Description

Field of the Invention

The present invention relates to an environmental sound, simple and cost-effective method of controlling water-breeding mosquitoes.

Background of the Invention

Some 2 million people die every year as a result of a mosquito bite. The World Health Organization considers mosquito control as a critical element of any mosquito-borne disease prevention.

The effectiveness of any method using chemical agents is dropping more and more. This is proven by the world-wide rise of mosquito-related fatalities.

Summary of the Invention

The invention provides a method and an apparatus to collect mosquito eggs and mosquito larvae of water-breeding mosquitoes.

A stagnant water surface is provided for the mosquitoes under the typical tropical weather conditions by plain mechanical means. The collected mosquito eggs and the eventually already developed larvae and pupae are regularly destroyed. The cycle can then be automatically restarted if a fresh water supply is available. A manual intervention is needed if no water supply is provided.

The apparatus can be integrated into a building structure. The functional elements are separated from the frames which are integrated into the building structure first. The functional elements are added after the construction work on the building structure is finished.

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Brief Description of the Drawings

Figure 1 illustrates a Mechanical Auomatic Lethal Ovitrap.

Figure 2 illustrates installed frames in a horizontal surface and in a vertical surface.

Figure 3 illustrates a frame for being used in a horizontal surface in a top-view.

Figure 4 illustrates a frame for use in a horizontal surface as a sectional cut in a side-view.

Figure 5 illustrates a frame to be used in a vertical surface in a sectional cut in a side-view.

Figure 6 illustrates a functional element with the function of an ovitrap.

Figure 7 illustrates a functional element with the function of an ovitrap as a sectional cut in side-view.

Figure 7 illustrates an ovitrap as a functional element to be used with a frame in a sectional cut in a side-view.

Figure 8 illustrates the installation of a frame.

Figure 9 illustrates an system to automatically refill the Mechanical Automatic Lethal Ovitrap.

Figure 10 illustrates an alternative water supply system for an ovitrap used in an Automatic Lethal Ovitrap.

Figure 11 illustrates an alternative water level regulator to be used in an Automatic Lethal Ovitrap.

Figure 12 illustrates an ovitrap with an egg collection unit.

Detailed Description of the Drawings

Figure 1

Figure 1 illustrates a Mechanical Automatic Lethal Ovitrap.

A container 1000 with an opening on its top with side walls and a bottom designed to hold water is located at the highest point of the system. A container 1200 designed to hold water is located inside the container 1000 so that an opening on or near its top is at a given level near the top of the container 1000. A valve 1201 is installed near or at the bottom of the container 1200 so that if the valve 1201 is opened the water contained in the container 1200 will flow with a predefined flow rate into the container 1000. The valve 1201 is activated by a floater 1202.

A valve 1010 is installed near or at the bottom of the container 1000. The valve 1010 is activated by a floater 1016.

A valve 1081 is installed near or at the top of the container 1000. The valve 1081 is activated by a floater 1082. The valve 1081 is connected to a water inlet 1080. The water inlet 1080 is connected to a fresh water supply.

A net 1100 is installed near or a the top of the container 1000. The net 1100 is installed so that the water contained in the container 1000 will not reach the net 1100. The openings in the net 1100 are so small that mosquitoes cannot pass through it while water can easily flow through it.

A net 1101 is installed inside the container 1000 so that it blocks larger objects from entering the valve 1010.

A water pipe 1072 is installed so that water flowing through it will flow into the container 1000.

The water contained in the container 1000 will result in a water level 1001.

The water contained in the container 1200 will result in a water level 1091.

A container 1015 with an opening on its top with side walls and a bottom designed to hold water is installed so that the water flowing out of the valve 1010 will flow into the container 1015 and the floater 1016 can float on the water inside the container 1015. A valve 1018 is installed near or the bottom of the container 1015. The valve 1018 is activated by a floater 1017. A pipe 1012 is installed near or at the bottom of the container 1015. The water contained in the container 1015 results in the water level 1011.

Water Level Regulator

A container 1020 with an opening on its top with side walls and a bottom designed to hold water is installed so that the water flowing through the

valve 1018 and the pipe 1012 will flow into the container 1020 and the floater 1017 and the floater 1202 can float on the water stored in the container 1020.

A pipe 1025 is installed in the bottom of the container 1020. The end of the pipe 1025 inside the container 1020 is at a predefined level 1023 above the bottom of the container 1020. A pipe 1024 is installed at the bottom of the container 1020. The end of the pipe 1024 inside the container 1020 is at the lowest point of the container 1020. A pipe 1500 is installed near or at the bottom of the container 1020. The opening of the pipe 1500 inside the container 1020 is shaped so that water flowing into the pipe 1500 flows upward into the pipe 1500 before it will flow downward.

A vertical wall 1075 is installed in the container 1020. The vertical wall 1075 is installed so that it separates the space aound the pipe 1500 from the other parts of the container 1020.

A vertical wall 1070 is installed in the container 1020. The vertical wall 1070 is installed so that it separates the space containing the vertical wall 1075 and the water pipe 1500 from the other parts of the container 1020.

A pipe 1071 is installed so that it allows the free flow of water from one side of the wall 1070 to the other side of the wall 1070. The pipe 1071 has an end 1078. The end 1078 is located on the side of the wall 1070 which is on the side of the wall 1075. The pipe 1071 has an end 1076. The pipe 1071 has an end 1077. The end 1076 and the end 1077 are located on the side of the wall 1070 which does not include the wall 1075. The end 1076 is located so that it is above the predefined water level 1023. The end 1077 is located so that it is below the height at which the pipe 1071 passes through the wall 1070. The end 1078 is located so that it is below the height at which the pipe 1071 passes through the wall 1070.

