VACCINE COMPOSITION COMPRISING AN INACTIVATED CHIKUNGUNYA VIRUS STRAIN

FIELD OF THE INVENTION

The invention relates to stable immunogenic compositions for prophylaxis and treatment against any infections caused by Chikungunya Virus. The present invention particularly relates to compositions of Chikungunya virus (henceforth termed as CHIKV) strains and use of the subunit antigens of the virus thereof, for prophylaxis, therapeutic treatment and diagnosis of Chikungunya infections in humans. More particularly, the invention relates to stable immunogenic vaccine compositions for prophylaxis and treatment against any genotypes or antigenic variants or mutants of Chikungunya virus conferring an antibody titer sufficient for the seroprotection for any genotypic variant or mutant for the Chikungunya virus. The invention also relates to vaccine compositions for immunization against Chikungunya virus in combination with other bacterial and viral infections selected from the following list that include but is not limited to vaccines for Japanese encephalitis virus, dengue vaccines, West Nile virus vaccine and Chandipura virus vaccine and rabies vaccines. Combinations with other viral vaccines are also within the scope of the invention.

BACKGROUND OF THE INVENTION

Chikungunya virus (CHIKV) is an alphavirus of the family *Togaviridae*. It is a positive strand RNA virus that causes a generally non-fatal infection characterized by high fever and sudden onset of polyarthralgia. Hemorrhagic and neurological manifestations including seizures, lymphadenopathy, fulminant hepatitis and conjunctivitis not hitherto associated with CHIKV infections were reported since the re-surgent infection in 2005 (Sourisseau et al., 2007; Kannan et al., 2007). Phylogenetic analyses based on the partial E1 structural glycoprotein sequences have identified three CHIKV lineages, the West African, Asian and the East, Central and South African (ECSA) (Powers et al., 2000). Asian lineage circulated in India and Southeast Asia until it was replaced by the ECSA genotype, which emerged during the 2005–2006 outbreak in the Indian Ocean islands (Yergolkar et al., 2006). Sub-lineages of ECSA strains that had established locally were spread by travellers from endemic areas to Africa, Asia and Europe and caused local outbreaks (Powers and Logue, 2007).

Nearly 1.39 million suspected cases of Chikungunya virus infection occurred in India in 2006. (National Vector Borne Disease Control Programme (NVBDCP), 2007) which was caused by the ECSA strain carrying the E1-226A (Arankalle et al., 2007). The E1-A226V adaptive mutation that increases transmissibility by *Aedes albopictus* is responsible for the wide geographical spread of the virus since then (de Lamballerie et al., 2008). Host immune pressure and resultant site specific mutations in the human leukocyte antigen (HLA) class-1 restricting elements of CHIKV genome are implicated in the explosive Chikungunya virus outbreaks since 2005 (Tong et al., 2010). Prior art known in the field do not include any vaccine candidate derived from the ECSA strain. Bharat Biotech International Limited has earlier developed (disclosed in WO 2008/026225) the 2006 ECSA strain with E1-226A and its use in the development of potential vaccines against Chikungunya virus infections.

Chikungunya virus strains of the urban (epidemic) transmission cycles show a higher evolutionary rate than that of the enzootic (sylvatic) cycle, and the difference in the evolutionary dynamics between the two transmission cycles are influenced by several factors that determine virus-host interactions such as vector diversity and abundance, vector larval habitats and herd immunity in the population (Volk et al., 2010). Arboviruses like Chikungunya interacts with both the arthropod and the vertebrate hosts, and the selection pressure on the envelope glycoproteins are driven by preferences for vector adaptation and by vertebrate host immune defense mechanisms. Viral evolution tends to select for mutations in the antigenic determinants involved in neutralization as well as those residues involved in vector/host adaptation.

The vaccines under development such as that disclosed in WO 2008030220 and in Akahata et al. 2010 make use of the West African genotype and the E1-A226V isolates. Another CHIKV vaccine development is a DNA vaccine (Mallilankaraman et al., 2011) which is different in scope from that disclosed in this invention. An earlier prototype vaccine which is a live attenuated vaccine used the Asian genotype of the virus (Edelman et al., 2001). DNA vaccines have not been successful in human prophylactic vaccination so far, and live attenuated CHIKV vaccine caused side effects in human subjects (Edelman et al., 2001) who received the vaccine. The CHIKV strain used in the earlier vaccine development (WO 2008/026225) was the 2006 ECSA strain with E1-226A. The strains isolated in 2009-2010

from India as disclosed in this invention belong to a distinct sub-lineage within the ECSA lineage and carry novel mutations in the E2 and E1 envelope glycoproteins. One of the mutations in the E1 glycoprotein in all the isolates reported in the study maps to a region that determines host vector specificity and is under significant positive selection for enhanced adaptation to *Adis. aegypti*, which is the most abundant mosquito vector in the region and indeed in the tropical countries where prevalence of Chikungunya virus infection is now endemic. Other novel mutations hitherto unreported are also disclosed. Thus it is desirable to make a vaccine composition which would confer immunity to the newly developed and distinct sublineages of the ECSA strain of the Chikungunya virus which would also confer immune protection to the other mutated strains of the ECSA strain propagated by the vector *Aedis aegypti*. Inventors in this application after prolonged research disclose such an effective vaccine in this application including other additional advantages over the earlier vaccine (WO 2008/026225) such as new methods of inactivation of the virus and improved formulations with novel adjuvants that enhance the immunogenicity of the inactivated viral vaccine and the recombinant subunit vaccines and virosomes which are also included herein this invention.

OBJECT OF THE INVENTION

One object of the present invention is to provide a stable vaccine composition that is capable to prevent as well as provide treatment from infections caused by Chikungunya virus. The said vaccine composition is applicable to any genotypic variants of the Chikungunya virus for prophylaxis and treatment thereof.

Another object of the invention is to provide for a stable vaccine composition that is capable to prevent as well as provide treatment from infections caused by Chikungunya virus propagated by any suitable vector which includes prevention and treatment of Chikungunya infections propagated by the vectors *Aedis albopictus* and *Aedis aegypit* which happens to be the most commonly adaptable vectors of the Chikungunya virus.

Yet another object of the invention is to provide for a stable vaccine composition which is effective against any genotypic variants of the Chikungunya virus particularly of the ECSA strain and its particular distinct and unique sublineages as applicable thereof.

One more object of the invention is to provide for a stable vaccine composition wherein the antigenic component of the vaccine includes the whole inactivated virion or the subunit antigens of the recombinant CHIKV viral strains that can be expressed as Virus Like particles (henceforth termed as VLPs) in combination of suitable pharmaceutically acceptable carriers, stabilizers, and adjuvants.

Yet another object of the invention is to provide a method for preparation of a stable vaccine composition that is capable to elicit an immune response sufficient to prevent as well as provide treatment from infections caused by any genotypic mutants or variants of Chikungunya virus including inactivation of the CHIKV virus and mixing with adjuvants in appropriate amounts.

Another object of the invention is to provide antibodies so generated against the Chikungunya virus strains or its subunit antigens useful for diagnosis of Chikungunya virus infections in humans.

One more object of the invention relates to provide major antigenic determinants of the Chikungunya virus which are suitable as effective vaccine candidates and nucleotide and protein sequences disclosed thereof.

Yet another object of the invention includes combined vaccine compositions which are effective for prophylaxis and treatment of infections caused by Chikungunya virus and other other bacterial and viral infections selected from the following list that includes but is not limited to vaccines for Japanese encephalitis virus vaccines, dengue vaccines, West Nile virus vaccine and Chandipura virus vaccine and rabies vaccines.

SUMMARY OF THE INVENTION

According to one aspect of the invention, the invention includes vaccine compositions which specifically contain the whole inactivated virion or the subunit antigens of the CHIKV virus strains. The compositions of the present invention more particularly relate to vaccine capable of eliciting protective antibody and strong T cell responses against Chikungunya virus infection.

Another aspect of the invention is to provide inactivated recombinant CHIKV vaccines along with appropriate adjuvants that offer high protective efficacy.

Yet another aspect of the invention of the present invention more particularly relate to vaccine capable of eliciting protective antibody and strong T cell responses against Chikungunya virus infections.

One another aspect of the invention relate to methods of preparing and using Chikungunya virus (CHIKV) antigens of defined sequences expressed as recombinant proteins, virus like particles and as virosomes which are used to elicit protective immune response. The potency of such subunit vaccines are comparable to that elicited by the vaccine consisting of whole inactivated virion of CHIKV that are inactivated with reagents under conditions that confer high immunogenicity to the vaccine.

Another aspect of the invention relates to methods of inactivation of the virus which comprises heat, gamma irradiation, ultraviolet light or chemically inactivated whole virion of Chikungunya virus isolates in a stable formulation. A combination of two or more inactivating agents has also been used with similar effect. The virus isolates disclosed in the invention are used in vaccine development, and all the methods are applicable to any genotypes or genotypic variants/serotypes/strains/mutants of Chikungunya virus.

One another aspect of the invention is to provide vaccine compositions against Chikungunya virus that elicit strong immunological response when administered parenterally, preferably intradermally, intramuscularly or sub-cutaneously in mammals preferably in humans, and are effective when administered mucosally and by other routes such as oral routes.

Yet another object of the invention is to provide antibodies against Chikungunya virus or the subunit antigens thereof to be used for treatment and diagnosis of Chikungunya virus infections in mammals, preferably humans.

One another aspect of the invention is to provide a composition for eliciting protective antibody and strong T cell responses either singly or in combination with other vaccines included within the scope of the invention. The other vaccines in combination are but not limited to vaccines for Japanese encephalitis virus vaccines, dengue vaccines, West Nile virus vaccine and Chandipura virus vaccine and rabies vaccines.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1:

Immunogenicity of CHIKV whole virion antigen inactivated by several inactivation methods were tested for potency. The details of inactivation procedures are provided in Example 2. Potency of the 15 µg of the inactivated viral vaccine was tested in three intramuscular injections in 4-6 week old Balb/c mice (8 nos per group) at intervals of 0, 7 and 21 days and bled 7 days after the last dose administration. Only a single dose of the live virus was administered for comparison. The potency of the vaccine preparations were tested by estimating the titer of neutralizing antibodies by $PRNT_{50}$.

Figure 2:

Immunogenicity of the CHIKV vaccine preparation with and without adjuvants was tested in three intramuscular injections in 4-6 week old Balb/c mice (8 nos per group) at intervals of 0, 7 and 21 days and bled 7 days after the last dose administration. The composition of the adjuvanted vaccine formulations are provided in Example 5. The potency of the vaccine preparations were tested by estimating the titer of neutralizing antibodies by $PRNT_{50}$.

DETAILED DESCRIPTION OF THE INVENTION

No detailed study on evolution of CHIKV serotypes due to sequence diversity has been reported. We report for the first time the adaptive evolution of ECSA strains of CHIKV to *Ae.aegypti* as found in the 2009-2010 virus isolates from India. Incidentally, *Ae.aegypti* is the most prevalent vector in India and indeed in several tropical countries. Despite unique mutations in isolates reported in the current invention, the virus strains cross neutralize the Asian genotypes and various ECSA sub-lineages of CHIKV indicating that they are good candidates for vaccine development. Using virus strains or antigens derived from such strains thereof, that are better adapted to the most prevalent vector in the region is important for vaccine development rather than using strains of West African or Asian genotype which are not so widely prevalent now than the ECSA genotype. Even among the ECSA genotype, using candidates such as LR2006 isolates from Reunion Island that carry E1-A226V mutation which is an adaptive mutation to increase transmissibility in *Ae.albopictus* is less advantageous as *Ae.albopictus* vector in India is prevalent widely only along the West coast of India such as in the states of Kerala and South coastal Karnataka, whereas the mosquito vector that is most abundant in the rest of the country is *Ae.aegypti*. The virus strains isolated and reported in this invention are unique in that they show adaptive evolution to *Ae.aegypti* and at the same time also infect *Ae.albopictus*. Apart from the unique mutations that increase adaptation to *Aedes aegypti*, the advantage of the invention is that the virus isolates cross neutralize the Asian genotypes and various ECSA variant strains and hence are good candidate vaccines. Hence, a subunit vaccine derived from the virus antigens or recombinant antigens of these isolates are good vaccine candidates as well, as the recombinant vaccine antisera also cross neutralizes the different genotypes and genotypic variants.

Hence, using the Indian virus strains that show unique adaptation to *Ae.aegypti* and also infects *Ae.albopictus* is advantageous than using the West African, Asian or ECSA E1-226A and other variant strains as *Ae.aegypti* is the most widely prevalent vector in the India which has the highest incidence of CHIKV infection in the world.

The Chikungunya virus isolates within the scope of the invention are those that belong to the ECSA (East, Central and South African) genotype whose structural polyprotein sequence comprises of the capsid, E3, E2, 6K and E1 (C-E3-E2-6K-E1) proteins. The

isolates obtained from the Indian epidemic of 2009-2010 are unique in the sequence reported so far. The structural polyprotein sequence comprising the C-E3-E2-6K-E1 proteins have been deposited in the public sequence repository (GenBank) on 27th April 2010 and have been assigned the accession numbers HM159385 to HM159390. The sequences were published in March 2012 after the date of filing the provisional patent. The unique nucleotide sequences reported in this invention are SEQ ID NO.1 (isolate TN01610), SEQ ID NO.2 (isolate TN15110) SEQ ID NO.3 (isolate TN06210), SEQ ID NO. 4 (TN06310), SEQ ID NO. 5 (TN06410) and SEQ ID NO.6 (AP0109), whose corresponding protein sequences when translated are SEQ ID NO.8, SEQ ID NO.9, SEQ ID NO.10, SEQ ID NO.11, SEQ ID NO.12 and SEQ ID NO.13 respectively. The CHIKV strain CHIKV/03/06 has structural polyprotein of SEQ ID NO.7 and was isolated during the 2006 Indian epidemic, the corresponding protein sequence is SEQ ID NO.14. The names of the virus isolates are provided in the brackets. The full length genomic RNA sequences of the above mentioned virus isolates of the current invention are provided in SEQ ID NO.15 to SEQ ID NO.20.

The sequence of the isolates disclosed in the invention have unique genetic signatures such as the combination of T1766C (E2-V264A) + A3058G (E1-K211E) + 3104C (E1-226A) in the structural polyprotein sequence in addition to other amino acid changes when compared to the S27 African prototype (Gen Bank Acc No. AF369024). The position of nucleotide substitution in the structural polyprotein and the corresponding amino acid change in the individual proteins within the polyprotein is indicated in brackets. Other unique mutations that are being reported are Capsid-A232V in TN06310, E3-D40N in TN15110, E2-K47N in TN06210, E2-G55R in TN01610 and AP0109, E2-K66E in TN064110, E1-P58L in AP0109, and E1-G195R in TN15110 and TN06310. Codon by codon analyses by maximum likelihood estimates of 'ω' (the ratio of non-synonymous to synonymous substitutions) of the ECSA strains show that the amino acid mutation E1-K211E in the isolates reported in the invention (of SEQ ID NO. 8 to SEQ ID NO.13) is under significant positive selection (posterior probability of ≥ 0.97; $p<0.05$) and is suggestive of adaptive mutation to increase infectivity in the *Aedes* mosquito vectors, particularly in *Aedes aegypti*. The amino acid residue E1-211E is conserved in the Asian genotypes of CHIKV which are circulated by *Ae.aegypti*. Additional mutations disclosed in this invention such as the three

novel mutations E2-K47N, E2-G55R and E2-K66E also cluster in the same region of the E2 protein that are reported to increase the infectivity of the Sindbis virus in *Aedes aegypti.* The E2 aa 52 – 82 region is exposed at the top of the spike, which is the point of contact with cellular receptors. Codon by codon maximum likelihood estimates of 'ω' by SLAC (Single Likelihood Ancestor Counting), eFEL (Fixed Effects Likelihood), iFEL (internal Fixed Effects Likelihood) and REL (Random Effects Likelihood) identified amino acid sites across the capsid and the structural glycoproteins under significant purifying selection. Among the amino acid sites that were negatively selected, the E2-199Y residue was selected as the genetic loci under most significant purifying selection by all the four likelihood estimates (posterior probability >0.99 by REL, $p<0.01$ by iFEL, $p=0.001$ by SLAC and $p=0.00$ by eFEL). E2-199Y is an important residue in Chikungunya virus determining virus fitness in mosquitoes.

Viral evolution tends to select for mutations in the antigenic determinants involved in neutralization as well as those residues involved in vector/host adaptation. Because of its high immunological specificity, the serum neutralization test is often the gold standard against which the specificity of the other serological techniques is evaluated. The antisera raised against the virus isolates reported in the invention neutralized the virus isolates of Asian and ECSA lineages and several variant strains of ECSA genotype including the E1-A226V ECSA variant strain, indicating that they are good vaccine candidates as they have broad neutralizing activity.

The properties of Chikungunya virus particles as an immunogen, adaptation and propagation of the virus in host cell lines to a high titer, determination of the identity of the virus by RT-PCR, methods of purification and inactivation of the virus, preparation of stable vaccine formulation in a pharmaceutically acceptable carrier suitable for administration in humans, the viral assays and tests for vaccine potency in animal models are also within the scope of the invention. The virus particles obtained from infected patients or isolated from the vectors of the virus where the virus resides, are adapted in cell lines and propagated *in vitro* in cell culture in several passages.

The use of the CHIKV strains in the development of an inactivated whole virion vaccine is one aspect of the invention. The Chikungunya virus strains were infected in mammalian cell lines for production of the virions. The mammalian cells include but are not limited to Vero cells (ATCC CCL-81), MRC-5 or any other cell line suitable for vaccine production for human use.

The whole virions obtained from cell culture were inactivated with different inactivating agents. The optimum time, temperature and use of stabilizers such as sugars like sucrose, lactose, trehalose and other sugars and sugar combinations, and the addition of sugar alcohols such as mannitol or sorbitol either alone or in combination with different sugars, addition of human serum albumin either alone or in combination with sugars, amino acids and sugar alcohols during the inactivation process are within the scope of the invention. The virus was rendered non-infectious by inactivating either by heat, gamma irradiation or ultra violet light or by chemical means with formalin and beta-propiolactone (BPL) among others under conditions that retained high immunogenicity of the vaccine preparation. The conditions of virus inactivation were optimized and are presented in Example 2. Chemical inactivating agents are selected from the following list which includes but is not limited to: formalin, beta-propiolactone, glutaraldehyde, N-acetylethyleneimine, binary ethyleneimine, tertiary ethyleneimine, ascorbic acid, caprylic acid, psolarens, detergents including non-ionic detergents etc. is added to a virus suspension to inactivate the virus. The concentration of the sugars, sugar alcohols, human serum albumin and amino acids either when used alone or in various combinations were in the concentration range of 0.01% to 20%, preferably 0.1% to 10% and most preferably 0.1% to 5%. Time and temperature of inactivation in the presence of the stabilizers were optimized from 2-8^{0}C to 37^{0}C for varying period of time such as 30 min to 20 days. Such vaccine formulations were highly immunogenic and elicited protective neutralizing antibodies.

The structural glycoproteins C-E3-E2-6K-E1 of the Chikungunya virus are the major antigenic determinants. Hence, the structural glycoproteins are excellent vaccine candidates for subunit vaccine for prophylaxis of CHIKV infections. The sequence of the structural proteins as defined in SEQ ID NO.8 to SEQ ID NO. 14. The recombinant non-structural proteins are also immunogenic and are good candidate vaccines. The eukaryotic expression system of choice includes mammalian cells, baculovirus in insect cells, and yeast cells of

any species, most preferably *Pichia pastoris* or *Saccharomyces cerevisiae.* Genes encoding the subunit antigens were also expressed in prokaryotic cells such as *E.coli* using any of the suitable prokaryotic expression vectors. *Pichia pastoris* as recombinant expression host is advantageous at industrial scale as it is cost effective for large scale manufacture compared to other eukaryotic expression systems. Recombinant proteins derived from *Pichia pastoris* have been successfully commercialized and have been found safe for human use. The structural proteins such as C-E3-E2-6K-E1 of the sequences disclosed in this application are capable of assembling into 'virus like particles' (VLPs). Alternatively, the VLPs contain only the E3-E2-6K-E1 or E2-6K-E1 or only E2-E1 proteins and are immunogenic and elicited protective immune response when administered in animals. The subunit antigens comprising E3-E2-6K-E1 or E2-6K-E1 are also capable of assembling into virosomes as CHIKV is an enveloped virus. Virosomes comprising E3-E2-6K-E1 or E2-6K-E1 or only E2-E1 are also immunogenic. The liposomes and virosomes can contain different combination of lipid soluble substances which include but are not limited to cholecalciferol, cholesterol, phospholipids etc. and the viral envelope proteins. The methods for virosomes preparation such as solubilization of the virus particles with detergents or with short chain phospholipids and reconstitution of the envelope proteins after removal of the chaotropic agents and the non-envelope proteins and RNA that are applicable to any enveloped virus are also applicable to CHIKV.

Purification of the virus was achieved by physical or chemical means and preferably by a combination of both. Physical methods utilize the physical properties of the virus such as density, size, mass, sedimentation coefficient etc. and include any of the following techniques but are not limited to: ultracentrifugation, density gradient centrifugation, ultrafiltration etc. Purification through chemical means employs methods such as adsorption/desorption through chemical or physiochemical reactions such as ion exchange chromatography, affinity chromatography, hydrophobic interaction chromatography, gel filtration chromatography, hydroxyapatite matrix, salting with inorganic salts one such example being ammonium sulphate, and by the use of proprietary Himax™ technology, organic salts and organic compounds such as polyethylene glycol. Purification of the virus or the recombinant virus antigens was achieved by either one or a combination of two or more of the above mentioned methods.

The antigenic compositions of the above mentioned CHIKV candidate vaccines, such as the inactivated whole virion vaccines or the recombinant vaccines were formulated in pharmaceutically acceptable carrier for immunization in mammals, preferably humans. The Chikungunya virus vaccine formulation was adjuvanted and adjuvants were selected from the following list, which includes but is not limited to: alum; calcium phosphate; inulin of any polymorphic form, preferably gamma inulin; adjuvants containing inulin in combination with other organic and inorganic compounds such as aluminum hydroxide, aluminum phosphate, aluminum sulphate phosphate and calcium phosphate; liposomes, chitosan and complex carbobhydrates such as dextran, dextrins, starch, inulin, mannans and glucomannans, galactomannans, beta-glucans, heparin, cellulose, pectins and pectinates, lectins and any other carbohydrates either synthetic or derived from any source, any biodegradable and biocompatible polymers, such as poly lactide and poly(lactide co-glycolides; PLG) or PLGA; any emulsions including but not limited to oil in water emulsions one such example being ASO3, other squalene based adjuvants such as MF59 etc., any water in oil emulsion; liposomes prepared with cholecalciferol as one of the ingredients along with other lipid soluble compounds; liposomes of other compositions; RIBI adjuvant systems, saponins including but not limited to QS-21, QuilA, tomatine, ISCOMs, ISCOMATRIX etc, lipopeptides, glycopeptides, lipopolysaccharides, muramyl dipeptides and any peptide based adjuvants, oligonucleotides, any TLR ligands as adjuvants, any cytokine, vitamins and non-toxic bacterial toxins etc. The most compatible and cost effective adjuvant was selected in the final vaccine formulation after testing for immunogenicity which was enhanced by the addition of adjuvants. In addition to the above, any other organic and inorganic substances that have good immunopotentiating activity can also be used as adjuvants either singly or in combinations to enhance the immunogenicity of Chikungunya virus vaccines. In addition to the inactivated whole virion vaccine, the aforementioned adjuvants or adjuvant combinations are also effective with recombinant Chikungunya virus vaccine using recombinant subunit antigens either when presented as virosome, virus like particles (VLPs) or when expressed, purified and formulated as individual recombinant proteins. The use of suitable adjuvants in the vaccine formulations reduces the amount of antigen required and helps in the manufacture of low-cost vaccines thus conferring economic advantage.

The buffer used in the formulations is phosphate or phosphate-citrate buffer or any other pharmaceutically acceptable buffer. The vaccines optionally contain preservative(s), stabilizer(s) etc. The excipients were selected from a list that includes but is not limited to reducing and non-reducing sugars, sugar alcohols such sorbitol and mannitol, glycerol, amino acids, human serum albumin, inulin, thiomerosol and a choice of adjuvant from the aforementioned list of adjuvants. The excipients are added in the range of 0.01% to 20% for the liquid formulation and upto 60% of the total solids for a lyophilized formulation. The vaccine formulations were also presented as emulsions, either as water in oil emulsion or as oil in water emulsion. Such emulsions of vaccine antigens contain preservatives and stabilizers and other adjuvants. Such a stable formulation of the immunogen either in a liquid or in a lyophilized form and after reconstitution in a pharmaceutically acceptable buffer or water is suitable for administration parenterally in human host and is also formulated for mucosal administration. The vaccine formulations were highly immunogenic and neutralized homologous and heterologous CHIKV strains.

For potency testing of the vaccine, the vaccine formulations were tested in Balb/c mice and rabbits. The resultant serum is assayed by *in vitro* neutralization tests and the antibody titer is determined by ELISA. Seroconversion was observed in the animals immunized with the vaccine formulations described in the present invention. Efficacy of the recombinant vaccine in offering a protective immune response was comparable with the whole virion vaccine and the titers of the neutralizing antibody responses were determined by either serum neutralization test (SNT), plaque reduction neutralization test ($PRNT_{50}$) and ELISA among other methods. Passive immunization of the vaccine antibody offered good protection against virus infection indicating therapeutic use of CHIKV antibodies. The presence of virus in infected patients samples were accurately determined using CHIKV antibodies. Chikungunya virus vaccine obtained by the methods included in the scope of the current invention elicits strong neutralizing antibodies in combination with other vaccines. The vaccines that can be included in the combination are selected from the following list that includes but is not limited to vaccines for Japanese encephalitis virus, Dengue vaccines, West Nile virus vaccine and Chandipura virus vaccine and rabies vaccines. Combinations with other viral vaccines are also within the scope of the invention. As known to those skilled in the art, a bivalent or polyvalent vaccine can be prepared by mixing vaccines

produced from two or more CHIKV strains, and is mixed in a suitable ratio based on the antigen content. Such mixing provides a vaccine preparation having a broad antigenic spectrum for protection against the infection.

According to the present invention, the methods and compositions of CHIKV strains of the current invention is applicable to any CHIKV strain. The vaccines of this invention offered good immune protection against plural strains of CHIKV in addition to the virus strains used in production of the vaccine. The CHIKV isolates reported in the study have broad neutralizing activity as they cross neutralize different genotypes /genotypic variants / strains of CHIKV and are ideal vaccine candidates for development of whole inactivated virion vaccine or recombinant vaccines comprising the antigens derived from these virus isolates. The methods disclosed in the invention are applicable to any genotype/genotypic variants/serotype/strain of Chikungunya virus and as demonstrated offer good cross protection against multiple gentotypes/genotypic variants of the virus.

The invention is further described in the following examples. It should be noted that features, integers, characteristics, ranges, compounds, and/or groups described in conjunction with a particular aspect, embodiment or example of the invention are to be understood to be applicable to any other aspect, embodiment or example described herein unless incompatible therewith and should be considered within the scope of the invention.

Example 1: Isolation of virus strains

The virus strains were isolated from blood samples collected from febrile patients with their informed consent during an epidemic outbreak in India in 2009-2010. The blood samples were collected during the acute phase of Chikungunya virus infection when patients reported high fever, acute polyarthralgia and painful swelling in joints and rashes. The patients' sera samples were transported on dry ice to the laboratory. About 0.05 ml of the serum was used for infection of Vero cells (ATCC No. CCL-81) in 25^2cm flask in medium containing DMEM (Dulbecco's Modified Eagle Medium; Sigma- Aldrich Catalog # D5523) containing 1% fetal bovine serum (FBS). The flasks were incubated at 34^0C to 37^0C. The virus was harvested 48 hours after infection. Scaled up cultures of the virus were

made in cell stacks or in cell factories or in bioreactors in liquid culture All the blood samples were negative for Dengue infection by specific IgM ELISA (National Institute of Virology, Pune). The infectious titer of the virus increased more than 10 fold after the virus particles were passaged once in suckling mice brain or after passage in mosquito cell lines such as C6/36 cells, and also after repeated passage of the virus in cell culture *in vitro*.

Example 2: Purification and inactivation of CHIKV virus

The two virus isolates TN01610 and TN15110 were purified from the infected Vero cell monolayers from scaled up cultures by initial ultrafiltration to remove cellular debris, and by filtration and concentration through a 300 kD membrane followed by purification by ion exchange and gel filtration column chromatography. Heat inactivation of the virus was carried out at different temperatures ranging from 45^{0}C to 60^{0}C for 30 min to 4 hrs and optimally at 56^{0}C for 30 min. Inactivation by ultraviolet (UV) light was done at 254 nm for varying period of time from 30 – 120 min on ice, and optimally for 40 min. Chikungunya virus was inactivated effectively by formalin at ratios upto 1:3000 for formalin:virus at 2^{0}C -8^{0}C upto 7 days, and with beta propiolactone at 1:1000 to 1:2500 (beta propiolactone:virus) for upto 7 days at 2^{0}C -8^{0}C. In both the cases, the time of inactivation was reduced to 24-48 hrs when carried out at ambient temperatures of +20 - 25^{0}C. Formalin and beta propiolactone were removed by dialysis. During inactivation, use of additives such as glycine, mannitol, sorbitol and sugars and sugar combinations increased the stability of the vaccine preparation. The sugars used may be selected from sucrose, lactose, trehalose, maltose at varying concentrations from 0.5% to 5%. Inactivation of the virus by gamma irradiation was carried out by exposure of the virus samples to a dose of 10 kGy (Kilo Gray) to 25 kGy from a ^{60}Co source (Ms.Gamma Agro-Medical Processings Pvt.Ltd. Hyderabad) and optimally to 20 kGy. Complete inactivation of the virus samples by all of the above methods were confirmed by three serial passages in Vero cells for absence of virus cytopathic effect, and additionally by the absence of growth abnormalities and death when inoculated by intracerebral route in the brain of 2-day old mice. The inactivated virus antigens were tested for potency as candidate vaccines..

Example 3: Reverse Transcriptase- Polymerase Chain Reaction (RT-PCR) and Sequencing:

Viral RNA was isolated using Absolutely RNA Miniprep kit (Stratagene, La Jolla, CA) from infected Vero cells (ATCC CCL-81), after a single passage. RT-PCR was carried out using the AccuScript High Fidelity 1st Strand cDNA Synthesis Kit (Stratagene) as per the kit protocols, and the 3,747 bp structural polyprotein gene was amplified with the PfuUltra High-Fidelity DNA polymerase (Stratagene). PCR primers were designed based on the consensus sequence of the S27-African prototype (AF369024) and the Indian 2006 isolate (HM159384), and used to amplify overlapping sequences of the structural polyprotein gene. PCR reaction consisted of initial denaturation at 95^{0}C for 1 min, followed by 32 thermal cycling steps at 94^{0}C for 40 sec, annealing at 52–65^{0}C (depending on the primer sets) for 30 sec and extension at 70^{0}C for 3 min, followed by final extension at 70^{0}C for 10min. PCR products were purified by QIAquick gel extraction kit (QIAGEN, Hilden, Germany) after separation on 1% agarose gel and used for DNA sequencing. Nucleotide sequencing of CHIKV structural polyprotein gene gel purified PCR products were sequenced on both strands of DNA by BigDye terminator v3.1 reaction (Applied Biosystems, Foster City, CA) and the sequence data was analyzed using Sequencher v4.7 (GeneCodes, Ann Arbor, MI). The sequences were deposited in GenBank on 27th April 2010 before filing the provisional patent and published by GenBank on 02 March 2012. The unique nucleotide sequences reported in this invention are SEQ ID NO.1 (isolate TN01610), SEQ ID NO.2 (isolate TN15110) SEQ ID NO.3 (isolate TN06210), SEQ ID NO. 4 (TN06310), SEQ ID NO.5 (TN06410) and SEQ ID NO.6 (AP0109), whose corresponding protein sequences when translated are SEQ ID NO.8, SEQ ID NO.9, SEQ ID NO.10, SEQ ID NO.11, SEQ ID NO.12 and SEQ ID NO.13 respectively. The CHIKV strain CHIKV/03/06 has structural polyprotein gene of sequence SEQ ID NO.7 and was isolated during the 2006 Indian epidemic and its corresponding protein sequence is SEQ ID NO.14. The names of the virus isolates are provided in the brackets. For complete genomic RNA sequences, the sequencing reactions were performed using sequencing by synthesis (SBS) technology on the Illumina GAIIx (Genotypic Technology Pvt. Ltd. Bangalore). The complete nucleotide sequences (in the form of cDNA) of the virus genomic RNA of the above mentioned virus strains are provided in SEQ ID NO.15 to SEQ ID NO.20. Mutations identified with

reference to strain S27-African prototype (AF369024) were mapped to the individual structural proteins and are presented in Table 1.

TABLE I. Unique mutations in the Chikungunya virus structural genes reported in this study.

Amino acid position		Nucleotide change in polypeptide	strain S27-African prototype	CHIKV/03/06	TN01610	TN151100	TN06210	TN06310	TN06410	AP0109
Poly-peptide	Protein									
232	C-232	c695t	A	.	.	.	.	V	.	.
301	E3-40	g901a	D	.	.	N	.	.	.	.
372	E2-47	a1116t	K	.	.		N	.	.	.
380	E2-55	g1138a	G	.	R	.	.	.	.	R
391	E2-66	a1171g	K	.	.	.	.	.	E	.
589	E2-264	t1766c	V	.	A	A	A	A	A	.
867	E1-58	c2600t	P	.	.	.	.	.	.	L
1004	E1-195	g3010c	G	.	.	R	.	R	.	.
1020	E1-211	a3058g	K	.	E	E	E	E	E	E

Unique mutations identified in the capsid, E1, E2 and the E3 structural glycoproteins in the 2009-2010 CHIKV isolates from the States of Tamil Nadu and Andhra Pradesh.

