



**UNIVERSITI PUTRA MALAYSIA**

**CHEMOTAXONOMIC STUDIES ON PSYCHOTRIA ROSTRATA  
AND ALSEODAPHNE PERAKENSIS**

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CHEMOTAXONOMIC STUDIES ON PSYCHOTRIA ROSTRATA  
AND ALSEODAPHNE PERAKENSIS

by

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Thesis Submitted in Fulfilment of the  
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## LIST OF ABBREVIATIONS

br	broad
CA	Chemical Abstract
dea	diethylamine
D O 2	deuterium oxide
EtOAc	ethyl acetate
EtOH	ethanol
HMR	proton magnetic resonance
hr	hour
IR	infra red
l	liter
MeOH	methanol
MS	mass spectrum/ mass spectrometry
NMR	nuclear magnetic resonance
pet. ether	petroleum ether
plc	preparative layer chromatography
s	strong (absorption)
sh	shoulder
T	temperature
tea	triethylamine
tlc	thin layer chromatography
UV	ultra violet
w	weak



Abstract of the thesis presented to the Senate of Universiti  
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August 1989

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Faculty : Science and Environmental Studies

A chemotaxonomic investigation on the basic fraction of a medicinal plant Psychotria rostrata, has resulted in the isolation of six alkaloidal components. The structures of these alkaloids were elucidated using spectroscopic methods such as UV, IR, NMR, MS and also by comparison with literature. The alkaloids were found to be chimonanthine, calycanthine, hodgkinsine, a stereoisomer of quadrigemine B, designated as Z-2 and two new compounds, Z-3 and Z-4.

All these alkaloids were actually oligomers of either two, three or four units of compounds derived from tryptamines.

Chimonanthine, hodgkinsine, Z-2 and Z-4 were made up of pyrrolidinoindoline type structures while calycanthine was a



dibenzonaphthyridine. The new trimeric base Z-3 was believed to arise from the condensation of these two types of structures.

A similar study on the basic fraction from the leaves of Alseodaphne perakensis afforded morphinandienone type alkaloids, O-methylflavinanthine and a minor component O-methylflavinanthine N-oxide. In addition, 7-hydroxy-2,3,6-trimethoxyphenanthrene was also isolated.

The structures of O-methylflavinanthine N-oxide and 7-hydroxy-2,3,6-trimethoxyphenanthrene were determined based on the spectroscopic data and also by chemical conversion.

Reduction of O-methylflavinanthine with sodium borohydride gave a quantitative yield of epimeric dienols. Treatment of the dienols with acid in methanol yielded a mixture of substituted and rearranged products.



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KAJIAN KIMOTAKSONOMI KE ATAS PSYCHOTRIA ROSTRATA  
DAN ALSEODAPHNE PERAKENSIS

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Kajian kimotaksonomi ke atas pecahan bes daripada tumbuhan ubatan tradisional Psychotria rostrata, memberikan enam komponen alkaloid. Struktur alkaloid ini telah dikenalpasti dengan menggunakan kaedah spektroskopi seperti UV, IR, NMR, MS dan juga perbandingan dengan literatur. Alkaloid ini di kenalpasti sebagai kimonantina, kalikantina, hodgkinsina, stereoisomer kuadrigemina B, yang disebutkan sebagai Z-2 dan dua komponen yang belum pernah ditemui, yang disebutkan sebagai Z-3 dan Z-4.

Kesemua alkaloid ini sebenarnya terdiri daripada samada dua, tiga atau empat unit sebatian yang diterbitkan daripada triptamina.



Kimantina, hodgkinsina, Z-2 dan Z-4 terdiri daripada struktur jenis pirolidinoindolina manakala kalikantina daripada jenis dibenzonaftiridina. Bes trimer Z-3 yang pertama kali dijumpai, dipercayai terhasil daripada kondensasi kedua-dua jenis struktur ini.

Kajian yang serupa ke atas daun pokok Alseodaphne perakensis menghasilkan alkaloid jenis morfinandienon iaitu, O-metilflavinantina dan komponen minor O-metilflavinantina N-oksida. Di samping itu, 7-hidroksi-2,3,6-trimetoksifenantrena juga telah diasingkan.

Struktur O-metilflavinantina N-oksida dan 7-hidroksi-2,3,6-trimetoksifenantrena telah ditentukan berdasarkan kepada data spektroskopi dan penukaran kimia.

