THE MEDICINAL PLANTS OF GUNUNG LEUSER NATIONAL PARK INDONESIA

BY

STEPHEN ELLIOTT & JOSEPH BRIMACOMBE

THE AUTHORS

Dr. Stephen Elliott Ph.D. – graduated from the Department of Forestry and Natural Resources, Edinburgh University in 1981 in Ecological Sciences and gained his Ph.D. on the effects of secondary plant products on deer nutrition at the same department in 1985. He is currently carrying out research on the nutritional ecology of the western lowland gorilla in Gabon.
Current address: Zoology Department, Edinburgh University, King's Buildings, West Mains Rd., Edinburgh, Scotland, EH9 3JT.

Dr. Joseph Brimacombe M.B. Ch.B. – graduated from Edinburgh University Medical School in 1983 and has worked as house officer at the Western General and Deaconess Hospitals in Edinburgh.
Current address: 10 Broadelms Lane, Sheffield, England 119RQ.

Cover: Traditional plant remedies on sale at Kutacane market.

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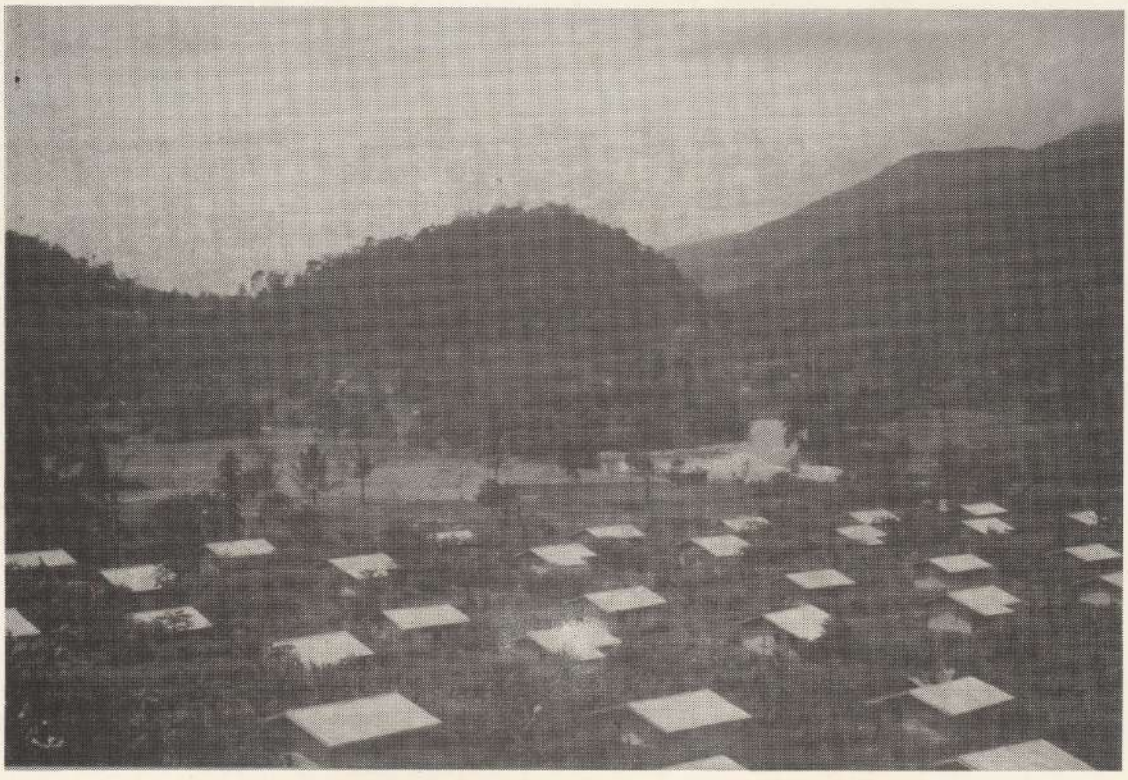
1985



Uning Puni "translok" settlement in Gumpang enclave.

Frontispiece: Another hectare of Gunung Leuser National Park goes up in smoke, despite its protected status. In 30 years virtually all tropical forests will be destroyed and 40,000 plant species will be extinct. A resource of incalculable value to the pharmaceutical industry will disappear, unless action is taken now to prevent this.

CONTENTS

Acknowledgments	2
Glossary	4
Summary	5
1. Introduction	6
2. Project Objectives	7
3. The Study Area and its People	9
3.1 Gunung Leuser National Park	9
3.2 The Enclaves	9
3.3 Living Conditions	10
3.4 Health	11
3.5 Dukuns	13
4. Methods	15
5. Results	15
6. Why Pharmacy Needs Tropical Forests	48
Bibliography	51
Appendix - Budget	52
Index of Symptoms, Signs and Disease Names	53
Index of Vernacular and Generic Plant Names	54

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Figs. 2-5 are taken from 'Tumbuhan Obat' - Lembaga Biologi Nasional - LIPI, Bogor, 1978.

GLOSSARY

Anthelmintic	killing parasitic worms.
Cirrhosis	a toxic degenerative disease of the liver.
Decoction	extraction by boiling.
Diuretic	promoting urination.
Epigastric pain	central upper abdominal pain.
Haematuria	presence of blood in the urine.
Haemoptysis	coughing up blood.
Indigestion	mild upper abdominal discomfort related to meals.
Infusion	liquid extract.
Jamu	commercially produced packaged traditional remedies. Usually tonics for general strength and fitness.
Kebun	an area of land (usually 1 ha) used for subsistence or cash crops.
Officinal	used in the preparation of recognised medicines sold in pharmacies.
Peduncle	flower stalk.
Pessary	medicinal preparation inserted into the vagina.
Petiole	leaf stalk.
Rubifacient	reddening and warming of the skin.
Trachoma	an infectious disease of the eyes.

SUMMARY

Although tropical plants have provided the pharmaceutical industry with many valuable products in the past, there appears to be little current interest within the industry in contributing towards the conservation of tropical forest areas to protect plants which could be useful in the future development of new drugs and medicines.

The objectives of this project were to compile an inventory of medicinal plants used by the people of Marpunga and Gumpang; populated enclaves within Gunung Leuser National Park, Sumatra, Indonesia. These settlements are surrounded by tropical forest which is one of the most diverse plant communities in the world. Their residents have virtually no access to modern medicine and they rely almost entirely on medicinal plants, administered by native doctors called dukuns, for all medical treatment.

During ten weeks field work, the medicinal uses of 171 plant species were recorded. Specimens collected were identified at the Herbarium Bogoriense in Java. Samples from several species are currently undergoing chemical analysis at the Jodrell Laboratory, Kew, Surrey.

The study concludes that a wide variety of tropical plants are of potential value to the pharmaceutical industry and that pharmaceutical companies have much to gain from investing in the conservation of tropical forests.

1. INTRODUCTION

On planet Earth it is estimated there are 300,000-500,000 species of higher plants. They are a source of organic products of incalculable value to industry. However plant species are also a resource which is rapidly diminishing. It is estimated that plants are becoming extinct at the rate of 1-2 species per day, which means that about 10% of plant species will disappear over the next 50 years, unless action is taken to prevent this. Often species become extinct before they are known to science and almost always before their usefulness to Mankind has been investigated. The time has come for industry to invest in conserving the diversity of the plant kingdom.

Some of the most valuable plant products are drugs. It is not surprising that plants produce compounds which are pharmacologically active in animal systems, since many of the so called 'secondary' plant compounds (i.e. those not essential to normal plant metabolism such as alkaloids, sterols and glycosides etc.) function as chemical defence mechanisms which protect plants against plant-eating animals. Some secondary compounds can be lethally toxic (eg. several alkaloids) but most have more subtle physiological effects (eg. plant oestrogens) which can be exploited by the pharmaceutical industry. It is estimated that already over 25% of the world's pharmaceutical products are derived from plants (Farnsworth and Morris 1976) and in particular tropical plants have provided us with a wide range of valuable products such as vincristine, reserpine, quinene and steroids to name but few. Although some drugs originally derived from tropical plants are now synthesized industrially, the majority are still extracted from plants for economic or practical reasons.

The lowland tropical forests of S.E. Asia are a particularly promising area in which to search for medicinal plants because of their high species diversity. More than 25,000 species of flowering plants grow in S.E. Asia compared with only 5,000 for the whole of Europe (which covers twice the area). In tropical forests, competition between plants and plant-eating animals is intense and chemical systems of plant defence are at their most highly developed. Therefore the diversity of secondary plant compounds of potential value to the pharmaceutical industry is greatest there. However it is the flora of tropical forests which is most threatened with extinction. Each year 245,000 km^2 of tropical forest (the size of the United Kingdom) is felled to satisfy the developed nations' demand for timber and to provide agricultural land for the ever expanding populations of the developing nations. At this rate virtually all tropical forest outside protected areas will be destroyed in less than 30 years (Myers 1979 p20).

The World Conservation Strategy (IUCN 1980) states that a major reason to conserve tropical forests is because of their potential to provide Mankind with new drugs and medicines. However although plants have provided us with valuable pharmaceutical products in the past; at present there appears to be very little interest within the pharmaceutical industry either in developing new products from tropical plants or in investing in the conservation of areas of tropical forest which could act as 'biochemical libraries' for future research projects. Whilst organising this project, we approached over 200 pharmaceutical companies for support. Of the 90 companies which replied, only 6 offered token support totalling £ 700. Only one company stated that they were involved in a medicinal plants program. Unless the pharmaceutical industry can be persuaded to make greater use of tropical forest plants to develop new products, the case for the conservation of tropical forests will be weakened.

2. PROJECT OBJECTIVES

1. To compile an inventory of the medicinal plants used by the people of the Marpunga and Gumpang enclaves in Gunung Leuser National Park, Sumatra, Indonesia.

2. By publicising our results to increase awareness within the pharmaceutical industry of:

    a. the potential of tropical forest plants to yield new pharmaceutical products and

    b. the need to invest in the conservation of tropical forests to protect medicinal plants of potential value.

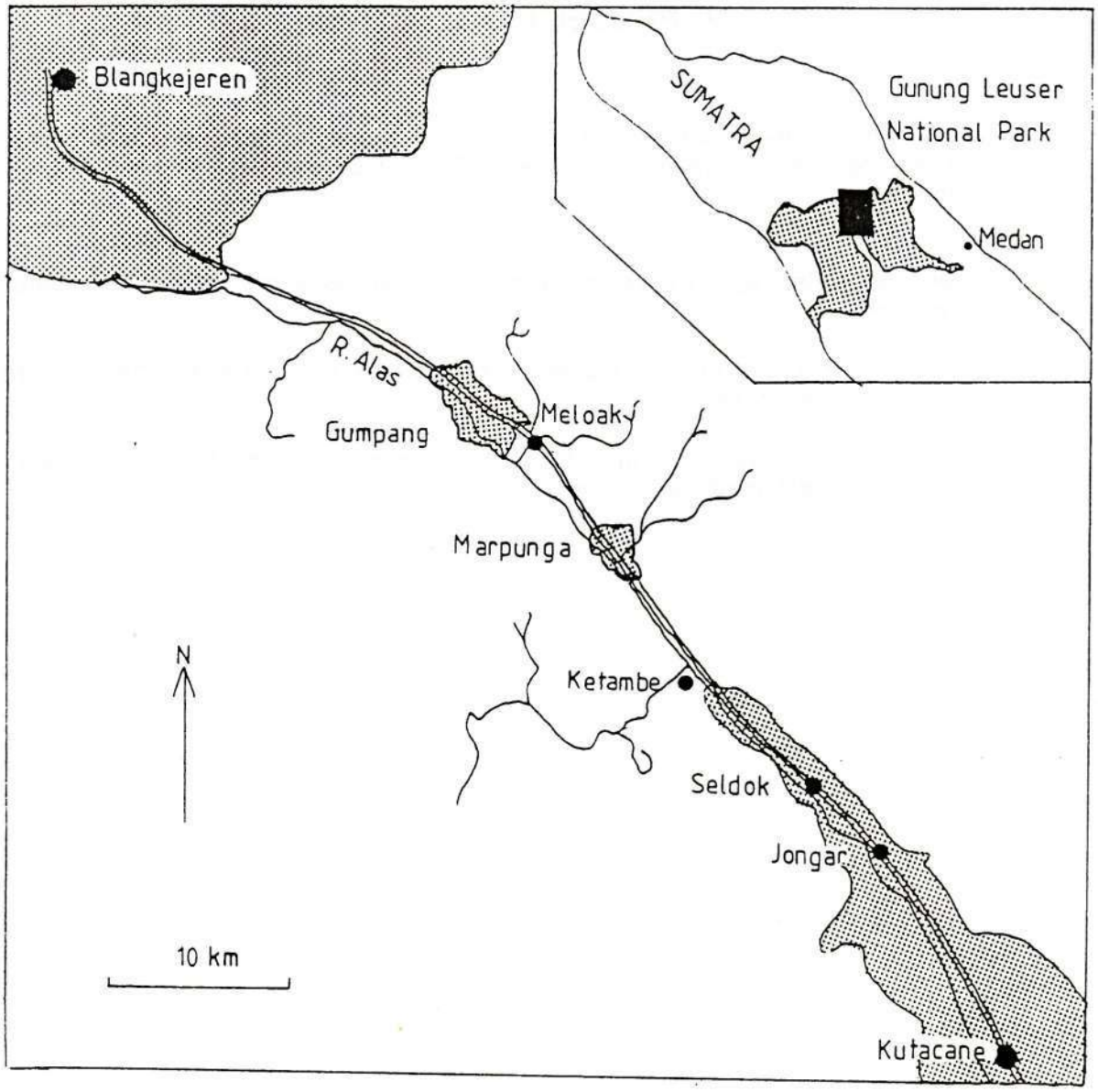


Fig. 1. The Alas valley section of Gunung Leuser National Park, Indonesia.

