Ethnobotanical survey of the ginger family in selected Malay villages in Peninsular Malaysia

Halijah Ibrahim, Ong Hean Chooi and Rohani Hassan

Institute Biological of Sciences University of Malaya, 50603 Kuala Lumpur, Malaysia

ABSTRACT The study was carried out to document the traditional uses of plants belonging to the ginger family (Zingiberaceae) in 14 selected villages in the states of Kelantan, Selangor and Wilayah Persekutuan, Peninsular Malaysia. Sixteen species in 7 genera are used as food, medicine, spices, condiments, dyes and in rituals. Except Alpinia conchigera which can be found also in secondary forest, the species are cultivated in home-gardens. Only 3 of these species, i.e. Alpinia conchigera, Curcuma mangga and Ettlingera elatior are native to Peninsular Malaysia.


(Zingiberaceae, traditional medicine, food, spice)

INTRODUCTION

Reports on traditional uses of plants by the Malay villagers of Peninsular Malaysia date back to the 19th century. Of these, the uses of plants in traditional medicine is perhaps the most significant. Among the early reports on the Malay traditional medicinal materials were those of Holmes [1], Ridley [2] and Ahmad [3]. Other studies include rituals and beliefs among the Malays [4]. Later Burkill [5] summarized all the earlier records of medicinal uses as well as other uses of economic importance of the various plant families. This was followed by an extensive review by Perry [6] of "Medicinal Plants of East and South-East Asia", utilised during or before 1961.

Zingiberaceae is one of the largest monocotyledonous families of the order Zingiberales which have been reported to be useful as food, traditional medicine, spice, condiment, dye and flavour. These are perennial, aromatic herbs which form part of the undergrowth flora of tropical and sub-tropical forests with orchid-like flowers. The plants thrive well in damp, shaded habitats. More than 150 wild and cultivated zingiberaceous species have been reported for Peninsular Malaysia [7] of which at least 40-50 species have been widely utilised for various purposes [5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17]. The significance of zingiberaceous species in traditional cosmetics was also reported [18]. Lately there have been pronounced interest in the study of the ginger family in medicine and many species were screened for various compounds [19, 20, 21, 22, 23].

The present study documents the ethnobotanical uses of members of the ginger family among Malay villagers in Kelantan, Selangor and Wilayah Persekutuan, Peninsular Malaysia.

MATERIALS AND METHOD

One hundred households from 14 villages were randomly selected in Kelantan, Selangor and Wilayah Persekutuan representing the East and West parts of Peninsular Malaysia, respectively (Table 1). These villages were selected based on their remoteness covering as many representative areas as possible over the two states. A set of systematic questionnaire was prepared and members of each household were individually interviewed. The questions asked among others require information on: (1) useful herbaceous plants (local
names, wild or domesticated, parts used, detailed procedures for specific uses, knowledge of past uses, their present and past importance to the community; (2) if domesticated - methods of propagation, maintenance, purpose of domestication; (3) if wild - methods of gathering, types of forests; and (4) socio-economic status of each household.

These information were recorded in detail and field characters were also noted. Whenever possible plants were acquired for herbarium specimens. The data were analysed with comparison to past and current references.

Table 1. List of villages selected for survey.

