AUTOMATED MASS REARING SYSTEM FOR INSECT LARVAE

BACKGROUND

[0001] Mass rearing of mosquito larvae has conventionally been very labor intensive, requiring massive manpower. A lab technician may manually add a number of eggs or mosquito larvae to a plastic tray and determine the amount of food and water to add into the tray for the mosquito larvae. The lab technician may hand carry the plastic tray to a storage area to store the plastic tray. Periodically, the lab technician may perform observations on the mosquito larvae in the plastic tray and add food and water as needed. After the mosquito larvae evolve into pupae, the lab technician may segregate the females from the males using two glass plates. Not only are these processes very labor intensive, but also highly inaccurate when carried out by a person.

BRIEF SUMMARY

[0002] According to a first aspect of the present invention, there is provided an automated insect rearing system comprising: an insect dispenser comprising an insect container and an insect dispensing vessel, a first end of the insect dispensing vessel coupled to a first orifice defined in the insect container and a second end of the insect dispensing vessel movable to be proximate to a rearing container to dispense one or more insects from the insect container into the rearing container; a food dispenser comprising a food container and a food dispensing vessel, a first end of the food dispensing vessel coupled to a second orifice defined in the food container and a second end of the food dispensing vessel movable to be proximate to the rearing container, the food dispenser configured to dispense food into the rearing container; a robotic storage system comprising one or more shelves to store one or more rearing containers; and a transportation unit comprising a robotic arm positioned and configured to transport rearing containers.

[0003] According to a second aspect of the present invention, there is provided a method of rearing insects comprising: dispensing, by an insect dispenser of an automated rearing system, one or more insects into a rearing container, the insect dispenser comprising an insect container and an insect dispensing vessel, a first end of the insect dispensing vessel coupled to a first orifice defined in the insect container and a second end of the insect dispensing vessel movable to be proximate to a rearing container to dispense one or more insects from the insect container into the rearing container; dispensing, by a food dispenser of the automated rearing system, food for the one or more insects into the rearing container, the food dispenser comprising a food container and a food dispensing vessel, a first end of the food dispensing vessel coupled to a second orifice defined in the food container and a second end of the food dispensing vessel movable to be proximate to the rearing container; and monitoring, by one or more processors coupled to

the automated rearing system, development of the one or more insects in the rearing container using one or more sensors in a storage area of the automated rearing system.

[0004] These illustrative examples are mentioned not to limit or define the scope of this disclosure, but rather to provide examples to aid understanding thereof. Illustrative examples are described in the Detailed Description, which provides further description. Advantages offered by various examples may be further understood by examining this disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] Fig. 1 illustrates a simplified block diagram of an automated mass rearing system in accordance with some embodiments.

[0006] Fig. 2 illustrates a simplified automated process of mass rearing insect larvae performed by an automated mass rearing system in accordance with some embodiments.

[0007] Fig. 3 depicts a flow chart for mass rearing insect larvae using an automated mass rearing system in accordance with certain embodiments.

[0008] Fig. 4 depicts another flow chart for mass rearing mosquito larvae using an automated mass rearing system in accordance with certain embodiments.

[0009] Fig. 5 depicts an example computing device for automated mass rearing systems according to this disclosure.

DETAILED DESCRIPTION

[0010] Examples are described herein in the context of automated mass rearing systems for insect larvae. Those of ordinary skill in the art will realize that the following description is illustrative only and is not intended to be in any way limiting. Reference will now be made in detail to implementations of examples as illustrated in the accompanying drawings. The same reference indicators will be used throughout the drawings and the following description to refer to the same or like items.

[0011] In the interest of clarity, not all of the routine features of the examples described herein are shown and described. It will, of course, be appreciated that in the development of any such actual implementation, numerous implementation-specific decisions must be made in order to achieve the developer's specific goals, such as compliance with application- and business-related constraints, and that these specific goals will vary from one implementation to another and from one developer to another.

CLAIMS

1. An automated insect rearing system comprising:

an insect dispenser comprising an insect container and an insect dispensing vessel, a first end of the insect dispensing vessel coupled to a first orifice defined in the insect container and a second end of the insect dispensing vessel movable to be proximate to a rearing container to dispense one or more insects from the insect container into the rearing container;

a food dispenser comprising a food container and a food dispensing vessel, a first end of the food dispensing vessel coupled to a second orifice defined in the food container and a second end of the food dispensing vessel movable to be proximate to the rearing container, the food dispenser configured to dispense food into the rearing container;

a robotic storage system comprising one or more shelves to store one or more rearing containers; and

a transportation unit comprising a robotic arm positioned and configured to transport rearing containers.

2. The automated insect rearing system of claim 1 further comprising a conveyor configured to transport the rearing container to or from the robotic storage system.

