Bul.inf. Soc.lepid.rom. 5(3-4): 291-296, 1994(1995). ISSN 1221-5244

The territorial behaviour of the Mantis religiosa and its migration propensity

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Abstract

Summing up the results of a series of observations conducted over a period of 17 years on a 90 000 m² plot on the outskirts of Budapest, it can be said that *Mantis religiosa* males have shown a greater propensity to migrate, and females greater territorial behaviour. Territorial aggressivity increases with age. The migration of female adult females-given an even supply of food-is minimal.

Introduction

For the understanding of the structure and degree of organization of populations, the discovery of their time dynamics is of fundamental importance. While we have a considerable amount of information concerning the time dynamics of insect populations-primarily in connection with economically relevant examinations of pestiferous insects and those that hold them in check-, we know much less about the spatial relationships of insects, especially about the background dynamics shaping given patterns.

An earlier publication (HIDEG, 1991) has reported on the time dynamics of the *Mantis religiosa*; in the present paper an account will be given on the spatial relations of this same population.

Methods and Material

The examination of the *Mantis* population was conducted in a suburb of Budapest, on a 90 000 m² (9 hectare) typical loessial grassland plot divisible into 3 parts of different degrees of exposure: a southern, 18°, slope (Zone A), a northern, 22°, slope (Zone C), and the ditch-like strip stretching between the two (Zone B).

Up until 1972 a *Mantis religiosa* population of very small density lived on the plot, and therefore 200 cocoons were introduced, into Zone B of the plot.

Later on, what happened to introduced population was closely monitored.

Estimation of the density of the population was conducted using the mark-release-recapture and bait-stick methods. The individual marking of the animals mirrored their occurrence on the plot (Fig. 1).

The degree of dispersal of individuals was determined using the nearest neighbour method (CLARK & EVANS, 1954). The marking of individuals was similarly used to indicate age and migration.

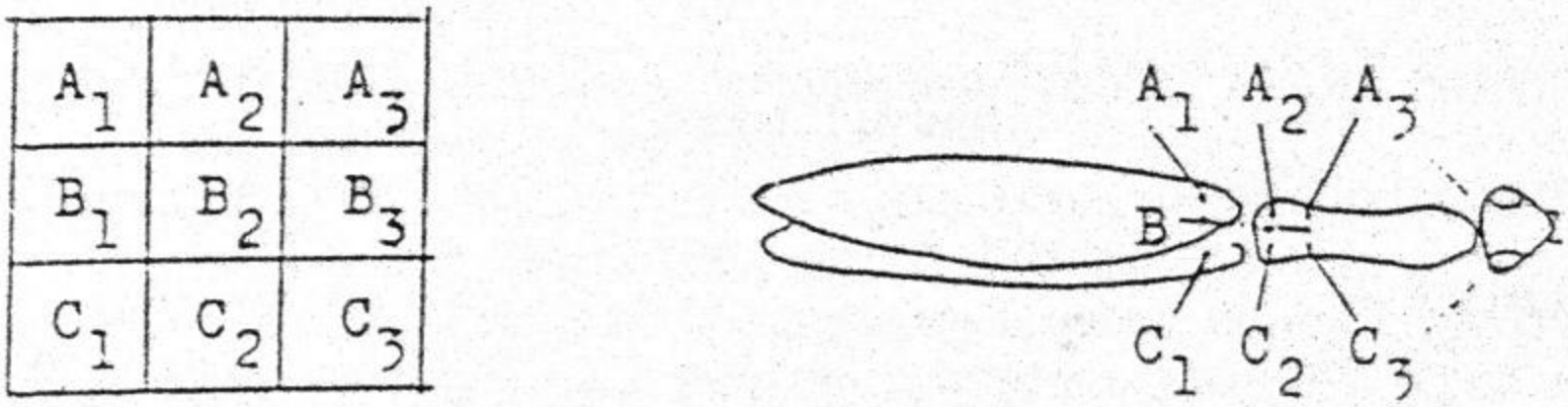

Fig. 1. The basic marking of individual animals

Results

Migration and territorial behaviour

Of the cocoons that were introduced, 18% of the larvae had migrated into Zones A and C by the third day after hatching. Later, the number of individuals in Zone A increased as a result of migration (Fig. 2). In the years that followed, the pattern of migration was similar (Fig. 3).

