Synomone-induced suppression of take-off in the phytoseiid mite *Phytoseiulus persimilis* Athias-Henriot

M.W. Sabelis and B.P. Afman

*Department of Pure and Applied Ecology, University of Amsterdam, Kruislaan 320, 1098 SM Amsterdam, The Netherlands*

**ABSTRACT**


**Key words:** Dispersal behaviour, Phytoseiidae, synomones, semiochemicals.

Plant-inhabiting predatory mites in the family Phytoseiidae are known to disperse passively on air currents. In this article we analyse observations on the behaviour that initiates aerial dispersal, the so-called take-off behaviour. When starved for 24 hours at 25°C and 35% RH, about 80% of the females of *Phytoseiulus persimilis* Athias-Henriot became airborne during 10 minute exposure to wind velocities of 2 m s⁻¹ or higher. However, take-off was suppressed when females were exposed to volatile chemicals emanating from leaves that had been infested by two-spotted spider mites (*Tetranychus urticae* Koch) during one day preceding the experiments. This result is the first unambiguous proof that phytoseiid mites exert control over take-off. Interestingly, the females of the predator strain under study did not show the characteristic upright posture that was hypothesized to be important for take-off in two other species of phytoseiid mites (*Amblyseius fallacis* Garman and *Metaseiulus occidentalis* (Nesbitt)). These observations shed new light on the behaviour involved in controlling take-off. It is suggested that take-off control is exerted mainly via the grasp of the claws and the adhesive empodia in a way reminiscent of that described for aphids.

**INTRODUCTION**

Long-range dispersal in phytoseiid mites probably occurs to a large extent by passive dispersal on air currents (Sabelis and Dicke, 1985). Johnson and Croft (1979, 1981) recorded predatory mites in sticky traps positioned at various distances downwind from an apple orchard in Michigan. They found mostly adult females of *Amblyseius fallacis* (Garman) on traps up to ~70 m away from the orchard. Moreover, they observed a steep increase in predator densities in the groundcover vegetation exactly when prey became scarce in the trees, and inferred that the increase was due to ambulatory and aerial emigration of predatory mites as a consequence of starvation. Hoy (1982) suspected aerial dispersal of a carbaryl
resistant strain of *Metaseiulus occidentalis* (Nesbitt), because the predators “had moved so far so quickly” (*cit.*) in a Californian almond orchard. She found large numbers of females on sticky panels located outside the almond orchard, and in a later study (Hoy et al., 1985) she reported carbaryl resistance in predator populations from almond orchards surrounding the sites where the resistant strain was originally released. Based on this type of evidence she inferred that the predators had dispersed over at least 800 meters in the period from 1981 to 1983. Dunley and Croft (1990) studied colonization rates on small groups of potted apple trees placed beneath the canopy of an apple orchard in Oregon and on distant groups at 10 m and 100 m away from an apple orchard in the open field. They found that the distant groups of trees were colonized faster by *M. occidentalis* than by *Typhlodromus pyri* Scheuten, whereas the ones placed beneath the orchard canopy were colonized at more or less equal rates by both phytoseiid species. The underlying causes for differential dispersal rates remain to be elucidated; this requires a combination of detailed laboratory studies on dispersal behaviour and carefully designed field studies to test the predictions from behavioural studies.

Aerial dispersal in the field has also been shown to occur in *Phytoseiulus persimilis* Athias-Henriot (Charles and White, 1988). However, preliminary observations on the dispersal behaviour of females of various strains of *P. persimilis* (Sabelis and Afman, 1984) suggested the absence of the dispersal posture described for *A. fallacis* and *M. occidentalis* (Johnson and Croft, 1975, 1976; Field and Hoy, 1985). This posture consists of an upright stance and is considered to promote successful take-off in that it helps crossing the low-wind-speed barrier in the laminar boundary layer above the leaf surface (Washburn and Washburn, 1984). Hence, it is of interest to study take-off behaviour in more detail and to make a comparison with the behaviour of *A. fallacis* under the same experimental conditions. In particular, we ask the question whether phytoseiid mites can exert control over the take-off event in response to cues related to feeding by their prey and whether the dispersal posture described by Johnson and Croft (1976) is essential to achieve such control.

**MATERIALS AND METHODS**

**Origin and state of the predator**
The strain of *P. persimilis* was obtained from the rearing unit of Koppert Ltd (Berkelen Rodenrijs The Netherlands) and was subsequently maintained in the laboratory on Lima bean leaves infested by *Tetranychus urticae* Koch. The experiments were carried out with females of *P. persimilis* that were in the oviposition phase for 2 to 6 days. They were in a well fed state when collected, and then starved individually in Munger cages for one day at 25°C and 35% RH, unless explicitly stated otherwise for experiments designed to investigate the effect of these factors. The Munger cages comprised of a rectangular piece of Perspex (10 × 5 × 1 cm) with a hole in the middle (2.5 cm diameter) that was closed at one side by a glass