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Chapter

The Intervention of Gold Nanoparticles (AuNPs) Interactions Lead to the Disappearing of Virus Particles

Noorah Abdulaziz Othman Alkubaisi and
Nagwa Mohammed Amin Aref

Abstract

In the context of plant-pathogen interaction, the application of nanoparticle technology and efficient transportation of substances, such as systemic AuNPs to the specific coupling of AuNPs and virus, provide novel solutions for the treatment of plants against the virus. The included data proved that AuNPs provide an efficient means to control virus infection in a fashion way with reducing collateral damage. The AuNPs assure fatal damage to the VLPs with low concentration using different AuNPs sizes. Synergistic therapeutic effects could lead to virus resistance.

Keywords: Barley Yellow Dwarf Virus (BYDV-PAV), Gold nanoparticles (AuNPs)

1. Introduction

In our study by inducing virus particles combining with AuNPs, having an interaction performance (**Figures 1** and **2**), as illustrated in TEM disappearing **Figure 3(B)** or/and swelling **Figure 4(B)**, smashing **Figure 4(C)**, deformation **Figure 4(E)** and **(F)**, corrosive, and puffiness of infected virus particles **Figure 4(I), (G)**, and **(H)** [1]. Multicomponent surface chemistry has also been explored in the context of gene regulation [2]. Modification of the Au NPs with more than one class of functional group can enable multiple functionalities. One example is that Au NPs have been derivatized with both antisense oligonucleotides and thiolated nuclear localization signal (NLS) peptides. The oligonucleotides on the AuNPs surface are close enough. The counter ions associated with one oligonucleotide also act to screen negative charge on adjacent oligonucleotides; this additional charge screening results in more excellent oligonucleotide duplex stabilization relative to free DNA strands. It explains why the DNA AuNPs aggregates melt at higher temperatures than the same unconjugated oligonucleotide duplexes under the same conditions [3].

