VirusResearch News

Volume 2 No. 1&2 December 2013

A Half Yearly News Letter of Indian Virological Society on Research and Development in the Field of Virology

From IVS President Desk

I feel elated to write this message on behalf of IVS Team worked hard to fill in a gap: reducing the TIME FRAME to reach to our valuable Readers with the latest worth news from researchers in the area of VIRUS & VIRAL DISEASE(S).

The Indian Virological Society (IVS) has done not only well but 'VERY WELL DONE' by bringing the Indian Journal of Virology now titled as "VirusDisease". There are no two opinions that today we have quality research going on in the country's need based: Virus & Viral Diseases. It, therefore, becomes essential that the same is shared with and, to keep appraised all concerned.

IVS feels proud as being a rare 'Society' of all Virologists from Plant, Medical, Animal Sciences & Marine Sciences of this country, offering a common platform for discussion & share "the NEW", among all virologists, as well with other Virologist from countries globally, on the work done here. The Research Journal publication was one such step, besides our Annual Conferences, Seminars/ Symposium organized in the past, and going on with new future plans. The NEWS LETTER, "VirusResearch News" is another positive step in this direction.

I congratulate our team for their effortful sincere thinking & work which could result in establishing printing Newsletter as an additional positive step in spreading information to all. At the same time we also 'Invite our Readers for their feedback and suggestion to improve our effort.

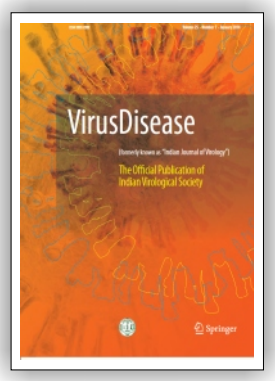
In this Issue

Editorial Board

IVS INTERNATIONAL CONFERENCE

Indian Virological Society in association with Amity University, Noida will be organizing "Asia Pacific Congress of Virology" at Amity University, Noida, India during December 17-20, 2013. The congress will focus on the viral disease problems of animal, human, plants and aquatic animals in the Asia Pacific Region. Large number of students, scientists, science administrators, industry partners will be participating the congress. Several special lectures will be delivered by world authorities in the congress.

IVS JOURNAL NEWS



The official journal of Indian Virological Society is Indian Journal of Virology- an international journal publishes original research work on viruses affecting any living organisms. Articles are submitted from as many as 22 countries. During 2013 three issues of the journal have been published including a special issue on 'Emerging Viral Diseases of Livestock in the Developing World'.

The Indian Journal of Virology has been renamed as VirusDisease. From 2014, the new name will be effective. The new name has been coined with the idea that it denotes both virus and disease that is the focus of the journal. The frequency of the journal has been increased from two to four issues from 2014 onward. A special issue on ' Enteric Viral infection in Human and Animal' is under preparation will be published during 2014.

RESEARCH NEWS

Catalytic nucleic acids as potential therapeutic tools to combat influenza virus infections

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Pervasive stigma has surrounded the whole world since the beginning of the 2009 pandemic as influenza viruses (Family: Orthomyxoviridae) still continue to pose serious health