3. THE STUDY AREA AND ITS PEOPLE

3.1 GUNUNG LEUSER NATIONAL PARK

Non-seasonal rainforest has probably occupied most of lowland Sumatra since the Tertiary period 10 million years ago (Whitten *et al.* 1984 p 23). This long history of ecological stability has allowed the evolution of some of the most species-rich plant communities in the world (Whitmore 1975). Sumatra with an area of 476,000 km^2 has over 10,000 species of higher plants. (In comparison the British Isles has 65% of the area but only 13% of the number of species (Whitten *et al.* 1984 p 85)). However, as in most other tropical countries, the forest is rapidly disappearing. It is estimated that 60-80% of Sumatra's lowland forest has already been cleared.

Gunung Leuser National Park was established in 1980 to protect some of the last remaining areas of undisturbed forest in Sumatra. The park covers 8,000 km^2 (the size of North Yorkshire) in the provinces of Aceh and North Sumatra and consists of two major mountain ranges: the Leuser-Mamas range to the west and the Kappi-Alas range to the east, separated by the heavily populated Alas-Ranun rift valley which bisects the park from north to south (see fig. 1). Gunung Leuser is probably the most species rich of all Indonesia's national parks (WWF Yearbook 1980-81), but most of this species diversity is confined to the lowland forest which comprises less than 25% of the park's area (WWF 1978, probably much less now). The best areas of lowland forest remaining in the park are in the Alas valley. The park includes the habitats of several rare large mammals such as the tiger *(Panthera tigris)*, the clouded leopard *(Neofelis nebulosis)*, and the Asiatic elephant *(Elephus maximus)*. It is also the last stronghold of the Sumatran rhino *(Dicerorhinus sumatrensis)* and the Sumatran orang-utan *(Pongo pygmaeus)*.

In order to accommodate people already resident within the park boundaries at the time of the park's declaration, two settlements were allowed to remain in the Alas valley. Marpunga and Gumpang were delineated as populated 'enclaves' within the park and other people who had previously been living elsewhere within the park boundaries were translocated into these enclaves. Officially these settlements are not part of the park, although they are completely surrounded by it. Whilst the people of Marpunga and Gumpang are no longer 'primative', they retain a simple agricultural way of life and they have little access to modern medicine. Through their native doctors called dukuns, they continue to rely almost entirely on plants for medical treatment.

3.2 THE ENCLAVES

3.2.1 Marpunga

Marpunga with an area of 1456.4 ha is the southernmost enclave in the Alas valley. The first settlers there were of Gayo origin, arriving from the Blangkejeren area probably in the 1920's. (The Gayo hill people originated in the upland areas to the north of Gunung Leuser.) In 1960, 150 families, also from Blangkejeren, moved to Marpunga, but by 1962 about half of these people had returned to Blangkejeren because they found Marpunga unsuitable. In 1979 one hundred families of Alas origin (the tribe which traditionally occupied the lower Alas valley) were translocated from their original village, within the southwestern sector of the

national park, to Marpunga where they founded the settlement of Lengat in the northeastern corner of the enclave.

Marpunga now contains 256 families, about 1,700 people. The enclave contains a 'puskesmas' (a small community clinic, as yet unopened because there is no doctor) and two schools; one for Gayo and one for Alas children, which are attended by about 250 pupils aged 7-12 years.

3.2.2 Gumpang

Twenty five kilometres to the north of Marpunga lies Gumpang enclave which covers an area of 1893.8 ha. Settlements have probably existed in the Gumpang area for over 100 years. At present the 375 families, about 2,500 people, living there are nearly all Gayo. Recently two major translocations into the area have occured, more than doubling the population.

In 1980 the 'PKMT translok' village was built in the southwest of the enclave. About half of the 90 houses were occupied by families from the Blangkejeren area and the rest by poorly housed families already living elsewhere in Gumpang. The people of Gumpang are currently constructing a 1 km surfaced road to improve access to PKMT from the main road.

The second 'translok' settlement in Gumpang enclave called Uning Puni was established in 1984 in the north of the enclave in a fertile area close to the road and river. Of the 90 families living there, 80 came from the Blangkejeren area, 2 from Kutacane and 8 from other parts of Gumpang.

There are two schools in Gumpang catering for children aged 7-12 years. One is located in PKMT and has about 50 pupils and the other is in the centre of the enclave and has about 150 pupils. There is no puskesmas in Gumpang.

3.3 LIVING CONDITIONS

3.3.1 The Economy

The economy is based entirely on agriculture. Most families own 1-2 ha land, valued at approximately US$ 200 per hectare. The valley bottom is used for wet rice cultivation ('sawah') and the lower slopes are used to cultivate a wide range of crops in 'kebun'(s) (literally translates as 'gardens'). Beyond the cultivated areas is primary forest. Forest products are still a source of income for many families, though now gradually decreasing in importance.

Over the years there has been gradual shift from a subsistence economy to a market economy. This shift was accelerated by the completion of the Kutacane to Blangkejeren road in 1978-79 which made these market towns accessible from Marpunga and Gumpang. There is a public bus service along the road: 3 buses a day in each direction. Blangkejeren can be reached from Gumpang in about 2 hr, and Kutacane from Marpunga in 1.5 hr.

Neither enclave is self-supporting in rice. Cash crops are exchanged for rice at the markets. The most important cash crops are coffee, chilis, 'kemiri' nuts (from *Aleurites moluccana)* and 'nilam' oil (from *Pogostemon cablin).*

3.3.2 Housing

Families live in small wooden houses rooved with palm leaves or corrugated iron. The houses usually consist of two rooms; a large living room and a smaller

PLATE 1. Sanitation in Marpunga and Gumpang is basic.

The valley bottom is used to cultivate rice, whilst the forest on the slopes is cleared for kebuns.

Local transport links the enclaves with market towns.

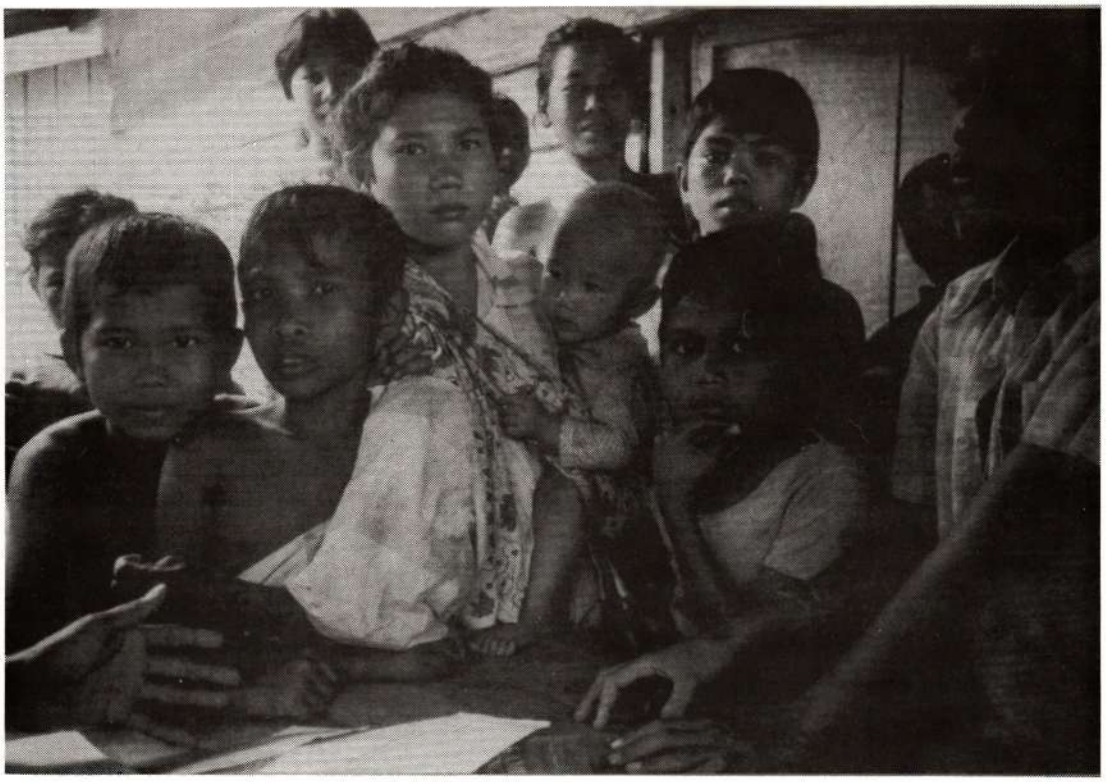
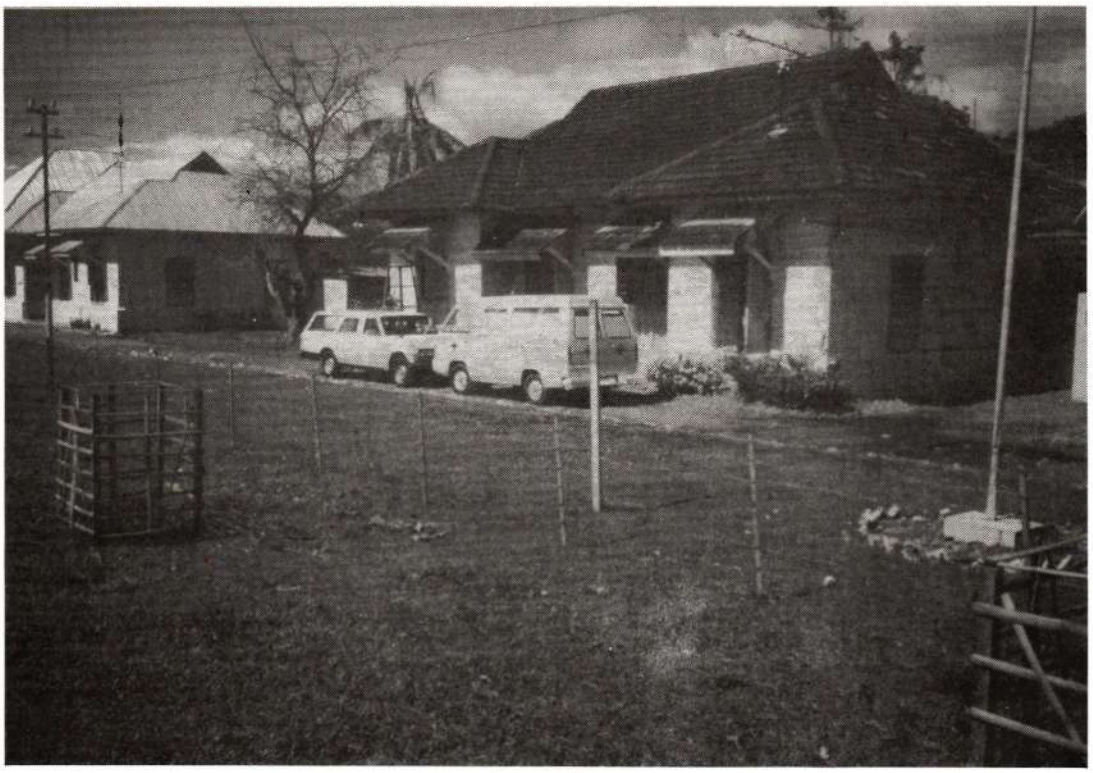


PLATE 2. The populations of Marpunga and Gumpang are predominantly young and are rapidly expanding.