The pipe 1071 has a filter 1073 installed near or at its end 1078. The pipe 1071 has a filter 1074 installed near or at its end 1076. THe pipe 1071 has a filter 1072 installed at or near its end 1077.

The filters 1072, 1073 and 1074 are designed to that water and air can free flow through them while larvae and adult mosquitoes cannot pass through them.

The height of the vertical wall 1075 is set so that it is lower than the water level 1023 and higher than the openingsof the pipe 1071 and 1500 next to it.

Collection Water Tank

A container 1030 with an opening on its top with side walls and a bottom designed to hold water is installed so that the water flowing through the

pipes 1024 and 1025 will flow into the container 1030. A valve 1032 is installed near or at the bottom of the container 1030.

A net 1104 is installed near or at the top of the container 1030. The net 1104 is installed so that the water inside the container 1030 cannot reach the net 1104. The openings in the net 1104 are so small that mosquitoes cannot pass through the net 1104 but water is able to pass through. A pipe 1071 is installed at or near the bottom of the container 1030.

A pump 1070 connects the pipe 1071 with the pipe 1072. A floater 1090 is connected to the pump 1070. The pump 1070 will pump water from the container 1030 via the pipes 1071 and 1072 into the container 1000.

The water contained in the container 1030 results in the water level 1031.

A container 1040 with an opening on its top with side walls and a bottom designed to hold water is installed so that the water contained in it can have the same water level as the water contained in the container 1020. A valve 1042 is installed near or at the bottom of the container 1040. The valve 1042 is activated by a floater 1022. A pipe 1044 is connected to the valve 1042 to lead the water away from the valve 1042. The floater floats on the water contained in the container 1020.

A pipe 1043 is installed near or at the bottom of the container 1040. The pipe 1043 is laid so that it is always below the predefined water levels 1023, 1041 and 1061. The pipe 1043 is to be installed in a way the the water contained in it can freely flow between the container 1040 and connected ovitraps 1060.

An end 1080 of the pipe 1043 connects to additional ovitraps 1060. The end 1080 has to be closed if no additional ovitraps are connected/

One or more ovitraps 1060 are installed so that they can contain the same water level as the containers 1020 and 1040.

When the water level 1023 has reached the end of the pipe 1025 inside the container 1020, the water contained in the ovitraps 1060 results in the nominal water level 1061.

A pipe 1062 is installed in the bottom of the ovitraps so that the end ending inside the ovitraps 1060 is above the nominal water level 1061 but below the top of the ovitraps 1060.

The pipe 1043 is connected to the bottom of the ovitraps 1060. The end of the pipe 1043 inside the ovitraps 1060 is as low as the lowest point of the ovitraps 1060. The pipe 1500 is connected to the bottom of the ovitraps 1060. The end of the pipe 1500 inside the ovitraps 1060 is higher than the lowest point of the ovitraps 1060 but lower than the nominal water level 1061.

A connector 1400 drains additional ovitraps 1060. The connector 1401 supplies additional ovitraps 1060.

Design

The size and volume contained in the ovitraps 1060 has to be adjusted to the targeted mosquito. Mosquitoes of the Aedes species are targeted with a volume of 1l to 2l. Some Anopheles species are targeted with a volume of some 10l. A water surface area of some 100mm * 100mm is accepted by most Aedes species. A water surface of some 100mm * 1000mm is accepted by some Anopheles species. The depth of the water will be in a range from 10mm to some 100mm.

The water flow rate through the pipe 1024 is set so that it is below the water flow rate of the pipe 1012. The water flow rate through pipe 1024 should be set so that the water level 1023 drops in some 1h below its nominal value so that the valves 1201 and 1042 are opened.

The water flow rate through the pipe 1012 is set so that all the water contained in the container 1000 will flow through it before any mosquito can develop out of the eggs collected in the ovitraps 1060. A reasonable time value will be some 96h.

The water flow rate through the valve 1201 is adjusted so that the water level in the container 1200 falls within some 4h below the level to open the valve 1081 and activate the pump 1070.

The volume of the container 1000 is set so that it can contain all the water needed to fill the containers 1015, 1020, 1040 and all the connected ovitraps 1060 plus an additional volume to flow through the pipe 1012 during a single cycle. A reasonable flow rate for the pipe 1012 is 1l/h. The flow rate through the pipe 1012 has to be at least so high that all the water vaporising especially in the connected ovitraps 1060 can be replaced so that the water level in the ovitraps 1060 does not change during a longer period of sunshine.

The container 1200 has to be located so that the water can freely flow from the container 1000 into the container 1200 above a predefined water level 1001. The container 1200 has to be located so that the water level 1091 will not drop below the predefined level to open the valve 1081 when the water level 1001 falls further as long as the valve 1201 stays closed. The container 1200 has to be located so that the water level 1091 will not drop below the predefined level to activate the pump 1070 when the water level 1001 falls further as long as the valve 1201 stays closed.

The containers 1015, 1020 and 1040 have to be installed in a way that mosquitoes do not get access to the water stored in them and mosquitoes which eventually develop in them cannot escape.