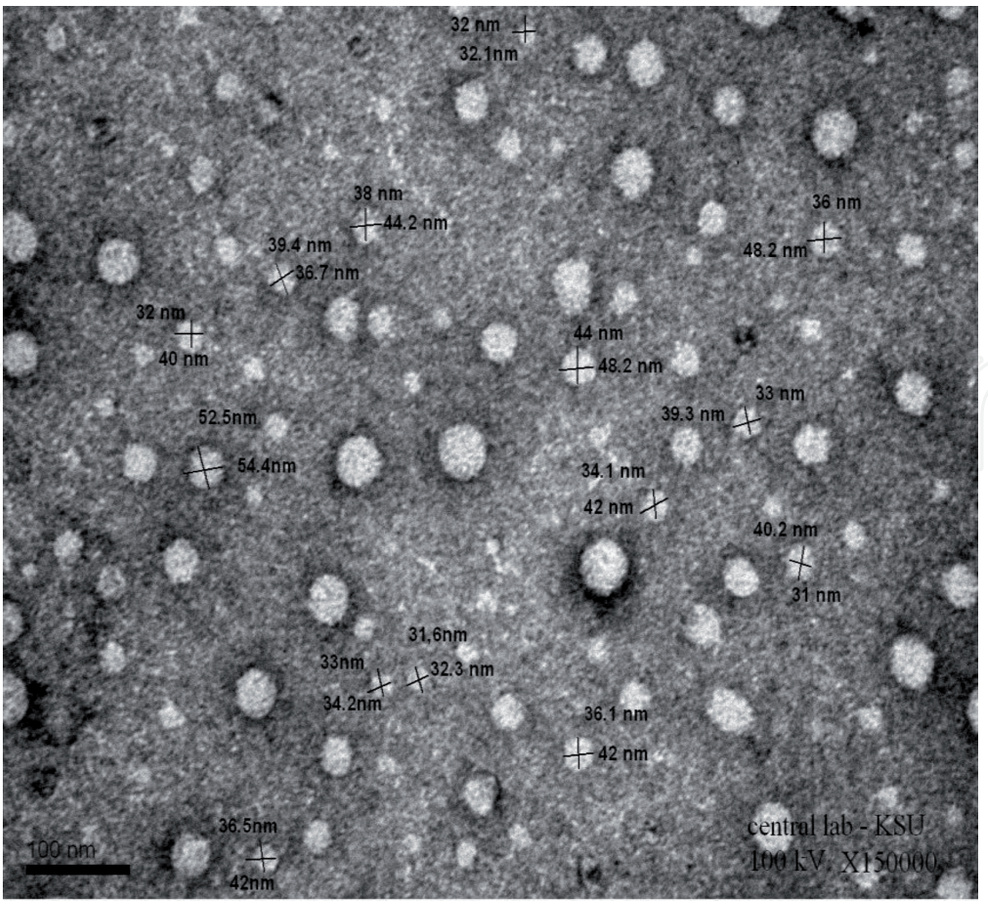


Figure 1.
Electron micrograph showing a purified crude sap of barley yellow dwarf virus (BYDV-PAV), micrograph of BYDV-PAV purification (Control of virus particles). Scale bars 100 nm.

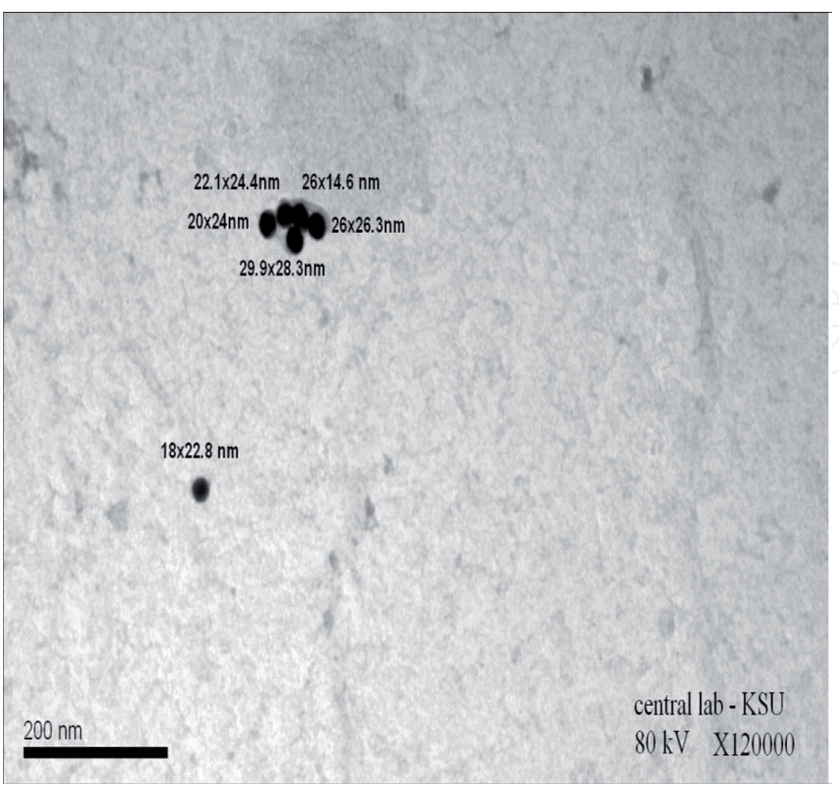


Figure 2.
Electron micrograph showing a purified crude sap of Gold nanoparticles (AuNPs). Micrograph of the size for AuNPs particles (Control of Nanoparticles). Scale bars 200 nm.

