CLAIMS

Claim 1. A system for rearing invertebrates, the system comprising a climate chamber (2) and a plurality of crates (4) arranged into at least two stacks (6), each crate in a stack defining an airflow path (80) there through from an inlet opening (48) in a first wall (46) to an outlet opening (48) in a second wall (46) opposite the first wall, characterised in that said climate chamber comprises:

an internal volume enclosed by walls, a floor, and a ceiling;

a first row of air outlets (20) extending in a first direction within the internal volume;

a second row of air outlets (20) extending parallel to the first row of air outlets within the internal volume;

a row of air inlets (18) located between the first and second rows of air outlets, and extending parallel thereto, and spaced apart from the first and second rows of air outlets in a second direction, perpendicular to the first direction;

at least one first stack (6) of crates (4) arranged in a space between the first row of air outlets and the row of air inlets;

at least one second stack (6) of crates (4) arranged in a space between the second row of air outlets (20) and the row of air inlets (18);

a conduit (38) extending from each of the plurality of air inlets between the first and second stack of crates, said conduit comprising a plurality of conduit openings (40) configured to align with inlet openings (48) of the plurality of crates (4) in each stack (6);

wherein the crates (4) are arranged with the airflow path (80) oriented perpendicular to the first direction;

wherein the climate chamber further comprises at least two tracks (10) extending in the first direction with the climate chamber, wherein each track of at least two tracks (10) comprises a first wall (12) and a second wall (12), and a channel (14) defined there between; and

whereby each of the at least one stack (6) of crates (4) and the at least one second stack (6) of crates (4), optionally positioned on a pallet, rests on a corresponding of the at least two tracks (10).

Claim 2. The system according to claim 1, wherein each track (10) is configured to support a row of crate stacks (6) above the channel (14).

Claim 3. The system according to claim 1 or claim 2, wherein each track (10) is configured to support a pallet comprising four stacks of crates (6) arranged in a 2x2 arrangement.

Claim 4. The system according to any one of claims 1-3, wherein each of the first and second walls (12) comprises a solid wall, wherein the first and second walls (12) are arranged parallel to each other.

Claim 5. The system according to claim 4, wherein each of the first and second walls (12) separates the channel (14) from an adjacent gutter (16).

Claim 6. The system according to any one of claims 1 to 5, wherein the climate chamber (2) further comprises a plurality of air inlets (18) and a plurality of air outlets (20).

Claim 7. The system according to any one of claims 1 to 6, wherein the at least one air inlet (18) and/or the at least one air outlet (20) are provided in a ceiling (22) of the climate chamber (2).

Claim 8. The system according to any one of claims 1 to 7, wherein the climate chamber (2) is divided into a plurality of sub-chambers (2a).

Claim 9. The system according to claim 8, wherein each sub-chamber (2a) has a first side wall and a second side wall, and a first track (10) and a second track (10),

Wherein the first track (10) is separated from the first side wall by a first gutter (28),

wherein the first track (10) is separated from the second track (10) by a second gutter (32), and

wherein the second track (10) is separated from the second side wall by a third gutter (36).

Claim 10. The system according to claim 9, when depending from claim 6, wherein the plurality of air inlets (18) are arranged above the second gutter (32), and wherein the plurality of air outlets (20) are arranged above the first gutter (28) and the third gutter (36).

Claim 11. The system according to any one of claims 1 to 10, further comprising a control system (1) configured to maintain a pressure gradient between the inlet openings (48) and the outlet openings (48), wherein a pressure at the inlet openings is higher than a pressure at the outlet openings, such that air flows from the inlet openings, through the climate chamber (2), and out of the outlet openings.

Claim 12. The system according to any one of claims 1 to 11, further comprising at least one sensor (52) configured to measure at least one environmental condition within at least one of the plurality of crates (4).

Claim 13. The system according to claim 12, wherein the at least one environmental condition includes one or more of:

temperature;

humidity;

oxygen concentration;

carbon dioxide concentration;
pressure; and
air flow.

Claim 14. The system according to claim 12, wherein the at least one sensor (52) is arranged in a base of the crates (4).