"." Amino acids identical to the reference strain S27-African prototype (AF369024). The GenBank accession numbers of the isolates from Tamil Nadu are HM159385 (TN01610), HM159386 (TN15110), HM159387 (TN06210), HM159388 (TN06310), HM159389 (TN06410), and from Hyderabad, Andhra Pradesh are HM159384 (CHIKV/03/06) and HM159390 (AP0109).

Example 4: Phylogenetic Analyses and Inference of Selection Pressure

The sequences reported in this study and those retrieved from GenBank were screened for recombination by the Genetic Algorithm Recombination Detection (GARD) (Kosakovsky Pond et al. 2006) prior to phylogenetic analysis. Evolutionary analyses were performed in MEGA5 (Tamura et al. 2007) using Kimura-2 parameter model of nucleotide substitution with 1000 bootstrap replicates. Multiple sequence alignment was performed using ClustalW2.0.3. The ECSA structural polyprotein sequences from 2005-2010 retrieved from GenBank and those reported in the study were used in the inference of selection pressure on the ECSA lineage. About 52 unique sequences were short listed by Hyphy (Pond et al. 2005) from 58 sequences retrieved from GenBank for the analyses. Codon-based Maximum Likelihood estimates of ω or the dN/dS (the ratio of non-synonymous to synonymous substitutions) were inferred by Random Effects Likelihood (REL), Fixed Effects Likelihood (eFEL) and selection along the internal branches of phylogeny was tested using Internal Fixed Effects Likelihood (iFEL) method in HyPhy. In the likelihood methods, positive selection was inferred as significant if the p value of the likelihood ratio test (LRT) was less than 0.05 or when the Bayes factor was equal to or larger than 100 for a site. Statistical testing of positive selection operating on the entire protein was inferred by Single Likelihood Ancestor Counting (SLAC) method in HyPhy. Inference of ω by empirical Bayesian method using LRT (Likelihood Ratio Test) with the MEC (Mechanistic Empirical Combination) model for positive selection, and M8a model for purifying and neutral selection was carried out using Selecton v2.2 (Stern et al. 2007). The amino acid sites of CHIKV structural proteins under significant positive and purifying selection is provided in accompanying Table II.

TABLE II. Amino acid sites of CHIKV structural proteins under significant positive and purifying selection

Method	Codon no. in structural polyprotein	Positively selected amino acid	Negatively selected amino acid	p-value	Posterior probability	Bayes factor†
REL	523	E2-198R			0.87	111.55
	524		E2-199Y		0.999	505.10
	645	E2-320T			0.86	100.71
	711	E2-386A			0.87	108.86

	1020	E1-211K			0.97	532.15
	1035	E1-226A			0.98	773.33
	1078	E1-269V			0.86	100.10
	1113	E1-304 P			0.88	120.58
iFEL	28		C-28I	0.034		
	273		E3-12N	0.008		
	326		E2-1S	0.036		
	397		E2-72N	0.008		
	524		E2-199Y	0.003		
	834		E1-25S	0.036		
	909		E1-100N	0.005		
	916		E1-107H	0.016		
	1020	E1-211K		0.040		
	1035	E1-226A		0.006		
	1120		E1-311D	0.042		
	1245		E1-436F	0.009		

The amino acids under positive selection in the capsid (C) and in the E1, E2 and E3 glycoproteins in the 2009-2010 Indian CHIKV isolates were inferred by Random Effects Likelihood (REL) and by Internal Fixed Effects Likelihood (iFEL) methods using the HyPhy package. The amino acid sites under significant positive and purifying selection in the E1 and E2 proteins respectively (Bayes factor >500, posterior probability ≥0.97 and $p<0.05$) are indicated in boldface. †Bayes factor is statistical estimation of posterior odds/prior odds for positive selection (dN>dS) at the site.

Example 5: Cloning and Expression of the Structural Polyprotein Sequences

The virus isolates reported in this patent was used as the source for cloning and expression of all viral antigens. The complete open reading frame of the Chikungunya virus structural polyprotein encoded by the SEQ ID NO.1 was amplified by RT-PCR of the viral genomic RNA using the primers CHKVCPFP as the forward primer and CHKVE1RP as the reverse

primer to obtain a ~ 3747 bp PCR fragment. The sequence of the PCR primers used for PCR amplification is:

CHKVCPFP:

55' ACAGAATTCATATGGAGTTCATCCCAACCCAAAC 3'

CHKVE1RP:

5' AATTGGATCCGCGGCCGCTTAGTGCCTGCTGAACGACACGC 3'

The PCR fragment was digested with Nde1 and BamH1 and cloned into the Nde1 and BamH1 sites of the prokaryotic expression vector, pET-11B and the recombinant plasmid containing the insert was transformed in *E.coli* DH5a. The recombinant plasmid DNA isolated from DH5a was used to transform the *E.coli* strain BL21(DE3). The PCR gene fragment was digested with EcoR1 and Not 1, gel purified by standard protocols and cloned into EcoR1 and Not1 sites of the yeast expression vector pPIC3.5K (Invitrogen Corporation, Carlsbad, USA) and transformed in *E.coli* DH5a. Recombinant plasmid DNA isolated from *E.coli* clone was linearized with BglII and was transformed into *Pichia Pastoris* GS115 as per the protocol from manufacturers (Invitrogen). The gene has been cloned into the *AOX1* locus and expressed under the *AOX1* promoter by methanol induction. The cloning, screening, isolation of the recombinant *Pichia* strains and induction of the cloned gene with methanol were carried out as per the User's manual "A Manual of Methods for Expression of Recombinant Proteins in *Pichia pastoris*" Version M Jan 2002, of *Pichia* Expression Kit, Catalog # K1710-01, Invitrogen Corporation, Carlsbad, USA).

Example 6: *In vivo* potency testing of the vaccine formulations:

The inactivated virus sample in vaccine formulations was tested with different adjuvants for potency. The adjuvants tested (at concentrations per single human dose) in hydroxide (0.5mg aluminum content) b) aluminum phosphate (0.5 mg aluminum content) c) gamma inulin (10 mg), d) algammulin (a combination of aluminum hydroxide and gamma inulin) at 10 mg, e) cholecalciferol in oil at 0.75 mg per dose, f) an oil in water emulsion OWEM1, containing 4.3% squalene, 0.5% tween-80, and 0.5% Span-85 (Sigma Aldrich product # S7135) in 10 mM phosphate-citrate buffer, f) oil in water emulsion OWEM2

containing 9.5mg squalene, 1 mg tween-80, 1 mg Span-85, 11 mg alpha tocopherol in phosphate-citrate buffer, g) an oil in water emulsion OWEM3 containing at the same concentration of excipients as in OWEM2 except that alpha tocopherol is replaced with 1-10 mg cholecalciferol. The formulated and adjuvanted vaccine preparations were injected intramuscularly in mice and booster doses were administered on day 7 and day 21 after administration of the first dose. Blood was collected at 28 days after the first dose was administered. Pooled sera from each test group were complement inactivated at 56^0C for about 30 min. All the formulations contained 15 μg viral antigen in 40 mM phosphate buffer, pH 6.8 – 7.2 containing 150 mM NaCl. Sera samples were used for estimation of neutralizing antibodies and for the estimation antibody titer by ELISA. Vaccinated animals offered complete protection against viremia with a virus challenge dose of $10^{4.5}$ pfu/ml when monitored over a period of 72 hours after intravenous/intraperitoneal administration of the challenge virus. In another experiment, passive immunization with rabbit antisera with $PRNT_{50}$ titer of 640 when administered intravenously in 4-6 week old Balb/c mice offered complete protection against viremia when challenged with $10^{4.5}$ pfu/ml of the challenge virus. For serotype analyses, antisera against CHIKV/03/06 neutralized heterotypic virus isolates of the Asian genotype (GenBank Acc No. EF027140, isolated in Kolkata in 1963), ECSA, (E1-A226V, E1-211K; GenBank Acc No. FJ000069, isolated in Kerala in 2007) and ECSA (E1-226A, E1-K211E, GenBank Acc No. HM159386, obtained from Tamil Nadu in 2010 with neutralizing antibody titer ≥ 40 indicating heterotypic protection against genotypic variants, and also indicating that no distinct serotypes have evolved.

Example 7: Plaque Reduction Neutralization Assay

One day prior to the assay 6-well plates were seeded with 2.5 x 10^3 Vero cells (ATCC CCL-81) per well and the plates were incubated at 37°C in a 5% CO_2 incubator. To 4-fold dilutions of the sera samples in MEM containing 2% fetal bovine serum, equal volume of the standardized virus (10^5 pfu/ml) was added and incubated at 37°C with 5% CO_2 for 90 min. The cells were washed twice with 1 x PBS pH 7.4 (10 mM phosphate with 150 mM NaCl) and 0.3 ml of each dilution of the serum-virus mixture was added to the corresponding well and incubated for 90 min at 37°C in a 5% CO_2 incubator. Each assay was carried out in triplicates. The cells were overlaid with 2 ml of 0.85% methyl cellulose in MEM containing 10% fetal bovine serum, 1% penicillin-streptomycin and 1% L-

glutamine. The plates were incubated at 37°C in a 5% CO_2 incubator for 5 days. At the end of incubation, the plaques were fixed with 10% formalin, washed with 1 x PBS, pH 7.4 and were visualized with 0.1% crystal violet. The highest dilution of serum causing 50% reduction in plaques formed by the control virus sample was estimated as the $PRNT_{50}$ titer. $PRNT_{50}$ assays were carried out to test the potency of the vaccine preparations by various inactivation methods, as well as for adjuvanted CHIKV vaccines and vaccine combination with JEV vaccine..

Example 8: Vaccine combinations

A combination of CHIKV vaccine inactivated by beta-propiolactone was tested in combination with formalin inactivated vaccine for Japanese encephalitis virus (JEV). 15 μg of CHIKV vaccine antigen formulated in alum (0.5mg aluminum/ dose) was tested in combination with inactivated JE (JEV) virus vaccine containing 6 μg of Japanese encephalitis virus whole virion antigen also formulated in alum. The vaccine combination was injected in 8 nos of Balb/c mice with appropriate controls that included either of the antigens alone, and also control animals that received equivalent amount of alum. The animals were boosted at 7 and at 21 days after the first immunization. Blood was collected at 7 days after the last booster injection. Pooled sera from each group were complement inactivated at 56^0C for about 30 min. The sera samples were used for estimation of neutralizing antibody by $PRNT_{50}$ for both CHIKV and JEV. The buffer used in all the formulations was 40 mM phosphate buffer, pH 6.8 – 7.2 containing 150 mM NaCl. All the methods disclosed above are applicable to any genotype/genotypic variants/serotypes and strains of Chikungunya virus.

References:

1. Kannan M, Rajendran R, Sunish IP, Balasubramaniam R, Arunachalam N, Paramsivan R, Tewari SC, Samuel PP, Tyagi BK. 2007. A study on Chikungunya outbreak during 2007 in Kerala, south India. Indian J Med Res 129:311-315

2. Sourisseau M, Schilte C, Casartelli N, Trouillet C, Guivel-Benhassine F, Rudnicka D, Sol-Foulon N, Le Roux K, Prevost MC, Fsihi H, Frenkiel MP, Blanchet F, Afonso PV, Ceccaldi PE, Ozden S, Gessain A, Schuffenecker I, Verhasselt B, Zamborlini A, Saïb A, Rey FA, Arenzana-Seisdedos F, Desprès P, Michault A, Albert ML, Schwartz O. 2007. Characterization of reemerging Chikungunya virus. PLoS Pathog 3:e89.

3. Powers AM, Brault AC, Tesh RB, Weaver SC. 2000. Re-emergence of Chikungunya and o'nyong-nyong viruses: evidence for distinct geographical lineages and distant evolutionary relationships. J Gen Virol 81:471-479.

4. Yergolkar PN, Tandale BV, Arankalle VA, Sathe PS, Sudeep AB, Gandhe SS, Gokhle MD, Jacob GP, Hundekar SL, Mishra AC. 2006. Chikungunya outbreaks caused by African genotype, India. Emerg Infect Dis 12:1580-1583.

5. Powers AM, Logue CH. 2007. Changing patterns of Chikungunya virus: re-emergence of a zoonotic arbovirus. J Gen Virol 88:2363–2377.

6. Arankalle VA, Shrivastava S, Cherian S, Gunjikar RS, Walimbe, AM, Jadhav, SM, Sudeep AB, Mishra AC. 2007. Genetic divergence of Chikungunya viruses in India (1963-2006) with special reference to the 2005-2006 explosive epidemic. J Gen Virol 88:1967-1976.

7. de Lamballerie X, Leroy E, Charrel RN, Ttsetsarkin K, Higgs S, Gould EA. 2008. Chikungunya virus adapts to tiger mosquito via evolutionary convergence: a sign of things to come? Virol J 5:33.

8. Tong JC, Simarmata D, Lin RT, Rénia L, Ng LF. 2010. HLA Class I restriction as a possible driving force for Chikungunya evolution. PLoS One 5:e9291.

9. Volk SM, Chen R, Tsetsarkin KA, Adams AP, Garcia TI, Sall AA, Nasar F, Schuh AJ, Holmes EC, Higgs S, Maharaj PD, Brault AC, Weaver SC. 2010. Genome-scale phylogenetic analyses of Chikungunya virus reveal independent emergences of recent epidemics and various evolutionary rates. J Virol 84:6497-6504.

10. Akahata W, Yang ZY, Andersen H, Sun S, Holdaway HA, Kong WP, Lewis MG, Higgs S, Rossmann MG, Rao S, Nabel GJ. 2010. A virus-like particle vaccine for epidemic Chikungunya virus protects nonhuman primates against infection. Nat Med. 2010; 16(3):334-8.

11. Mallilankaraman K, Shedlock DJ, Bao H, Kawalekar OU, Fagone P, Ramanathan AA, Ferraro B, Stabenow J, Vijayachari P, Sundaram SG, Muruganandam N, Sarangan G, Srikanth P, Khan AS, Lewis MG, Kim JJ, Sardesai NY, Muthumani K, Weiner DB. 2011: A DNA

vaccine against Chikungunya virus is protective in mice and induces neutralizing antibodies in mice and nonhuman primates. PLoS Negl Trop Dis.; 5(1):e928.

12. Edelman R, Tacket CO, Wasserman SS, Bodison SA, Perry JG, Mangiafico JA. 2001: Phase II safety and immunogenicity study of live Chikungunya virus vaccine TSI-GSD-218. Am J Trop Med Hyg. 2000; 62(6):681-5.

SEQUENCE LISTING

<110> BHARAT BIOTECH INTERNATIONAL LIMITED

<120> Vaccine compositions for Chikungunya Virus Infection

<130> BBIL/CHK-II

<140> IN/2067/CHE/2011
<141> 2011-06-17

<160> 20

<170> PatentIn version 3.5

<210> 1
<211> 3747
<212> DNA
<213> Chikungunya virus

<400> 1
atggagttca tcccaaccca aacttttttac aataggaggt accagcctcg accctggact 60

ccgcgctcta ctatccaaat cattaggccc agaccgcgcc ctcagaggca agctgggcaa 120

cttgcccagc tgatctcagc agttaataaa ctgacaatgc gcgcggtacc ccaacagaag 180

ccacgcagga atcggaagaa taagaagcaa aagcaaaaac aacaggcgcc acaaaacaac 240

acaaatcaaa agaagcagcc acctaaaaag aaaccggctc aaaagaaaaa gaagccgggc 300

cgcagagaga ggatgtgcat gaaaatcgaa aatgattgta ttttcgaagt caagcacgaa 360

ggtaaggtaa caggttacgc gtgcctggtg ggggacaaag taatgaaacc agcacacgta 420

aaggggacca tcgataacgc ggacctggcc aaactggcct ttaagcggtc atctaagtat 480

gaccttgaat gcgcgcagat acccgtgcac atgaagtccg acgcttcgaa gttcacccat 540

gagaaaccgg aggggtacta caactggcac cacggagcag tacagtactc aggaggccgg 600

ttcaccatcc ctacaggtgc tggcaaacca ggggacagcg gcagaccgat cttcgacaac 660

aagggacgcg tggtggccat agtcttagga ggagctaatg aaggagcccg tacagccctc 720

tcggtggtga cctggaataa agacattgtc actaaaatca cccccgaggg ggccgaagag 780

tggagtcttg ccatcccagt tatgtgcctg ctggcaaaca ccacgttccc ctgctcccag 840

ccccccttgca cgccctgctg ctacgaaaag gaaccggagg aaaccctacg catgcttgag 900

gacaacgtca tgagacctgg gtactatcag ctgctacagg catccttaac atgttctccc 960

caccgccagc gacgcagcac caaggacaac ttcaatgtct ataaagccac aagaccatac 1020

ttagctcact gtcccgactg tggagaaggg cattcgtgcc atagtcccgt agcactagaa 1080

cgcatcagaa atgaagcgac agacgggacg ctgaaaatcc aggtctcctt gcaaatcaga 1140

ataaagacgg atgacagcca cgattggacc aagctgcgtt atatggacaa ccacatgcca 1200

gcagacgcag agagggcggg gctatttgta agaacatcag caccgtgtac gattactgga 1260

acaatgggac acttcatcct ggcccgatgt ccaaaagggg aaactctgac ggtgggattc 1320

actgacagta ggaagattag tcattcatgt acgcacccat ttcaccacga ccctcctgtg 1380

ataggtcggg aaaaattcca ttcccgaccg cagcacggta aagagctacc ttgcagcacg 1440

tacgtgcaga gcaccgccgc aactaccgag gagatagagg tacacatgcc cccagacacc 1500

cctgatcgca cattaatgtc acaacagtcc ggcaacgtaa agatcacagt caatggccag 1560

acggtgcggt acaagtgtaa ttgcggtggc tcaaatgaag gactaacaac tacagacaaa 1620

gtgattaata actgcaaggt tgatcaatgt catgccgcgg tcaccaatca caaaaagtgg 1680

cagtataact cccctctggt cccgcgtaat gctgaacttg gggaccgaaa aggaaaaatt 1740

cacatcccgt ttccgctggc aaatgcaaca tgcagggtgc ctaaagcaag gaaccccacc 1800

gtgacgtacg ggaaaaacca agtcatcatg ctactgtatc ctgaccaccc aacactcctg 1860

tcctaccgga atatgggaga agaaccaaac tatcaagaag agtgggtgat gcataagaag 1920

gaagtcgtgc taaccgtgcc gactgaaggg ctcgaggtca cgtggggcaa caacgagccg 1980

tataagtatt ggccgcagtt atctacaaac ggtacagccc atggccaccc gcatgagata 2040

attctgtatt attatgagct gtaccctact atgactgtag tagttgtgtc agtggccacg 2100

ttcatactcc tgtcgatggt gggtatggca gcggggatgt gcatgtgtgc acgacgcaga 2160

tgcatcacac cgtatgaact gacaccagga gctaccgtcc ctttcctgct tagcctaata 2220

tgctgcatca gaacagctaa agcggccaca taccaagagg ctgcgatata cctgtggaac 2280

gagcagcaac ctttgttttg gctacaagcc cttattccgc tggcagccct gattgttcta 2340

tgcaactgtc tgagactctt accatgctgc tgtaaaacgt tggctttttt agccgtaatg 2400

agcgtcggtg cccacactgt gagcgcgtac gaacacgtaa cagtgatccc gaacacggtg 2460

ggagtaccgt ataagactct agtcaataga cctggctaca gccccatggt attggagatg 2520

gaactactgt cagtcacttt ggagccaaca ctatcgcttg attacatcac gtgcgagtac 2580

aaaaccgtca tcccgtctcc gtacgtgaag tgctgcggta cagcagagtg caaggacaaa 2640

aacctacctg actacagctg taaggtcttc accggcgtct acccatttat gtggggcggc 2700

gcctactgct tctgcgacgc tgaaaacacg cagttgagcg aagcacatgt ggagaagtcc 2760

gaatcatgca aaacagaatt tgcatcagca tacagggctc ataccgcatc tgcatcagct 2820

aagctccgcg tcctttacca aggaaataac atcactgtaa ctgcctatgc aaacggcgac 2880

catgccgtca cagttaagga cgccaaattc attgtggggc caatgtcttc agcctggaca 2940

cctttcgaca acaaaattgt ggtgtacaaa ggtgacgtct ataacatgga ctacccgccc 3000

tttggcgcag gaagaccagg acaatttggc gatatccaaa gtcgcacacc tgagagtgaa 3060

gacgtctatg ctaatacaca actggtactg cagagaccgg ctgcgggtac ggtacacgtg 3120

ccatactctc aggcaccatc tggctttaag tattggctaa aagaacgcgg ggcgtcactg 3180

cagcacacag caccatttgg ctgccaaata gcaacaaacc cggtaagagc ggtgaactgc 3240

gccgtaggga acatgcccat ctccatcgac ataccggaag cggccttcac tagggtcgtc 3300

gacgcgccct ctttaacgga catgtcgtgc gaggtaccag cctgcaccca ttcctcagac 3360

tttgggggcg tcgccattat taaatatgca gccagcaaga aaggcaagtg tgcggtgcat 3420

tcgatgacta acgccgtcac tattcgggaa gctgagatag aagttgaagg gaattctcag 3480

ctgcaaatct ctttctcgac ggccttagcc agcgccgaat tccgcgtaca agtctgttct 3540

acacaagtac actgtgcagc tgagtgccac cccccgaagg accacatagt caactacccg 3600

gcgtcacata ccaccctcgg ggtccaggac atctccgcta cggcgatgtc atgggtgcag 3660

aagatcacgg gaggtgtggg actggttgtt gctgttgccg cactgattct aatcgtggtg 3720

ctatgcgtgt cgttcagcag gcactaa 3747

<210> 2
<211> 3747
<212> DNA
<213> Chikungunya virus

<400> 2
atggagttca tcccaaccca aacttttttac aataggaggt accagcctcg accctggact 60

ccgcgctcta ctatccaaat cattaggccc agaccgcgcc ctcagaggca agctgggcaa 120

cttgcccagc tgatctcagc agttaataaa ctgacaatgc gcgcggtacc ccaacagaag 180

ccacgcagga atcggaagaa taagaagcaa aagcaaaaac aacaggcgcc acaaaacaac 240

acaaatcaaa agaagcagcc acctaaaaag aaaccggctc aaaagaaaaa gaagccgggc 300

cgcagagaga ggatgtgcat gaaaatcgaa aatgattgta ttttcgaagt caagcacgaa 360

ggtaaggtaa caggttacgc gtgcctggtg ggggacaaag taatgaaacc agcacacgta 420

aaggggacca tcgataacgc ggacctggcc aaactggcct ttaagcggtc atctaagtat 480

gaccttgaat gcgcgcagat acccgtgcac atgaagtccg acgcttcgaa gttcacccat 540

gagaaaccgg aggggtacta caactggcac cacggagcag tacagtactc aggaggccgg 600

ttcaccatcc ctacaggtgc tggcaaacca ggggacagcg gcagaccgat cttcgacaac 660

aagggacgcg tggtggccat agtcttagga ggagctaatg aaggagcccg tacagccctc 720

tcggtggtga cctggaataa agacattgtc actaaaatca cccccgaggg ggccgaagag 780

tggagtcttg ccatcccagt tatgtgcctg ctggcaaaca ccacgttccc ctgctcccag 840

ccccttgca cgccctgctg ctacgaaaag gaaccggagg aaaccctacg catgcttgag 900

aacaacgtca tgagaccagg gtactatcag ctgctacagg catccttaac atgttctccc 960

caccgccagc gacgcagcac caaggacaac ttcaatgtct ataaagccac aagaccatac 1020

ttagctcact gtcccgactg tggagaaggg cactcgtgcc atagtcccgt agcactagaa 1080

cgcatcagaa atgaagcgac agacgggacg ctgaaaatcc aggtctcctt gcaaatcgga 1140

ataaagacgg atgacagcca cgattggacc aagctgcgtt atatggacaa ccacatgcca 1200

gcagacgcag agagggcggg gctatttgta agaacatcag caccgtgtac gattactgga 1260

acaatgggac acttcatcct ggcccgatgt ccaaaagggg aaactctgac ggtgggattc 1320

actgacagta ggaagattag tcattcatgt acgcacccat ttcaccacga ccctcctgtg 1380

ataggtcggg aaaaattcca ttcccgaccg cagcacggta aagagctacc ttgcagcacg 1440

tacgtgcaga gcaccgccgc aactaccgag gagatagagg tacacatgcc cccagacacc 1500

cctgatcgca cattaatgtc acaacagtcc ggcaacgtaa agatcacagt caatggccag 1560

acggtgcggt acaagtgtaa ttgcggtggc tcaaatgaag gactaacaac tacagacaaa 1620

gtgattaata actgcaaggt tgatcaatgt catgccgcgg tcaccaatca caaaaagtgg 1680

cagtataact cccctctggt cccgcgtaat gctgaacttg gggaccgaaa aggaaaaatt 1740

cacatcccgt ttccgctggc aaatgcaaca tgcagggtgc ctaaagcaag gaaccccacc 1800

gtgacgtacg ggaaaaacca agtcatcatg ctactgtatc ctgaccaccc aacactcctg 1860

tcctaccgga atatgggaga agaaccaaac tatcaagaag agtgggtgat gcataagaag 1920

gaagtcgtgc taaccgtgcc gactgaaggg ctcgaggtca cgtggggcaa caacgagccg 1980

tataagtatt ggccgcagtt atctacaaac ggtacagccc atggccaccc gcatgagata 2040

attctgtatt attatgagct gtaccctact atgactgtag tagttgtgtc agtggccacg 2100

ttcatactcc tgtcgatggt gggtatggca gcggggatgt gcatgtgtgc acgacgcaga 2160

tgcatcacac cgtatgaact gacaccagga gctaccgtcc ctttcctgct tagcctaata 2220

tgctgcatca gaacagctaa agcggccaca taccaagagg ctgcgatata cctgtggaac 2280

gagcagcaac ctttgttttg gctacaagcc cttattccgc tggcagccct gattgttcta 2340

tgcaactgtc tgagactctt accatgctgc tgtaaaacgc tggctttttt agccgtaatg 2400

agcgtcggtg cccacactgt gagcgcgtac gaacacgtaa cagtgatccc gaacacggtg 2460

ggagtaccgt ataagactct agtcaataga cctggctaca gccccatggt attggagatg 2520

gaactactgt cagtcacttt ggagccaaca ctatcgcttg attacatcac gtgcgagtac 2580

aaaaccgtca tcccgtctcc gtacgtgaag tgctgcggta cagcagagtg caaggacaaa 2640

aacctacctg actacagctg taaggtcttc accggcgtct acccatttat gtggggcggc 2700

gcctactgct tctgcgacgc tgaaaacacg cagttgagcg aagcacatgt ggagaagtcc 2760

gaatcatgca aaacagaatt tgcatcagca tacagggctc ataccgcatc tgcatcagct 2820

aagctccgcg tcctttacca aggaaataac atcactgtaa ctgcctatgc aaacggcgac 2880

catgccgtca cagttaagga cgccaaattc attgtggggc caatgtcttc agcctggaca 2940

cctttcgaca acaaaattgt ggtgtacaaa ggtgacgtct ataacatgga ctacccgccc 3000

tttggcgcac gaagaccagg acaatttggc gatatccaaa gtcgcacacc tgagagtgaa 3060

gacgtctatg ctaatacaca actggtactg cagagaccgg ctgcgggtac ggtacacgtg 3120

ccatactctc aggcaccatc tggctttaag tattggctaa aagaacgcgg ggcgtcactg 3180

cagcacacag caccatttgg ctgccaaata gcaacaaacc cggtaagagc ggtgaactgc 3240

gccgtaggga acatgcccat ctccatcgac ataccggaag cggccttcac tagggtcgtc 3300

gacgcgccct ctttaacgga catgtcgtgc gaggtaccag cctgcaccca ttcctcagac 3360

tttgggggcg tcgccattat taaatatgca gccagcaaga aaggcaagtg tgcggtgcat 3420

tcgatgacta acgccgtcac tattcgggaa gctgagatag aagttgaagg gaattctcag 3480

ctgcaaatct ctttctcgac ggccttagcc agcgccgaat tccgcgtaca agtctgttct 3540

acacaagtac actgtgcagc tgagtgccac cccccgaagg accacatagt caactacccg 3600

gcgtcacata ccaccctcgg ggtccaggac atctccgcta cggcgatgtc atgggtgcag 3660

aagatcacgg gaggtgtggg actggttgtt gctgttgccg cactgattct aatcgtggtg 3720

ctatgcgtgt cgttcagcag gcactaa 3747

<210> 3
<211> 3747
<212> DNA
<213> Chikungunya virus

<400> 3

atggagttca tcccaaccca aacttttttac aataggaggt accagcctcg accctggact 60

ccgcgctcta ctatccaaat cattaggccc agaccgcgcc ctcagaggca agctgggcaa 120

cttgcccagc tgatctcagc agttaataaa ctgacaatgc gcgcggtacc ccaacagaag 180

ccacgcagga atcggaagaa taagaagcaa aagcaaaaac aacaggcgcc acaaaacaac 240

acaaatcaaa agaagcagcc acctaaaaag aaaccggctc aaaagaaaaa gaagccgggc 300

cgcagagaga ggatgtgcat gaaaatcgaa aatgattgta ttttcgaagt caagcacgaa 360

ggtaaggtaa caggttacgc gtgcctggtg ggggacaaag taatgaaacc agcacacgta 420

aaggggacca tcgataacgc ggacctggcc aaactggcct ttaagcggtc atctaagtat 480

gaccttgaat gcgcgcagat acccgtgcac atgaagtccg acgcttcgaa gttcacccat 540

gagaaaccgg aggggtacta caactggcac cacggagcag tacagtactc aggaggccgg 600

ttcaccatcc ctacaggtgc tggcaaacca ggggacagcg gcagaccgat cttcgacaac 660

aagggacgcg tggtggccat agtcttagga ggagctaatg aaggagcccg tacagccctc 720

tcggtggtga cctggaataa agacattgtc actaaaatca cccccgaggg ggccgaagag 780

tggagtcttg ccatcccagt tatgtgcctg ctggcaaaca ccacgttccc ctgctcccag 840

ccccccttgca cgccctgctg ctacgaaaag gaaccggagg aaaccctacg catgcttgag 900

gacaacgtca tgagacctgg gtactatcag ctgctacagg catccttaac atgttctccc 960

caccgccagc gacgcagcac caaggacaac ttcaatgtct ataaagccac aagaccatac 1020

ttagctcact gtcccgactg tggagaaggg cactcgtgcc atagtcccgt agcactagaa 1080

cgcatcagaa atgaagcgac agacgggacg ctgaatatcc aggtctcctt gcaaatcgga 1140

ataaagacgg atgacagcca cgattggacc aagctgcgtt atatggacaa ccacatgcca 1200

gcagacgcag agagggcggg gctatttgta agaacatcag caccgtgtac gattactgga 1260

acaatgggac acttcatcct ggcccgatgt ccaaaagggg aaactctgac ggtgggattc 1320

actgacagta ggaagattag tcattcatgt acgcacccat ttcaccacga ccctcctgtg 1380

ataggtcggg aaaaattcca ttcccgaccg cagcacggta aagagctacc ttgcagcacg 1440

tacgtgcaga gcaccgccgc aactaccgag gagatagagg tacacatgcc cccagacacc 1500

cctgatcgca cattaatgtc acaacagtcc ggcaacgtaa agatcacagt caatggccag 1560

acggtgcggt acaagtgtaa ttgcggtggc tcaaatgaag gactaacaac tacagacaaa 1620

gtgattaata actgcaaggt tgatcaatgt catgccgcgg tcaccaatca caaaaagtgg 1680
cagtataact cccctctggt cccgcgtaat gctgaacttg gggaccgaaa aggaaaaatt 1740
cacatcccgt ttccgctggc aaatgcaaca tgcagggtgc ctaaagcaag gaaccccacc 1800
gtgacgtacg ggaaaaacca agttatcatg ctactgtatc ctgaccaccc aacactcctg 1860
tcctaccgga atatgggaga agaaccaaac tatcaagaag agtgggtgat gcataagaag 1920
gaagtcgtgc taaccgtgcc gactgaaggg ctcgaggtca cgtggggcaa caacgagccg 1980
tataagtatt ggccgcagtt atctacaaac ggtacagccc atggccaccc gcatgagata 2040
attctgtatt attatgagct gtaccctact atgactgtag tagttgtgtc agtggccacg 2100
ttcatactcc tgtcgatggt gggtatggca gcggggatgt gcatgtgtgc acgacgcaga 2160
tgcatcacac cgtatgaact gacaccagga gctaccgtcc ctttcctgct tagcctaata 2220
tgctgcatca gaacagctaa agcggccaca taccaagagg ctgcgatata cctgtggaac 2280
gagcagcaac ctttgttttg gctacaagcc cttattccgc tggcagccct gattgtccta 2340
tgcaactgtc tgagactctt accatgctgc tgtaaaacgt tggctttttt agccgtaatg 2400
agcgtcggtg cccacactgt gagcgcgtac gaacacgtaa cagtgatccc gaacacggtg 2460
ggagtaccgt ataagactct agtcaataga cctggctaca gccccatggt attggagatg 2520
gaactactgt cagtcacttt ggagccaaca ctatcgcttg attacatcac gtgcgagtac 2580
aaaaccgtca tcccgtctcc gtacgtgaag tgctgcggta cagcagagtg caaggacaaa 2640
aacctacctg actacagctg taaggtcttc accggcgtct acccatttat gtggggcggc 2700
gcctactgct tctgcgacgc tgaaaacacg cagttgagcg aagcacatgt ggagaagtcc 2760
gaatcatgca aaacagaatt tgcatcagca tacagggctc ataccgcatc tgcatcagct 2820
aagctccgcg tcctttacca aggaaataac atcactgtaa ctgcctatgc aaacggcgac 2880
catgccgtca cagttaagga cgccaaattc attgtggggc caatgtcttc agcctggaca 2940
cctttcgaca acaaaattgt ggtgtacaaa ggtgacgtct ataacatgga ctacccgccc 3000
tttggcgcag gaagaccagg acaatttggc gatatccaaa gtcgcacacc tgagagtgaa 3060
gacgtctatg ctaatacaca actggtactg cagagaccgg ctgcgggtac ggtacacgtg 3120
ccatactctc aggcaccatc tggctttaag tattggctaa aagaacgcgg ggcgtcactg 3180
cagcacacag caccatttgg ctgccaaata gcaacaaacc cggtaagagc ggtgaactgc 3240
gccgtaggga acatgcccat ctccatcgac ataccggaag cggccttcac tagggtcgtc 3300
gacgcgccct ctttaacgga catgtcgtgc gaggtaccag cctgcaccca ttcctcagac 3360
tttgggggcg tcgccattat taaatatgca gccagcaaga aaggcaagtg tgcggtgcat 3420
tcgatgacta acgccgtcac tattcgggaa gctgagatag aagttgaagg gaattctcag 3480
ctgcaaatct ctttctcgac ggccttagcc agcgccgaat tccgcgtaca agtctgttct 3540
acacaagtac actgtgcagc tgagtgccac cccccgaagg accacatagt caactacccg 3600
gcgtcacata ccaccctcgg ggtccaggac atctccgcta cggcgatgtc atgggtgcag 3660