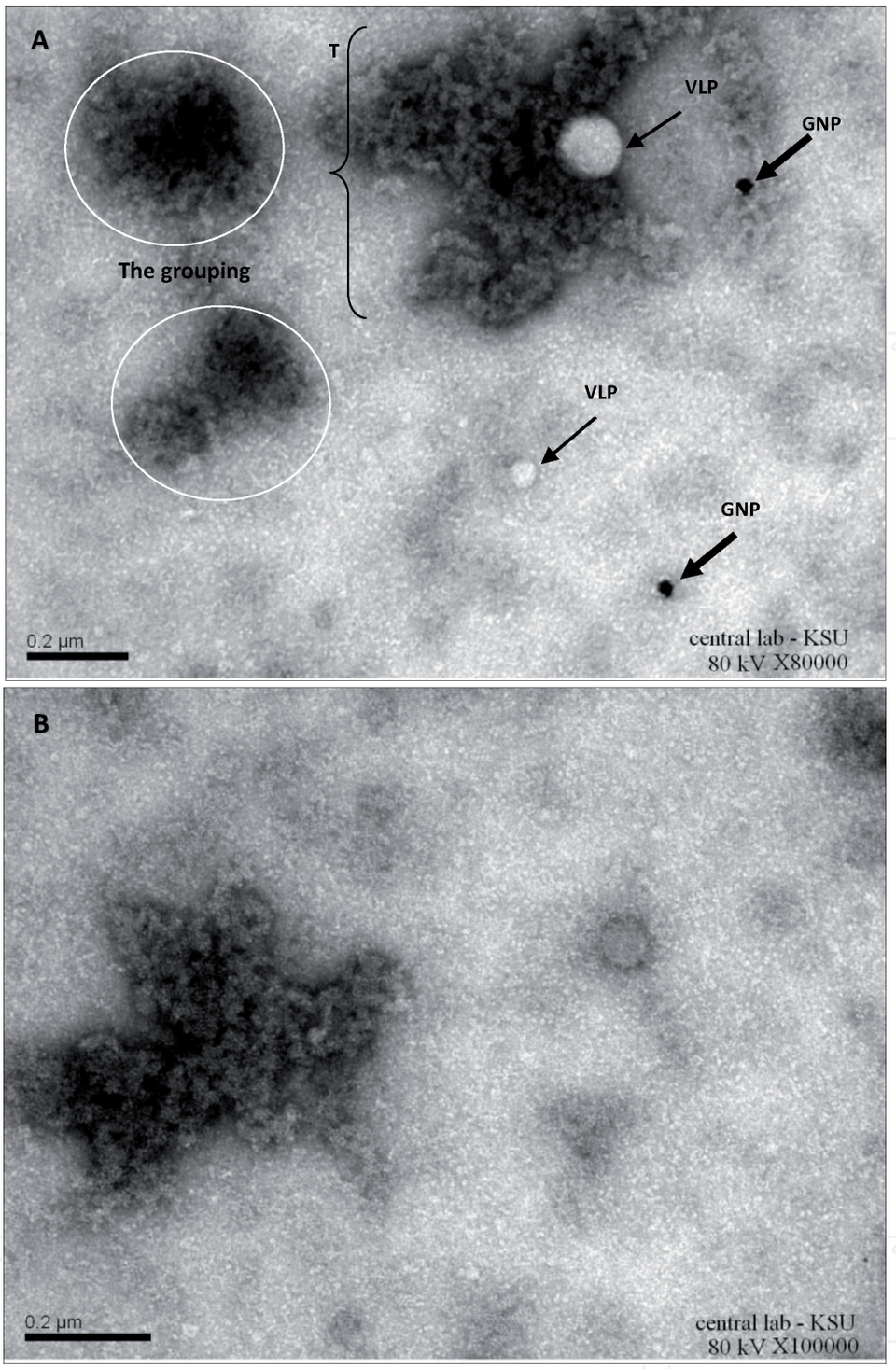
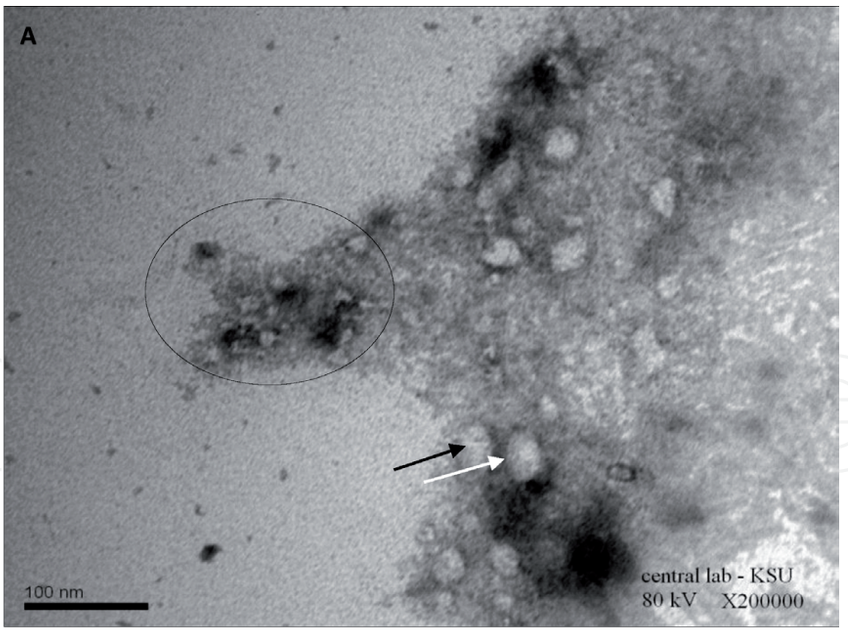
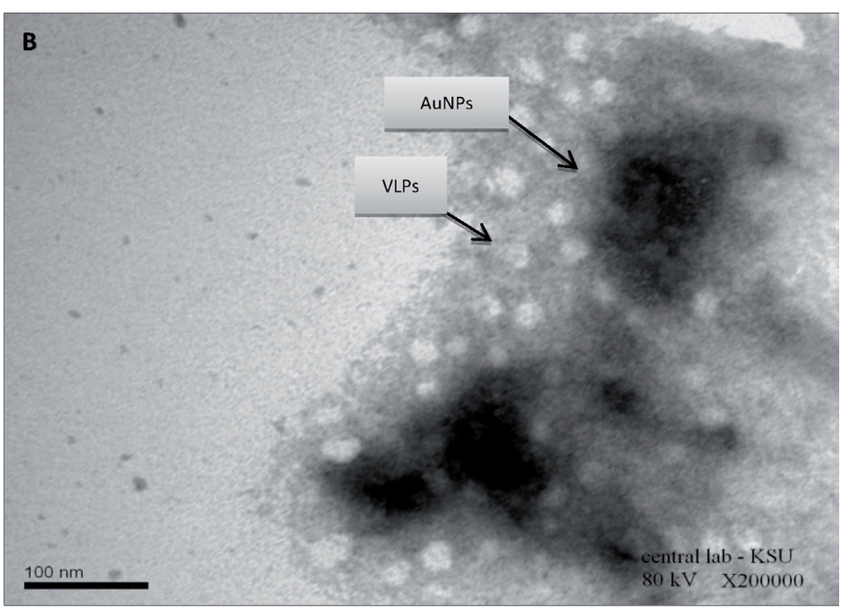