The hospital and ambulance at Kutacane.

room for cooking and preparing food. Food is cooked on wood fires. Fire is an everpresent hazard. During our study 125 houses were destroyed by a fire at a nearby village 30 km south of Kutacane. The houses usually contain no furniture. Everyone sleeps on the floor.

3.3.3 Water and Sanitation

All drinking water is obtained from mountain streams which flow into the Alas River. Nobody is far from running water which is often brought closer to homes in bamboo pipes. Water is usually boiled before consumption. Excreta and other waste materials are dumped into these streams usually downstream from the places where drinking water is collected and bathing takes place.

3.3.4 Diet

Rice is eaten with every meal and is the main source of carbohydrate. Protein comes mainly from fish caught locally and is supplemented by eggs, chicken and rarely beef, duck and goat. Pork is never eaten because Islamic traditions are very strongly adhered to in this area. Fish stocks are low because of overfishing made possible by the widespread use of explosives, electrofishing and toxic chemicals (mainly commercially available pesticides). Vegetables and fruit are plentiful and include 'kemiri' nuts (from *Aleurites moluccana*), peppers, banana, coconut, pineapple, papaya, peanuts, onions, durian, sugarcane and a little maize. The diet tends towards protein deficiency and is almost completely lacking in iodine (see also section 3.4.2).

3.3.5 Education

Primary schooling for children 6-12 years old is meant to be free and compulsory but in effect, teachers usually levy a small 'sports fee'. Absenteeism is common and difficult to control. Children are often needed by their parents for work in the fields, although some absenteeism is due to illness. For secondary schooling, children must go to Blangkejeren or Kutacane and live away from home. Most parents cannot afford to send their children away for secondary schooling. Monthly fees for state schools are US$ 0.2 for 12-16 year olds and US$ 0.4 for 16-19 year olds.

3.4 HEALTH

3.4.1 Mortality and Natality

The populations of Marpunga and Gumpang suffer high mortality rates, particularly during the first five years of life. In the Alas valley 6-8% of infants die during their first year of life. This mortality rate is more than offset by the birth rate resulting in an expanding and predominately young population. Average family size is 7-8.

Women are usually married and pregnant before they are twenty and continue to reproduce until the menopause. All mothers breast feed for as long as possible. This acts as a natural contraceptive spacing births by 2-3 years. Contraceptives, although free and readily available in Kutacane and Blangkejeren are rarely used.

3.4.2 Common Diseases

Dr. Rajali Husin, a senior doctor in Kutacane hospital, regarded the following as major causes of serious morbidity and mortality in the Alas valley:

1. Malaria
2. Tuberculosis
3. Leprosy
4. Malnutrition (usually protein deficiency).
5. diarrhoea and vomiting - various causes.
6. Polio
7. Tetanus
8. Cirrhosis
9. Chest and wound infections.
10. Urinary tract calculi.
11. Measles
12. Chickenpox - seems to have been introduced into the area about 15 years ago. Many adults have severe scars and several deaths have occurred from chickenpox meningitis.
13. Goitre - endemic in this area due to iodine deficiency in the diet. In Gumpang about 1.5% of the population had a clinically obvious goitre. This represents a very high percentage of the older population.

Deaths by various accidents are also fairly common. The Alas river is crossed only by makeshift wire bridges. In 1983 a six year old boy fell to his death from such a bridge in Marpunga. Snake bites and dog bites are common. In 1984 a 5 year old girl died after developing tetanus following a dog bite. Rabies also occurs in the area.

Rheumatic heart disease is not common and 'western' diseases such as atherosclerosis and cancer are rarely diagnosed. Only 4 cases of carcinoma have been recorded in the last two years: lung, breast, uterus and tongue.

3.4.3 Medical Facilities

Modern medicine has barely touched the settlers of Gumpang and Marpunga. They are isolated from it by distance, poverty and ignorance. Furthermore the health care system that does exist to the north and south is ill-suited to their needs.

The nearest doctors are in Blangkejeren, 40 km to the north of Gumpang and in Kutacane, 35 km to the south of Marpunga. The nearest hospital capable of carrying out surgery under general anaesthesia is at Medan, 250 km away. The Indonesian government subsidizes certain essential drugs and pays the salaries of hospital staff. These employees are underpaid and overworked and consequently a system of unofficial 'fees' has arisen to supplement their low income. These 'fees' are variable depending on the financial status of the patient. Doctors said that the poor received free treatment. However in practice, scant medical facilities are consumed by those better able to pay for treatment. The poor are simply unable to afford treatment. The system therefore fails those most in need of medical care.

In comparison the native doctors called dukuns cost little. They are familiar to their patients and are probably capable of providing greater reassurance than a busy hospital doctor. For the people of Marpunga and Gumpang these points are particularly pertinent. They are rarely visited by doctors. Occasionally a nurse from Blangkejeren visits Gumpang to administer vaccinations to those who can afford it, but few children are protected as yet.

3.4.3.1 Kutacane

Three doctors work in and around Kutacane, serving a population of about 60,000. All three doctors help to run the hospital and its clinics and have their own separate private practices. The Kutacane hospital has 40 beds, 4 midwives, 6 trained nurses and 20 auxilliaries. Most treatment is medical. Surgical procedures are limited to minor operations under local anaesthetic. Forceps deliveries are possible but blood transfusions are not. Diagnostic facilities are confined to simple urine tests and a microscope with stains. The nearest blood test and x-ray facilities are at Medan (250 km away) and Kubajahe (100km away) respectively. The hospital has an ambulance (which can reach Medan in 6 hours) and a stock of essential drugs provided by the government including: a range of antibiotics, aspirin, paracetamol, prednisolone, oral anti-histamines, anthelmintics, antimalarials (including intravenous quinine), electrolyte replacements, plasmar expanders, vitamins, antacids, contraceptive pills and IUCD, antileprotics, anti-TB drugs, vaccinations (including rabies), morphine and anti-sera for snake bites.

3.4.3.2 Blangkejeren

In Blangkejeren there is one doctor who is responsible for 80,000 people spread throughout the area. Blangkejeren has a hospital with 40 beds, 2 midwives and 3 nurses but only 15 beds are usable. Drug and diagnostic facilities are similar to those in Kutacane. Though major hospitals in Banda Aceh and Sigli are geographically closer, the roads to the north are so poor that it is quicker to go to Medan for major treatment. The ambulance from Blangkejeren takes 10 hr to get there

3.4.3.3 Chemists

The chemists have few modern medicines and are mainly stocked with pre-packaged traditional medicines called jamu from Banda Aceh and Jakarta. Those modern medicines which are available are usually sold in their most expensive, glossy forms and are often grossly abused. Penicillin is regarded by many people living in the Alas Valley as a miracle cure for all ailments. The chemists take advantage of this. They know that if a packet has penicillin written on it, it will sell. Unfortunately vials of intra-muscular penicillin are now available, unprescribed across the counter. The vial costs only US$ 0.7 and the needle and syringe only US$ 0.5. Such practices are highly dangerous.

3.5 DUKUNS

A dukun is a native doctor who uses herbs and spiritual powers to treat illnesses. Potentially anyone can be a dukun, but they are usually those individuals recognised by their own communities as being particularly knowledgeable about plants or privileged spiritually in their administration.

Dukuns are quite common in the Alas valley. Gumpang has at least fifteen dukuns (i.e. one per 160 head of population). Like western doctors, dukuns often specialize. Female dukuns often specialize in treating other women. Some dukuns specialize in the treatment of specific illnesses such as leprosy. Some dukuns emphasize their spiritual powers and some their herbal knowledge. The dukuns of the Alas valley place more emphasis on the use of plants than dukuns from the nearest city, Medan. Treatment is usually given free. In fact it is thought to be unlucky to offer a dukun money for his services. The dukuns benefit from increased standing within their communities but they also accept gifts in kind, such as chickens for example.

Most illnesses are believed to be caused by evil spirits entering the body, often at specific times of the day. For example it is commonly believed that washing at night allows spirits to enter the body to cause chest complaints and infertility. Evil spirits are often thought to be sent by enemies, 'mad men' or animals. Eating food in the wrong way or at the wrong time of day is also thought to cause illness. Plants are believed to contain good spirits which are capable of combating these evil spirits. Generally the people do not feel that such beliefs conflict with their Islamic beliefs

Knowledge of medicinal plants is passed by word of mouth from generation to generation. Those plants which have genuine medicinal properties should be incorporated into the dukuns' repertoire by a process of selection by trial and error. In principle therefore, plants used in traditional remedies should be more likely to yield active pharmacological products than plants selected at random. However this selective process is limited by several factors:

(A) Doctrine of Signatures and Opposites - It is a commonly held belief in many cultures that the use of a plant is indicated by its form or colour. For example the articulated branches of the shrub *Euphorbia tirucalli* resemble bones. By the doctrine of signatures the latex from this plant is spread on broken limbs and its name in Indonesian literally translates as 'broken bone'. However the use of a plant in accordance with the doctrine of signatures does not necessarily preclude it from having any medicinal properties at all. For example van Steenis-Kruseman (1953) recorded that the yellow colour of the rootstock of *Curcuma xanthorrhiza* dictated its initial use for jaundice, but subsequently it was found to be effective against fevers. A doctrine of opposites also exists, especially in the field of antidotes. For example snake bites may be treated with snake excrement and bee stings with honey.

(B) Diagnostic inability - Except for visibly obvious diagnoses such as fractures or clearly recognisable diseases such as leprosy, dukuns base their treatments on signs and symptoms. In western medicine, associations between certain signs and symptoms often lead to an accurate diagnosis and determine subsequent treatment. Many such diagnostic symptom-sign complexes have been recognized by western medicine for centuries but few dukuns have grasped them. Being unable to put labels to these complexes has reduced the rate at which pharmacologically active plants are added to the dukuns' repertoire because of treatment inconsistency. For example patients suffering from hepatitis would be treated differently depending on which was their dominant symptom or sign. For hepatitis this could be fever, urinary tract disorders or jaundice.

4. METHODS

The study consisted of a series of interviews with dukuns in which the following information was recorded: the vernacular names of plants used in traditional medicine; the plant parts used; methods of preparation; quantities used; recommended doses and a description of the symptom-sign complex being treated. Although the majority of dukuns interviewed were resident in Marpunga and Gumpang, some information from one dukun in Jongar and two in Seldok is included in the inventory.

Plant specimens were collected for formal identification. Sometimes dukuns provided specimens of plants used in their remedies, but more often, plants were located using a local guide with a proven knowledge of plant names in both Indonesian and Gayo. He had been reliable in previous botanical studies at Ketambe Research Station. At the time of collection, a standard herbarium record sheet was completed. Plant specimens were preserved in alcohol (Womersley 1981). In the humid tropics, this method is easier than drying. Specimens were folded in sheets of newspaper and stacked in bundles 8-10 cm thick. The bundles were placed in a polythene bag, saturated with 98% commercial grade ethyl alcohol and the bag sealed. Specimens thus preserved keep for three months before drying is necessary. The plant specimens were flown to the Herbarium Bogoriense in Java where they were dried and formally identified by the staff there. The voucher specimens remain at the herbarium. A collection was also made of the various plant parts (bark, seeds, roots etc.) used in traditional remedies. These were dried in an oven over a paraffin stove and sent to the Museum Division and the Jodrell Laboratory of the Royal Botanic Gardens, Kew, Surrey for analysis.

5. RESULTS

During ten weeks spent in the Alas valley, 21 dukuns were interviewed and the vernacular names of 171 plants used in traditional medicine and the recipes of 201 traditional remedies were recorded. Specimens of 136 plants were collected for identification and 83 dried samples were sent to the Royal Botanic Gardens, Kew.

There were several problems with the technique of interviewing dukuns to obtain information. The major ones are summarized below:

(1) Often western disease names were used inaccurately. For example 'kuncing manis' translates as 'sweet urine' or diabetes, yet none of the symptoms described for this disease indicated this diagnosis.

(2) Western disease names were not used consistently. 'Kuncing manis' meant different things to different dukuns.

(3) Often a very large number of symptoms were ascribed to locally named diseases which did not fit any specific diagnosis that would be recognised by western medicine. Such large lists of symptoms probably encompassed several different diseases.

(4) Syphilis (locally, 'siplis') was used to describe any disorder of the urinary tract.

(5) 'Sakit satin' (meaning sickness of the devil) was used to describe any form of mental illness but this term was also applied to antisocial behaviour, stupidity and even tantrums in children.

(6) In most instances malaria had come to mean any condition with fever.