aagatcacgg gaggtgtggg actggttgtt gctgttgccg cactgattct aatcgtggtg 3720

ctatgcgtgt cgttcagcag gcactaa 3747

<210> 4
<211> 3747
<212> DNA
<213> Chikungunya virus

<400> 4
atggagttca tcccaaccca aacttttttac aataggaggt accagcctcg accctggact 60

ccgcgctcta ctatccaaat cattaggccc agaccgcgcc ctcagaggca agctgggcaa 120

cttgcccagc tgatctcagc agttaataaa ctgacaatgc gcgcggtacc ccaacagaag 180

ccacgcagga atcggaagaa taagaagcaa aagcaaaaac aacaggcgcc acaaaacaac 240

acaaatcaaa agaagcagcc acctaaaaag aaaccggctc aaaagaaaaa gaagccgggc 300

cgcagagaga ggatgtgcat gaaaatcgaa aatgattgta ttttcgaagt caagcacgaa 360

ggtaaggtaa caggttacgc gtgcctggtg ggggacaaag taatgaaacc agcacacgta 420

aaggggacca tcgataacgc ggacctggcc aaactggcct ttaagcggtc atctaagtat 480

gaccttgaat gcgcgcagat acccgtgcac atgaagtccg acgcttcgaa gttcacccat 540

gagaaaccgg aggggtacta caactggcac cacggagcag tacagtactc aggaggccgg 600

ttcaccatcc ctacaggtgc tggcaaacca ggggacagcg gcagaccgat cttcgacaac 660

aagggacgcg tggtggccat agtcttagga ggagttaatg aaggagcccg tacagccctc 720

tcggtggtga cctggaataa agacattgtc actaaaatca cccccgaggg ggccgaagag 780

tggagtcttg ccatcccagt tatgtgcctg ctggcaaaca ccacgttccc ctgctcccag 840

ccccccttgca cgccctgctg ctacgaaaag gaaccggagg aaaccctacg catgcttgag 900

gacaacgtca tgagacctgg gtactatcag ctgctacagg catccttaac atgttctccc 960

caccgccagc gacgcagcac caaggacaac ttcaatgtct ataaagccac aagaccatac 1020

ttagctcact gtcccgactg tggagaaggg cactcgtgcc atagtcccgt agcactagaa 1080

cgcatcagaa atgaagcgac agacgggacg ctgaaaatcc aggtctcctt gcaaatcgga 1140

ataaagacgg atgacagcca cgattggacc aagctgcgtt atatggacaa ccacatgcca 1200

gcagacgcag agagggcggg gctatttgta agaacatcag caccgtgtac gattactgga 1260

acaatgggac acttcatcct ggcccgatgt ccaaaagggg aaactctgac ggtgggattc 1320

actgacagta ggaagattag tcattcatgt acgcacccat ttcaccacga ccctcctgtg 1380

ataggtcggg aaaaattcca ttcccgaccg cagcacggta aagagctacc ttgcagcacg 1440

tacgtgcaga gcaccgccgc aactaccgag gagatagagg tacacatgcc cccagacacc 1500

cctgatcgca cattaatgtc acaacagtcc ggcaacgtaa agatcacagt caatggccag 1560

acggtgcggt acaagtgtaa ttgcggtggc tcaaatgaag gactaacaac tacagacaaa 1620

gtgattaata actgcaaggt tgatcaatgt catgccgcgg tcaccaatca caaaaagtgg 1680

cagtataact cccctctggt cccgcgtaat gctgaacttg gggaccgaaa aggaaaaatt 1740

cacatcccgt ttccgctggc aaatgcaaca tgcagggtgc ctaaagcaag gaaccccacc 1800

gtgacgtacg ggaaaaacca agtcatcatg ctactgtatc ctgaccaccc aacactcctg 1860

tcctaccgga atatgggaga agaaccaaac tatcaagaag agtgggtgat gcataagaag 1920

gaagtcgtgc taaccgtgcc gactgaaggg ctcgaggtca cgtggggcaa caacgagccg 1980

tataagtatt ggccgcagtt atctacaaac ggtacagccc atggccaccc gcatgagata 2040

attctgtatt attatgagct gtaccctact atgactgtag tagttgtgtc agtggccacg 2100

ttcatactcc tgtcgatggt gggtatggca gcggggatgt gcatgtgtgc acgacgcaga 2160

tgcatcacac cgtatgaact gacaccagga gctaccgtcc ctttcctgct tagcctaata 2220

tgctgcatca gaacagctaa agcggccaca taccaagagg ctgcgatata cctgtggaac 2280

gagcagcaac ctttgttttg gctacaagcc cttattccgc tggcagccct gattgttcta 2340

tgcaactgtc tgagactctt accatgctgc tgtaaaacgc tggcttttt agccgtaatg 2400

agcgtcggtg cccacactgt gagcgcgtac gaacacgtaa cagtgatccc gaacacggtg 2460

ggagtaccgt ataagactct agtcaataga cctggctaca gccccatggt attggagatg 2520

gaactactgt cagtcacttt ggagccaaca ctatcgcttg attacatcac gtgcgagtac 2580

aaaaccgtca tcccgtctcc gtacgtgaag tgctgcggta cagcagagtg caaggacaaa 2640

aacctacctg actacagctg taaggtcttc accggcgtct acccatttat gtggggcggc 2700

gcctactgct tctgcgacgc tgaaaacacg cagttgagcg aagcacatgt ggagaagtcc 2760

gaatcatgca aaacagaatt tgcatcagca tacagggcgc ataccgcatc tgcatcagct 2820

aagctccgcg tcctttacca aggaaataac atcactgtaa ctgcctatgc aaacggcgac 2880

catgccgtca cagttaagga cgccaaattc attgtggggc caatgtcttc agcctggaca 2940

cctttcgaca acaaaattgt ggtgtacaaa ggtgacgtct ataacatgga ctacccgccc 3000

tttggcgcac gaagaccagg acaatttggc gatatccaaa gtcgcacacc tgagagtgaa 3060

gacgtctatg ctaatacaca actggtactg cagagaccgg ctgcgggtac ggtacacgtg 3120

ccatactctc aggcaccatc tggctttaag tattggctaa aagaacgcgg ggcgtcactg 3180

cagcacacag caccatttgg ctgccaaata gcaacaaacc cggtaagagc ggtgaactgc 3240

gccgtaggga acatgcccat ctccatcgac ataccggaag cggccttcac tagggtcgtc 3300

gacgcgccct ctttaacgga catgtcgtgc gaggtaccag cctgcaccca ttcctcagac 3360

tttgggggcg tcgccattat taaatatgca gccagcaaga aaggcaagtg tgcggtgcat 3420

tcgatgacta acgccgtcac tattcgggaa gctgagatag aagttgaagg gaattctcag 3480

ctgcaaatct ctttctcgac ggccttagcc agcgccgaat tccgcgtaca agtctgttct 3540

acacaagtac actgtgcagc tgagtgccac cccccgaagg accacatagt caactacccg 3600

gcgtcacata ccaccctcgg ggtccaggac atctccgcta cggcgatgtc atgggtgcag 3660

aagatcacgg gaggtgtggg actggttgtt gctgttgccg cactgattct aatcgtggtg 3720

ctatgcgtgt cgttcagcag gcactaa 3747

<210> 5
<211> 3747
<212> DNA
<213> Chikungunya virus

<400> 5
atggagttca tcccaaccca acttttttac aataggaggt accagcctcg accctggact 60

ccgcgctcta ctatccaaat cattaggccc agaccgcgcc ctcagaggca agctgggcaa 120

cttgcccagc tgatctcagc agttaataaa ctgacaatgc gcgcggtacc ccaacagaag 180

ccacgcagga atcggaagaa taagaagcaa aagcaaaaac aacaggcgcc acaaaacaac 240

acaaatcaaa agaagcagcc acctaaaaag aaaccggctc aaaagaaaaa gaagccgggc 300

cgcagagaga ggatgtgcat gaaaatcgaa aatgattgta ttttcgaagt caagcacgaa 360

ggtaaggtaa caggttacgc gtgcctggtg ggggacaaag taatgaaacc agcacacgta 420

aaggggacca tcgataacgc ggacctggcc aaactggcct ttaagcggtc atctaagtat 480

gaccttgaat gcgcgcagat acccgtgcac atgaagtccg acgcttcgaa gttcacccat 540

gagaaaccgg aggggtacta caactggcac cacggggcag tacagtactc aggaggccgg 600

ttcaccatcc ctacaggtgc tggcaaacca ggggacagcg gcagaccgat cttcgacaac 660

aagggacgcg tggtggccat agtcttagga ggagctaatg aaggagcccg tacagccctc 720

tcggtggtga cctggaataa agacattgtc actaaaatca cccccgaggg ggccgaagag 780

tggagtcttg ccatcccagt tatgtgcctg ctggcaaaca ccacgttccc ctgctcccag 840

ccccccttgca cgccctgctg ctacgaaaag gaaccggagg aaaccctacg catgcttgag 900

gacaacgtca tgagacctgg gtactatcag ctgctacagg catccttaac atgttctccc 960

caccgccagc gacgcagcac caaggacaac ttcaatgtct ataaagccac aagaccatac 1020

ttagctcact gtcccgactg tggagaaggg cactcgtgcc atagtcccgt agcactagaa 1080

cgcatcagaa atgaagcgac agacgggacg ctgaaaatcc aggtctcctt gcaaatcgga 1140

ataaagacgg atgacagcca cgattggacc gagctgcgtt atatggacaa ccacatgcca 1200

gcagacgcag agagggcggg gctatttgta agaacatcag caccgtgtac gattactgga 1260

acaatgggac acttcatcct ggcccgatgt ccaaaagggg aaactctgac ggtgggattc 1320

actgacagta ggaagattag tcattcatgt acgcacccat ttcaccacga ccctcctgtg 1380

ataggtcggg aaaaattcca ttcccgaccg cagcacggta aagagctacc ttgcagcacg 1440

tacgtgcaga gcaccgccgc aactaccgag gagatagagg tacacatgcc cccagacacc 1500

cctgatcgca cattaatgtc acaacagtcc ggcaacgtaa agatcacagt caatggccag 1560

acggtgcggt acaagtgtaa ttgcggtggc tcaaatgaag gactaacaac tacagacaaa 1620

gtgattaata actgcaaggt tgatcaatgt catgccgcgg tcaccaatca caaaaagtgg 1680

cagtataact cccctctggt cccgcgtaat gctgaacttg gggaccgaaa aggaaaaatt 1740

cacatcccgt ttccgctggc aaatgcaaca tgcagggtgc ctaaagcaag gaaccccacc 1800

gtgacgtacg ggaaaaacca agtcatcatg ctactgtatc ctgaccaccc aacactcctg 1860

tcctaccgga atatgggaga agaaccaaac tatcaagaag agtgggtgat gcataagaag 1920

gaagtcgtgc taaccgtgcc gactgaaggg ctcgaggtca cgtggggcaa caacgagccg 1980

tataagtatt ggccgcagtt atctacaaac ggtacagccc atggccaccc gcatgagata 2040

attctgtatt attatgagct gtaccctact atgactgtag tagttgtgtc agtggccacg 2100

ttcatactcc tgtcgatggt gggtatggca gcggggatgt gcatgtgtgc acgacgcaga 2160

tgcatcacac cgtatgaact gacaccagga gctaccgtcc ctttcctgct tagcctaata 2220

tgctgcatca gaacagctaa agcggccaca taccaagagg ctgcgatata cctgtggaac 2280

gagcagcaac ctttgttttg gctacaagcc cttattccgc tggcagccct gattgttcta 2340

tgcaactgtc tgagactctt accatgctgc tgtaaaacgc tggcttttt agccgtaatg 2400

agcgtcggtg cccacactgt gagcgcgtac gaacacgtaa cagtgatccc gaacacggtg 2460

ggagtaccgt ataagactct agtcaataga cctggctaca gccccatggt attggagatg 2520

gaactactgt cagtcacttt ggagccaaca ctatcgcttg attacatcac gtgcgagtac 2580

aaaaccgtca tcccgtctcc gtacgtgaag tgctgcggta cagcagagtg caaggacaaa 2640

aacctacctg actacagctg taaggtcttc accggcgtct acccatttat gtggggcggc 2700

gcctactgct tctgcgacgc tgaaaacacg cagttgagcg aagcacatgt ggagaagtcc 2760

gaatcatgca aaacagaatt tgcatcagca tacagggcgc ataccgcatc tgcatcagct 2820

aagctccgcg tcctttacca aggaaataac atcactgtaa ctgcctatgc aaacggcgac 2880

catgccgtca cagttaagga cgccaaattc attgtggggc caatgtcttc agcctggaca 2940

cctttcgaca acaaaattgt ggtgtacaaa ggtgacgtct ataacatgga ctacccgccc 3000

tttggcgcag gaagaccagg acaatttggc gatatccaaa gtcgcacacc tgagagtgaa 3060

gacgtctatg ctaatacaca actggtactg cagagaccgg ctgcgggtac ggtacacgtg 3120

ccatactctc aggcaccatc tggctttaag tattggctaa aagaacgcgg ggcgtcactg 3180

cagcacacag caccatttgg ctgccaaata gcaacaaacc cggtaagagc ggtgaactgc 3240

gccgtaggga acatgcccat ctccatcgac ataccggaag cggccttcac tagggtcgtc 3300

gacgcgccct ctttaacgga catgtcgtgc gaggtaccag cctgcaccca ttcctcagac 3360

tttgggggcg tcgccattat taaatatgca gccagcaaga aaggcaagtg tgcggtgcat 3420

tcgatgacta acgccgtcac tattcgggaa gctgagatag aagttgaagg gaattctcag 3480

ctgcaaatct ctttctcgac ggccttagcc agcgccgaat tccgcgtaca agtctgttct 3540

acacaagtac actgtgcagc tgagtgccac cccccgaagg accacatagt caactacccg 3600

gcgtcacata ccaccctcgg ggtccaggac atctccgcta cggcgatgtc atgggtgcag 3660

aagatcacgg gaggtgtggg actggttgtt gctgttgccg cactgattct aatcgtggtg 3720

ctatgcgtgt cgttcagcag gcactaa 3747

<210> 6
<211> 3747
<212> DNA
<213> Chikungunya virus

<400> 6

atggagttca tcccaaccca aacttttac aataggaggt accagcctcg accctggact 60

ccgcgctcta ctatccaaat catcaggccc agaccgcgcc ctcagaggca agctgggcaa 120

cttgcccagc tgatctcagc agttaataaa ctgacaatgc gcgcggtacc ccaacagaag 180

ccacgcagga atcggaagaa taagaagcaa aagcaaaaac aacaggcgcc acaaaacaac 240

acaaatcaaa agaagcagcc acctaaaaag aaaccggctc aaaagaaaaa gaagccgggc 300

cgcagagaga ggatgtgcat gaaaatcgaa aatgattgta ttttcgaagt caagcacgaa 360

ggtaaggtaa caggttacgc gtgcctggtg ggggacaaag taatgaaacc agcacacgta 420

aaggggacca tcgataacgc ggacctggcc aaactggcct ttaagcggtc atctaagtat 480

gaccttgaat gcgcgcagat acccgtgcac atgaagtccg acgcttcgaa gttcacccat 540

gagaaaccgg aggggtacta caactggcac cacggagcag tacaatactc aggaggccgg 600

ttcaccatcc ctacaggtgc tggcaaacca ggggacagcg gcagacctat cttcgacaac 660

aagggacgcg tggtggccat agtcttagga ggagctaatg aaggagcccg tacagccctc 720

tcggtggtga cctggaataa agacattgtc actaaaatca cccccgaggg ggccgaagag 780

tggagtcttg ccatcccagt tatgtgcctg ttggcaaaca ccacgttccc ctgctcccag 840

ccccccttgca cgccctgctg ctacgaaaag gaaccggagg aaaccctacg catgcttgag 900

gacaacgtca tgagacctgg gtactatcag ctgctacaag catccttaac atgttctccc 960

caccgccagc gacgcagcac caaggacaac ttcaatgtct ataaagccac aagaccatac 1020

ttagctcact gtcccgactg tggagaaggg cactcgtgcc atagtcccgt agcactagaa 1080

cgcatcagaa atgaagcgac agacgggacg ctgaaaatcc aggtctcctt gcaaatcaga 1140

ataaagacgg atgacagcca cgattggacc aagctgcgtt atatggacaa ccacatgcca 1200

gcagacgcag agagggcggg gctatttgta agaacatcag caccgtgtac gattactgga 1260

acaatgggac acttcatcct ggcccgatgt ccaaaagggg aaactctgac ggtgggattc 1320

actgacagta ggaagattag tcattcatgt acgcacccat ttcaccacga ccctcctgtg 1380

ataggtcggg aaaaattcca ttcccgaccg cagcacggta aagagctacc ttgcagcacg 1440

tacgtgcaga gcaccgccgc aactaccgag gagatagagg tacacatgcc cccagacacc 1500

cctgatcgca cattaatgtc acaacagtcc ggcaacgtaa agatcacagt caatggccag 1560

acggtgcggt acaagtgtaa ttgcggtggc tcaaatgaag gactaacaac tacagacaaa 1620

gtgattaata actgcaaggt tgatcaatgt catgccgcgg tcaccaatca caaaaagtgg 1680

cagtataact cccctctggt cccgcgtaat gctgaacttg gggaccgaaa aggaaaaatt 1740

cacatcccgt ttccgctggc aaatgtaaca tgcagggtgc ctaaagcaag gaaccccacc 1800

gtgacgtacg ggaaaaacca agtcatcatg ctactgtatc ctgaccaccc aacactcctg 1860

tcctaccgga atatgggaga agaaccaaac tatcaagaag agtgggtgat gcataagaag 1920

gaagtcgtgc taaccgtgcc gactgaaggg ctcgaggtca cgtggggcaa caacgagccg 1980

tataagtatt ggccgcagtt atctacaaac ggtacagccc atggccaccc gcatgagata 2040

attctgtatt attatgagct gtaccctact atgactgtag tagttgtgtc agtggccacg 2100

ttcatactcc tgtcgatggt gggtatggca gcggggatgt gcatgtgtgc acgacgcaga 2160

tgcatcacac cgtatgaact gacaccagga gctaccgtcc ctttcctgct tagcctaata 2220

tgctgcatca gaacagctaa agcggccaca taccaagagg ctgcgatata cctgtggaac 2280

gagcagcaac ctttgttttg gctacaagcc cttattccgc tggcagccct gattgttcta 2340

tgcaactgtc tgagactctt accatgctgc tgtaaaacgt tggctttttt agccgtaatg 2400

agcgtcggtg cccacactgt gagcgcgtac gaacacgtaa cagtgatccc gaacacggtg 2460

ggagtaccgt ataagactct agtcaataga cctggctaca gccccatggt attggagatg 2520

gaactactgt cagtcacttt ggagccaaca ctatcgcttg attacatcac gtgcgagtac 2580

aaaaccgtca tcccgtctct gtacgtgaag tgctgcggta cagcagagtg caaggacaaa 2640

aacctacctg actacagctg taaggtcttc accggcgtct acccatttat gtggggcggc 2700

gcctactgct tctgcgacgc tgaaaacacg cagttgagcg aagcacatgt ggagaagtcc 2760

gaatcatgca aaacagaatt tgcatcagca tacagggctc ataccgcatc tgcatcagct 2820

aagctccgcg tcctttacca aggaaataac atcactgtaa ctgcctatgc aaacggcgac 2880

catgccgtca cagttaagga cgccaaattc attgtggggc caatgtcttc agcctggaca 2940

cctttcgaca acaaaattgt ggtgtacaaa ggtgacgtct ataacatgga ctacccgccc 3000

tttggcgcag gaagaccagg acaatttggc gatatccaaa gtcgcacacc tgagagtgaa 3060

gacgtctatg ctaatacaca actggtactg cagagaccgg ctgcgggtac ggtacacgtg 3120

ccatactctc aggcaccatc tggctttaag tattggctaa aagaacgcgg ggcgtcactg 3180

cagcacacag caccatttgg ctgccaaata gcaacaaacc cggtaagagc ggtgaactgc 3240

gccgtaggga acatgcccat ctccatcgac ataccggaag cggccttcac tagggtcgtc 3300

gacgcgccct ctttaacgga catgtcgtgc gaggtaccag cctgcaccca ttcctcagac 3360

tttgggggcg tcgccattat taaatatgca gccagcaaga aaggcaagtg tgcggtgcat 3420

tcgatgacta acgccgtcac tattcgggaa gctgagatag aagttgaagg gaattctcag 3480

ctgcaaatct ctttctcgac ggccttagcc agcgccgaat tccgcgtaca agtctgttct 3540

acacaagtac actgtgcagc tgagtgccac cccccgaagg accacatagt caactacccg 3600

gcgtcacata ccaccctcgg ggtccaggac atctccgcta cggcgatgtc atgggtgcag 3660

aagatcacgg gaggtgtggg actggttgtt gctgttgccg cactgattct aatcgtggtg 3720

ctatgcgtgt cgttcagcag gcactaa 3747

<210> 7
<211> 3747
<212> DNA

<213> Chikungunya virus

<400> 7

atggagttca tcccaaccca aacttttac aataggaggt accagcctcg accctggact 60

ccgcgctcta ctatccaaat catcaggccc agaccgcgcc ctcagaggca agctgggcaa 120

cttgcccagc tgatctcagc agttaataaa ctgacaatgc gcgcggtacc ccaacagaag 180

ccacgcagga atcggaagaa taagaagcaa aagcaaaaac aacaggcgcc acaaaacaac 240

acaaatcaaa agaagcagcc acctaaaaag aaaccggctc aaaagaaaaa gaagccgggc 300

cgcagagaga ggatgtgcat gaaaatcgaa aatgattgta ttttcgaagt caagcacgaa 360

ggtaaggtaa caggttacgc gtgcctggtg ggggacaaag taatgaaacc agcacacgta 420

aaggggacca tcgataacgc ggacctggcc aaactggcct ttaagcggtc atctaagtat 480

gaccttgaat gcgcgcagat acccgtgcac atgaagtccg acgcttcgaa gttcacccat 540

gagaaaccgg aggggtacta caactggcac cacggagcag tacagtactc aggaggccgg 600

ttcaccatcc ctacaggtgc tggcaaacca ggggacagcg gcagacctat cttcgacaac 660

aagggacgcg tggtggccat agtcttagga ggagctaatg aaggagcccg tacagccctc 720

tcggtggtga cctggaataa agacattgtc actaaaatca cccccgaggg ggccgaagag 780

tggagtcttg ccatcccagt tatgtgcctg ttggcaaaca ccacgttccc ctgctcccag 840

ccccccttgca cgccctgctg ctacgaaaag gaaccggagg aaaccctacg catgcttgag 900

gacaacgtca tgagacctgg gtactatcag ctgctacaag catccttaac atgttctccc 960

caccgccagc gacgcagcac caaggacaac ttcaatgtct ataaagccac aagaccatac 1020

ttagctcact gtcccgactg tggagaaggg cactcgtgcc atagtcccgt agcactagaa 1080

cgcatcagaa atgaagcgac agacgggacg ctgaaaatcc aggtctcctt gcaaatcgga 1140

ataaagacgg atgacagcca cgattggacc aagctgcgtt atatggacaa ccacatgcca 1200

gcagacgcag agagggcggg gctatttgta agaacatcag caccgtgtac gattactgga 1260

acaatgggac acttcatcct ggcccgatgt ccaaaagggg aaactctgac ggtgggattc 1320

actgacagta ggaagattag tcactcatgt acgcacccat ttcaccacga ccctcctgtg 1380

ataggtcggg aaaaattcca ttcccgaccg cagcacggta aagagctacc ttgcagcacg 1440

tacgtgcaga gcaccgccgc aactaccgag gagatagagg tacacatgcc cccagacacc 1500

cctgatcgca cattaatgtc acaacagtcc ggcaacgtaa agatcacagt caatggccag 1560

acggtgcggt acaagtgtaa ttgcggtggc tcaaatgaag gactaacaac tacagacaaa 1620

gtgattaata actgcaaggt tgatcaatgt catgccgcgg tcaccaatca caaaaagtgg 1680

cagtataact cccctctggt cccgcgtaat gctgaacttg gggaccgaaa aggaaaaatt 1740

cacatcccgt ttccgctggc aaatgtaaca tgcagggtgc ctaaagcaag gaaccccacc 1800

gtgacgtacg ggaaaaacca agtcatcatg ctactgtatc ctgaccaccc aacactcctg 1860

tcctaccgga atatgggaga agaaccaaac tatcaagaag agtgggtgat gcataagaag 1920

gaagtcgtgc taaccgtgcc gactgaaggg ctcgaggtca cgtggggcaa caacgagccg 1980

tataagtatt ggccgcagtt atctacaaac ggtacagccc atggccaccc gcatgagata 2040

attctgtatt attatgagct gtaccccact atgactgtag tagttgtgtc agtggccacg 2100

ttcatactcc tgtcgatggt gggtatggca gcggggatgt gcatgtgtgc acgacgcaga 2160

tgcatcacac cgtatgaact gacaccagga gctaccgtcc ctttcctgct tagcctaata 2220

tgctgcatca gaacagctaa agcggccaca taccaagagg ctgcgatata cctgtggaac 2280

gagcagcaac ctttgttttg gctacaagcc cttattccgc tggcagccct gattgttcta 2340

tgcaactgtc tgagactctt accatgctgc tgtaaaacgt tggctttttt agccgtaatg 2400

agcgtcggtg cccacactgt gagcgcgtac gaacacgtaa cagtgatccc gaacacggtg 2460

ggagtaccgt ataagactct agtcaataga cctggctaca gccccatggt attggagatg 2520

gaactactgt cagtcacttt ggagccaaca ctatcgcttg attacatcac gtgcgagtac 2580

aaaaccgtca tcccgtctcc gtacgtgaag tgctgcggta cagcagagtg caaggacaaa 2640

aacctacctg actacagctg tagggtcttc accggcgtct acccatttat gtggggtggc 2700

gcctactgct tctgcgacgc tgaaaacacg cagttgagcg aagcacatgt ggagaagtcc 2760

gaatcatgca aaacagaatt tgcatcagca tacagggctc ataccgcatc tgcatcagct 2820

aagctccgcg tcctttacca aggaaataac atcactgtaa ctgcctatgc aaacggcgac 2880

catgccgtca cagttaagga cgccaaattc attgtggggc caatgtcttc agcctggaca 2940

cctttcgaca acaaaattgt ggtgtacaaa ggtgacgtct ataacatgga ctacccgccc 3000

tttggcgcag gaagaccagg acaatttggc gatatccaaa gtcgcacacc tgagagtaaa 3060

gacgtctatg ctaatacaca actggtactg cagagaccgg ctgcgggtac ggtacacgtg 3120

ccatactctc aggcaccatc tggctttaag tattggctaa aagaacgcgg ggcgtcactg 3180

cagcacacag caccatttgg ctgccaaata gcaacaaacc cggtaagagc ggtgaactgc 3240

gccgtaggga acatgcccat ctccatcgac ataccggaag cggccttcac tagggtcgtc 3300

gacgcgccct ctttaacgga catgtcgtgc gaggtaccag cctgcaccca ttcctcagac 3360

tttgggggcg tcgccattat taaatatgca gccagcaaga aaggcaagtg tgcggtgcat 3420

tcgatgacta acgccgtcac tattcgggaa gctgagatag aagttgaagg gaattctcag 3480

ctgcaaatct ctttctcgac ggccttagcc agcgccgaat tccgcgtaca agtctgttct 3540

acacaagtac actgtgcagc tgagtgccac cccccgaagg accacatagt caactacccg 3600

gcgtcacata ccaccctcgg ggtccaggac atctccgcta cggcgatgtc atgggtgcag 3660

aagatcacgg gaggtgtggg actggttgtt gctgttgccg cactgattct aatcgtggtg 3720

ctatgcgtgt cgttcagcag gcactaa 3747

<210> 8
<211> 1248
<212> PRT
<213> Chikungunya virus

<400> 8

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
1 5 10 15

Arg Pro Trp Thr Pro Arg Ser Thr Ile Gln Ile Ile Arg Pro Arg Pro
20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
50 55 60

Arg Lys Asn Lys Lys Gln Lys Gln Lys Gln Gln Ala Pro Gln Asn Asn
65 70 75 80

Thr Asn Gln Lys Lys Gln Pro Pro Lys Lys Lys Pro Ala Gln Lys Lys
85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Thr Gly Tyr Ala Cys
115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile
130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu
225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Ile Pro Val Met Cys Leu Leu Ala
260 265 270

```
Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr
        275                 280                 285

Glu Lys Glu Pro Glu Glu Thr Leu Arg Met Leu Glu Asp Asn Val Met
    290                 295                 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Gln Ala Ser Leu Thr Cys Ser Pro
305                 310                 315                 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala
                325                 330                 335

Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser
            340                 345                 350

Cys His Ser Pro Val Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp
        355                 360                 365

Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Arg Ile Lys Thr Asp
    370                 375                 380

Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Asn His Met Pro
385                 390                 395                 400

Ala Asp Ala Glu Arg Ala Gly Leu Phe Val Arg Thr Ser Ala Pro Cys
                405                 410                 415

Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys
            420                 425                 430

Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His
        435                 440                 445

Ser Cys Thr His Pro Phe His His Asp Pro Pro Val Ile Gly Arg Glu
    450                 455                 460

Lys Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr
465                 470                 475                 480

Tyr Val Gln Ser Thr Ala Ala Thr Thr Glu Glu Ile Glu Val His Met
                485                 490                 495

Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Ser Gln Gln Ser Gly Asn
            500                 505                 510

Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys
        515                 520                 525

Gly Gly Ser Asn Glu Gly Leu Thr Thr Thr Asp Lys Val Ile Asn Asn
    530                 535                 540
```

```
Cys Lys Val Asp Gln Cys His Ala Ala Val Thr Asn His Lys Lys Trp
545                 550                 555                 560

Gln Tyr Asn Ser Pro Leu Val Pro Arg Asn Ala Glu Leu Gly Asp Arg
                565                 570                 575

Lys Gly Lys Ile His Ile Pro Phe Pro Leu Ala Asn Ala Thr Cys Arg
            580                 585                 590

Val Pro Lys Ala Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn Gln Val
        595                 600                 605

Ile Met Leu Leu Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr Arg Asn
    610                 615                 620

Met Gly Glu Glu Pro Asn Tyr Gln Glu Glu Trp Val Met His Lys Lys
625                 630                 635                 640

Glu Val Val Leu Thr Val Pro Thr Glu Gly Leu Glu Val Thr Trp Gly
                645                 650                 655

Asn Asn Glu Pro Tyr Lys Tyr Trp Pro Gln Leu Ser Thr Asn Gly Thr
            660                 665                 670

Ala His Gly His Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr
        675                 680                 685

Pro Thr Met Thr Val Val Val Val Ser Val Ala Thr Phe Ile Leu Leu
    690                 695                 700

Ser Met Val Gly Met Ala Ala Gly Met Cys Met Cys Ala Arg Arg Arg
705                 710                 715                 720

Cys Ile Thr Pro Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro Phe Leu
                725                 730                 735

Leu Ser Leu Ile Cys Cys Ile Arg Thr Ala Lys Ala Ala Thr Tyr Gln
            740                 745                 750

Glu Ala Ala Ile Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu
        755                 760                 765

Gln Ala Leu Ile Pro Leu Ala Ala Leu Ile Val Leu Cys Asn Cys Leu
    770                 775                 780

Arg Leu Leu Pro Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala Val Met
785                 790                 795                 800

Ser Val Gly Ala His Thr Val Ser Ala Tyr Glu His Val Thr Val Ile
                805                 810                 815
```

```
Pro Asn Thr Val Gly Val Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly
            820                 825                 830

Tyr Ser Pro Met Val Leu Glu Met Glu Leu Leu Ser Val Thr Leu Glu
        835                 840                 845

Pro Thr Leu Ser Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile
    850                 855                 860

Pro Ser Pro Tyr Val Lys Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys
865                 870                 875                 880

Asn Leu Pro Asp Tyr Ser Cys Lys Val Phe Thr Gly Val Tyr Pro Phe
                885                 890                 895

Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr Gln Leu
            900                 905                 910

Ser Glu Ala His Val Glu Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala
        915                 920                 925

Ser Ala Tyr Arg Ala His Thr Ala Ser Ala Ser Ala Lys Leu Arg Val
    930                 935                 940

Leu Tyr Gln Gly Asn Asn Ile Thr Val Thr Ala Tyr Ala Asn Gly Asp
945                 950                 955                 960

His Ala Val Thr Val Lys Asp Ala Lys Phe Ile Val Gly Pro Met Ser
                965                 970                 975

Ser Ala Trp Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys Gly Asp
            980                 985                 990

Val Tyr Asn Met Asp Tyr Pro Pro  Phe Gly Ala Gly Arg  Pro Gly Gln
        995                 1000                1005

Phe Gly  Asp Ile Gln Ser Arg  Thr Pro Glu Ser Glu  Asp Val Tyr
    1010                1015                1020

Ala Asn  Thr Gln Leu Val Leu  Gln Arg Pro Ala Ala  Gly Thr Val
    1025                1030                1035

His Val  Pro Tyr Ser Gln Ala  Pro Ser Gly Phe Lys  Tyr Trp Leu
    1040                1045                1050

Lys Glu  Arg Gly Ala Ser Leu  Gln His Thr Ala Pro  Phe Gly Cys
    1055                1060                1065

Gln Ile  Ala Thr Asn Pro Val  Arg Ala Val Asn Cys  Ala Val Gly
    1070                1075                1080
```

```
Asn Met  Pro Ile Ser Ile Asp  Ile Pro Glu Ala Ala  Phe Thr Arg
    1085                 1090                 1095

Val Val  Asp Ala Pro Ser Leu  Thr Asp Met Ser Cys  Glu Val Pro
    1100                 1105                 1110

Ala Cys  Thr His Ser Ser Asp  Phe Gly Gly Val Ala  Ile Ile Lys
    1115                 1120                 1125

Tyr Ala  Ala Ser Lys Lys Gly  Lys Cys Ala Val His  Ser Met Thr
    1130                 1135                 1140

Asn Ala  Val Thr Ile Arg Glu  Ala Glu Ile Glu Val  Glu Gly Asn
    1145                 1150                 1155

Ser Gln  Leu Gln Ile Ser Phe  Ser Thr Ala Leu Ala  Ser Ala Glu
    1160                 1165                 1170

Phe Arg  Val Gln Val Cys Ser  Thr Gln Val His Cys  Ala Ala Glu
    1175                 1180                 1185

Cys His  Pro Pro Lys Asp His  Ile Val Asn Tyr Pro  Ala Ser His
    1190                 1195                 1200

Thr Thr  Leu Gly Val Gln Asp  Ile Ser Ala Thr Ala  Met Ser Trp
    1205                 1210                 1215

Val Gln  Lys Ile Thr Gly Gly  Val Gly Leu Val Val  Ala Val Ala
    1220                 1225                 1230

Ala Leu  Ile Leu Ile Val Val  Leu Cys Val Ser Phe  Ser Arg His
    1235                 1240                 1245
```

