

## QUANTIFICATION AND PATTERN OF PLANT-INSECT INTERACTIONS IN THE FOSSIL RECORD AND THE PROBLEM OF TAPHONOMIC BIAS

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It is generally accepted that the number and diversity of types of plant-arthropod interaction increases from the Devonian to the Recent, yet there is little quantitative data to support this. Most data to date is of a qualitative nature concerning the presence of an 'interaction' type or trace-fossil taxon. In many cases the numbers of specimens of any interaction is very small. For example, specimens of leaf mines in the Triassic so far published are less than five. A database of how many specimens have been examined for this type of damage is, however, lacking. It may be that a simple record of the appearance of interaction type may yield as much meaningful data as can be expected from the fossil record. This type of approach can give support to the idea of increasing complexity of interaction through time. This data does not give any idea as to the importance of interactions such as leaf mining or leaf feeding, nor how frequently such interactions may be found nor on any aspect of host specificity which would suggest co-evolution of plants and insects. There have been relatively few attempts at quantitative analysis, but many questions can be asked as to the importance of quantitative data and its reliability, especially with regard to taphonomic effects.

A wide range of quantitative data that could be obtained from fossil collections can be identified. A number of different approaches and data types are presented and examples given wherever possible:

1. Number of damaged specimens known - In many cases it is not possible to give the data as a % as there may be so few damaged specimens. This data, however, may be obtained from all specimens worldwide of any particular geological period or else with relation to a more restricted time or geographical interval;
2. Number of species or genera known showing damage - Other data might include the number of interaction types known as well as the number of species or specimens showing more than one type of damage. Where the numbers of damaged specimens and number of species showing damage increases then it may be possible to obtain data on the total % of any damage category present;
3. The number of taxa in the flora or assemblage that show damage - In addition, with the case of leaf feeding, some data may be obtainable on the % damage to leaves. Not only can data be obtained for vegetation as a whole but also comparisons may be made between different plant assemblages.
4. Another possibility is to obtain data on host specificity. It may be possible to consider the relationship between leaf shape, taxon and damage type.

It is necessary to not only to obtain quantitative data for one assemblage or flora but also to be able to compare the data through the stratigraphical record. Recording of the damage data may not be obvious. Should damage categories be used, trace fossil taxa, leaf species or leaf shape? It may be possible to obtain this from a single data set. Having decided on the method of quantitative data collection and type of interaction to be studied any interpretation of the data must address several taphonomic issues. What is the relationship between the fossil assemblage data and the living population data? Does damage cause preferential destruction? Can we get data on inter-assemblage taphonomic effects? Can we calculate missing data or gauge if sufficient material has been studied? Can a data set even from the modern be recalculated? What is the effect of using trace fossil taxa, species, leaf shape or damage categories? What are the dangers in trying to interpret causal insect taxa? In addition to fossil data some taphonomic experiments on Recent material, which should help in the interpretation of the fossil data, is presented.