<table>
<thead>
<tr>
<th>Village</th>
<th>Selangor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kuala Kubur Datu, Ulu Kelantan (102° 00 'E 5° 24'N)</td>
<td>Kg. Melayu, Batu 13 1/2, Sungai Buluh (101° 18 'E 3° 18'N)</td>
</tr>
<tr>
<td>Kg. Jerimbong, Kuala Krai, Ulu Kelantan (101° 54 'E 5° 29'N)</td>
<td>Kg. Melayu, Pasir Baru, Ulu Semenyih (101° 50 'E 2° 58'N)</td>
</tr>
<tr>
<td>Kg. Paloh Rawa, Machang (102° 10 'E 5°45'N)</td>
<td>Kg. Ijok, Batu 8, Kuala Selangor (101° 06 'E 3° 37'N)</td>
</tr>
<tr>
<td>Kg. Selising, Pasir Putih (102° 20 'E 5°54'N)</td>
<td>Kg. Sungai Pusu, Batu 8 1/2, Gombak (101° 43 'E 3° 16'N)</td>
</tr>
<tr>
<td>Kg. Bukit Bidang, Melor (102° 18 'E 5°56'N)</td>
<td>Kg. Padang, Batu 20, Ulu Langat (101° 52 'E 3° 12'N)</td>
</tr>
<tr>
<td>Kg. Kuali, Ketereh (102° 15 'E 6°00 'N)</td>
<td>Kg. Sekinchan, Batu 7, Sungai Leman, Sabak Bernam. Kuala Selangor (101° 08 'E 3° 12 'N)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Village</th>
<th>Wilayah Persekutuan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kg. Segambut Tengah, Segambut, Kuala Lumpur (101° 38 'E 3° 15'N)</td>
<td>Kg. Segambut, Kuala Lumpur (101° 38 'E 3° 15'N)</td>
</tr>
</tbody>
</table>

RESULTS

At least 16 zingiberaceous species are frequently utilised by village folks for various purposes (Tables 2, 3, 4). All the species recorded are cultivated plants grown mostly in home-gardens for home consumption. A few species such as *Alpinia galanga*, *Zingiber officinale* and its red variety *Zingiber officinale var. rubrum* (‘halia bara’), *Curcuma domestica*, *Etilingera elatior* and *Kaempferia galanga* are grown to be sold in the wet market. Of the 16 species studied, only *Alpinia conchigera* is found both cultivated and wild. It normally grows in the ‘belukar’ in wet but exposed habitats along the periphery of the villages or sometimes in palm oil and rubber estates. Only three of these species, i.e. *Alpinia conchigera*, *Curcuma mangga* and *Etilingera elatior*, are native to Peninsular Malaysia.

The usage of the 16 zingiberaceous species can be categorised into three main groups (Tables 2, 3, 4):

(a) species used in traditional medicine (Table 2)

All the 16 species are medicinally important for a wide variety of illnesses. At least 9 species are frequently used as post partum medicine in the form of poultices, health drinks, salad or bath mixtures. Rhizomes of *C. aurantiaca*, *C. domestica*, *Z. officinale* and young shoots of *A. galanga* are used in the treatment of colic. Two species are used for strains and sprains. Poultice of *A. conchigera* is used to cure skin fungal infection.
Table 2. List of Zingiberaceous species used in traditional medicine. (K=Kelantan; S=Selangor/Wilayah Persekutuan)

