

Investigations on biology and behavior of *Halyomorpha halys* (Heteroptera: Pentatomidae) aimed at its sustainable management in agro-ecosystems



PH.D student: Giacomo Bulgarini

Tutor: Dr Lara Maistrello

Doctorate in Agri-Food Science, Technologies and Bio-Technologies

XXXIII cycle, 1° year

Introduction

Halyomorpha halys (Heteroptera, Pentatomidae) (Fig. 1), native to East Asia, is a polyphagous species with more than 300 host plants recognized. Thanks to its close association with manmade structures during the overwinter period, that facilitates human assisted spread, this insect is a fast spreading invasive pest of fruit orchards and many other crops both in the U.S.A., in Italy and other European countries



Fig. 1 Adult of *H. halys*

Using its piercing-sucking apparatus on plants tissues, particularly of fruits and seeds, *H. halys* can cause deformities, suberification, discoloration, necrotic areas and watery rot, that render products unmarketable (Fig. 2). To manage the invasion of this pest, farmers have increased the use of broad spectrum insecticides, resulting in disruption of the most Innovative IPM strategies, with serious risks for both the economy and the environment. In particular, the massive use of these insecticides can lead to the reduction of beneficial insects, such as pollinators, parasitoids and predators, altering balance in agroecosystems. Therefore, it is necessary to identify more sustainable strategies to manage this pest.



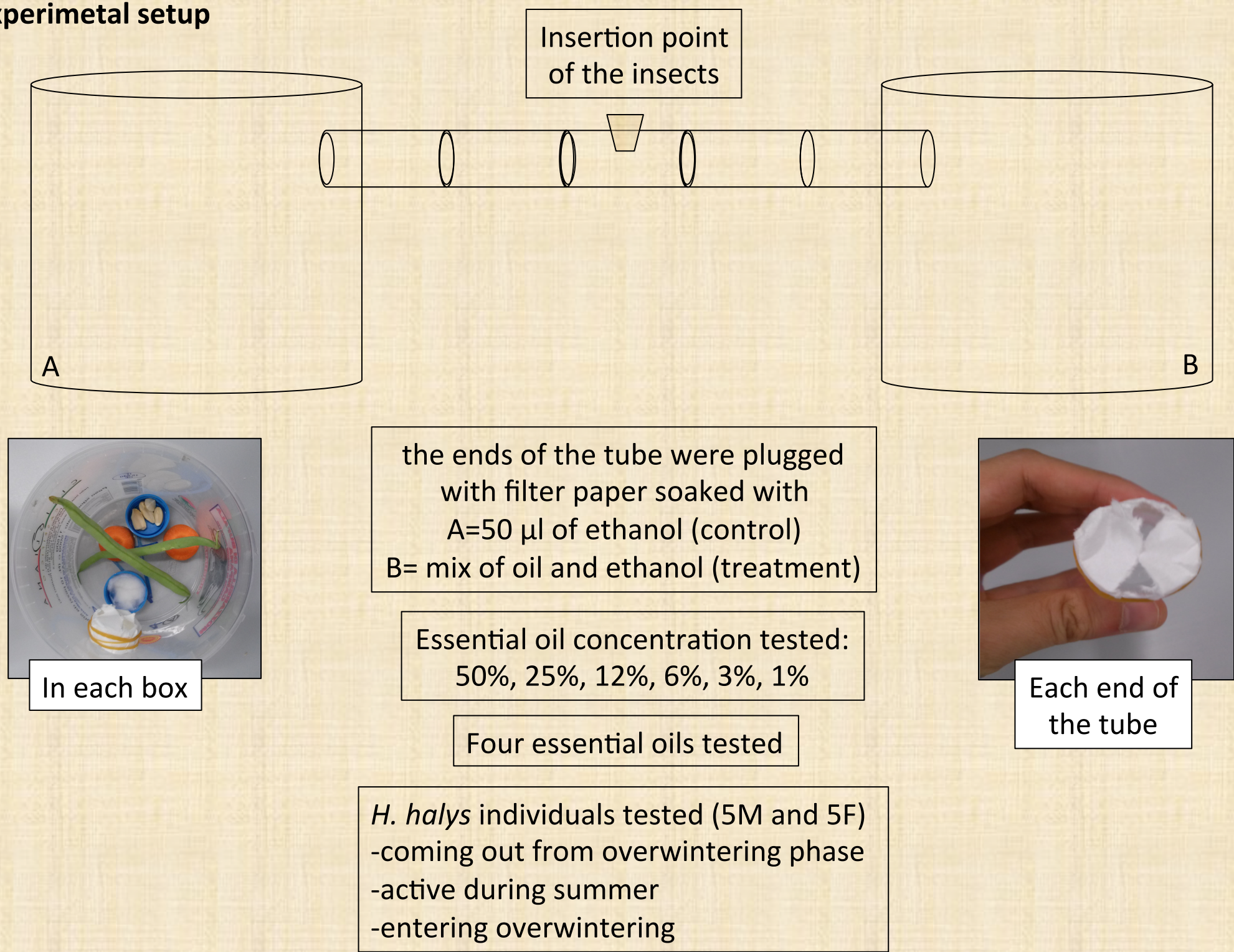
Fig. 2 examples of damage from *H. halys*