Claim 15. The system according to claim 6 or any preceding claim depending from claim 8, wherein the plurality of air inlets (18) are arranged along a duct (68), wherein the duct is configured to be supplied with climate controlled air via a master inlet (70).

Claim 16. The system according to claim 15, wherein the duct (68) has a variable height H, and wherein the height of the duct decreases as the distance from the master inlet (70) increases.

Claim 17. The system according to claim 15 or claim 16, wherein the system further comprises a conduit (38) in fluid communication with the duct (68), and wherein the conduit comprises a flexible conduit comprising a plurality of holes (40) along opposing sides.

Claim 18. The system according to any one of claims 1 to 17, wherein the climate chamber (2) is provided in a static structure.

Claim 19. The system according to any one of claims 1 to 18, wherein the climate chamber (2) is provided in a portable container, e.g. a shipping container, a reefer, a truck trailer.

Claim 20. The system according to claim 11 or any preceding claim depending from claim 11, wherein the control system (1) is configured to adjust at least one of the following parameters based on environmental conditions detected by at least one sensor:
temperature;
humidity;
oxygen concentration;
carbon dioxide concentration;
pressure at the inlet and/or outlet; and
air flow.

Claim 21. The system according to any one of claims 1 to 20, wherein the climate chamber (2) further comprises at least one rail (52) extending in the second direction adjacent open ends of the at least two tracks.

Claim 22. The system according to claim 21, wherein a track of the at least two tracks comprises a ledge (14a) on an internal surface of the first wall and second wall (12) with respect to the channel (14), which provides runners along which a robotic device (86) can run.

Claim23. The system according to claim 22, wherein the at least one rail (52) is configured to convey the robotic device (86) in a perpendicular direction, in front of the open ends of the at least two tracks, wherein optionally the robotic device (86) comprises a frame (88) or carrier (88) configured to travel along the at least one rail (52), and comprises a robot unit configured to travel along the runners in the channel (14) formed by the ledge (14a).

Claim 24. The system according to any one of claims 1 to 23, wherein the climate chamber (2) further comprises at least one robotic device (86) configured to move along the at least one track (10).

Claim 25. The system according to any one of claims 1 to 24, further comprising at least one robotic device (86) configured to freely move and

place one or more crates (4) into the first and/or the second stack of crates (6), or

take one or more crates from the first and/or the second stack of crates.

Claim 26. A method for rearing invertebrates, the method comprising the steps of:

(i) providing a plurality of crates (4), each crate having a first opening (48) in a first wall (46) and a second opening (48) in a second wall (46) opposite the first opening (48) to define a first air flow path (80) between the first and second openings;

(ii) filling at least a portion of each crate of the plurality of crates with a substrate and a plurality of invertebrates at a first developmental stage;

(iii) stacking the plurality of crates;

(iii) providing a climate chamber (2) comprising:

an internal volume enclosed by walls, a floor, and a ceiling;

a first row of air outlets (20) extending in a first direction within the internal volume;

a second row of air outlets (20) extending parallel to the first row of air outlets within the internal volume;

a row of air inlets (18) located between the first and second rows of air outlets, and extending parallel thereto, and spaced apart from the first and second rows of air outlets in a second direction, perpendicular to the first direction;

at least one first stack of crates (6) arranged in a space between the first row of air outlets and the row of air inlets;

at least one second stack of crates (6) arranged in a space between the second row of air outlets and the row of air inlets;

a conduit (38) extending from each of the plurality of air inlets between the first and second stack of crates, said conduit comprising a plurality of conduit openings (40) configured to align with inlet openings (48) of the plurality of crates in each stack; and

at least two tracks (10) extending in the first direction with the climate chamber, wherein each track of the at least two tracks (10) comprises a first wall (12) and a second wall (12), and a channel (14) defined there between;

(iv) positioning the at least one first stack of crates (6) and the at least one second stack of crates (6) on a corresponding track of the at least two tracks (10) wherein the crates are arranged with the airflow path oriented perpendicular to the first direction and in the second direction;

(v) applying a pressure differential between the air inlet and the air outlet.

