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Editorial

Mechanical vs Agroinfiltration: Efficient mechanism of plant RNA virus infection

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Plant RNA viruses play a pivotal role in understanding the biology of viruses. The first virus to be discovered was a plant RNA virus, Tobacco mosaic virus (TMV) [1]. Positive sense RNA viruses have a wide host range [2]. Hence it is imperative to investigate their replication [3-6], packaging [5-10], interaction with host proteins (3, 11), competition with satellite RNAs, if they encapsidate any [11-14], and immune response against virus infection [15-17].

Unlike animal viruses which have receptors for mediating the infection of cells, plant viruses can only infect cells through a natural opening or wound [2]. In case of positive sense RNA viruses, once the virus enters cell, it uncoats, translation of replication machinery takes place, followed by replication, translation of structural proteins, and encapsidation [2]. Once the virus is encapsidated, it either moves from one cell to another using plasmodesmata, or infects other plants through vectors [2, 18]. Though movement of viruses or nucleoprotein complex can also takes place using complexes of virus encoded movement protein (MP) [19], capsid protein (CP), HC-Pro [20] etc. In case of vector transmission, most of the plant viruses use insect vectors but do not replicate in insect vectors. Hence, it is imperative to find an appropriate transmission method to study virus propagation and devise techniques to curb virus replication. There are various methods to infect plant viruses, the most widely used ones are mechanical inoculation and agrobacterium mediated inoculation of viral genomes [21].

Mechanical inoculation is widely used technique for more than 100 years, where virus, ground infected sap or viral RNA/RNAs are inoculated into cells after gentle injury made by abrasives. On the other hand, agrobacterium mediated inoculation provides a good alternative to study viruses limited to vascular system. In this method, infectious clones of cDNAs of RNA viruses are transformed in agrobacterium, and are inoculated to plants by a needleless syringe [22].

Both the approaches have their merits and demerits; mechanical inoculation provides close to natural infection procedure that take place by insect bite [23], rubbing of saps, or mechanical abrasion. It lacks the ability to provide with efficient and even distribution of infectious material to be delivered to every part of the leaf. Additionally, degradation of mRNA can be a big problem along with the activation of wound related gene expression in plants. Agrobacterium mediated gene transfer makes a better approach to study multicomponent viruses, where all the components of the virus have to enter the cell to lead an efficient infection [24]. Along with it being a robust approach, which leads to even distribution of infectious cDNA of virus, agrobacterium provides an ability to transiently express proteins,

along with minimal activation of wound related genes. It also serves as a more economically feasible approach compared to instances where *in vitro* RNA transcription is required for the infection of cells for mechanical inoculation [25]. Even a robust approach like agrobacterium mediated gene transfer doesn't come without limitations, as it is limited to dicotyledonous plants and is not amenable for monocots [26]. Moreover, there is difference in the virulence of strains for *Agrobacterium tumefaciens*, and requires extensive optimization of technique as a protocol for transformation differs from one species to another [25, 27].

In conclusion, there are pros and cons for both the most widely used approaches for infection of plants by RNA viruses, and it is suggested that one should carefully select the approach for virus inoculation.

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