Selain daripada itu, penurunan O-metilflavinantina dengan menggunakan natrium borohidrida memberikan hasil kuantiti epimer dienol. Tindakbalas dienol dengan asid di dalam metanol seterusnya memberikan campuran hasil tukargantian dan juga penyusunan semula.





PART I

ALKALOIDS OF PSYCHOTRIA ROSTRATA



## INTRODUCTION

*"It is He Who has created for you all things that are on earth; ..."*

*(Al-Baqarah: 29)*

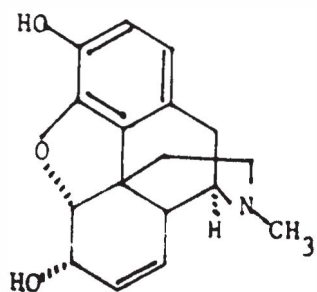
### General Introduction

Man has long been associated with plants for various reasons such as for food, medicine, raw material for buildings, dye and etc. In medicine, various plants derived constituents were used to treat different types of diseases and ailments. Some of the well known examples include the use of morphine (1), as an analgesic, quinine (2) as an anti-malarial drug, digitoxin (3) in the treatment of heart disease and reserpine (4) as an anti-hypertensive agent.

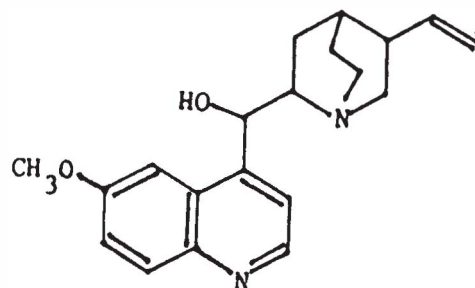
Some other plants derived chemicals may be used as a building block for semi-synthetic derivatives. An example of this is diosgenin (5) which has been used as the primary starting material for the synthesis of the majority of steroidal hormones currently used in medicine.

Amongst the different classes of plants derived compounds, alkaloid formed one of the largest group of secondary metabolites. Because of its marked physiological activities

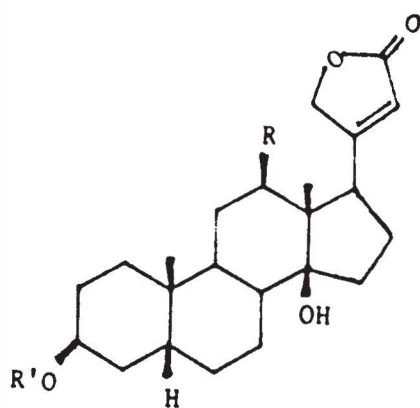




(1)



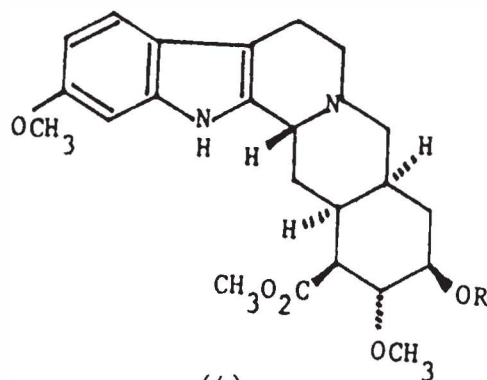
(2)



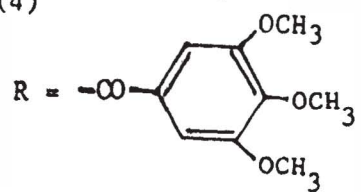
(3)

$R = H$

$R' = \text{sugar residue}$



(4)



(5)

and potential uses in medicine, much of the research activities have been directed in search for active compounds in this class of natural products. In fact, a large percentage of therapeutic drugs derived from plants were contributed by this class of compounds (Farnsworth et al., 1977).

Recently, there has been resurgence of interest and research in medicinal plants amongst the local scientists in Malaysia. A number of individuals and groups have conducted various research activities related to medicinal plants and these were reviewed in various publications; Marziah (1983), Latiff et al. (1984), Nordin et al. (1985). Since Malaysia is rich with flora, many of which were claimed to have some medicinal uses, the growing interest in the studies of these plants is understandable.

The earliest record on the uses of local medicinal plants were given by Gimlet and Thompson (1939), Burkill and Haniff (1930) and Burkill (1935). It was also reported that there existed about 6,800 of seed plants and 600 seedless plants in the Peninsular Malaysia (Holttum 1954; Keng 1970). About 15.5 percent of these were claimed to have some medicinal uses (Latiff et al., 1984).

