EGG HATCHING AND LARVAE SEPARATION DEVICES AND METHODS

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is related to and claims priority benefit from U.S. Non-Provisional Application No. 16/288,287, filed on February 28, 2019, and entitled "Egg Hatching and Larvae Separation Devices and Methods," ("the '287 application"). The '287 application is hereby incorporated in its entirety by this reference.

FIELD

[0002] The present disclosure relates generally to the mass-rearing of insects. More specifically, but not by way of limitation, this disclosure relates to devices and methods for separating insect larvae from egg hatching debris.

BACKGROUND

[0003] The mass-rearing of insect larvae can be very time and labor intensive. To produce insect larvae, insect eggs are flooded in a solution (e.g., water plus yeast) and left for a number of hours in a container (e.g., a jar) at an appropriate temperature to allow for the desired number of larvae to hatch. A technician would then perform the difficult task of separating the hatched larvae from the egg hatching debris (e.g., the egg casings and the non-egg debris, such as mosquito body parts) in order to conduct a smooth and accurate larvae counting/allocation operation. Separating the hatched larvae from the egg hatching debris would typically be done by transferring the hatched larvae and the debris from the container to a tray for a technician to hand pluck the larvae from the egg hatching debris. This method often involved significant amounts of human labor and time, such as manually moving the hatched larvae and solution from the container to the tray, hand separating the hatched larvae from the egg casings and the non-egg debris, etc.

SUMMARY

[0004] Various aspects are described for devices and methods for egg hatching and larvae separation. ~~According to a first aspect of the present disclosure, there is provided a fluid-tight container, wherein the fluid-tight container includes a base having a first portion and a second portion; at least one wall enclosing the base and coupled to the base to form a fluid-tight seal; wherein the first portion of the base includes a first color and defines a recess; and wherein the second portion of the base includes a second color darker than the first color.~~

According to a first aspect of the present disclosure, there is provided a device including a fluid-tight container, wherein the fluid-tight container includes: a base having a first portion and a second portion; and at least one wall enclosing the base and coupled to the base to form a fluid-tight seal; wherein the first portion of the base comprises a first color, a first end, and a second end, the second end being proximate to the second portion and opposite to the first end, and the first portion defines a recess to receive a plurality of hatchable mosquito eggs, the recess being arranged at the first end of the first portion; and

wherein the second portion of the base comprises a second color darker than the first color.

[0004a] ~~According to a second aspect of the present disclosure, there is provided an insect larvae separating device, including: a fluid-tight container including: a base having a first portion and a second portion; at least one wall enclosing the base and coupled to the base to form a fluid-tight seal, at least a portion of the at least one wall being translucent; wherein the first portion of the base comprises a first color and defines a recess and a slope inclining from the recess to the second portion; and wherein the second portion of the base includes a second color darker than the first color and contiguous with the first portion; a liquid disposed in the fluid-tight container; a light source positioned and oriented to transmit light through the translucent portion of the at least one wall into the fluid-tight container; a vibration generator coupled to the fluid-tight container to output a mechanical vibration to the first portion; a heat source positioned to maintain a temperature of the liquid disposed in the fluid-tight container; a temperature measuring device to measure the temperature of the liquid disposed in the fluid-tight container; and a processor configured to execute processor executable instructions stored in a memory to: activate and deactivate the light source, activate and deactivate the vibration generator, receive a signal from the temperature~~

~~measuring device, and output a signal to the heat source based on the signal from the temperature measuring device.~~

According to a second aspect of the present disclosure, there is provided an insect larvae separating device, including: a fluid-tight container including: a base having a first portion and a second portion; and at least one wall enclosing the base and coupled to the base to form a fluid-tight seal, at least a portion of the at least one wall being translucent; wherein the first portion of the base comprises a first color, a first end, and a second end, the second end being proximate to the second portion and opposite to the first end, the first portion defines a recess to receive a plurality of hatchable mosquito eggs, the recess being arranged at the first end of the first portion and the first portion further comprises a slope inclining from the recess to the second portion; and wherein the second portion of the base comprises a second color darker than the first color and contiguous with the first portion; a liquid disposed in the fluid-tight container; a light source positioned and oriented to transmit light through the translucent portion of the at least one wall into the fluid-tight container; a vibration generator coupled to the fluid-tight container to output a mechanical vibration to the first portion; a heat source positioned to maintain a temperature of the liquid disposed in the fluid-tight container; a temperature measuring device to measure the temperature of the liquid disposed in the fluid-tight container; and a processor configured to execute processor executable instructions stored in a memory to: activate and deactivate the light source, activate and deactivate the vibration generator, receive a signal from the temperature measuring device, and output a signal to the heat source based on the signal from the temperature measuring device.