<table>
<thead>
<tr>
<th>Species</th>
<th>Part used</th>
<th>Treatment</th>
<th>Method of utilisation (state)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Alpinia conchigera</em></td>
<td>Rhizome</td>
<td>Skin fungal infection or rash</td>
<td>Poultice rubbed on infected parts (K)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Health drink</td>
<td>Rhizome juice + fresh milk (K)</td>
</tr>
<tr>
<td><em>Alpinia galanga</em></td>
<td>Young shoots</td>
<td>Expel water leech ('Lintah'); Colic.</td>
<td>Juice taken orally (K), Juice + other plant parts taken orally (K)</td>
</tr>
<tr>
<td><em>Amomum kepulaga</em></td>
<td>Leaves</td>
<td>Post partum medicine</td>
<td>Mixture with other leaves in water for bathing, to remove body odour (K&amp;S)</td>
</tr>
<tr>
<td>(A. cardamomum)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Boesenbergia rotunda</em></td>
<td>Rhizomes</td>
<td>Post partum medicine</td>
<td>Eaten raw or pickled (K&amp;S)</td>
</tr>
<tr>
<td><em>Curcuma aeruginosa</em></td>
<td>Whole plant</td>
<td>Muscle pains and strains</td>
<td>Decoction taken orally (K&amp;S)</td>
</tr>
<tr>
<td><em>Curcuma aurantiaca</em></td>
<td>Rhizome</td>
<td>Post partum medicine</td>
<td>Poultice with lime and pepper rubbed on abdomen. (K&amp;S)</td>
</tr>
<tr>
<td><em>Curcuma domestica</em></td>
<td>Rhizome</td>
<td>Post partum medicine</td>
<td>Juice taken orally (S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Poultice with other plant parts pasted on abdomen (K&amp;S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Young rhizome eaten with salt and black pepper (K)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Applied onto circumcision wound (S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Juice mixed with egg yolk, taken orally (S)</td>
</tr>
<tr>
<td><em>Curcuma mangga</em></td>
<td>Rhizome</td>
<td>Colic</td>
<td>Eaten raw with rice or pickled (K&amp;S)</td>
</tr>
<tr>
<td><em>Curcuma sederaria</em></td>
<td>Rhizome</td>
<td>Colic</td>
<td>Juice taken orally (K)</td>
</tr>
<tr>
<td><em>Etingera elatior</em></td>
<td>Leaves</td>
<td>Post partum medicine</td>
<td>Mixture with other herbs in water for bathing to remove body odour (K&amp;S)</td>
</tr>
<tr>
<td><em>Kaempferia galanga</em></td>
<td>Rhizome</td>
<td>Post partum medicine</td>
<td>Eaten raw with areca nut and bottle leaves (S)</td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Family planning</td>
<td>Eaten raw (S)</td>
</tr>
<tr>
<td></td>
<td>Rhizome</td>
<td>Fever</td>
<td>Poultice applied onto the head (S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mouth ulcers</td>
<td>Eaten raw (K)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sprains</td>
<td>Poultice with rice, applied topically (S)</td>
</tr>
<tr>
<td><em>Zingiber montanum</em></td>
<td>Leaves</td>
<td>Post partum medicine</td>
<td>Mixture with other herbs in water for bathing, to remove body odour (K&amp;S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Itch caused by caterpillars</td>
<td>Poultice applied topically (K)</td>
</tr>
<tr>
<td><em>Zingiber officinale</em></td>
<td>Rhizome</td>
<td>Colic</td>
<td>Juice taken orally (K&amp;S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diuretic</td>
<td>Juice taken orally (K&amp;S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jaundice</td>
<td>Decoction with other herbs taken orally (K)</td>
</tr>
<tr>
<td><em>Zingiber officinale</em></td>
<td>Rhizome</td>
<td>Aching joints</td>
<td>Juice mixed with vinegar, applied topically (S)</td>
</tr>
<tr>
<td>var. rubrum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Zingiber otensii</em></td>
<td>Rhizome</td>
<td>Stimulate appetite</td>
<td>Juice mixed with papaya leaf juice taken orally (S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post partum Medicine</td>
<td>Rhizome juice taken orally (S)</td>
</tr>
<tr>
<td><em>Zingiber zerumbet</em></td>
<td>Rhizome</td>
<td>Same as above</td>
<td>Same as above</td>
</tr>
</tbody>
</table>
(b) species used as food (Table 3)

Eight species can be consumed as spice and eaten raw or pickled as salads. Rhizomes of *A. galanga*, *Z. officinale*, inflorescence of *Etingera elatior* and leaves of *C. domestica* are popular as food flavours.