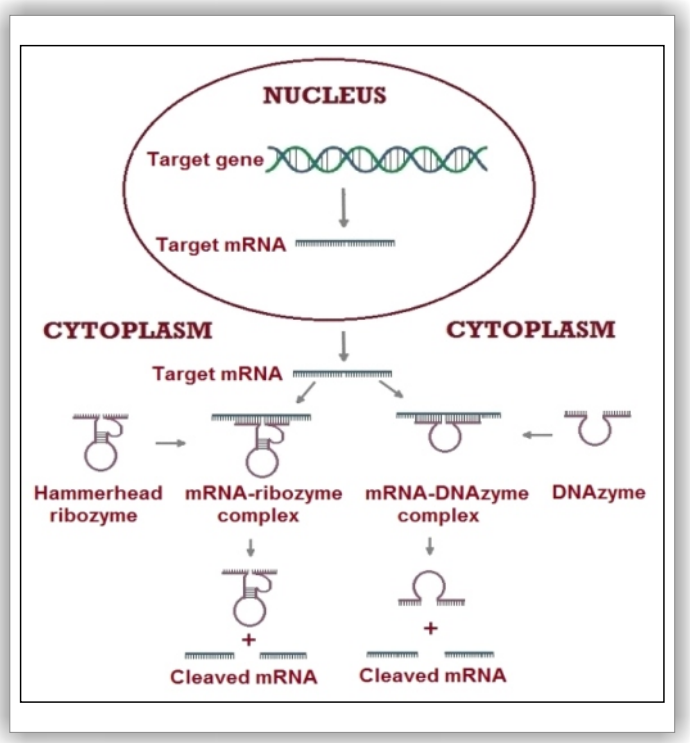

Fig. 1. Mechanism of action of DNAzyme and ribozyme

emergencies leading to enormous socio-economic loss. The frequent emergence of the influenza A strain in humans demonstrates the rapid and unpredictable nature of influenza virus evolution and the need for effective surveillance to control such outbreaks. The existing vaccines (Killed virus or recombinant surface glycoprotein) and therapy for influenza infection have limited values, thus posing serious threat of a new influenza pandemic. According to recent studies, the efficacy of such vaccines has been observed to be less than 40% which is not sufficient enough for significant protection against the influenza viruses.

The increasing understanding of the regulatory mechanisms involved in the pathogenesis of influenza is opening up opportunities for new therapeutic intervention.

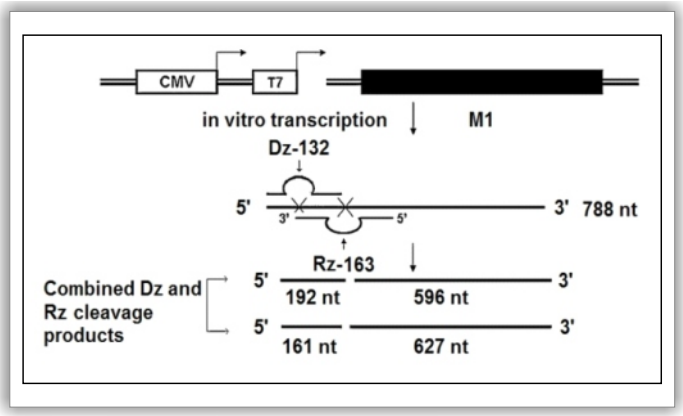

Fig. 2. Schematic representation of the combined cleavage of M1 RNA with Dz and Rz

Among the several range of agents that encompasses gene silencing therapeutics, the DNAzymes (Dz) and ribozymes (Rz) have shown proven results in down-regulating the replication of many pathogens, including influenza viruses, in mammalian hosts. Various researchers, worldwide, have also successfully demonstrated the potential of several Dz and Rz to selectively down-regulate the vital genes in HIV, Hepatitis B viruses and Japanese Encephalitis Virus.

We have recently studied the effect of various gene silencing tools for specific down-regulation of the influenza A virus genome segment 7, encoding the protein M1, which is the matrix protein playing crucial role in the virus life cycle. We designed several 10-23 DNAzymes and constructed hammer head ribozymes in combination of antisense molecules (AS), based on the predicted secondary structures of M1 gene using the M-fold RNA folding program, to analyze their ability to cleave the target gene transcript. These molecules were named based on the base position at which they were supposed to cleave the mRNA, thus the Dz-132 and Rz-163 were designed to cleave the 788 nucleotides M1 transcript into 192+596 and 161+627 nucleotides respectively and ASI and ASII to hybridize upstream and downstream of the substrate binding arm of Rz-163.

Our results showed that these molecules significantly reduced the M1 viral gene expression and were dependent on MgCl2 in a dose dependent manner. The real-time PCR analysis showed that Dz-132 (3 µg) reduced the M1 gene expression to 26% while the Rz-163 (3 µg) suppressed the gene expression upto 28%. The combined effect of both Dz-132 and Rz-163 showed a significant 54% down-regulation of target gene. The Rz-163 when combined with ASI molecules gave 42% gene suppression while with ASII, the suppression was found to be 46%. The combined effect of ASI and ASII with Rz-163 further increased the gene silencing upto 60%. The same Dz and Rz cleaved both the truncated and full-length substrate RNA, and as expected, the cleavage was better with the truncated substrate RNA.

Conclusively, the quantitative gene suppression by Dz was found little less however the protection conferred against influenza viruses was observed for a comparatively longer duration of time as compared to the Rz results.

Earlier, researchers had reported the use of either Dz or Rz to individually cleave the specific target genes; however, in our study we achieved the best results by using both the strategies additively. The use of AS molecules further enhanced the efficiency of our constructed ribozymes. We successfully achieved the cleavage of longer target gene transcript (788 nucleotides) which has very less been reported as compared to down-regulation of shorter transcripts.

Acknowledgement: We thankfully acknowledge the financial support provided by Department of Biotechnology, Government of India.

