INSECT TRAPPING SYSTEMS

BACKGROUND

[0001] Conventionally, insect traps, especially those dealing with disease transmitting insects such as mosquitoes, have been designed to capture insects and do not discriminate between males and females or even species of insects. As a result, these traps may also result in undesirable by-catch (e.g., insects other than a target sex and/or other types of insects).

BRIEF SUMMARY

[0002] Various examples are described relating to insect trapping systems including insect trapping apparatuses, and corresponding methods.

[0003] One general aspect includes an insect trapping system, including a trapping container including a top, a bottom, and at least one side wall which together with the top and the bottom defines an interior volume, where an entrance hole is formed in the at least one side wall and allows access to the interior volume and the top is characterized by a planar interior surface that faces the interior volume. The insect trapping container also includes a diverter wall that extends between the planar interior surface of the top and the bottom and that divides the interior volume to define a first chamber and a second chamber, where distal edges of the diverter wall physically contact opposing surfaces of the at least one side wall, where the diverter wall is characterized by a length extending between the distal edges and a vertex region, where the vertex region is defined along the length, where a window is formed in the vertex region and is characterized by an axis that is transverse to the length, where the window is defined by a pair of opposing substantially parallel edges and connects the first chamber and the second chamber, and where a distal portion of the diverter wall is characterized by an edge profile that is held in physical contact with the planar interior surface. The insect trapping system also includes an acoustic lure device disposed within the ~~interior volume of the trapping container adjacent~~first chamber between the entrance hole and the window, the acoustic lure device to output an acoustic tone for an insect population. ~~The insect trapping system also includes a sensor package configured to detect when an insect passes through the entrance hole, the sensor package comprising a plurality of parts, with a first part of the plurality of parts mounted on the at least one side wall adjacent a first side of the entrance hole, and a second part of the plurality of parts~~

~~mounted on the at least one side wall adjacent a second side of the entrance hole.~~ The insect trapping system also includes a support stand to physically support the trapping container, the support stand to function as a visual lure for the insect population.

[0004] Another general aspect includes an apparatus, including a trapping container including a top, a bottom, and at least one side wall that together define an interior volume, where the top is characterized by a planar interior surface that faces the interior volume. The apparatus also includes a diverter wall that extends between the planar interior surface of the top and the bottom and is positioned within the interior volume, the diverter wall dividing the interior volume to define a first chamber and a second chamber, where distal edges of the diverter wall physically contact opposing surfaces of the at least one side wall, wherein the diverter wall is characterized by a length extending between the distal edges and a vertex region, wherein the vertex region is defined along the length, where a window is formed in the vertex region of the diverter wall that connects the first chamber and the second chamber, where the window is characterized by an axis that is transverse to the length, where the window is defined by a pair of opposing substantially parallel edges,~~and~~ where an entrance hole is formed in the at least one side wall and allows access to the first chamber, and where a distal portion of the diverter wall is characterized by an edge profile that is held in physical contact with the planar interior surface. ~~The apparatus also includes a sensor package located in the first chamber adjacent to the entrance hole, the sensor package to detect when an insect passes through the entrance hole.~~ The apparatus also includes an acoustic lure device disposed within the first chamber between~~adjacent~~ the entrance hole and the window, the acoustic lure device to output an acoustic tone.

[0005] Another general aspect includes a method, including providing a container that includes a top, a bottom and a perimeter wall that encircles the bottom to define an interior volume, where the top is characterized by a planar interior surface that faces the interior volume. The method also includes installing a diverter wall within the interior volume that~~o define~~ extends between the planar interior surface of the top and the bottom and defines a first chamber and a second chamber, where the distal edges of the diverter wall contact opposing surfaces of the perimeter wall, where the diverter wall is characterized by a length extending between the distal edges and a vertex region, and where the vertex region is defined along the length. The method also includes forming an entrance hole in the

perimeter wall to enable access to the first chamber. The method also includes forming a window in the vertex region of the diverter wall that connects the first chamber and the second chamber, where the window is characterized by an axis that is transverse to the length, where the window is defined by a pair of opposing substantially parallel edges, and where a distal portion of the diverter wall is characterized by an edge profile that is held in physical contact with the planar interior surface. The method also includes installing an acoustic lure in the first chamber. ~~The method also includes installing a sensor package in the first chamber at a location between the entrance hole and the acoustic lure, the sensor package to detect when an insect passes through the entrance hole.~~

[0006] Another general aspect includes a computer-implemented method, including instructing an acoustic lure located within an interior volume of an insect trapping container to output an acoustic tone via an insect entrance hole formed in the insect trapping container. The computer-implemented method also includes receiving sensor data from a sensor package mounted to an interior surface of the trapping container adjacent the insect entrance hole, the sensor data representative of insects within the interior volume; responsive to receiving the sensor data. The computer-implemented method also includes instructing an imaging device to capture image data representative of the insects within the interior volume, or determining insect count data based on the sensor data. The computer-implemented method also includes transmitting output data to a remote computing system, the output data including at least one of a first portion of the image data or a second portion of the insect count data. Other embodiments of this aspect include corresponding computer systems, apparatus, and computer programs recorded on one or more computer storage devices, each configured to perform the actions of the methods.