<table>
<thead>
<tr>
<th>Species</th>
<th>Part used</th>
<th>Food type</th>
<th>Method of Utilisation (state)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Alpinia galanga</em></td>
<td>Rhizome</td>
<td>Spice</td>
<td>One of various spices used for cooking (K&amp;S)</td>
</tr>
<tr>
<td></td>
<td>Young rhizome</td>
<td>Eaten raw or pickled</td>
<td>Thin slices eaten with rice (K&amp;S)</td>
</tr>
<tr>
<td></td>
<td>Young leaves</td>
<td>Vegetable</td>
<td>Cooked with coconut milk and chilies (S)</td>
</tr>
<tr>
<td></td>
<td>Inflorescence</td>
<td>Eaten raw or scalded</td>
<td>Eaten with rice (K&amp;S)</td>
</tr>
<tr>
<td></td>
<td>Rhizome</td>
<td>Adding aroma to meat</td>
<td>Fried with ginger and boiled with meat (K)</td>
</tr>
<tr>
<td><em>Anomum kepulaga</em></td>
<td>Fruit</td>
<td>Spice</td>
<td>One of various spices used for cooking (K&amp;S)</td>
</tr>
<tr>
<td>(A. cardamomum)</td>
<td></td>
<td>Eaten raw</td>
<td>Eaten with rice (K)</td>
</tr>
<tr>
<td><em>Boosenbergia</em></td>
<td>Young rhizome</td>
<td>Eaten raw or pickled</td>
<td>Thin slices eaten with rice (K&amp;S)</td>
</tr>
<tr>
<td><em>rotunda</em></td>
<td></td>
<td>Eaten raw</td>
<td>Eaten with rice (K&amp;S)</td>
</tr>
<tr>
<td><em>Curcuma domestica</em></td>
<td>Mature rhizome</td>
<td>Spice</td>
<td>One of various spices used for cooking (K&amp;S)</td>
</tr>
<tr>
<td></td>
<td>Young rhizome</td>
<td>Eaten raw or pickled</td>
<td>Thin slices eaten with rice (K&amp;S)</td>
</tr>
<tr>
<td></td>
<td>Inflorescence</td>
<td>Eaten raw</td>
<td>Eaten with rice (K&amp;S)</td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Spice, Flavou r ing</td>
<td>One of various spices used for cooking (S)</td>
</tr>
<tr>
<td><em>Curcuma mangga</em></td>
<td>Young rhizome</td>
<td>Eaten raw or pickled</td>
<td>Eaten with rice (K&amp;S)</td>
</tr>
<tr>
<td><em>Etingera elatior</em></td>
<td>Inflorescence</td>
<td>Spice, Flavouring</td>
<td>Mixed with rice (K)</td>
</tr>
<tr>
<td></td>
<td>Pith</td>
<td>Flavouring, Vegetable</td>
<td>Noodle dish ('laks') (S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fish curry (S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Flavouring various dishes (S)</td>
</tr>
<tr>
<td><em>Kaempferia galanga</em></td>
<td>Rhizome</td>
<td>Eaten raw</td>
<td>Eaten with rice (K&amp;S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spice</td>
<td>One of various spices used for cooking (K&amp;S)</td>
</tr>
<tr>
<td><em>Zingiber officinale</em></td>
<td>Mature rhizome</td>
<td>Spice</td>
<td>One of various spices used for cooking (K&amp;S)</td>
</tr>
<tr>
<td></td>
<td>Young rhizome</td>
<td>Flavouring drinks</td>
<td>As ginger juice or mixed with various drinks (K&amp;S)</td>
</tr>
<tr>
<td></td>
<td>Inflorescence</td>
<td>Eaten raw or pickled</td>
<td>Eaten with rice (K&amp;S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eaten raw or scalded</td>
<td>Eaten with rice (K&amp;S)</td>
</tr>
</tbody>
</table>

(c) species with miscellaneous uses (Table 4)

Except *K. galanga*, the species are utilised in rituals associated with beliefs, customs and traditions. Only *C. domestica* is known to be used as a colouring agent.
Table 4. Miscellaneous uses of Zingiberaceae species. (K= Kelantan; S= Selangor/Wilayah Persekutuan)