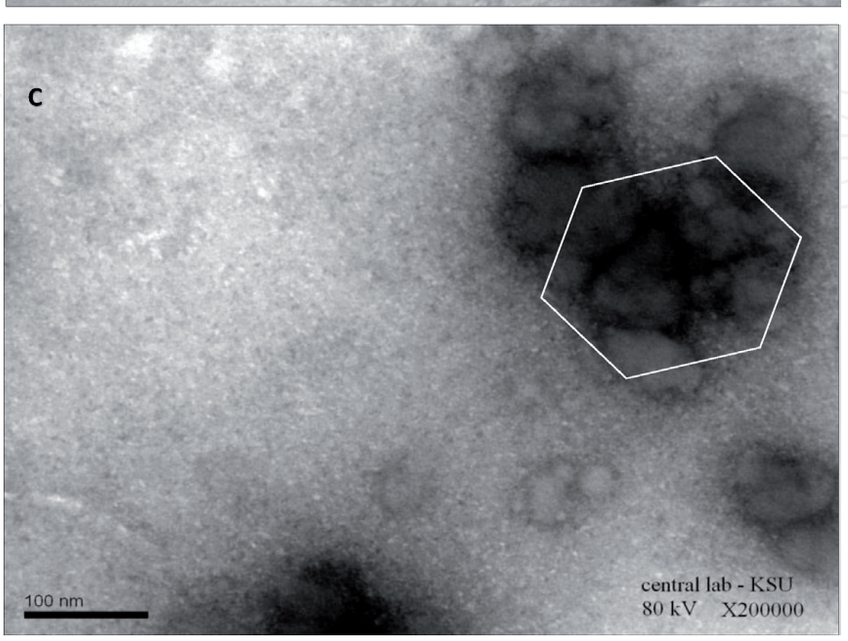
Figure 3.
Electron micrographs showing the treatments of gold nanoparticles (AuNPs) with virus particles In vitro *for 24 hr. (A) Aggregated the virus particles within AuNPs (outlined) with one blowing VLP particle inside the batch's areas of accumulated AuNPs. Scale bar 0.2 µm. (B) Higher magnification of (A). Scale bar 0.2 µm.*