The invariably intense mobility of animals younger than 8 days, and-in the case of the animals older than this-increasing territorial behaviour meant that the distribution which was still uneven in April already showed considerable evenness by March: R=1.92 (Fig. 4).

In parallel with the decrease in the numbers of individuals, the R values, too, became smaller from month to month; but as a result of increased defence of territory, even distribution was maintained to the end. The smallest value, R=1.69, could be expected by August, when a marked decrease in density is accompanied by considerable heterogeneity in the population members: individuals in four different stages of development are present alongside each other. By September, with regard to falling density values, a further decrease in the R value could be expected, but the September average, R=1.8, showed the opposite of this. In this month the aggressivity and cannibalism accompanying the territorial behaviour of the female animals reached its height. At this time 87.8% of the population of Zone A was female, while 58.8% of the *Mantis* stock was male. Their proportion in the ditch-like area between these two zones was already just 15.2%. From the markings on individuals it turned out that in the course of two months 86% of the population's male individuals, but just 6% of the female ones, left the area they inhabited in August.

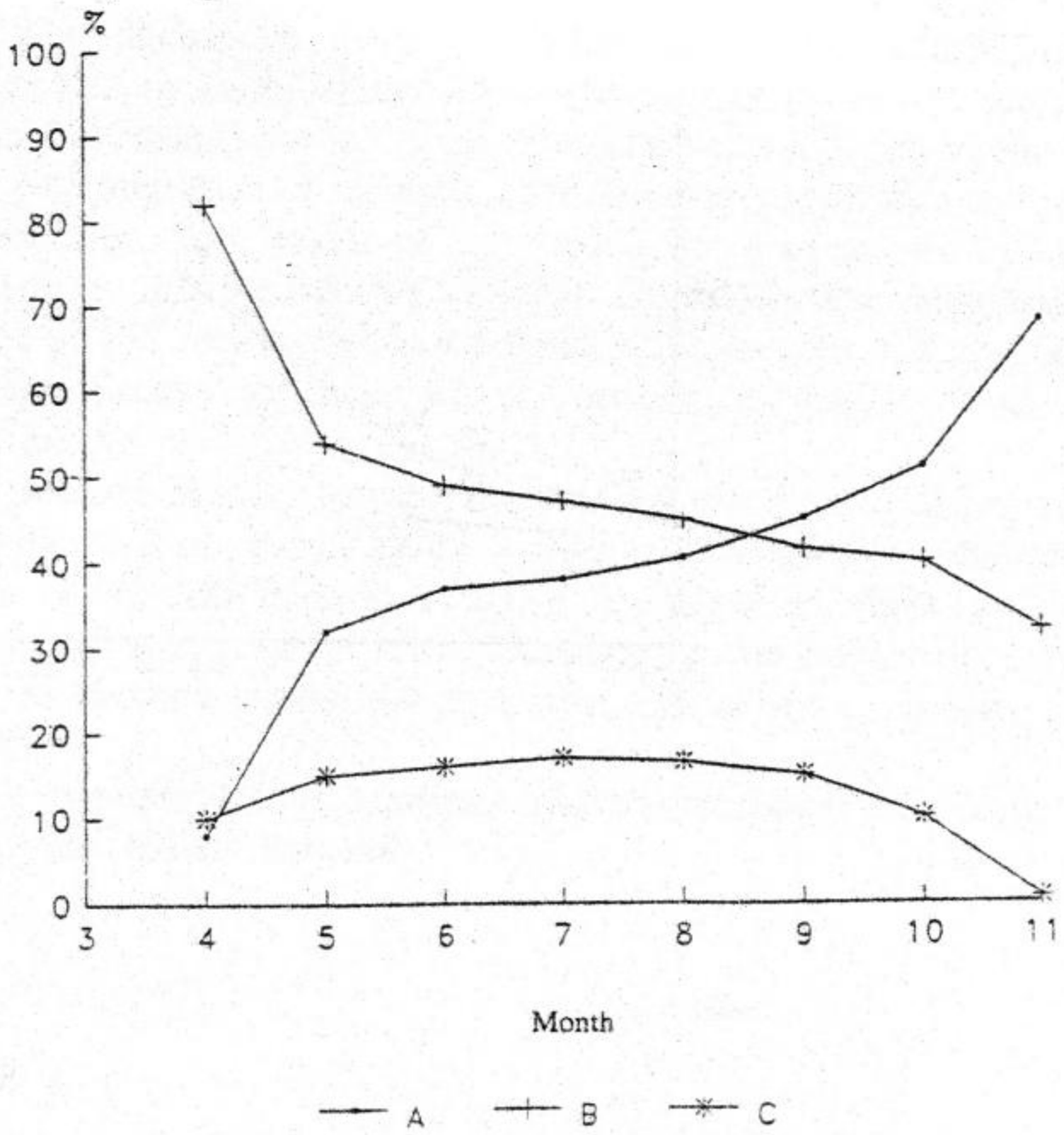

Fig. 2. The percentage distribution of individual animals in the 3 zones in 1972

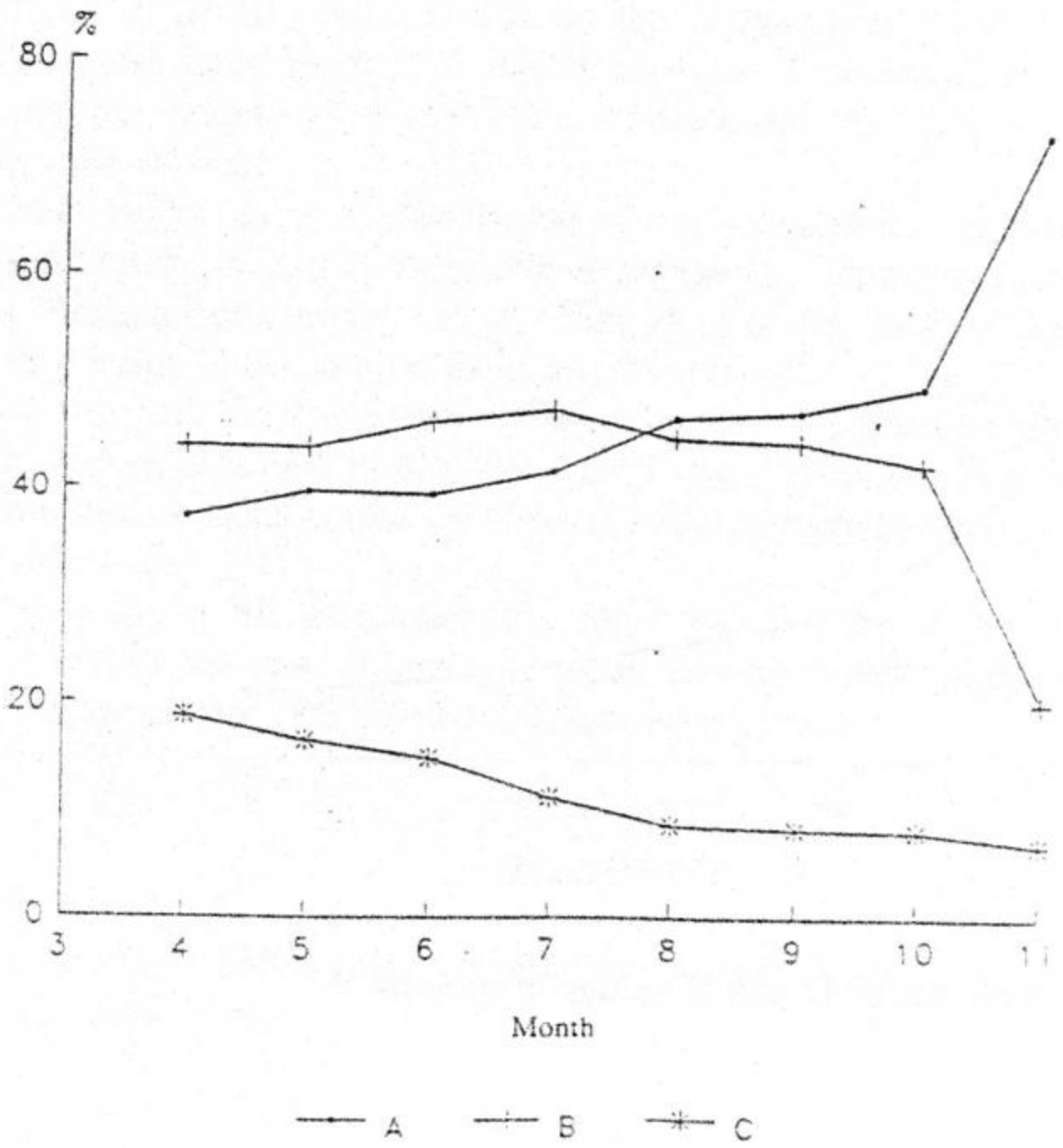

Fig. 3 The percentage distribution of individual animals in the 3 zones (17 year average)