<210> 9
<211> 1248
<212> PRT
<213> Chikungunya virus

<400> 9

```
Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
1               5                  10                  15

Arg Pro Trp Thr Pro Arg Ser Thr Ile Gln Ile Ile Arg Pro Arg Pro
            20                  25                  30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
        35                  40                  45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
    50                  55                  60
```

Arg Lys Asn Lys Lys Gln Lys Gln Lys Gln Gln Ala Pro Gln Asn Asn
65 70 75 80

Thr Asn Gln Lys Lys Gln Pro Pro Lys Lys Lys Pro Ala Gln Lys Lys
85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Thr Gly Tyr Ala Cys
115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile
130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu
225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Ile Pro Val Met Cys Leu Leu Ala
260 265 270

Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr
275 280 285

Glu Lys Glu Pro Glu Glu Thr Leu Arg Met Leu Glu Asn Asn Val Met
290 295 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Gln Ala Ser Leu Thr Cys Ser Pro
305 310 315 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala
325 330 335

```
Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser
            340                 345                 350

Cys His Ser Pro Val Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp
        355                 360                 365

Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp
    370                 375                 380

Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Asn His Met Pro
385                 390                 395                 400

Ala Asp Ala Glu Arg Ala Gly Leu Phe Val Arg Thr Ser Ala Pro Cys
                405                 410                 415

Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys
            420                 425                 430

Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His
        435                 440                 445

Ser Cys Thr His Pro Phe His His Asp Pro Pro Val Ile Gly Arg Glu
    450                 455                 460

Lys Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr
465                 470                 475                 480

Tyr Val Gln Ser Thr Ala Ala Thr Thr Glu Glu Ile Glu Val His Met
                485                 490                 495

Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Ser Gln Gln Ser Gly Asn
            500                 505                 510

Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys
        515                 520                 525

Gly Gly Ser Asn Glu Gly Leu Thr Thr Thr Asp Lys Val Ile Asn Asn
    530                 535                 540

Cys Lys Val Asp Gln Cys His Ala Ala Val Thr Asn His Lys Lys Trp
545                 550                 555                 560

Gln Tyr Asn Ser Pro Leu Val Pro Arg Asn Ala Glu Leu Gly Asp Arg
                565                 570                 575

Lys Gly Lys Ile His Ile Pro Phe Pro Leu Ala Asn Ala Thr Cys Arg
            580                 585                 590

Val Pro Lys Ala Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn Gln Val
        595                 600                 605
```

Ile Met Leu Leu Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr Arg Asn
610 615 620

Met Gly Glu Glu Pro Asn Tyr Gln Glu Glu Trp Val Met His Lys Lys
625 630 635 640

Glu Val Val Leu Thr Val Pro Thr Glu Gly Leu Glu Val Thr Trp Gly
645 650 655

Asn Asn Glu Pro Tyr Lys Tyr Trp Pro Gln Leu Ser Thr Asn Gly Thr
660 665 670

Ala His Gly His Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr
675 680 685

Pro Thr Met Thr Val Val Val Val Ser Val Ala Thr Phe Ile Leu Leu
690 695 700

Ser Met Val Gly Met Ala Ala Gly Met Cys Met Cys Ala Arg Arg Arg
705 710 715 720

Cys Ile Thr Pro Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro Phe Leu
725 730 735

Leu Ser Leu Ile Cys Cys Ile Arg Thr Ala Lys Ala Ala Thr Tyr Gln
740 745 750

Glu Ala Ala Ile Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu
755 760 765

Gln Ala Leu Ile Pro Leu Ala Ala Leu Ile Val Leu Cys Asn Cys Leu
770 775 780

Arg Leu Leu Pro Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala Val Met
785 790 795 800

Ser Val Gly Ala His Thr Val Ser Ala Tyr Glu His Val Thr Val Ile
805 810 815

Pro Asn Thr Val Gly Val Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly
820 825 830

Tyr Ser Pro Met Val Leu Glu Met Glu Leu Leu Ser Val Thr Leu Glu
835 840 845

Pro Thr Leu Ser Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile
850 855 860

Pro Ser Pro Tyr Val Lys Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys
865 870 875 880

Asn Leu Pro Asp Tyr Ser Cys Lys Val Phe Thr Gly Val Tyr Pro Phe
885 890 895

Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr Gln Leu
900 905 910

Ser Glu Ala His Val Glu Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala
915 920 925

Ser Ala Tyr Arg Ala His Thr Ala Ser Ala Ser Ala Lys Leu Arg Val
930 935 940

Leu Tyr Gln Gly Asn Asn Ile Thr Val Thr Ala Tyr Ala Asn Gly Asp
945 950 955 960

His Ala Val Thr Val Lys Asp Ala Lys Phe Ile Val Gly Pro Met Ser
965 970 975

Ser Ala Trp Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys Gly Asp
980 985 990

Val Tyr Asn Met Asp Tyr Pro Pro Phe Gly Ala Arg Arg Pro Gly Gln
995 1000 1005

Phe Gly Asp Ile Gln Ser Arg Thr Pro Glu Ser Glu Asp Val Tyr
1010 1015 1020

Ala Asn Thr Gln Leu Val Leu Gln Arg Pro Ala Ala Gly Thr Val
1025 1030 1035

His Val Pro Tyr Ser Gln Ala Pro Ser Gly Phe Lys Tyr Trp Leu
1040 1045 1050

Lys Glu Arg Gly Ala Ser Leu Gln His Thr Ala Pro Phe Gly Cys
1055 1060 1065

Gln Ile Ala Thr Asn Pro Val Arg Ala Val Asn Cys Ala Val Gly
1070 1075 1080

Asn Met Pro Ile Ser Ile Asp Ile Pro Glu Ala Ala Phe Thr Arg
1085 1090 1095

Val Val Asp Ala Pro Ser Leu Thr Asp Met Ser Cys Glu Val Pro
1100 1105 1110

Ala Cys Thr His Ser Ser Asp Phe Gly Gly Val Ala Ile Ile Lys
1115 1120 1125

Tyr Ala Ala Ser Lys Lys Gly Lys Cys Ala Val His Ser Met Thr
1130 1135 1140

Asn Ala Val Thr Ile Arg Glu Ala Glu Ile Glu Val Glu Gly Asn
1145 1150 1155

Ser Gln Leu Gln Ile Ser Phe Ser Thr Ala Leu Ala Ser Ala Glu
1160 1165 1170

Phe Arg Val Gln Val Cys Ser Thr Gln Val His Cys Ala Ala Glu
1175 1180 1185

Cys His Pro Pro Lys Asp His Ile Val Asn Tyr Pro Ala Ser His
1190 1195 1200

Thr Thr Leu Gly Val Gln Asp Ile Ser Ala Thr Ala Met Ser Trp
1205 1210 1215

Val Gln Lys Ile Thr Gly Gly Val Gly Leu Val Val Ala Val Ala
1220 1225 1230

Ala Leu Ile Leu Ile Val Val Leu Cys Val Ser Phe Ser Arg His
1235 1240 1245

<210> 10
<211> 1248
<212> PRT
<213> Chikungunya virus

<400> 10

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
1 5 10 15

Arg Pro Trp Thr Pro Arg Ser Thr Ile Gln Ile Ile Arg Pro Arg Pro
20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
50 55 60

Arg Lys Asn Lys Lys Gln Lys Gln Lys Gln Gln Ala Pro Gln Asn Asn
65 70 75 80

Thr Asn Gln Lys Lys Gln Pro Pro Lys Lys Lys Pro Ala Gln Lys Lys
85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Thr Gly Tyr Ala Cys
115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile

130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu
225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Ile Pro Val Met Cys Leu Leu Ala
260 265 270

Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr
275 280 285

Glu Lys Glu Pro Glu Glu Thr Leu Arg Met Leu Glu Asp Asn Val Met
290 295 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Gln Ala Ser Leu Thr Cys Ser Pro
305 310 315 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala
325 330 335

Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser
340 345 350

Cys His Ser Pro Val Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp
355 360 365

Gly Thr Leu Asn Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp
370 375 380

Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Asn His Met Pro
385 390 395 400

Ala Asp Ala Glu Arg Ala Gly Leu Phe Val Arg Thr Ser Ala Pro Cys

405 410 415

Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys
420 425 430

Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His
435 440 445

Ser Cys Thr His Pro Phe His His Asp Pro Pro Val Ile Gly Arg Glu
450 455 460

Lys Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr
465 470 475 480

Tyr Val Gln Ser Thr Ala Ala Thr Thr Glu Glu Ile Glu Val His Met
485 490 495

Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Ser Gln Gln Ser Gly Asn
500 505 510

Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys
515 520 525

Gly Gly Ser Asn Glu Gly Leu Thr Thr Thr Asp Lys Val Ile Asn Asn
530 535 540

Cys Lys Val Asp Gln Cys His Ala Ala Val Thr Asn His Lys Lys Trp
545 550 555 560

Gln Tyr Asn Ser Pro Leu Val Pro Arg Asn Ala Glu Leu Gly Asp Arg
565 570 575

Lys Gly Lys Ile His Ile Pro Phe Pro Leu Ala Asn Ala Thr Cys Arg
580 585 590

Val Pro Lys Ala Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn Gln Val
595 600 605

Ile Met Leu Leu Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr Arg Asn
610 615 620

Met Gly Glu Glu Pro Asn Tyr Gln Glu Glu Trp Val Met His Lys Lys
625 630 635 640

Glu Val Val Leu Thr Val Pro Thr Glu Gly Leu Glu Val Thr Trp Gly
645 650 655

Asn Asn Glu Pro Tyr Lys Tyr Trp Pro Gln Leu Ser Thr Asn Gly Thr
660 665 670

Ala His Gly His Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr

675 680 685

Pro Thr Met Thr Val Val Val Val Ser Val Ala Thr Phe Ile Leu Leu
690 695 700

Ser Met Val Gly Met Ala Ala Gly Met Cys Met Cys Ala Arg Arg Arg
705 710 715 720

Cys Ile Thr Pro Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro Phe Leu
725 730 735

Leu Ser Leu Ile Cys Cys Ile Arg Thr Ala Lys Ala Ala Thr Tyr Gln
740 745 750

Glu Ala Ala Ile Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu
755 760 765

Gln Ala Leu Ile Pro Leu Ala Ala Leu Ile Val Leu Cys Asn Cys Leu
770 775 780

Arg Leu Leu Pro Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala Val Met
785 790 795 800

Ser Val Gly Ala His Thr Val Ser Ala Tyr Glu His Val Thr Val Ile
805 810 815

Pro Asn Thr Val Gly Val Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly
820 825 830

Tyr Ser Pro Met Val Leu Glu Met Glu Leu Leu Ser Val Thr Leu Glu
835 840 845

Pro Thr Leu Ser Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile
850 855 860

Pro Ser Pro Tyr Val Lys Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys
865 870 875 880

Asn Leu Pro Asp Tyr Ser Cys Lys Val Phe Thr Gly Val Tyr Pro Phe
885 890 895

Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr Gln Leu
900 905 910

Ser Glu Ala His Val Glu Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala
915 920 925

Ser Ala Tyr Arg Ala His Thr Ala Ser Ala Ser Ala Lys Leu Arg Val
930 935 940

Leu Tyr Gln Gly Asn Asn Ile Thr Val Thr Ala Tyr Ala Asn Gly Asp

945 950 955 960

His Ala Val Thr Val Lys Asp Ala Lys Phe Ile Val Gly Pro Met Ser
965 970 975

Ser Ala Trp Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys Gly Asp
980 985 990

Val Tyr Asn Met Asp Tyr Pro Pro Phe Gly Ala Gly Arg Pro Gly Gln
995 1000 1005

Phe Gly Asp Ile Gln Ser Arg Thr Pro Glu Ser Glu Asp Val Tyr
1010 1015 1020

Ala Asn Thr Gln Leu Val Leu Gln Arg Pro Ala Ala Gly Thr Val
1025 1030 1035

His Val Pro Tyr Ser Gln Ala Pro Ser Gly Phe Lys Tyr Trp Leu
1040 1045 1050

Lys Glu Arg Gly Ala Ser Leu Gln His Thr Ala Pro Phe Gly Cys
1055 1060 1065

Gln Ile Ala Thr Asn Pro Val Arg Ala Val Asn Cys Ala Val Gly
1070 1075 1080

Asn Met Pro Ile Ser Ile Asp Ile Pro Glu Ala Ala Phe Thr Arg
1085 1090 1095

Val Val Asp Ala Pro Ser Leu Thr Asp Met Ser Cys Glu Val Pro
1100 1105 1110

Ala Cys Thr His Ser Ser Asp Phe Gly Gly Val Ala Ile Ile Lys
1115 1120 1125

Tyr Ala Ala Ser Lys Lys Gly Lys Cys Ala Val His Ser Met Thr
1130 1135 1140

Asn Ala Val Thr Ile Arg Glu Ala Glu Ile Glu Val Glu Gly Asn
1145 1150 1155

Ser Gln Leu Gln Ile Ser Phe Ser Thr Ala Leu Ala Ser Ala Glu
1160 1165 1170

Phe Arg Val Gln Val Cys Ser Thr Gln Val His Cys Ala Ala Glu
1175 1180 1185

Cys His Pro Pro Lys Asp His Ile Val Asn Tyr Pro Ala Ser His
1190 1195 1200

Thr Thr Leu Gly Val Gln Asp Ile Ser Ala Thr Ala Met Ser Trp

1205 1210 1215

Val Gln Lys Ile Thr Gly Gly Val Gly Leu Val Val Ala Val Ala
1220 1225 1230

Ala Leu Ile Leu Ile Val Val Leu Cys Val Ser Phe Ser Arg His
1235 1240 1245

<210> 11
<211> 1248
<212> PRT
<213> Chikungunya virus

<400> 11

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
1 5 10 15

Arg Pro Trp Thr Pro Arg Ser Thr Ile Gln Ile Ile Arg Pro Arg Pro
20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
50 55 60

Arg Lys Asn Lys Lys Gln Lys Gln Lys Gln Gln Ala Pro Gln Asn Asn
65 70 75 80

Thr Asn Gln Lys Lys Gln Pro Pro Lys Lys Lys Pro Ala Gln Lys Lys
85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Thr Gly Tyr Ala Cys
115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile
130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
210 215 220

Val Ala Ile Val Leu Gly Gly Val Asn Glu Gly Ala Arg Thr Ala Leu
225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Ile Pro Val Met Cys Leu Leu Ala
260 265 270

Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr
275 280 285

Glu Lys Glu Pro Glu Glu Thr Leu Arg Met Leu Glu Asp Asn Val Met
290 295 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Gln Ala Ser Leu Thr Cys Ser Pro
305 310 315 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala
325 330 335

Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser
340 345 350

Cys His Ser Pro Val Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp
355 360 365

Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp
370 375 380

Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Asn His Met Pro
385 390 395 400

Ala Asp Ala Glu Arg Ala Gly Leu Phe Val Arg Thr Ser Ala Pro Cys
405 410 415

Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys
420 425 430

Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His
435 440 445

Ser Cys Thr His Pro Phe His His Asp Pro Pro Val Ile Gly Arg Glu
450 455 460

Lys Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr
465 470 475 480

Tyr Val Gln Ser Thr Ala Ala Thr Thr Glu Glu Ile Glu Val His Met
485 490 495

Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Ser Gln Gln Ser Gly Asn
500 505 510

Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys
515 520 525

Gly Gly Ser Asn Glu Gly Leu Thr Thr Thr Asp Lys Val Ile Asn Asn
530 535 540

Cys Lys Val Asp Gln Cys His Ala Ala Val Thr Asn His Lys Lys Trp
545 550 555 560

Gln Tyr Asn Ser Pro Leu Val Pro Arg Asn Ala Glu Leu Gly Asp Arg
565 570 575

Lys Gly Lys Ile His Ile Pro Phe Pro Leu Ala Asn Ala Thr Cys Arg
580 585 590

Val Pro Lys Ala Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn Gln Val
595 600 605

Ile Met Leu Leu Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr Arg Asn
610 615 620

Met Gly Glu Glu Pro Asn Tyr Gln Glu Glu Trp Val Met His Lys Lys
625 630 635 640

Glu Val Val Leu Thr Val Pro Thr Glu Gly Leu Glu Val Thr Trp Gly
645 650 655

Asn Asn Glu Pro Tyr Lys Tyr Trp Pro Gln Leu Ser Thr Asn Gly Thr
660 665 670

Ala His Gly His Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr
675 680 685

Pro Thr Met Thr Val Val Val Val Ser Val Ala Thr Phe Ile Leu Leu
690 695 700

Ser Met Val Gly Met Ala Ala Gly Met Cys Met Cys Ala Arg Arg Arg
705 710 715 720

Cys Ile Thr Pro Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro Phe Leu
725 730 735

Leu Ser Leu Ile Cys Cys Ile Arg Thr Ala Lys Ala Ala Thr Tyr Gln
740 745 750

Glu Ala Ala Ile Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu
755 760 765

Gln Ala Leu Ile Pro Leu Ala Ala Leu Ile Val Leu Cys Asn Cys Leu
770 775 780

Arg Leu Leu Pro Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala Val Met
785 790 795 800

Ser Val Gly Ala His Thr Val Ser Ala Tyr Glu His Val Thr Val Ile
805 810 815

Pro Asn Thr Val Gly Val Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly
820 825 830

Tyr Ser Pro Met Val Leu Glu Met Glu Leu Leu Ser Val Thr Leu Glu
835 840 845

Pro Thr Leu Ser Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile
850 855 860

Pro Ser Pro Tyr Val Lys Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys
865 870 875 880

Asn Leu Pro Asp Tyr Ser Cys Lys Val Phe Thr Gly Val Tyr Pro Phe
885 890 895

Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr Gln Leu
900 905 910

Ser Glu Ala His Val Glu Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala
915 920 925

Ser Ala Tyr Arg Ala His Thr Ala Ser Ala Ser Ala Lys Leu Arg Val
930 935 940

Leu Tyr Gln Gly Asn Asn Ile Thr Val Thr Ala Tyr Ala Asn Gly Asp
945 950 955 960

His Ala Val Thr Val Lys Asp Ala Lys Phe Ile Val Gly Pro Met Ser
965 970 975

Ser Ala Trp Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys Gly Asp
980 985 990

Val Tyr Asn Met Asp Tyr Pro Pro Phe Gly Ala Arg Arg Pro Gly Gln
995 1000 1005

Phe Gly Asp Ile Gln Ser Arg Thr Pro Glu Ser Glu Asp Val Tyr
1010 1015 1020

Ala Asn Thr Gln Leu Val Leu Gln Arg Pro Ala Ala Gly Thr Val
1025 1030 1035

His Val Pro Tyr Ser Gln Ala Pro Ser Gly Phe Lys Tyr Trp Leu
1040 1045 1050

Lys Glu Arg Gly Ala Ser Leu Gln His Thr Ala Pro Phe Gly Cys
1055 1060 1065

Gln Ile Ala Thr Asn Pro Val Arg Ala Val Asn Cys Ala Val Gly
1070 1075 1080

Asn Met Pro Ile Ser Ile Asp Ile Pro Glu Ala Ala Phe Thr Arg
1085 1090 1095

Val Val Asp Ala Pro Ser Leu Thr Asp Met Ser Cys Glu Val Pro
1100 1105 1110

Ala Cys Thr His Ser Ser Asp Phe Gly Gly Val Ala Ile Ile Lys
1115 1120 1125

Tyr Ala Ala Ser Lys Lys Gly Lys Cys Ala Val His Ser Met Thr
1130 1135 1140

Asn Ala Val Thr Ile Arg Glu Ala Glu Ile Glu Val Glu Gly Asn
1145 1150 1155

Ser Gln Leu Gln Ile Ser Phe Ser Thr Ala Leu Ala Ser Ala Glu
1160 1165 1170

Phe Arg Val Gln Val Cys Ser Thr Gln Val His Cys Ala Ala Glu
1175 1180 1185

Cys His Pro Pro Lys Asp His Ile Val Asn Tyr Pro Ala Ser His
1190 1195 1200

Thr Thr Leu Gly Val Gln Asp Ile Ser Ala Thr Ala Met Ser Trp
1205 1210 1215

Val Gln Lys Ile Thr Gly Gly Val Gly Leu Val Val Ala Val Ala
1220 1225 1230

Ala Leu Ile Leu Ile Val Val Leu Cys Val Ser Phe Ser Arg His
1235 1240 1245

<210> 12
<211> 1248
<212> PRT
<213> Chikungunya virus

<400> 12

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
1 5 10 15

Arg Pro Trp Thr Pro Arg Ser Thr Ile Gln Ile Ile Arg Pro Arg Pro
20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
50 55 60

Arg Lys Asn Lys Lys Gln Lys Gln Lys Gln Gln Ala Pro Gln Asn Asn
65 70 75 80

Thr Asn Gln Lys Lys Gln Pro Pro Lys Lys Lys Pro Ala Gln Lys Lys
85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Thr Gly Tyr Ala Cys
115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile
130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu
225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Ile Pro Val Met Cys Leu Leu Ala
260 265 270

```
Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr
        275                 280                 285

Glu Lys Glu Pro Glu Glu Thr Leu Arg Met Leu Glu Asp Asn Val Met
    290                 295                 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Gln Ala Ser Leu Thr Cys Ser Pro
305                 310                 315                 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala
                325                 330                 335

Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser
            340                 345                 350

Cys His Ser Pro Val Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp
        355                 360                 365

Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp
    370                 375                 380

Asp Ser His Asp Trp Thr Glu Leu Arg Tyr Met Asp Asn His Met Pro
385                 390                 395                 400

Ala Asp Ala Glu Arg Ala Gly Leu Phe Val Arg Thr Ser Ala Pro Cys
                405                 410                 415

Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys
            420                 425                 430

Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His
        435                 440                 445

Ser Cys Thr His Pro Phe His His Asp Pro Pro Val Ile Gly Arg Glu
    450                 455                 460

Lys Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr
465                 470                 475                 480

Tyr Val Gln Ser Thr Ala Ala Thr Thr Glu Glu Ile Glu Val His Met
                485                 490                 495

Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Ser Gln Gln Ser Gly Asn
            500                 505                 510

Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys
        515                 520                 525

Gly Gly Ser Asn Glu Gly Leu Thr Thr Thr Asp Lys Val Ile Asn Asn
    530                 535                 540
```

Cys Lys Val Asp Gln Cys His Ala Ala Val Thr Asn His Lys Lys Trp
545 550 555 560

Gln Tyr Asn Ser Pro Leu Val Pro Arg Asn Ala Glu Leu Gly Asp Arg
565 570 575

Lys Gly Lys Ile His Ile Pro Phe Pro Leu Ala Asn Ala Thr Cys Arg
580 585 590

Val Pro Lys Ala Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn Gln Val
595 600 605

Ile Met Leu Leu Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr Arg Asn
610 615 620

Met Gly Glu Glu Pro Asn Tyr Gln Glu Glu Trp Val Met His Lys Lys
625 630 635 640

Glu Val Val Leu Thr Val Pro Thr Glu Gly Leu Glu Val Thr Trp Gly
645 650 655

Asn Asn Glu Pro Tyr Lys Tyr Trp Pro Gln Leu Ser Thr Asn Gly Thr
660 665 670

Ala His Gly His Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr
675 680 685

Pro Thr Met Thr Val Val Val Val Ser Val Ala Thr Phe Ile Leu Leu
690 695 700

Ser Met Val Gly Met Ala Ala Gly Met Cys Met Cys Ala Arg Arg Arg
705 710 715 720

Cys Ile Thr Pro Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro Phe Leu
725 730 735

Leu Ser Leu Ile Cys Cys Ile Arg Thr Ala Lys Ala Ala Thr Tyr Gln
740 745 750

Glu Ala Ala Ile Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu
755 760 765

Gln Ala Leu Ile Pro Leu Ala Ala Leu Ile Val Leu Cys Asn Cys Leu
770 775 780

Arg Leu Leu Pro Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala Val Met
785 790 795 800

Ser Val Gly Ala His Thr Val Ser Ala Tyr Glu His Val Thr Val Ile
805 810 815

Pro Asn Thr Val Gly Val Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly
820 825 830

Tyr Ser Pro Met Val Leu Glu Met Glu Leu Leu Ser Val Thr Leu Glu
835 840 845

Pro Thr Leu Ser Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile
850 855 860

Pro Ser Pro Tyr Val Lys Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys
865 870 875 880

Asn Leu Pro Asp Tyr Ser Cys Lys Val Phe Thr Gly Val Tyr Pro Phe
885 890 895

Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr Gln Leu
900 905 910

Ser Glu Ala His Val Glu Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala
915 920 925

Ser Ala Tyr Arg Ala His Thr Ala Ser Ala Ser Ala Lys Leu Arg Val
930 935 940

Leu Tyr Gln Gly Asn Asn Ile Thr Val Thr Ala Tyr Ala Asn Gly Asp
945 950 955 960

His Ala Val Thr Val Lys Asp Ala Lys Phe Ile Val Gly Pro Met Ser
965 970 975

Ser Ala Trp Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys Gly Asp
980 985 990

Val Tyr Asn Met Asp Tyr Pro Pro Phe Gly Ala Gly Arg Pro Gly Gln
995 1000 1005

Phe Gly Asp Ile Gln Ser Arg Thr Pro Glu Ser Glu Asp Val Tyr
1010 1015 1020

Ala Asn Thr Gln Leu Val Leu Gln Arg Pro Ala Ala Gly Thr Val
1025 1030 1035

His Val Pro Tyr Ser Gln Ala Pro Ser Gly Phe Lys Tyr Trp Leu
1040 1045 1050

Lys Glu Arg Gly Ala Ser Leu Gln His Thr Ala Pro Phe Gly Cys
1055 1060 1065

Gln Ile Ala Thr Asn Pro Val Arg Ala Val Asn Cys Ala Val Gly
1070 1075 1080

Asn Met Pro Ile Ser Ile Asp Ile Pro Glu Ala Ala Phe Thr Arg
1085 1090 1095

Val Val Asp Ala Pro Ser Leu Thr Asp Met Ser Cys Glu Val Pro
1100 1105 1110

Ala Cys Thr His Ser Ser Asp Phe Gly Gly Val Ala Ile Ile Lys
1115 1120 1125

Tyr Ala Ala Ser Lys Lys Gly Lys Cys Ala Val His Ser Met Thr
1130 1135 1140

Asn Ala Val Thr Ile Arg Glu Ala Glu Ile Glu Val Glu Gly Asn
1145 1150 1155

Ser Gln Leu Gln Ile Ser Phe Ser Thr Ala Leu Ala Ser Ala Glu
1160 1165 1170

Phe Arg Val Gln Val Cys Ser Thr Gln Val His Cys Ala Ala Glu
1175 1180 1185

Cys His Pro Pro Lys Asp His Ile Val Asn Tyr Pro Ala Ser His
1190 1195 1200

Thr Thr Leu Gly Val Gln Asp Ile Ser Ala Thr Ala Met Ser Trp
1205 1210 1215

Val Gln Lys Ile Thr Gly Gly Val Gly Leu Val Val Ala Val Ala
1220 1225 1230

Ala Leu Ile Leu Ile Val Val Leu Cys Val Ser Phe Ser Arg His
1235 1240 1245

<210> 13
<211> 1248
<212> PRT
<213> Chikungunya virus

<400> 13

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
1 5 10 15

Arg Pro Trp Thr Pro Arg Ser Thr Ile Gln Ile Ile Arg Pro Arg Pro
20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
50 55 60

Arg Lys Asn Lys Lys Gln Lys Gln Lys Gln Gln Ala Pro Gln Asn Asn
65 70 75 80

Thr Asn Gln Lys Lys Gln Pro Pro Lys Lys Lys Pro Ala Gln Lys Lys
85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Thr Gly Tyr Ala Cys
115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile
130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu
225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Ile Pro Val Met Cys Leu Leu Ala
260 265 270

Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr
275 280 285

Glu Lys Glu Pro Glu Glu Thr Leu Arg Met Leu Glu Asp Asn Val Met
290 295 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Gln Ala Ser Leu Thr Cys Ser Pro
305 310 315 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala
325 330 335

```
Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser
            340                 345                 350

Cys His Ser Pro Val Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp
        355                 360                 365

Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Arg Ile Lys Thr Asp
    370                 375                 380

Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Asn His Met Pro
385                 390                 395                 400

Ala Asp Ala Glu Arg Ala Gly Leu Phe Val Arg Thr Ser Ala Pro Cys
                405                 410                 415

Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys
            420                 425                 430

Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His
        435                 440                 445

Ser Cys Thr His Pro Phe His His Asp Pro Pro Val Ile Gly Arg Glu
    450                 455                 460

Lys Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr
465                 470                 475                 480

Tyr Val Gln Ser Thr Ala Ala Thr Thr Glu Glu Ile Glu Val His Met
                485                 490                 495

Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Ser Gln Gln Ser Gly Asn
            500                 505                 510

Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys
        515                 520                 525

Gly Gly Ser Asn Glu Gly Leu Thr Thr Thr Asp Lys Val Ile Asn Asn
    530                 535                 540

Cys Lys Val Asp Gln Cys His Ala Ala Val Thr Asn His Lys Lys Trp
545                 550                 555                 560

Gln Tyr Asn Ser Pro Leu Val Pro Arg Asn Ala Glu Leu Gly Asp Arg
                565                 570                 575

Lys Gly Lys Ile His Ile Pro Phe Pro Leu Ala Asn Val Thr Cys Arg
            580                 585                 590

Val Pro Lys Ala Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn Gln Val
        595                 600                 605
```

Ile Met Leu Leu Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr Arg Asn
610 615 620

Met Gly Glu Glu Pro Asn Tyr Gln Glu Glu Trp Val Met His Lys Lys
625 630 635 640

Glu Val Val Leu Thr Val Pro Thr Glu Gly Leu Glu Val Thr Trp Gly
645 650 655

Asn Asn Glu Pro Tyr Lys Tyr Trp Pro Gln Leu Ser Thr Asn Gly Thr
660 665 670

Ala His Gly His Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr
675 680 685

Pro Thr Met Thr Val Val Val Val Ser Val Ala Thr Phe Ile Leu Leu
690 695 700

Ser Met Val Gly Met Ala Ala Gly Met Cys Met Cys Ala Arg Arg Arg
705 710 715 720

Cys Ile Thr Pro Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro Phe Leu
725 730 735

Leu Ser Leu Ile Cys Cys Ile Arg Thr Ala Lys Ala Ala Thr Tyr Gln
740 745 750

Glu Ala Ala Ile Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu
755 760 765

Gln Ala Leu Ile Pro Leu Ala Ala Leu Ile Val Leu Cys Asn Cys Leu
770 775 780

Arg Leu Leu Pro Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala Val Met
785 790 795 800

Ser Val Gly Ala His Thr Val Ser Ala Tyr Glu His Val Thr Val Ile
805 810 815

Pro Asn Thr Val Gly Val Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly
820 825 830

Tyr Ser Pro Met Val Leu Glu Met Glu Leu Leu Ser Val Thr Leu Glu
835 840 845

Pro Thr Leu Ser Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile
850 855 860

