DROSOPHILA SPECIES, BREEDING IN THE STINKHORN
(PHALUS IMPUDICUS PERS.)
AND THEIR LARVAL PARASITOIDS

by

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SUMMARY

A field survey was carried out in the seasons of 1985 and 1986 in a woodland area, situated in the central western part of The Netherlands, to study the community of Drosophila breeding in the stinkhorn, Phallus impudicus, and their larval parasitoids.

The fluctuations of the fungi, Drosophila, and parasitoid populations are presented.

During a large part of the season the system is relatively simple, comprising one Drosophila species, D. phalerata, and one parasitoid, Leptopilina clavipes. In autumn other parasitoids become common in Ph. impudicus.

Most parasitoid species are polyphagous with respect to the host species they parasitize.

As a consequence of high rates of parasitism, host populations regularly pass bottlenecks within one season, especially in July when parasitism can rise up to 100%.

Mean Drosophila egg to adult development lasts 25-32 days in the field and species can realize at most 4-5 generations in one season. Parasitoid development takes 40-55 days and not more than 2 generations can be completed.

Temperature explains 94% of the rate of development of the egg and first two larval stages of D. phalerata.

Drosophila oviposition behaviour and larval development creates patches containing suitable hosts during several successive days.

Parasitoids arrive in new patches from the first day of their appearance and, in general, patches are exploited by more than one parasitoid.

Some implications of these features on the behavioural ecology of the parasitoids and population dynamics are discussed.

KEY WORDS: Drosophila, parasitoids, parasitism, phenology, host range, generation times, field ecology.

INTRODUCTION

Insect parasitoids are the subject of a wide range of behavioural and ecological studies, ranging from tests of optimization models, predicting the behaviour of individual females (Stephens & Krebs, 1986),

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to population and community-ecological studies testing models on population dynamics of parasitoid-host systems (e.g. Hassell, 1978). Integrated research on these levels may enable us to understand how decisions made by individuals affect the dynamics of populations and community structure, and should ideally be carried out on the same system. Such a study requires an intimate knowledge of how parasitoids behave in their natural habitat and how host populations are structured in space and time.

Theoretical models on both the foraging behaviour of individuals and the population dynamics of parasitoid-host systems are often based on simplifying assumptions. These assumptions, made to allow tractable mathematics, often ignore essential aspects of the biology of a species. For example, many population dynamical models assume discrete generations and equal generation times for parasitoid and host. Likewise, optimal foraging models often assume a patchy distribution of hosts with patches containing only one type of host, all individuals being of the same age. Tests of these models may show a discrepancy between predictions and experimental results because the parasitoids are adapted to a different world.

Janssen et al. (1988) reported on the impact of parasitoids on natural populations of temperate woodland Drosophila in The Netherlands. They showed that there is a distinct group of parasitoid species that attack Drosophila breeding in fungi. Of the fungi, the stinkhorn, Phallus impudicus Pers., is the only species with fruit bodies abundantly present from June until October. Moreover, parasitism of Drosophila in stinkhorns is, in general, much higher than in any other mushroom species studied. These findings, together with the fact that Ph. impudicus fruit bodies are easily found, examined and manipulated, make this system a convenient object for the study of parasitoid-host interactions in the field.

This paper describes the distribution and abundance of fungi, Drosophila and parasitoids through two successive years. It provides relevant biological characteristics of the system, information about the potential host spectra of parasitoids and the relative importance of the various parasitoid species. We also present results of field and laboratory experiments on oviposition and developmental rates. These data will form the backbone for future publications on foraging behaviour and population dynamics of species in this system.

METHODS AND MATERIALS

The results presented in this paper are based on a monitoring and sampling programme carried out during the seasons of 1985 and 1986. The study area, called