Outbreak of leaf curl disease in bitter gourd in Maharashtra

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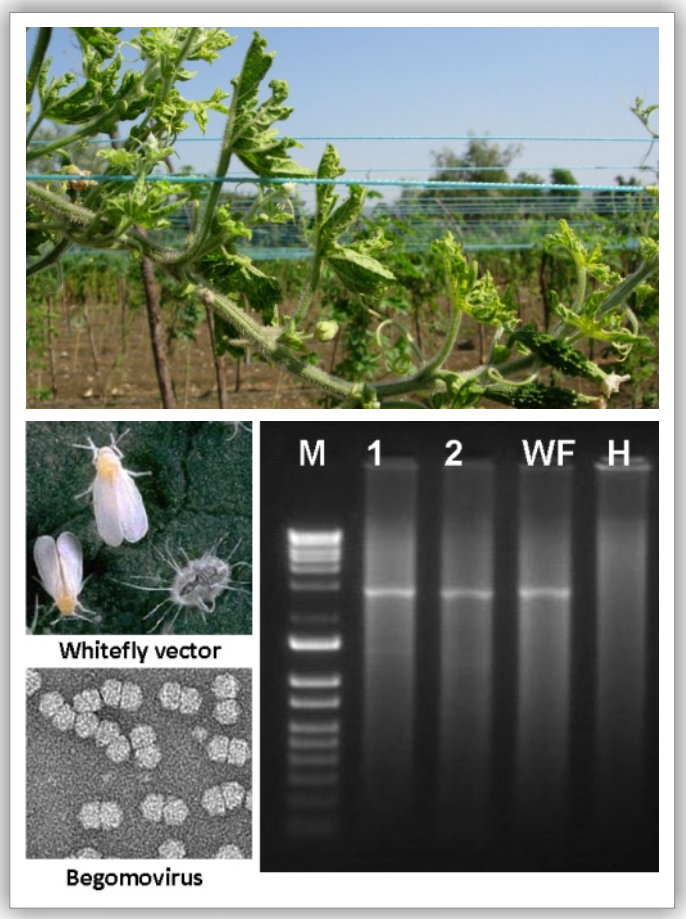
The farmers in 15 to 19 villages from Phalgar taluk of Maharashtra grow bitter gourd in rotation with tomato under intensive cultivation over an area of 125 acres. The farmers get income of Rs. 75,000 to 1,00,000 per acre from one crop. The bitter gourd crop planted between September to October 2012 has been severely affected by viral disease. The high incidence of leaf curl, severe mosaic, distortion and stunting of bitter gourd plants were noticed in farmer's fields on several hybrids in the entire Phalgar taluk (Fig 1). Unusual rain followed by high temperature and humidity led to the severe outbreak of whiteflies coupled. The presence of tomato leaf curl disease in tomato, growing of bitter gourd towards the end of the tomato season led to the fast spread of leaf curl causing to bitter gourd. The bitter gourd crop before reaching to the flowering stage, 100% incidence of leaf curl was noticed on the bitter gourd hybrids grown in this area. Due to virus infection at the early stage, less flowing and poor fruit set resulted in severe reduction in crop yield. Most of the plants either did not develop fruits or produced distorted small fruits, which were unmarketable. This led to the overall yield loss to 90-100% in varieties or hybrids of bitter gourd grown in this area.



Bitter gourd leaf curl, the vector, whitefly and detection of the begomovirus.

To know the exact cause of the disease, infected bitter gourd samples and whiteflies from fields were investigated in our Virology Laboratory at Indian Institute of Horticultural Research, Bangalore. ELISA test using CMV, CGMMV and PRSV-W specific antibodies gave negative result, whereas monoclonal antibody to Indian cassava mosaic virus (ICMV-2H-12) showed highly positive reaction indicating the presence of a begomovirus. Further, genome fragment of the virus was successfully amplified with the begomovirus specific

primers from whiteflies and infected leaf samples (Fig 3). Sequence generated from pre-coat protein and coat protein genes revealed that the begomovirus in bitter gourd shared 94.5-97.6% sequence identity.

The recent introduction of different genotypes/hybrids of bitter gourd, continuous and large scale cultivation as monocrop and favourable environmental conditions are the reasons for outbreak of whitefly (*Bemisia tabaci*) and leaf curl in bitter gourd. Whitefly is the sole transmitter of begomoviruses. They are responsible for spreading begomoviruses that cause significant yield losses in a wide variety of crops in India.