Aim

- The project is focused on the sustainable management of the invasive alien species *H. halys*. Specifically, the work was divided into different trials:
1. Repellency test: The repellency of essential oils in comparison with the attractiveness of the food on starving individuals was tested.
 2. Predatory test: The predatory ability of solitary generalist predators was tested on eggs and the first two instars of the *H. halys*.
 3. Predatory sampling and gut content analysis: Predators were field-sampled in the Reggio Emilia urban parks and their gut content will be analysed.
 4. Predatory test with social insects: The predatory ability of the ant species *Lasius niger* on the eggs and all the juvenile stages of *H. halys* will be test.

Trial 1

Experimental setup

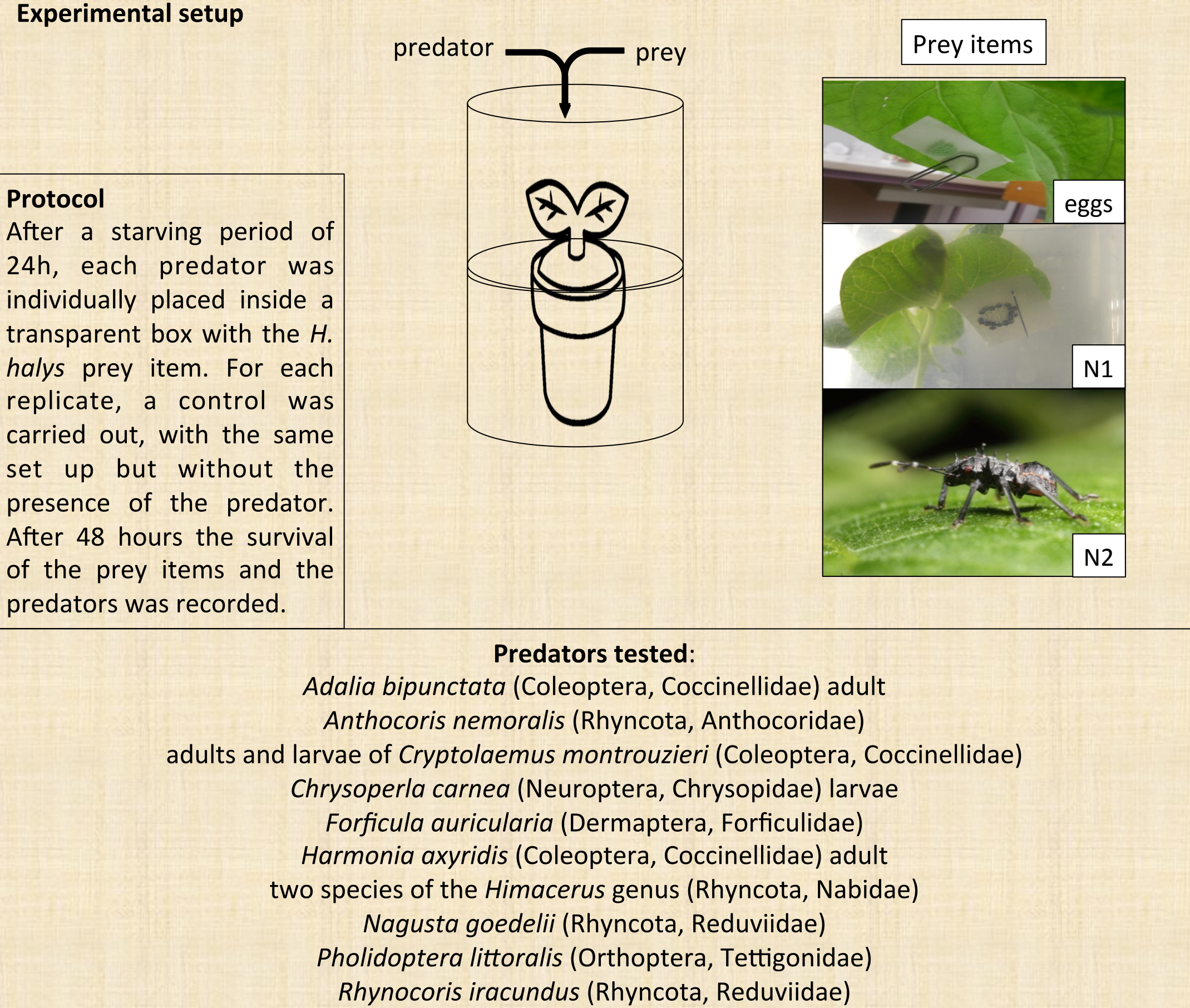


Protocol

After a 24h period of fasting, the adults were inserted individually into the tube. A check was performed after 1h, after 6h and after 24h, observing in which direction the individuals were directed.

Trial 2

Experimental setup



Trial 3

Four urban parks of the city of Reggio Emilia were selected with an area of at least 500 square meters, close (30-50 m) to a water source and close to an agro-ecosystem.