<table>
<thead>
<tr>
<th>Species</th>
<th>Part used</th>
<th>Uses</th>
<th>Method of utilisation (state)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpinia galanga</td>
<td>Young leaves</td>
<td>Charm cure</td>
<td>Used for exorcising spirits from possessed persons (K)</td>
</tr>
<tr>
<td>Curcuma aromatasa</td>
<td>Mature rhizome</td>
<td>Talisman</td>
<td>Worn as talisman to improve business (S)</td>
</tr>
<tr>
<td>Curcuma domestica</td>
<td>Mature rhizome</td>
<td>Talisman</td>
<td>Worn as talisman for protection (K)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Charm cure</td>
<td>For healing children with sores and expelling worms (K)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fever, ritual healing</td>
<td>Chewed together with betel leaves, areca nut and 'gambir'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stomachache, ritual healing</td>
<td>and this mixture is spat on patient from head to toes. (S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Colouring</td>
<td>Mixed with lime and applied onto stomach. (S)</td>
</tr>
<tr>
<td>Curcuma zedoaria</td>
<td>Mature rhizome</td>
<td>Talisman</td>
<td>Worn as talisman to improve business (K)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cosmetic powder</td>
<td>Rhizome, glutinous rice, 100 types of flowers, pounded</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>finely and soaked in water. (K) or rhizome mixed with</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>several aromatic plant parts, rice pounded together</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>and soaked in water. (K)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Residue used as cosmetic powder.</td>
<td></td>
</tr>
<tr>
<td>Kaempferia galanga</td>
<td>Mature rhizome  and leaves</td>
<td>Cosmetic powder</td>
<td>Rice pounded with rhizome and leaves. (S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Leaves mixed with several aromatic plant parts, rice</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>pounded together and soaked in water. (K)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Residue used as cosmetic powder.</td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION

The present ethnobotanical survey shows that the Zingiberaceae species have been widely utilised in the Malay villages for various purposes. Perry [6] recorded 39 medicinal species belonging to 10 genera from the family Zingiberaceae, of which 4 species from 4 genera are of minor medicinal value. Our study shows that all the 16 species from 7 genera investigated are medicinally important and these are comparable to Perry's data. Of these, 15 species are recorded for Selangor and Wilayah Persekutuan while 12 species are recorded for Kelantan. Four medicinal species, namely A. keralanga, Z. officinale var. rubrum (red variety or 'halia bara'), Z. otteni and Z. zerumbet were recorded to be used only in Selangor. Similarly the medicinal uses of A. conchigera, A. galanga and C. zedoaria are specific to Kelantan. The usage of these species in traditional medicine and rituals are more pronounced in Kelantan than in Selangor and Wilayah Persekutuan.

Zingiberaceous species are among the most frequently used species as post-partum medicine but generally there is no significant difference between the two states investigated. There are however obvious disparities between the two states in the treatment of other illnesses. Amomum keralanga, E. elatior and Z. montanum are often mixed with other herbs for bathing, to remove body odour during confinement. Generally these plants are aromatic and many species are known to be rich in essential oils.

The anti-fungal effect of A. conchigera could be attributable to the presence of cineol, an antiseptic compound which is frequently observed in several Alpinia spp. [24, 25]. In Kelantan, the juice extracted from the young shoots of A. galanga is taken orally to expel water leech or mixed with other plants and taken for colic. Pearce et al [26] reported that in the Iban community, Sarawak, the rhizomes mixed with salt are rubbed on the skin to cure ringworm. In another study potent anti-ulcer principles namely, 1'- acetoxychavicol acetate and 1'- acetoxycugenol acetate were isolated from the seeds of A. galanga and methanolic extract of the seeds showed significant anti-ulcer activity in rats [27].

This study reveals that the rhizome of Boesenbergia rotunda is eaten raw or pickled as a post-partum treatment and also as food in Kelantan and Selangor. Records by Burkhill and Haniff [8] and Burkill [5] show that it has been used as external applications for rheumatic and muscular problems.
pains after childbirth. Sasmito [23] found that the essential oil from the rhizomes of *B. rotunda* which contains methylcinnama-mate and zingiberone has the ability to solubilize calcium kidney stones.

The rhizomes of *C. domestica* and *K. galanga* have been reported for their antiseptic property in healing wounds, cuts and ulcers in Kelantan and Selangor respectively. *C. domestica*, *Z. officinale* and *Z. zerumbet* have also been used as antiseptic medicine in other countries [28, 29, 30, 31, 32]. The antiseptic property of *C. domestica* is attributable to its curcumin content which has been reported to show antibacterial activities [33]. The utilisation of *K. galanga* in post partum medicine and *Z. officinale* (red variety) in treating joints and strains in Selangor are also reported by Fasihudin and Hasmah [16] for Sabah.