2. Five determinant factors and viral deformation

The application of AuNPs revealed potential damage on VLPs according to five determinant factors that play an essential role in viral particle deformation. First, the incubation period's time duration with virus particles; (24 hr.& 48 hr.) incubation period exhibited deformation highly and vanishing VLPs weather (in *vivo* or in *vitro*). Second & third; Concentration and toxicity of AuNPs. 0.00034 g AuNPs was an initial concentration in one ml distilled water, which


A
100 nm
central lab - KSU
80 kV X200000


B
AuNPs
VLPs
100 nm
central lab - KSU
80 kV X200000


C
100 nm
central lab - KSU
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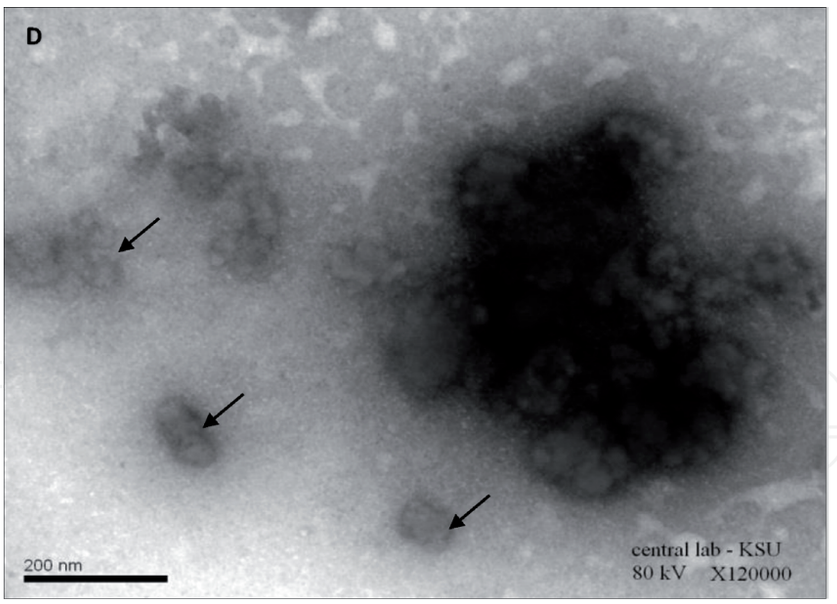
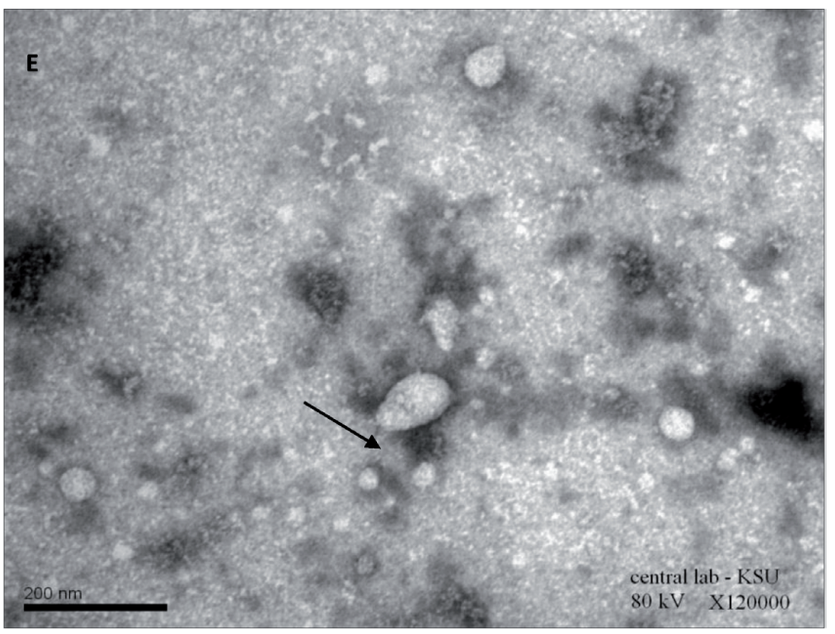

