SHORT REPORT

J. Sci. Soc. Thailand, 12 (1986) 239–242

ANTIMICROBIAL ACTIVITIES OF CHEMICAL CONSTITUENTS FROM *GARCINIA MANGOSTANA* LINN.

WILAWAN MAHABUSARAKAM,[a] PICHAET WIRIYACHITRA[a,c] AND SAOWALUK PHONGPAICHIT[b]

[a]*Department of Chemistry, Prince of Songkla University, Hat Yai, Thailand.*

[b]*Department of Microbiology, Prince of Songkla University, Hat Yai, Thailand.*

[c]*To whom correspondence should be adressed.*

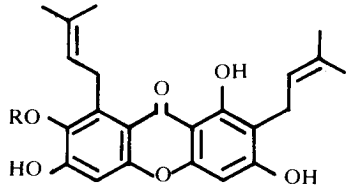
(Received 16 July 1986)

Abstract

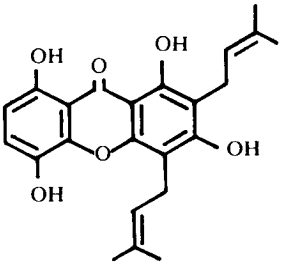
Mangostin, gartanin, γ-mangostin, 1-isomangostin and 3-isomangostin isolated from Garcinia mangostana *Linn. (Guttiferae) were investigated for their in vitro activities against* Staphylococcus aureus *both normal and penicillin-resistant strains. The best activity against both strains was found in mangostin. Mangostin, γ-mangostin and gartanin showed no activity against* Candida albicans *and* Cryptococcus neoformans, *but exhibited moderate activities against* Trichophyton mentagrophytes *and* Microsporum gypseum.

Garcinia mangostana Linn., commonly known as the mangosteen tree, has received extensive investigation since 1855 when Schmid isolated mangostin from the fruit hull.[1] Later investigations resulted in the isolation of many other substances from this plant,[2-11] other major components apart from mangostin being β-and-γ-mangostin, 1-and 3-isomangostin and gartanin. Our interest in this plant arose from the fact that the bark is described in Thai folklore as a remedy for skin diseases and for healing wounds.[12] This work was then undertaken with the aim to isolate the active components for antibacterial and antifungal testing and to explore the possibility of developing them into some pharmaceutical preparations for these purposes.

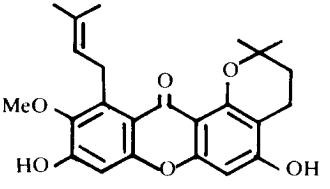
Reinvestigation of the extract from the fruit hulls has resulted in the isolation of mangostin **(1)** gartanin **(2)**, γ-mangostin **(3)**, 1-isomangostin **(4)**, 3-isomangostin **(5)**, and five new naturally occuring xanthones. Work on the xanthones will appear in a



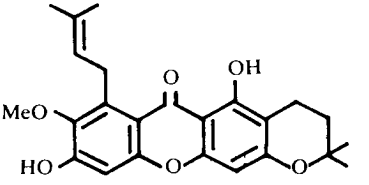
(1) R = Me, mangostin
(3) R = H, γ-mangostin



(2) gartanin



(4) 1-isomangostin



(5) 3-isomangostin

future report. The identities of the known compounds were confirmed by spectroscopic methods and by comparison of their melting points with those in previous reports.

The above-mentioned known components were tested for their activities against a normal strain of *Staphylococcus aureus* (ATCC 25923) using the broth dilution method[13] and using methicillin as a comparison. The order of the efficacy determined by the minimal inhibitory concentration (MIC μg/ml) was found to be methicillin (3.9) > mangostin (15.6) > γ-mangostin (31.2) > 1-isomangostin (62.5) > 3-isomangostin (125) > gartanin (250). When these compounds were tested against 41 samples of penicillin-resistant strains of *S. aureus* using the agar dilution method,[13] the following result was obtained: mangostin (1.56-12.5) > methicillin (1.56-12.5) > 1-isomangostin (125) > 3-isomangostin (250), γ-mangostin (250), gartanin (250). The 41 penicillin-resistant strains of *S. aureus* were obtained from Songklanagarind Hospital, Hat Yai and Siriraj Hospital, Bangkok.

During the course of our investigation, there was a report,[15] that mangostin and isomangostin had an MIC in the range of 12.5 μg/ml - 50 μg/ml for bacteria and 1-5 μg/ml for fungi. However, in that report no test was performed on a penicillin-resistant strain of *S. aureus*.