Viruses associated with grapevine leafroll disease in India

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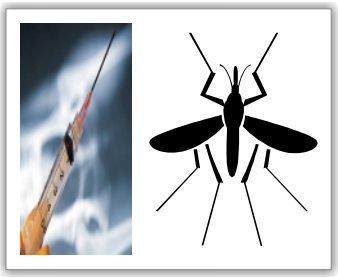
Grapevine leafroll disease (GLD) is a complex viral disease of grapevine accounting for more than 60 % of yield losses due to viruses. It is caused by eleven distinct filamentous viruses (recently proposed to be recognized as genetically five distinct viruses)belonging to the family Closteroviridae. These viruses are named according to their sequential discovery as Grapevine leafroll-associated virus1, -2, -3 and so on (GLRaV-1, -2, -3 and so on). Despite being known to be present since one decade in Indian vineyards, no authentic study on GLD has been carried out. On the basis of serology, electron microscopy, RT-PCR (reverse transcriptase polymerase chain reaction) and sequencing, we report for the first time, the association of GLRaV-1 and -3 with GLD symptomatic vines of the vineyards of Nashik and Pune regions of India.These studies provide a base for the better understanding of biology and epidemiology of grapevine leafroll disease across grape growing regions of India.

Leafroll on white (light fruited) varieties. Cupped leaves and yellowish colour.

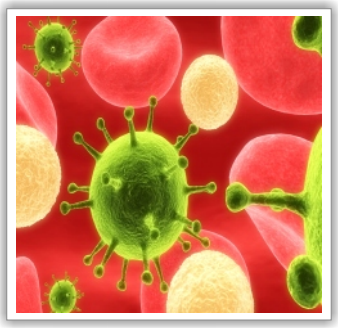
INNOVATION NEWS

Flying syringe



Flying syringe is a catchword that is used to refer the genetically modified mosquitoes which can inject vaccines into host when they bite them. Recently, the project was funded by Gates Foundation to Hiroyuki Matsuoka of Jichi Medical University in Japan to do research on them, with a condition that any discoveries that were funded by the grant must be made available at affordable prices in the developing world. If Matsuoka proves that his idea has merit, he will be eligible for an additional $1 million of funding.

Switch to boost anti-viral response



Scientists from Bioprocessing Technology Institute (BTI) Singaporeunder the Agency of Science, Technology and Research (ASTAR) have for the first time, identified the molecular 'switch' capable of stimulating body's primary defence system "innate immunity"against invading pathogens. The 'switch' called Bruton's tyrosine kinase (BTK) when turned on, activates the production of interferons - a potent class of virus killers that enables the body to fight harmful pathogens such as dengue and influenza viruses. This discovery of BTK's role as a critical 'switch' that boosts the body's anti-viral response, paves the way for developing anti-viral drugs that target the BTK 'switch' to fight infectious diseases. To investigate the role of BTK in innate immunity, the research team from BTI extracted a class of innate immune cells known as macrophages from both normal mice and from mice deficient in BTK and challenged them with the dengue virus. They found that the BTK-deficient immune cells were unable to produce interferons, and hence had much higher viral counts compared to the healthy immune cells that had high-levels of interferons to fight the virus effectively.

New anti-viral drug that cures nearly any viral infection

Unlike bacterial infections which can be treated with antibiotics such as penicillin, such drugs are useless against viral infections, including influenza, the common cold and deadly hemorrhagic fevers such as Ebola. Researchers at MIT's Lincoln Lab have developed technology that could transform how viral infections are treated. They have designed a drug that can identify cells that have been infected by any type of virus, then kill those cells to terminate the infection like common cold, influenza and other ailments.

The drug has been tested against 15 viruses, and found effective against all of them — including rhinoviruses that cause the common cold, H1N1 influenza, a stomach virus, a polio virus, dengue fever and several other types of hemorrhagic fever. The drug works by targeting a type of RNA produced only in cells that have been infected by viruses. The researchers are now testing this drug against more viruses in mice and beginning to get promising results. It is in line to license the technology for trials in larger animals and for eventual human clinical trials.

IVS AWARDS - 2013

Prof. K.S. Bhargava Oration Award-2013

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Emeritus Medical Scientist of ICMR, CMC, Vellure

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Assistant Director General (Animal Health),
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Guidelines

Submit news article, which has some application prospect to any one of the editors. The article to be written in a popular format not exceeding 1000 words with a few simple table and or high quality figures. Article structure: Title, author(s), full address, email,telephone, self photo of corresponding author, running text and references not required.

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