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] Various examples are described for automated insect rearing systems and methods. According to a first aspect of the present invention, there is provided an automated insect rearing system comprising: an insect dispensing station having a first horizontal surface; 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 the first horizontal surface to dispense one or more insects from the insect container into a rearing container at the first horizontal surface; a food dispensing station having a second horizontal surface; 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 second horizontal surface to dispense food from the food container into the rearing container at the second horizontal surface; and a robotic storage system comprising at least one robotic arm and a shelf, the robotic arm configured to transfer the rearing container from the second horizontal surface to the shelf.

[0003] According to a second aspect of the present invention, there is provided a method of rearing insects, the method comprising dispensing, by an insect dispenser of an automated rearing system, one or more insects into a

rearing container; dispensing, by a food dispenser of the automated rearing system, food for the one or more insects into the rearing container; transporting, by one or more robotic arms of the automated rearing system, the rearing container to a storage area of the automated rearing system; and monitoring, by one or more processors coupled to

CLAIMS

WHAT IS CLAIMED IS:

1. An automated insect rearing system comprising:

an insect dispensing station having a first horizontal surface;

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 the first horizontal surface to dispense one or more insects from the insect container into a rearing container at the first horizontal surface;

a food dispensing station having a second horizontal surface;

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 second horizontal surface to dispense food from the food container into the rearing container at the second horizontal surface; and

a robotic storage system comprising at least one robotic arm and a shelf, the robotic arm configured to transfer the rearing container from the second horizontal surface to the shelf.

2. The system of claim 1, wherein the first horizontal surface and the second horizontal surface are the same surface.

3. The 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.

4. The system of claim 1, wherein the robotic storage system comprises a plurality of shelves.

5. The 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.

6. The system of claim 1, further comprising:

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

7. The 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.

8. The system of claim 1, wherein the robotic arm comprises a gripper arm with a vacuum cup for grasping the rearing container.

9. The 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 system of claim 6, 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 system of claim 1, wherein the one or more insects is dispensed from the insect container to the rearing container, and wherein the food is dispensed from the food container to the rearing container.

12. The 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 system of claim 1, further comprising:

an inspection station having a third 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 third horizontal surface.

14. The system of claim 1, further comprising:

a water dispensing station having a third horizontal surface; and

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 be proximate to the third horizontal surface to dispense water from the water container at the third horizontal surface into the rearing container.

15. A method of rearing insects, the method comprising:

dispensing, by an insect dispenser of an automated rearing system, one or more insects into a rearing container;

dispensing, by a food dispenser of the automated rearing system, food for the one or more insects into the rearing container;

transporting, by one or more robotic arms of the automated rearing system, the rearing container to a storage area of the automated rearing system; 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 the storage area of the automated rearing system.

16. The method of claim 15, wherein the one or more robotic arms of the automated rearing system includes a gripper arm, and wherein the one or more robotic arms transports the rearing container via a vacuum cup coupled to the gripper arm.

17. The method of claim 15, further comprising:

creating, by the automated rearing system, the rearing container for housing the one or more insects; and

dispensing, by a water dispenser, water into the rearing container.

18. The method of claim 17, further comprising:

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

refilling, by the water dispenser, additional water into the rearing container to replace at least a portion of the water drained from the rearing container; and

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

19. The method of claim 17, wherein creating the rearing container for housing the one or more insects includes:

dispensing a bottom layer and a top layer of heat moldable material from a spool of the heat moldable material; and

partially sealing, using a heat sealer, edges of the bottom layer and the top layer of the heat moldable material.

20. 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.

21. 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.

22. 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 is mosquito eggs and the insect larvae is mosquito larvae, and wherein the method further comprises:

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

23. The method of claim 15, further comprising:

presenting a user interface on a display of a computing device;

receiving a selection of one or more rearing containers; and

receiving adjustments to one or more parameters associated with the selected rearing containers.

24. The method of claim 23, wherein the one or more parameters comprise one or more of an environment parameter or an action to be taken on the selected reraing containers.

25. The method of claim 24, wherein the action comprises one of dispensing food or water into the container, draining water from the container; draining insect larvae or insect pupae from the container, or transporting the selected containers to another position within the automated rearing system.

26. The method of claim 15, further comprising:

receiving sensor signals from the one or more sensors, wherein the monitoring is based on the received sensor signals.

27. The method of claim 15, further comprising:

detecting, via the one or more sensors, a change associated with contents of the rearing container; and

adjusting one or more parameters associated with the rearing container in response to the detected change.

28. The method of claim 15, further comprising:

detecting an environmental condition associated with the rearing container;

in response to determining the environmental condition exceeds a predetermined setting, modifying an environmental control based on the environmental condition and the predetermined setting.

29. The method of claim 28, wherein the environmental condition comprises one or more of a temperature, a humidity, or a lighting condition, and wherein the environmental control comprises one or more of a temperature control, a humidity control, or a lighting control.

30. The method of claim 15, further comprising:

receiving, by a computing device, a selection of the rearing container;

in response to the selection:

retrieving and transporting, by one of the one or more robotic arms, the rearing container from the storage area to an inspection station.

31. The method of claim 15, further comprising:

determining, by a computing device, that the rearing container is in a low food condition;

in response to the low food condition:

retrieving and transporting, by one of the one or more robotic arms, the rearing container from the storage area to a dispensing station;

dispensing, by the food dispenser, food into the rearing container; and

transporting, by one of the one or more robotic arms, the rearing container from the dispensing station to the storage area.

32. The method of claim 15, further comprising:

determining, by a computing device, that the rearing container is in a low water quality condition;

in response to the low water quality condition:

opening a drainage passage of the rearing container to drain water from the rearing container;

retrieving and transporting, by one of the one or more robotic arms, the rearing container from the storage area to a dispensing station;

dispensing water into the rearing container; and

transporting, by one of the one or more robotic arms, the rearing container from the dispensing station to the storage area.