(7) Magic, whether administered separately or incorporated into the power of plants, was universally believed in.

(8) Assessment of treatment effectiveness was very difficult. Dukuns almost never admitted to treatment failure and we were not able to interview sufficient numbers of patients to obtain a useful assessment of the successfulness of specific treatments.

(9) 'Darah tinggi' translates as high blood pressure and was a term used commonly by the dukuns. Usually it referred to vague symptoms such as dizziness and tiredness in old and often obese people. On only one occasion had high blood pressure been confirmed by measurement.

Despite these difficulties there were several occasions on which dukuns described clear symptom-sign complexes which corresponded very closely to recognizable western diagnoses. Also dukuns were remarkably consistent in their use of local names for plants.

The following inventory describes the uses of medicinal plants in the Alas valley. The plants are arranged in alphabetical order according to family name. This arrangement emphasizes the common properties of closely related species. The latin names are those provided by the Herbarium Bogoriense. The origin of vernacular names is indicated in brackets:- (Bl)=Bahasa Indonesia; (G)=Gayo; (Al)=Alas; (Ac)=Aceh; (Bt)=Batak; (?)=unknown. When a plant was used in combination with few others, details of the recipe are included, but this is omitted for highly complex remedies (some contained 10-15 ingredients) to avoid widespread repetition under every ingredient name. Details of complex recipes are available from the authors on request. Quantities used are also omitted because of the large variability and inconsistent use of the measures described (a 'kecal', for example varied from a handful to armsful). Dosages and claimed effects are also omitted for reasons outlined above. When a dukun described a symptom-sign complex which closely corresponded to a recognizable diagnosis, a western diagnostic label is used in the text eg. malaria, tuberculosis etc. but when a diagnosis could not be determined, the dominant symptoms and signs are listed eg. fever, cough etc.

ACANTHACEAE

1. ***Graptophyllum*** **sp**, Puding Hitam (Bl).

A small tree. The juice from the ground leaves, applied to the eyes, was said to cure trachoma.

2. ***Justicia gendarusa*** Burm. f., Bebetu (Bl), Bebesi (G).

A widely distributed shrub. Sometimes planted in kebuns. A decoction of the leaves was drunk as a remedy for bloody diarrhoea and the leaves were also used in remedies for fevers. Burkhill (1935) records that the leaves of *J. bracteata* are also used in a decoction for diarrhoea.

AMARANTHACEAE

3. ***Amaranthus spinosus*** L., Bayam Duri (G).

A widely distributed, thorny shrub often growing near homes. The leaves were used in a poultice applied to boils to hasten suppuration. This effect is also reported by van Steenis-Kruseman (1953). This plant has a long history of medicinal use and Burkhill (1935) suggests the active ingredients are saponins.

AMARYLLIDACEAE

4. ***Crinum asiaticum*** L., Bakung Bakung (Bl, Al) (Fig. 2)

This very variable herb was common in lowland forests in the study area. It was also planted in kebuns traditionally near burial grounds. The leaves were wrapped around sprained or fractured limbs as a supportive dressing and analgesic. The leaves were heated and spread with bird oils before application. Sometimes used prior to fracture reduction.

ANACARDIACEAE

5. ***Magnifera indica*** L., The Mango, Mangga (Bl), Mamplan (Ac).

A native of India, the mango is cultivated throughout S.E. Asia. The bark was included in four oral remedies for abdominal pain and diarrhoea (including bloody diarrhoea) and a decoction of the bark with other ingredients was drunk as a remedy for malaria.

Burkhill (1935) notes that a solution of the resin obtained from the bark is swallowed for dysentery in Kampuchea and India. The bark contains resin canals in which terpenes accumulate and is also said to be rich in tannins. Lewis & Elvin-Lewis (1977) state that the oleoresin contains urushiol and catechol.

ANNONACEAE

6. ***Cananga odorata*** **(Lamk.) Hook. f. & Thoms.**, Bunga Selanga (G).

A tree of lowland forests found from India to Australia. In the study area it was occasionally planted as an ornamental. The flowers were ground finely with powdered lime and spread on skin irritations. An infusion of the flowers, in coconut milk, together with those of four other species, was drunk as a remedy for fevers.

Heyne (1927) states that the dried flowers are used against malaria. Burkhill (1935) quotes Schimmel & Co (Report for 1907 p 15) who suggests that the flower oil could be used as a substitute for quinine against malaria. The oil contains volatile oxygenated and esterified monoterpenes.

7. ***Goniothalamus*** **sp**, Durian Belander (Bl).

This genus is cultivated throughout S.E. Asia as a fruit tree. The fruit juice was rubbed on sprains and fractures to relieve pain.

APIACEAE

8. ***Centella asiatica*** (L.) Urb., Pegaga (Bl, G) (Fig. 2)

A creeping herb distributed throughout the tropics. It was common in fields and by roadsides in the study area. A decoction of the leaves with gambir (see *Uncaria gambir)* was drunk as a remedy for stones and infections of the urinary tract.

Van Steenis-Kruseman (1953) records its use as a mild diuretic and for the treatment of syphilis. The leaves are bitter and contain high levels of tannins.

9. ***Coriandrum sativum*** L., Coriander, Ketumbar (Bl, Al), Ketumar (G).

An annual herb, native of the Mediterranean. Coriander seeds are a spice used in cooking. The seeds were used in oral remedies for coughs, leprosy, central chest pain and indigestion. Burkhill (1935) records that coriander "stimulates the digestion".

Coriander seeds were also included in a pessary used routinely by mothers 4-11 days after childbirth and they were also an ingredient in simple cough mixtures. The seeds contain monoterpenes especially linalool, and exhibit hypoglycemic activity (Lewis & Elvin-Lewis 1977).

10. ***Foeniculum vulgare*** Mill., Fennel, Jira or Jintan Manis (Bl, G).

Fennel is a culinary herb. In the study area it was sometimes cultivated on rice terraces and the seeds were sold commonly at markets. A decoction of the seeds was part of a complex preparation taken orally for tuberculosis. The ground seeds were included in a complex oral remedy for leprosy; a pessary used routinely by mothers 4-11 days after childbirth; a body powder used after childbirth and a complex oral remedy for indigestion. Fennel seeds contain terpenes and a phenol called anethole (Lewis & Elvin-Lewis 1977).

APOCYNACEAE

11. ***Alstonia scholaris*** R. Br., Rutih (G), Geceh (Al) (Fig. 3).

A tree distributed throughout the Far East. Copious quantities of white latex exude from all parts of this tree when wounded. The latex or bark was said to be effective against malaria. A decoction of the bark was prepared with several other ingredients or the latex was mashed with the seeds of *Luffa acutangula* and eaten. Mashed with ginger root in coconut milk, the bark was said to be effective against diarrhoea and abdominal colic. Also the latex was claimed to be anthelmintic.

In Malaysia this tree has a long history of use as an anthelmintic and in the Philippines it is commonly used to treat fevers, diarrhoea and dysentery (Burkhill 1935). In India also, the bark is claimed to be effective against diarrhoea (Lewis & Elvin-Lewis 1977).

12. ***Alyxia*** sp, Kayu Pelasari (G).

Lianas of mountain forests found throughout tropical Asia. A decoction of the wood and bark was drunk as a remedy for headaches. The bark contains tannins, coumarin and alkaloids (van Steenis-Kruseman 1953).

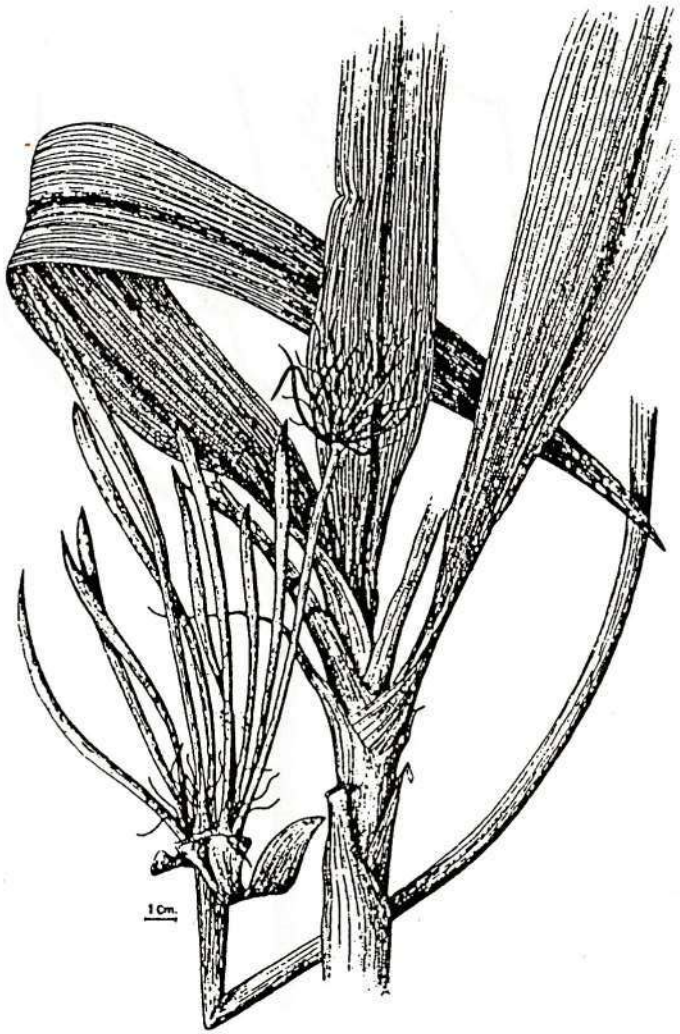
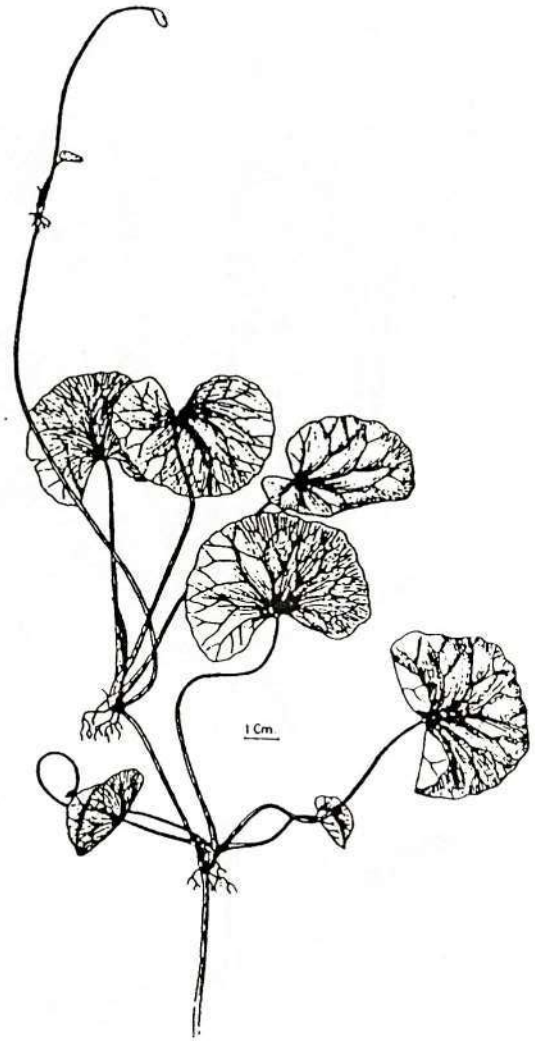
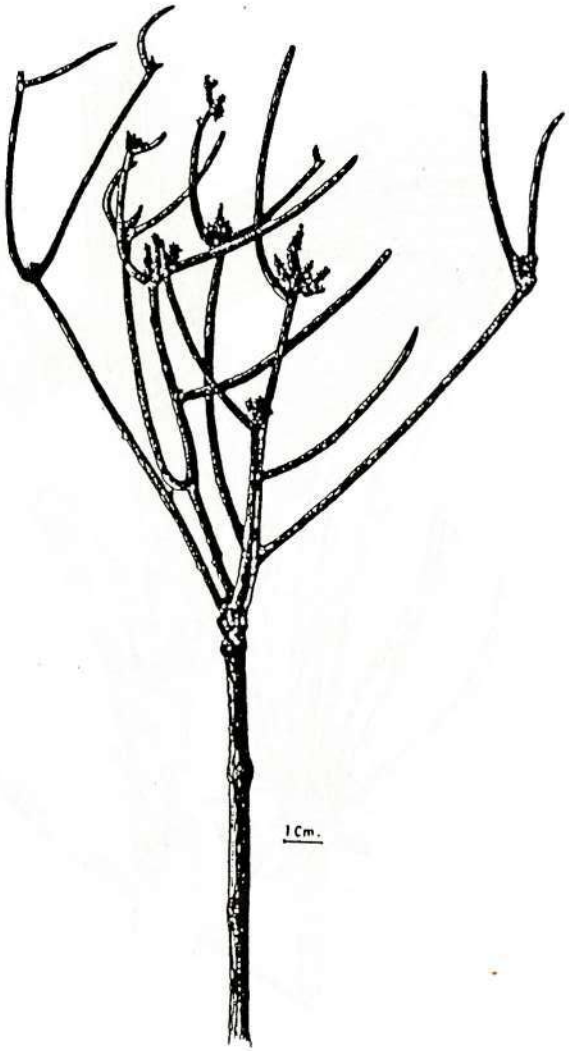


FIG. 2. *Crinum asiaticum* (4) – the leaves were applied to sprains and fractures.