[0005] ~~According to a third aspect of the present disclosure, there is provided a fluid-tight container and a liquid disposed in the fluid-tight container, wherein the fluid-tight container includes a base having a first portion and a second portion; at least one wall enclosing the base and coupled to the base to form a fluid-tight seal; wherein the first portion of the base includes a first color and defines a recess; and wherein the second portion of the base includes a second color darker than the first color; dispensing a plurality of insect eggs into the recess of the fluid-tight container; and removing at least one larvae from the second portion of the fluid-tight container, the at least one larvae having hatched from an insect egg of the plurality of insect eggs.~~

According to a third aspect of the present disclosure, there is provided a method including, providing a fluid-tight container and a liquid disposed in the fluid-tight container, wherein the fluid-tight container comprises a base having a first portion and a second portion; and at least one wall enclosing the base and coupled to the base to form a fluid-tight seal; wherein the first portion of the base comprises a first color, a first end, and a second end, the second end being proximate to the second portion and opposite to the first end, and the first portion defines a recess to receive a plurality of hatchable mosquito eggs, the recess being arranged at the first end of the first portion; and wherein the second portion of the base comprises a second color darker than the first color; dispensing a plurality of insect eggs into the recess of the fluid-tight container; and removing at least one larvae from the second portion of the fluid-tight container, the at least one larvae having hatched from a mosquito egg of the plurality of mosquito eggs.

[0006] 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 discussed in the Detailed Description, which provides further description. Advantages offered by various examples may be further understood by examining this specification.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The accompanying drawings, which are incorporated into and constitute a part of this specification, illustrate one or more certain examples and, together with the description of the example, serve to explain the principles and implementations of the certain examples.

[0008] Figures 1-8 and 11 show example devices for egg hatching and larvae separation according to this disclosure;

[0009] Figure 9 shows a flowchart for an example method for egg hatching and larvae separation according to this disclosure; and

[0010] Figure 10 shows an example computing device for egg hatching and larvae separation according to this disclosure.

DETAILED DESCRIPTION

[0011] Examples are described herein in the context of devices and methods for egg hatching and larvae separation. Those of ordinary skill in the art

CLAIMS

~~That which is claimed is:~~

1. A device comprising a fluid-tight container, wherein the fluid-tight container comprises:

a base having a first portion and a second portion; and

at least one wall enclosing the base and coupled to the base to form a fluid-tight seal;

wherein the first portion of the base comprises a first color, a first end, and a second end, the second end being proximate to the second portion and opposite to the first end, and the first portion defines a recess to receive a plurality of hatchable mosquito eggs, the recess being arranged at the first end of the first portion; and

wherein the second portion of the base comprises a second color darker than the first color.

2. The device of claim 1, wherein a liquid is disposed within the fluid-tight container.

3. The device of claim 2, further comprising a heat source positioned to maintain a predetermined temperature of the liquid disposed in the fluid-tight container.

4. The device of claim 3, further comprising a temperature measuring device configured to measure and regulate the temperature of the liquid disposed in the fluid-tight container.

5. The device of claim 1, wherein the base comprises a rectangular shape.

6. The device of claim 1, wherein the base and at least one wall comprise a single molded piece of material.

7. The device of claim 1, wherein the first color comprises white and the second color comprises black.

8. The device of claim 1, wherein the first portion and the second portion are contiguous.

9. The device of claim 1, wherein a portion of the at least one wall is translucent and a light source is positioned and oriented to emit light through the translucent portion into the fluid-tight container.

10. The device of claim 9, wherein the light source is attached to an outer surface of the fluid-tight container.

11. The device of claim 1, wherein the at least one wall includes two wall sections, wherein a dividing member:

extends over the base between the two wall sections, and

defines a gap between the base and the dividing member,

wherein the dividing member is configured to permit insect larvae to pass from one side of the member to the other side of the member and prevent an insect egg hatching debris from passing from one side of the member to the other side of the member.