The pipes 1043 and 1500 have be laid so that the water can freely flow into both directions without any externally supplied force. The pipes 1043 and 1500 have to be located below the water level 1023 preferable even below the level of the container 1020's bottom.

The pipe 1500 has to be installed so that the water flowing through the end 1079 into the pipe 1500 flows upward while the pipe 1500 is installed in the bottom of the container 1020. With other words, the end of the pipe 1500 inside the container 1020 is shaped like a U which is turned upside-down.

The end of the pipe 1500 inside the container 1020 should be as close as possible to the bottom of the container 1020 but high enough to allow dirt to settle on the bottom of the container 1020. Some 20 mm have been a reasonable distance.

The pipe 1071 has to be installed horizontally at a height heigher than the ends 1077 and 1078 but lower than the height of the wall 1075.

The end 1079 is located very close to the bottom of the container 1020. The space between the end 1079 and the bottom of the container 1020 should be set so that eventually collecting dirt will not block the water flow.Some 20mm have been a resonable distance.

The end 1078 is located very close to the bottom of the container 1020. The space between the end 1078 and the bottom of the container 1020 should be set so that eventually collecting dirt will not block the water flow.

The end 1077 is located very close to the bottom of the container 1020. The space between the end 1077 and the bottom of the container 1020 should set so that eventually commection dirt will not block the water flow. Some 20mm have been a reasonable distance.

The pipe 1062 drains surplus water off the ovitraps 1060 in case the pipe 1500 is not able to do so. The end of the pipe 1062 outside of the ovitraps 1060 has to end in a place where mosquitoes which might develop out of the water drained by the pipe 1062 cannot escape. A net might be installed inside the pipe 1062 to block mosquitoes from escaping. The pipe 1062 might be connected to the pipe 1044.

The diameter of the pipes used must be large enough to allow a free flow of water. The diameter of the pipe 1025 must be large enough to handle the in-flow through the pipe 1012 and the return flow through the pipe 1500.

The pipe 1025 can be replaced by an overflow of any kind.

The water levels 1023, 1041 and 1061 will be at the same absolute level after the water has had time to flow between the containers.

The highest point inside the U shaped end of the pipe 1500 has to be set so that the water will only start to flow into the pipe 1500 after the floater 1022 is pushed high enough to close the valve 1042.

Alternatively the pipe 1071 can be located so that the floater 1022 is pushed high enough to close the valve 1042.

The floater 1022 should preferable float in the section of the container 1020 in which the pipe 1071 has the end 1077.

Alternatively the pipe 1025 can be replaced by a reduced height of side wall of the container 1020. The water will than flow out over the side wall. The location of the wall with the reduced height has to be adjusted so that the surplus water can flow into the container 1030 just as it would when the pipe 1025 is installed.

Operation

No water is contained in any containers of ovitraps at the start.

The valves 1081, 1201, 1010, 1018 and 1042 are in their open state.

The pump 1070 will be activated by the floater 1090.

Water is supplied to the inlet 1080. The water will flow into the container 1000 until the water level 1001 reaches the top of the container 1200. The water will then also flow into the container 1200 until the water level 1091 reaches the predefined water level to close the valve 1081. The containers 1000 and 1020 will contain at this moment of time the water volume to operate the mechanical automatic ovitrap for a single cycle.

The water will flow through the pipe 1010 into the container 1015. The water level 1011 will rise until it reaches the predefined value to close the valve 1010.

The water will flow out of the container 1015 via the valve 1018 and the pipe 1012 into the container 1020.

When the water level 1023 reaches a predefined level, the valve 1018 will be closed by the floater 1017. When the water level 1023 reaches a predefined level, the valve 1201 will be closed by the floater 1202. When the water level 1023 reaches a predefined level, the valve 1042 will be closed by the floater 1022.

When the water level 1023 is high enough, water wll start to flow through the pipe 1071 to the other side of the wall 1070. When the water level 1023 is high enough the water will start to flow over the wall 1075 into the last section from where is can flow into the pipe 1500.

The water will flow through the pipe 1500 to the ovitraps 1060. The water level 1023 will rise until it reaches the height of the end of the pipe 1025 inside the container 1020. All surplus water will now flow out of the container 1020 through the pipe 1025. Water will also flow through the pipe 1024.

The water flowing through the pipes 1024 and 1025 will be collected in the container 1030.

The system will stay in this state until the water level 1011 starts to drop. The floater 1016 will then open the valve 1010 to supply more water to the container 1015.

When the container 1000 does not contain any water any more, the water supply to the containers 1015 and 1020 will stop. As a result, the water level 1023 will start to drop. The valve 1042 will be opened by the floater 1022 at a predefined level and the water contained in the container 1040 will flow out. This will also result in the drainage of all the water contained in all connected ovitraps 1060.

The valve 1201 will be opened by the floater 1202 at a predefined level and the water contained in the container 1200 will start to flow out. This results in a drop of the water level 1091.

The start of the drop of the water level 1091 marks the end of one cycle. The ovitraps 1060 are empty at this moment of time. The period of time during which the water level 1091 drops until the pump 1070 is activated and the valve 1081 is opened is used to dry the ovitraps 1060 and kill so all the remaining larvae and pupae. A new cycle will be automatically started with the activation of the pump 1070 and the opening of the valve 1081 soon.

When the water level 1091 falls to a predefined level, the valve 1081 is opened and fresh water is supplied to the container 1000. When the water level 1091 rises above a predefined level, the valve 1081 is closed and the supply of fresh water stops.