TABLE 1. % GROWTH INHIBITION BY MANGOSTIN

concentration μg/ml / fungus	1000	500	250	125	62.5	control
T. mentagrophytes						
the diameter of colony (mm)	15.5	21	22	27	27	42.5
% inhibition	63.3	52.4	48.2	36.4	36.4	
M. gypseum						
the diameter of colony (mm)	17.5	20.5	26	28	28	42.5
% inhibition	57.3	50.0	36.5	31.7	31.7	

TABLE 2. % GROWTH INHIBITION BY GARTANIN

concentration μg/ml / fungus	1000	500	250	125	62.5	control
T. mentagrophytes						
the diameter of colony (mm)	16	18	21	33.5	37	42.5
% inhibition	62.3	57.6	50.5	21.1	12.9	
M. gypseum						
the diameter of colony (mm)	21	24.5	26	29.5	32.5	42.5
% inhibition	48.7	40.2	36.5	28.0	20.7	

TABLE 3. % GROWTH INHIBITION BY γ-MANGOSTIN

concentration μg/ml / fungus	1000	500	250	125	62.5	control
T. mentagrophytes						
the diameter of colony (mm)	14	16	18.5	16.5	28	42.5
% inhibition	67.0	62.3	56.4	61.1	34.1	
M. gypseum						
the diameter of colony (mm)	13.5	15.5	18	16	24	42.5
% inhibition	67.0	62.2	43.9	60.9	41.4	

Our results on the penicillin-resistant *S. aureus* complement that report. However, while our results with the normal strain of *S. aureus* agree with the previous findings, we did not obtain MIC values for fungi as low as those previously reported. After several unsuccessful trials, we believe that the MIC for fungi should be several magnitudes higher than those reported in the previous work.

The activities of mangostin, gartanin and γ-mangostin against *Candida albicans, Cryptococcus neoformans, Trichophyton mentagrophytes* and *Microsporum gypseum* were tested using the agar dilution method.[14] All of the components showed moderate activities against *T. mentagrophytes* and *M. gypseum* but exhibited no activity against *C. albicans* and *C. neoformans*. Results for the dermatophytes are shown in Tables 1-3.

Acknowledgement

We thank the Deutsches Forschungsgemeinshaft and the International Development Program adjunct Network for the Chemistry of Biologically Important Natural Products for their financial and other support for this investigation.

References

1. Schmid, W. (1855) *Ann.*, **93**, 83.
2. Sen, A. K., Sarkar, K. K., Majumder, P. C., Benerji, N., Uusvuori, R. and Hase, T. A. (1982) *Phytochemistry*, **21**, 1747-50.
3. Sen, A. K., Sarkar, K. K., Majumder, P. C. and Benerji, N. (1980) *Indian J. Chem. Sect. B.* **19B**, 1008.
4. Sen, A. K., Sarkar, K. K., Majumder, P. C., Benerji, N., Uusvuori, R. and Hase, T. A. (1980) *Phytochemistry*, **19**, 2223.
5. Du, C.T. and Francis, F.J. (1977) *J. Food Sci.*, **42**, 1667.
6. Holloway, D. M. and Scheinmann, F. (1975) *Phytochemistry*, **14**, 2517.
7. Govindachari, T. R., Kalyanaraman, P. S., Muthukumaraswamy, N. and Pai, B. R. (1971) *Tetrahedron* **27**, 3919.
8. Govindachari, T. R., Kalyanaraman, P. S., Muthukumaraswamy, N. and Pai, B. R. (1971) *Indian J. Chem.* **9**, 505.
9. Jefferson, A., Guillinan, A. J., Scheinmann, F. and Sim, K. Y. (1970) *Aust. J. Chem.*, **23**, 2539.
10. Yates, P. and Bhat, H. B. (1968) *Canadian J. Chem.*, **46**, 3770.
11. Crichton, E. G. and Waterman, P. G. (1979) *Phytochemistry*, **18**, 1553.
12. Phaet Tha-nesuan, P. (1973) *'Texts on Traditional Thai Medicinal Plants'*, Part 3, Phichai Press, Bangkok.
13. Washington II, J. A. and Barry, A. L. (1974) Dilution Test Method. In *Manual of Clinical Microbiology*, ed. Lennette E. H., Spaulding, E.H. and Truant J.P., American Society for Microbiology, Washington, D.C., p. 414.

14. ibid, p. 573.

15. Sundaram, B. M., Gopalakrishnan, C., Subramanian, S., Shankaranaraynan, D. and Kamesavaran, L. (1983) *Planta Medica,* **49**, 60.

บทคัดย่อ

สารแมงโกสติน การ์ทานิน แกมมาแมงโกสติน 1–ไอโซแมงโกสติน และ 3-ไอโซแมงโกสติน ซึ่งสกัดได้จากต้นมังคุดแสดงฤทธิ์ต้านเชื้อสแตฟฟัยโลคอคคัส ออเรียส ได้ทั้งสายพันธุ์ปกติและสายพันธุ์ที่ดื้อต่อเพนนิซิลิน โดยแมงโกสตินแสดงฤทธิ์ดีที่สุด แมงโกสติน แกมมาแมงโกสติน และการ์ทานินไม่แสดงฤทธิ์ต้านเชื้อแคนดิดา อัลบิแคนส์ และ คริพโทคอคคัส นีโอฟอร์แมนส์ แต่แสดงฤทธิ์ต้านเชื้อโทรโคฟัยทัน แมนทาโกรฟัยท์ และไมโครสพอรัม จิพเซียม ได้ในระดับปานกลาง