Pro Ser Leu Tyr Val Lys Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys
865 870 875 880

```
Asn Leu Pro Asp Tyr Ser Cys Lys Val Phe Thr Gly Val Tyr Pro Phe
                885                 890                 895

Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr Gln Leu
            900                 905                 910

Ser Glu Ala His Val Glu Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala
        915                 920                 925

Ser Ala Tyr Arg Ala His Thr Ala Ser Ala Ser Ala Lys Leu Arg Val
    930                 935                 940

Leu Tyr Gln Gly Asn Asn Ile Thr Val Thr Ala Tyr Ala Asn Gly Asp
945                 950                 955                 960

His Ala Val Thr Val Lys Asp Ala Lys Phe Ile Val Gly Pro Met Ser
                965                 970                 975

Ser Ala Trp Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys Gly Asp
            980                 985                 990

Val Tyr Asn Met Asp Tyr Pro Pro  Phe Gly Ala Gly Arg  Pro Gly Gln
        995                 1000                1005

Phe Gly  Asp Ile Gln Ser Arg  Thr Pro Glu Ser Glu  Asp Val Tyr
    1010                1015                1020

Ala Asn  Thr Gln Leu Val Leu  Gln Arg Pro Ala Ala  Gly Thr Val
    1025                1030                1035

His Val  Pro Tyr Ser Gln Ala  Pro Ser Gly Phe Lys  Tyr Trp Leu
    1040                1045                1050

Lys Glu  Arg Gly Ala Ser Leu  Gln His Thr Ala Pro  Phe Gly Cys
    1055                1060                1065

Gln Ile  Ala Thr Asn Pro Val  Arg Ala Val Asn Cys  Ala Val Gly
    1070                1075                1080

Asn Met  Pro Ile Ser Ile Asp  Ile Pro Glu Ala Ala  Phe Thr Arg
    1085                1090                1095

Val Val  Asp Ala Pro Ser Leu  Thr Asp Met Ser Cys  Glu Val Pro
    1100                1105                1110

Ala Cys  Thr His Ser Ser Asp  Phe Gly Gly Val Ala  Ile Ile Lys
    1115                1120                1125

Tyr Ala  Ala Ser Lys Lys Gly  Lys Cys Ala Val His  Ser Met Thr
    1130                1135                1140
```

```
Asn Ala  Val Thr Ile Arg Glu  Ala Glu Ile Glu Val  Glu Gly Asn
    1145                 1150                 1155

Ser Gln  Leu Gln Ile Ser Phe  Ser Thr Ala Leu Ala  Ser Ala Glu
    1160                 1165                 1170

Phe Arg  Val Gln Val Cys Ser  Thr Gln Val His Cys  Ala Ala Glu
    1175                 1180                 1185

Cys His  Pro Pro Lys Asp His  Ile Val Asn Tyr Pro  Ala Ser His
    1190                 1195                 1200

Thr Thr  Leu Gly Val Gln Asp  Ile Ser Ala Thr Ala  Met Ser Trp
    1205                 1210                 1215

Val Gln  Lys Ile Thr Gly Gly  Val Gly Leu Val Val  Ala Val Ala
    1220                 1225                 1230

Ala Leu  Ile Leu Ile Val Val  Leu Cys Val Ser Phe  Ser Arg His
    1235                 1240                 1245
```

<210> 14
<211> 1248
<212> PRT
<213> Chikungunya virus

<400> 14

```
Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
1               5                  10                  15

Arg Pro Trp Thr Pro Arg Ser Thr Ile Gln Ile Ile Arg Pro Arg Pro
            20                  25                  30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
        35                  40                  45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
    50                  55                  60

Arg Lys Asn Lys Lys Gln Lys Gln Lys Gln Gln Ala Pro Gln Asn Asn
65                  70                  75                  80

Thr Asn Gln Lys Lys Gln Pro Pro Lys Lys Lys Pro Ala Gln Lys Lys
                85                  90                  95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
            100                 105                 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Thr Gly Tyr Ala Cys
        115                 120                 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile
```

130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu
225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Ile Pro Val Met Cys Leu Leu Ala
260 265 270

Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr
275 280 285

Glu Lys Glu Pro Glu Glu Thr Leu Arg Met Leu Glu Asp Asn Val Met
290 295 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Gln Ala Ser Leu Thr Cys Ser Pro
305 310 315 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala
325 330 335

Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser
340 345 350

Cys His Ser Pro Val Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp
355 360 365

Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp
370 375 380

Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Asn His Met Pro
385 390 395 400

Ala Asp Ala Glu Arg Ala Gly Leu Phe Val Arg Thr Ser Ala Pro Cys

405 410 415

Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys
420 425 430

Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His
435 440 445

Ser Cys Thr His Pro Phe His His Asp Pro Pro Val Ile Gly Arg Glu
450 455 460

Lys Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr
465 470 475 480

Tyr Val Gln Ser Thr Ala Ala Thr Thr Glu Glu Ile Glu Val His Met
485 490 495

Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Ser Gln Gln Ser Gly Asn
500 505 510

Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys
515 520 525

Gly Gly Ser Asn Glu Gly Leu Thr Thr Thr Asp Lys Val Ile Asn Asn
530 535 540

Cys Lys Val Asp Gln Cys His Ala Ala Val Thr Asn His Lys Lys Trp
545 550 555 560

Gln Tyr Asn Ser Pro Leu Val Pro Arg Asn Ala Glu Leu Gly Asp Arg
565 570 575

Lys Gly Lys Ile His Ile Pro Phe Pro Leu Ala Asn Val Thr Cys Arg
580 585 590

Val Pro Lys Ala Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn Gln Val
595 600 605

Ile Met Leu Leu Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr Arg Asn
610 615 620

Met Gly Glu Glu Pro Asn Tyr Gln Glu Glu Trp Val Met His Lys Lys
625 630 635 640

Glu Val Val Leu Thr Val Pro Thr Glu Gly Leu Glu Val Thr Trp Gly
645 650 655

Asn Asn Glu Pro Tyr Lys Tyr Trp Pro Gln Leu Ser Thr Asn Gly Thr
660 665 670

Ala His Gly His Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr

675 680 685

Pro Thr Met Thr Val Val Val Val Ser Val Ala Thr Phe Ile Leu Leu
690 695 700

Ser Met Val Gly Met Ala Ala Gly Met Cys Met Cys Ala Arg Arg Arg
705 710 715 720

Cys Ile Thr Pro Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro Phe Leu
725 730 735

Leu Ser Leu Ile Cys Cys Ile Arg Thr Ala Lys Ala Ala Thr Tyr Gln
740 745 750

Glu Ala Ala Ile Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu
755 760 765

Gln Ala Leu Ile Pro Leu Ala Ala Leu Ile Val Leu Cys Asn Cys Leu
770 775 780

Arg Leu Leu Pro Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala Val Met
785 790 795 800

Ser Val Gly Ala His Thr Val Ser Ala Tyr Glu His Val Thr Val Ile
805 810 815

Pro Asn Thr Val Gly Val Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly
820 825 830

Tyr Ser Pro Met Val Leu Glu Met Glu Leu Leu Ser Val Thr Leu Glu
835 840 845

Pro Thr Leu Ser Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile
850 855 860

Pro Ser Pro Tyr Val Lys Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys
865 870 875 880

Asn Leu Pro Asp Tyr Ser Cys Arg Val Phe Thr Gly Val Tyr Pro Phe
885 890 895

Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr Gln Leu
900 905 910

Ser Glu Ala His Val Glu Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala
915 920 925

Ser Ala Tyr Arg Ala His Thr Ala Ser Ala Ser Ala Lys Leu Arg Val
930 935 940

Leu Tyr Gln Gly Asn Asn Ile Thr Val Thr Ala Tyr Ala Asn Gly Asp

945 950 955 960

His Ala Val Thr Val Lys Asp Ala Lys Phe Ile Val Gly Pro Met Ser
965 970 975

Ser Ala Trp Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys Gly Asp
980 985 990

Val Tyr Asn Met Asp Tyr Pro Pro Phe Gly Ala Gly Arg Pro Gly Gln
995 1000 1005

Phe Gly Asp Ile Gln Ser Arg Thr Pro Glu Ser Lys Asp Val Tyr
1010 1015 1020

Ala Asn Thr Gln Leu Val Leu Gln Arg Pro Ala Ala Gly Thr Val
1025 1030 1035

His Val Pro Tyr Ser Gln Ala Pro Ser Gly Phe Lys Tyr Trp Leu
1040 1045 1050

Lys Glu Arg Gly Ala Ser Leu Gln His Thr Ala Pro Phe Gly Cys
1055 1060 1065

Gln Ile Ala Thr Asn Pro Val Arg Ala Val Asn Cys Ala Val Gly
1070 1075 1080

Asn Met Pro Ile Ser Ile Asp Ile Pro Glu Ala Ala Phe Thr Arg
1085 1090 1095

Val Val Asp Ala Pro Ser Leu Thr Asp Met Ser Cys Glu Val Pro
1100 1105 1110

Ala Cys Thr His Ser Ser Asp Phe Gly Gly Val Ala Ile Ile Lys
1115 1120 1125

Tyr Ala Ala Ser Lys Lys Gly Lys Cys Ala Val His Ser Met Thr
1130 1135 1140

Asn Ala Val Thr Ile Arg Glu Ala Glu Ile Glu Val Glu Gly Asn
1145 1150 1155

Ser Gln Leu Gln Ile Ser Phe Ser Thr Ala Leu Ala Ser Ala Glu
1160 1165 1170

Phe Arg Val Gln Val Cys Ser Thr Gln Val His Cys Ala Ala Glu
1175 1180 1185

Cys His Pro Pro Lys Asp His Ile Val Asn Tyr Pro Ala Ser His
1190 1195 1200

Thr Thr Leu Gly Val Gln Asp Ile Ser Ala Thr Ala Met Ser Trp

1205 1210 1215

Val Gln Lys Ile Thr Gly Gly Val Gly Leu Val Val Ala Val Ala
1220 1225 1230

Ala Leu Ile Leu Ile Val Val Leu Cys Val Ser Phe Ser Arg His
1235 1240 1245

<210> 15
<211> 11234
<212> DNA
<213> Chikungunya virus

<400> 15
atggatcctg tgtacgtgga catagacgct gacagcgcct ttttgaaggc cctgcaacgt 60
gcgtacccca tgtttgaggt ggaaccaagg caggtcacac cgaatgacca tgctaatgct 120
agagcgttct cgcatctagc tataaaacta atagagcagg aaattgaccc cgactcaacc 180
atcctggata tcggcagtgc gccagcaagg aggatgatgt cggacaggaa gtaccactgc 240
gtctgcccga tgcgcagtgc ggaagatccc gagagactcg ctaattatgc gagaaagcta 300
gcatctgccg caggaaaagt cctggacaga aacatctctg gaaagatcgg ggacttacaa 360
gcagtaatgg ccgtgccaga caaggagacg ccaacattct gcttacacac agacgtctca 420
tgtagacaga gagcagacgt cgctatatac caagacgtct atgctgtaca cgcacccacg 480
tcgctatacc accaggcgat taaaggggtc cgagtggcgt actgggttgg gttcgacaca 540
accccgttca tgtacaatgc catggcgggt gcctaccccc catactcgac aaactgggca 600
gatgagcagg tactgaaggc taagaacata ggattatgtt caacagacct gacggaaggt 660
agacgaggca agttgtctat tatgagaggg aaaaagctaa aaccgtgcga ccgtgtgctg 720
ttctcagtag ggtcaacgct ttacccggaa agccgcaagc tacttaagag ctggcacctg 780
ccatcggtgt tccatttaaa gggcaaactc agcttcacat gccgctgtga tacagtggtt 840
tcgtgtgagg gctacgtcgt taagagaata acgatgagcc caggccttta tggaaaaacc 900
acagggtatg cggtaaccca ccacgcagac ggattcctga tgtgcaagac taccgacacg 960
gttgacggcg aaagagtgtc attctcggtg tgcacatacg tgccggcgac catttgtgat 1020
caaatgaccg gcatccttgc tacagaagtc acgccggagg atgcacagaa gctgttggtg 1080
gggctgaacc agagaatagt ggttaacggc agaacgcaac ggaatatgaa caccatgaaa 1140
aattatctgc ttcccgtggt cgcccaagcc ttcagtaagt gggcaaagga gtgccggaaa 1200
gacatggaag atgaaaaact cctgggggtc agagaaagaa cactgacctg ctgctgtcta 1260
tgggcattca agaagcagaa aacacacacg gtctacaaga ggcctgatac ccagtcaatt 1320
cagaaggttc aggccgagtt tgacagcttt gtggtaccga gtctgtggtc gtccgggttg 1380
tcaatccctt tgaggactag aatcaaatgg ttgttaagca aggtgccaaa aaccgacctg 1440
atcccataca gcggagacgc ccgagaagcc cgggacgcag aaaaagaagc agaggaagaa 1500
cgagaagcag aactgactcg cgaagcccta ccacctctac aggcagcaca ggaagatgtt 1560

caggtcgaaa tcgacgtgga acagcttgag gacagagcgg gcgcaggaat aatagagact 1620
ccgagaggag ctatcaaagt tactgcccaa ccaacagacc acgtcgtggg agagtacctg 1680
gtactctccc cgcagaccgt actacgtagc cagaagctca gtctgattca cgctttggcg 1740
gagcaagtga agacgtgcac gcacaacgga cgagcaggga ggtatgcggt cgaagcgtac 1800
gacggccgag tcctagtgcc ctcaggctat gcaatctcgc ctgaagactt ccagagtcta 1860
agcgaaagcg caacgatggt gtataacgaa agagagttcg taaacagaaa gctacaccat 1920
attgcgatgc acggaccagc cctgaacacc gacgaagagt cgtatgagct ggtgagggca 1980
gagaggacag aacacgagta cgtctacgac gtggatcaga gaagatgctg taagaaggaa 2040
gaagccgcag gactggtact ggtgggcgac ttgactaatc cgccctacca cgaattcgca 2100
tatgaagggc taaaaatccg ccctgcctgc ccatacaaaa ttgcagtcat aggagtcttc 2160
ggagtaccgg gatctggcaa gtcagctatt atcaagaacc tagttaccag gcaggacctg 2220
gtgactagtg gaaagaaaga aaactgccaa gaaatcacca ccgacgtgat gagacagaga 2280
ggtctagaga tatctgcacg tacggttgac tcgctgctct tgaatggatg caacagacca 2340
gtcgacgtgt tgtacgtaga cgaggcgttt gcgtgccact ctggaacgct acttgctttg 2400
atcgccttgg tgagaccaag gcagaaagtt gtactttgtg gtgacccgaa gcagtgcggc 2460
ttcttcaata tgatgcagat gaaagtcaac tacaatcaca acatctgcac ccaagtgtac 2520
cacaaaagta tctccaggcg gtgtacactg cctgtgaccg ccattgtgtc atcgttgcat 2580
tacgaaggca aaatgcgcac tacgaatgag tacaacaagc cgattgtagt ggacactaca 2640
ggctcaacaa aacctgaccc tggagacctc gtgttaacgt gcttcagagg gtgggttaaa 2700
caactgcaaa ttgactatcg tggatacgag gtcatgacag cagccgcatc ccaagggtta 2760
accagaaaag gagtttacgc agttagacaa aaagttaatg aaaacccgct ctatgcatca 2820
acgtcagagc acgtcaacgt actcctaacg cgtacggaag gtaaactggt atggaagaca 2880
ctttccggcg acccgtggat aaagacgctg cagaacccac cgaaaggaaa cttcaaagca 2940
actattaagg agtgggaggt ggagcatgca tcaataatgg cgggcatctg cagtcaccaa 3000
atgaccttcg atacattcca aaataaagcc aacgtttgtt gggctaagag cttggtccct 3060
atcctcgaaa cagcggggat aaaactaaat gataggcagt ggtctcagat aattcaagcc 3120
ttcaaagaag acaaagcata ctcacctgaa gtagccctga atgaaatatg tacgcgcatg 3180
tatggggtgg atctagacag cgggctattt tctaaaccgt tggtgtctgt gtattacgcg 3240
gataaccact gggataatag gcctggaggg aaaatgttcg gatttaaccc cgaggcagca 3300
tccattctag aaagaaagta tccattcaca aaagggaagt ggaacatcaa caagcagatc 3360
tgcgtgacta ccaggaggat agaagacttt aaccctacca ccaacatcat accggccaac 3420
aggagactac cacactcatt agtggccgaa caccgcccag taaaagggga aagaatggaa 3480
tggctggtta acaagataaa cggccaccac gtgctcctgg tcagtggcta taaccttgca 3540
ctgcctacta agagagtcac ttgggtagcg ccgttaggtg tccgcggagc ggactacaca 3600

tacaacctag agttgggtct gccagcaacg cttggtaggt atgaccttgt ggtcataaac 3660
atccacacac cttttcgcat acaccattac caacagtgcg tcgaccacgc aatgaaactg 3720
caaatgctcg ggggtgactc attgagactg ctcaaaccgg gcggctctct attgatcaga 3780
gcatatggtt acgcagatag aaccagtgaa cgagtcatct gcgtattggg acgcaagttt 3840
agatcgtcta gagcgttgaa accaccatgt gtcaccagca acactgagat gtttttccta 3900
ttcagcaact ttgacaatgg cagaaggaat ttcacaactc atgtcatgaa caatcaactg 3960
aatgcagcct tcgtaggaca ggtcacccga gcaggatgtg caccgtcgta ccgggtaaaa 4020
cgcatggaca tcgcgaagaa cgatgaagag tgcgtagtca acgccgctaa ccctcgcggg 4080
ttaccgggtg acggtgtttg caaggcagta tacaaaaaat ggccggagtc ctttaagaac 4140
agtgcaacac cagtgggaac cgcaaaaaca gttatgtgcg gtacgtatcc agtaatccac 4200
gctgttggac caaacttctc taattattcg gagtctgaag gggaccggga attggcagct 4260
gcctatcgag aagtcgcaaa ggaagtaact aggctgggag taaatagtgt agctatacct 4320
ctcctctcca caggtgtata ctcaggaggg aaagacaggc tgacccagtc actgaaccac 4380
ctctttacag ccatggactc gacggatgca gacgtggtca tctactgccg cgacaaagaa 4440
tgggagaaga aaatatctga ggccatacag atgcggaccc aagtagagct gctggatgag 4500
cacatctcca tagactgcga tattgttcgc gtgcaccctg acagcagctt ggcaggcaga 4560
aaaggataca gcaccacgga aggcgcactg tactcatatc tagaagggac ccgttttcat 4620
cagacggctg tggatatggc ggagatacat actatgtggc caaagcaaac agaggccaat 4680
gagcaagtct gcctatatgc cctgggggaa agtattgaat cgatcaggca gaaatgcccg 4740
gtggatgatg cagacgcatc atctcccccc aaaactgtcc cgtgcctttg ccgttacgct 4800
atgactccag aacgcgtcac ccggcttcgc atgaaccacg tcacaagcat aattgtgtgt 4860
tcttcgtttc ccctcccaaa gtacaaaata gaaggagtgc aaaaagtcaa atgctctaag 4920
gtaatgctat ttgaccacaa cgtgccatcg cgcgtaagtc caagggaata tagatcttcc 4980
caggagtctg cacaggaggc gagtacaatc acgtcactga cgcatagtca attcgaccta 5040
agcgttgatg gcgagatact gcccgtcccg tcagacctgg atgctgacgc cccagcccta 5100
gaaccagcac tagacgacgg ggcgacacac acgctgccat ccacaaccgg aaaccttgcg 5160
gccgtgtctg actgggtaat gagcaccgta cctgtcgcgc cgcccagaag aaggcgaggg 5220
agaaacctga ctgtgacatg tgacgagaga gaagggaata taacacccat ggctagcgtc 5280
cgattcttta gggcagagct gtgtccggtc gtacaagaaa cagcggagac gcgtgacaca 5340
gcaatgtctc ttcaggcacc accgaatacc gccacggaac cgaatcatcc gccgatctcc 5400
ttcggagcat caagcgagac gttccccatt acatttgggg acttcaacga aggagaaatc 5460
gaaagcttgt cttctgagct actaactttc ggagacttct taccaggaga agtggatgac 5520
ttgacagaca gcgactggtc cacgtgctca gacacggacg acgagttatg actagacagg 5580
gcaggtgggt atatattctc gtcggacacc ggtccaggtc atttacaaca gaagtcagta 5640

cgccagtcag tgctgccggt gaacaccctg gaggaagtcc acgaggagaa gtgttaccca 5700
cctaagctgg atgaagcaaa ggagcaacta ttacttaaga aactccagga gagtgcatcc 5760
atggccaaca gaagcaggta tcagtcgcgc aaagtagaaa atatgaaagc agcaatcatc 5820
cagagactaa agagaggctg tagactatac ttaatgtcag agaccccaaa agtccctact 5880
taccggacta catatccggc gcctgtgtac tcgcctccga tcaacgtccg attgtccaat 5940
cccgagtccg cagtggcagc atgcaatgag ttcttagcta gaaactatcc aactgtctca 6000
tcataccaaa ttaccgacga gtatgatgca tatctagaca tggtggacgg gtcggagagt 6060
tgcctggacc gagcgacatt caatccgtca aaactcagga gctacccgaa acagcacgct 6120
taccacgcgc cctccatcag aagcgctgta ccgtccccat tccagaacac actacagaat 6180
gtactggcag cagccacgaa aagaaactgc aacgtcacac agatgaggga attacccact 6240
ttggactccg cagtattcaa cgtggagtgt ttcaaaaaat tcgcatgcaa ccaagaatac 6300
tgggaagaat ttgctgccag ccctattagg ataacaactg agaatttagc aacctatgtt 6360
actaaactaa aagggccaaa agcagcagcg ctattcgcaa aaacccataa tctactgcca 6420
ctacaggaag taccaatgga taggttcaca gtagatatga aaagggacgt gaaggtgact 6480
cctggtacaa agcatacaga ggaaagacct aaggtgcagg ttatacaggc ggctgaaccc 6540
ttggcgacag catacctatg tgggattcac agagagctgg ttaggaggct gaacgccgtc 6600
ctcctaccca atgtacatac actatttgac atgtctgccg aggatttcga tgccatcata 6660
gccgcacact ttaagccagg agacactgtt ttggaaacgg acatagcctc ctttgataag 6720
agccaagatg attcacttgc gcttactgct ttgatgctgt tagaggattt aggggtggat 6780
cactccctgc tggacttgat agaggctgct ttcggagaga tttccagctg tcacctaccg 6840
acaggtacgc gcttcaagtt cggcgccatg atgaaatcag gtatgttcct aactctgttc 6900
gtcaacacat tgttaaacat caccatcgcc agccgagtgc tggaagatcg tctgacaaaa 6960
tccgcgtgcg cggccttcat cggcgacgac aacataatac atggagtcgt ctccgatgaa 7020
ttgatggcag ccagatgtgc cacttggatg aacatggaag tgaagatcat agatgcagtt 7080
gtatccttga aagcccctta cttttgtgga gggtttatac tgcacgatac tgtgacagga 7140
acagcttgca gagtggcaga cccgctaaaa aggcttttta aactgggcaa accgctagcg 7200
gcaggtgacg aacaagatga agatagaaga cgagcgctgg ctgacgaagt gatcagatgg 7260
caacgaacag ggctaattga tgagctggag aaagcggtat actctaggta cgaagtgcag 7320
ggtatatcag ttgtggtaat gtccatggcc acctttgcaa gctccagatc caacttcgag 7380
aagctcagag gacccgtcat aactttgtac ggcggtccta ataggtatg cactacagct 7440
acctattttg cagaagccga cagcaagtat ctaaacacta atcagctaca atggagttca 7500
tcccaaccca aacttttac aataggaggt accagcctcg accctggact ccgcgctcta 7560
ctatccaaat cattaggccc agaccgcgcc ctcagaggca agctgggcaa cttgcccagc 7620
tgatctcagc agttaataaa ctgacaatgc gcgcggtacc ccaacagaag ccacgcagga 7680

atcggaagaa taagaagcaa aagcaaaaac aacaggcgcc acaaaacaac acaaatcaaa 7740
agaagcagcc acctaaaaag aaaccggctc aaaagaaaaa gaagccgggc cgcagagaga 7800
ggatgtgcat gaaaatcgaa aatgattgta ttttcgaagt caagcacgaa ggtaaggtaa 7860
caggttacgc gtgcctggtg ggggacaaag taatgaaacc agcacacgta aaggggacca 7920
tcgataacgc ggacctggcc aaactggcct ttaagcggtc atctaagtat gaccttgaat 7980
gcgcgcagat acccgtgcac atgaagtccg acgcttcgaa gttcacccat gagaaaccgg 8040
aggggtacta caactggcac cacggagcag tacagtactc aggaggccgg ttcaccatcc 8100
ctacaggtgc tggcaaacca ggggacagcg gcagaccgat cttcgacaac aagggacgcg 8160
tggtggccat agtcttagga ggagctaatg aaggagcccg tacagccctc tcggtggtga 8220
cctggaataa agacattgtc actaaaatca cccccgaggg ggccgaagag tggagtcttg 8280
ccatcccagt tatgtgcctg ctggcaaaca ccacgttccc ctgctcccag ccccccttgca 8340
cgccctgctg ctacgaaaag gaaccggagg aaaccctacg catgcttgag gacaacgtca 8400
tgagacctgg gtactatcag ctgctacagg catccttaac atgttctccc caccgccagc 8460
gacgcagcac caaggacaac ttcaatgtct ataaagccac aagaccatac ttagctcact 8520
gtcccgactg tggagaaggg cattcgtgcc atagtcccgt agcactagaa cgcatcagaa 8580
atgaagcgac agacgggacg ctgaaaatcc aggtctcctt gcaaatcaga ataaagacgg 8640
atgacagcca cgattggacc aagctgcgtt atatggacaa ccacatgcca gcagacgcag 8700
agagggcggg gctatttgta agaacatcag caccgtgtac gattactgga acaatgggac 8760
acttcatcct ggcccgatgt ccaaaagggg aaactctgac ggtgggattc actgacagta 8820
ggaagattag tcattcatgt acgcacccat ttcaccacga ccctcctgtg ataggtcggg 8880
aaaaattcca ttcccgaccg cagcacggta aagagctacc ttgcagcacg tacgtgcaga 8940
gcaccgccgc aactaccgag gagatagagg tacacatgcc cccagacacc cctgatcgca 9000
cattaatgtc acaacagtcc ggcaacgtaa agatcacagt caatggccag acggtgcggt 9060
acaagtgtaa ttgcggtggc tcaaatgaag gactaacaac tacagacaaa gtgattaata 9120
actgcaaggt tgatcaatgt catgccgcgg tcaccaatca caaaaagtgg cagtataact 9180
cccctctggt cccgcgtaat gctgaacttg gggaccgaaa aggaaaaatt cacatcccgt 9240
ttccgctggc aaatgcaaca tgcagggtgc ctaaagcaag gaaccccacc gtgacgtacg 9300
ggaaaaacca agtcatcatg ctactgtatc ctgaccaccc aacactcctg tcctaccgga 9360
atatgggaga agaaccaaac tatcaagaag agtgggtgat gcataagaag gaagtcgtgc 9420
taaccgtgcc gactgaaggg ctcgaggtca cgtggggcaa caacgagccg tataagtatt 9480
ggccgcagtt atctacaaac ggtacagccc atggccaccc gcatgagata attctgtatt 9540
attatgagct gtaccctact atgactgtag tagttgtgtc agtggccacg ttcatactcc 9600
tgtcgatggt gggtatggca gcggggatgt gcatgtgtgc acgacgcaga tgcatcacac 9660
cgtatgaact gacaccagga gctaccgtcc ctttcctgct tagcctaata tgctgcatca 9720

gaacagctaa agcggccaca taccaagagg ctgcgatata cctgtggaac gagcagcaac 9780
ctttgttttg gctacaagcc cttattccgc tggcagccct gattgttcta tgcaactgtc 9840
tgagactctt accatgctgc tgtaaaacgt tggctttttt agccgtaatg agcgtcggtg 9900
cccacactgt gagcgcgtac gaacacgtaa cagtgatccc gaacacggtg ggagtaccgt 9960
ataagactct agtcaataga cctggctaca gccccatggt attggagatg gaactactgt 10020
cagtcacttt ggagccaaca ctatcgcttg attacatcac gtgcgagtac aaaaccgtca 10080
tcccgtctcc gtacgtgaag tgctgcggta cagcagagtg caaggacaaa aacctacctg 10140
actacagctg taaggtcttc accggcgtct acccatttat gtggggcggc gcctactgct 10200
tctgcgacgc tgaaaacacg cagttgagcg aagcacatgt ggagaagtcc gaatcatgca 10260
aaacagaatt tgcatcagca tacagggctc ataccgcatc tgcatcagct aagctccgcg 10320
tcctttacca aggaaataac atcactgtaa ctgcctatgc aaacggcgac catgccgtca 10380
cagttaagga cgccaaattc attgtggggc caatgtcttc agcctggaca cctttcgaca 10440
acaaaattgt ggtgtacaaa ggtgacgtct ataacatgga ctacccgccc tttggcgcag 10500
gaagaccagg acaatttggc gatatccaaa gtcgcacacc tgagagtgaa gacgtctatg 10560
ctaatacaca actggtactg cagagaccgg ctgcgggtac ggtacacgtg ccatactctc 10620
aggcaccatc tggctttaag tattggctaa aagaacgcgg ggcgtcactg cagcacacag 10680
caccatttgg ctgccaaata gcaacaaacc cggtaagagc ggtgaactgc gccgtaggga 10740
acatgcccat ctccatcgac ataccggaag cggccttcac tagggtcgtc gacgcgccct 10800
ctttaacgga catgtcgtgc gaggtaccag cctgcaccca ttcctcagac tttgggggcg 10860
tcgccattat taaatatgca gccagcaaga aaggcaagtg tgcggtgcat tcgatgacta 10920
acgccgtcac tattcgggaa gctgagatag aagttgaagg gaattctcag ctgcaaatct 10980
ctttctcgac ggccttagcc agcgccgaat tccgcgtaca agtctgttct acacaagtac 11040
actgtgcagc tgagtgccac cccccgaagg accacatagt caactacccg gcgtcacata 11100
ccaccctcgg ggtccaggac atctccgcta cggcgatgtc atgggtgcag aagatcacgg 11160
gaggtgtggg actggttgtt gctgttgccg cactgattct aatcgtggtg ctatgcgtgt 11220
cgttcagcag gcac 11234

