

Comparative Evaluation of Phytochemicals, and Antidiabetic and Antioxidant Activities of *Cuscuta reflexa* Grown on Different Hosts in Northern Thailand

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For the first time, total phytochemical profiles of methanol crude extracts of *Cuscuta reflexa* grown on three different hosts, *Coccinia grandis*, *Ficus racemosa* and *Samanea saman*, that were cultivated in northern Thailand were examined, along with their antidiabetic and antioxidant activities. The highest level of total flavonoids (114.4 mg QE/ g extract) and total phenolic content (90.8 mg GAE/ g extract) were observed in the extract of *Cu. reflexa* that was grown on *Co. grandis*. The GC-MS results showed that various types of phenolic compounds, hydrocarbons, saturated fatty acids and methyl ester of fatty acids, unsaturated fatty acids and methyl ester of fatty acids, vitamin E, terpenes and sterol contained in the extracts of *Cu. reflexa* were capable of being grown on three hosts. Moreover, the HPLC results showed the presence of gallic acid, catechin, vanillic acid, rutin and quercetin in all *Cu. reflexa* samples. The extract of *Cu. reflexa* that was grown on *Co. grandis* represented the highest antidiabetic activity with a percent inhibition of 51.2. Moreover, the extract also possessed the greatest antioxidant activity (DPPH; IC₅₀ 168.6 µg/mL, FRAP; 40.5 mg GAE/ g extract).

Keywords: *Cuscuta reflexa*, Phytochemical, Total flavonoid content, Total phenolic content, Antidiabetic activity, Antioxidant activity.

The parasitic plant, *Cuscuta*, is commonly used as an ingredient in functional food and in medicinal tonics as a nutrient. It is also often used in alcoholic beverages [1]. In northern Thailand, one of the most widely distributed *Cuscuta* plants is *Cu. reflexa* Roxb. This can grow on a wide variety of plant hosts including a number of perennial plants and annual crop species. Previous research reported that the chemical constituents of *Cuscuta* depend on the type of host [2–3]. Various types of phenolic compounds and their glycosides, terpenes, sterols, saturated aliphatic hydrocarbon, saturated fatty acids and unsaturated fatty acids were found in *Cu. reflexa* [4]. The study of Perveen *et al.* [5] revealed that the phenolic acid and other phenolic components, such as flavonoids found in *Cu. reflexa*, are often extracted in higher amounts in more polar solvents. Furthermore, previous research studies indicated that the stem of *Cu. reflexa* possessed antibacterial, antiviral, anticancer and antioxidant activities [6–7]. The objectives of this study were to identify the total flavonoid content (TFC) and total phenolic content (TPC), and chemical constituents in the methanol crude extracts of *Cu. reflexa* that were grown on three different hosts, *Coccinia grandis* (L.) Voigt., *Ficus racemosa* Linn. and *Samanea saman* (Jacq.) Merr., as well as to evaluate the antidiabetic and antioxidant activities of the above mentioned crude extracts.

Total flavonoid and total phenolic contents of the extracts of *Cu. reflexa* were evaluated, and the results are shown in Table 1. TFC values ranged from 67.5 to 114.4 mg QE/ g extract, while the TPC values ranged from 84.4 to 90.8 mg GAE/ g extract. The highest value of TFC and TPC was exhibited in the extract of *Cu. reflexa* grown on *Co. grandis*. Anjum *et al.* [1] demonstrated the TFC and TPC in methanol extracts of *Cuscuta* sp. that were grown on 9 different hosts. The results revealed that the TFC ranged from 47.0 to 81.0 mg catechin/ g of the dry weight, while the TPC value was in the range of 39.4 to 66.2 mg/g.

Table 1: Total flavonoid and total phenolic contents of the methanol crude extracts of *Cuscuta reflexa* grown on *Coccinia grandis*, *Ficus racemosa* and *Samanea saman*.

Host plant	Total flavonoid contents (mg QE/ g extract)	Total phenolic contents (mg GAE/ g extract)
<i>Coccinia grandis</i>	114.4±0.7a	90.8±2.9a
<i>Ficus racemosa</i>	79.0±1.8b	86.6±0.5b
<i>Samanea saman</i>	67.5±2.6c	84.4±1.4b

*Average ± standard deviation from three replicates.

The different letters in the same column are considered significantly different according to Duncan's multiple comparison test ($P < 0.05$).

The phytochemicals of the all extracts of *Cu. reflexa* were analyzed by gas chromatography and mass-spectrometry (GC-MS). Each compound was identified based on mass spectral matching ($\geq 90\%$) from W8N08 and Wiley7n libraries and is reported in Table 2. The compounds identified in all of the *Cu. reflexa* extracts were (1) phenolic compounds (4-vinylphenol, 4-vinylguaiacol, methyl cinnamate, methyl 4-hydroxycinnamate and methyl-3-(3,5-ditertbutyl-4-hydroxyphenyl) propionate), (2) hydrocarbons (cyclopentadecane, nanocosane and squalene), (3) saturated fatty acids and methyl esters of fatty acids (palmitic acid methyl ester, steric acid methyl ester, palmitic acid amide, arachidic acid methyl ester, stearic acid amide, and lignoceric acid methyl ester), (4) unsaturated fatty acids and methyl esters of fatty acids (linoleic acid methyl ester, linolenic acid methyl ester and oleic acid amide), (5) vitamin E (α - and γ -tocopherol), (6) terpenes (phytol and β -amyryl), and (7) sterols (campesterol, stigmasterol, (24R)-24, 27-dimethylcholesta-5,26-dien-3 β -ol and β -sitosterol). However, methyl ferulate, palmitic acid, pentadecanoic acid methyl ester, palmitoleic acid methyl ester, *E*-9-heptadecenal and baccharan-3 β -ol were only found in the extract of *Cu. reflexa* grown on *Co. grandis*. Additionally, docosanoic acid methyl ester was only detected in the extract of *Cu. reflexa* grown on *S. saman*. As in the study of Bais and Kakkar [3], the chemical constituents of *Cu. reflexa* vary with the type hosts. In the same way, linolenic acid, linoleic acid, oleic acid, stearic acid, palmitic acid, β -sitosterol,