Protocol

In these urban parks, 20 attractive trees for *H. halys* were selected. On each tree a tree-beating session (Fig. 3) was performed using a stick and a tray. In the four urban parks there was also a sweep net session (Fig.4) consisting of 10 shots in 5 points characterized by tall grass. The potential predators were collected in falcon vials, then transferred in the freezer at -20°C. Sampling was performed in each park every 15 days from the beginning of May to the beginning of October. In the next months the gut content of the collected predators will be analysed using molecular techniques to see if they had preyed on *H. halys*.



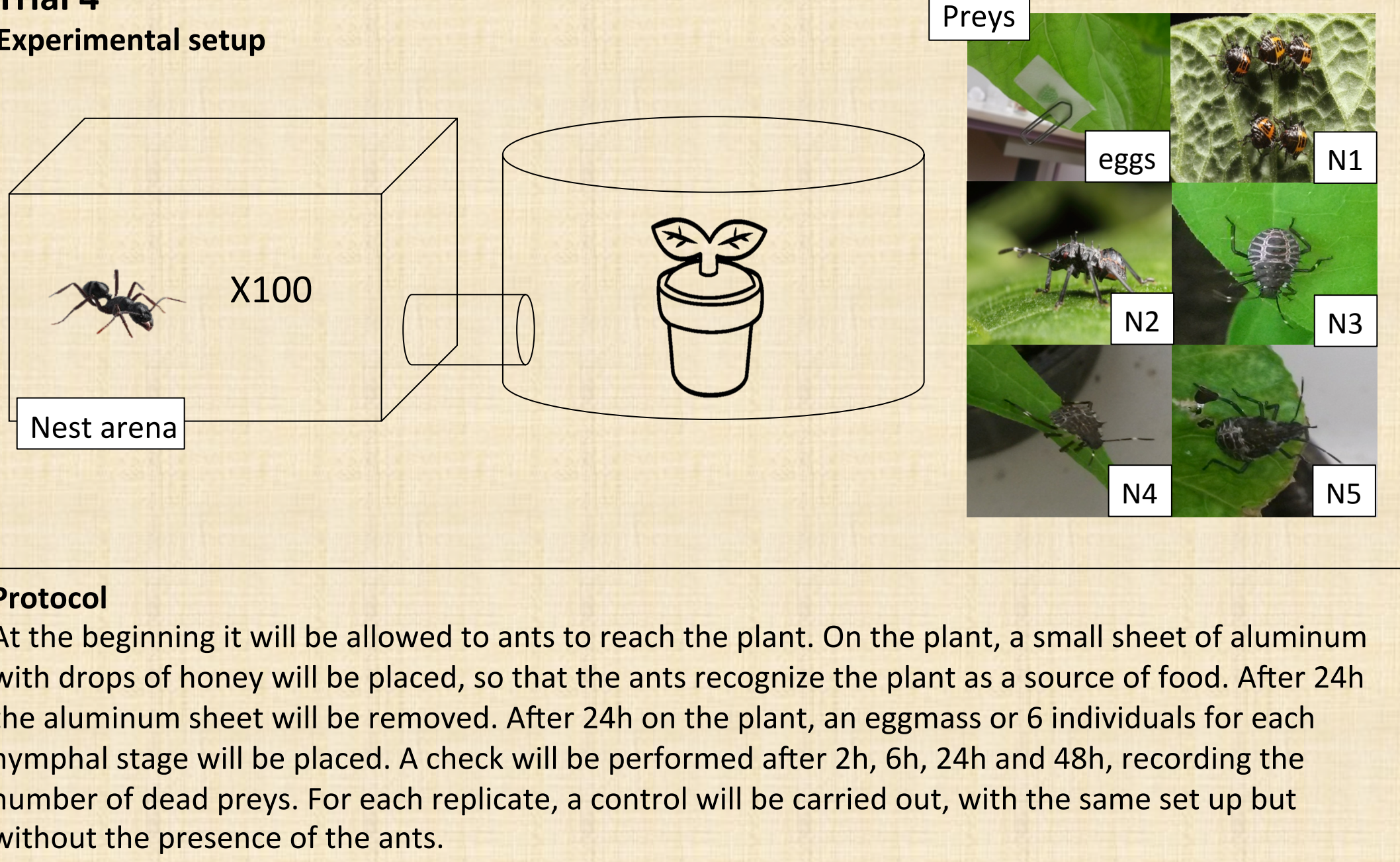
Fig. 3 a tree-beating session



Fig. 4 a sweep net session

Trial 4

Experimental setup



First results –Trial 2

From the comparison between the survivors of the treatment group (prey and predator) and the control one (no predators) it emerged that: *Pholidoptera littoralis* is the only predator capable of predating all the instars tested, including eggs. *N. goedelii*, *C. carnea* larvae and nabids from *Himacerus* genus significantly predated the first instars. *R. iracundus* and nabids of the *Himacerus* genus significantly preyed on second instars. *R. iracundus* significantly predated also adult individuals of *H. halys*.