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] FIG. 1 illustrates a perspective view of an insect trapping system, according to at least one example.

[0009] FIG. 2 illustrates a side profile view of the insect trapping system of FIG. 1, according to at least one example.

[0010] FIG. 3 illustrates a top view of the insect trapping system of FIG. 1, according to at least one example.

[0011]

[0011] FIG. 4 illustrates an end view of the insect trapping system of FIG. 1, according to at least one example.

[0012] FIG. 5 illustrates a perspective view of the insect trapping system of FIG. 1, according to at least one example.

WHAT IS CLAIMED IS:

1. An insect trapping system, comprising:

a trapping container comprising~~-~~:

a top~~,~~ ;

a bottom~~, and~~ ;

at least one side wall, which together ~~define~~with the top and the bottom defines an interior volume, wherein an entrance hole is formed in the at least one side wall and allows access to the interior volume~~;~~ , wherein the top is characterized by a planar interior surface that faces the interior volume; and

a diverter wall that extends between the planar interior surface of the top and the bottom and that divides the interior volume to define a first chamber and a second chamber, wherein distal edges of the diverter wall physically contact opposing surfaces of the at least one side wall, wherein the diverter wall is characterized by a length extending between the distal edges and a vertex region, wherein the vertex region is defined along the length, wherein a window is formed in the vertex region and is characterized by an axis that is transverse to the length, wherein the window is defined by a pair of opposing substantially parallel edges and connects the first chamber and the second chamber, and wherein a distal portion of the diverter wall is characterized by an edge profile that is held in physical contact with the planar interior surface;

an acoustic lure device disposed within the ~~interior volume of the trapping container adjacent~~first chamber between the entrance hole and the window, the acoustic lure device to output an acoustic tone for an insect population; and

~~a sensor package configured to detect when an insect passes through the entrance hole, the sensor package comprising a plurality of parts, with a first part of the plurality of parts mounted on the at least one side wall adjacent a first side of the entrance hole, and a second part of the plurality of parts mounted on the at least one side wall adjacent a second side of the entrance hole; and~~

a support stand to physically support the trapping container, the support stand to function as a visual lure for the insect population.

~~2. The insect trapping system of claim 1, wherein the trapping container is formed from a clear material or a translucent material.~~

23. The insect trapping system of ~~any one of~~ claim~~s~~ 1 ~~or 2~~, wherein the entrance hole is formed as an inverted triangle, with a base leg at a first elevation and an apex at a second elevation that is below the first elevation.

43. The insect trapping system of ~~any one of claims~~claim 1 ~~3~~, wherein the insect population comprises at least one of a sex of mosquitoes or a species of mosquitoes.

~~5~~4. The insect trapping system of claim ~~4~~3, wherein the species of mosquitoes comprises at least one of *Aedes aegypti or Aedes albopictus*.

~~6~~5. The insect trapping system of ~~any one of claims 4 or 5~~claim 3, wherein one or more first properties of the acoustic tone and one or more second properties of the support stand are selected based at least in part on the species of mosquitoes.

~~7~~6. The insect trapping system of claim ~~6~~5, wherein the one or more first properties of the acoustic tone comprise a frequency, a volume, or a duration, and the one or more second properties of the support stand comprise a color or a height.

~~8~~7. The insect trapping system of ~~any one of claims~~claim 1 ~~7~~, further comprising:

a controller comprising one or more processors; and

one or more of:

a sensor package to detect when an insect passes through the entrance hole;

a transceiver device;

a memory module; or

an imaging device to capture images of the insect within the interior volume.

~~9~~8. The insect trapping system of claim ~~1~~7, wherein the ~~first part~~sensor package comprises an infra-red sensor transmitter~~, the second part comprises~~ disposed at a first side of the entrance hole, an infra-red sensor receiver~~, and~~ disposed at a ~~third part~~second side of the ~~plurality of parts comprises~~entrance hole, and an optics lens disposed between the entrance hole and the infra-red sensor receiver.