12. The device of claim 1, wherein the first portion defines a slope inclining from the recess to the second portion.

13. The device of claim 1, further comprising a vibration generator to output a mechanical vibration to the first portion.

14. The device of claim 13, wherein the vibration generator is attached to an outside surface of the fluid-tight container at a location proximate to the first portion.

15. The device of claim 1, wherein the second portion defines a resealable hole to drain a liquid and a plurality of insect larvae from the second portion.

16. The device of claim 1, wherein the fluid-tight container further comprises a pump configured to extract a liquid and a plurality of insect larvae from the second portion.

17. The device of claim 1, further comprising a chemical deterrent located in the first portion.

18. The device of claim 1, further comprising a chemical attractant located in the second portion.

19. The device of claim 1, wherein the fluid-tight container further comprises a removable opaque cover.

20. The device of claim 1, wherein the fluid-tight container further comprises a removable substantially translucent or transparent cover.

21. An insect larvae separating device, comprising:

a fluid-tight container comprising:

a base having a first portion and a second portion; and

at least one wall enclosing the base and coupled to the base to form a fluid-tight seal, at least a portion of the at least one wall being translucent;

wherein the first portion of the base comprises a first color, a first end, and a second end, the second end being proximate to the second portion and opposite to the first end, ~~and~~ the first portion defines a recess to receive a plurality of hatchable mosquito eggs, the recess being arranged at the first end of the first portion and the first portion further comprises a slope inclining from the recess to the second portion; and

wherein the second portion of the base comprises a second color darker than the first color and contiguous with the first portion;

a liquid disposed in the fluid-tight container;

a light source positioned and oriented to transmit light through the translucent portion of the at least one wall into the fluid-tight container;

a vibration generator coupled to the fluid-tight container to output a mechanical vibration to the first portion;

a heat source positioned to maintain a temperature of the liquid disposed in the fluid-tight container;

a temperature measuring device to measure the temperature of the liquid disposed in the fluid-tight container; and

a processor configured to execute processor executable instructions stored in a memory to:

activate and deactivate the light source,

activate and deactivate the vibration generator,

receive a signal from the temperature measuring device, and

output a signal to the heat source based on the signal from the temperature measuring device.

22. A method comprising,

providing a fluid-tight container and a liquid disposed in the fluid-tight container, wherein the fluid-tight container comprises a base having a first portion and a second portion;

and at least one wall enclosing the base and coupled to the base to form a fluid-tight seal; wherein the first portion of the base comprises a first color, a first end, and a second end, the second end being proximate to the second portion and opposite to the first end, and the first portion defines a recess to receive a plurality of hatchable mosquito eggs, the recess being arranged at the first end of the first portion; and wherein the second portion of the base comprises a second color darker than the first color;

dispensing a plurality of insect eggs into the recess of the fluid-tight container; and

removing at least one larvae from the second portion of the fluid-tight container, the at least one larvae having hatched from ~~an insect~~a mosquito egg of the plurality of ~~insect~~ mosquito eggs.

23. The method of claim 22, further comprising:

receiving, by a processor from a sensor, sensor signals indicating insect larvae being removed from the second portion; and

counting, by the processor, the insect larvae based on the sensor signals.

24. The method of claim 22, further comprising emitting light, by at least one light source positioned and oriented to emit light, through a translucent portion of the at least one wall into the fluid-tight container.

25. The method of claim 22, further comprising outputting a mechanical vibration to the first portion using a vibration generator.

26. The method of claim 22, wherein removing the at least one larvae from the second portion comprises draining the at least one larvae from the fluid-tight container.

27. The method of claim 22, wherein removing the at least one larvae from the second portion comprises pumping out the liquid and the at least one larvae from the fluid-tight container.

28. The method of claim 22, further comprising introducing a chemical attractant to the second portion.

29. The method of claim 22, further comprising introducing a chemical deterrent to the first portion.

30. The method of claim 22, further comprising applying heat from a heat source to the fluid-tight container and monitoring the temperature of the liquid using

a temperature measuring device and monitoring the temperature of the liquid using a temperature measuring device.

~~31. The method of claim 30, further comprising monitoring the temperature of the liquid using a temperature measuring device.~~

31. The device of claim 1, wherein the recess extending along at least a majority of a width of the first portion.