D
200 nm
central lab - KSU
80 kV X120000


E
200 nm
central lab - KSU
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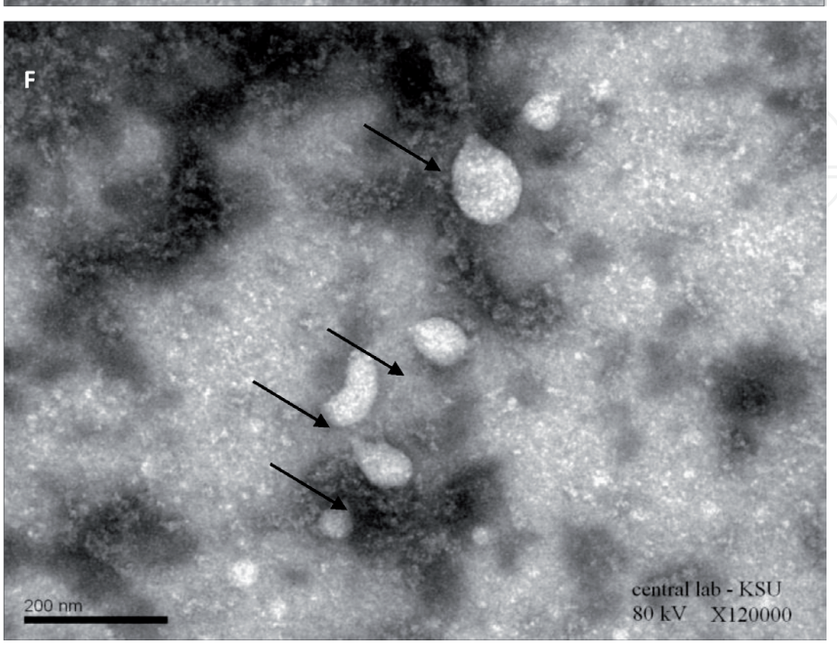
F
200 nm
central lab - KSU
80 kV X120000

