

Claims

What is claimed is:

1. An apparatus for rearing aquatic arthropod larvae, comprising:
a container comprising a porous barrier which partitions the container into a first chamber and a second chamber, wherein:
the second chamber comprises a drain outlet; and
the porous barrier is capable of preventing the larvae from exiting the first chamber into the second chamber while permitting at least the passage of water between the chambers, when water is supplied to the first chamber and drained from the container via the drain outlet of the second chamber,
wherein the porous barrier has an average aperture diameter ranging from about 100 μm to about 1,000 μm , or from about 123 μm to about 152 μm .
2. The apparatus of claim 1, wherein the drain outlet comprises a valve and/or a pipe sealed or affixed on the drain outlet opening,
optionally wherein the valve is an overflow valve, wherein water passes from the container through the overflow valve after the maximum water level has been attained in the container.
- ~~3. The apparatus of claim 2, wherein the valve is an overflow valve, wherein water passes from the container through the overflow valve after the maximum water level has been attained in the container.~~
- ~~4.3.~~ The apparatus of ~~any one of claims 1-3~~ claim 1 or 2, wherein the drain outlet is positioned substantially 180° on a horizontal plane to the position where water enters the container.
- ~~5.4.~~ The apparatus of any one of claims ~~1-4~~ 1-3, further comprising a pipe for supplying water to the container, wherein the pipe for supplying water optionally comprises a filter, such as a mechanical filter, a biological filter, a chemical filter, or a combination thereof.
- ~~6. The apparatus of claim 5, wherein the pipe for supplying water comprises a filter.~~

~~7. The apparatus of claim 6, wherein the filter is a mechanical filter, a biological filter, a chemical filter, or a combination thereof.~~

8.5. The apparatus of ~~any one of claims 5-7~~ claim 4, further comprising a water tank connected, directly or indirectly, to the pipe for supplying water to the container, wherein the water tank stores water supplied to the container.

optionally wherein the water tank is connected, directly or indirectly, to the drain outlet of the second chamber, whereby water drained from the container is recycled and supplied to the container, wherein the water tank is optionally connected to the drain outlet via a filtering device capable of filtering water drained from the container, and wherein the filtering device comprises a filter and a waste outlet for removing waste.

~~9. The apparatus of claim 8, wherein the water tank is connected, directly or indirectly, to the drain outlet of the second chamber, whereby water drained from the container is recycled and supplied to the container.~~

~~10. The apparatus of claim 9, wherein the water tank is connected to the drain outlet via a filtering device capable of filtering water drained from the container.~~

~~11. The apparatus of claim 10, wherein the filtering device comprises a filter and a waste outlet for removing waste.~~

12.6. The apparatus of any one of claims ~~1-11~~ 1-5, further comprising a sensor for measuring a property of water supplied to and/or drained from the container, such as concentration of oxygen, temperature, pH, conductivity, oxidation-reduction potential (ORP), or concentration of a chemical compound.

~~13. The apparatus of claim 12, wherein the property of water is concentration of oxygen, temperature, pH, conductivity, oxidation-reduction potential (ORP), or concentration of a chemical compound.~~

14.7. The apparatus of any one of claims ~~1-13~~ 1-6, further comprising a levelling valve arranged to maintain a minimum level of water in the container, and/or a microcontroller for automating the apparatus.

~~15.—The apparatus of any one of claims 1-14, further comprising a microcontroller for automating the apparatus.~~

~~16.8.~~ The apparatus of any one of claims ~~1-15~~ 1-7, wherein the porous barrier is removable from the container, and/or permits the passage of feed, waste, and other debris, including waste produced by the larvae.

~~17.—The apparatus of any one of claims 1-16, wherein the porous barrier permits the passage of feed, waste, and other debris, including waste produced by the larvae.~~

~~18.9.~~ The apparatus of any one of claims ~~1-17~~ 1-8, wherein the porous barrier comprises a mesh, membrane, screen, paper, woven cloth, non-woven cloth, fabric, fiber, foam, sieve, entangled wires, electrospun polymeric fiber, or a combination thereof, and optionally wherein the porous barrier has an average wire diameter ranging from about 1 μm to about 1,000 μm .

~~19.—The apparatus of claim 18, wherein the porous barrier has an average wire diameter ranging from about 1 μm to about 1,000 μm .~~

~~20.10.~~ The apparatus of any one of claims ~~1-19~~ 1-9, which is used for mass rearing of the aquatic arthropod larvae, for rearing aquatic arthropod larvae at a density ranging from about one larva to about 12 larvae per cm^2 of the bottom plate of the container, or at a density of about 10 larvae per cm^2 of the bottom plate of the container, and/or for rearing aquatic arthropod larvae at a density ranging from about 1,500 larvae to about 4,000 larvae per liter of water in the container.