Centella asiatica (8) – included in remedies for disorders of the urinary tract.

FIG. 3. *Alstonia scholaris* (11) – used against worms and diarrhea.



Euphorbia tirucalli (46) – an example of the doctrine of signatures.

ARACEAE

13. ***Acorus calamus*** L., Jerango (BI, G).

A herb of marshlands occurring throughout S.E. Asia. A decoction of the leaves with nine other ingredients was applied externally to treat musculo-skeletal disorders.

Burkhill (1935) records that all parts of the plant are used mixed with the leaves of various Zingiberaceae species in lotions applied to rheumatic pains and lumbago. Perry & Metzger (1980) list several references recording the use of the rhizome in poultices to treat rheumatism. They also list the chemical constituents of *A. calamus.*

14. ***Colocasia esculenta*** (L.) **Shott**, Keladi (BI, G).

Distributed throughout the tropics. This robust herb grew very commonly in the lowland forest in the Alas valley. Both wild and cultivated plants were eaten as vegetables. The milky exudate from the leaf stalks was said to be effective against snake bites (this agrees with the observations of Burkhill (1935)) and a decoction of the leaf stalks was an ingredient in a complex lotion applied to various muscular aches and pains.

ASCLEPIADACEAE

15. ***Heterostema*** **sp**, Sigentut (BI), Sibusuk (G).

A tree of lowland forests sometimes also found in kebuns in the study area. The leaves were mashed with camphor and pasted on to a cloth applied to the chest to relieve the symptoms of colds and flu.

ASTERACEAE

16. ***Blumea balsamifera*** (L.) **DC.**, Gelunggung (BI), Capa (G).

An aromatic shrub of lowland forests from the Himalayas to the Philippines. Sometimes cultivated for its medicinal properties. Two dukuns recommended the use of the leaves in oral remedies for recurrent fevers. One remedy consisted of a simple decoction of the leaves; the other involved pounding the leaves of *B. balsamifera* with the bark of *Lansium domesticum* and the tubers of *Curcuma domestica* and drinking the resulting juice. The leaves were also an ingredient in a complex preparation rubbed on the skin to treat irritations and scabies.

The leaves contain camphor and are quoted by Lewis & Elvin-Lewis (1977) as causing contact dermatitis. Burkhill (1935) also records that decoctions of the leaves are taken for fever in Sarawak. Other chemical constituents of this plant included monoterpene hydrocarbons, sesquiterpene alcohols, tannins and glycosides (Perry and Metzger 1980).

17. ***Blumea pubigera*** (L.) **Merr.**, Serungkas Sebekas (Al).

A shrub sometimes planted for its medicinal properties. The leaves were included in a complex remedy taken orally and applied externally for leprosy and (externally only) for paralysis (including strokes). The leaves were also used in remedies for mental disorders.

18. ***Helianthus annuus*** L., Sunflower, Bunga Mata Hari (Bl).

A native of N. America, the sunflower is cultivated in several forms in S.E. Asia as an ornamental and also for oils extracted from the seeds. The flowers, along with those of five other plants, were soaked in coconut milk which was drunk as a remedy for fever.

BEGONIACEAE

19. ***Begonia isoptera*** **Dryand.**, Reriang (G).

A creeping herb of lowland forests found in the Malay Peninsula and Sumatra. The leaves were used in a paste applied to fractures.

BIGNONIACEAE

20. ***Spathodea campanulata*** **Beauv.**, Bunga Merah (Bl).

A native of Africa, cultivated as an ornamental. A common wayside tree in the Alas valley. The flowers, together with those of other species, were soaked in coconut milk drunk as a remedy for fever with no other associated symptoms. The flowers were also an optional ingredient in an oral remedy for anaemia associated with gastro-intestinal bleeding and epigastric pain.

BOMBACEAE

21. ***Ceiba pentandra*** **(L.) Gaernt. var.** ***indica*** **(D.C.) Bakh.**, Kapas Besar (?).

A tree cultivated throughout the tropics. Sap from the trunk was dripped into eyes to relieve soreness and irritation.

22. ***Durio zibethinus*** **Merr.**, Durian (Bl), Durin (G).

A domestic tree producing pungent edible fruits. The skin of the fruit was used in a complex decoction taken for disorders of the urinary tract.

23. ***Gassampinus valetonii*** **(Hocker) Buakh.**, Kapuk Rimba (Bl), Kekabu (G).

A forest tree of lowland forest clearings. Thin suckers of this tree from the base of the trunk were cut and the juice blown into eyes to relieve soreness and swelling of the eyelids.

BROMELIACEAE

24. ***Ananas comosus*** **(L.) Merr.**, Pine-apple, Nanas (Bl), Nines (G).

The pine-apple is cultivated in the east but is a native of tropical America. The leaf shoots were included in a complex decoction taken for jaundice and urinary tract disorders. Use of the leaves to treat jaundice may be in accordance with the doctrine of signatures since the infusion is yellow in colour. Pine-apples were said to dissolve urinary tract calculi. A large pine-apple was boiled for 3 hr with 1 oz of alum. A slice of the fruit was eaten and some of the docoction drunk every day for 7 days.

Pine-apple juice is a diuretic and abortifacient, capable of causing strong uterine contractions in high doses (Burkhill 1935). Perry and Metzger (1980) record that an infusion of the roots is also used to treat kidney stones in Indo-China.

CARICACEAE

25. ***Carica papaya*** L., Papaya (Bl), Kates (Bl), Pertik (G).

A native of tropical America, now cultivated throughout the tropics. Papayas were a common crop throughout the study area. Several dukuns recommended the use of the old leaves against malaria and other fevers. The juice of the pounded leaves was said to be effective on its own or a decoction of the leaves was made which included the leaves of *Blumea balsamifera* or the barks of *Lansium domesticum* or *Citrus hystrix*. The leaves were also included in a complex decoction drunk for tuberculosis. The latex was said to be anthelmintic. The pounded roots mixed with pepper were applied to the forehead as a remedy for colds and flu. The roots were also included in a complex oral remedy for peritonitis.

The anthelmintic properties of the latex are apparently known in many countries (Perry & Metzger 1980). It is effective against round worms, pin worms and tape worms. Van Steenis-Kruseman (1953) also recorded that in Indonesia the roots are used as an anthelmintic, especially against pin worms.

COMMELINACEAE

26. ***Murdannia nudiflora*** (L.) Brenan, Urip Urip (Bl, G).

This herb of rice fields is found throughout the tropics. A decoction of the leaves, used as a mouthwash, was said to relieve toothache.

COMPOSITAE

27. ***Vernonia arborea*** Ham., Dedalu (G).

A tree of lowland forests. A decoction of the bark or leaves of this tree with garlic and 'inggu' (see *Ruta graveolens)* was used to treat epigastric pain and various disorders of the urinary tract.

28 ***Wedelia biflora*** (L.) D.C., Pesol (Al), Keketah (G).

Found throughout S.E. Asia. This herb occurred wild in the Alas valley but was also cultivated. The leaves ground with 'kemiri' nuts (see *Aleurites moluccana)* and the rhizomes of *Curcuma domestica*, applied to the skin, was said to be the most effective traditional remedy for leprous sores. Perry & Metzger (1980) list ten references recording the use of this plant in poultices and lotions for sores, insect bites and wounds etc.

29. ***Wedelia montana*** Boerl., Sesemuh (G), Bicar (Al).

A small herb of primary forests. This plant was common in forest clearings and by roadsides throughout the study area. Two dukuns recommended chewing the flowers and roots to relieve toothache.

CONVOLVULACEAE

30. ***Ipomea aquatica*** Forsk., Kankung (Bl).

This herb is distributed throughout the tropics and is sometimes eaten as a vegetable. A decoction of the whole plant was drunk for insomnia. The stems were used to prepare a paste, with powdered lime and the leaves of *I. batatas* and

Amaranthus spinosus, and applied to boils.

Burkhill (1935) recommends this plant for "certain nervous conditions with sleeplessness and headache" and Heyne (1927) also recorded its external application to boils in Indonesia. The leaves contain high levels of minerals and vitamins (especially carotene), hentriacontane, sitosterol and sitosterol glycoside (Perry & Metzger 1980).

31. ***Ipomea batatas*** **Lam.**, Ubi Rambat (G).

A creeping herb cultivated in the tropics. This plant was common as a weed in kebuns in the study area. The leaves, macerated with lime and the leaves of *I. aquatica* and *Amaranthus spinosus*, were applied to boils.

CRASSULACEAE

32. ***Kalanchoe lacinata*** **(L.) DC.**, Dedining Putih (G).

A succulent herb found widely in the Old World tropics. In the study area it was sometimes grown near houses. The juice sqeezed from the leaves was drunk and rubbed on the skin as a remedy for fever in childhood. Heyne (1927) also recorded its use for poulticing foreheads and bodies in Indonesia.

33. ***Kalanchoe pinnata*** **(Lmk.) Pers.**, Dedining Hitam (G), Pepulih (Al).

A succulent herb distributed throughout the tropics. Sometimes planted for its medicinal properties. The leaves were dry-fried and used in a complex preparation applied to leprous sores and motor disorders. The juice of the leaves was rubbed on the forehead to reduce fever.

Perry & Metzger (1980) state that the crushed leaves are widely used to treat skin disorders, wounds and burns etc. They are considered to relieve pain and act as a disinfectant. The leaves contain bryophylline, a substance used to treat intestinal troubles caused by bacteria.

CRUCIFERAE

34. ***Raphanus sativus*** **L.**, Raddish, Lobak (G).

The origins of the raddish are obscure. It was rarely cultivated in the study area. The leaves, rubbed with powdered lime, were applied to cuts. The plant contains the antibiotic raphin which is active against gram-positive and gram-negative bacteria (Lewis & Elvin-Lewis 1977).

CUCURBITACEAE

35. ***Cucumis sativus*** **Linn.**, Cucumber, Timun (Bl, G).

Cucumbers were cultivated in the study area. The juice from over-mature cucumbers mixed with nutmeg was said to be effective against infections of the urinary tract. Perry & Metzger (1980) describe the cucumber as diuretic. Cucumbers contain saponins, a proteolytic enzyme and glutathione.

36. ***Luffa acutangula*** **(L.) Roxb.**, Gambas (Bl), Petule (G).

A climbing annual herb, cultivated since ancient times, probably native of N. India. In the study area the unripe fruits were eaten as a vegetable. Medicinally

the seeds were recommended throughout the study area as a cure for malaria and other fevers. The seeds were ground and eaten raw or mixed with the latex of *Alstonia scholaris*. The seeds are oily and contain a bitter principle, cucurbitacin B (amarin), sapogenic and oleanic acids (Perry & Metzger 1980).

CYATHEACEAE

37. ***Cyathea* sp**, Parkis Kecil (?).

A small fern. The roots were added to a complex decoction drunk for abdominal pain with jaundice.

38. ***Cyathea* sp**, Parkis Besar (Al).

A tree fern. The stem of this tree, when still very young, was included in a complex oral remedy for bloody diarrhoea.

CYPERACEAE

39. ***Carex indica* L.**, User (G).

A sedge common by roadsides in the study area. The roots were included in a complex decoction taken for jaundice with abdominal pain.

DENNSTAEDTIACEAE (LOMARIOPSIS GROUP)

40. ***Lomagramma sumatrana* v.A.v.R.**, Parkis Lompat (Bl), Sorpe Lompat (Al), Keluang Lompat (G).

An epiphytic fern of lowland forests. The leaves were included in a complex remedy used both internally and externally against leprosy. *Microsorium nigrescens* (Bl.) Copel. *(Polypodiaceae)* was know by the same vernacular names and used in the same way.

DIPTEROCARPACEAE

41. ***Dipterocarpus* sp.**, Kayu Patimah (G, Al).