The areas of research ranged from phytochemical work to pharmacological testing of the potentially active components. However, many of these were isolated from one another and

therefore a drive to encourage collaboration amongst scientists from various disciplines is deemed necessary in order to generate the most useful and meaningful results.

A number of phytochemical survey works have been conducted in UPM in order to select plants for chemical investigation. From these activities, a plant species Psychotria rostrata collected from Air Hitam, Puchong, Selangor was shown to have positive Mayer's test for alkaloids.

Even though this plant was claimed to be used for various medicinal purposes (Burkill, 1935), no scientific investigation has ever been reported. As an initial approach to a more detail scientific investigation, a phytochemical study is carried out in order to establish the chemical constituents of this plant.

#### Genus Psychotria

Psychotria is a very large genus of shrubs from the family Rubiaceae. It can be found in all tropical countries around the world. It is estimated that there are about 700 species which belong to this genera (Usher, 1974).

Most of the Malayan species of the genus are shrubs or climber and one was recorded to be an epiphyte. Some of their uses by the local people have been described by Burkill (1935) and is summarized in Table 1.

Table 1  
Medicinal Uses of Psychotria species

Species	Uses
<u>P. grifithii</u>	- decoction of the roots drunk for pains in the bones.
<u>P. viridiflora</u>	- for skin complaints, bites of poisonous insects or snakes.
<u>P. stipulaceae</u>	- the roots and leaves are used for skin complaints and swelling as poultices. - for fever, the root was boiled and the water used for bathing.
<u>P. rhinoceros</u>	- used as medicine after confinement, in the form of decoction which is administered over the first three days.
<u>P. montana</u>	- roots are used externally in Pahang for poulticing ulcer and swellings. - it is also made into lotion which is used hot, for bathing the body in fever and for enlarged spleen.
<u>P. sarmentosa</u>	- leaves are used as poultices for sore. - also used by the Sakai of Kuala Lipis as drugs to expedite childbirth.

In other regions, several species of Psychotria were also used in traditional medicine. In Phillipines for example, the fresh leaves of P. luzoniensis, were applied to ulcerating

wound and headache while its roots were used in treatment for dysentery. In Taiwan, a tincture of decoction of P. serpen was used as a medication to improve the circulation of the blood, and to cure rheumatism and arthristis (Perry, 1980). The use of P. cooperi for treatment of rheumatism was also known in Colombia, South America (Usher, 1974).

Psychotria rostrata which is shown in Plate 1 is a glabrous shrubs with slender branches about 1.8 metre tall (Ridley, 1967). The fruit of this plant is pulpy white and obovoid. It is common in lowland woods. This species was reported (Ridley, 1967) to occur at Sedenak, Simpai, Batu Pahat in Johor, at Ayer Keroh in Malacca, at the base of Mount Opir and at Beranang and Gunung Bemban in Negri Sembilan. In Selangor, it is found in Kuala Lumpur area, Semangkuk and Dusun Tua, in Perak at Larut and Dinding while in Kelantan, it is found at Chaning.

P. rostrata are locally named as 'Sedoman' or 'Seruwai Jantan'. The wood has little value, but may be used for rafters and firewood. The teeth can be blackened by using it, and in Pahang, the leaves are made into decoction to relieve constipation (Burkill, 1935).



Plate 1. Psychotria rostrata



## Objective

In view of its high content of alkaloids and its uses in relieving constipation, a research work on this plant was carried out with the following objectives:

- (1) To extract and isolate the alkaloids.
- (2) To elucidate the structures of the components isolated using modern spectroscopic methods.
- (3) If substantial amount of pure compound could be isolated, pharmacological screenings would be carried out in collaboration with pharmacologists.

## Previous Work On Genus Psychotria

Urzua et al. (1972) had isolated N,N - dimethyltryptamine from two species of Psychotria, namely P. viridis and P. carthagenensis, which are used as admixture with Basteriopsis caapi in hallucinogenic beverages Ayahuasca. These hallucinogenic Ayahuasca which are also known as yage, caapi and pinde, were widely used for medicinal, ritual and recreational purposes by the aboriginal and mestizo populations inhabiting the Amazon basin. The B. caapi contained  $\beta$  - carboline alkaloids; harmine, harmaline, tetrahydroharmine while P. viridis contained N,N - dimethyltryptamine (DMT) (6) as a single major base.