~~21.—The apparatus of any one of claims 1-20, which is used for rearing aquatic arthropod larvae at a density ranging from about one larva to about 12 larvae per cm^2 of the bottom plate of the container, or at a density of about 10 larvae per cm^2 of the bottom plate of the container.~~

~~22.—The apparatus of any one of claims 1-21, which is used for rearing aquatic arthropod larvae at a density ranging from about 1,500 larvae to about 4,000 larvae per liter of water in the container.~~

~~23.11.~~ The apparatus of any one of claims ~~1-22~~ 1-10, which comprises a plurality of the containers, such as 5, 10, 100, 500, 1,000, 5,000, or more of the containers.

~~24.—The apparatus of claim 23, which comprises about 5, 10, 100, 500, 1,000, 5,000, or more of the containers.~~

~~25.12.~~ The apparatus of claim ~~23 or 24~~ 11, wherein at least some of the plurality of containers are sequentially connected to each other or stacked on top of one another, wherein water passes from the first container in the sequence or stack through intervening container(s) to the last container in the sequence or stack, wherein the first container is connected to or supplied by a pipe supplying water and the last container is connected to a pipe draining water, and wherein the drained water is recycled to the first container, and/or

wherein at least some of the plurality of containers are connected in parallel to the pipe supplying water and/or the pipe draining water, and wherein the drained water is recycled to the containers.

~~26.—The apparatus of any one of claims 23-25, wherein at least some of the plurality of containers are connected in parallel to the pipe supplying water and/or the pipe draining water, and wherein the drained water is recycled to the containers.~~

~~27.13.~~ An apparatus for rearing aquatic arthropod larvae, comprising:

(1) a first container comprising a porous barrier which partitions the first container into a first chamber and a second chamber, wherein:

the second chamber comprises a drain outlet; and

the porous barrier is capable of preventing the larvae from exiting the first chamber into the second chamber while permitting at least the passage of water between the chambers, when water is supplied to the first chamber and drained from the first container via the drain outlet of the second chamber; and

(2) a second container constructed substantially similar to the first container, wherein water drained from the first container passes into the first chamber of the second container; and

optionally (3) a rack on which the first and second containers are disposed.

~~28.—The apparatus of claim 27, further comprising a rack on which the first and second containers are disposed.~~

29.—~~The apparatus of claim 27 or 28, wherein the first container is vertically stacked above the second container.~~

30.—~~The apparatus of any one of claims 27-29, wherein the drain outlet of the first and/or container comprises a valve and/or a pipe sealed or affixed on the drain outlet opening.~~

31.—~~The apparatus of claim 30, wherein the valve is an overflow valve, wherein water passes from the first container through the overflow valve after the maximum water level has been attained in the first container into the second container.~~

32.—~~The apparatus of any one of claims 27-31, wherein the drain outlet of each container is positioned substantially 180° on a horizontal plane to the position where water enters the container.~~

33.—~~The apparatus of any one of claims 27-32, further comprising a pipe for supplying water to the first container.~~

34.—~~The apparatus of claim 33, wherein the pipe for supplying water comprises a filter.~~

35.—~~The apparatus of claim 34, wherein the filter is a mechanical filter, a biological filter, a chemical filter, or a combination thereof.~~

36.—~~The apparatus of any one of claims 33-35, further comprising a water tank connected, directly or indirectly, to the pipe for supplying water to the first container, wherein the water tank stores water supplied to the containers.~~

37.—~~The apparatus of claim 36, wherein the water tank is connected, directly or indirectly, to the drain outlet of the second container, whereby water drained from the second container is recycled and supplied to the first container.~~

38.—~~The apparatus of claim 37, wherein the water tank is connected to the drain outlet via a filtering device capable of filtering water drained from the second container.~~

39.—~~The apparatus of claim 38, wherein the filtering device comprises a filter and a waste outlet for removing waste.~~

40.—~~The apparatus of any one of claims 27-39, further comprising a sensor for measuring a property of water supplied to and/or drained from the containers.~~