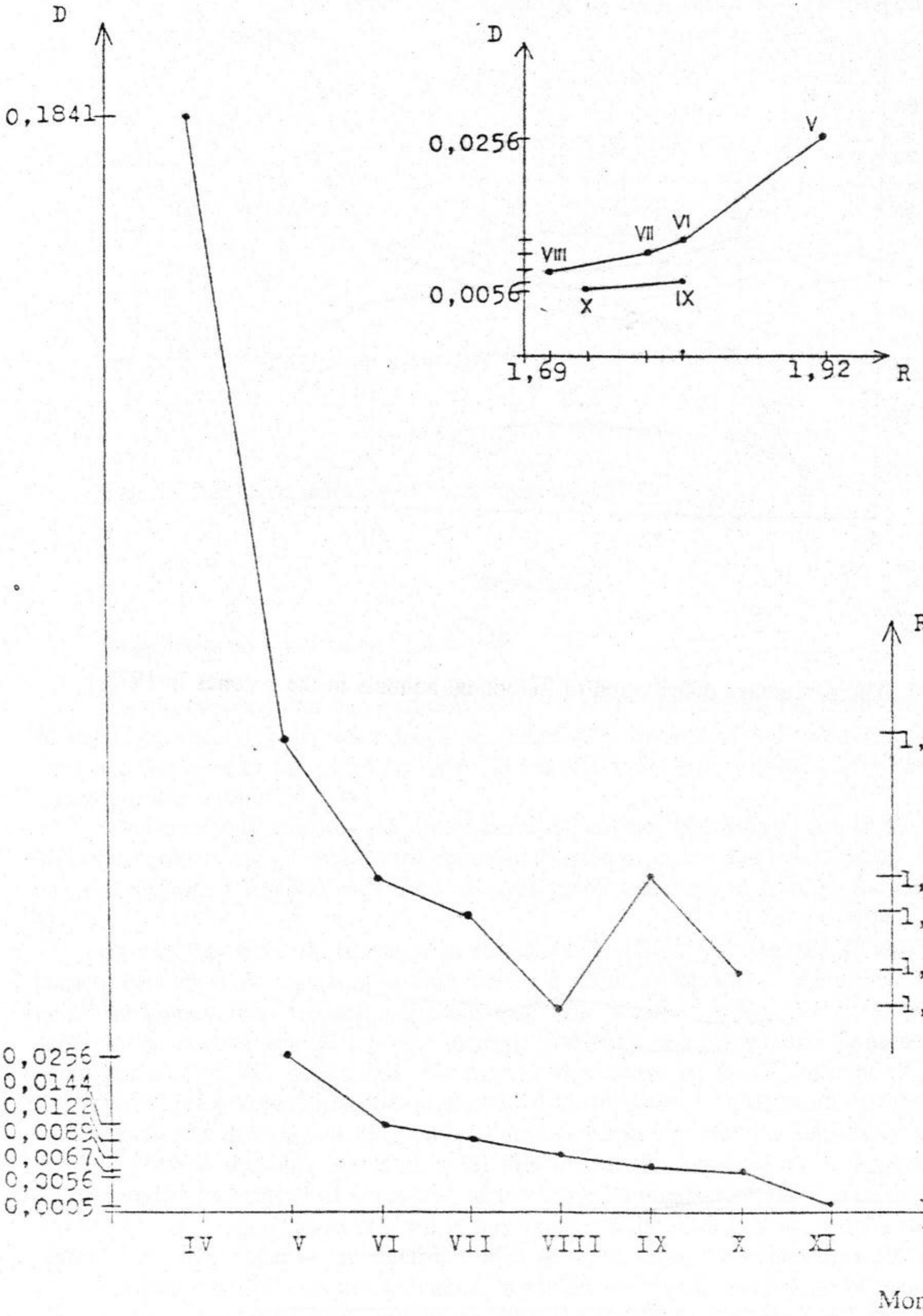

Fig. 4. The relatedness of D and R values in months V-X

The aggressive territorial behaviour of the female animals was very often accompanied by cannibalism. This behaviour of theirs was unrelated to the sex of their victims, but males showing weak territorial behaviour fell victim to it more often.

The migration of the male animals began to increase on the thirteenth day after the last moulting, as a result of the search for a mate. At the same time the females' propensity to migrate became minimal. On average the migration of males extended to a distance of 150 metres, while for females the average was not more than 30 metres. The maximum distance for males was 270 metres; for females it was 160 metres (from Zone C to Zone A).

Because of their territorial behaviour, the limited ability to fly of the females and a complete lack of propensity for long distance migration, Mantideae hardly ever broaden the area of their diffusion in an active way. However, their hardy cocoons are excellently suited to being carried to other locations on the bodies of larger animals or on man. Insofar as hatched larvae find in a new biotope the conditions for life, the type can be naturalized.

It is probable that Mantises might have spread in this way in areas of Budapest's southern and eastern suburbs.

Discussion

EHRMANN (1986) stresses the negligible propensity to migrate of female Mantises, and also refers to their territorial behaviour. According to the observations of KEVAN (1985), *Mantis religiosa* sometimes confronts smaller vertebrates, snakes for example.

RATHET & HURD (1983) report on the competition between each other of three types living in the same biotope: *Tenodora sinensis, Tenodora angustipennis,* and *Mantis religiosa.* In the course of the present investigation the importance of intraspecific competition was proved.

BRIAN (1965), in an investigration of ant populations, established that degree of dispersion is closely related to competitive behaviour. This is supported by the fact that as density increases-presumably as a result of growing intraspecific competition-, the degree of dispersion shifts in a uniform direction (GALLÉ, 1975; 1978). These statements accord very well with the conspicuously even degrees of dispersion accompanying the high May density values observed in Mantises: the 17-year average was R=1.92. The evenness of the distribution was increased by the territorial behaviour then just developing in the young animals.

In the wake of the increased September aggressivity of the female Mantises, the competition within the new strong type again faithfully reflects the increasing R values observable in September (the 17-year average was R=1.8).

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