<210> 16
<211> 11234
<212> DNA
<213> Chikungunya virus

<400> 16
atggatcctg tgtacgtgga catagacgct gacagcgcct ttttgaaggc cctgcaacgt 60
gcgtacccca tgtttgaggt ggaaccaagg caggtcacac cgaatgacca tgctaatgct 120
agagcgttct cgcatctagc tataaaacta atagagcagg aaattgaccc cgactcaacc 180
atcctggata tcggcagtgc gccagcaagg aggatgatgt cggacaggaa gtaccactgc 240

gtctgcccga tgcgcagtgc ggaagatccc gagagactcg ctaattatgc gagaaagcta 300

gcatctgccg caggaaaagt cctggacaga aacatctctg gaaagatcgg ggacttacaa 360

gcagtaatgg ccgtgccaga caaggagacg ccaacattct gcttacacac agacgtctca 420

tgtagacaga gagcagacgt cgctatatac caagacgtct atgctgtaca cgcacccacg 480

tcgctatacc accaggcgat taaaggggtc cgagtggcgt actgggttgg gttcgacaca 540

accccgttca tgtacaatgc catggcgggt gcctaccccct catactcgac aaactgggca 600

gatgagcagg tactgaaggc taagaacata ggattatgtt caacagacct gacggaaggt 660

agacgaggca agttgtctat tatgagaggg aaaaagctaa aaccgtgcga ccgtgtgctg 720

ttctcagtag ggtcaacgct ttacccggaa agccgcaagc tacttaagag ctggcacctg 780

ccatcggtgt tccatttaaa gggcaaactc agcttcacat gccgctgtga tacagtggtt 840

tcgtgtgagg gctacgtcgt taagagaata acgatgagcc caggccttta tggaaaaacc 900

acagggtatg cggtaaccca ccacgcagac ggattcctga tgtgcaagac tactgacacg 960

gttgacggcg aaagagtgtc attctcggtg tgcacatacg tgccggcgac catttgtgat 1020

caaatgaccg gcatccttgc tacagaagtt acgccggagg atgcacagaa gctgttggtg 1080

gggctgaacc agagaatagt ggttaacggc agaacgcaac ggaatatgaa caccatgaaa 1140

aattatctgc ttcccgtggt cgcccaagcc ttcagtaagt gggcaaagga gtgccggaaa 1200

gacatggaag atgaaaaact cctgggggtc agagaaagaa cactgacctg ctgctgtcta 1260

tgggcattca agaagcagaa aacacacacg gtctacaaga ggcctgatac ccagtcaatt 1320

cagaaggttc aggccgagtt tgacagcttt gtggtaccga gtctgtggtc gtccgggttg 1380

tcaatccctt tgaggactag aatcaaatgg ttgttaagca aggtgccaaa aaccgacctg 1440

atcccataca gcggagacgc ccgagaagcc cgggacgcag aaaaagaagc agaggaagaa 1500

cgagaagcag aactgactcg cgaagcccta ccacctctac aggcagcaca ggaagatgtt 1560

caggtcgaaa tcgacgtgga acagcttgag gacagagcgg gcgcaggaat aatagagact 1620

ccgagaggag ctatcaaagt tactgcccaa ccaacagacc acgtcgtggg agagtacctg 1680

gtactctccc cgcagaccgt actacgtagc cagaagctca gtctgattca cgctttggcg 1740

gagcaagtga agacgtgcac gcacaacgga cgagcaggga ggtatgcggt cgaagcgtac 1800

gacggccgag tcctagtgcc ctcaggctat gcaatctcgc ctgaagactt ccagagtcta 1860

agcgaaagcg caacgatggt gtataacgaa agagagttcg taaacagaaa gctacaccat 1920

attgcgatgc acggaccagc cctgaacacc gacgaagagt cgtatgagct ggtgagggca 1980

gagaggacag aacacgagta cgtctacgac gtggatcaga gaagatgctg taagaaggaa 2040

gaagccgcag gactggtact ggtgggcgac ttgactaatc cgccctacca cgaattcgca 2100

tatgaagggc taaaaatccg ccctgcctgc ccatacaaaa ttgcagtcat aggagtcttc 2160

ggagtaccgg gatctggcaa gtcagctatt atcaagaacc tagttaccag gcaggacctg 2220

gtgactagtg gaaagaaaga aaactgccaa gaaatcacca ccgacgtgat gagacagaga 2280

ggtctagaga tatctgcacg tacggttgac tcgctgctct tgaatggatg caacagacca 2340

gtcgacgtgt tgtacgtaga cgaggcgttt gcgtgccact ctggaacgct acttgctttg 2400

atcgccttgg tgagaccaag gcagaaagtt gtactttgtg gtgacccgaa gcagtgcggc 2460

ttcttcaata tgatgcagat gaaagtcaac tacaatcaca acatctgcac ccaagtgtac 2520

cacaaaagta tctccaggcg gtgtacactg cctgtgaccg ccattgtgtc atcgttgcat 2580

tacgaaggca aaatgcgcac tacgaatgag tacaacaagc cgattgtagt ggacactaca 2640

ggctcaacaa aacctgaccc tggagacctc gtgttaacgt gcttcagagg gtgggttaaa 2700

caactgcaaa ttgactatcg tggatacgag gtcatgacag cagccgcatc ccaagggtta 2760

accagaaaag gagtttacgc agttagacaa aaagttaatg aaaacccgct ctatgcatca 2820

acgtcagagc acgtcaacgt actcctaacg cgtacggaag gtaaactggt atggaagaca 2880

ctttccggcg acccgtggat aaagacgctg cagaacccac cgaaaggaaa cttcaaagca 2940

actattaagg agtgggaggt ggagcatgca tcaataatgg cgggcatctg cagtcaccaa 3000

atgaccttcg atacattcca aaataaagcc aacgtttgtt gggctaagag cttggtccct 3060

atcctcgaaa cagcggggat aaaactaaat gataggcagt ggtctcagat aattcaagcc 3120

ttcaaagaag acaaagcata ctcacctgaa gtagccctga atgaaatatg tacgcgcatg 3180

tatggggtgg atctagacag cgggctattt tctaaaccgt tggtgtctgt gtattacgcg 3240

gataaccact gggataatag gcctggaggg aaaatgttcg gatttaaccc cgaggcagca 3300

tccattctag aaagaaagta tccattcaca aaagggaagt ggaacatcaa caagcagatc 3360

tgcgtgacta ccaggaggat agaagacttt aaccctacca ccaacatcat accggccaac 3420

aggagactac cacactcatt agtggccgaa caccgcccag taaaagggga aagaatggaa 3480

tggctggtta acaagataaa cggccaccac gtgctcctgg tcagtggcta taaccttgca 3540

ctgcctacta agagagtcac ttgggtagcg ccgttaggtg tccgcggagc ggactacaca 3600

tacaacctag agttgggtct gccagcaacg cttggtaggt atgaccttgt ggtcataaac 3660

atccacacac cttttcgcat acaccattac caacagtgcg tcgaccacgc aatgaaactg 3720

caaatgctcg ggggtgactc attgagactg ctcaaaccgg gcggctctct attgatcaga 3780

gcatatggtt acgcagatag aaccagtgaa cgagtcatct gcgtattggg acgcaagttt 3840

agatcgtcta gagcgttgaa accaccatgt gtcaccagca acactgagat gtttttccta 3900

ttcagcaact ttgacaatgg cagaaggaat ttcacaactc atgtcatgaa caatcaactg 3960

aatgcagcct tcgtaggaca ggtcacccga gcaggatgtg caccgtcgta ccgggtaaaa 4020

cgcatggaca tcgcgaagaa cgatgaagag tgcgtagtca acgccgctaa ccctcgcggg 4080

ttaccgggtg acggtgtttg caaggcagta tacaaaaaat ggccggagtc ctttaagaac 4140

agtgcaacac cagtgggaac cgcaaaaaca gttatgtgcg gtacgtatcc agtaatccac 4200

gctgttggac caaacttctc taattattcg gagtctgaag gggaccggga attggcagct 4260

gcctatcgag aagtcgcaaa ggaagtaacc aggctgggag taaatagtgt agctatacct 4320

ctcctctcca caggtgtata ctcaggaggg aaagacaggc tgacccagtc actgaaccac 4380

ctctttacag ccatggactc gacggatgca gacgtggtca tctactgccg cgacaaagaa 4440

tgggagaaga aaatatctga ggccatacag atgcggaccc aagtagagct gctggatgag 4500

cacatctcca tagactgcga tattgttcgc gtgcaccctg acagcagctt ggcaggcaga 4560

aaaggataca gcaccacgga aggcgcactg tactcatatc tagaagggac ccgttttcat 4620

cagacggctg tggatatggc ggagatacat actatgtggc caaagcaaac agaggccaat 4680

gagcaagcct gcctatatgc cctgggggaa agtattgaat cgatcaggca gaaatgcccg 4740

gtggatgatg cagacgcatc atctcccccc aaaactgtcc cgtgcctttg ccgttacgct 4800

atgactccag aacgcgtcac ccggcttcgc atgaaccacg tcacaagcat aattgtgtgt 4860

tcttcgtttc ccctcccaaa gtacaaaata gaaggagtgc aaaaagtcaa atgctctaag 4920

gtaatgctat ttgaccacaa cgtgccatcg cgcgtaagtc caagggaata tagatcttcc 4980

caggagtctg cacaggaggc gagtacaatc acgtcactga cgcatagtca attcgaccta 5040

agcgttgatg gcgagatact gcccgtcccg tcagacctgg atgctgacgc cccagcccta 5100

gaaccagcac tagacgacgg ggcgacacac acgctgccat ccacaaccgg aaaccttgcg 5160

gccgtgtctg actgggtaat gagcaccgta cctgtcgcgc cgcccagaag aaggcgaggg 5220

agaaacctga ctgtgacatg tgacgagaga gaagggaata taacacccat ggctagcgtc 5280

cgattcttta gggcagagct gtgtccggtc gtacaagaaa cagcggagac gcgtgacaca 5340

gcaatgtctc ttcaggcacc accgagtacc gccacggaac cgaatcatcc gccgatctcc 5400

ttcggagcat caagcgagac gttccccatt acatttgggg acttcaacga aggagaaatc 5460

gaaagcttgt cttctgagct actaactttc ggagacttct taccaggaga agtggatgac 5520

ttgacagaca gcgactggtc cacgtgctca gacacggacg acgagttatg actagacagg 5580

gcaggtgggt atatattctc gtcggacacc ggtccaggtc atttacaaca gaagtcagta 5640

cgccagtcag tgctgccggt gaacaccctg gaggaagtcc acgaggagaa gtgttaccca 5700

cctaagctgg atgaagcaaa ggagcaacta ttacttaaga aactccagga gagtgcatcc 5760

atggccaaca gaagcaggta tcagtcgcgc aaagtagaaa acatgaaagc agcaatcatc 5820

cagagactaa agagaggctg tagactatac ttaatgtcag agaccccaaa agtccctact 5880

taccggacta tatatccggc gcctgtgtac tcgcctccga tcaacgtccg attgtccaat 5940

cccgagtccg cagtggcagc atgcaatgag ttcttagcta gaaactatcc aactgtctca 6000

tcataccaaa ttaccgacga gtatgatgca tatctagaca tggtggacgg gtcggagagt 6060

tgcctggacc gagcgacatt caatccgtca aaactcagga gctacccgaa acagcacgct 6120

taccacgcgc cctccatcag aagcgctgta ccgtccccat tccagaacac actacagaat 6180

gtactggcag cagccacgaa aagaaactgc aacgtcacac agatgaggga attacccact 6240

ttggactccg cagtattcaa cgtggagtgt ttcaaaaaat tcgcatgcaa ccaagaatac 6300

tgggaagaat ttgctgccag ccctattagg ataacaactg agaatttagc aacttatgtt 6360

actaaactaa aagggccaaa agcagcagcg ctattcgcaa aaacccataa tctactgcca 6420

ctacaggaag taccaatgga taggttcaca gtagatatga aaagggacgt gaaggtgact 6480

cctggtacaa agcatacaga ggaaagacct aaggtgcagg ttatacaggc ggctgaaccc 6540

ttggcgacag catacctatg tgggattcac agagagctgg ttaggaggct gaacgctgtc 6600

ctcctaccca atgtacatac actatttgac atgtctgccg aggatttcga tgccatcata 6660

gccgcacact ttaagccagg agacactgtt ttggaaacgg acatagcctc ctttgataag 6720

agccaagatg attcacttgc gcttactgct ttgatgctgt tagaggattt aggggtggat 6780

cactccctgc tggacttgat agaggctgct ttcggagaga tttccagctg tcacctaccg 6840

acaggtacgc gcttcaagtt cggcgccatg atgaaatcag gtatgttcct aactctgttc 6900

gtcaacacat tgttaaacat caccatcgcc agccgagtgc tggaagatcg tctgacaaaa 6960

tccgcgtgcg cggccttcat cggcgacgat aacataatac atggagtcgt ctccgatgaa 7020

ttgatggcag ccagatgtgc cacttggatg aacatggaag tgaagatcat agatgcagtt 7080

gtatctttga aagcccctta cttttgtgga gggtttatac tgcacgatac tgtgacagga 7140

acagcttgca gagtggcaga cccgctaaaa aggcttttta aactgggcaa accgctagcg 7200

gcaggtgacg aacaagatga agatagaaga cgagcgctgg ctgacgaagt gatcagatgg 7260

caacgaacag ggctaattga tgagctggag aaagcggtat actctaggta cgaagtgcag 7320

ggtatatcag ttgtggtaat gtccatggcc acctttgcaa gctccagatc caacttcgag 7380

aagctcagag gacccgtcat aactttgtac ggcggtccta aataggtacg cactacagct 7440

acctattttg cagaagccga cagcaagtat ctaaacacta atcagctaca atggagttca 7500

tcccaaccca aacttttac aataggaggt accagcctcg accctggact ccgcgctcta 7560

ctatccaaat cattaggccc agaccgcgcc ctcagaggca agctgggcaa cttgcccagc 7620

tgatctcagc agttaataaa ctgacaatgc gcgcggtacc ccaacagaag ccacgcagga 7680

atcggaagaa taagaagcaa aagcaaaaac aacaggcgcc acaaaacaac acaaatcaaa 7740

agaagcagcc acctaaaaag aaaccggctc aaaagaaaaa gaagccgggc cgcagagaga 7800

ggatgtgcat gaaaatcgaa aatgattgta ttttcgaagt caagcacgaa ggtaaggtaa 7860

caggttacgc gtgcctggtg ggggacaaag taatgaaacc agcacacgta aaggggacca 7920

tcgataacgc ggacctggcc aaactggcct ttaagcggtc atctaagtat gaccttgaat 7980

gcgcgcagat acccgtgcac atgaagtccg acgcttcgaa gttcacccat gagaaaccgg 8040

aggggtacta caactggcac cacggagcag tacagtactc aggaggccgg ttcaccatcc 8100

ctacaggtgc tggcaaacca ggggacagcg gcagaccgat cttcgacaac aagggacgcg 8160

tggtggccat agtcttagga ggagctaatg aaggagcccg tacagccctc tcggtggtga 8220

cctggaataa agacattgtc actaaaatca cccccgaggg ggccgaagag tggagtcttg 8280

ccatcccagt tatgtgcctg ctggcaaaca ccacgttccc ctgctcccag ccccccttgca 8340

cgccctgctg ctacgaaaag gaaccggagg aaaccctacg catgcttgag aacaacgtca 8400

tgagaccagg gtactatcag ctgctacagg catccttaac atgttctccc caccgccagc 8460

gacgcagcac caaggacaac ttcaatgtct ataaagccac aagaccatac ttagctcact 8520

gtcccgactg tggagaaggg cactcgtgcc atagtcccgt agcactagaa cgcatcagaa 8580

atgaagcgac agacgggacg ctgaaaatcc aggtctcctt gcaaatcgga ataaagacgg 8640

atgacagcca cgattggacc aagctgcgtt atatggacaa ccacatgcca gcagacgcag 8700

agagggcggg gctatttgta agaacatcag caccgtgtac gattactgga acaatgggac 8760

acttcatcct ggcccgatgt ccaaaagggg aaactctgac ggtgggattc actgacagta 8820

ggaagattag tcattcatgt acgcacccat ttcaccacga ccctcctgtg ataggtcggg 8880

aaaaattcca ttcccgaccg cagcacggta aagagctacc ttgcagcacg tacgtgcaga 8940

gcaccgccgc aactaccgag gagatagagg tacacatgcc cccagacacc cctgatcgca 9000

cattaatgtc acaacagtcc ggcaacgtaa agatcacagt caatggccag acggtgcggt 9060

acaagtgtaa ttgcggtggc tcaaatgaag gactaacaac tacagacaaa gtgattaata 9120

actgcaaggt tgatcaatgt catgccgcgg tcaccaatca caaaaagtgg cagtataact 9180

cccctctggt cccgcgtaat gctgaacttg gggaccgaaa aggaaaaatt cacatcccgt 9240

ttccgctggc aaatgcaaca tgcagggtgc ctaaagcaag gaaccccacc gtgacgtacg 9300

ggaaaaacca agtcatcatg ctactgtatc ctgaccaccc aacactcctg tcctaccgga 9360

atatgggaga agaaccaaac tatcaagaag agtgggtgat gcataagaag gaagtcgtgc 9420

taaccgtgcc gactgaaggg ctcgaggtca cgtggggcaa caacgagccg tataagtatt 9480

ggccgcagtt atctacaaac ggtacagccc atggccaccc gcatgagata attctgtatt 9540

attatgagct gtaccctact atgactgtag tagttgtgtc agtggccacg ttcatactcc 9600

tgtcgatggt gggtatggca gcggggatgt gcatgtgtgc acgacgcaga tgcatcacac 9660

cgtatgaact gacaccagga gctaccgtcc ctttcctgct tagcctaata tgctgcatca 9720

gaacagctaa agcggccaca taccaagagg ctgcgatata cctgtggaac gagcagcaac 9780

ctttgttttg gctacaagcc cttattccgc tggcagccct gattgttcta tgcaactgtc 9840

tgagactctt accatgctgc tgtaaaacgc tggctttttt agccgtaatg agcgtcggtg 9900

cccacactgt gagcgcgtac gaacacgtaa cagtgatccc gaacacggtg ggagtaccgt 9960

ataagactct agtcaataga cctggctaca gccccatggt attggagatg gaactactgt 10020

cagtcacttt ggagccaaca ctatcgcttg attacatcac gtgcgagtac aaaaccgtca 10080

tcccgtctcc gtacgtgaag tgctgcggta cagcagagtg caaggacaaa aacctacctg 10140

actacagctg taaggtcttc accggcgtct acccatttat gtggggcggc gcctactgct 10200

tctgcgacgc tgaaaacacg cagttgagcg aagcacatgt ggagaagtcc gaatcatgca 10260

aaacagaatt tgcatcagca tacagggctc ataccgcatc tgcatcagct aagctccgcg 10320

tcctttacca aggaaataac atcactgtaa ctgcctatgc aaacggcgac catgccgtca 10380

cagttaagga cgccaaattc attgtggggc caatgtcttc agcctggaca cctttcgaca 10440

acaaaattgt ggtgtacaaa ggtgacgtct ataacatgga ctacccgccc tttggcgcac 10500

gaagaccagg acaatttggc gatatccaaa gtcgcacacc tgagagtgaa gacgtctatg 10560

ctaatacaca actggtactg cagagaccgg ctgcgggtac ggtacacgtg ccatactctc 10620

aggcaccatc tggctttaag tattggctaa aagaacgcgg ggcgtcactg cagcacacag 10680

caccatttgg ctgccaaata gcaacaaacc cggtaagagc ggtgaactgc gccgtaggga 10740

acatgcccat ctccatcgac ataccggaag cggccttcac tagggtcgtc gacgcgccct 10800

ctttaacgga catgtcgtgc gaggtaccag cctgcaccca ttcctcagac tttgggggcg 10860

tcgccattat taaatatgca gccagcaaga aaggcaagtg tgcggtgcat tcgatgacta 10920

acgccgtcac tattcgggaa gctgagatag aagttgaagg gaattctcag ctgcaaatct 10980

ctttctcgac ggccttagcc agcgccgaat tccgcgtaca agtctgttct acacaagtac 11040

actgtgcagc tgagtgccac cccccgaagg accacatagt caactacccg gcgtcacata 11100

ccaccctcgg ggtccaggac atctccgcta cggcgatgtc atgggtgcag aagatcacgg 11160

gaggtgtggg actggttgtt gctgttgccg cactgattct aatcgtggtg ctatgcgtgt 11220

cgttcagcag gcac 11234

<210> 17
<211> 11234
<212> DNA
<213> Chikungunya virus

<400> 17

atggatcctg tgtacgtgga catagacgct gacagcgcct ttttgaaggc cctgcaacgt 60

gcgtacccca tgtttgaggt ggaaccaagg caggtcacac cgaatgacca tgctaatgct 120

agagcgttct cgcatctagc tataaaacta atagagcagg aaattgaccc cgactcaacc 180

atcctggata tcggcagtgc gccagcaagg aggatgatgt cggacaggaa gtaccactgc 240

gtctgcccga tgcgcagtgc ggaagatccc gagagactcg ctaattatgc gagaaagcta 300

gcatctgccg caggaaaagt cctggacaga aacatctctg gaaagatcgg ggacttacaa 360

gcagtaatgg ccgtgccaga caaggagacg ccaacattct gcttacacac agacgtctca 420

tgtagacaga gagcagacgt cgctatatac caagacgtct atgctgtaca cgcacccacg 480

tcgctatacc accaggcgat taaaggggtc cgagtggcgt actgggttgg gttcgacaca 540

accccgttca tgtacaatgc catggcgggt gcctacccct catactcgac aaactgggca 600

gatgagcagg tactgaaggc taagaacata ggattatgtt caacagacct gacggaaggt 660

agacgaggca agttgtctat tatgagaggg aaaaagctaa aaccgtgcga ccgtgtgctg 720

ttctcagtag ggtcaacgct ttacccggaa agccgcaagc tacttaagag ctggcacctg 780

ccatcggtgt tccatttaaa gggcaaactc agcttcacat gccgctgtga tacagtggtt 840

tcgtgtgagg gctacgtcgt taagagaata acgatgagcc caggccttta tggaaaaacc 900

acagggtatg cggtaaccca ccacgcagac ggattcctga tgtgcaagac taccgacacg 960

gttgacggcg aaagagtgtc attctcggtg tgcacatacg tgccggcgac catttgtgat 1020

caaatgaccg gcatccttgc tacagaagtc acgccggagg atgcacagaa gctgttggtg 1080

gggctgaacc agagaatagt ggttaacggc agaacgcaac ggaatacgaa caccatgaaa 1140

aattatctgc ttcccgtggt cgcccaagcc ttcagtaagt gggcaaagga gtgccggaaa 1200

gacatggaag atgaaaaact cctgggggtc agagaaagaa cactgacctg ctgctgtcta 1260

tgggcattca agaagcagaa aacacacacg gtctacaaga ggcctgatac ccagtcaatt 1320

cagaaggttc aggccgagtt tgacagcttt gtggtaccga gtctgtggtc gtccgggttg 1380

tcaatccctt tgaggactag aatcaaatgg ttgttaagca aggtgccaaa aaccgacctg 1440

atcccataca gcggagacgc ccgagaagcc cgggacgcag aaaaagaagc agaggaagaa 1500

cgagaagcag aactgactcg cgaagcccta ccacctctac aggcagcaca ggaagatgtt 1560

caggtcgaaa tcgacgtgga acagcttgag gacagagcgg gcgcaggaat aatagagact 1620

ccgagaggag ctatcaaagt tactgcccaa ccaacagacc acgtcgtggg agagtacctg 1680

gtactctccc cgcagaccgt actacgtagc cagaagctca gtctgattca cgctttggcg 1740

gagcaagtga agacgtgcac gcacaacgga cgagcaggga ggtatgcggt cgaagcgtac 1800

gacggccgag tcctagtgcc ctcaggctat gcaatctcgc ctgaagactt ccagagtcta 1860

agcgaaagcg caacgatggt gtataacgaa agagagttcg taaacagaaa gctacaccat 1920

attgcgatgc acggaccagc cctgaacacc gacgaagagt cgtatgagct ggtgagggca 1980

gagaggacag aacacgagta cgtctacgac gtggatcaga gaagatgctg taagaaggaa 2040

gaagccgcag gactggtact ggtgggcgac ttgactaatc cgccctacca cgaattcgca 2100

tatgaagggc taaaaatccg ccctgcctgc ccatacaaaa ttgcagtcat aggagtcttc 2160

ggagtaccgg gatctggcaa gtcagctatt atcaagaacc tagttaccag gcaggacctg 2220

gtgactagtg gaaagaaaga aaactgccaa gaaatcacca ccgacgtgat gagacaaaga 2280

ggtctagaga tatctgcacg tacggttgac tcgctgctct tgaatggatg caacagacca 2340

gtcgacgtgt tgtacgtaga cgaggcgttt gcgtgccact ctggaacgct acttgctttg 2400

atcgccttgg tgagaccaag gcagaaagtt gtactttgtg gtgacccgaa gcagtgcggc 2460

ttcttcaata tgatgcagat gaaagtcaac tacaatcaca acatctgcac ccaagtgtac 2520

cacaaaagta tctccaggcg gtgtacactg cctgtgaccg ccattgtgtc atcgttgcat 2580

tacgaaggca aaatgcgcac tacgaatgag tacaacaagc cgattgtagt ggacactaca 2640

ggctcaacaa aacctgaccc tggagacctc gtgttaacgt gcttcagagg gtgggttaaa 2700

caactgcaaa ttgactatcg tggatacgag gtcatgacag cagccgcatc ccaagggtta 2760

accagaaaag gagtttacgc agttagacaa aaagttaatg aaaacccgct ctatgcatca 2820

acgtcagagc acgtcaacgt actcctaacg cgtacggaag gtaaactggt atggaagaca 2880

ctttccggcg acccgtggat aaagacgctg cagaacccac cgaaaggaaa cttcaaagca 2940

actattaagg agtgggaggt ggagcatgca tcaataatgg cgggcatctg cagtcaccaa 3000

atgaccttcg atacattcca aaataaagcc aacgtttgtt gggctaagag cttggtccct 3060

atcctcgaaa cagcggggat aaaactaaat gataggcagt ggtctcagat aattcaagcc 3120
ttcaaagaag acaaagcata ctcacctgaa gtagccctga atgaaatatg tacgcgcatg 3180
tatggggtgg atctagacag cgggctattt tctaaaccgt tggtgtctgt gtattacgcg 3240
gataaccact gggataatag gcctggaggg aaaatgttcg gatttaaccc cgaggcagca 3300
tccattctag aaagaaagta tccattcaca aaagggaagt ggaacatcaa caagcagatc 3360
tgcgtgacta ccaggaggat agaagacttt aaccctacca ccaacatcat accggccaac 3420
aggagactac cacactcatt agtggccgaa caccgcccag taaaagggga aagaatggaa 3480
tggctggtta acaagataaa cggccaccac gtgctcctgg tcagtggcta taaccttgca 3540
ctgcctacta agagagtcac ttgggtagcg ccgttaggtg tccgcggagc ggactacaca 3600
tacaacctag agttgggtct gccagcaacg cttggtaggt atgaccttgt ggtcataaac 3660
atccacacac cttttcgcat acaccattac caacagtgcg tcgaccacgc aatgaaactg 3720
caaatgctcg ggggtgactc attgagactg ctcaaaccgg gcggctctct attgatcaga 3780
gcatatggtt acgcagatag aaccagtgaa cgagtcatct gcgtattggg acgcaagttt 3840
agatcgtcta gagcgttgaa accaccatgt gtcaccagca acactgagat gtttttccta 3900
ttcagcaact ttgacaatgg cagaaggaat ttcacaactc atgtcatgaa caatcaactg 3960
aatgcagcct tcgtaggaca ggtcacccga gcaggatgtg caccgtcgta ccgggtaaaa 4020
cgcatggaca tcgcgaagaa cgatgaagag tgcgtagtta acgccgctaa ccctcgcggg 4080
ttaccgggtg acggtgtttg caaggcagta tacaaaaaat ggccggagtc ctttaagaac 4140
agtgcaacac cagtgggaac cgcaaaaaca gttatgtgcg gtacgtatcc agtaatccac 4200
gctgttggac caaacttctc taattattcg gagcctgaag gggaccggga attggcagct 4260
gcctatcgag aagtcgcaaa ggaagtaact aggctgggag taaatagtgt agctatacct 4320
ctcctctcca caggtgtata ctcaggaggg aaagacaggc tgacccagtc actgaaccac 4380
ctctttacag ccatggactc gacggatgca gacgtggtca tctactgccg cgacaaagaa 4440
tgggagaaga aaatatctga ggccatacag atgcggaccc aagtagagct gctggatgag 4500
cacatctcca tagactgcga tattgttcgc gtgcaccctg acagcagctt ggcaggcaga 4560
aaaggataca gcaccacgga aggcgcactg tactcatatc tagaagggac ccgttttcat 4620
cagacggctg tggatatggc ggagatacat actatgtggc caaagcaaac agaggccaat 4680
gagcaagtct gcctatatgc cctgggggaa agtattgaat cgatcaggca gaaatgcccg 4740
gtggatgatg cagacgcatc atctcccccc aaaactgtcc cgtgcctttg ccgttacgct 4800
atgactccag aacgcgtcac ccggcttcgc atgaaccacg tcacaagcat aattgtgtgt 4860
tcttcgtttc ccctcccaaa gtacaaaata gaaggagtgc aaaaagtcaa atgctctaag 4920
gtaatgctat ttgaccacaa cgtgccatcg cgcgtaagtc caagggaata tagatcttcc 4980
caggagtctg cacaggaggc gagtacaatc acgtcactga cgcatagtca attcgaccta 5040
agcgttgatg gcgagatact gcccgtcccg tcagacctgg atgctgacgc cccagcccta 5100

gaaccagcac tagacgacgg ggcgacacac acgctgccat ccacaaccgg aaaccttgcg 5160
gccgtgtctg actgggtaat gagcaccgta cctgtcgcgc cgcccagaag aaggcgaggg 5220
agaaacctga ctgtgacatg tgacgagaga gaagggaata taacacccat ggctagcgtc 5280
cgattcttta gggcagagct gtgtccggtc gtacaagaaa cagcggagac gcgtgacaca 5340
gcaatgtctc ttcaggcacc accgagtacc gccacggaac cgaatcatcc gccgatctcc 5400
ttcggagcat caagcgagac gttccccatt acatttgggg acttcaacga aggagaaatc 5460
gaaagcttgt cttctgagct actaactttc ggagacttct taccaggaga agtggatgac 5520
ttgacagaca gcgactggtc cacgtgctca gacacggacg acgagttatg actagacagg 5580
gcaggtgggt atatattctc gtcggacacc ggtccaggtc atttacaaca gaagtcagta 5640
cgccagtcag tgctgccggt gaacaccctg gaggaagtcc acgaggagaa gtgttaccca 5700
cctaagctgg atgaagcaaa ggagcaacta ttacttaaga aactccagga gagtgcatcc 5760
atggccaaca gaagcaggta tcagtcgcgc aaagtagaaa acatgaaagc agcaatcatc 5820
cagagactaa agagaggctg tagactatac ttaatgtcag agaccccaaa agtccctact 5880
taccggacta catatccggc gcctgtgtac tcgcctccga tcaacgtccg attgtccaat 5940
cccgagtccg cagtggcagc atgcaatgag ttcttagcta gaaactatcc aactgtctca 6000
tcataccaaa ttaccgacga gtatgatgca tatctagaca tggtggacgg gtcggagagt 6060
tgcctggacc gagcgacatt caatccgtca aaactcagga gctacccgaa acagcacgct 6120
taccacgcgc cctccatcag aagcgctgta ccgtccccat tccagaacac actacagaat 6180
gtactggcag cagccacgaa aagaaactgc aacgtcacac agatgaggga attacccact 6240
ttggactccg cagtattcaa cgtggagtgt ttcaaaaaat tcgcatgcaa ccaagaatac 6300
tgggaagaat ttgctgccag ccctattagg ataacaactg agaatttagc aacctatgtt 6360
actaaactaa aagggccaaa agcagcagcg ctattcgcaa aaacccataa tctactgcca 6420
ctacaggaag taccaatgga taggttcaca gtagatatga aaagggacgt gaaggtgact 6480
cctggtacaa agcatacaga ggaaagacct aaggtgcagg ttatacaggc ggctgaaccc 6540
ttggcgacag catacctatg tgggattcac agagagctgg ttaggaggct gaacgccgtc 6600
ctcctaccca atgtacatac actatttgac atgtctgccg aggatttcga tgccatcata 6660
gccgcacact ttaagccagg agacactgtt ttggaaacgg acatagcctc ctttgataag 6720
agccaagatg attcacttgc gcttactgct ttgatgctgt tagaggattt aggggtggat 6780
cactccctgc tggacttgat agaggctgct ttcggagaga tttccagctg tcacctaccg 6840
acaggtacgc gcttcaagtt cggcgccatg atgaaatcag gtatgttcct aactctgttc 6900
gtcaacacat tgttaaacat caccatcgcc agccgagtgc tggaagatcg tctgacaaaa 6960
tccgcgtgcg cggccttcat cggcgacgac aacataatac atggagtcgt ctccgatgaa 7020
ttgatggcag ccagatgtgc cacttggatg aacatggaag tgaagatcat agatgcagtt 7080
gtatccttga aagcccctta cttttgtgga gggtttatac tgcacgatac tgtgacagga 7140

acagcttgca gagtggcaga cccgctaaaa aggcttttta aactgggcaa accgctagcg 7200
gcaggtgacg aacaagatga agatagaaga cgagcgctgg ctgacgaagt gatcagatgg 7260
caacgaacag ggctaattga tgagctggag aaagcggtat actctaggta cgaagtgcag 7320
ggtatatcag ttgtggtaat gtccatggcc acctttgcaa gctccagatc caacttcgag 7380
aagctcagag gacccgtcat aactttgtac ggcggtccta ataggtacg cactacagct 7440
acctattttg cagaagccga cagcaagtat ctaaacacta atcagctaca atggagttca 7500
tcccaaccca aacttttac aataggaggt accagcctcg accctggact ccgcgctcta 7560
ctatccaaat cattaggccc agaccgcgcc ctcagaggca agctgggcaa cttgcccagc 7620
tgatctcagc agttaataaa ctgacaatgc gcgcggtacc ccaacagaag ccacgcagga 7680
atcggaagaa taagaagcaa aagcaaaaac aacaggcgcc acaaaacaac acaaatcaaa 7740
agaagcagcc acctaaaaag aaaccggctc aaaagaaaaa gaagccgggc cgcagagaga 7800
ggatgtgcat gaaaatcgaa aatgattgta ttttcgaagt caagcacgaa ggtaaggtaa 7860
caggttacgc gtgcctggtg ggggacaaag taatgaaacc agcacacgta aaggggacca 7920
tcgataacgc ggacctggcc aaactggcct ttaagcggtc atctaagtat gaccttgaat 7980
gcgcgcagat acccgtgcac atgaagtccg acgcttcgaa gttcacccat gagaaaccgg 8040
aggggtacta caactggcac cacggagcag tacagtactc aggaggccgg ttcaccatcc 8100
ctacaggtgc tggcaaacca ggggacagcg gcagaccgat cttcgacaac aagggacgcg 8160
tggtggccat agtcttagga ggagctaatg aaggagcccg tacagccctc tcggtggtga 8220
cctggaataa agacattgtc actaaaatca cccccgaggg ggccgaagag tggagtcttg 8280
ccatcccagt tatgtgcctg ctggcaaaca ccacgttccc ctgctcccag ccccttgca 8340
cgccctgctg ctacgaaaag gaaccggagg aaaccctacg catgcttgag gacaacgtca 8400
tgagacctgg gtactatcag ctgctacagg catccttaac atgttctccc caccgccagc 8460
gacgcagcac caaggacaac ttcaatgtct ataaagccac aagaccatac ttagctcact 8520
gtcccgactg tggagaaggg cactcgtgcc atagtcccgt agcactagaa cgcatcagaa 8580
atgaagcgac agacgggacg ctgaatatcc aggtctcctt gcaaatcgga ataaagacgg 8640
atgacagcca cgattggacc aagctgcgtt atatggacaa ccacatgcca gcagacgcag 8700
agagggcggg gctatttgta agaacatcag caccgtgtac gattactgga acaatgggac 8760
acttcatcct ggcccgatgt ccaaaagggg aaactctgac ggtgggattc actgacagta 8820
ggaagattag tcattcatgt acgcacccat ttcaccacga ccctcctgtg ataggtcggg 8880
aaaaattcca ttcccgaccg cagcacggta aagagctacc ttgcagcacg tacgtgcaga 8940
gcaccgccgc aactaccgag gagatagagg tacacatgcc cccagacacc cctgatcgca 9000
cattaatgtc acaacagtcc ggcaacgtaa agatcacagt caatggccag acggtgcggt 9060
acaagtgtaa ttgcggtggc tcaaatgaag gactaacaac tacagacaaa gtgattaata 9120
actgcaaggt tgatcaatgt catgccgcgg tcaccaatca caaaaagtgg cagtataact 9180

ccctctggt cccgcgtaat gctgaacttg gggaccgaaa aggaaaaatt cacatcccgt 9240
ttccgctggc aaatgcaaca tgcagggtgc ctaaagcaag gaaccccacc gtgacgtacg 9300
ggaaaaacca agttatcatg ctactgtatc ctgaccaccc aacactcctg tcctaccgga 9360
atatgggaga agaaccaaac tatcaagaag agtgggtgat gcataagaag gaagtcgtgc 9420
taaccgtgcc gactgaaggg ctcgaggtca cgtggggcaa caacgagccg tataagtatt 9480
ggccgcagtt atctacaaac ggtacagccc atggccaccc gcatgagata attctgtatt 9540
attatgagct gtaccctact atgactgtag tagttgtgtc agtggccacg ttcatactcc 9600
tgtcgatggt gggtatggca gcggggatgt gcatgtgtgc acgacgcaga tgcatcacac 9660
cgtatgaact gacaccagga gctaccgtcc ctttcctgct tagcctaata tgctgcatca 9720
gaacagctaa agcggccaca taccaagagg ctgcgatata cctgtggaac gagcagcaac 9780
ctttgttttg gctacaagcc cttattccgc tggcagccct gattgtccta tgcaactgtc 9840
tgagactctt accatgctgc tgtaaaacgt tggctttttt agccgtaatg agcgtcggtg 9900
cccacactgt gagcgcgtac gaacacgtaa cagtgatccc gaacacggtg ggagtaccgt 9960
ataagactct agtcaataga cctggctaca gccccatggt attggagatg gaactactgt 10020
cagtcacttt ggagccaaca ctatcgcttg attacatcac gtgcgagtac aaaaccgtca 10080
tcccgtctcc gtacgtgaag tgctgcggta cagcagagtg caaggacaaa aacctacctg 10140
actacagctg taaggtcttc accggcgtct acccatttat gtggggcggc gcctactgct 10200
tctgcgacgc tgaaaacacg cagttgagcg aagcacatgt ggagaagtcc gaatcatgca 10260
aaacagaatt tgcatcagca tacagggctc ataccgcatc tgcatcagct aagctccgcg 10320
tcctttacca aggaaataac atcactgtaa ctgcctatgc aaacggcgac catgccgtca 10380
cagttaagga cgccaaattc attgtggggc caatgtcttc agcctggaca cctttcgaca 10440
acaaaattgt ggtgtacaaa ggtgacgtct ataacatgga ctacccgccc tttggcgcag 10500
gaagaccagg acaatttggc gatatccaaa gtcgcacacc tgagagtgaa gacgtctatg 10560
ctaatacaca actggtactg cagagaccgg ctgcgggtac ggtacacgtg ccatactctc 10620
aggcaccatc tggctttaag tattggctaa aagaacgcgg ggcgtcactg cagcacacag 10680
caccatttgg ctgccaaata gcaacaaacc cggtaagagc ggtgaactgc gccgtaggga 10740
acatgcccat ctccatcgac ataccggaag cggccttcac tagggtcgtc gacgcgccct 10800
ctttaacgga catgtcgtgc gaggtaccag cctgcaccca ttcctcagac tttgggggcg 10860
tcgccattat taaatatgca gccagcaaga aaggcaagtg tgcggtgcat tcgatgacta 10920
acgccgtcac tattcgggaa gctgagatag aagttgaagg gaattctcag ctgcaaatct 10980
ctttctcgac ggccttagcc agcgccgaat tccgcgtaca agtctgttct acacaagtac 11040
actgtgcagc tgagtgccac cccccgaagg accacatagt caactacccg gcgtcacata 11100
ccaccctcgg ggtccaggac atctccgcta cggcgatgtc atgggtgcag aagatcacgg 11160
gaggtgtggg actggttgtt gctgttgccg cactgattct aatcgtggtg ctatgcgtgt 11220

