

### Antifungal Activity of some Constituents of *Murraya koenigii* Spreng

In the course of our investigations on the antimicrobial properties of some plant isolates, we reported the antifungal and antibacterial properties of some natural coumarins<sup>1-3</sup>. These coumarins are new additions to the already known antibiotic substances or preparations from plant sources<sup>4,5</sup>. Recently we have isolated and characterized several crystalline constituents of the stem-bark of *Murraya koenigii* Spreng. (Fam. Rutaceae) an Indian medicinal plant of repute<sup>6,7</sup>. Of these murrayanine C<sub>14</sub>H<sub>11</sub>O<sub>2</sub>N, m.p. 168°, has been tentatively formulated as 3-formyl-1-methoxy carbazole<sup>8</sup>, while girinimbine<sup>9</sup> C<sub>18</sub>H<sub>17</sub>ON, m.p. 176°, and mahanimbine<sup>10</sup> C<sub>23</sub>H<sub>25</sub>ON, m.p. 94–95°, optical rotation D 26.5 = +45.4 (chloroform), have been found to be pyrano-carbazole derivatives. The stem-bark of the plant is used in the indigenous system of medicine against eruptions and bites of poisonous animals. It was therefore of interest to examine the antimicrobial properties of the compound isolated from the stem-bark of *M. koenigii*. In the present communication the antifungal action of murrayanine, girinimbine and mahanimbine on some human pathogenic fungi is reported. The compounds were tested against the fungi *Microsporium gypseum*, *Microsporium audouini*, *Trichophyton rubrum*, *Nocardia asteroides*, *Epidermophyton floccosum* and *Candida albicans*.

Table I. Results of assay

Test organisms	Zone of inhibition in mm		
	Girinimbine	Murrayanine	Mahanimbine
<i>Microsporium gypseum</i>	20	14	12
<i>Microsporium audouini</i>	18	–	–
<i>Trichophyton rubrum</i>	16	10	12
<i>Nocardia asteroides</i>	24	–	20
<i>Epidermophyton floccosum</i>	–	–	–
<i>Candida albicans</i>	9	9	9

Table II. Minimum inhibitory concentration (MIC) of the substances in µg/ml

Test organisms	MIC in µg/ml		
	Girinimbine	Murrayanine	Mahanimbine
<i>Microsporium gypseum</i>	300	3000	3000
<i>Microsporium audouini</i>	300	–	–
<i>Trichophyton rubrum</i>	300	3000	3000
<i>Nocardia asteroides</i>	30	3000	300

*cosum* and *Candida albicans*. The results on the antibiotic action of the compounds against some test bacteria and plant pathogenic fungi were not promising and therefore the data are not reported.

The experiments were carried out by the usual agar-cup assay method using Sabouraud's agar medium. After incubation at 37°C for 120–150 h, the inhibition zones produced by the compounds were measured. As the test materials were not soluble in water, 30 mg of each were dissolved in 10 ml of a mixture of ethanol and ethylene glycol (1:4). The results of assay are presented in Table I. The minimum inhibitory concentration (MIC) was determined, using dilute solution of the materials in the assay procedure. This is shown in Table II. It will be evident from the Tables that the activity of the compounds is species selective. The highest activity has been shown by girinimbine against *N. asteroides*.

The constituents of *M. koenigii*, therefore, may be regarded as new additions to the list of already known antibiotics derived from higher plants, although the inhibitory power of these compounds is limited<sup>5</sup>. The compounds belong to a hitherto unknown group of plant products built up on the carbazole skeleton. Some synthetic carbazole derivatives have also been found to be quite active against the above fungi. Carbazole and N-methyl carbazole have, however, no inhibitory action against these fungi. More results will be reported shortly.

*Zusammenfassung.* Es wird über die antifungale Wirksamkeit der Murrayanine, Girinimbine und Mahanimbine, drei aus *Murraya koenigii* Spreng. isolierte Carbazol-derivate, berichtet.

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### The Effect of Diet on the Hemolymph Amino Acid Constituents of the Larvae and Pupae of *Sarcophaga ruficornis* (Fabricius): (Diptera)

The hemolymph of a number of dipterous insects, for example *Musca* (PRATT<sup>1</sup>, PRICE<sup>2</sup>), *Gastrophilus* (LEVENBOOK<sup>3</sup>) and *Calliphora* (FINLAYSON and HAMMER<sup>4</sup>, HACKMAN<sup>5</sup>), have been analysed by paper partition

chromatography and a wide variation has been found in their amino acid constituents. These variations have been

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