

a robot arm configured to move the collecting mechanism to catch the insects being knocked down.

A tenth aspect of the present embodiments relates to placing cartridges directly over the pupa trays and opening doors so that the emerging insects are filled directly into the cartridges.

In this aspect there is provided a method for filling cartridges with adult insects, comprising:

- providing pupae in water, typically in pupa trays;
- closing first ends of the cartridges over the pupae;
- allowing the pupae to emerge as adults into the cartridges;
- closing doors at the first ends of the cartridges; and
- removing the cartridges with the adults therein.

In accordance with an aspect of the disclosure, there is provided an apparatus for loading of insects into cartridges for storage and dispersal of the insects, comprising:

- a cartridge for storage and dispersal of said insects,, wherein said cartridge comprises upper doors, said upper doors comprising an upper door latch mechanism for robot operation, or wherein said cartridge further comprises lower doors facing said upper doors, said lower doors comprising a lower door latch mechanism for robot operation;
- a loading mechanism for loading insects into said cartridge; and
- an expulsion system for expelling said insects from said cartridge.

In accordance with an aspect of the disclosure, there is provided an apparatus for dispersal of insects, comprising:

- a cartridge expulsion mechanism, said cartridge expulsion mechanism comprising a funnel, an air pressure source and an outlet, the expulsion mechanism configured to provide a wave of air pressure along each cartridge when an opening of a respective cartridge is in front of said expulsion mechanism; or
- comprising an opening mechanism to open doors of a cartridge at two opposite ends and provide a wave of air pressure to expel insects from within said cartridge via an outlet for dispersion; or
- comprising a plurality of cartridges placed together in a magazine, and a pupa filling robot configured to direct pupa from a pupa source to succeeding ones of said cartridges, thereby to fill all cartridges of said magazine with pupae, or comprising a closing robot configured with a door contact and a latch contact, to close and latch upper doors of said cartridges after filling of respective cartridges and an opening mechanism to

open doors of a cartridge at two opposite ends and provide a wave of air pressure to expel insects from within said cartridge via an outlet for dispersion.

In accordance with an aspect of the disclosure, there is provided an apparatus for drawing adult insects or pupae from a source for placing in a cartridge, the apparatus comprising:

- a suction tube;

- a propeller-free pump associated with said suction tube to apply suction along said suction tube and wherein the cartridge comprises a latch for robotic opening, the cartridge having two openings to allow a wave of air pressure to move along said cartridge to expel said insects;

- or wherein said apparatus comprises a sensor to count a number of insects being loaded into each cartridge.

In accordance with an aspect of the disclosure, there is provided an apparatus for loading and then expelling insects, comprising:

- a queue of cartridges stacked together in a second axis perpendicular to said first axis, the cartridges filled with insects;

- an expulsion unit, configured to expel insects from said cartridges placed in said expulsion unit by applying a wave of air pressure along a longitudinal axis of said cartridge; and
- a transport unit configured to transport said cartridges of said queue in a third axis, said third axis being perpendicular to both of said first and second axes.

In accordance with an aspect of the disclosure, there is provided a cartridge for holding adult insects, the cartridge comprising openable doors at a first end and at a second end opposite said first end, and at least one feed opening, the feed opening containing a liquid absorbent material, a first layer of netting being located on one side of said layer of liquid absorbent material, and wherein said liquid absorbent layer is located between said first layer and one other layer.

In accordance with an aspect of the disclosure, there is provided an apparatus for automatic loading of pupae into cartridges for growing, hatching into adults and dispersal of the adults, comprising:

- a source of pupae;

- one or more cartridges for hatching said pupae into adults and placement in a dispersal machine for dispersal of said adults; and

a collecting mechanism for collecting said pupae from a predetermined part of said source and dispensing collected pupae into said one or more cartridges; and

a gathering mechanism configured to gather said pupae into said predetermined part for said collecting.

In accordance with an aspect of the disclosure, there is provided an apparatus for loading and then expelling insects, comprising:

a first queue of magazines extending in one axis, each magazine comprising a plurality of cartridges stacked together in a second axis perpendicular to said first axis, the cartridges filled with insects;

an expulsion unit, configured to expel insects from cartridges of a magazine placed in said expulsion unit; and

a first transport element, configured to transport said cartridges from magazines of said queue to said expulsion unit.

In accordance with an aspect of the disclosure, there is provided a method for automatic loading of pupae into cartridges for growing, hatching into adults and dispersal of the adults, comprising:

obtaining pupae in water;

collecting said pupae;

measuring said collected pupae;

placing a measured number of said pupae in water in a cartridge;

automatically feeding said insects using a robot arm to insert liquid feed into a liquid absorbing substance in a feeding hole of said cartridge;

waiting until said pupae have hatched into adult insects;

draining said cartridge by raising said cartridge and allowing to drain through a drainage hole; and

opening both ends of said cartridge and applying an air pressure source to expel said adult insects from said cartridge.

In accordance with an aspect of the disclosure, there is provided a method for filling cartridges with adult insects, comprising:

providing pupae in trays in water;

aligning a cartridge over a respective tray;

keeping closed first ends away from the trays of the respective cartridges over said pupae, second ends of the cartridges towards said trays being opened;
allowing said pupae to emerge as adults into the cartridges;
closing doors at said second ends of the cartridges; and
removing the cartridges with said adults therein.

Unless otherwise defined, all technical and/or scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the invention pertains. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of embodiments of the invention, exemplary methods and/or materials are described below. In case of conflict, the patent specification, including definitions, will control. In addition, the materials, methods, and examples are illustrative only and are not intended to be necessarily limiting.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Some embodiments of the invention are herein described, by way of example only, with reference to the accompanying drawings. With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of embodiments of the invention. In this regard, the description taken with the drawings makes apparent to those skilled in the art how embodiments of the invention may be practiced.

In the drawings:

Fig. 1 is a photograph showing manual filling of cartridges as commonly done today;

Fig. 2 is a view from above showing manual filling of cartridges as commonly done today;

Fig. 3 is a simplified flow chart showing a high level view of an automated insect rearing process according to the present embodiments;

Fig. 4 is a simplified view of the process according to the present embodiments from pupa tray to flow of filled cartridges;