cgttcagcag gcac 11234

<210> 18
<211> 11234
<212> DNA
<213> Chikungunya virus

<400> 18
atggatcctg tgtacgtgga catagacgct gacagcgcct ttttgaaggc cctgcaacgt 60
gcgtacccca tgtttgaggt ggaaccaagg caggtcacac cgaatgacca tgctaatgct 120
agagcgttct cgcatctagc tataaaacta atagagcagg aaattgaccc cgactcaacc 180
atcctggata tcggcagtgc gccagcaagg aggatgatgt cggacaggaa gtaccactgc 240
gtctgcccga tgcgcagtgc ggaagatccc gagagactcg ctaattatgc gagaaagcta 300
gcatctgccg caggaaaagt cctggacaga aacatctctg gaaagatcgg ggacttacaa 360
gcagtaatgg ccgtgccaga caaggagacg ccaacattct gcttacacac agacgtctca 420
tgtagacaga gagcagacgt cgctatatac caagacgtct atgctgtaca cgcacccacg 480
tcgctatacc accaggcgat taaaggggtc caagtggcgt actgggttgg gttcgacaca 540
accccgttca tgtacaatgc catggcgggt gcctaccct catactcgac aaactgggca 600
gatgagcagg tactgaaggc taagaacata ggattatgtt caacagacct gacggaaggt 660
agacgaggca agttgtctat tatgagaggg aaaaagctaa aaccgtgcga ccgtgtgctg 720
ttctcagtag ggtcaacgct ttacccggaa agccgcaagc tacttaagag ctggcacctg 780
ccatcggtgt tccatttaaa gggcaaactc agcttcacat gccgctgtga tacagtggtt 840
tcgtgtgagg gctacgtcgt taagagaata acgatgagcc caggccttta tggaaaaacc 900
acagggtatg cggtaaccca ccacgcagac ggattcctga tgtgcaagac taccgacacg 960
gttgacggcg aaagagtgtc attctcggtg tgcacatacg tgccggcgac catttgtgat 1020
caaatgaccg gcatccttgc tacagaagtc acgccggagg atgcacagaa gctgttggtg 1080
gggctgaacc agagaatagt ggttaacggc agaacgcaac ggaatacgaa caccatgaaa 1140
aattatctgc ttcccgtggt cgcccaagcc ttcagtaagt gggcaaagga gtgccggaaa 1200
gacatggaag atgaaaaact cctgggggtc agagaaagaa cactgacctg ctgctgtcta 1260
tgggcattca agaagcagaa aacacacacg gtctacaaga ggcctgatac ccagtcaatt 1320
cagaaggttc aggccgagtt tgacagcttt gtggtaccga gtctgtggtc gtccgggttg 1380
tcaatccctt tgaggactag aatcaaatgg ttgttaagca aggtgccaaa aaccgacctg 1440
atcccataca gcggagacgc ccgagaagcc cgggacgcag aaaaagaagc agaggaagaa 1500
cgagaagcag aactgactcg cgaagcccta ctacctctac aggcagcaca ggaagatgtt 1560
caggtcgaaa tcgacgtgga acagcttgag gacagagcgg gcgcaggaat aatagagact 1620
ccgagaggag ctatcaaagt tactgcccaa ccaacagacc acgtcgtggg agagtacctg 1680
gtactctccc cgcagaccgt actacgtagc cagaagctca gtctgattca cgctttggcg 1740

gagcaagtga agacgtgcac gcacaacgga cgagcaggga ggtatgcggt cgaagcgtac 1800

gacggccgag tcctagtgcc ctcaggctat gcaatctcgc ctgaagactt ccagagtcta 1860

agcgaaagcg caacgatggt gtataacgaa agagagttcg taaacagaaa gctacaccat 1920

attgcgatgc acggaccagc cctgaacacc gacgaagagt cgtatgagct ggtgagggca 1980

gagaggacag aacacgagta cgtctacgac gtggatcaga gaagatgctg taagaaggaa 2040

gaagccgcag gactggtact ggtgggcgac ttgactaatc cgccctacca cgaattcgca 2100

tatgaagggc taaaaatccg ccctgcctgc ccatacaaaa ttgcagtcat aggagtcttc 2160

ggagtaccgg gatctggcaa gtcagctatt atcaagaacc tagttaccag gcaggacctg 2220

gtgactagtg gaaagaaaga aaactgccaa gaaatcacca ccgacgtgat gagacagaga 2280

ggtctagaga tatctgcacg tacggttgac tcgctgctct tgaatggatg caacagacca 2340

gtcgacgtgt tgtacgtaga cgaggcgttt gcgtgccact ctggaacgct acttgctttg 2400

atcgccttgg tgagaccaag gcagaaagtt gtactttgtg gtgacccgaa gcagtgcggc 2460

ttcttcaata tgatgcagat gaaagtcaac tacaatcaca acatctgcac ccaagtgtac 2520

cacaaaagta tctccaggcg gtgtacactg cctgtgaccg ccattgtgtc atcgttgcat 2580

tacgaaggca aaatgcgcac tacgaatgag tacaacaagc cgattgtagt ggacactaca 2640

ggctcaacaa aacctgaccc tggagacctc gtgttaacgt gcttcagagg gtgggttaaa 2700

caactgcaaa ttgactatcg tggatacgag gtcatgacag cagccgcatc ccaagggtta 2760

accagaaaag gagtttacgc agttagacaa aaagttaatg aaaacccgct ctatgcatca 2820

acgtcagagc acgtcaacgt actcctaacg cgtacggaag gtaaactggt atggaagaca 2880

ctttccggcg acccgtggat aaagacgctg cagaacccac cgaaaggaaa cttcaaagca 2940

actattaagg agtgggaggt ggagcatgca tcaataatgg cgggcatctg cagtcaccaa 3000

atgaccttcg atacattcca aaataaagcc aacgtttgtt gggctaagag cttggtccct 3060

atcctcgaaa cagcggggat aaaactaaat gataggcagt ggtctcagat aattcaagcc 3120

ttcaaagaag acaaagcata ctcacctgaa gtagccctga atgaaatatg tacgcgcatg 3180

tatggggtgg atctagacag cgggctattt tctaaaccgt tggtgtctgt gtattacgcg 3240

gataaccact gggataatag gcctggaggg aaaatgttcg gatttaaccc cgaggcagca 3300

tccattctag aaagaaagta tccattcaca aaagggaagt ggaacatcaa caagcagatc 3360

tgcgtgacta ccaggaggat agaagacttt aaccctacca ccaacatcat accggccaac 3420

aggagactac cacactcatt agtggccgaa caccgcccag taaaagggga aagaatggaa 3480

tggctggtta acaagataaa cggccaccac gtgctcctgg tcagtggcta taaccttgca 3540

ctgcctacta agagagtcac ttgggtagcg ccgttaggtg tccgcggagc ggactacaca 3600

tacaacctag agttgggtct gccagcaacg cttggtaggt atgaccttgt ggtcataaac 3660

atccacacac cttttcgcat acaccattac caacagtgcg tcgaccacgc aatgaaactg 3720

caaatgctcg ggggtgactc attgagactg ctcaaaccgg gcggctctct attgatcaga 3780

gcatatggtt acgcagatag aaccagtgaa cgagtcatct gcgtattggg acgcaagttt 3840

agatcgtcta gagcgttgaa accaccatgt gtcaccagca acactgagat gtttttcctа 3900

ttcagcaact ttgacaatgg cagaaggaat ttcacaactc atgtcatgaa caatcaactg 3960

aatgcagcct tcgtaggaca ggtcacccga gcaggatgtg caccgtcgta ccgggtaaaa 4020

cgcatggaca tcgcgaagaa cgatgaagag tgcgtagtca acgccgctaa ccctcgcggg 4080

ttaccgggtg acggtgtttg caaggcagta tacaaaaaat ggccggagtc ctttaagaac 4140

agtgcaacac cagtgggaac cgcaaaaaca gttatgtgcg gtacgtatcc agtaatccac 4200

gctgttggac caaacttctc taattattcg gagtctgaag gggaccggga attggcagct 4260

gcctatcgag aagtcgcaaa ggaagtaact aggctgggag taaatagtgt agctatacct 4320

ctcctctcca caggtgtata ctcaggaggg aaagacaggc tgacccagtc actgaaccac 4380

ctctttacag ccatggactc gacggatgca gacgtggtca tctactgccg cgacaaagaa 4440

tgggagaaga aaatatctga ggccatacag atgcggaccc aagtagagct gctggatgag 4500

cacatctcca tagactgcga tattgttcgc gtgcaccctg acagcagctt ggcaggcaga 4560

aaaggataca gcaccacgga aggcgcactg tactcatatc tagaagggac ccgttttcat 4620

cagacggctg tggatatggc ggagatacat actatgtggc caaagcaaac agaggccaat 4680

gagcaagtct gcctatatgc cctgggggaa agtattgaat cgatcaggca gaaatgcccg 4740

gtggatgatg cagacgcatc atctcccccc aaaactgtcc cgtgcctttg ccgttacgct 4800

atgactccag aacgcgtcac ccggcttcgc atgaatcacg tcacaagcat aattgtgtgt 4860

tcttcgtttc ccctcccaaa gtacaaaata gaaggagtgc aaaaagtcaa atgctctaag 4920

gtaatgctat ttgaccacaa cgtgccatcg cgcgtaagtc caagggaata tagatcttcc 4980

caggagtctg cacaggaggc gagtacaatc acgtcactga cgcatagtca attcgaccta 5040

agcgttgatg gcgagatact gcccgtcccg tcagacctgg atgctgacgc cccagcccta 5100

gaaccagcac tagacgacgg ggcgacacac acgctgccat ccacaaccgg aaaccttgcg 5160

gccgtgtctg actgggtaat gagcaccgta cctgtcgcgc cgcccagaag aaggcgaggg 5220

agaaacctga ctgtgacatg tgacgagaga gaagggaata taacacccat ggctagcgtc 5280

cgattcttta gggcagagct gtgtccggtc gtacaagaaa cagcggagac gcgtgacaca 5340

gcaatgtctc ttcaggcacc accgagtacc gccacggaac cgaatcatcc gccgatctcc 5400

ttcggagcat caagcgagac gttccccatt acatttgggg acttcaacga aggagaaatc 5460

gaaagcttgt cttctgagct actaactttc ggagacttct taccaggaga agtggatgac 5520

ttgacagaca gcgactggtc cacgtgctca gacacggacg acgagttatg actagacagg 5580

gcaggtgggt atatattctc gtcggacacc ggtccaggtc atttacaaca gaagtcagta 5640

cgccagtcag tgctgccggt gaacaccctg gaggaagtcc acgaggagaa gtgttaccca 5700

cctaagctgg atgaagcaaa ggagcaacta ttacttaaga aactccagga gagtgcatcc 5760

atggccaaca gaagcaggta tcagtcgcgc aaagtagaaa acatgaaagc agcaatcatc 5820

cagagactaa agagaggctg tagactatac ttaatgtcag agaccccaaa agtccctact 5880

taccggacta catatccggc gcctgtgtac tcgcctccga tcaacgtccg attgtccaat 5940

cccgagtccg cagtggcagc atgcaatgag ttcttagcta gaaactatcc aactgtctca 6000

tcataccaaa ttaccgacga gtatgatgca tatctagaca tggtggacgg gtcggagagt 6060

tgcctggacc gagcgacatt caatccgtca aaactcagga gctacccgaa acagcacgct 6120

taccacgcgc cctccatcag aagcgctgta ccgtccccat tccagaacac actacagaat 6180

gtactggcag cagccacgaa aagaaactgc aacgtcacac agatgaggga attacccact 6240

ttggactccg cagtattcaa cgtggagtgt ttcaaaaaat tcgcatgcaa ccaagaatac 6300

tgggaagaat ttgctgccag ccctattagg ataacaactg agaatttagc aacttatgtt 6360

actaaactaa aagggccaaa agcagcagcg ctattcgcaa aaacccataa tctactgcca 6420

ctacaggaag taccaatgga taggttcaca gtagatatga aaagggacgt gaaggtgact 6480

cctggtacaa agcatacaga ggaaagacct aaggtgcagg ttatacaggc ggctgaaccc 6540

ttggcgacag catacctatg tgggattcac agagagctgg ttaggaggct gaacgccgtc 6600

ctcctaccca atgtacatac actatttgac atgtctgccg aggatttcga tgccatcata 6660

gccgcacact ttaagccagg agacactgtt ttggaaacgg acatagcctc ctttgataag 6720

agccaagatg attcacttgc gcttactgct ttgatgctgt tagaggattt aggggtggat 6780

cactccctgc tggacttgat agaggctgct ttcggagaga tttccagctg tcacctaccg 6840

acaggtacgc gcttcaagtt cggcgccatg atgaaatcag gtatgttcct aactctgttc 6900

gtcaacacat tgttaaacat caccatcgcc agccgagtgc tggaagatcg tctgacaaaa 6960

tccgcgtgcg cggccttcat cggcgacgac aacataatac atggagtcgt ctccgatgaa 7020

ttgatggcag ccagatgtgc cacttggatg aacatggaag tgaagatcat agatgcagtt 7080

gtatccttga aagcccctta cttttgtgga gggtttatac tgcacgatac tgtgacagga 7140

acagcttgca gagtggcaga cccgctaaaa aggcttttta aactgggcaa accgctagcg 7200

gcaggtgacg aacaagatga agatagaaga cgagcgctgg ctgacgaagt gatcagatgg 7260

caacgaacag ggctaattga tgagctggag aaagcggtat actctaggta cgaagtgcag 7320

ggtatatcag ttgtggtaat gtccatggcc acctttgcaa gctccagatc caacttcgag 7380

aagctcagag gacccgtcat aactttgtac ggcggtccta aataggtacg cactacagct 7440

acctattttg cagaagccga cagcaagtat ctaaacacta atcagctaca atggagttca 7500

tcccaaccca aacttttac aataggaggt accagcctcg accctggact ccgcgctcta 7560

ctatccaaat cattaggccc agaccgcgcc ctcagaggca agctgggcaa cttgcccagc 7620

tgatctcagc agttaataaa ctgacaatgc gcgcggtacc ccaacagaag ccacgcagga 7680

atcggaagaa taagaagcaa aagcaaaaac aacaggcgcc acaaaacaac acaaatcaaa 7740

agaagcagcc acctaaaaag aaaccggctc aaaagaaaaa gaagccgggc cgcagagaga 7800

ggatgtgcat gaaaatcgaa aatgattgta ttttcgaagt caagcacgaa ggtaaggtaa 7860

caggttacgc gtgcctggtg ggggacaaag taatgaaacc agcacacgta aaggggacca 7920

tcgataacgc ggacctggcc aaactggcct ttaagcggtc atctaagtat gaccttgaat 7980

gcgcgcagat acccgtgcac atgaagtccg acgcttcgaa gttcacccat gagaaaccgg 8040

aggggtacta caactggcac cacggagcag tacagtactc aggaggccgg ttcaccatcc 8100

ctacaggtgc tggcaaacca ggggacagcg gcagaccgat cttcgacaac aagggacgcg 8160

tggtggccat agtcttagga ggagttaatg aaggagcccg tacagccctc tcggtggtga 8220

cctggaataa agacattgtc actaaaatca cccccgaggg ggccgaagag tggagtcttg 8280

ccatcccagt tatgtgcctg ctggcaaaca ccacgttccc ctgctcccag ccccccttgca 8340

cgccctgctg ctacgaaaag gaaccggagg aaaccctacg catgcttgag gacaacgtca 8400

tgagacctgg gtactatcag ctgctacagg catccttaac atgttctccc caccgccagc 8460

gacgcagcac caaggacaac ttcaatgtct ataaagccac aagaccatac ttagctcact 8520

gtcccgactg tggagaaggg cactcgtgcc atagtcccgt agcactagaa cgcatcagaa 8580

atgaagcgac agacgggacg ctgaaaatcc aggtctcctt gcaaatcgga ataaagacgg 8640

atgacagcca cgattggacc aagctgcgtt atatggacaa ccacatgcca gcagacgcag 8700

agagggcggg gctatttgta agaacatcag caccgtgtac gattactgga acaatgggac 8760

acttcatcct ggcccgatgt ccaaaagggg aaactctgac ggtgggattc actgacagta 8820

ggaagattag tcattcatgt acgcacccat ttcaccacga ccctcctgtg ataggtcggg 8880

aaaaattcca ttcccgaccg cagcacggta aagagctacc ttgcagcacg tacgtgcaga 8940

gcaccgccgc aactaccgag gagatagagg tacacatgcc cccagacacc cctgatcgca 9000

cattaatgtc acaacagtcc ggcaacgtaa agatcacagt caatggccag acggtgcggt 9060

acaagtgtaa ttgcggtggc tcaaatgaag gactaacaac tacagacaaa gtgattaata 9120

actgcaaggt tgatcaatgt catgccgcgg tcaccaatca caaaaagtgg cagtataact 9180

cccctctggt cccgcgtaat gctgaacttg gggaccgaaa aggaaaaatt cacatcccgt 9240

ttccgctggc aaatgcaaca tgcagggtgc ctaaagcaag gaaccccacc gtgacgtacg 9300

ggaaaaacca agtcatcatg ctactgtatc ctgaccaccc aacactcctg tcctaccgga 9360

atatgggaga agaaccaaac tatcaagaag agtgggtgat gcataagaag gaagtcgtgc 9420

taaccgtgcc gactgaaggg ctcgaggtca cgtggggcaa caacgagccg tataagtatt 9480

ggccgcagtt atctacaaac ggtacagccc atggccaccc gcatgagata attctgtatt 9540

attatgagct gtaccctact atgactgtag tagttgtgtc agtggccacg ttcatactcc 9600

tgtcgatggt gggtatggca gcggggatgt gcatgtgtgc acgacgcaga tgcatcacac 9660

cgtatgaact gacaccagga gctaccgtcc ctttcctgct tagcctaata tgctgcatca 9720

gaacagctaa agcggccaca taccaagagg ctgcgatata cctgtggaac gagcagcaac 9780

ctttgttttg gctacaagcc cttattccgc tggcagccct gattgttcta tgcaactgtc 9840

tgagactctt accatgctgc tgtaaaacgc tggctttttt agccgtaatg agcgtcggtg 9900

cccacactgt gagcgcgtac gaacacgtaa cagtgatccc gaacacggtg ggagtaccgt 9960

ataagactct agtcaataga cctggctaca gccccatggt attggagatg gaactactgt 10020

cagtcacttt ggagccaaca ctatcgcttg attacatcac gtgcgagtac aaaaccgtca 10080

tcccgtctcc gtacgtgaag tgctgcggta cagcagagtg caaggacaaa aacctacctg 10140

actacagctg taaggtcttc accggcgtct acccatttat gtggggcggc gcctactgct 10200

tctgcgacgc tgaaaacacg cagttgagcg aagcacatgt ggagaagtcc gaatcatgca 10260

aaacagaatt tgcatcagca tacagggcgc ataccgcatc tgcatcagct aagctccgcg 10320

tcctttacca aggaaataac atcactgtaa ctgcctatgc aaacggcgac catgccgtca 10380

cagttaagga cgccaaattc attgtggggc caatgtcttc agcctggaca cctttcgaca 10440

acaaaattgt ggtgtacaaa ggtgacgtct ataacatgga ctacccgccc tttggcgcac 10500

gaagaccagg acaatttggc gatatccaaa gtcgcacacc tgagagtgaa gacgtctatg 10560

ctaatacaca actggtactg cagagaccgg ctgcgggtac ggtacacgtg ccatactctc 10620

aggcaccatc tggctttaag tattggctaa aagaacgcgg ggcgtcactg cagcacacag 10680

caccatttgg ctgccaaata gcaacaaacc cggtaagagc ggtgaactgc gccgtaggga 10740

acatgcccat ctccatcgac ataccggaag cggccttcac tagggtcgtc gacgcgccct 10800

ctttaacgga catgtcgtgc gaggtaccag cctgcaccca ttcctcagac tttgggggcg 10860

tcgccattat taaatatgca gccagcaaga aaggcaagtg tgcggtgcat tcgatgacta 10920

acgccgtcac tattcgggaa gctgagatag aagttgaagg gaattctcag ctgcaaatct 10980

ctttctcgac ggccttagcc agcgccgaat tccgcgtaca agtctgttct acacaagtac 11040

actgtgcagc tgagtgccac cccccgaagg accacatagt caactacccg gcgtcacata 11100

ccaccctcgg ggtccaggac atctccgcta cggcgatgtc atgggtgcag aagatcacgg 11160

gaggtgtggg actggttgtt gctgttgccg cactgattct aatcgtggtg ctatgcgtgt 11220

cgttcagcag gcac 11234

<210> 19
<211> 11234
<212> DNA
<213> Chikungunya virus

<400> 19
atggatcctg tgtacgtgga catagacgct gacagcgcct ttttgaaggc cctgcaacgt 60

gcgtacccca tgtttgaggt ggaaccaagg caggtcacac cgaatgacca tgctaatgct 120

agagcgttct cgcatctagc tataaaacta atagagcagg aaattgaccc cgactcaacc 180

atcctggata tcggcagtgc gccagcaagg aggatgatgt cggacaggaa gtaccactgc 240

gtctgcccga tgcgcagtgc ggaagatccc gagagactcg ctaattatgc gagaaagcta 300

gcatctgccg caggaaaagt cctggacaga aacatctctg gaaagatcgg ggacttacaa 360

gcagtaatgg ccgtgccaga caaggagacg ccaacattct gcttacacac agacgtctca 420

tgtagacaga gagcagacgt cgctatatac caagacgtct atgctgtaca cgcacccacg 480

tcgctatacc accaggcgat taaaggggtc cgagtggcgt actgggttgg gttcgacaca 540

accccgttca tgtacaatgc catggcgggt gcctaccct catactcgac aaactgggca 600

gatgagcagg tactgaaggc taagaacata ggattatgtt caacagacct gacggaaggt 660

agacgaggca agttgtctat tatgagaggg aaaaagctaa aaccgtgcga cagtgtgctg 720

ttctcagtag ggtcaacgct ttacccggaa agccgcaagc tacttaagag ctggcacctg 780

ccatcggtgt tccatttaaa gggcaaactc agcttcacat gccgctgtga tacagtggtt 840

tcgtgtgagg gctacgtcgt taagagaata acgatgagcc caggccttta tggaaaaacc 900

acagggtatg cggtaaccca ccacgcagac ggattcctga tgtgcaagac taccgacacg 960

gttgacggcg aaagagtgtc attctcggtg tgcacatacg tgccggcgac catttgtgat 1020

caaatgaccg gcatccttgc tacagaagtc acgccggagg atgcacagaa gctgttggtg 1080

gggctgaacc agagaatagt ggttaacggc agaacgcaac ggaatacgaa caccatgaaa 1140

aattatctgc ttcccgtggt cgcccaagcc ttcagtaagt gggcaaagga gtgccggaaa 1200

gacatggaag atgaaaaact cctgggggtc agagaaagaa cactgacctg ctgctgtcta 1260

tgggcattca agaagcagaa aacacacacg gtctacaaga ggcctgatac ccagtcaatt 1320

cagaaggttc aggccgagtt tgacagcttt gtggtaccga gtctgtggtc gtccgggttg 1380

tcaatccctt tgaggactag aatcaaatgg ttgttaagca aggtgccaaa aaccgacctg 1440

atcccataca gcggagacgc ccgagaagcc cgggacgcag aaaaagaagc agaggaagaa 1500

cgagaagcag aactgactcg cgaagcccta ctacctctac aggcagcaca ggaagatgtt 1560

caggtcgaaa tcgacgtgga acagcttgag gacagagcgg gcgcaggaat aatagagact 1620

ccgagaggag ctatcaaagt tactgcccaa ccaacagacc acgtcgtggg agagtacctg 1680

gtactctccc cgcagaccgt actacgtagc cagaagctca gtctgattca cgctttggcg 1740

gagcaagtga agacgtgcac gcacaacgga cgagcaggga ggtatgcggt cgaagcgtac 1800

gacggccgag tcctagtgcc ctcaggctat gcaatctcgc ctgaagactt ccagagtcta 1860

agcgaaagcg caacgatggt gtataacgaa agagagttcg taaacagaaa gctacaccat 1920

attgcgatgc acggaccagc cctgaacacc gacgaagagt cgtatgagct ggtgagggca 1980

gagaggacag aacacgagta cgtctacgac gtggatcaga gaagatgctg taagaaggaa 2040

gaagccgcag gactggtact ggtgggcgac ttgactaatc cgccctacca cgaattcgca 2100

tatgaagggc taaaaatccg ccctgcctgc ccatacaaaa ttgcagtcat aggagtcttc 2160

ggagtaccgg gatctggcaa gtcagctatt atcaagaacc tagttaccag gcaggacctg 2220

gtgactagtg gaaagaaaga aaactgccaa gaaatcacca ccgacgtgat gagacagaga 2280

ggtctagaga tatctgcacg tacggttgac tcgctgctct tgaatggatg caacagacca 2340

gtcgacgtgt tgtacgtaga cgaggcgttt gcgtgccact ctggaacgct acttgctttg 2400

atcgccttgg tgagaccaag gcagaaagtt gtactttgtg gtgacccgaa gcagtgcggc 2460

ttcttcaata tgatgcagat gaaagtcaac tacaatcaca acatctgcac ccaagtgtac 2520

cacaaaagta tctccaggcg gtgtacactg cctgtgaccg ccattgtgtc atcgttgcat 2580
tacgaaggca aaatgcgcac tacgaatgag tacaacaagc cgattgtagt ggacactaca 2640
ggctcaacaa aacctgaccc tggagacctc gtgttaacgt gcttcagagg gtgggttaaa 2700
caactgcaaa ttgactatcg tggatacgag gtcatgacag cagccgcatc ccaagggtta 2760
accagaaaag gagtttacgc agttagacaa aaagttaatg aaaacccgct ctatgcatca 2820
acgtcagagc acgtcaacgt actcctaacg cgtacggaag gtaaactggt atggaagaca 2880
ctttccggcg acccgtggat aaagacgctg cagaacccac cgaaaggaaa cttcaaagca 2940
actattaagg agtgggaggt ggagcatgca tcaataatgg cgggcatctg cagtcaccaa 3000
atgaccttcg atacattcca aaataaagcc aacgtttgtt gggctaagag cttggtccct 3060
atcctcgaaa cagcggggat aaaactaaat gataggcagt ggtctcagat aattcaagcc 3120
ttcaaagaag acaaagcata ctcacctgaa gtagccctga atgaaatatg tacgcgcatg 3180
tatggggtgg atctagacag cgggctattt tctaaaccgt tggtgtctgt gtattacgcg 3240
gataaccact gggataatag gcctggaggg aaaatgttcg gatttaaccc cgaggcagca 3300
tccattctag aaagaaagta tccattcaca aaagggaagt ggaacatcaa caagcagatc 3360
tgcgtgacta ccaggaggat agaagacttt aaccctacca ccaacatcat accggccaac 3420
aggagactac cacactcatt agtggccgaa caccgcccag taaaagggga aagaatggaa 3480
tggctggtta acaagataaa cggccaccac gtgctcctgg tcagtggcta taaccttgca 3540
ctgcctacta agagagtcac ttgggtagcg ccgttaggtg tccgcggagc ggactacaca 3600
tacaacctag agttgggtct gccagcaacg cttggtaggt atgaccttgt ggtcataaac 3660
atccacacac cttttcgcat acaccattac caacagtgcg tcgaccacgc aatgaaactg 3720
caaatgctcg ggggtgactc attgagactg ctcaaaccgg gcggctctct attgatcaga 3780
gcatatggtt acgcagatag aaccagtgaa cgagtcatct gcgtattggg acgcaagttt 3840
agatcgtcta gagcgttgaa accaccatgt gtcaccagca acactgagat gtttttccta 3900
ttcagcaact ttgacaatgg cagaaggaat ttcacaactc atgtcatgaa caatcaactg 3960
aatgcagcct tcgtaggaca ggtcacccga gcaggatgtg caccgtcgta ccgggtaaaa 4020
cgcatggaca tcgcgaagaa cgatgaagag tgcgtagtca acgccgctaa ccctcgcggg 4080
ttaccgggtg acggtgtttg caaggcagta tacaaaaaat ggccggagtc ctttaagaac 4140
agtgcaacac cagtgggaac cgcaaaaaca gttatgtgcg gtacgtatcc agtaatccac 4200
gctgttggac caaacttctc taattattcg gagtctgaag gggaccggga attggcagct 4260
gcctatcgag aagtcgcaaa ggaagtaact aggctgggag taaatagtgt agctatacct 4320
ctcctctcca caggtgtata ctcaggaggg aaagacaggc tgacccagtc actgaaccac 4380
ctctttacag ccatggactc gacggatgca gacgtggtca tctactgccg cgacaaagaa 4440
tgggagaaga aaatatctga ggccatacag atgcggaccc aagtagagct gctggatgag 4500
cacatctcca tagactgcga tattgttcgc gtgcaccctg acagcagctt ggcaggcaga 4560

aaaggataca gcaccacgga aggcgcactg tactcatatc tagaagggac ccgttttcat 4620
cagacggctg tggatatggc ggagatacat actatgtggc caaagcaaac agaggccaat 4680
gagcaagtct gcctatatgc cctgggggaa agtattgaat cgatcaggca gaaatgcccg 4740
gtggatgatg cagacgcatc atctcccccc aaaactgtcc cgtgcctttg ccgttacgct 4800
atgactccag aacgcgtcac ccggcttcgc atgaatcacg tcacaagcat aattgtgtgt 4860
tcttcgtttc ccctcccaaa gtacaaaata gaaggagtgc aaaaagtcaa atgctctaag 4920
gtaatgctat ttgaccacaa cgtgccatcg cgcgtaagtc caagggaata tagatcttcc 4980
caggagtctg cacaggaggc gagtacaatc acgtcactga cgcatagtca attcgaccta 5040
agcgttgatg gcgagatact gcccgtcccg tcagacctgg atgctgacgc cccagcccta 5100
gaaccagcac tagacgacgg ggcgacacac acgctgccat ccacaaccgg aaaccttgcg 5160
gccgtgtctg actgggtaat gagcaccgta cctgtcgcgc cgcccagaag aaggcgaggg 5220
agaaacctga ctgtgacatg tgacgagaga gaagggaata taacacccat ggctagcgtc 5280
cgattcttta gggcagagct gtgtccggtc gtacaagaaa cagcggagac gcgtgacaca 5340
gcaatgtctc ttcaggcacc accgagtacc gccacggaac cgaatcatcc gccgatctcc 5400
ttcggagcat caagcgagac gttccccatt acatttgggg acttcaacga aggagaaatc 5460
gaaagcttgt cttctgagct actaactttc ggagacttct taccaggaga agtggatgac 5520
ttgacagaca gcgactggtc cacgtgctca gacacggacg acgagttatg actagacagg 5580
gcaggtgggt atatattctc gtcggacacc ggtccaggtc atttacaaca gaagtcagta 5640
cgccagtcag tgctgccggt gaacaccctg gaggaagtcc acgaggagaa gtgttaccca 5700
cctaagctgg atgaagcaaa ggagcaacta ttacttaaga aactccagga gagtgcatcc 5760
atggccaaca gaagcaggta tcagtcgcgc aaagtagaaa acatgaaagc agcaatcatc 5820
cagagactaa agagaggctg tagactatac ttaatgtcag agaccccaaa agtccctact 5880
taccggacta catatccggc gcctgtgtac tcgcctccga tcaacgtccg attgtccaat 5940
cccgagtccg cagtggcagc atgcaatgag ttcttagcta gaaactatcc aactgtctca 6000
tcataccaaa ttaccgacga gtatgatgca tatctagaca tggtggacgg gtcggagagt 6060
tgcctggacc gagcgacatt caatccgtca aaactcagga gctacccgaa acagcacgct 6120
taccacgcgc cctccatcag aagcgctgta ccgtccccat tccagaacac actacagaat 6180
gtactggcag cagccacgaa aagaaactgc aacgtcacac agatgaggga attacccact 6240
ttggactccg cagtattcaa cgtggagtgt ttcaaaaaat tcgcatgcaa ccaagaatac 6300
tgggaagaat ttgctgccag ccctattagg ataacaactg agaatttagc aacttatgtt 6360
actaaactaa aagggccaaa agcagcagcg ctattcgcaa aaacccataa tctactgcca 6420
ctacaggaag taccaatgga taggttcaca gtagatatga aaagggacgt gaaggtgact 6480
cctggtacaa agcatacaga ggaaagacct aaggtgcagg ttatacaggc ggctgaaccc 6540
ttggcgacag catacctatg tgggattcac agagagctgg ttaggaggct gaacgccgtc 6600

