

Anti-nosemosis Activity of *Artemisia dubia* and *Aster scaber*

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Nosemosis is one of the most common protozoan diseases of adult bees (*Apis mellifera*). Nosemosis is caused by two species of microsporidia; *Nosema apis* and *Nosema ceranae*. *Nosema ceranae* is potentially more dangerous because it has the ability to infect multiple cell types, and it is now the predominant microsporidian species in *A. mellifera*. In this study, we identified two anti-nosemosis plants, *Aster scaber* and *Artemisia dubia*, which reduced the spore development of *N. ceranae* in spore-infected cells.

We intend to establish the anti-nosemosis activity of aqueous, ethyl acetate (EA), and butanol (BuOH) extracts of *A. dubia* and *A. scaber*. In order to determine the optimal dose, we did *in vitro* and *in vivo* toxicity for all the extracts and carried out anti-nosemosis experiments. Although all of the extracts (aqueous, EA, and BuOH) showed *in vitro* and *in vivo* anti-nosemosis activity in a dose-dependent manner, the aqueous extracts of *A. dubia* and *A. scaber* showed more potent anti-nosemosis activity than the EA and BuOH extracts.

And then, we isolated five phenolic compounds [chlorogenic acid, 3,4-dicaffeoylquinic acid (3,4-DCQA), 3,5-dicaffeoylquinic acid (3,5-DCQA), 4,5-dicaffeoylquinic acid (4,5-DCQA), and coumarin] from *A. dubia*, *A. scaber*, and *A. dubia* + *A. scaber* aqueous extracts and screened for their toxicities and anti-*Nosema* effects in both *in vivo* and *in vitro* conditions. Among these five compounds, coumarin, chlorogenic acid, and 4,5-DCQA exhibited less toxic but more potent anti-*Nosema* effects than the other two compounds. Especially, chlorogenic acid and coumarin showed prominent anti-*Nosema* activities even at the lowest concentration (10 µg/mL). They might have potential to be developed as alternative compounds for the control of *Nosema* disease.

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