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Trophic Links of Leaf-Rolling Weevils (Coleoptera, Rhynchitidae and Attelabidae)

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Abstract—The majority of beetle species examined develop on a limited set of plants, comprising species of 1 or 2 genera of the same family or, less frequently, of two closely related families. Some representatives of Rhynchitidae (mainly leaf-rollers) and Attelabidae populate several plant families, which is associated with an increased ability for larval development in dead tissues.

Leaf-rolling weevils (Rhynchitidae and Attelabidae) are obligatory phytophagous species. The World fauna comprises about 1110 species of Rhynchitidae and about 1000 species of Attelabidae (Legalov, 2003). These beetles are widespread, but most species dwell in subtropical and tropical zones. Larval development is associated with vegetative and generative parts of plants. Many species make leaf rolls, where larvae are placed; adult insects also feed on plants during additional feeding. Trophic links of these families are poorly studied. In this relation, the goal of the present study included revealing of these links and also analyzing of beetle population on plants depending on their regional distribution, evolutionary state, and biological peculiarities of Rhynchitidae and Attelabidae. The list of beetle species and their host plants was published earlier (Legalov, 2003); in this publication trophic associations of beetle larvae and adults and various groups of host plants were analyzed. In addition to observations of the author, the data on trophic links were taken from the literature (see References).

TROPHIC LINKS OF RHYNCHITIDAE

Trophic Links of Rhynchitidae of the World Fauna

The family Rhynchitidae is associated with 49 plant families. The largest number of species (Fig. 1) develops on Rosaceae, Fagaceae, and Betulaceae (about 20, 15, and 12%, respectively), comprising about 50% of species of the World fauna. 6% of species were found on Saliaceae and more than 5%, on Fabaceae. Hence, the basis (62.1%) of the World fauna of Rhynchitidae belongs to species associated with 5 plant families; the rest of Rhynchitidae develop on plants of 43 families: 2 species on a single host plant family, on the average. 25 (51%) of the mentioned floral composition in question serve as trophic plants only for Rhynchitidae (Berberidaceae, Bombaceae, Cistaceae, Clusiaceae, Cupressaceae, Dioscoreacea, Eleagnaceae, Hamamelidaceae, Illiceaceae, Junglandaceae, Menispermaceae, Mimosaceae, Moraceae, Myricaceae, Mersinaceae, Oleaceae, Onagraceae, Pinaceae, Platanaceae, Podocarpaceae, Rhamnaceae, Sonneratiaceae, Symplocaceae, Tamaricaceae, and Vitaceae). More than 18% of Rhynchitidae feed on plants of these families.

Trophic Links of Rhynchitidae of the Temperate Zone

In the temperate zone, Rhynchitidae are associated with 36 plant families. Similarly to the World fauna, the largest number of species is associated with Rosaceae, Fagaceae, and Betulaceae (26, 25, and 11%, respectively), with the number of species developing on plants of the family Betulaceae being somewhat decreased (7.4% against 12.5%). Thus, species developing on plants of these three families form the basis of the fauna of the temperate zone, comprising more than 60% of species. Species, associated with remaining 32 host plant families, are less important in the structure of the fauna. On the average, 2 species of Rhynchitidae develop on plants of each of these families.

Trophic Links of Rhynchitidae of the Tropic Zone

In the tropic fauna, in comparison with the temperate zone, the number of trophic plants somewhat decreases (from 36 to 33). No species, associated with the following 13 families, were found: Dioscoreacea, Eleagnaceae, Illiciaceae, Junglandaceae, Lamiaceae,

of species. Attelabidae are even more specialized than Rhynchitidae. For example, 75% of their species are associated with a single plant genus; 18% of species were found on 2 or 3 genera. Only 6% of species are associated with 4–8 plant genera. In Rhynchitidae and Attelabidae on the whole, the fraction of monophagous species constitutes 65%. 20% of species successfully develop on 2 or 3 genera. Only 12% of the species adapted to host plants of 4–12 genera.

Thus, the main part of weevils examined become adapted to development on a small number of plants, as a rule, belonging to 1 or 2 genera of the same family or, less frequently, of two closely related families. Some representatives of advanced groups (mainly leaf-rollers) could populate several, sometimes even remote plant families. For such species, not the host plant species, but its part, where a larva develops, is important. It could be explained by the development of larvae in dead plant tissues, because a female gnaws conductive tubules and part of the plant with the laid eggs dies. However, even these polyphagous species possess preferable plants.

The largest number of species of weevils examined develops on cosmopolite and tropical plant families. In all the zones, the richest fauna of Rhynchitidae and Attelabidae was noted on representatives of widespread families Rosaceae and Fagaceae, and also on cosmopolite Betulaceae. In the temperate zone, the role of Salicaceae and Aceraceae as host plants increases; Fagaceae, Myrtaceae, and Lauraceae are very important in feeding of tropical species. The spectrum of trophic plant families is wider in Rhynchitidae (49) in comparison with Attelabidae (44).

Thus, angiosperm plants, which appeared in the early Cretaceous (Abramov *et al.*, 2001) and, probably, caused the Cretacean biocenotic crisis, strongly affected insects (Zherikhin, 1980). The development of diversity of angiosperm plants (about 250 thousand modern species) that served as a basis for the formation of various ecological groups of Rhynchitidae and Attelabidae and allowed them to populate different parts of plants. The appearance of the leaf plate was most important, because beetles started to roll it, providing the successful development of larvae. In the Paleogene, all this resulted in the appearance of many new tribes of Rhynchitidae and in the formation of a new family Attelabidae that completely passed to leaf rolling. Thus the ability to develop on angiosperm plants has strongly influenced the evolution of Rhynchitidae and Attelabidae, providing their diversity.

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