~~10~~9. The insect trapping system of ~~any one of claims 8-9~~claim 7, wherein the one or more processors are configured to:

receive sensor data from the sensor package; and

perform at least one action after receiving the sensor data.

~~11~~10. The insect trapping system of claim ~~10~~9, wherein the at least one action comprises determining a count of individual insects detected by the sensor package.

~~12~~11. The insect trapping system of claim ~~11~~10, wherein the at least one action further comprises at least one of storing the count locally within the memory module or transmitting the count via the transceiver device to a remote computing system.

~~13~~12. The insect trapping system of ~~any one of claims 8-12~~claim 7, wherein the one or more processors are configured to:

activate the imaging device to capture images of insects within the interior volume;

activate the acoustic lure device to output the acoustic tone;

cause transmission of output data via the transceiver device; or

receive and store input data received via the transceiver device.

~~14. The insect trapping system of any one of claims 1-13, wherein the trapping container comprises a diverter wall that divides the interior volume to define a first chamber and a second chamber, wherein a window is formed in the diverter wall that connects the first chamber and the second chamber.~~

~~15. The insect trapping system of claim 14, wherein the acoustic lure device is mounted in the first chamber and oriented to project the acoustic tone through the interior volume in the first chamber and out of the trapping container via the entrance hole.~~

136. The insect trapping system of claim 1~~5~~, further comprising an insect killing component ~~disposed within the interior volume, the insect killing component~~ comprising at least one of a glue panel or an insecticide~~, and~~.

14. The insect trapping system of claim 13, wherein the ~~acoustic lure device is disposed in the first chamber and the~~ insect killing component is disposed in the second chamber.

15~~7~~. The insect trapping system of claim 13~~5~~, ~~wherein the acoustic lure device is disposed within the first chamber, and the insect trapping system~~ further comprise~~s~~ing an imaging device disposed within the second chamber, the imaging device configured to capture images of insects within the second chamber.

~~18. The insect trapping system of any one of claims 15-17, wherein the diverter wall comprises a curved V-shape, wherein distal edges of the diverter wall physically contact opposing surfaces of the at least one side wall and the window is formed in a vertex region of the curved V-shape.~~

~~19~~16. An apparatus, comprising:

a trapping container comprising a top, a bottom, and at least one side wall that together define an interior volume~~;~~, wherein the top is characterized by a planar interior surface that faces the interior volume;

a diverter wall that extends between the planar interior surface of the top and the bottom and is positioned within the interior volume, the diverter wall dividing the interior volume to define a first chamber and a second chamber, wherein distal edges of the diverter wall physically contact opposing surfaces of the at least one side wall, wherein the diverter wall is characterized by a length extending between the distal edges and a vertex region, wherein the vertex region is defined along the length, wherein a window is formed in the vertex region of the diverter wall that connects the first chamber and the second chamber, ~~and~~wherein the window is characterized by an axis that is transverse to the length, wherein the window is defined by a pair of opposing substantially parallel edges, wherein an entrance hole is formed in the at least one side wall and allows access to the first chamber~~;~~, and wherein a distal portion of the diverter wall is characterized by an edge profile that is held in physical contact with the planar interior surface; and

an acoustic lure device disposed within the first chamber between the entrance hole and the window, the acoustic lure device to output an acoustic tone.

17. The apparatus of claim 16, further comprising a controller located in the interior volume, the controller comprising one or more processors.

18. The apparatus of claim 16, further comprising a sensor package located in the first chamber adjacent to the entrance hole, the sensor package to detect when an insect passes through the entrance hole; and.

an acoustic lure device disposed within the first chamber adjacent the entrance hole, the acoustic lure device to output an acoustic tone.

20. The apparatus of claim 19, further comprising a controller located in the interior volume, the controller comprising one or more processors.

21. The apparatus of any of claims 19 or 20, wherein the sensor package comprises a plurality of parts, with a first part mounted adjacent a first side of the entrance hole and a second part mounted adjacent a second side of the entrance hole.

1922. The apparatus of claim 1821, further comprising a transceiver device to transmit sensor data from the sensor package to a remote computing system.

2023. The apparatus of any one of claims 19-22claim 16, wherein a first area on an exterior surface of the at least one side wall surrounding the entrance hole is coated with a light-colored material, and a second area on an interior surface of the at least one side wall surrounding the entrance hole is coated with a dark-colored material.

2124. The apparatus of any one of claims 19-22claim 16, further comprising an insect killing component disposed within the second chamber, the insect killing component comprising at least one of a glue panel or an insecticide.