A large tree of lowland forests. The leaves were used in a complex remedy used both internally and externally for leprosy. They were also an ingredient in a skin lotion applied to paralytic disorders.

42. ***Dryobalanops aromatica* Gaertn. F.**, The Camphor Tree, Kapur Barus (Bl, Al).

A very large tree of lowland rain forests found from Sumatra to Borneo. In the north of Sumatra however this species is now extremely rare, although until recently it was common. Camphor accumulates in cavities in the trunk of this species and crystalezes there. It is still gathered from the forest but probably not within the Alas valley.

Camphor was pounded with the leaves of *Heterostema* sp and rubbed on the chest to relieve the symptoms of colds and flu. It was also used in a complex oral remedy for leprosy and in a lotion applied to ringworm.

Camphor has a long history of use in Eastern medicine. Its use against ringworm is reported by Burkhill (1935). He suggests this is due to camphor's rubefacient properties. Camphor from this species consists of borneol, camphene,

terpineol and sesquiterpenes (Perry & Metzger 1980).

43. ***Parashorea lucida*** **(Miq.) Kurz.**, Kayu Intap (Bl), Damar Pepening (G).

A large tree of lowland forests distributed in Sumatra and Borneo. The solidified resin from the trunk of this tree was ground with gambir (see *Uncaria gambir*), mixed with honey and eaten as a remedy for urinary tract infections.

EUPHORBIACEAE

44. ***Aleurites moluccana*** **(L.) Willd.**, Kemiri (Bl), Kembiri (Al), Gembiri (Al), Kemili (G).

A native of lowland forests of Indonesia and Malaysia. This tree was cultivated as a cash crop in the study area. It produces nuts similar in texture and taste to Brazil nuts. These were used in cooking and were processed for their oil (similar to linseed oil).

It was common knowledge throughout the study area that grated kemiri nuts are applied to boils and cuts. They were also sometimes applied to leprous sores and ringworm. Kemiri nuts were also an ingredient in a complex oral remedy for indigestion and in a pessary used routinely by mothers 4–11 days after childbirth.

45. ***Baccaurea kunstleri*** **King.**, Rambe (Bl).

A tree of lowland forests with reportedly edible fruits. The roots were grated, mixed with water and the juice squeezed into eyes to relieve soreness and irritation.

46. ***Euphorbia tirucalli*** L., Patah Tulang (Bl) (Fig. 3).

A shrub, native to Africa, cultivated in Sumatra. The latex was spread on broken limbs and was said to set like rubber. Both Heyne (1927) and van Steenis-Kruseman (1953) record this use for this species. It is probably in accordance with the doctrine of signatures, since the articulated branches of this shrub resemble bones.

47. ***Glochidion*** **sp.**, Nggering (Bl), Cermeh (G).

A tree of lowland forest clearings. The leaves, together with those of *Nypa fruticans, Psidium guajava* and *Justicia gendarusa*, were used in a decoction taken for bloody diarrhoea. According to Heyne (1927) *G. littorale* is used for this purpose in Indonesia.

48. ***Glochidion*** **sp.**, Menit (Bl, G).

A tree sometimes found near houses in the study area. It often had a bushy appearance due to continuous cropping of the leaf shoots. The leaves were included in a complex decoction taken for malaria and other fevers. They were also claimed to cure diarrhoea.

49. ***Homalanthus populifolius*** Pasc., Gelpak (Al).

A shrub of lowland forests, distributed from Malaysia to Australia. It was sometimes planted near houses in the study area because of its medicinal properties. The leaves were dry-fried and used in a complex preparation applied to leprous sores and motor disorders.

50. *Phyllanthus niruri* **Linn.**, Dukung Anak (Bl), Meniran (Bl), Kekeramilen (G).

A weed of cultivated fields and roadsides found widely throughout the tropics. This plant was widely known in the study area as a cure for malaria. A decoction of the whole plant often with the leaves of *Eurycoma longifolia* was taken orally. A decoction of the whole plant was also said to be effective against disorders of the urinary tract including calculi.

This species is widely known as a diuretic and is used throughout the East to treat kidney complaints.

FABACEAE

51. *Flemingia strobilifera* **R. Br.**, Reringan (G), Reriang (G).

A small shrub found throughout Sumatra. The leaf juice was used in a bathing tonic. (This is similar to the observations of Burkhill (1935)). The leaves were also applied to boils.

GESNERIACEAE

52. *Monophyllae horsfieldii* **R. Br.**, Leluik (G).

A rare herb of streams and wet cliffs on limestone in lowland forest. The leaves and the stem yield large quantities of juice when pressed. The juice was splashed on young babies and was said to promote health and fitness. There are no previous references to this species in the literature on medicinal plants.

GRAMINEAE

53. *Bambusa* **spp**, Bamboo Kecil (Bl), Rebun Tipes (G).

A wide variety of bamboos grow throughout the wetter regions of S.E. Asia. Bamboo shoots were used in a complex preparation taken for abdominal pain and jaundice. A decoction of bamboo shoots with the root of the coconut palm was drunk as a remedy for insomnia. Burkhill (1935) records that the shoots of *B. vulgaris* are used to treat jaundice in Malaysia.

54. *Cymbopogon citratus* **(D.C.) Stapf.**, Serai Dapur (Bl), Srei (Al).

A domestic aromatic grass. In the study area it was cultivated for flavouring fish. Medicinally it was used to treat anaemia. The juice of the leaves was mixed with the rhizomes of *Curcuma* spp and the fruits of *Citrus aurantium* and drunk. If the dosage was too high, a side effect was said to be drowsiness. A decoction of the roots was used in a complex oral remedy for jaundice with abdominal pain and the roots were also included in a mouth wash for toothache.

The essential oils of this plant include the monoterpenes: citral, citronellal, geraniol and myrcene (Perry & Metzger 1980).

55. *Eleusine indica* **(L.) Gaertn.**, Tetegu (G).

A grass distributed throughout the tropics. Grows in forest clearings. The leaves were macerated with those of *Paspulum conjugatum* and powdered lime and applied to skin infections.

56. *Leptaspis urceolata* (Rxb.) R. Br., Balik Putar (Al, G).

A tall grass of lowland forests. Evidently the leaves of *L. urceolata* were interchangeable with those of *Aglaia argentea* as ingredients in some medicinal preparations. The leaves of either species were used in a complex preparation taken to treat leprosy and paralysis. A decoction of the leaves was drunk as a cure for fevers and a poultice of the boiled leaves was applied to sprains. The juice of the leaves was an ingredient in a remedy for diarrhoea and abdominal colic.

57. *Oryza sativa* L., Rice, Beras (Bl).

In Indonesia many varieties of rice are cultivated in both wet and dry systems. Dried ground rice was used as a base for a range of pastes and powders. These included body powders used by mothers after childbirth (called 'obat luar') and others spread on the forehead as treatment for headaches. Many of these preparations were used more for their cosmetic effects rather than for any medicinal effects.

58. *Paspalum conjugatum* Berg., Kerpe Belender (G, Ac), Dukut Lalah (Al).

A common grass of forest edge and roadsides. Possibly an introduction. Macerated with *Eleusine indica* and powdered lime, this plant was applied to infected wounds.

59. *Saccharum officinarum* L., Sugar Cane, Gula Pasir (Bl, Al), Saka (Ac), Tebu (G).

Sugar cane probably originated somewhere in the Indo-Pacific region and underwent domestication at a very remote period. It was commonly cultivated in the study area. Sugar cane juice was extracted by pounding the canes with wooden pummels. The juice was then boiled down and cooled to allow crystallization of the sugar. Unrefined rock sugar ('gula batu') was available at traditional medicine stalls at local markets. Poorly refined sugar used to sweeten tea etc. was known as 'gula pasir'.

Gula batu was used in remedies for flatulence, cough with vomiting, peritonitis, dizziness and bloody diarrhoea. Gula pasir was used in remedies for cough with vomiting, diarrhoea, infertility in women and disorders of the urinary tract. Gula pasir, ground with tobacco leaves was also applied to cuts.

Heyne (1927) reports that in Indonesia the roots of *S. officinarum* are chewed for diarrhoea and the stalk is included in a preparation used as an abortifacient.

GUTTIFERACEAE

60. *Garcinia mangostana* L., The Mangosteen, Manggis (Bl).

A domestic fruit tree of unknown origin. A decoction of the fruit skin with the bark of *Lansium domesticum* was drunk as a remedy for bloody diarrhoea. Burkhill (1935) also recorded that a decoction of the rind of the mangosteen was administered against diarrhoea in Malaysia. He described it as an astringent.

61. *Mesua* sp, Sari Munia (Al).

A tree sometimes grown in villages. The leaves were used in an external remedy for jaundice.

LABIATAE

62. ***Coleus scutellaroides*** **(L.) Bth.**, Reruku (?), Trangon (G) (Fig. 4).

A herb of rice fields. Sometimes cultivated near villages. The juice extracted from the leaves, sometimes mixed with gambir (see *Uncaria gambir)* was drunk as a treatment for abdominal pain, and for both simple and bloody diarrhoea.

Burkhill (1935) records that the leaves stimulate digestion and relieve epigastric pain and heartburn. Perry & Metzger (1980) state that the leaf juice is used as a remedy for indigestion, nausea and distention of the stomach in Indo-China.

63. ***Ocimum canum*** **Sims.**, Kemángi (Al).

A shrub distributed throughout the Old World tropics. Sometimes cultivated in the study area. Sap from the leaves was dripped into ears to relieve earache.

64. ***Orthosiphon aristatus*** **(Bl.) Miq.**, The Cat's Whiskers, Kumis Kucing (Bl) (Plate 3).

A herb cultivated for its medicinal properties. This plant was dried and packaged locally for sale at traditional medicine stalls at Kutacane market. The roots and leaves were common ingredients in decoctions drunk as treatment for disorders of the urinary tract including renal colic.

The use of this plant as a diuretic is very common throughout Indonesia (Perry & Metzger 1980). Its diuretic properties have been known to western science since 1927 (Pharm. J. ser. 4 vol. 65 p 494). It contains high levels of potassium salts and a glycoside (orthosiphon).

65. ***Pogostemon cablin*** **(Blanco) Benth.**, Nilam (Bl).

This plant was cultivated in the study area because it yields a valuable oil ('minyak nilam') used in the scent industry. The leaves were sun dried and the oil extracted locally in apparatus constructed from oil drums. Medicinally the oil was recommended for cuts, itches and for removing ear wax. It was included in cough mixtures and oral remedies for diarrhoea and vague symptoms including dizziness in older people, believed due to high blood pressure but not confirmed by measurement. The oil consists of patchouli alcohol, cadenene, benzaldehyde, eugenol and coerulein (Perry & Metzger 1980).

LAURACEAE

66. ***Cinnamomum burmanii*** **Bl.**, Cinnamon, Kulit Manis (Bl, Al, G) (Plate 3).

This tree is indigenous to Sumatra. The dried ground bark is the spice cinnamon. In the study area the bark was collected from both wild trees and those occurring in kebuns. However those in kebuns were all much older than the kebuns themselves and therefore they must have started life as forest trees. Cinnamon sticks were sold at markets in the area.

Cinnamon was added to oral remedies for cough associated with vomiting, leprosy, chest infections, tuberculosis, headaches and epigastric pain. The chief aromatic substance in cinnamon is cinnamic aldehyde (Heyne 1927).

67. ***Cinnamomum iners*** **Reinw.**, Nggepak (Al), Gerpa (G).

A lowland forest tree occurring from India to the Philippines. The leaves were an ingredient in a lotion rubbed on the skin for jaundice. The leaves contain eugenol, terpene and cinnamic aldehyde (Perry & Metzger 1980).

68. ***Litsea noronhae*** **Bl.**, Gajah Tengaal (Ac).

A tree of lowland forests. A decoction of the leaves was drunk as a general tonic to improve strength and fitness in men ('obat kuat').

69. ***Persea americana*** **Willd.**, Pokat (Bl).

A native of America. Widely cultivated in the East. The leaves or fruits were said to be effective against hypertension. This diagnosis had apparently been confirmed in some instances by measurement of blood pressure. The juice of the leaves was drunk cold or a decoction of the fruit and leaves taken. The leaves contain methyl-chavicol (Burkhill 1935).

LEGUMINOSAE

70. ***Acacia farnesiana*** **Willd.**, Bunga Mestu or Metu (G).

An ornamental shrub of unknown origin. The flowers and bark were used in preparations both applied externally and taken orally as treatment for various mental disorders. The flowers were also said to be an essential ingredient in an oral remedy for anaemia associated with gastro-intestinal bleeding and epigastric pain.

