

Acetylcholinesterase and Insect Growth Inhibitory Activities of *Gutierrezia microcephala* on Fall Armyworm *Spodoptera frugiperda* J. E. Smith

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From the aerial parts of *Gutierrezia microcephala* (Asteraceae), four oxyflavones were isolated, namely 5,7,2'-trihydroxy-3,6,8,4',5'-pentamethoxyflavone (**1**); 5,7,4'-trihydroxy-3,6,8-trimethoxyflavone (**2**); 5,7,2',4'-tetrahydroxy-3,6,8,5'-tetramethoxyflavone (**3**); 5,2'-dihydroxy-3,6,7,8,4',5'-hexamethoxyflavone (**4**), and an *ent*-clerodane, bacchabolivic acid (**5**). Compounds **1-5**, the synthetic methyl ester (**6**), *n*-hexane and MeOH extracts were evaluated against the fall armyworm (*Spodoptera frugiperda*). Gedunin, a known insect growth regulator isolated from *Cedrela* spp. was used as a positive control. When tested for activity on neonate larvae into the no-choice artificial diet bioassay, flavone (**1**), clerodane (**5**), its methyl ester (**6**), MeOH and *n*-hexane extracts caused significant larval mortality with MC₅₀ of 3.9, 10.7, 3.46, 7.95 and 7.5 ppm at 7 days, respectively, as well as growth reduction. They also increased the development time of surviving larvae and a significant delay in time to pupation and adult emergence. Acute toxicity against adults of *S. frugiperda* was also found, **5, 6**, gedunin and *n*-hexane extract had the most potent activity with LD₅₀ value of 6.59, 15.05, 10.78, and 12.79 ppm, respectively. In addition, MeOH, *n*-hexane extracts, **5, 6** and gedunin caused acetylcholinesterase inhibition with 93.7, 100, 90.2, 62.0 and 100% at 50.0 ppm, respectively; whereas **1-4** exhibited only moderate inhibitory activity. Compounds **1, 5** and **6** showed inhibitory activities comparable with gedunin. These compounds could be responsible of the insect growth inhibitory activity of this plant.