A packaging and delivery system for aerial release of Phytoseiidae for biological control

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ABSTRACT


A new packaging system for the aerial release of phytoseiids was designed and tested in the laboratory and in the field. The observed escapes before and after release, mortality during all stages of release, and fecundity after release indicated that the system was suitable for transporting and distributing phytoseiids. Other evaluated properties of the packaging system included container opening efficiency, container dispersion over the field at several fly-over altitudes, and the probability of containers to be lodged in the cassava canopy. Aerial release trials followed by recoveries of viable adult female phytoseiids from the target fields demonstrated the feasibility of aerial releases as a means for distributing phytoseiid natural enemies.

INTRODUCTION

The cassava green mite, Mononychellus tanajoa (Bondar) (Acari: Tetranychidae) and the cassava mealybug, Phenacoccus manihoti (Matile-Ferrero) (Homoptera: Pseudococcidae) are the two most serious pests of cassava (Manihot esculenta Crantz) in Africa. Both pests were accidentally introduced from the Neotropics (Herren and Bennett, 1984), and are presently the target of an Africa-wide biological control campaign initiated by the International Institute of Tropical Agriculture (IITA) in the 1980’s (Herren, 1987). Work on M. tanajoa has intensified recently as promising exotic natural enemies have been discovered and shipped to Africa for experimental release (Yaninek et al., 1989).

The exotic natural enemies being imported are neotropical predaceous mites belonging to the family Phytoseiidae (Yaninek et al., 1989). Cultures of these predators are being maintained and mass produced by IITA for experimental releases (Friese et al., 1987; Mégervand et al., 1987 and this volume). Recently, one exotic phytoseiid species has been confirmed as being established in the field (Yaninek et al., 1989).
al., 1991), while a second species shows similar promise (J. S. Yaninek, unpub. data). These findings now open the way to large-scale production and release, provided that an efficient way of dispersing these biological control agents is developed.

Aerial delivery and release of natural enemies of cassava pests has been incorporated into the Africa-wide campaign from the beginning (Herren and Bennett, 1984). The extent of the cassava belt in Africa, the limited number of scheduled flights between major cities and the poor internal road networks in most African countries makes this necessary. Aerial releases have been made by means of an aircraft equipped with an Airborne Insect Release System (AIRS), originally designed and developed for releasing Epidinocarsis lopezi (De Santis)(Hym: Encyrtidae) a parasitoid of the cassava mealybug. It was later adapted for experimental release trials of exotic phytoseiid predators imported for the biological control of M. tana joa (Herren et al., 1987).

Previous work by Pickett et al. (1987) on the predator Phytoseiulus persimilis Athias-Henriot demonstrated that phytoseiids can be released from the air into a corn field on carrier materials such as corncob grits. Experiments by Drukker et al. (1991) showed that other phytoseiids can be released aerially into a cassava field on bran-like carrier materials. They concluded however, that this method was not accurate enough for targeting the predators into African cassava fields, which are on average much smaller than the corn fields used by Pickett. Herren et al. (1987) tested a prototype container for aerially releasing phytoseiids. Their study demonstrated the feasibility of dropping phytoseiids in a closed container. However, improvements were still needed to assure confinement of the phytoseiids once airborne and prompt release after the container with the predators reached the field.

The aim of this study was to develop and test a packaging system that can be dropped with the Airborne Insect Release System (AIRS). In this paper a new system is described and its properties with respect to three important conditions for successful application are evaluated: (1) The adverse effects on the condition of the predators should be comparable to those of the conventional release methods. (2) The method should allow for a rapid release and dispersal of the predators on the cassava plants. (3) The method should be accurate enough to make aerial release into small cassava fields possible.

MATERIALS AND METHODS

Aircraft

The aircraft in which the Airborne Insect Release System (AIRS) was mounted was a Volpar Turbo Beech 18 adapted for aerial releases. It was equipped with twin-turboprops, had a range of 2,100 km and a cruising speed of 300 to 330 km/h. The aircraft was operated by ZIMEX Aviation, Zürich, Switzerland under contract to the Biological Control Program (BCP) of the International Institute of Tropical Agriculture (IITA).