71. ***Cassia alata*** **L.**, Golden Candlesticks, Gelinggan (Bl, G) (Plate 3).

A shrub of forest edges and clearings with conspicuous spikes of bright yellow flowers. A native of America, now distributed throughout the tropics. The leaves were included in two external remedies for ringworm. One remedy used the macerated leaves with powdered lime and sulphur; the other combined the leaves with camphor and the crushed seeds of *Aleurites moluccana*. A decoction of the leaves with those of *Carica papaya* was drunk as a cure for malaria. When mashed with coconut milk and boiled, the leaves were used to treat lower abdominal pain. They were also included in a complex preparation applied externally for jaundice associated with upper abdominal pain.

The use of this plant to treat ringworm is apparently well known from India to S.E. Asia. Existing records describe the plant as a laxative and purgative (Perry & Metzger 1980).

72. ***Cassia siamea*** **Lamk.**, Juhar (G).

A tree found from India through most of Indonesia and Malaysia. A decoction of the leaf petioles with the rhizomes of *Curcuma domestica* was claimed to be an effective cure for late-onset diabetes. Apparently patients who had had diabetes clinically diagnosed had used this remedy and had subsequently had laboratory tests to determine whether the treatment had been effective. However we could not find corroborative evidence to support these claims. An infusion of the leaves was also rubbed on the skin to cure scabies and other skin irritations.

The leaves contain tannins and an alkaloid which is poisonous to pigs (Burkhill 1935).

PLATE 3.

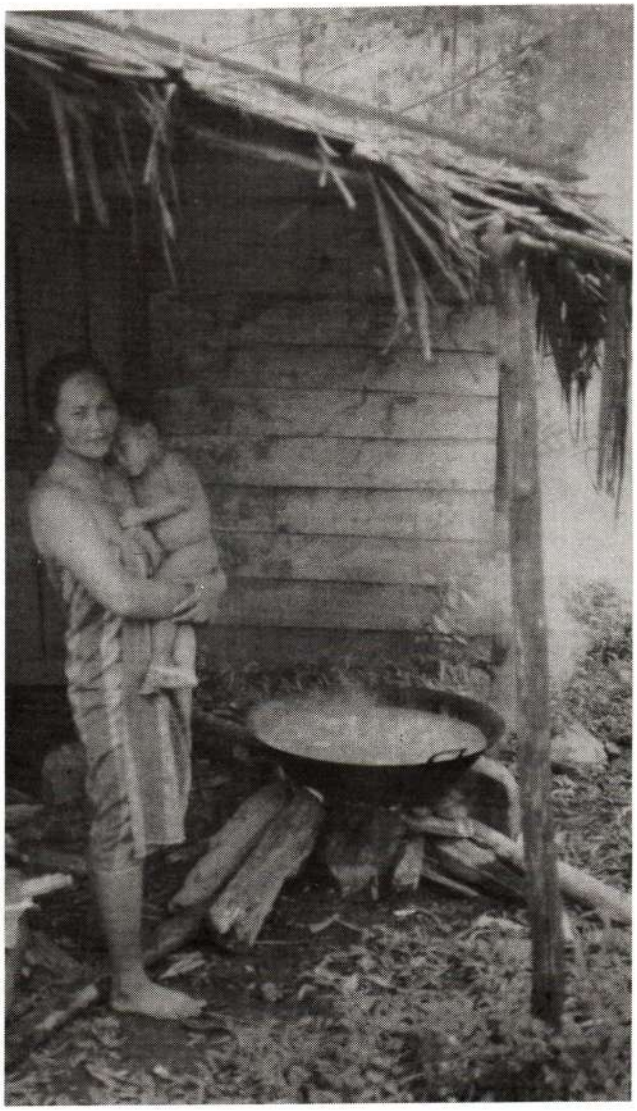
Cassia alata (71). The leaves are a treatment for ringworm.

Cinnamomum burmanii (66). The bark was a frequent addition to medicinal preparations.

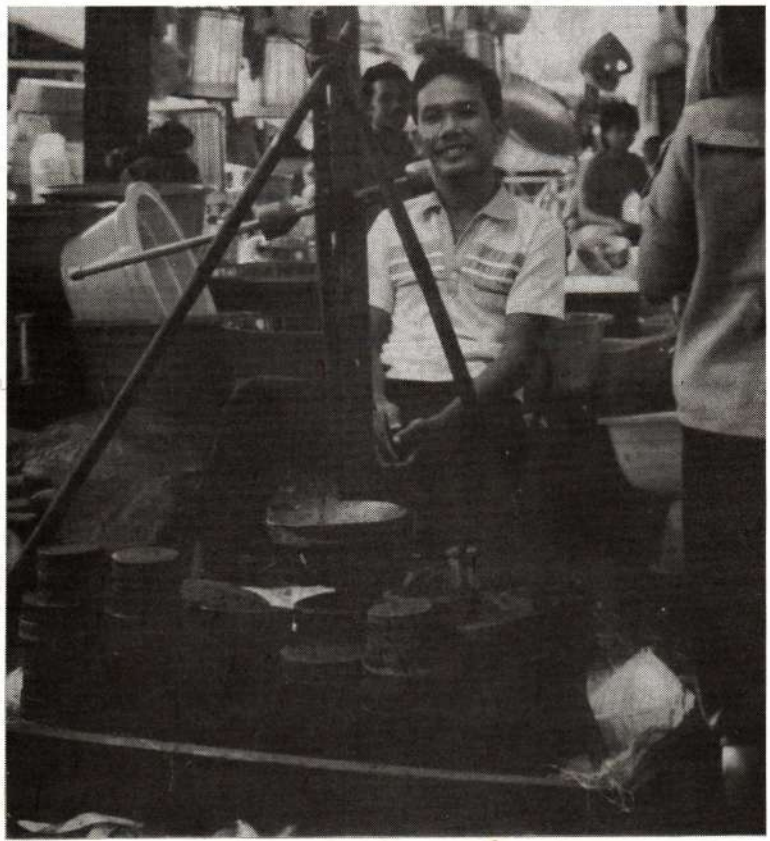
Orthosiphon aristatus (64). A proven diuretic.

PLATE 4.

Arenga pinnata (107). Man's earliest source of sugar.



The sap is reduced by boiling.



'Gula Merah', red sugar on sale at Kutacane market.

73. ***Cassia* sp.** Bunga Merak (Bl, Al).

An ornamental tree. The roots were used in a complex preparation applied to the face for mental disorders.

74. ***Cassia* sp.** Bunge Remungge (G).

An ornamental tree sometimes planted near houses in the Alas valley. The flowers were said to be an essential ingredient in an oral remedy for anaemia associated with gastro-intestinal bleeding and epigastric pain. The roots were used in a preparation applied externally for mental disorders and were claimed to be anthelmintic.

75. ***Leucaena leucocephala* (Lamk.) de Wit.**, Lamtorogung (Bl), Pete Cina (Bl).

A tree native of tropical America introduced into Indonesia at a very remote period. It is cultivated for its edible seeds and is naturalized in the Alas valley. The seeds were claimed to be anthelmintic. The anthelmintic use of the seeds in Indonesia is also recorded by Heyne (1927). The seeds contain high levels of the toxic amino acid, mimosine (van Steenis-Kruseman 1953).

76. ***Mimosa invisa* Mart.**, Mali Mali (Ac), Malu Malu (G).

A prickly creeping shrub of lowland forest edges, native of Brazil. The leaves close up when touched and this gives the plant its name. Mali mali means shyness or modesty. In the East this plant is cultivated as a cover crop (Burkhill 1935). It was naturalized in the study area. Juice from the pounded roots was taken as a treatment for bloody diarrhoea.

77 ***Parkia roxburghii* G. Don.**, Kedawung (Bl, Al), Rampah (Bl, G) (Fig. 4).

A lowland forest tree found from N.E. India to Java. The seeds were gathered from the forest and sold at traditional medicine stalls at Kutacane market. As a remedy for colic, the seeds were roasted, mashed with water and eaten. Burkhill (1935) and van Steenis-Kruseman (1953) also report the use of the seeds for colic in Malaysia, Java and Borneo. Chewing the raw seeds was said to relieve headaches and they were also claimed to be anthelmintic. Externally they were applied to cuts. Perry & Metzger (1980) quote a reference which records that a decoction of the seeds is applied to wounds and ulcers in the Philippines.

The leaves were included in an oral remedy for abdominal pain.

78. ***Sindora bruggemanii* De Wit.**, Kayu Tapak Itik (Al).

A lowland forest tree. The leaves were included in a complex preparation taken orally and applied externally to treat leprosy.

79. ***Sindora sumatrana* Miq.**, Kayu Sena (G).

A large tree of lowland forests, often by rivers, distributed throughout S.E. Asia. The wood when wounded produces copious amounts of a viscous blood-red exudate. The exudate mixed with *Scoparia dulcis* leaves and alum was taken as a treatment for infections of the urinary tract.

80. ***Tamarindus indica*** **L.**, Assam Jawa (BI, G).

A domestic fruit tree, native of Africa and India. Brought to the Indonesia probably around 400 BC (Burkhill 1935). Cultivated throughout the Alas valley. The fruit was used to treat a wide range of symptoms. It was sometimes used as a flavouring to make otherwise unpleasant medicinal preparations more palatable. It's most common use was to treat coughs associated with vomiting. The juice of the fruit (either raw or roasted) was drunk on its own or with other ingredients (including cinnamon, cloves, nutmeg and coriander). The fruit juice was also used in oral remedies for bloody diarrhoea, epigastric pain, central chest pain and in tonics taken by mothers after childbirth.

LILIACEAE

81. ***Allium cepa*** **f. var.** ***ascalonicum*** **(L.) Baker**, Bawang Merah (BI).

A small red onion, native of W. Asia. Commonly cultivated in the study area. It was included in remedies for various disorders of the digestive tract, including bloody diarrhoea, diarrhoea with vomiting, indigestion and vague abdominal pain. Roasted and mixed with lime juice, the onion was taken to treat coughs with vomiting. Externally it was included in a body powder used by mothers for two weeks after childbirth.

82. ***Allium sativum*** **L.**, Garlic, Bawang Putih (BI), Lasun Putih (G).

Garlic was cultivated in the Alas valley. It was one of the ingredients in a body powder used by mothers after childbirth and was included in poultices applied to scorpion stings and snake and centipede bites. Garlic was also an ingredient in a preparation applied to muscular aches and pains. It was included in oral remedies for indigestion, diarrhoea with vomiting, epigastric pain, disorders of the urinary tract, infertility in women, anorexia and upper abdominal pain associated with jaundice.

Garlic has a long history of medicinal use. For a full acount see Burkhill (1935). Its use externally for rheumatic pain and insect and snake bites is recorded by Perry & Metzger (1980) and van Steenis-Kruseman (1953). The latter also reports that in Indonesia, garlic has a general reputation as an antiseptic and is regarded as preventing infectious diseases. Garlic contains allicin and has a bacteriostatic effect on both gram-positive and gram-negative bacteria.

83. ***Aloe vera*** **(L.) Webb**, Bitter Aloes, Jadam (BI), Jadem (G).

A herb cultivated throughout the topics. Sometimes grown in pots in the study area. When cut, the leaves exude a mucilagenous juice and it was this which was used medicinally. The juice was recommended in several preparations taken orally and rubbed on the skin for mental disorders. It was also included in lotions applied to musculo-skeletal disorders and was a common ingredient in traditional 'shampoos'. It was said to promote hair growth.

Heyne (1927) records that in Java also, this plant is used to promote hair growth. Chemical constituents include anthraquinones, anthrals, glycosides and chrysophanic acid (Perry & Metzger 1980).

LORANTHACEAE

84. ***Scurrula* sp**, Mendalu (G).

A parasite on *Citrus* sp trees. The leaves were boiled with those of *Citrus aurantifolia* and the resulting decoction drunk as a remedy for epigastric pain.

MAGNOLIACEAE

85. ***Michelia champaca* L.**, Bunga Cempa (G).

A native of India, cultivated as an ornamental. A cold infusion of the flowers was said to be an essential ingredient in a treatment taken for anaemia associated with gastro-intestinal bleeding and epigastric pain. Reported chemical constituents of this plant include cineole, iso-eugenol, benzoic acid, benzylalcohol, benzylaldehyde, p-cresol methyl ether and an alkaloid (Perry & Metzger 1980).

MALVACEAE

86. ***Hibiscus rosa-sinensis* L.**, Bunga Raya (Bl), Bunga Raye (Al).