When the water level 1091 falls to a predefined level, the pump 1070 is activated by the floater 1090 and the water from the container 1030 is pumped into the container 1000. When the water level 1091 rises above a predefined level, the pump 1070 is deactivated. The floater 1090 should activate the pump 1070 before the floater 1082 opens the valve 1081 to give the pump 1070 enough time to pump the water from the container 1030 into the container 1000 before additional water is supplied by the fresh water supply.

A system without the container 1200, the valve 1081 and the pump 1070 can be build which will run only a single cycle automatically. The water has then manually be moved from the container 1030 into the container 1000 and any used-up water has to be replaced manually. This can be used to

build low-cost systems.

The valve 1032 can be used to empty the container 1030 manually.

During the normal regulation of the water level 1023 water from the connected ovitraps 1060 can flow back via the pipe 1500 into the container 1020. The water might contain dirt, mosquito eggs and larvae. While the design makes it highly unlikely that a high number of eggs will be moved into the container 1020, it is still possible that a low number will be.

During normal ooperation the water level 1023 will be at or near its predefined value. As a result, the wall 1075 and the ends 1079 and 1078 will be fully covered by water. The eggs will then rise to the water surface.

The wall 1070 will stop them from moving into the other part of the container. When the water level 1023 falls below its nominal value, fresh water will be supplied. Water will then flow through the pipe 1071 and the pipe 1500 to the connected ovitraps 1060.

As the eggs will float on the water, no eggs will be able to enter the end 1079 of the pipe 1500. When no fresh water is supplied anymore, the water level 1023 will continue to drop until the main section of the container 1020 is empty.

The water level in the section of the container 1020 in which the end 1079 is installed, will drop until the water level reaches the height of the wall 1075. The water level in the section of the container 1020 in which the end 1078 is installed will continie to drop until it reaches the height at which the pipe 1071 is installed in the wall 1070. Eggs eventually floating on the water in this section will not be able to enter the pipe 1071 at its end 1078 as the water level will stay above the height of its end.

Figure 2

Figure 2 illustrates installed frames in a horizontal surface and in a vertical surface.

A horizontal surface 2001 contains a frame 2003 for a horizontal surface.

A vertical surface 2000 contains a frame 2002 for a vertical surface.

The details of the frame 2003 for a horizontal surface are shown with figure 3.

The details of the frame 2002 for a vertical surface are shown with figure 5.

Figure 3

Figure 3 illustrates a frame for being used in a horizontal surface in a top-view.

A frame 3000 is shaped like a container with an open top and a closed bottom. A rectangle shape is used here. Any other shape can be used as long as both the frame and the functional elelment have the same shape. The surrounding walls have an even top surface. The inside of the surrounding walls have a step 3001. The step 3001 is lower than the surrounding walls.

A vertical niche 3002 interrupts the side wall of the container 3000. A vertical niche 3003 interrupts the side wall of the container 3000. A vertical niche 3004 interrupts the side wall of the container 3000. A vertical niche 3005 interrupts the side wall of the container 3000. A vertical niche 3100 interrupts the side wall of the container 3000. A vertical niche 3101 interrupts the side wall of the container 3000. A vertical niche 3102 interrupts the side wall of the container 3000. A vertical niche 3103 interrupts the side wall of the container 3000.

A horizontal niche 3020 interrupts the side wall and the step 3001 so that it connects directly to the vertical niche 3002. A horizontal niche 3030 interrupts the side wall and the step 3001 so that it connects directly to the vertical niche 3003. A horizontal niche 3110 interrupts the side wall and the step 3001 so that it connects directly to the vertical niche 3100. A horizontal niche 3111 interrupts the side wall and the step 3001 so that it connects directly to the vertical niche 3101. A horizontal niche 3112 interrupts the side wall and the step 3001 so that it connects directly to the vertical niche 3102. A horizontal niche 3113 interrupts the side wall and the step 3001 so that it connects directly to the vertical niche 3103. A horizontal niche 3114 interrupts the side wall and the step 3001 so that it connects directly to the vertical niche 3104. A horizontal niche 3115 interrupts the side wall and the step 3001 so that it connects directly to the vertical niche 3105.

Inner side walls 3005, 3006, 3007 and 3008 shape the inside of the frame 3000 so that the functional element can later be inserted from the top.

A connector 3010 is installed at the lowest point of the bottom of the frame 3000. A connector 3011 is installed in the bottom of the frame 3000. A connector 3012 is installed in the bottom of the frame 3000.

Figure 4

Figure 4 illustrates a frame for use in a horizontal surface as a sectional cut in a side-view.

Figure 4 shows the frame from figure 3 in a different view.

The frame 3000 has the step 3001 on its inside walls 3005 and 3006. The inside wall and the step 3001 are interrupted by the horizontal niches 3020 and 3030 and the vertical niches 3002 and 3003.

The inner side walls 3005 and 3006 can be slanted so that the bottom area of the frame 3000 will be smaller than its top area. The bottom 3007 of the frame 3007 is shaped so that all liquids eventually reaching the bottom 3007 will flow into the connector 3010. The connectors 3011 and 3012 are installed so in the bottom 3007 that their ends outside the frame 3000 can easily be connected to pipes and their ends inside the frame 3000 fits to the pipes of the functional element the frame pairs up with.

The frame 3000 has an outer side wall 4010. The frame 3000 has an outer side wall 4011.

