New trap for emergent *Megaplatypus mutatus*

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Abstract—*Megaplatypus mutatus* (= *Platypus mutatus*) (Chapuis), an ambrosia beetle (Coleoptera: Platypodidae) native to South America, is a forest pest that attacks live standing trees, affecting commercial poplar and other broadleaf plantations. Traditionally, single-chambered emergence traps have been used to collect live beetles for field and laboratory studies. However, the lack of separation in these chambers results in antagonistic interactions between individuals. Wounded *M. mutatus* are incapable of successful reproduction and are of little value in physiological and behavioral experiments. We introduce a new, multiple-chambered trap that isolates individual insects until collection, thus increasing the number of uninjured and fully functional insects available for physiological and behavioral experiments.

Résumé—*Megaplatypus mutatus* (= *Platypus mutatus*) (Chapuis), un scolyte ambrosia (Coleoptera: Platypodidae) indigène d'Amérique du Sud, est un ravageur qui attaque les arbres vivants sur pied, ce qui affecte les plantations commerciales de peupliers et d'autres essences à feuilles larges. Pour les études de terrain et de laboratoire, on récolte généralement les insectes vivants à l'aide de pièges d'émergence comprenant une seule cellule. Cependant, l'absence de séparation dans ces cellules permet des interactions agonistes entre les individus. Les *M. mutatus* blessés sont incapables de se reproduire avec succès et sont de peu d'utilité pour les expériences de physiologie et de comportement. Dans notre étude, nous avons mis au point un nouveau piège à cellules multiples qui isole les individus jusqu'au moment de la récolte, ce qui fournit un nombre plus élevé d'insectes sains et complètement fonctionnels pour les expériences physiologiques et comportementales.

[Traduit par la Rédaction]

Megaplatypus mutatus (= *Platypus mutatus*) (Chapuis, 1865), an ambrosia beetle (Coleoptera: Platypodidae: Platypodinae: Platypodini) native to South America (Wood 1993), is a major forest pest that attacks live standing trees, affecting commercial poplar and other broadleaf plantations (Bascialli *et al.* 1996). Male beetles build short nuptial galleries in selected host trees and then attract females by using a sex pheromone (Gonzalez Audino *et al.* 2005). Following copulation, the females extend the galleries in order to lodge their brood.

Diverse trapping systems have been developed in the past to ensure adequate numbers of bark and ambrosia beetles for physiological, behavioral, and ecological experiments. Beetles were collected either at light sources or from standing and felled trees, fallen fruits and seeds, petioles of large fallen leaves (Beaver 1988), and chunks of wood (McIntosh and McLean 1992). The screened windows of rearing cages, flight barriers, and pheromone-baited traps have also been employed to capture insects for use in various types of experiments (Borden and Stokkink 1973; MacConnell *et al.* 1977; Lindgren 1983; Byers *et al.* 1989, 2004; Ytsma 1989; McIntosh and McLean 1997). In some cases, Petri plates have been affixed to the galleries to collect emergent ambrosia beetles (Liu and McLean 1993).

In some of the first efforts to trap *M. mutatus*, nylon bags attached around emergence holes on the bark of trees were used (Santoro 1963). This design evolved, with nylon bags replaced by capped plastic tubes drilled in the center to allow beetle emergence and affixed to the bark of the tree, to become the first single-chambered trap for catching this ambrosia beetle (Santoro 1967). Single-chambered traps are still used in some population studies (E. Thomas, Delegación Forestal Neuquen, Ministerio de Produccion y Turismo, Neuquen, Argentina, personal communication). The next step in trap evolution was the addition of a second compartment to the plastic tube to act as a depository for emerging beetles.

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Fig. 1. Physical damage to *Megaplatypus mutatus* resulting from antagonistic interactions between males and females in a single-chambered emergence trap. (A) Female with mutilated legs (arrows) and damaged abdomen (arrowhead). (B) Male with antennal mutilation (arrowhead).

