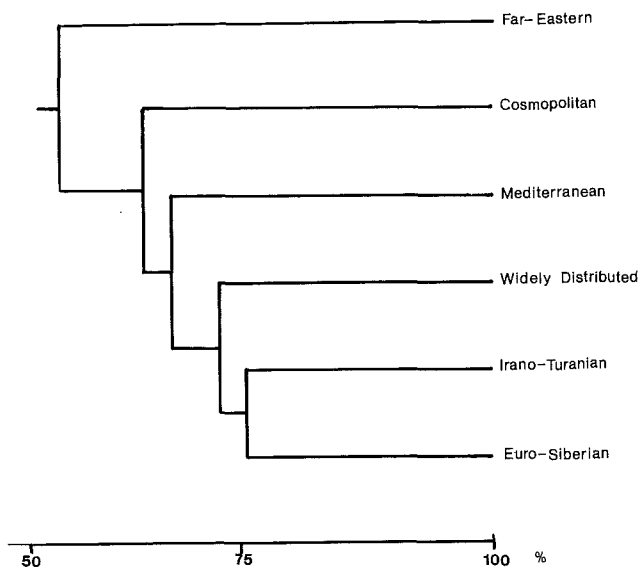


Fig. 6. Similarity of the total number of species in different families of Coccoidea in the subregions of the Palearctic region.

Euro-Siberian and Irano-Turanian subregions were again very similar (Fig. 6). The degree of endemism in the different subregions was also calculated (Table 1).

TABLE 1  
Degree of endemism in the different subregions

Subregion	Endemic genera (%)	Endemic species (%)
Euro-Siberian	18.3	13.3
Mediterranean	32.5	22.2
Irano-Turanian	22.0	15.6
Far Eastern	49.0	33.0

The percentage of endemism for the whole Palearctic region was 74.2 for genera and 89.0 for species, while the ratio of species to genera was 2.8:1 in the Euro-Siberian, 2.7:1 in the Mediterranean, 2.8:1 in the Irano-Turanian, and 3.2:1 in the Far-Eastern subregion (mean of 2.9:1). The mean ratio is intermediate between that for the Middle East (2.0) and California (5.5), given by Ben-Dov (1985) for the Pseudococcidae.

When the richness of species in the different subregions was compared, it was found that, for the whole area of the Far-Eastern, Irano-Turanian and Mediterranean subregions, the average territory per one scale-insect species was 16,000–25,000 km<sup>2</sup>, whereas in the Euro-Siberian region it was 93,000 km<sup>2</sup>; this means that the latter subregion is four times purer than the others. When the richness of scale insect species was compared with that of the flora, a different picture

emerged. The average number of plant species per one scale insect species was 10–12 in the Euro-Siberian and Mediterranean subregions, as compared with 20 in the Irano-Turanian and Far-Eastern subregions.

When the affinities of the different scale insect families between subregions were analysed, different associations were found. The Euro-Siberian and Mediterranean subregions had the largest number of local genera of Coccidae but on the other hand the Euro-Siberian subregion is associated also with the Irano-Turanian one by shared genera. Within the Diaspididae and Pseudococcidae, the largest number of genera was from the Mediterranean and Irano-Turanian subregions, but the greatest number of shared genera was in the Diaspididae family. However, the Far-Eastern subregion was found to be the least similar, especially in the Diaspididae and Pseudococcidae.

#### CONCLUSIONS

The Palearctic region has a rich and diverse scale insect fauna with 1,938 species, about one third of the known species of the world. Within this region the different subregions have many local genera and species, reflecting a similar trend of speciation, and endemism at both the generic and species level. The Far-East has a rich, highly differentiated fauna. Specific endemism could be studied in more detail in the subregions, or even within districts of the different subregions, as was done for the Pseudococcidae in the Levant district by Ben-Dov (1990). It is clear that the Euro-Siberian and Irano-Turanian subregions are closely associated, as are also the Irano-Turanian and Mediterranean subregions based on shared genera and species. These connections are believed to reflect specialised local speciation in the different subregions, or even districts, but which has been modified by species migration routes.

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