ctcctaccca atgtacatac actatttgac atgtctgccg aggatttcga tgccatcata 6660
gccgcacact ttaagccagg agacactgtt ttggaaacgg acatagcctc ctttgataag 6720
agccaagatg attcacttgc gcttactgct ttgatgctgt tagaggattt aggggtggat 6780
cactccctgc tggacttgat agaggctgct ttcggagaga tttccagctg tcacctaccg 6840
acaggtacgc gcttcaagtt cggcgccatg atgaaatcag gtatgttcct aactctgttc 6900
gtcaacacat tgttaaacat caccatcgcc agccgagtgc tggaagatcg tctgacaaaa 6960
tccgcgtgcg cggccttcat cggcgacgac aacataatac atggagtcgt ctccgatgaa 7020
ttgatggcag ccagatgtgc cacttggatg aacatggaag tgaagatcat agatgcagtt 7080
gtatccttga aagcccctta cttttgtgga gggtttatac tgcacgatac tgtgacagga 7140
acagcttgca gagtggcaga cccgctaaaa aggcttttta aactgggcaa accgctagcg 7200
gcaggtgacg aacaagatga agatagaaga cgagcgctgg ctgacgaagt gatcagatgg 7260
caacgaacag ggctaattga tgagctggag aaagcggtat actctaggta cgaagtgcag 7320
ggtatatcag ttgtggtaat gtccatggcc acctttgcaa gctccagatc caacttcgag 7380
aagctcagag gacccgtcat aactttgtac ggcggtccta aataggtacg cactacagct 7440
acctattttg cagaagccga cagcaagtat ctaaacacta atcagctaca atggagttca 7500
tcccaaccca aacttttac aataggaggt accagcctcg accctggact ccgcgctcta 7560
ctatccaaat cattaggccc agaccgcgcc ctcagaggca agctgggcaa cttgcccagc 7620
tgatctcagc agttaataaa ctgacaatgc gcgcggtacc ccaacagaag ccacgcagga 7680
atcggaagaa taagaagcaa aagcaaaaac aacaggcgcc acaaaacaac acaaatcaaa 7740
agaagcagcc acctaaaaag aaaccggctc aaaagaaaaa gaagccgggc cgcagagaga 7800
ggatgtgcat gaaaatcgaa aatgattgta ttttcgaagt caagcacgaa ggtaaggtaa 7860
caggttacgc gtgcctggtg ggggacaaag taatgaaacc agcacacgta aaggggacca 7920
tcgataacgc ggacctggcc aaactggcct ttaagcggtc atctaagtat gaccttgaat 7980
gcgcgcagat acccgtgcac atgaagtccg acgcttcgaa gttcacccat gagaaaccgg 8040
aggggtacta caactggcac cacggggcag tacagtactc aggaggccgg ttcaccatcc 8100
ctacaggtgc tggcaaacca ggggacagcg gcagaccgat cttcgacaac aagggacgcg 8160
tggtggccat agtcttagga ggagctaatg aaggagcccg tacagccctc tcggtggtga 8220
cctggaataa agacattgtc actaaaatca cccccgaggg ggccgaagag tggagtcttg 8280
ccatcccagt tatgtgcctg ctggcaaaca ccacgttccc ctgctcccag ccccttgca 8340
cgccctgctg ctacgaaaag gaaccggagg aaaccctacg catgcttgag gacaacgtca 8400
tgagacctgg gtactatcag ctgctacagg catccttaac atgttctccc caccgccagc 8460
gacgcagcac caaggacaac ttcaatgtct ataaagccac aagaccatac ttagctcact 8520
gtcccgactg tggagaaggg cactcgtgcc atagtcccgt agcactagaa cgcatcagaa 8580
atgaagcgac agacgggacg ctgaaaatcc aggtctcctt gcaaatcgga ataaagacgg 8640

atgacagcca cgattggacc gagctgcgtt atatggacaa ccacatgcca gcagacgcag 8700
agagggcggg gctatttgta agaacatcag caccgtgtac gattactgga acaatgggac 8760
acttcatcct ggcccgatgt ccaaaagggg aaactctgac ggtgggattc actgacagta 8820
ggaagattag tcattcatgt acgcacccat ttcaccacga ccctcctgtg ataggtcggg 8880
aaaaattcca ttcccgaccg cagcacggta aagagctacc ttgcagcacg tacgtgcaga 8940
gcaccgccgc aactaccgag gagatagagg tacacatgcc cccagacacc cctgatcgca 9000
cattaatgtc acaacagtcc ggcaacgtaa agatcacagt caatggccag acggtgcggt 9060
acaagtgtaa ttgcggtggc tcaaatgaag gactaacaac tacagacaaa gtgattaata 9120
actgcaaggt tgatcaatgt catgccgcgg tcaccaatca caaaaagtgg cagtataact 9180
cccctctggt cccgcgtaat gctgaacttg gggaccgaaa aggaaaaatt cacatcccgt 9240
ttccgctggc aaatgcaaca tgcagggtgc ctaaagcaag gaaccccacc gtgacgtacg 9300
ggaaaaacca agtcatcatg ctactgtatc ctgaccaccc aacactcctg tcctaccgga 9360
atatgggaga agaaccaaac tatcaagaag agtgggtgat gcataagaag gaagtcgtgc 9420
taaccgtgcc gactgaaggg ctcgaggtca cgtggggcaa caacgagccg tataagtatt 9480
ggccgcagtt atctacaaac ggtacagccc atggccaccc gcatgagata attctgtatt 9540
attatgagct gtaccctact atgactgtag tagttgtgtc agtggccacg ttcatactcc 9600
tgtcgatggt gggtatggca gcggggatgt gcatgtgtgc acgacgcaga tgcatcacac 9660
cgtatgaact gacaccagga gctaccgtcc ctttcctgct tagcctaata tgctgcatca 9720
gaacagctaa agcggccaca taccaagagg ctgcgatata cctgtggaac gagcagcaac 9780
ctttgttttg gctacaagcc cttattccgc tggcagccct gattgttcta tgcaactgtc 9840
tgagactctt accatgctgc tgtaaaacgc tggctttttt agccgtaatg agcgtcggtg 9900
cccacactgt gagcgcgtac gaacacgtaa cagtgatccc gaacacggtg ggagtaccgt 9960
ataagactct agtcaataga cctggctaca gccccatggt attggagatg gaactactgt 10020
cagtcacttt ggagccaaca ctatcgcttg attacatcac gtgcgagtac aaaaccgtca 10080
tcccgtctcc gtacgtgaag tgctgcggta cagcagagtg caaggacaaa aacctacctg 10140
actacagctg taaggtcttc accggcgtct acccatttat gtggggcggc gcctactgct 10200
tctgcgacgc tgaaaacacg cagttgagcg aagcacatgt ggagaagtcc gaatcatgca 10260
aaacagaatt tgcatcagca tacagggcgc ataccgcatc tgcatcagct aagctccgcg 10320
tcctttacca aggaaataac atcactgtaa ctgcctatgc aaacggcgac catgccgtca 10380
cagttaagga cgccaaattc attgtggggc caatgtcttc agcctggaca cctttcgaca 10440
acaaaattgt ggtgtacaaa ggtgacgtct ataacatgga ctacccgccc tttggcgcag 10500
gaagaccagg acaatttggc gatatccaaa gtcgcacacc tgagagtgaa gacgtctatg 10560
ctaatacaca actggtactg cagagaccgg ctgcgggtac ggtacacgtg ccatactctc 10620
aggcaccatc tggctttaag tattggctaa aagaacgcgg ggcgtcactg cagcacacag 10680

caccatttgg ctgccaaata gcaacaaacc cggtaagagc ggtgaactgc gccgtaggga 10740

acatgcccat ctccatcgac ataccggaag cggccttcac tagggtcgtc gacgcgccct 10800

ctttaacgga catgtcgtgc gaggtaccag cctgcaccca ttcctcagac tttgggggcg 10860

tcgccattat taaatatgca gccagcaaga aaggcaagtg tgcggtgcat tcgatgacta 10920

acgccgtcac tattcgggaa gctgagatag aagttgaagg gaattctcag ctgcaaatct 10980

ctttctcgac ggccttagcc agcgccgaat tccgcgtaca agtctgttct acacaagtac 11040

actgtgcagc tgagtgccac cccccgaagg accacatagt caactacccg gcgtcacata 11100

ccaccctcgg ggtccaggac atctccgcta cggcgatgtc atgggtgcag aagatcacgg 11160

gaggtgtggg actggttgtt gctgttgccg cactgattct aatcgtggtg ctatgcgtgt 11220

cgttcagcag gcac 11234

<210> 20
<211> 11234
<212> DNA
<213> Chikungunya virus

<400> 20
atggatcctg tgtacgtgga catagacgct gacagcgcct ttttgaaggc cctgcaacgt 60

gcgtacccca tgtttgaggt ggaaccaagg caggtcacac cgaatgacca tgctaatgct 120

agagcgttct cgcatctagc tataaaacta atagagcagg aaattgaccc cgactcaacc 180

atcctggata tcggcagtgc gccagcaagg aggatgatgt cggacaggaa gtaccactgc 240

gtctgcccga tgcgcagtgc ggaagatccc gagagactcg ctaattatgc gagaaagcta 300

gcatctgccg caggaaaagt cctggacaga aacatctctg gaaagatcgg ggacttacaa 360

gcagtaatgg ccgtgccaga caaggagacg ccaacattct gcttacacac agacgtctca 420

tgtagacaga gagcagacgt cgctatatac caagacgtct atgctgtaca cgcacccacg 480

tcgctatacc accaggcgat taaaggggtc cgagtggcgt actgggttgg gttcgacaca 540

accccgttca tgtacaatgc catggcgggt gcctaccct catactcgac aaactgggca 600

gatgagcagg tactgaaggc taagaacata ggattatgtt caacagacct gacggaaggt 660

agacgaggca agttgtctat tatgagaggg aaaaagctaa aaccgtgcga ccgtgtgctg 720

ttctcagtag ggtcaacgct ctacccggaa agccgcaagc tacttaagag ctggcacctg 780

ccatcggtgt tccatttaaa gggcaaactc agcttcacat gccgctgtga tacagtggtt 840

tcgtgtgagg gctacgtcgt taagagaata acgatgagcc caggccttta tggaaaaacc 900

acagggtatg cggtaaccca ccacgcagac ggattcctga tgtgcaagac taccgacacg 960

gttgacggcg aaagagtgtc attctcggtg tgcacatacg tgccggcgac catttgtgat 1020

caaatgaccg gcatccttgc tacagaagtc acgccggagg atgcacagaa gctgttggtg 1080

gggctgaacc agagaatagt ggttaacggc agaacgcaac ggaatatgaa caccatgaaa 1140

aattatctgc ttcccgtggt cgcccaagcc ttcagtaagt gggcaaagga gtgccggaaa 1200

gacatggaag atgaaaaact cctgggggtc agagaaagaa cactgacctg ctgctgtcta 1260

tgggcattca agaagcagaa aacacacacg gtctacaaga ggcctgatac ccagtcaatt 1320

cagaaggttc aggccgagtt tgacagcttt gtggtaccga gtctgtggtc gtccgggttg 1380

tcaatccctt tgaggactag aatcaaatgg ttgttaagca aggtgccaaa aaccgacctg 1440

atcccataca gcggagacgc ccgagaagcc cgggacgcag aaaaagaagc agaggaagaa 1500

cgagaagcag aactgactcg cgaagcccta ccacctctac aggcagcaca ggaagatgtt 1560

caggtcgaaa tcgacgtgga acagcttgag gacagagcgg gcgcaggaat aatagagact 1620

ccgagaggag ctatcaaagt tactgcccaa ccaacagacc acgtcgtggg agagtacctg 1680

gtactctccc cgcagaccgt actacgtagc cagaagctca gtctgattca cgctttggcg 1740

gagcaagtga agacgtgcac gcacaacgga cgagcaggga ggtatgcggt cgaagcgtac 1800

gacggccgag tcctagtgcc ctcaggctat gcaatctcgc ctgaagagtt ccagagtcta 1860

agcgaaagcg caacgatggt gtataacgaa agagagttcg taaacagaaa gctacaccat 1920

attgcgatgc acggaccagc cctgaacacc gacgaagagt cgtatgagct ggtgagggca 1980

gagaggacag aacacgagta cgtctacgac gtggatcaga gaagatgctg taagaaggaa 2040

gaagccgcag gactggtact ggtgggcgac ttgactaatc cgccctacca cgaattcgca 2100

tatgaagggc taaaaatccg ccctgcctgc ccatacaaaa ttgcagtcat aggagtcttc 2160

ggagtaccgg gatctggcaa gtcagctatt atcaagaacc tagttaccag gcaggacctg 2220

gtgactagcg gaaagaaaga aaactgccaa gaaatcacca ccgacgtgat gagacagaga 2280

ggtctagaga tatctgcacg tacggttgac tcgctgctct tgaatggatg caacagacca 2340

gtcgacgtgt tgtacgtaga cgaggcgttt gcgtgccact ctggaacgct acttgctttg 2400

atcgccttgg tgagaccaag gcagaaagtt gtactttgtg gtgacccgaa gcagtgcggc 2460

ttcttcaata tgatgcagat gaaagtcaac tataatcaca acatctgcac ccaagtgtac 2520

cacaaaagta tctccaggcg gtgtacactg cctgtgaccg ccattgtgtc atcgttgcat 2580

tacgaaggca aaatgcgcac tacgaatgag tacaacaagc cgattgtagt ggacactaca 2640

ggctcaacaa aacctgaccc tggagacctc gtgttaacgt gcttcagagg gtgggttaaa 2700

caactgcaaa ttgactatcg tggatacgag gtcatgacag cagccgcatc ccaagggtta 2760

accagaaaag gagtttacgc agttagacaa aaagttaatg aaaacccgct ctatgcatca 2820

acgtcagagc acgtcaacgt actcctaacg cgtacggaag gtaaactggt atggaagaca 2880

ctttccggcg acccgtggat aaagacgctg cagaacccac cgaaaggaaa cttcaaagca 2940

actattaagg agtgggaggt ggagcatgca tcaataatgg cgggcatctg cagtcaccaa 3000

atgaccttcg atacattcca aaataaagcc aacgtttgtt gggctaagag cttggtccct 3060

atcctcgaaa cagcggggat aaaactaaat gataggcagt ggtctcagat aattcaagcc 3120

ttcaaagaag acaaagcata ctcacctgaa gtagccctga atgaaatatg tacgcgcatg 3180

tatggggtgg atctagacag cgggctattt tctaaaccgt tggtgtctgt gtattacgcg 3240

gataaccact gggataatag gcctggaggg aaaatgttcg gatttaaccc cgaggcagca 3300

tccattctag aaagaaagta tccattcaca aaagggaagt ggaacatcaa caagcagatc 3360

tgcgtgacta ccaggaggat agaagacttt aaccctacca ccaacatcat accggccaac 3420

aggagactac cacactcatt agtggccgaa caccgcccag taaaagggga aagaatggaa 3480

tggctggtta acaagataaa cggccaccac gtgctcctgg tcagtggcta taaccttgca 3540

ctgcctacta agagagtcac ttgggtagcg ccgttaggtg tccgcggagc ggactacaca 3600

tacaacctag agttgggtct gccagcaacg cttggtaggt atgaccttgt ggtcataaac 3660

atccacacac cttttcgcat acaccattac caacagtgcg tcgaccacgc aatgaaactg 3720

caaatgctcg ggggtgactc attgagactg ctcaaaccgg gcggctctct attgatcaga 3780

gcatatggtt acgcagatag aaccagtgaa cgagtcatct gcgtattggg acgcaagttt 3840

agatcgtcta gagcgttgaa accaccatgt gtcaccagca acactgagat gtttttcctа 3900

ttcagcaact ttgacaatgg cagaaggaat ttcacaactc atgtcatgaa caatcaactg 3960

aatgcagcct tcgtaggaca ggtcacccga gcaggatgtg caccgtcgta ccgggtaaaa 4020

cgcatggaca tcgcgaagaa cgatgaagag tgcgtagtca acgccgctaa ccctcgcggg 4080

ttaccaggtg acggtgtttg caaggcagta tacaaaaaat ggccggagtc ctttaagaac 4140

agtgcaacac cagtgggaac cgcaaaaaca gttatgtgcg gtacgtatcc agtaatccac 4200

gctgttggac caaacttctc taattattcg gagtctgaag gggaccggga attggcagct 4260

gcctatcgag aagtcgcaaa ggaagtaact aggctgggag taaatagtgt agctatacct 4320

ctcctctcca caggtgtata ctcaggaggg aaagacaggc tgacccagtc actgaaccac 4380

ctctttacag ccatggactc gacggatgca gacgtggtca tctactgccg cgacaaagaa 4440

tgggagaaga aaatatctga ggccatacag atgcggaccc aagtagagct gctggatgag 4500

cacatctcca tagactgcga tattgttcgc gtgcaccctg acagcagctt ggcaggcaga 4560

aaaggataca gcaccacgga aggcgcactg tactcatatc tagaagggac ccgttttcat 4620

cagacggctg tggatatggc ggagatacat actatgtggc caaagcaaac agaggccaat 4680

gagcaagtct gcctatatgc cctgggggaa agtattgaat caatcaggca gaaatgcccg 4740

gtggatgatg cagacgcatc atctcccccc aaaactgtcc cgtgcctttg ccgttacgct 4800

atgactccag aacgcgtcac ccggcttcgc atgaaccacg tcacaagcat aattgtgtgt 4860

tcttcgtttc ccctcccaaa gtacaaaata gaaggagtgc aaaaagtcaa atgctctaag 4920

gtaatgctat ttgaccacaa cgtgccatcg cgcgtaagtc caagggaata tagatcttcc 4980

caggagtctg cacaggaggc gagtacaatc acgtcactga cgcatagtca attcgaccta 5040

agcgttgatg gcgagatact gcccgtcccg tcagacctgg atgctgacgc cccagcccta 5100

gaaccagcac tagacgacgg ggcgacacac acgctgccat ccacaaccgg aaaccttgcg 5160

gccgtgtctg actgggtaat gagcactgta cctgtcgcgc cgcccagaag aaggcgaggg 5220

agaaacctga ctgtgacatg tgacgagaga gaaggaaata taacacccat ggctagcgtc 5280

cgattcttta gggcagagct gtgtccggtc gtacaagaaa cagcggagac gcgtgacaca 5340

gcaatgtctc ttcaggcacc accgagtacc gccacggaac cgaatcatcc gccgatctcc 5400

ttcggagcat caagcgagac gttccccatt acatttgggg acttcaacga aggagaaatc 5460

gaaagcttgt cttctgagct actaactttc ggagacttct taccaggaga agtggatgac 5520

ttgacagaca gcgactggtc cacgtgctca gacacggacg acgagttatg actagacagg 5580

gcaggtgggt atatattctc gtcggacacc ggtccaggtc atttacaaca gaagtcagta 5640

cgccagtcag tgctgccggt gaacaccctg gaggaagtcc acgaggagaa gtgttaccca 5700

cctaagctgg atgaagcaaa ggagcaacta ttacttaaga aactccagga gagtgcatcc 5760

atggccaaca gaagcaggta tcagtcgcgc aaagtagaaa acatgaaagc agcaatcatc 5820

cagagactaa agagaggctg tagactatac ttaatgtcag agaccccaaa agtccctact 5880

taccggacta catatccggc gcctgtgtac tcgcctccga tcaacgtccg attgtccaat 5940

cccgagtccg cagtggcagc atgcaatgag ttcttagcta gaaactatcc aactgtctca 6000

tcataccaaa ttaccgacga gtatgatgca tatctagaca tggtggacgg gtcggagagt 6060

tgcctggacc gagcgacatt caatccgtca aaactcagga gctacccgaa acagcacgct 6120

taccacgcgc cctccatcag aagcgctgta ccgtccccat tccagaacac actacagaat 6180

gtactggcag cagccacgaa aagaaactgc aacgtcacac agatgaggga attacccact 6240

ttggactcag cagtattcaa cgtggagtgt ttcaaaaaat tcgcatgcaa ccaagaatac 6300

tgggaagaat ttgctgccag ccctattagg ataacaactg agaatttagc aacctatgtt 6360

actaaactaa aagggccaaa agcagcagcg ctattcgcaa aaacccataa tctactgcca 6420

ctacaggaag taccaatgga taggttcaca gtagatatga aaagggacgt gaaggtgact 6480

cctggtacaa agcatacaga ggaaagacct aaggtgcagg ttatacaggc ggctgaaccc 6540

ttggcgacag catacctatg tgggattcac agagagctgg ttaggaggct gaacgccgtc 6600

ctcctaccca atgtacatac actatttgac atgtctgccg aggatttcga tgccatcata 6660

gccgcacact ttaagccagg agacactgtt ttggaaacgg acatagcctc ctttgataag 6720

agccaagatg attcacttgc gcttactgct ttgatgctgt tagaggattt aggggtggat 6780

cactccctgc tggacttgat agaggctgct ttcggagaga tttccagctg tcacctaccg 6840

acaggtacgc gcttcaagtt cggcgccatg atgaaatcag gtatgttcct aactctgttc 6900

gtcaacacat tgttaaacat caccatcgcc agccgagtgc tggaagatcg tctgacaaaa 6960

tccgcgtgcg cggccttcat cggcgacgac aacataatac atggagtcgt ctccgatgaa 7020

ttgatggcag ccagatgtgc cacttggatg aacatggaag tgaagatcat agatgcagtt 7080

gtatccttga aagcccctta cttttgtgga gggtttatac tgcacgatac tgtgacagga 7140

acagcttgca gagtggcaga cccgctaaaa aggcttttta aactgggcaa accgctagcg 7200

gcaggtgacg aacaagatga agatagaaga cgagcgctgg ctgacgaagt gatcagatgg 7260

caacgaacag ggctaattga tgagctggag aaagcggtat actctaggta cgaagtgcag 7320

ggtatatcag ttgtggtaat gtccatggcc acctttgcaa gctccagatc caacttcgag 7380

aagctcagag gacccgtcat aactttgtac ggcggtccta ataggtacg cactacagct 7440

acctattttg cagaagccga cagcaagtat ctaaacacta atcagctaca atggagttca 7500

tcccaaccca aacttttac aataggaggt accagcctcg accctggact ccgcgctcta 7560

ctatccaaat catcaggccc agaccgcgcc ctcagaggca agctgggcaa cttgcccagc 7620

tgatctcagc agttaataaa ctgacaatgc gcgcggtacc ccaacagaag ccacgcagga 7680

atcggaagaa taagaagcaa aagcaaaaac aacaggcgcc acaaaacaac acaaatcaaa 7740

agaagcagcc acctaaaaag aaaccggctc aaaagaaaaa gaagccgggc cgcagagaga 7800

ggatgtgcat gaaaatcgaa aatgattgta ttttcgaagt caagcacgaa ggtaaggtaa 7860

caggttacgc gtgcctggtg ggggacaaag taatgaaacc agcacacgta aaggggacca 7920

tcgataacgc ggacctggcc aaactggcct ttaagcggtc atctaagtat gaccttgaat 7980

gcgcgcagat acccgtgcac atgaagtccg acgcttcgaa gttcacccat gagaaaccgg 8040

aggggtacta caactggcac cacggagcag tacaatactc aggaggccgg ttcaccatcc 8100

ctacaggtgc tggcaaacca ggggacagcg gcagacctat cttcgacaac aagggacgcg 8160

tggtggccat agtcttagga ggagctaatg aaggagcccg tacagccctc tcggtggtga 8220

cctggaataa agacattgtc actaaaatca cccccgaggg ggccgaagag tggagtcttg 8280

ccatcccagt tatgtgcctg ttggcaaaca ccacgttccc ctgctcccag ccccttgca 8340

cgccctgctg ctacgaaaag gaaccggagg aaaccctacg catgcttgag gacaacgtca 8400

tgagacctgg gtactatcag ctgctacaag catccttaac atgttctccc caccgccagc 8460

gacgcagcac caaggacaac ttcaatgtct ataaagccac aagaccatac ttagctcact 8520

gtcccgactg tggagaaggg cactcgtgcc atagtcccgt agcactagaa cgcatcagaa 8580

atgaagcgac agacgggacg ctgaaaatcc aggtctcctt gcaaatcaga ataaagacgg 8640

atgacagcca cgattggacc aagctgcgtt atatggacaa ccacatgcca gcagacgcag 8700

agagggcggg gctatttgta agaacatcag caccgtgtac gattactgga acaatgggac 8760

acttcatcct ggcccgatgt ccaaaagggg aaactctgac ggtgggattc actgacagta 8820

ggaagattag tcattcatgt acgcacccat ttcaccacga ccctcctgtg ataggtcggg 8880

aaaaattcca ttcccgaccg cagcacggta aagagctacc ttgcagcacg tacgtgcaga 8940

gcaccgccgc aactaccgag gagatagagg tacacatgcc cccagacacc cctgatcgca 9000

cattaatgtc acaacagtcc ggcaacgtaa agatcacagt caatggccag acggtgcggt 9060

acaagtgtaa ttgcggtggc tcaaatgaag gactaacaac tacagacaaa gtgattaata 9120

actgcaaggt tgatcaatgt catgccgcgg tcaccaatca caaaaagtgg cagtataact 9180

cccctctggt cccgcgtaat gctgaacttg gggaccgaaa aggaaaaatt cacatcccgt 9240

ttccgctggc aaatgtaaca tgcagggtgc ctaaagcaag gaaccccacc gtgacgtacg 9300

ggaaaaacca agtcatcatg ctactgtatc ctgaccaccc aacactcctg tcctaccgga 9360

atatgggaga agaaccaaac tatcaagaag agtgggtgat gcataagaag gaagtcgtgc 9420

taaccgtgcc gactgaaggg ctcgaggtca cgtggggcaa caacgagccg tataagtatt 9480

ggccgcagtt atctacaaac ggtacagccc atggccaccc gcatgagata attctgtatt 9540

attatgagct gtaccctact atgactgtag tagttgtgtc agtggccacg ttcatactcc 9600

tgtcgatggt gggtatggca gcggggatgt gcatgtgtgc acgacgcaga tgcatcacac 9660

cgtatgaact gacaccagga gctaccgtcc ctttcctgct tagcctaata tgctgcatca 9720

gaacagctaa agcggccaca taccaagagg ctgcgatata cctgtggaac gagcagcaac 9780

ctttgttttg gctacaagcc cttattccgc tggcagccct gattgttcta tgcaactgtc 9840

tgagactctt accatgctgc tgtaaaacgt tggctttttt agccgtaatg agcgtcggtg 9900

cccacactgt gagcgcgtac gaacacgtaa cagtgatccc gaacacggtg ggagtaccgt 9960

ataagactct agtcaataga cctggctaca gccccatggt attggagatg gaactactgt 10020

cagtcacttt ggagccaaca ctatcgcttg attacatcac gtgcgagtac aaaaccgtca 10080

tcccgtctct gtacgtgaag tgctgcggta cagcagagtg caaggacaaa aacctacctg 10140

actacagctg taaggtcttc accggcgtct acccatttat gtggggcggc gcctactgct 10200

tctgcgacgc tgaaaacacg cagttgagcg aagcacatgt ggagaagtcc gaatcatgca 10260

aaacagaatt tgcatcagca tacagggctc ataccgcatc tgcatcagct aagctccgcg 10320

tcctttacca aggaaataac atcactgtaa ctgcctatgc aaacggcgac catgccgtca 10380

cagttaagga cgccaaattc attgtggggc caatgtcttc agcctggaca cctttcgaca 10440

acaaaattgt ggtgtacaaa ggtgacgtct ataacatgga ctacccgccc tttggcgcag 10500

gaagaccagg acaatttggc gatatccaaa gtcgcacacc tgagagtgaa gacgtctatg 10560

ctaatacaca actggtactg cagagaccgg ctgcgggtac ggtacacgtg ccatactctc 10620

aggcaccatc tggctttaag tattggctaa aagaacgcgg ggcgtcactg cagcacacag 10680

caccatttgg ctgccaaata gcaacaaacc cggtaagagc ggtgaactgc gccgtaggga 10740

acatgcccat ctccatcgac ataccggaag cggccttcac tagggtcgtc gacgcgccct 10800

ctttaacgga catgtcgtgc gaggtaccag cctgcaccca ttcctcagac tttgggggcg 10860

tcgccattat taaatatgca gccagcaaga aaggcaagtg tgcggtgcat tcgatgacta 10920

acgccgtcac tattcgggaa gctgagatag aagttgaagg gaattctcag ctgcaaatct 10980

ctttctcgac ggccttagcc agcgccgaat tccgcgtaca agtctgttct acacaagtac 11040

actgtgcagc tgagtgccac cccccgaagg accacatagt caactacccg gcgtcacata 11100

ccaccctcgg ggtccaggac atctccgcta cggcgatgtc atgggtgcag aagatcacgg 11160

gaggtgtggg actggttgtt gctgttgccg cactgattct aatcgtggtg ctatgcgtgt 11220

cgttcagcag gcac 11234

We claim :

1. A stable vaccine composition of inactivated Chikungunya virus strain with one or more mutations in the capsid, E1, E2 or E3 structural glycoproteins that enhance the adaptation of the virus to *Aedes aegypti* and capable of infecting *Aedes albopictus,* wherein the strains of the Chikungunya virus isolates are selected from TN01610, TN015110, TN06210, TN06310, TN06410, and AP0109 containing the nucleotide sequences disclosed in SEQ. ID NO.1 to SEQ ID NO.6, respectively and the corresponding full length genomic RNA sequences disclosed in SEQ ID NO.15 to SEQ ID NO.20, respectively.

2. The vaccine composition of claim 1, wherein the Chikungunya virus strain has a non-synonymous mutation K1020E in the structural polyprotein corresponding to E1-K211 E in the E1 structural glycoprotein either singly or in combination with other mutations selected from A232V, D301N, K327N, G380R, K391E, V589A, P867L, G1004R, and A1035V of the structural polyprotein sequence of the Chikungunya virus.

3. The vaccine composition of claim 1, wherein the Chikungunya virus isolates have the structural polyprotein sequences as disclosed in SEQ. ID No.8 to SEQ. ID NO.13 corresponding to nucleotide SEQ ID. NO.1 to SEQ ID NO.6 respectively, for use as vaccine against Chikungunya virus infections

4. The vaccine composition of claim 1 wherein the Chikungunya virus is inactivated by any of the following methods:

i) heat inactivation at 45°C to 60°C for 30 min to 4 hrs;
ii) Ultraviolet radiation at 254 nm for 30 min to 120 min;
iii) Formalin treatment at ratios up to 1:3000 (formalin-.virus) at 2°C-8°C for 7 days or at ambient temperatures ranging from 20°C-25°C for 2 days;
iv) Beta propiolactone (henceforth BPL) ratios up to 1:1000 to 1:2500 (BPL:virus) at 29C-8°C for 7 days or at ambient temperatures ranging from 20°C-25°C for 2 days wherein the additive is selected from glycine, mannitol, sorbitol, sucrose and trehalose;
v) Gamma irradiation by exposing the virus samples to a dose of 10kGy (Kilo Gray) to 25kGy from a ^{60}Co source.

5. The vaccine composition of claim 1 further comprising an adjuvant selected from (a) aluminum hydroxide (b) aluminum phosphate (c) gamma inulin, (d) algammulin (a combination of aluminum hydroxide and gamma inulin) (e) cholecalciferol in oil (f) an oil in water emulsion OWEM1, containing squalene, tween-80, Span-85 in 10 mM phosphate-citrate buffer, (f) oil in water emulsion OWEM2 containing squalene, tween-80, Span-85, alpha tocopherol in phosphate-citrate buffer, (g) an oil in water emulsion OWEM3 containing squalene, tween-80, Span-85, cholecalciferol in phosphate-citrate buffer.

6. The vaccine composition of claim 1, further comprising the viral antigen at doses ranging from 1 μg to 100 μg per human dose in 40 mM phosphate buffer and 150mM NaCl.

7. The vaccine composition of claim 1 for use as therapeutically active ingredient for prophylaxis, treatment and diagnosis of infections caused by Chikungunya virus thereby making it capable of conferring immunity against any genotypic variants or mutants of Chikungunya virus.

8. Chikungunya virus isolates whose structural polyprotein gene sequence is disclosed in SEQ. ID Nos. 1 to 6 and proteins translated thereof, as disclosed in SEQ. ID. Nos. 8 to 13 for use as an immunodiagnostic agent for detection of Chikungunya virus infections in humans.

9. A combined vaccine composition comprising inactivated Chikungunya virus antigen from a strain with one or more mutations in the capsid, E1, E2 or E3 structural glycoproteins that enhance the adaptation of the virus to *Aedes aegypti* and capable of infecting *Aedes albopictus,* wherein the strains of the Chikungunya virus isolates are selected from TN01610, TN015110, TN06210, TN06310, TN06410, and AP0109 containing the nucleotide sequences disclosed in SEQ. ID NO.1 to SEQ ID NO.6, respectively and the corresponding full length genomic RNA sequences disclosed in SEQ ID NO.15 to SEQ ID NO.20, respectively
and inactivated Japanese Encephalitis whole virion antigen
and an adjuvant selected from (a) aluminum hydroxide (b) aluminum phosphate (c) gamma inulin, (d) algammulin (a combination of aluminum hydroxide and gamma inulin) (e) cholecalciferol in oil (f) an oil in water emulsion OWEM1, containing squalene, tween-80, Span-85 in 10 mM phosphate-citrate buffer, (g) an oil in water emulsion OWEM2 containing squalene, tween-80, Span-85, alpha tocopherol in phosphate-citrate buffer, (h) an oil in water emulsion OWEM3 containing squalene, tween-80, Span-85, cholecalciferol in phosphate-citrate buffer for use in a method fort eliciting a protective immune response against Chikungunya virus and Japanese Encephalitis virus infections in humans.