- 41.—~~The apparatus of claim 40, wherein the property of water is concentration of oxygen, temperature, pH, conductivity, oxidation-reduction potential (ORP), or concentration of a chemical compound.~~
- 42.—~~The apparatus of any one of claims 27-41, wherein each container comprises a levelling valve arranged to maintain a minimum level of water in the container.~~
- 43.—~~The apparatus of any one of claims 27-42, further comprising a microcontroller for automating the apparatus.~~
- 44.—~~The apparatus of any one of claims 27-43, wherein the porous barrier is removable from each container.~~
- 45.—~~The apparatus of any one of claims 27-44, wherein the porous barrier in each container has an average aperture diameter ranging from about 100 μm to about 1,000 μm , or from about 123 μm to about 152 μm .~~
- 46.—~~The apparatus of any one of claims 27-45, wherein the porous barrier permits the passage of feed, waste, and other debris, including waste produced by the larvae.~~
- 47.—~~The apparatus of any one of claims 27-46, wherein the porous barrier in each container comprises a mesh, membrane, screen, paper, woven cloth, non-woven cloth, fabric, fiber, foam, sieve, entangled wires, electrospun polymeric fiber, or a combination thereof.~~
- 48.—~~The apparatus of claim 47, wherein the porous barrier in each container has an average wire diameter ranging from about 1 μm to about 1,000 μm .~~
- 49.—~~The apparatus of any one of claims 27-48, which is used for mass rearing of the aquatic arthropod larvae.~~
- 50.—~~The apparatus of any one of claims 27-49, which is used for rearing aquatic arthropod larvae at a density ranging from about one larva to about 12 larvae per cm^2 of the bottom plate of each container, or at a density of about 10 larvae per cm^2 of the bottom plate of the container.~~
- 51.—~~The apparatus of any one of claims 27-50, which is used for rearing aquatic arthropod larvae at a density ranging from about 1,500 larvae to about 4,000 larvae per liter of water in each container.~~

~~52.—The apparatus of any one of claims 1-51, wherein the aquatic arthropod is a pest.~~

~~53.—The apparatus of any one of claims 1-52, wherein the aquatic arthropod is an insect.~~

~~54.—The apparatus of claim 53, wherein the insect is a mosquito.~~

~~55.—The apparatus of claim 54, wherein the mosquito is from the genera *Stegomyia*, *Aedes*, *Anopheles*, *Culex*, or *Toxorhynchites*.~~

~~56.—The apparatus of claim 55, wherein the mosquito is selected from *Aedes aegypti*, *Aedes albopictus*, *Culex pipiens*, *Culex quinquefasciatus*, *Anopheles stephensi*, *Anopheles albimanus* and *Anopheles gambiae*.~~

14. A method for rearing aquatic arthropod larvae, comprising using the apparatus of any one of claims 1-13.

~~57.15.~~ A method for rearing aquatic arthropod larvae, comprising:

(1) placing larvae or eggs of an aquatic arthropod in a first chamber of a container, wherein the container comprises a porous barrier that separates the first chamber from a second chamber of the container, wherein the second chamber comprise a drain outlet, and the porous barrier is capable of preventing the larvae from exiting the first chamber into the second chamber while permitting at least the passage of water between the chambers; and

(2) supplying water on a continual basis and other suitable conditions in the container for rearing the larvae or eggs in the first chamber, wherein water is drained from the container via the drain outlet of the second chamber.

~~58.—The method of claim 57, wherein the drain outlet comprises a valve and/or a pipe sealed or affixed on the drain outlet opening.~~

~~59.—The method of claim 58, wherein the valve is an overflow valve, wherein water passes from the container through the overflow valve after the maximum water level has been attained in the container.~~

~~60.—The method of any one of claims 57-59, wherein the drain outlet is positioned substantially 180° on a horizontal plane to the position where water enters the container.~~

61.—~~The method of any one of claims 57-60, further comprising filtering the water before it is supplied to the container.~~

62.—~~The method of any one of claims 57-61, wherein water is supplied to the container by a pipe connected to a water tank.~~

63.—~~The method of claim 62, wherein the water tank is connected, directly or indirectly, to the drain outlet of the second chamber, and the method further comprises recycling water drained from the container.~~

64.—~~The method of any one of claims 57-63, further comprising filtering water drained from the container.~~

65.—~~The method of any one of claims 57-64, further comprising removing waste from water drained from the container.~~

66.—~~The method of any one of claims 57-65, further comprising measuring a property of water supplied to and/or drained from the container.~~

67.—~~The method of claim 66, wherein the property of water is concentration of oxygen, temperature, pH, conductivity, oxidation-reduction potential (ORP), or concentration of a chemical compound.~~

68.—~~The method of any one of claims 57-67, further comprising adjusting a property of the water drained from the container and/or to be supplied to the container, to optimal conditions for rearing aquatic arthropod larvae.~~

69.—~~The method of claim 68, wherein the property of water is concentration of oxygen, temperature, pH, conductivity, oxidation-reduction potential (ORP), or concentration of a chemical compound.~~

70.—~~The method of any one of claims 57-69, further comprising maintaining a minimum level of water in the container.~~

71.—~~The method of any one of claims 57-70, wherein the porous barrier is removable from the container.~~