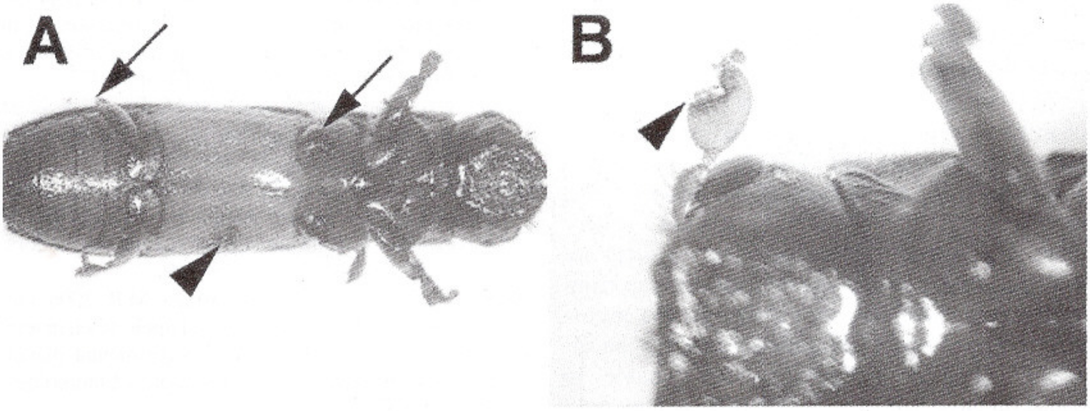
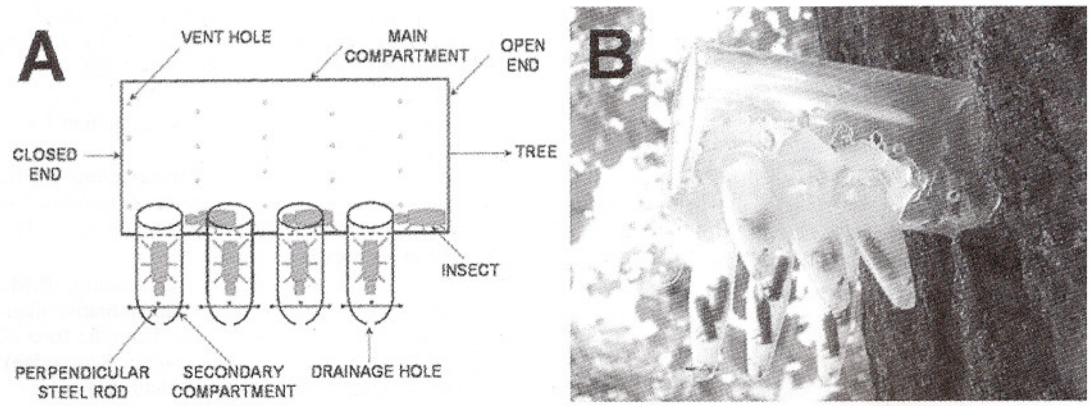


Fig. 2. Lateral view of a multiple-chambered trap. (A) Schematic diagram. (B) Trap in use.



In these traps, a single horizontal plastic tube is attached to the bark of the tree and the second compartment is joined perpendicularly to the first, giving the trap an "L" (Gonzalez Audino *et al.* 2005) or a "T" shape (Girardi *et al.* 2006).

However, the single-chambered and L- or T-shaped emergence traps confine live beetles in a common space, where they remain until collection. These designs allow antagonistic interactions to occur between beetles, often resulting in damage to the legs, antennae, thorax, and abdomen (Fig. 1). Successful reproduction can be inhibited by even slight damage to the tarsi, as males are unable to traverse the bark and excavate a gallery, and females are unable to participate in courtship. The increased loss of body fluid due to injury greatly compromises a beetle's chance of survival, as *M. mutatus* is particularly susceptible to dehydration during the flight season (P. Gatti Liguori, unpublished data).

The high level of damage experienced by beetles in this trap prompted us to design a new trap that isolates individual beetles until collection. Our new multiple-chambered trap consists of a main compartment (a 60 mm × 30 mm plastic tube) with a variable number of accessory compartments (8 mm × 30 mm plastic tubes) attached below (Fig. 2). The number of accessory compartments can be varied according to the number of emerging insects. The main and accessory compartments have vent holes (2 mm diameter) and drainage holes (4 mm diameter) to prevent water condensation and accumulation, which encourage the growth of spurious fungi. Perpendicular steel rods placed immediately in front of the drainage holes in the accessory compartments prevent insects from enlarging the holes and escaping.

The design allows easy drainage of accumulated rainwater that could drown emerging beetles or affect the microhabitat within the galleries, which in turn could affect emergence dynamics, particularly through invasion of spurious fungi. In addition, our multiple-chambered trap allows for easy elimination of frass expelled by *M. mutatus* and the visualization of trap contents, thus facilitating the scheduling of collection events

The main compartment of the multiple-chambered trap is attached to the tree horizontally, with the open end of the tube inserted into a circular track in the bark of the attacked tree, centered on the beetle's emergence gallery (Fig. 2). Upon emergence, adult *M. mutatus* are confined to the central corridor of the trap from which they have one-way access to the accessory compartments. Individuals entering an already occupied compartment are unable to cause damage to the earlier arrival, as they only have access to its caudal region. A row of physically intact insects thus forms within the accessory compartments (Fig. 2).

The main compartment can be designed to vary in size depending on the number of insects emerging daily. When the number is high, more accessory compartments can be added, always ensuring that a central corridor remains through which the insects can walk to the last accessory compartment of the trap. Our multiple-chambered trap provides double isolation of the beetles. First, the trap isolates the emerged beetles from the tree, protecting the tree from fresh attacks by newly emerged males. Second, the trap isolates individual *M. mutatus* from each other, thus preventing antagonistic interactions that diminish their physiological value for experimention. For tallying the emergence of other species of boring insects, the dimensions of our trap could be changed to fit the particular species under study, providing researchers with a supply of uninjured, functional insects with which to perform population, behavioral, and physiological studies.

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