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The use of phylogenetic data in a biogeographic study

RIENK de JONG

(Rijksmuseum van Natuurlijke Historie, Raamsteeg 2, Leiden, Nederland)

A historical interpretation of distributional data can be tackled in two ways, which will be called the faunal approach and the phylogenetic approach, respectively.

Faunal approach. A fauna is defined here as a collection of species that share some ecological and/or distributional characteristics. Thus a fauna can be recognized from the fact that the component species show a particular pattern of distribution. It is supposed that such patterns are influenced by, if not the result of, ecological changes in the past. This approach has, among other things, led to the recognition of the glacial refugia of the Holarctic region (see, e.g., de Lattin 1967), and is also used explain the existence of biogeographic regions. The applicability of this approach in the study of the history of a particular taxon is limited. Even if we can relate a species to a particular fauna, we can only state that its history is part of the history of that fauna for the unknown time the species was part of that fauna.

Phylogenetic approach. It is the only approach that can yield results if we are interested in the distributional history of a particular taxon. It was strongly advocated by Hennig (1960, 1966). It is a kind of geographic projection of a reconstructed phylogeny. As such, the correctness of the conclusions entirely depends on the correctness of the phylogenetic reconstruction. On the other hand, distributional data may help to solve phylogenetic problems („reciprocal illumination", Hennig 1966).

The genus *Spialia* (Hesperiidae) offers good opportunities to illustrate the faunal and phylogenetic approaches. Of the 26 species, 20 occur in the Afrotropics, five are confined to the Palaearctic and one to the Oriental region. Two of the strictly Palaearctic species, viz. *sertorius* and *orbifer*, are so similar that it seems justified to unite them into a single species, but for the existence of a small area of overlap without interbreeding. It is irrelevant for a biogeographic study whether *sertorius* and *orbifer* have or have not attained specific status, the only relevant assumption is their monophyly. This assumption can only be based on a phylogenetic study. Starting from the monophyly, the faunal approach leads to the conclusion that the West-Palaearctic *sertorius* (eastward to Hungary) originated in a West-Mediterranean refugium, while *orbifer* (Hungary to Korea) originated in an East-Mediterranean/Central Asian refugium. The geographic origin of their ancestor, however, has remained obscure by this procedure.

A phylogenetic study (De Jong 1978) has revealed the existence of seven monophyletic groups within *Spialia*, one of which is the *sertorius* group,

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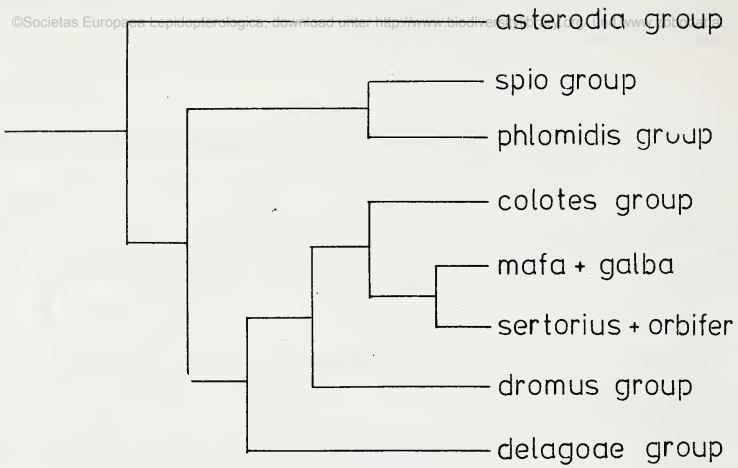

consisting of the Palaearctic *sertorius* and *orbifer,* the African *mafa,* and the Oriental *galba*. The supposed phylogeny of *Spialia* is shown in fig. 1. Apomorphous conditions particular to *sertorius* and *orbifer* are, e.g., the conjunction of the dorsal and ventral sclerites of the eigth abdominal segment of the female, and the use of Rosaceae as larval food plants (plesiomorphous condition in *Spialia:* Malvaceae).

Starting from the phylogeny as shown in fig. 1, the problem of the geographic origin of *sertorius* and *orbifer* can be tackled as follows. If we suppose that the ancestors of *sertorius* and *orbifer* have always been inhabitants of the Palaearctic, we are compelled to suppose that every cleavage of fig. 1 leading to *sertorius* and *orbifer* was the result of isolation between the original Palaearctic population and its progeny that colonized Africa. Moreover, it would imply that evolution proceeded mainly in the Palaearctic, the plesiomorphous condition after each cleavage being maintained in Africa, so that apomorphous conditions accumulated in the Palaearctic. For this reconstruction six independent colonizations of Africa are needed, apart from other, evolutionary assumptions. However, if we suppose that the main differentiation of *Spialia* took place in Africa, the only assumption for the explanation of the occurrence of *sertorius* and *orbifer* in the Palaearctic is a single colonization of the Palaearctic by the ancestor of *sertorius* and *orbifer*. It is easily understood that a change of food plants may have contributed to the success of *sertorius* and *orbifer* in the Palaearctic.

Reasoning along these lines leads to the assumption that the occurrence of *Spialia* species in the Palaearctic and Oriental regions is due to expansion of originally African species.

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