Design

Different pairs of frames and functional elements for the different functions have to be designed. The size of each frame will depend on the functional element it should hold. The number of connectors will have to be adjusted to the number of connections needed for the functional element. All frames will have at least the connector 3010 to drain all water off the inside of the frame. The shape of the side walls can be adapted to the needs of the functional element. The horizontal and vertical niches 3002, 3003, 3020, 3030, 3100, 3101, 3102, 3103, 3104, 3105, 3110, 3111, 3112, 3113, 3114 and 3115 are designed so that a tool can be inserted to remove the inserted functional element from the frame.

The connectors have to be designed so that inserting the functional element into the frame will also connect the pipes from the functional element with the connector with a minimum of leakage.

The top of the frame is used as a reference for the height level. Especially the installation of the frames for the ovitraps 1060 and the containers 1020 and 1040 has to be done on the same level so water does not flow out at the top of them.

Operation

The bottom 3007 of the frame 3000 is shaped so that all liquids reaching the inside of the frame will flow out through the connector 3010.

Eventual leakage of the other connectors will also be drained via the connector 3010.

The additional connectors 3011 and 3012 connect the functional element with the piping system.

Figure 5

Figure 5 illustrates a frame to be used in a vertical surface in a sectional cut in a side-view.

A frame 4000 has an upper side wall 4002. The frame 4000 has an upper side wall 4003. The frame 4000 has a top 4001. The frame 4000 has an opening 4005 on at least one side.

The lower section below the opening 4005 of the frame 4000 is identical to the frame 3000 as both frames should hold the same functional element.

Design

The lower section of the frame 4000 has to be designed identical to the frame 3000 when both have to hold the same functional element. The opening 4005 has to be large enough to allow the functional to fit through it and to allow the work needed inside the frame to extract the functional element later.

The upper side walls 4002 and the top 4001 are designed so that the frame 4000 can be inserted into a vertical surface keeping the opening 4005 free for later access.

The frame 4000 can be build into a vertical surface so that the side walls 4002 and 4003 and the top 4001 are even with the surrounding surface.

Figure 6

Figure 6 illustrates a functional element with the function of an ovitrap.

An ovitrap 8000 is shaped so that it can hold water and allows mosquitoes easy access through its top. The top of the ovitrap 8000 is an frame with an even surface.

A pipe 8010 is installed in the lowest part of the bottom of the ovitrap 8000. A pipe 8011 is installed in the bottom of the ovitrap 8000. A stone-like object 8002 is installed on the side wall of the ovitrap 8000. A stone-like object 8003 is installed on the side wall of the ovitrap 8000. A wall-like object 8004 is installed on the side wall of the ovitrap 8000. A pole-like object 8070 is installed on the side wall of the ovitrap 8000.

Figure 7

Figure 7 illustrates a functional element with the function of an ovitrap as a sectional cut in side-view.

The ovitrap 8000 has a negative step 8010 on its top so that the ovitrap fits into the step 3001 of the corresponding frame 3000.

The ovitrap 8000 has the inner side walls 8050 and 8060. The side walls are shaped so that they replicate the side alls of natural breeding spots mosquitoes find in open nature. The side walls 8050 and 8060 fall irregular from the top of the ovitrap 8000 to its bottom. The shape of the wall are just like the shapes of the sides found in open natur where water collects randomly and mosquitoes take those places as breeding spots.

Design

Pairs of functional elements like an ovitrap and frames have to be designed so that the step 3001 of the frame 3000 allows the insertion of the functional element like the ovitrap 8000 so that the top of the frame 3000 is on the same level as the top of the ovitrap 8000. The gap between the frame 3000 and the ovitrap 8000 should be minimised to minimise the flow of unwanted liquids into the frame 8000.

The pipes 8010 and 8011 have to fit into the connectors 3011 and 3012. The location of the pipes 8010 and 8011 in the bottom of the ovitrap 8000 has to chosen so that they connect to the corresponding connectors 3011 and 3012 when the ovitrap 8000 is inserted into the frame 3000. The end of the pipe 8010 inside the ovitrap 8000 has to be at the lowest point of the ovitrap 8000. All side walls and the bottom of the ovitrap 8000 have to be designed so that all the water will flow into the pipe 8010 when the water is drained off. The end of the pipe 8011 inside the ovitrap 8000 has to be located below the the nominal water level of the ovitrap 8000 and above the lowest point inside the ovitrap 8000. The higher the end of the pipe 8011 is the less unwanted objects will flow back into the pipe in case the ovitrap is drained or the water level regulator has to take water out in case of additional liquids or unwanted objects are supplied to the ovitrap 8000.

The pole-like object 8070 is designed so that its upper end is above the nominal water level inside the ovitrap 8000. The pole-like object 8070 allows the mosquito to sit on it just above the water surface.

The stone-like object 8002 is designed so that its upper end is above the nominal water level inside the ovitrap 8000. The stone-like object 8002 allows the mosquito to sit on it just above the water surface.

The side walls 8050 and 8060 are designed like the side walls of natural

breeding spots. Some sections of the side walls 8050 and 8060 are flat to simulate the situation of a beach with a lot of sand. Some sections of the side walls 8050 and 8060 are very steep to simulate the situation of a beach with a lot of rock. The side walls 8050 and 8060 have to be designed so that the number of larvae and pupae will get stuck when the water is drained out of the ovitrap 8000 is minimal.