Claim 27. The method according to claim 26, wherein each of the first and second walls (12) comprises a solid wall, wherein the first and second walls (12) are arranged parallel to each other.

Claim 28. The method according to claim 27, wherein each of the first and second walls (12) separates the channel (14) from an adjacent gutter (16).

Claim 29. The method according to any one of claims 26 to 28, wherein the method further comprises providing a plurality of air inlets (18) and a plurality of air outlets (20), and positioning at least one stack (6) between an air inlet and an air outlet aligned with each other in the first direction.

Claim 30. The method according to any one of claims 26 to 29, wherein the method further comprises: sensing, using at least one sensor (52), an environmental condition within one or more of the plurality of crates (6), where in the sensed environmental condition can comprise one or more of:

temperature;
humidity;
oxygen concentration;
carbon dioxide concentration;
pressure; and
air flow.

Claim 31. The method according to claim 30, further comprising controlling at least one of the following parameters based on the sensed environmental conditions within the crates:

temperature;
humidity;
oxygen concentration;
carbon dioxide concentration;
pressure at the inlet and/or outlet; and
air flow.

Claim 32. The method according to any one of claims 26 to 31, wherein the method further comprises arranging a plurality of stacks of crates (6) in rows along the tracks, wherein each stack abuts an adjacent stack in the second direction.

Claim 33. The method according to any one of claims 26 to 32, wherein the stacks (6) are arranged in a 2 x 2 arrangement.

Claim 34. The method according to any one of claims 26 to 33, further comprising, operating a robotic device (86) to move along a track of the at least two tracks (10), wherein the robotic device is configured to:

move at least one stack of crates (6) along the track;

detect environmental conditions within the channel (14);

read information from at least one crate (4) stacked above the channel.

Claim 35. The method according to any one of claims 26 to 33, further comprising, operating a robotic device (86) to freely move and:

place one or more crates (4) into the first and/or the second stack of crates (6), or

take one or more crates from the first and/or the second stack of crates.

Claim 36. The method according to any one of claims 26 to 35, wherein the method further comprises conveying a robotic device (86) in the second direction, in front of open ends of the at least two tracks (10), wherein the climate chamber (2) comprises at least one rail (52) extending in the second direction adjacent the open ends of the at least two tracks (10) wherein the at least one rail is configured to convey the robotic device (86), optionally the robotic device (86) comprises a frame (88) or carrier (88) configured to travel along the at least one rail, and comprises a robot unit configured to travel along a track of the at least two tracks (10).

Claim 37. The method according to claim 36, wherein the track of the at least two tracks (10) comprises a ledge (14a) on an internal surface of the first and second wall (12) with respect to the channel (14), which provides runners along which the robot unit can run, further comprising running the robot unit along the runners in the channel (14) formed by the ledge (14a).

Claim 38. An invertebrate rearing crate (4) suitable for use in the system of any one of claims 1 to 25 or in the method of any one of claims 26 to 37, characterized in that the crate (4) comprises a base, upstanding opposing side walls (44) having a length L, and upstanding opposing end walls (46) having a length W, defining a perimeter around the base, whereby W is less than L, wherein openings (48) are formed in the opposing end walls (46), as well as at least one projection (56) in an upper edge surface (54) thereof, and at least a corresponding recess (60) in a lower edge region (58), the recess being configured to receive a projection of a further crate on which it is stacked; and at least one sensor mounting region (50) arranged in the base of the crate.

Claim 39. The invertebrate rearing crate according to claim 38, wherein the base further comprises a plurality of sensors (52) arranged in the base of the crate.

Claim 40. The invertebrate rearing crate according to claim 38 or claim 39, wherein the crate further comprises a first receiving portion (62) configured to receive a removable identification tag, e.g., an RFID tag.

Claim 41. The invertebrate rearing crate according to claim 40, wherein the crate further comprises a second receiving portion (62) positioned on an opposing side of the crate in a corresponding position, such that the position of the second receiving portion maps the position of the first receiving portion when the crate is rotated 180 degrees about a vertical axis.

Claim 42. The invertebrate rearing crate according to claim 41, wherein the second receiving portion comprises an identification tag, e.g., an RFID tag.