

CONTRIBUTION TO THE ZOOGEOGRAPHY OF ANTS (HYMENOPTERA, FORMICIDAE) IN THE GREEK ISLANDS

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Very few data is known about the distribution, biology and ecology of ants in Greece. Over the past century, only less then ten researchers have published papers on the greek ant fauna and most of them before the 2nd world war. Therefore, it is not surprising that few regions are covered somehow adequately. As with many other animal groups, it is the greek islands that have attracted most of the attention of european naturalists and biologists. The greek islands, both in the Ionian and the Aegean Sea, offer a remarkable field of study of insular biogeography coupled with proximity to the big centres of biological research in Europe. Being under the influence of Asia, Europe and Africa, we find there animals whose centre of distribution is the Mediterranean, the Balkans, Asia Minor, the Middle East and North Africa and of course many endemic species.

The geographical distribution of the ants is one of the most significant in the animal kingdom. These insects form stable and long lasting colonies in one place but can also disperse over long distances carried by the wind over mountain and water barriers of considerable magnitude. Also, many are transported by man on every means and can attain even world wide distribution. The result is that the species of ants have become more widely distributed than any other insect with the exception of the Diptera (Wheeler 1913). It is in this context that the insular biogeography of ants is of considerable importance.

Materials and methods

The material for this study comes from two sources. The first is the literature on the ants of the islands (Collingwood 1963, Emery 1894, 1895, 1898, 1901, 1914, 1915, 1925, Finzi 1928, 1930, 1932, 1939, Forel, 1886, 1888, 1895, 1910, 1911, 1913, Menozzi 1928, 1929, 1936, Roger 1859, Santschi 1926, 1927, 1933, 1934, Stitz 1928, Zimmermann 1934). The literature has been surveyed critically and various revisions have been carried out such as new synonymies or changes from subspecific to specific level or vice versa. Some unconfirmed and dubious references have been omitted.

The second source is my personal collection from various islands of both the Ionian and the Aegean Sea.

For the analysis of the data, both species and confirmed subspecies have been included. The data have been analysed according to the method mentioned in Baroni Urbani and Collingwood, 1977. The islands have been grouped into four regions, Crete, Dodecanese, Cyclades and Ionian islands and one further region, Attica, has been included for comparative reasons. The Northern Sporades, Euboea and the islands of northern and eastern Aegean (Thasos, Samothraki, Limnos, Lesbos, Chios, Samos etc.) have not been included because there are few data on the occurrence of ants there. A similarity index S between two regions is obtained from the equation $S = \frac{\sqrt{ad} + a}{\sqrt{ad} + a + b + c}$ where a is the number of species common to both regions, b is the number present in the first but not in the second, c the number present in the second but not in the first and d the number absent from both but present in the other four regions.

Results and discussion

The results are summarised in tables I and II. In table I the first column shows the number of species and subspecies that have been observed up to now. The total number of species and subspecies for the five regions studied is 169. The high number of species observed in the Dodecanese may be a true representation of the actual situation but it may also be due to the extensive collecting that has been carried out there, more than in any other part of Greece. The same argument exists for the Ionian islands. The high number of species in Attica is most probably due to the fact that a large number of species have been brought there by man.

The second and third columns show the number and percentages of endemics in each region. Highest percentages occur in Crete and in the Dodecanese showing the early separation of these regions from the greek mainland. The Cyclades have only one endemic subspecies but the incomplete survey of these islands does not permit any conclusions on this point. It is noteworthy to observe the low number of endemics in Attica, a fact that corroborates the previous hypothesis on man introduced species. Most of the species that occur in the Ionian islands but not on other greek islands or Attica are not endemic but are species that occur also in Italy, Dalmatia, Albania and the western coast of Greece. For these species the eastern limit seems to be the Pindos mountains.

The following columns and table II show the similarity between the five regions as well as between them and their adjoining mainland. The Dodecanese have the most dissimilar ant fauna among them. All similarity indices are below 50%. A large number of species (14%, compared with 7% for Crete) have a Middle East and Asia Minor distribution pattern and the ants are clear-

Table I. Endemism and relation of the islands with their adjacent regions

Regions	No of sp. and ssp.	No of endemics	% of endemics	% of sp. with distr. all over Greece	% of sp. with Asian distr. not present in mainland	% of sp. with Aegean insular distr.	% sp. with mainland distrib.	% of sp. with west. distrib.
Dodecanese	85	15	18	55	14	12	—	—
Crete	45	7	16	63	7	14	—	—
Cyclades	43	1	2	74	17	5	2	—
Ionian is.	71	3	4	80	—	—	—	16
Attica	72	1	1	94	—	—	5	—

Table II. Similarity indices between insular regions.

Regions	Dodecanese	Crete	Cyclades	Ionian is.	Attica
Dodecanese	—	41.2	48.5	34.7	46.3
Crete	41.2	—	58.2	44.3	50.7
Cyclades	48.5	58.2	—	48.1	54.4
Ionian is.	34.7	44.3	48.1	—	58.3
Attica	46.3	50.7	54.4	58.3	—

ly heavily influenced by these regions: The Ionian islands also have a separate type of fauna. As mentioned before, their ant fauna is influenced by central and western mediterranean species. 16% belong to this type of distribution. Crete is distinguished from the other regions with highest affinities to the Cyclades. It is not clearly influenced by other distributions. Its ant fauna is a mixture of endemic species (16%), greek insular species (13,5%) and eastern mediterranean species (7%). The ants of the Cyclades seem to be related more closely to Crete and the Dodecanese than to the mainland. Characteristically, there are 9 species that the Cyclades have in common with Crete, the Dodecanese or the eastern Aegean islands and that don't occur in the mainland. On the contrary, there is only one species that occurs in the Cyclades and the mainland and doesn't occur in the other islands. However, the big majority of the Cyclades's ants (74%) are distributed all over Greece.

Looking at the Cyclades in detail, we see that most of the species with a distribution comprising the Aegean islands and the Asian coasts are distributed over most of the islands. There are however some that reach only the southern and eastern islands, Folegandros in one case and Amorgos in another.

Much more work remains to be carried out in the field of insular biogeography of ants in Greece. The results mentioned here are just a rough approximation and a first look into the problem. What is needed is a thorough and systematic look into each island.

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