3. The automated insect rearing system of claim 1 wherein the robotic storage system comprises an articulating robotic arm.

4. The automated insect rearing system of claim 2, wherein the robotic arm comprises a gripper arm with a vacuum cup for grasping the rearing container.

5. The automated insect rearing system of claim 1, wherein the insect dispenser includes an egg dispenser or a larvae dispenser, wherein the one or more insects includes insect eggs or insect larvae, wherein the insect eggs comprises mosquito eggs, and wherein the insect larvae comprises mosquito larvae.

6. The automated insect rearing system of claim 1, wherein the robotic storage system further includes one or more temperature controls and one or more lighting controls, the one or more temperature controls configured to adjust a temperature surrounding the rearing container and the one or more lighting controls configured to adjust a lighting surrounding the rearing container.

7. The automated insect rearing system of claim 1, further comprising:

a draining station comprising a horizontal surface, a blade, and an emergence vessel, the blade movable to be proximate to the horizontal surface to cut open the rearing container placed onto the horizontal surface to release contents of the rearing container into the emergence vessel.

8. The automated insect rearing system of claim 1, further comprising:

a computing device comprising a user interface, the user interface configured to manage a movement of one or more trays holding the rearing container, and wherein the user interface is further configured to schedule one or more actions to be performed on the rearing container.

9. The automated insect rearing system of claim 1, further comprising:

a disposable container creation system comprising at least a spool of heat moldable material and a form filling machine, the form filling machine configured to create one or more indentations in a layer of the heat moldable material.

10. The automated insect rearing system of claim 9, wherein the disposable container creation system further comprises a heat sealer configured to seal at least portions of an upper layer and a bottom layer of the heat moldable material to form the rearing container, and wherein the form filling machines comprises a post creation machine, the post creation machine configured to create one or more posts in the layer of the heat moldable material.

11. The automated insect rearing system of claim 1, wherein the one or more insects are dispensable from the insect container to the rearing container, and wherein the food is dispensable from the food container to the rearing container.

12. The automated insect rearing system of claim 1, further comprising:

a monitor system comprising a computing device and one or more sensors, the one or more sensors configured to monitor the one or more insects in the rearing container, and the computing device configured to adjust one or more parameters associated with the rearing container responsive to data obtained from the monitoring.

13. The automated insect rearing system of claim 1, further comprising:

an inspection station having a horizontal surface and one or more sensors, the one or more sensors configured to collect data on the rearing container while the rearing container is placed on the horizontal surface.

14. The automated insect rearing system of claim 1, further comprising:

a water dispenser comprising a water container and a water dispensing vessel, a first end of the water dispensing vessel coupled to a first orifice defined in the water container and a second end of the water dispensing vessel movable to dispense water from the water container into the rearing container.

15. A method of rearing insects comprising:

dispensing, by an insect dispenser of an automated rearing system, one or more insects into a rearing container, the insect dispenser comprising an insect container and an insect dispensing vessel, a first end of the insect dispensing vessel coupled to a first orifice defined in the insect container and a second end of the insect dispensing vessel movable to be proximate to a rearing container to dispense one or more insects from the insect container into the rearing container;

dispensing, by a food dispenser of the automated rearing system, food for the one or more insects into the rearing container, the food dispenser comprising a food container and a food dispensing vessel, a first end of the food dispensing vessel coupled to a second orifice defined in the food container and a second end of the food dispensing vessel movable to be proximate to the rearing container; and

monitoring, by one or more processors coupled to the automated rearing system, development of the one or more insects in the rearing container using one or more sensors in a storage area of the automated rearing system.

16. The method of claim 15, further comprising:

draining, using a water pump coupled to the automated rearing system, the water from the rearing container;

adding, by a water dispenser, water into the rearing container to replace at least a portion of the water drained from the rearing container; or

pumping, using an air pump coupled to the automated rearing system, additional air into the rearing container.

17. The method of claim 15, further comprising:

adjusting an amount of food that is dispensed into the rearing container based on data obtained from the monitoring.

18. The method of claim 15, further comprising:

receiving input specifying an adjustment to one or more parameters associated with the rearing container; and

updating an amount of food to dispense into the rearing container based on the received input, wherein the updated amount of food is automatically dispensed into the rearing container one or more times during a rearing process of the one or more insects.

19. The method of claim 15, wherein the one or more insects includes at least one of insect eggs or insect larvae, wherein the insect eggs are mosquito eggs and the insect larvae are mosquito larvae, and further comprising:

draining contents of the rearing container into an emergence vessel, wherein the contents include mosquito pupae evolved from the mosquito larvae.

20. The method of claim 15, further comprising transporting the rearing container to or from the storage area.