The utilisation of species as food in particular *A. galanga*, *C. domestica* and *Z. officinale* is a common practice in the Asian region. The consumption of the edible species (Table 3) for spice, vegetable, salad and food flavours is more or less similar for Kelantan, Selangor and Wilayah Persekutuan except *A. galanga*, *Anomum kepuлага* and *E. elatior*. For instance, the inflorescence and pith of *E. elatior* are used in Selangor to flavour various dishes whereas the inflorescence is one of the important ingredient of a special ‘vegetable rice’ in Kelantan.

The species that are used in rituals associated with belief or custom sometimes involve the element of magic in both states. This study also reveals that in Kelantan and Selangor, *K. galanga* is mixed with other aromatic plant parts to produce cosmetic powder, whereas a similar decoction involving *C. zedoaria* is specific for Kelantan. Their utilisation in cosmetic powder has not been reported before. Of the species recorded, *C. domestica* is the most widely used in all the three categories discussed for both states.

**Acknowledgments** The authors are grateful to the University of Malaya and the Malaysian Government for financial assistance under R & D Programme (07/04/049). The authors also thank the Malay villagers of Kelantan and Selangor for their cooperation in this study.

**REFERENCES**

di Sabah. Proceedings of the Conference 
Medicinal Products from Tropical Rain 
Forest (eds. S. Khozirah et al.): 80-92.
17 Tilaar M., Sangat-Roemantyo H. and 
Riswan S. (1992) Kunyit (Curcuma 
domestica), the queen of Jamu. Proceedings of 
the conference Medicinal Products from 
Tropical Rain Forest (ed. S. Khozirah, et 
al.): 73-79.
18 Riswan S. and Sangat-Roemantyo H. (1992) 
Javanese traditional cosmetics from plants. 
Proceedings of the conference Medicinal 
Products from Tropical Rain Forest (ed. S. 
Phytochemical screening of some Malaysian 
8: 125-128.
oils from three Malaysian Zingiberaceae 
21 Hashim M.S., Daud M.A and Rahman A.A. 
(1995) Constituents of some medicinal 
plants of Zingiber species. Proceeding on 
Trends in Traditional Medicine Research 
22 Kiuchi F., Goto Y., Sugimoto N., Akao N., 
23 Nematocidal 
activity of turmeric: Synergistic Action of 
turmeric. Proceedings on 
Trends in Traditional Medicine Research 
of Temu Kunci (Boesenbergia pandurata 
Roxb.) on calcium kidney stone solubility in 
vitro. Proceedings on Trends in Traditional 
Medicine Research (eds. K.L. Chan et al.): 
452-457.
25 De Pooter H.L., Omar M.N., Coolsaet B.A. and 
Schamp N.M. (1985) The essential oil of 
greater galanga (Alpinia galanga) from 
Comparative evaluation on the essential oil 
composition of some Malaysian Alpinia 
species. First Malaysian International 
Lumpur.
ethnobotanical study of an Iban community of 
the Pantu Sub-District, Sri Aman, Division 2, 
28 Mitsui S., Kobayashi S., Nagahori H. and 
Ogiso A. (1976) Constituents from seeds of 
Alpinia galanga Wild. and their anti-ulcer 
29 Uhe G. (1974) Medicinal plants of Samoa: A 
preliminary survey of the use of plants for 
medicinal purposes in the Samoan Islands. 
30 Holdsworth D. and Giheno J. (1975) A 
preliminary study of highland medicinal plants. 
Science in New Guinea. 3: 191-197.
31 Holdsworth D.K., Close K. and Close A. 
(1975) Some traditional medicinal plants of 
Papua New Guinea. Science in New Guinea 3: 
165-171.
Econ. Bot. 25: 423-449.
33 Nagata K.M. (1971) Hawaiian Medicinal 
34 Norzana Mahamad (1990) Sebastian-sebastian 
antibakteria daripada species-species 
Curcuma. B.Sc. Honours thesis, Dept. of 
Botany, University of Malaya.