~~72.—The method of any one of claims 57-71, wherein the porous barrier permits the passage of feed, waste, and other debris, including waste produced by the larvae.~~

~~73.—The method of any one of claims 57-72, wherein the porous barrier comprises a mesh, membrane, screen, paper, woven cloth, non-woven cloth, fabric, fiber, foam, sieve, entangled wires, electrospun polymeric fiber, or a combination thereof.~~

~~74.—The method of claim 73, wherein the porous barrier has an average wire diameter ranging from about 1 μm to about 1,000 μm .~~

~~75.—The method of any one of claims 57-74, which is used for mass rearing of the aquatic arthropod larvae.~~

~~76.—The method of any one of claims 57-75, which is used for rearing aquatic arthropod larvae at a density ranging from about one larva to about 12 larvae per cm^2 of the bottom plate of the container, or at a density of about 10 larvae per cm^2 of the bottom plate of the container.~~

~~77.—The method of any one of claims 57-76, which is used for rearing aquatic arthropod larvae at a density ranging from about 1,500 larvae to about 4,000 larvae per liter of water in the container.~~

~~78.16.~~ The method of ~~any one of claims 57-77~~ claim 15, wherein water is supplied to the container at a flow rate of between about 0.5 L/min and about 5 L/min, or at about 3 L/min.

~~79.17.~~ The method of ~~any one of claims 57-78~~ claim 15 or 16, wherein the flow rate of water draining from the container is substantially the same as the flow rate at which water is supplied to the container.

~~80.18.~~ The method of any one of claims ~~57-79~~ 15-17, further comprising adjusting the flow rate at which water is supplied to the container, and/or adjusting the flow rate of water draining from the container.

~~81.—The method of any one of claims 57-80, further comprising adjusting the flow rate of water draining from the container.~~

~~82.19.~~ The method of any one of claims ~~57-81~~ 15-18, wherein water is supplied to the container at a flow rate that maintains the temperature in the container at about $22\pm 3^{\circ}\text{C}$, about $26\pm 2^{\circ}\text{C}$, or between about 25°C and 28°C .

~~83.—The method of any one of claims 57-82, wherein a plurality of the containers are used.~~

~~84.—The method of claim 83, wherein about 5, 10, 100, 500, 1,000, 5,000, or more of the containers are used.~~

~~85.—The method of claim 83 or 84, wherein at least some of the plurality of containers are sequentially connected to each other or stacked on top of one another, wherein water passes from the first container in the sequence or stack through intervening container(s) to the last container in the sequence or stack, wherein the first container is connected to or supplied by a pipe supplying water and the last container is connected to a pipe draining water, and wherein the drained water is recycled to the first container.~~

~~86.—The method of any one of claims 83-85, wherein at least some of the plurality of containers are connected in parallel to the pipe supplying water and/or the pipe draining water, and wherein the drained water is recycled to the containers.~~

~~87.—The method of any one of claims 83-86, wherein water is supplied to each container at a flow rate of between about 0.5 L/min and about 5 L/min, or at about 3 L/min.~~

~~88.—The method of any one of claims 83-87, wherein the flow rate at which water is supplied to each container is substantially the same as the flow rate at which water is supplied to the next connected or stacked container.~~

~~89.—The method of any one of claims 83-88, wherein water is supplied to the each container at a flow rate that maintains the temperature in the containers at about $22\pm 3^{\circ}\text{C}$, about $26\pm 2^{\circ}\text{C}$, or between about 25°C and 28°C .~~

~~90.—The method of any one of claims 57-89, wherein at least one of steps is automated.~~

91.20. The apparatus or method of any one of claims ~~57-90~~ 1-19, wherein the aquatic arthropod is a pest.

92.21. The apparatus or method of any one of claims ~~57-91~~ 1-20, wherein the aquatic arthropod is an insect, optionally a mosquito, such as from the genera *Stegomyia*, *Aedes*,

Anopheles, Culex, or Toxorhynchites, wherein the mosquito is optionally selected from the group consisting of Aedes aegypti, Aedes albopictus, Culex pipiens, Culex quinquefasciatus, Anopheles stephensi, Anopheles albimanus and Anopheles gambiae.

93. — ~~The method of claim 92, wherein the insect is a mosquito.~~

94. — ~~The method of claim 93, wherein the mosquito is from the genera Stegomyia, Aedes, Anopheles, Culex, or Toxorhynchites.~~

95. — ~~The method of claim 94, wherein the mosquito is selected from Aedes aegypti, Aedes albopictus, Culex pipiens, Culex quinquefasciatus, Anopheles stephensi, Anopheles albimanus and Anopheles gambiae.~~