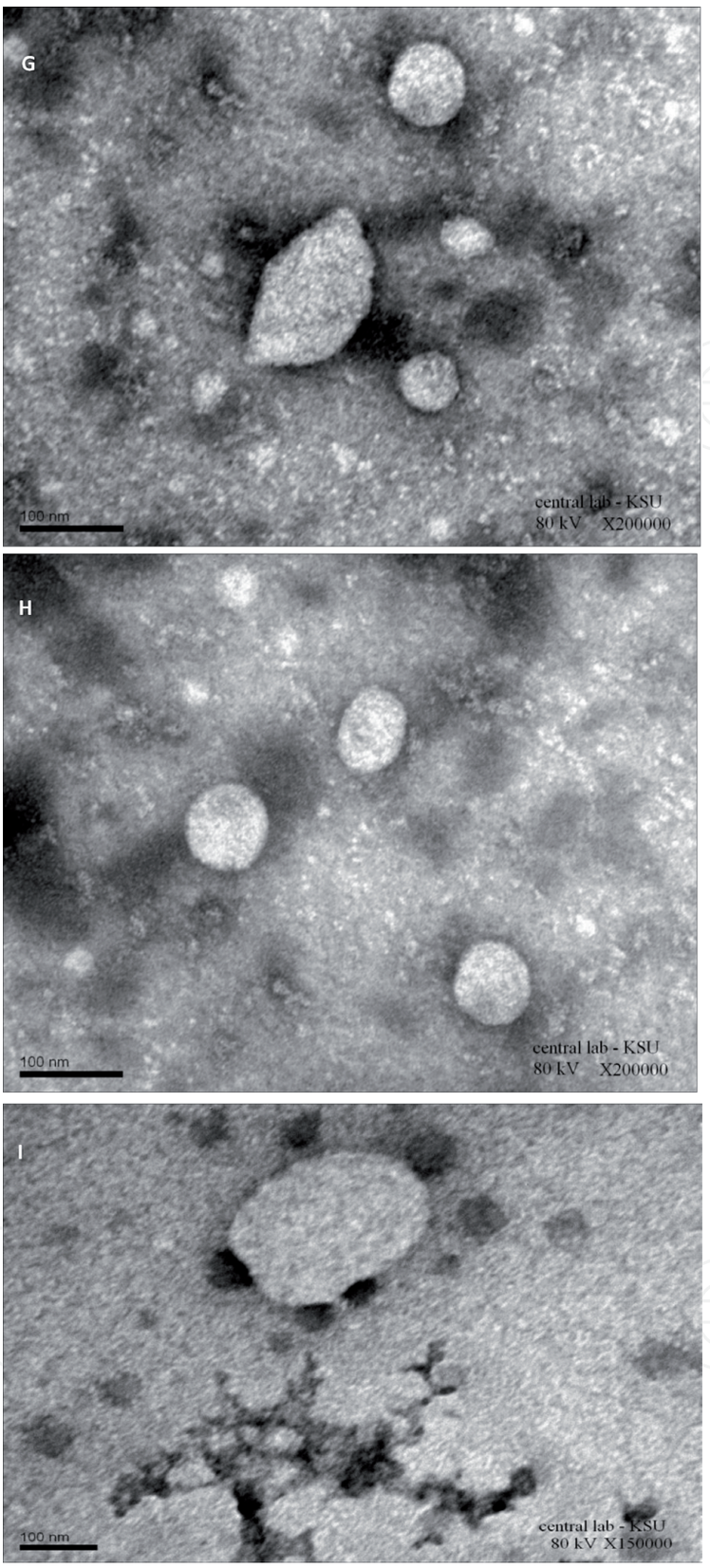

Figure 4.
Electron micrographs showing gold nanoparticles (AuNPs) with virus particles In vivo. *(A) Clotting and gathering VLPs (outlined), and then started to be billowed with dissociated unrounded particles (arrows). Scale bar 100 nm. (B) Some of the VLPs noticed in large size, and AuNPs clotted the particles around it. (arrows). Scale bar 100 nm. (C) Higher magnification for clotting crushed and smashed VLPs (outlined). Scale bar 200 nm. (D) AuNPs surround the VLPs, and the shapes of the particles were damaged and having asymmetric shapes in some other fields (arrows). Scale bar 200 nm. (E) Moreover, (F) high magnification for the deformed, abnormal particles having piriformis shape, different sizes, and shapes of the particles resulting from mixing AuNPs with crude sap as an inoculum (arrows). Scale bars 200 nm. (G) Moreover, (H) higher magnification indicating some individual abnormalities of blowing viral particles. Scale bars 100 nm. (I) Aggregation of VLPs with AuNPs and blown VLP particles surrounded by AuNPs. Scale bar 100 nm.*

had a significant effect on VLPs compared to the diluted one 0.00017 gm of AuNPs. It had excellent detrition results on virus particles in TEM, as shown in **Figures 3** and **4** as an application of AuNPs with virus infection.

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