2225. A method, comprising:

providing a container that comprises a top, a bottom, and a perimeter wall that encircles the bottom to define an interior volume;, wherein the top is characterized by a planar interior surface that faces the interior volume;

installing a diverter wall within the interior volume to definethat extends between the planar interior surface of the top and the bottom and defines a first chamber and a second chamber;, wherein distal edges of the diverter wall contact opposing surfaces of the perimeter wall, wherein the diverter wall is characterized by a length extending between the distal edges and a vertex region, and wherein the vertex region is defined along the length;

forming an entrance hole in the perimeter wall to enable access to the first chamber;

forming a window in the vertex region of the diverter wall that connects the first chamber and the second chamber;, wherein the window is characterized by an axis that is transverse to the length, wherein the window is defined by a pair of opposing substantially parallel edges, and wherein a distal portion of the diverter wall is characterized by an edge profile that is held in physical contact with the planar interior surface; and

installing an acoustic lure in the first chamber.

23. The method of claim 22, further comprising:

installing an insect killing component in the second chamber.

24. The method of claim 22, further comprising:

installing a controller in at least one of the first chamber or the second chamber, the controller comprising one or more processors; and

installing a sensor package in the first chamber at a location between the entrance hole and the acoustic lure, the sensor package to detect when an insect passes through the entrance hole.

25. The insect trapping system of claim 1, wherein the at least one side wall and the diverter wall of the trapping container are formed from a transparent or translucent material, and wherein the support stand is formed from an opaque dark-colored material.

26. The insect trapping system of claim 1, wherein the diverter wall has a curved V-shape, with the vertex region being defined at a valley of the curved V-shape.

27. The insect trapping system of claim 26, wherein the diverter wall is oriented with an interior of the curved V shape directed toward the entrance hole.

28. The insect trapping system of claim 1, wherein the top is removably connectable to the at least one side wall.

29. The insect trapping system of claim 1, wherein the edge profile is defined at a first top edge of the diverter wall, wherein the vertex region extends between the first top edge of the diverter wall and a first bottom edge of the diverter wall that is opposite the first top edge, and wherein the window is defined between the first top edge and the first bottom edge.

30. The insect trapping system of claim 1, wherein the distal edges of the diverter wall are substantially parallel, and wherein the opposing surfaces of the at least one side wall at which the distal edges contact are substantially parallel.

~~26. The method of claim 25, further comprising installing a lid on the container to enclose the interior volume.~~

~~27. The method of claim 25, further comprising installing an insect killing component in the second chamber.~~

~~28. The method of any one of claims 26 or 27, further comprising installing a controller in at least one of the first chamber or the second chamber, the controller comprising one or more processors.~~

~~29. The method of claim 28, wherein the sensor package comprises a plurality of parts, with a first part mounted on the permieter wall adjacent a first side of the entrance hole and a second part mounted on the permieter wall adjacent a second side of the entrance hole.~~

~~30. A computer-implemented method, comprising:~~

~~instructing an acoustic lure located within an interior volume of an insect trapping container to output an acoustic tone via an insect entrance hole formed in the insect trapping container;~~

~~receiving sensor data from a sensor package mounted to an interior surface of the trapping container adjacent the insect entrance hole, the sensor data representative of insects within the interior volume;~~

~~responsive to receiving the sensor data:~~

~~instructing an imaging device to capture image data representative of the insects within the interior volume; or~~

~~determining insect count data based on the sensor data; and~~

~~transmitting output data to a remote computing system, the output data comprising at least one of a first portion of the image data or a second portion of the insect count data.~~

~~31. The computer-implemented method of claim 30, wherein one or more properties of the acoustic tone are adjusted depending on a type of insect population, the one or more properties comprising a frequency, a volume, or a duration. 32. The computer-implemented method of any one of claims 30 or 31, wherein the sensor package comprises:~~

~~an infra-red sensor transmitter disposed on a first side of the insect entrance hole of the insect trapping container;~~

~~an infra-red sensor receiver disposed on a second side of the insect entrance hole; and~~

~~an optics lens disposed between the insect entrance hole and the infra-red sensor receiver.~~

~~33. The computer-implemented method of any one of claims 30-32, further comprising instructing an insect killing component located in the interior volume to emit an insecticide.~~

~~34. The computer-implemented method of any one of claims 30-33, further comprising receiving operational instructions from at least one of the remote computing system or a different remote computing system.~~

~~35. The computer-implemented method of any one of claims 30-34, wherein the insect trapping container comprises a bottom, a lid, and at least one wall that together define the interior volume, at least one of the bottom, the lid, or the at least one wall formed from a transparent or translucent material.~~