Botanical review

Chelidonium majus

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THE MAIN ACTIVE CONSTITUENTS in *Chelidonium* are the alkaloids chelidonine, chelerythrine, sanguinarine (1,2) and sometimes protopine (3). Chelidonine is a major component in the roots but not in the tops (3). The concentration of chelerythrine is significantly greater than for sanguinarine, and a large number of minor alkaloids are also present (4). The roots contain greater amounts of alkaloids than the tops (1,3) with values ranging from 0.2-2.0% in the leaves, 0.1-0.8% in the stems, and 0.2-2.8% in the roots. Alkaloids are maximized when the plants grow in open sunshine in soils with a neutral pH(5). While the content of chelidonine remains constant after flowering, chelerythrine and sanguinarine(1) and the total alkaloid content increases from blossoming to late summer (0.5 to 1.7% alkaloids in the tops and 0.8 to 2.2% in the roots, respectively) and decreases in the autumn (6). Drying fresh plant material for 10 minutes at 105° retains the alkaloids, whereas drying at room temperature or 60° decreases the alkaloid content significantly (7).

Both empirical effects and results of tests with the alcoholic extract of *Chelidonium* show it to be a suitable treatment for patients with bile, liver, and digestive troubles (8). *Chelidonium* stimulates bile flow in guinea-pigs (9). *Chelidonium* extracts and their alkaloidal fractions relieve histamine-induced spasms of guinea-pig ileum *in vitro* (6). In frogs, mice, and rats an extract reduced pain sensation for 4-48 hours and relieved gastralgia from ulcers in the experimenters. It also toned the small intestine and stimulated the uterus of the rat while relaxing its colon. Chelidonine also produced the latter effects except it relaxed the rat uterus (10). Chelerythrine and protopine stimulated the isolated small intestine and uterus of rabbits and guinea-pigs, and chelidonine also stimulated these uteri (11,12). Chelerythrine and sanguinarine are anti-inflammatory with low toxicity and have been recommended for use in the treatment of oral inflammatory processes (13). They also inhibit liver alanine aminotransferase activity (14) and along with a number of minor *Chelidonium* alkaloids inhibit acetylcholinesterase activity (15).

Compared with other higher plants that were screened, *Chelidonium* root possesses potent *in vitro* antimicrobial activity specifically against *Staph. aureus*, *Klebsiella pneumoniae*, *Mycobacterium smegmatis*, and *Candida albicans* (16). Chelerythrine and sanguinarine were also more potent than the many other natural and synthetic alkaloids that were tested on the same organisms, with chelidonine being somewhat weaker (16,17). A *Chelidonium* alkaloid fraction and chelerythrine both produced *in vitro* inhibition of *Staph. aureus* and Group A beta-Streptococcus comparable to lincomycin (13). The activity of chelerythrine and sanguinarine is much greater against gram-positive than gram-negative bacteria (13,15,16,17). Treatment with extracts of *Chelidonium* of guinea-pigs that were inoculated with acid-fast *Mycobacterium tuberculosis* doubled their survival time (18). Sanguinarine had slightly greater fungistatic activity than chelidonine and protopine against *Epidermophyton floccosum in vitro* (19). Cheleythrine and its mixture with sanguinarine produced an antifungal effect *in vitro* against *Trichophyton mentagrophytes* and *T. rubrum*, *Microsporum canis*, *Epidermophyton floccosum*, and *Aspergillus fumigatus*. The activity of chelerythrine was comparable to that of the commercial preparations nitrofungin and myco-decidin (20).

The antiviral activity of *Chelidonium* was demonstrated when an extract of its root inhibited the measles virus *in vitro* (21). The alkaline ether extract of the entire plant inhibited the the Herpes virus *in vitro* (22). *Chelidonium* was also active against viral encephalomyocarditis (23). After neutralizing influenza virus *in vitro*, *Chelidonium* alkaloids given to mice with influenza virus-induced pneumonia were therapeutically effective when the virus dose was low (24), and prolonged the survival of mice infected with influenza A virus (25). The more potent thiophosphamide derivatives of chelidonine (25) have been shown to reverse the T-helper cell deficiency and diminish the T-suppressor cell overgrowth in patients with AIDS (26).

The carcinostatic tumor inhibition of sarcoma 180 and Ehrlich carcinoma by chelidonine and protopine was associated with considerable cytotoxic activity (27,28). For chelidonine and sanguinarine this activity was shown in HeLa, normal rabbit kidney, and Ehrlich ascites carcinoma cell cultures (29). Sanguinarine and chelerythrine were both cytotoxic against KB cells at low doses (17), causing changes in cell shapes and inhibiting cell mitoses in HEp-2 cell cultures (30). Several minor *Chelidonium* alkaloids also exhibit cytotoxic activity against Eagle's 9 KB carcinoma of the nasopharynx in cell culture (31).

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