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Life underground: Exposing the subterranean stage in the holocycle of galling aphids (Homoptera: Pemphigidae: Fordinae) on *Pistacia* (Anacardiaceae)

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ABSTRACT

We present, for the first time, biological observations and quantitative ecological data on the subterranean stage in the life cycle of gall-forming aphids (Fordinae: Pemphigidae: Homoptera) on the roots of their (putative) secondary hosts. This stage is normally difficult to investigate because the presence of the aphids cannot be detected unless the plant is pulled out of the soil. Successful rearing and inspection of Fordinae colonies on grass roots in simple and convenient root cages (without soil) enables the study of behavior and ecology during the relatively unknown part of the life cycle and opens the way to controlled experiments on induction of winged morphs and the switch from parthenogenetic to sexual reproduction in subterranean aphids. The aphids of seven species persisted and reproduced parthenogenetically in the laboratory for 3–19 generations, forming colonies of a few to hundreds of apterous (wingless) aphids. Alate (winged) sexuparae were formed in the cages in the summer, and the sexual morphs were subsequently produced. The data indicate differential success of the subterranean Fordinae in colonizing different plant species — contrary to the accepted opinion that host specificity in galling aphids is limited to the primary host. Ecological and behavioral differences among species are described, and quantitative data on survival and fecundity in the laboratory cages are presented.

KEY WORDS: galling aphids, Pemphigidae, Fordinae, subterranean stage, *Pistacia*.

INTRODUCTION

Fifteen species of aphids of the subfamily Fordinae (Aphidoidea, Pemphigidae) induce galls on trees of the genus *Pistacia* (Anacardiaceae) in Israel (Koach and Wool, 1977; Wool, 1995). Aphid life cycles in general are complex (Moran, 1992) and galling aphids are no exception. The complete life cycle (holocycle) of all but one species of Fordinae in Israel includes host alternation between *Pistacia* and secondary hosts — mostly grass