Variants

Different mosquito species prefer very different breeding habitats. These breeding habitats can be simulated by using different sizes of stones, different objects floating in the water like leafs, small branches or grass and also different shapes. Also, the size and shape of the ovitrap has to be adjusted to the targeted mosquito species.

Stones

Some mosquito species prefer breeding in locations like river banks. Small stones in the ovitrap are then used to emulate this. The stone size can be varied from less than a mm up to several cm. The stones must be integrated into the ovitrap's body so, that no space is created which will keep water while the ovitrap is emptied.

Soil

Some mosquito species prefer breeding in locations like depressions in fields where water can collect. The inside of the ovitrap is then covered with soil found near the installation site of the ovitrap. Other soil can be used but catch results will not be this good.

Size

The size of an ovitrap has to be adjusted to the targeted mosquito species. A small ovitrap (100mm times 100mm) will work for many species. Some species will need an ovitrap much larger to emulate a portion of a rice field (1000mm times 1000mm). It is also possible to use medium sized ovitraps (100mm times 1000mm) to emulate depressions in a natural field.

Shape

The shape of most variants will be a simple rectangle. Possibel variants here are round and irregular shaped ovitraps. Especially for mosquitoes breeding in open natur, a regular shape will not attrackt them enough.

Shade

Different levels of shade has to be provided for different mosquito species. The shade can be provided naturally by plants planted near ALO or between

ALO's functional elements like ovitraps and water tanks. Some mosquito species do not prefer to have any shade. Some mosquito species prefer lighting conditions found deep in tropical jungles.

Some mosquito species prefer to breed in fully shaded tree holes. This environment can be simulated by placing the ovitrap at the end of a pipe through which the mosquito has to fly before reaching the ovitrap.

Objects

Small objects can be added to the water in a way that they float while the ovitrap is filled with water. When the water is removed from the ovitrap, the objects will sink to the filter installed. Some mosquito species prefer to lay they eggs onto the objects. Only the larvae will move into water after hatching. It must be made sure that the water is removed often enough so that evenutally hatched larvae will either die in the emptied ovitrap or will be washed out with the water.

The objects can be anything from small stones resting directly on the filter, soil from the natural environment of the ovitrap or biological material like leafs or small wood pieces.

Function

The side walls and the objects inside the water have also the function providing a resting place for the mosquito. The resting place can be used as a general resting place or as a resting place while the eggs are actually laid. Especially important is the design of the resting places for laying the eggs (oviposition). Different mosquito species have different preferences for the resting place. Some species prefer very step surfaces while others prefer very flat resting places during ovipositioning.

The surface of the resting place has also to be designed according to the preferences of the targeted mosquito species. Some mosquito species prefer even surfaces while other prefer rough surfaces.

Food Supply

Mosquitoes need flowers as their source of energy. Providing flowers next to the ovitraps will increase the acceptance of the ovitraps as breeding spots by mosquitoes.

Operation

Water is supplied to the ovitrap 8000 via the pipe 8011. Water is drained off the ovitrap 8000 via the pipe 8010. The end of the pipe 8011 has to be some distance below the nominal water level inside the ovitrap 8000. The larger the distance between the water surface inside the ovitrap 8000 and the end

of the pipe 8011 inside the ovitrap 8000 gets, the lower the influence of the water level regulator becomes to the water surface inside the ovitrap and the more objects will flow back into the container 1020 when surplus water has to be taken out of the ovitrap.

Competition

The breeding spots provided in the form of the ovitraps compete in open nature with the breeding spots provided by nature or by humans. The majority of those breeding spots will have certain limitations as seen by the mosquitoes. Adapting the ovitraps fully to the preferences of the targeted mosquito species will give it a much higher chance to for ovipositioning. As a result, the mosquitoes living near a Mechanical Automatic Lethal Ovitrap will prefer the artificial ovitraps. As a result, the number of mosquitoes borne in this area will drop.

The regulation of the water level in the ovitrap is a central element to maintain a high attracktiveness under all operating conditions. It is so possible to provide the water level presicely at the level needed by the small animals. A resting place for ovipositioning can be located just one or two mm above water level under all conditions.

Figure 8

Figure 8 illustrates the installation of a frame.

The frame 3000 is set into some soft material 8500 and 8501 so that its top is on the level for the function element is is meant for. The soft material 8500 and 8501 can be a concrete just after it is mixed. The soft material 8500 and 8501 should harden over time to hold the frame 3000 in its position while the construction work in its surrounding is finished.

The inside of the frame 3000 can be protected by a cover during the construction work.

Figure 9

Figure 9 illustrates an automatic refilling system for a Mechanical Automatic Lethal Ovitrap.

The elements 1072, 1080, 1070, 1071 and 1030 are already described with figure 1.

A system controller 9010 is connected via a connection 9011 with an electric valve 9002. The system controller 9010 is connected via a connection 9012 with the pump 1070. The electric valve 9002 is connected to a water supply 9020. The electrical valve 9002 is connected with a mechanical valve 9001. The mechanical valve 9001 is controlled by a floater 9000. The mechanical valve 9001 is opened by the floater 9000 when the water level 1104 falls below a predefined value. The mechanical valve 9001 is closed by the floater 9000 when the water level 1104 rises above a predefined value.

The predefined value for the water level 1104 is set so that volume of water contained in the container 1030 when the mechanical valve 9001 closes is the volume needed to operate the mechanical automatic ovitrap for a single cycle.

Operation

Default Operation

The system controller 9010 instructs the electrical valve 9002 to close. The system controller 9010 instructs the pump 1070 to stop pumping.

