Trace Fossils of Plant-Arthropod Interactions

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INTRODUCTION

An examination of any modern terrestrial ecosystem will reveal a vast array of arthropod (particularly insect) - plant interactions. It has been calculated that there are more than one million extant insect species, more than 400,000 plant species, and that the total number of their interactions exceeds their combined total. Studies of the co-evolution of insects and plants have indicated that the development of these interactions must have taken considerable time (Southwood, 1973, 1985; Strong et al., 1984). For example, the evolution of the angiosperms (flowering plants) and insects are seen to be closely interlinked (Friis et al., 1987).

The range of interactions is diverse: from feeding to shelter, transport, reproduction and disease transmission (Figure 1) (Southwood, 1985). Many of these interactions leave traces, which may be preserved in the fossil record (Scott and Paterson, 1984; Scott et al., 1985; Scott, 1991). When studying modern traces a direct link between arthropod species A and plant species B may be known and this may indicate a certain behavior. In the fossil record, however, there is a large number of unknowns. In some cases traces may be rather specific and hence attributable to particular species (Hickey and Hodges, 1975), but in general this is not the case. Many of the traces can, however, be interpreted in terms of arthropod behavior, which, at least in some examples, may be specific to one causal group (e.g., caddis fly cases) (Mackay and Wiggins, 1979; Hickin, 1952).

In this paper I will attempt to illustrate the range of traces of plant-arthropod interaction that are found in the modern vegetation (Figure 2), provide characteristics enabling their recognition, and consider their fossilization potential. I will then consider fossil examples and discuss the limits to their interpretation. This contribution is not a catalogue of fossil data. Reviews of some of these interactions have recently been published (e.g. Scott et al., 1992; Stephenson and Scott, 1992). The biggest problem is absence of data. This is generally not because evidence is lacking, but that it has never been adequately recorded. In this contribution I take the opportunity to publicize the importance of recording trace fossils of plant-arthropod interactions so that a more accurate picture of the interaction and coevolution of plants and arthropods can be provided in future. There is currently no clear nomenclature for such trace fossils and I am currently undertaking a revision. As the paleobiologist is likely to collect and examine separate plant organs, I have arranged the paper with respect to damage to leaves, wood, seeds, etc.

	FEEDING	SHELTER	TRANSPORT	REPRODUCTION	DISEASE TRANSMISSION
PLANTS FOR ARTHROPODS	MAJOR	MAJOR	VERY MINOR	VERY MINOR	MINOR
ARTHROPODS FOR PLANTS	MINOR	MINOR	MAJOR	MAJOR	MAJOR

FIGURE 1—The interrelationships of plants and arthropods (modified after Southwood 1985).

FIGURE 2—The variety of plant-arthropod interactions (modified after Scott et al., 1992).