CLAIMS

What is claimed is:

1. A method of controlling *Zika* virus in a mosquito comprising the *Zika* virus, the method comprising the steps of:

introducing into the mosquito a genetically modified bacteria that colonizes the mosquito, wherein the bacteria comprises an expression control sequence operably linked to a nucleotide sequence encoding a heterologous double stranded RNA (dsRNA) polynucleotide that inhibits expression of an essential gene of the *Zika* virus; wherein the dsRNA polynucleotide is selected from one of the nucleotide sequences of SEQ ID NO:s. 1, 2, 3, 4 and 5; and

wherein expression of the dsRNA polynucleotide within the mosquito inhibits expression of the essential gene of the *Zika* virus.

2. The method of claim 1, wherein the mosquito is:

a female mosquito that transmits the *Zika* virus to a mammalian organism,

a mosquito larvae,

a third instar larva,

a pupa, or

an adult mosquito.

3. The method of claim 2, wherein the introducing to a mosquito the genetically modified bacteria comprises a method selected from the group consisting of:

soaking,

spraying,

injecting,

feeding,

introducing to through an aerosolized disbursement,

introducing to through an environmental aerosolized disbursement,

introducing to through an environmental aerosolized disbursement in water sources,

brushing,

dressing,

dripping, and

coating the mosquito; and

wherein during the introduction the bacteria is lyophilized, freeze-dried, microencapsulated, desiccated, in an aqueous carrier or in a solution.

4. The method of claim 2, wherein the genetically modified bacteria is obtained from a bacteria selected from the group consisting of: an endosymbiotic bacteria that persists through the life-cycle of the mosquito, *Pseudomonas putida* strain Ae171, and *Pseudomonas putida* strain Ae142.

5. The method of claim 4 wherein the genetically modified endosymbiotic bacteria further expresses a heterologous nucleotide encoding a VrrA small-non-coding RNA.

6. The method of claim 1, wherein the essential pathogen gene of the *Zika* virus is: NS2B, NS3, or NS4.

7. A paratransgenic system for the bio-control of a Zika virus-carrying mosquito comprising the steps of:

generating a genetically modified endosymbiotic bacteria comprising an expression control sequence operably linked to at least one heterologous nucleotide encoding at least one inhibitory RNA polynucleotide that downregulates expression of at least one *Zika* virus gene, and wherein the genetically modified endosymbiotic bacteria is paratransgenic with the mosquito;

introducing into the mosquito an effective amount of the genetically modified endosymbiotic bacteria that colonizes the mosquito and expresses the at least one inhibitory RNA polynucleotide that downregulates expression of the at least one *Zika* virus gene; and

wherein the at least one inhibitory RNA polynucleotide is selected from the nucleotide sequences of SEQ ID No:s 1, 2, 3, 4 and 5.

8. The method of claim 7, wherein the mosquito is: *Aedes aegypti*, *Aedes albopictus*, or *Anopheles gambiae*.

9. The method of claim 8, wherein the mosquito is: a female mosquito that transmits the Zika virus to a mammalian organism; a mosquito larvae, a third instar larva, a pupa, or an adult mosquito.

10. The method of claim 9, wherein the introducing to the mosquito an effective amount of the genetically modified endosymbiotic bacteria comprises a method selected from the group consisting of: administering an effective amount of the genetically modified endosymbiotic bacteria through one or more of the following methods selected from the groups consisting of: soaking, spraying, injecting, feeding, introducing to through an aerosolized disbursement, introducing to through an environmental aerosolized disbursement, introducing to through an environmental aerosolized disbursement in water sources, brushing, dressing, dripping, and coating the mosquito and wherein during the introduction the bacteria is lyophilized, freeze-dried, microencapsulated, desiccated, in an aqueous carrier or in a solution.

11. The method of claim 7 wherein the genetically modified endosymbiotic bacteria is obtained from: *E. coli* strain JC803l, an autotropic endosymbiotic enteric bacteria, an RNase III deficient endosymbiotic enteric bacteria, *E. coli* strain HT115, *E. coli* strain HT27, *E. coli* strain JC8031, *Pantoea* strain Ae16, *Serratia* strain AeS1, *Serratia* strain MS5, *Pseudomonas putida* strain Ae076, or *Pseudomonas putida* Ae171.

12. The method of claim 11, wherein said at least one inhibitory RNA polynucleotide is a dsRNA polynucleotide molecule.

13. The method of claim 12, wherein the endosymbiotic bacteria further expresses a heterologous nucleotide encoding a VrrA small-non-coding RNA.

14. The method of claim 12, wherein the at least one *Zika* virus gene is selected from the group consisting of: NS2B, NS3, and NS4.

15. A method of controlling pathogens in mosquitos comprising:

introducing a genetically modified bacteria to a mosquito to configure the mosquito to express a heterologous double stranded RNA (dsRNA) polynucleotide directed to an essential gene in a pathogen;

expressing the dsRNA polynucleotide; and

inhibiting the essential gene expression through a dsRNA induced RNA interference mechanism.

16. The method of claim 15, wherein the pathogen comprises a *Zika* virus or a *Dengue* virus.

17. The method of claim 15, wherein the dsRNA polynucleotide is selected from a group consisting of: SEQ ID No 1, SEQ ID NO. 2, SEQ ID NO. 3, SEQ ID NO. 4, and/or SEQ ID NO. 5; and wherein the dsRNA polynucleotide targets a sequence within SEQ ID NO. 6.

18. The method of claim 15 wherein the mosquito comprises a mosquito selected from the group consisting of:

a female mosquito being capable of transmitting a disease to a mammalian organism;
a mosquito larvae;
a third instar larva;
a pupa; and
an adult mosquito.

19. The method of claim 15 wherein the genetically modified bacteria comprises an endosymbiotic bacteria that persist through a life-cycle of the mosquito and may further be selected from the group consisting of: Ae171 and/or Ae142.

20. The method of claim 19 wherein the genetically modified endosymbiotic bacteria comprises a genetically modified endosymbiotic bacteria expressing a heterologous VrrA small-non-coding RNA (sRNA).