The Mechanical Automatic Lethal Ovitrap stays in this state until the system controller believes that all ovitraps 1060 are empty or sensors installed in the system report that there is no water contained anymore in the system.

Refilling

The system controller 9010 instructs the electrical valve 9002 to open. Water will flow now via the mechanical valve 9001 into the container 1030 until the water level 1104 reaches the predefined value and the mechanical valve 9001 closes.

The system controller 9010 will instruct after a predefined time the electrical valve 9002 to close. The system controller 9010 will instruct the pump 1070 to start pumping after the electrical valve 9002 has closed. The system controller 9010 will instruct the pump 1070 to pump for a predefined time. The time will be set so that all the water contained in container 1030 will have been moved into the contain er 1000.

In an alternative implementation, the ovitraps 1060 are equipped with a sensor and the system controller 9010 uses the sensor signal to trigger the refilling the the container 1030.

In an alternative implementation, the system controller 9010 is able to control the emptying of the ovitraps. The system controller 9010 will than first instruct the mechanical automatic lethal ovitrap to empty its ovitraps 1060 befor it starts the refilling cycle.

In an alternative implementation, the container 1030 is equipped with a water level sensor. The signal of the water level sensor will be used to stop the pump 1070 when the water level 1104 falls below a predefined value.

Figure 10

Figure 10 illustrates an ovitrap with an alternative water supply in a sectional side view.

An ovitrap 10000 is connected to a water supply pipe 10001. The ovitrap 10000 is connected to a water drainage pipe 10002. The water contained in the ovitrap 10000 is under normal operating conditions below or at a predefined water level 10010.

The water supply pipe 10001 is installed so that it is located below the level of the predefined water level 10010.

The water supply pipe 10001 has an opening 10010. The opening 10010 is located so that air can move freely into it when the water inside the ovitrap 10000 is near or below its predefined water level 10010. The water supply pipe 10001 has an opening 10011. The opening 10011 is located at a height below the predefined water level 10010 inside the ovitrap 10000 so that the supplied water has to flow downward fom the water supply pipe 10001 into the ovitrap 10000.

A filter 10004 is installed in the water supply pipe 10001 near or at it's opening 10010. The filter 10004 has openings large enough to allow the free flow of water and air but will now allow adult mosquitoes and/or larvae to pass through.

A filter 10003 is installed in the water supply pipe 10001 near or at it's opening 10011. The filter 10003 has openings large enough to allow the free flow of water but will not allow adult mosquitoes and/or larvae to pass through.

The water drainage pipe 10002 is placed so that all water eventually contained in the ovitrap 10000 can flow out through it.

Under normal operating conditions, the water in the ovitrap 10000 will be at a predefined water level 10010.

An end 11500 of the pipe 11002 is connected to the drainage of the surplus water.

An end 11501 of the pipe 11003 is connected to the ovitraps as the water supply pipe.

Operation

The ovitrap 10000 is empty. Water is supplied through the water supply pipe 10001. The water flows into the ovitrap 10000 until the predefined water level 10010 is reached. The water will stop flowing until the water level changes. If the water level in the ovitrap 10000 will become lower than

the predefined water level 10010 fresh water will be supplied through the water supply pipe 10001. If the water level in the ovitrap 10000 will become higher than the predefined water level 10010, water will start to flow out through the water supply pipe 10001.

The shape of the water supply pipe 10001 makes sure that objects floating or swimming in the water cannot sink into the water supply pipe 10001.

The filter 10004 makes sure that floating objects and larvae will not be able to enter the water supply pipe 10001.

Figure 11

Figure 11 illustrates a water level regulator with an alternative water outlet in a sectional side view.

The water filled into the water level regulator 11000 will result in a predefined water level 11001.

A water level regulator 11000 has a water outlet pipe 11003 installed at or near it's lowest point.

The water level regulator 11000 has a filter 11005 installed so that the filter 11005 separates the space around the water outlet pipe 11003 from the remaining space inside the water level regulator 11000.

The water level regulator 11000 has an overflow pipe 11002 installed so that all surplus water supplied to the water level regulator 11000 can freely flow out through it. The end of the pipe 11002 ending inside the water level regulator 11000 has to be installed at the same level as the predefined water level 11001 will be.

All water which would result in a water level higher than the predefined water level 11001 is considered surplus water.

The water level regulator 11000 has a water supply pipe 11004 installed so that water can be supplied to the water level regulator.

The water outlet pipe 11003 is shaped so that connection pipe 11032 can be installed at it's lowest point. The connection pipe 11032 connects the water outlet pipe 11003 with the overflow pipe 11002.

The flow capacity of the connection pipe 11032 is small compared to the flow capacity of the water outlet pipe 11003. The flow capacity of the connection pipe 11032 is small compared to the water capacity supplied to the water level regulator 11000.

The water level regulator 11000 has a pipe 11020 installed so that water reaching a certain water level inside the water level regulator 11000 can flow freely into the pipe 11020. The pipe 11020 is connected to a valve 11021. The valve 11021 is connected to the junction 11022.

End end of pipe 11020 inside the water level regulator 11000 is installed at a lower height than the end of pipe 11002 inside the water level regulator 11000.

Operation

Water is supplied to the water level regulator through the water supply pipe 11004. The supplied water will flow out through the water outlet pipe

11003 until the water level in all connected ovitraps reach the predefined water level 11001. A small percentage of the water fowing out through the water outlet pipe 11003 will flow through the connection pipe 11032 into the overflow pipe 11002.

