

WHAT IS CLAIMED IS:

1. Apparatus for loading of pupae into cartridges for growing, hatching into adults and dispersal of the adults, comprising:

a source of pupae in liquid;

a cartridge for hatching said pupae into adults and placement in a dispersal machine for dispersal of said adults, said cartridge having at least one drainage hole covered with a closure at a lower end; and

a water tray; and wherein said cartridge is configured to support a liquid phase for said pupae, wherein said cartridge, when filled with pupae may be placed in said water tray to retain water in said cartridge, and wherein, following hatching of said pupae, said cartridge drainable via said at least one drainage hole to provide a dry environment for said adults; and

an expulsion mechanism configured to open said cartridge at first and second opposite ends and apply a wave of air pressure along said open cartridge to expel insects therefrom.

2. Apparatus according to claim 1, further comprising a suction tube connected to said source of pupae to suck pupae from said source for filling said cartridge, or comprising a suction tube connected to a robot arm to direct said suction tube to said pupae, or comprising a scoop configured to scoop up said pupae from said pupae source, or comprising a measuring cup configured to collect pupae from said suction tube, thereby to fill a measured dose of said pupae into said cartridge, or comprising a measuring cup having a sensor for detecting when said cup is full.

3. Apparatus according to claim 2, wherein said sensor is one member of the group consisting of: a weight detector, a proximity detector, an ultrasonic sensor, a capacitive sensor and a camera, or wherein said suction tube comprises one member of the group consisting of a propeller-free pump, a Venturi pump, a pipette and a piston.

4. 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.

5. Apparatus according to any one of the preceding claims, wherein said cartridge comprises at least one feeding hole, said feeding hole containing a liquid absorbent material for holding sugar water, wherein said pupa source comprises water holding said pupae and an air current mechanism configured to blow across said water to concentrate said pupae for collection, or wherein said pupa source comprises water holding said pupae and a net configured to move across said water to concentrate said pupae at one side of said pupa source for collection.

6. 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.

7. Apparatus according to any one of the preceding claims, further comprising a feeding robot, said feeding robot comprising a liquid dispenser for dispensing sugar water to said cartridges, said feeding robot configured to direct said liquid dispenser to feeding holes in successive cartridges to dispense sugar water for each cartridge.

8. Apparatus according to any one of the preceding claims, further comprising an expulsion mechanism, said expulsion mechanism comprising a funnel, an air pressure source and an outlet, the expulsion mechanism configured to provide a wave of air from end to end of each cartridge when an opening of a respective cartridge is adjacent the expulsion mechanism; or the expulsion mechanism configured to open doors of successive cartridges at two opposite ends and provide a wave of air pressure to expel insects from within said cartridge via said outlet for dispersion; or

wherein said expulsion mechanism is slidably mounted for controllable travel along a height to reach respective ones of said successive cartridges.

9. Apparatus according to any one of the preceding claims further comprising a suction tube, a sensor, and a pick up robot, said sensor configured to detect pupae or clusters of pupae in said pupa source, and said robot being configured to align said suction tube with said detected pupae or clusters, and said suction tube applying suction when aligned, thereby to pick up pupae from said source to place in a respective cartridge.

10. 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.

11. 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.

12. Apparatus according to claim 11, wherein said cartridges comprise upper doors and lower doors opposite said upper doors, said upper and lower doors being openable by said expulsion mechanism, or wherein said expulsion mechanism comprises a funnel, an air pressure source and an outlet, the expulsion mechanism configured to open doors of successive cartridges at two opposite ends and provide a wave of air pressure to expel insects from within said cartridge via said outlet for dispersion.

13. Apparatus for filling a cartridge with adult insects from an insect source, the apparatus comprising:

an air pressure source;

an aiming mechanism configured to aim said air pressure source at one or more adult insects; and

a collecting mechanism configured to collect insects knocked towards said collecting mechanism by said air pressure source.

14. Apparatus according to claim 13, wherein said air pressure source is configured to provide a directable blade of moving air, or said air pressure source is a suction source or a blowing source provided through said collecting mechanism, or said aiming mechanism comprises a camera.

15. Apparatus according to claim 13 or claim 14, further comprising a counting device for counting numbers of said adult insects passing through said collecting device, thereby to supply cartridges with predetermined numbers of insects.

16. 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.

17. 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.

18. Apparatus according to claim 17, wherein said gathering mechanism comprises an air pressure source to blow across said pupa source to concentrate said pupae at said predetermined part for collection, or wherein said gathering mechanism comprises a net configured to move across said source to concentrate said pupae at said predetermined part for collection.

19. 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.

20. Apparatus according to claim 19, wherein said transport element is a conveyor belt, said conveyor belt extending in a third axis, said third axis being perpendicular to both of said first and second axes, or wherein said apparatus comprises at least one additional queue of magazines and an additional conveyor associated with said at least one additional queue, said conveyor configured to transport cartridges from said at least one additional queue to said first conveyor.

21. 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.

22. The method of claim 21, comprising carrying out said draining at a temperature below 10 degrees Celsius or below 9 degrees Celsius or below 6 degrees Celsius.

23. The method of claim 21, or claim 22, comprising

providing said cartridges as a magazine of multiple cartridges and placing said magazines in one or more queues with an expulsion unit;

transporting the cartridges to the expulsion unit;

opening the cartridges at first and second opposite ends; and

providing air pressure to expel said adult insects from the cartridges.

24. The method of any one of claims 21 to 23, wherein said automatically feeding is repeated at least once.

25. 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.

26. Apparatus according to claim 11, wherein said expulsion unit comprises a pressure source, an opener being located in front of said pressure source, the opener being configured to operate an opening mechanism on a cartridge approaching said expulsion unit, thereby to open said cartridge on approach to said expulsion unit.

27. Apparatus according to claim 26, further comprising a second opener located to open a second door at a far end of said approaching cartridge.

28. Apparatus according to claim 27, wherein a reciprocal motion of said pressure source towards and away from said approaching cartridge moves one or both openers to operate respective opening mechanisms in a correct sequence to open said first and second cartridge doors.