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"In vitro" investigation on anti influenza A H1N1 and SARS-CoV-2 var. delta of a chemically characterized poplar-type propolis

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Effective prophylactic and therapeutic options for severe viral infections, such as influenza and COVID-19, are currently limited. This study investigates the antiviral and anti-inflammatory properties of a chemically characterized Euro-Asian poplar-type propolis extract.

The same propolis sample (a hydro-ethanolic dry extract obtained from a commercial poplar-type propolis authorized for use in food supplements and cosmetics within the EU) was used in three independent studies, ensuring quality control and a clear relationship between chemical composition and biological effects.

Propolis was analyzed using validated UV and HPLC methods. In vitro antiviral tests were performed against the influenza A (H1N1) virus in MDCK cells and SARS-CoV-2 (delta variant) in VERO E6 and CALU3 cells. Peripheral blood mononuclear cells (PBMC) were used to test anti-inflammatory activity. Cell-free enzymatic assays and cell-based molecular investigations completed the experimental protocol.

Chemical analysis confirmed a high flavonoid content (>15%) and total polyphenols (>18%), with major compounds including galangin, chrysin, pinocembrin, and caffeic acid phenethyl ester (CAPE).

In antiviral assays, the propolis extract did not show a significant effect against H1N1. However, it demonstrated strong anti-neuraminidase activity. More promising results were obtained against SARS-CoV-2 (delta variant) in VERO E6 and CALU3 cell cultures, where the extract protected cells from cytopathic effects in a concentration-dependent manner. Ultrastructural analysis revealed a decrease in viral particles, and viral titration confirmed a significant decrease in infectivity. Gene expression analysis revealed downregulation of viral N and E transcripts, suggesting inhibition of viral replication. The antiviral effect was due to a synergistic action of CAPE, galangin, and pinocembrin. Furthermore, propolis exhibited potent anti-inflammatory activity in LPS-stimulated PBMC, significantly reducing IL-1β, IL-6, and TNF-α, with an efficacy comparable to that of flurbiprofen.

These findings highlight the potential of poplar-type propolis for future experimental and clinical research in viral infections and inflammation management.