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Biopharming: A Biosecurity Measure to Combat Newcastle Disease for Household Food Security

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Editorial

Agricultural land is shrinking because of ever increasing population in the developing world. Shrinking farm land warrants alternative measures of food security, particularly of the rural community. One of the options on the list is rearing of poultry birds at both captive and commercial levels. Poultry provides food, energy, fertilizer and a renewable asset to over 80 percent of rural household [1]. Nevertheless, 100 percent potential is not harvested due to a number of factors; including, poor housing, insufficient quality nutrition and devastating diseases. Amongst diseases, Newcastle has become a pandemic disease. It not only affects domesticated but also wild poultry throughout the world [2-5].

Newcastle is a highly contagious viral disease caused by avian Paramyxovirus type-1, commonly known as Newcastle disease virus (NDV), which is a member of genus *Avulavirus* of the *Paramyxoviridae* family. NDV is an enveloped, non-segmented, single-stranded and negative-sense RNA virus [6-8]. Its genome encodes six structural proteins; namely, nucleocapsid (NP), phosphoprotein (P), matrix (M), fusion (F), hemagglutinin-neuraminidase (HN), and large RNA-dependent RNA polymerase (L). Based on the sequence of the pathogenic precursor protein (F) the NDV strains are grouped into three types; velogenic, mesogenic and lentogenic. NDV outbreaks are occurring not only in the domesticated poultry birds but also in wild birds [6-8]. During 2010-12, a number of outbreaks were recorded that heavily damaged commercial and wild poultry birds in Pakistan [5].

Poultry sector is one of the vibrant segments of agriculture industry of Pakistan. This sector generates employment (direct/indirect) and income for about 1.5 million people. Its contribution in agricultural and Livestock growth is 4.81% 9.84%, respectively. Poultry meat contributes 19% of the total meat production in the country. The success of the Pakistan poultry industry depends on the ability to maintain healthy birds. Current disease management approach of poultry industry in Pakistan is to immunize birds by using live or killed bugs-based vaccines. Despite extensive vaccination of commercial poultry birds using live lentogenic strains, for example Lasota, outbreaks are witnessed in Pakistan. Since disease continues to appear in both vaccinated flocks as well as unvaccinated commercial and wild poultry birds, therefore molecular characterization of evolving NDV strains from different countries is reported [9-14] that will help in developing vaccines.

One of the approaches is genotype-matched using reverse genetics approach [10] but development of a reverse genetics system for a circulating NDV strains is very costly and laborious. This necessitates exploring alternative approaches to develop genotype-matched vaccines. Of the alternative strategies, expressing engineered pathogenicity-causing genes in edible plants could be a cost effective and clean-gene strategy to immunize wild captive, rural and commercial poultry flocks.

When we talk about plant system to express antigenic proteins there are a number of options; including, nuclear transformation, protein targeting to plastids after expression from nuclear genome and chloroplast genome engineering. Of these systems, chloroplast genome engineering is considered superior because it addresses biosafety issues by providing natural transgene containment since plastid DNA is lost during pollen maturation and hence is not transmitted to the next generation [15,16]. Additionally, biologically active proteins may accumulate to exceptionally high levels due to the polyploid nature of plastids and presence of chaperonin proteins in plastids [17-20].

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