When the water reaches the predefined water level 11001, all surplus water will flow into the overflow pipe 11002. This will keep the water level constant as long as enough water is supplied.

When the valve 11021 is opened all water above the end of the pipe 11020 will flow out of the water level regulator 11000. This will result in a second water level inside the water level regulator 11000. When the valve 11021 is closed again. The water stops flowing out of the water level regulator 11000 and the water level starts rising until it reaches the end of the pipe 11002.

With other words, opening and closing the valve 11021 will set the water level regulator so that it regulates the water level to different heights.

When the supply of water stops, the water stored in the water level regulator 11000 and the water outlet pipe 11003 will flow via the connection pipe 11032 into the overflow pipe 11002. Some additional water from the connected ovitraps will also flow back. As a result, the water level regulator and the water supply pipes connection all ovitraps with the water level regulator will be without water. If they kept dry long enough all eventually developed larvae will die.

Figure 12

Figure 12 illustrates the separation of the collected eggs.

An ovitrap 12000 is shaped so that it can contain water up to a certain water level 12001. The ovitrap 12000 has an opening at its top so that mosquitoes can access the water stored in it. A blotting paper 12002 is laid into the ovitrap from top so that some section of the blotting paper 12002 is below the water level 12001 during normal operation.

A net 12003 supports the blotting paper 12002 so that it keeps its position.

A cylinder 12010 is used to provide a storage for the unused part of the blotting paper 12002. A cylinder 12011 is used to provide a storage for the used part of the plotting paper 12002.

The cylinder 12011 can be controlled by the system controller 9010. The system controller 9010 will instruct the cylinder 12011 to rotate and so pull the blotting paper of the cyliner 12010 while the ovitrap 12000 is empty. As a result the eggs will be collected on the blotting paper stored on te cylinder 12011.

The ovitraps 12000 will be emptied and the blotting paper will be advanced while the mosquito activity is very low.

The blotting paper 12002 has to chosen so that water can seep through it while mosquito eggs will get caught.

Figure 13

Figure 13 illustrates the creation of a steady water stream in an ovitrap.

The elements with numbers below 13000 are described with Figure 1.

A pipe 13000 connects the ovitrap 1060 with the container 1030.

Design

The flow capacity of te pipe 13000 is low compered to the flow capacity of the pipe 1500. The end of the pipe 13000 inside the ovitrap 1060 is shaped like a U turned upside down to minimise the inflow of unwanted objects. The end of the pipe 13000 inside the ovitrap 1060 is located away from the end of the pipe 1500 inside the ovitrap so that the water has to flow some distance inside the ovitrap 1060.

The location of the end of the pipe 13000 inside of the ovitrap 1060 make sure that the mosquito eggs floating on the water surface cannot flow out through the pipe 13000. A filter can be inserted into the end of the pipe 13000 inside the ovitrap 1060 to block unwanted objects from entering the pipe.

Operation

The pipe 1500 supplies water to the ovitrap 1060 until it reaches the predefined water level 1061. The pipe 13000 drains water out of the ovitrap 1060.

Options

A valve can be inserted into the pipe 13000. The valve can then be opened and closed to start and stop the stream inside the ovitrap 1060.

Definiton of the Building Blocks and Components

Ovitrap

An ovitrap provides a breeding spot for mosquitoes.

Water Level Regulator

A Water Level Regulator regulates the water level in a given container to a preset level.

Fresh Water Supply

A Fresh Water Supply supplies the system with fresh water.

Collection Unit

A Collection Unit collects the mosquito eggs and larvae.

Destruction Unit

A Destruction Unit destroys the mosquito eggs and larvae.

Fresh Water Supply System

A Fresh Water Supply System supplies fresh water to the system.

Drainage System

A Drainage System drains the water with the collected mosquito eggs and larvae from the ovitraps.

The invention has now been described with reference to the preferred embodiments. Alternatives and substitutions will now be apparent to persons of skill in the art.

What is claimed is:

1. A method to provide a constant water level and keeping the water stagnant in an ovitrap comprising the steps of

   connecting an ovitrap to a first container so that water above a predefined level can flow freely between said ovitrap and said container;

   providing an overflow in said first container at the desired water level in said ovitrap;

   providing an outflow in said first container near or at the bottom of said first container and

   supplying water to said first container with a flow rate higher than the flow rate through said outflow.

2. The method of claim 1, further comprising the steps of

   constantly monitoring the water level in said first container;

   connecting the drain of said ovitrap to a first valve so that all the water contained in said ovitrap is drained out when said valve is opened;

   opening said first valve when the said water level in said first container falls below a predefined value and

   closing said first valve when the said water level in said first container rises above a predefined value;

3. The method of claim 1, further comprising the steps of

   providing a predefined volume of water in a second container at the highest point of the system;

   connecting said second container with a third container so that the water can flow freely from said second container into said third container when the water level in said second container is above a predefined value;

   supplying water to said second container via a second valve;

   constantly monitoring the water level in said third container;

   opening said second valve when said water level in said third container falls below a predefined level;

   closing said second valve when said water level in said third container rises above a predefined level;

providing a valve near or at the bottom of said third container with a predefined flow rate;

constantly monitoring said water level in said first container;

opening said third valve when said water level in said first container falls below a predefined level

and closing said third valve when said water level in said first container rises above a predefined level.