Distributed throughout the tropics, this ornamental tree was commonly planted near houses in the Alas valley. The roots were included in a complex preparation applied to the face to treat mental disorders.

87. ***Hibiscus surattensis* L. ssp. *surattensis*,** Sesusur (G).

A sprawling shrub distributed throughout the Old World tropics. In the study area this plant was cultivated specifically for its medicinal properties. A decoction of the foliage was taken to treat disorders of the kidneys and urinary tract.

88. ***Sida rhombifolia* L.**, Bunga Jejerun (G).

A small shrub distributed throughout the tropics. An infusion of the flowers in coconut milk was taken as a remedy for chickenpox and fevers. Burkhill (1935) records that in Malaysia a decoction of the roots is drunk for "high fevers" and that the whole plant is used externally to relieve skin irritation during chickenpox.

89. ***Urena lobata* L.**, Bunga Pelelut (G), Bunga Mawar (G).

A shrub of lowland forest edges and clearings, found throughout the tropics. The flowers, together with those of *Sida rhombifolia*, were mixed with coconut flesh and eaten as a remedy for chickenpox. The flowers were also included in treatments for mental disorders and in oral remedies for fevers.

MELASTOMATACEAE

90. ***Melastoma malabathricum* L.**, Bunga Bebeki (G).

A small shrub found from India to Australia. A cold infusion of the flowers was an optional ingredient in an oral remedy for anaemia associated with gastro-intestinal bleeding and epigastric pain.

MELIACEAE

91. ***Aglaia argentea*** **Bl.**, Balik Angin (G, Al), Balik Sempa (G).

A lowland forest tree found in Java, Sumatra, Borneo and the Malay Peninsula. Evidently *A. argentea* and *Leptaspis urceolata* were interchangeable as ingredients in several medicinal preparations. The leaves were included in a complex preparation taken to treat leprosy. A decoction of the leaves and bark was drunk to treat fevers and a poultice of the boiled leaves was applied to sprains. An infusion of the leaves was included in oral remedies for non-specific abdominal pain, diarrhoea and colic.

92. ***Lansium domesticum*** **Corr.**, Langsat (Bl).

A tree indigenous to Sumatra. The seeds, bark and leaves were all claimed to be effective against fevers (including malaria). The seeds were eaten raw or a decoction of the leaves and/or bark was taken. A decoction of the bark was also taken as a remedy for bloody diarrhoea.

The bark is also used against dysentery in Java, Borneo and Malaysia and against malaria in N. Borneo (Burkhill 1935). The seeds contain alkaloids (Perry & Metzger 1980).

MORACEAE

93. ***Artocarpus integra*** **(Thunb.) Merr.**, Nangka Kecil (G), Majik (G), Jekkar (Bt).

A domestic fruit tree, native of India. The juice of the young fruits was included in an oral remedy for fevers and the young fruit was mixed with gambir (see *Uncaria gambir)* and eaten as a treatment for abdominal pains. The leaves or fruits were included in complex oral remedies for bloody and simple diarrhoea. A decoction of the senescent leaves was used as a mouth wash to relieve toothache.

94. ***Ficus variegata*** **Bl.**, Gele (?).

A large tree found in lowland forests throughout the moister parts of S.E. Asia. The young leaves were included in a complex oral remedy for diarrhoea. Burkhill (1935) records that a decoction of the bark is also taken for dysentery in Malaysia

95. ***Ficus*** **sp**, Gala Garu (Bl), Gele Gari (G).

Gala garu was the solidified latex of a *Ficus* sp, obtained by tapping wild trees. It was black, became sticky when heated and was on sale in small quantities at high prices at traditional medicine stalls at Kutacane market. It was known throughout the study area as an effective ingredient in preparations applied externally to treat mental disorders. Its use was mostly associated with magic.

96. ***Ficus*** **sp**, Kayu Putih (Bl, G).

A large tree of lowland forests. In the Alas valley it's resin was gathered from the forest as a fuel used in torches made of bamboo. Medicinally this species was used to treat abdominal pain. The bark or resin was pounded with ginger, boiled and the resultant decoction drunk.

97. ***Ficus*** **sp**, Konyel (Bl, G).

A strangling fig of lowland forests. In areas where the forest was being cleared for cultivation konyel bark was available in considerable quantites. The bark was slightly sweet and was often chewed by older women either by itself or as part of the betel quid (see *Areca catechu*). Medicinally, the bark was claimed to be effective against abdominal pain and diarrhoea. Burkhill (1935) gives 'konyal' as the javanese name for *F. ramentacea*.

MUSACEAE

98. ***Musa*** **spp**, Banana, Pisang (Bl).

Many different varieties of banana were cultivated in the Alas valley. The latex exuded from banana flowers, mixed with charcoal of *Pinus merkusii* wood, the rhizomes of *Curcuma domestica* and kemenyan (see *Styrax benzoin*) was taken as a remedy for bloody diarrhoea. The juice from the stems of young banana trees was taken for indigestion and the pith, mixed with the leaves of *Curcuma domestica* and the bark of konyel (see *Ficus* sp) was used in a decoction taken for diarrhoea. A race known locally as 'pisang mur' was included in an oral remedy for diarrhoea and abdominal colic.

MYRISTICACEAE

99. ***Myristica fragrans*** **Houtt.**, Nutmeg, Pala (Bl, G).

A native of east Malaysia. Nutmeg was a common crop in the Alas valley. It was a frequent addition to medicinal preparations. It was included in oral remedies for cough with vomiting, disorders of the urinary tract, indigestion, and infertility in women. It was also included in a pessary used routinely by mothers 4–11 days after childbirth. Previous records of the use of nutmeg in remedies for indigestion and stomach complaints are provided by Burkhill (1935). Nutmeg contains myristicin (a narcotic), pinene, camphene, dipentene, safrol, and alcohols (Perry & Metzger 1980).

MYRTACEAE

100. ***Psidium guajava*** **L.**, The Guava, Jambu Kelutuk (Bl), Gelima (G).

A tree of lowland forests, native of America. In the Alas valley this species was cultivated for its edible fruits. It was recommended by six dukuns in remedies for stomach ache and diarrhoea. The roots were included in a decoction with the leaves of the Nypa palm, *Justicia gendarusa* and *Glochidon* spp, taken as a remedy for bloody diarrhoea. The leaf shoots were included in a complex oral remedy for simple diarrhoea. The bark was the most commonly used part. It was included in two preparations for abdominal pain, one for simple diarrhoea and one which was claimed to be effective against either simple or bloody diarrhoea.

Perry & Metzger (1980) list seven references to the antidiarrheic properties of this plant. The leaves contain terpenes, tannins and a substance antibiotic against *Staphylococcus*.

101. ***Syzygium aromaticum*** **(L.) Merr. & Perry**, Cloves, Cenkeh (Bl).

Cloves were a common crop in the Alas valley. They were an ingredient in a complex oral remedies for leprosy and for coughs with associated vomiting in children. Cloves were also included in a body powder used by mothers after

childbirth. In Malaysia also, cloves are used in post-partum body powders (Burkhill 1935). Clove oil contains eugenol (50-85%), gallotannic acid and calcium oxalate. It has antiseptic properties (Perry & Metzger 1980).

NYCTAGINACEAE

102. ***Bougainvillea glabra*** **Chois.**, Bunga Melati (Bl), Bunga Melur (Al), Bunga Merul (G).

An ornamental shrub, cultivated in the Alas valley. The roots and the flowers were included in complex preparations smeared on the body to treat mental disorders. The flowers were included in remedies for fever, when no other symptoms were present. They were also said to be an essential ingredient in an oral remedy for anaemia associated with gastro-intestinal bleeding and epigastric pain.

ORCHIDACEAE

103. ***Dendrobium*** **sp,** Bunga Kepias (G).

An epiphytic orchid of lowland forests. The flowers were included in a complex remedy for mental disorders. Burkhill (1935) states that the Malays do not distinguish between different species of *Dendrobium* and that this genus is considered to be the best traditional remedy for "afflictions of the brain and nerves".

104. ***Galeola altissima*** **Rchl.f.**, Akar Tulang (G).

A parasitic creeping herb of lowland forests, with red pigmented stems and vestigeal leaves and roots. The sap was drunk as a treatment for joint disorders. The plant was probably being used in accordance with the doctrine of signatures, because the jointed stems resemble bones.

OXALIDACEAE

105. ***Averrhoa belimbi*** **L.**, Belimbing (Bl).

A small tree indigenous to Sumatra, sometimes cultivated for its edible fruits. A decoction of the leaves was drunk as a remedy for dizziness and other vague symptoms, usually occurring in older people and believed due to high blood pressure. This diagnosis had been confirmed in some cases by measurement. The macerated leaves were also applied to cuts. The bark was roasted and included in a preparation taken to treat peritonitis. The fruit was an ingredient in oral remedies for diarrhoea and for vomiting. The stem sap was drunk as a cure for fevers.

Perry & Metzger (1980) record that in Indonesia the leaf sap is also taken for fevers. An extract of the leaves is known to have antibiotic activity against *Staphylococcus*.

PALMAE

106 ***Areca catechu*** **L.**, betel Nut Palm, Pinang Matah Merah (Bl), Pinang Matah Megare (Al).

A native of Old World tropics. Cultivated for its nuts which are chewed as a stimulant. This was a common habit amongst older people in the Alas valley. The

betel quid was prepared by sprinkling the leaves of *Piper betel* with a little lime and pounding these together with betel nuts and gambir (see *Uncari gambir).* An alkaloid present in betel nuts, arecoline, has similar effects on the nervous system as those of nicotine (Burkhill 1935).

The leaves were included in a complex remedy for leprosy and the vessels stripped from the petioles were applied to snake bites. The husk of the nut was included in an oral remedy for diarrhoea with vomiting. The nuts are used throughout S.E. Asia against diarrhoea and worms. They contain three other alkaloids besides arecoline, namely; arecaidine, guvacoline and guvaline. There are many references to the effects of arecoline and guvaline on the motility of the intestinal tract (Perry & Metzger 1980).

107. ***Arenga pinnata* (Wurmbe) Merr.**, The Red Sugar Palm, Gula Aren (Bl), Gula Merah (Bl), Gula Panguh (G) (Plate 4).

A palm of primary and secondary lowland forests. Common in the Alas valley. When the forest was cleared for cultivation, this species was left standing because of its commercial value. Sometimes also cultivated or encouraged.

This palm was probably Man's first source of sugar. It was used long before sugar cane. The plant stores a large quantity of starch in its stem which is mobilized as sugar just before flowering at 7-10 years of age. By tapping the peduncle of the male inflorescences, a sap rich in sugars is obtained. First the inflorescences are beaten with a stick for 3-7 days which is said to increase the yield of sap. Then the flower spikes are cut off and a receptacle is placed around the severed peduncle to collect the sugary exudate. This practice was widespread throughout the Alas valley. The sap was reduced by boiling in large shallow pans and the resulting red-brown sugar was formed into circular cakes 10-20 cm across and sold in the markets.

Although used mainly to sweeten unpalatable medicinal preparations, the raw sugar cakes may have some medicinal properties of their own since they contain a wide range of impurities and a diverse flora of yeasts and bacteria (Burkhill 1935). The sap fermented rapidly to give an alcoholic drink known locally as 'todi'. Red sugar was added to remedies for stomach ache, bloody and simple diarrhoea, coughs, malaria and other fevers, back ache, worms, central chest pain and tuberculosis. It was also an ingredient in a tonic taken by mothers after chilbirth. In Indonesia red sugar is officinal in its use against chronic constipation (van Steenis-Kruseman 1953).

108. ***Cocos nucifera* Linn.**, The Coconut, Kelapa (Bl).

The coconut palm was by far the most widely used plant in the medicinal remedies of the Alas valley. This contrasted with the city dukuns in Medan who were said never to use coconut in their remedies (Mary Steedly pers. comm.).

The coconut was used at all stages of development. Juice from the roasted flower (Bunga Kelapa (Bl)) mixed with gambir (see *Uncaria gambir)* was orally administered against bloody diarrhoea. The coconut collected during its earliest stages of development, when still about the size of a walnut (Momang Kelapa (Bl), Momang Keramil (G)), was included in a complex decoction taken as a remedy for jaundice or disorders of the urinary tract. The flesh of the young or green coconut (Kelapa Muda (Bl), Kelapa Hijau (Bl), Belalu (G)) was included in oral remedies for chickenpox, headaches, and coughs with associated vomiting, whereas the flesh from older coconuts was reserved for oral remedies for dry coughs and abdominal pains.

Coconut milk was used to flavour or provide a liquid medium for many remedies. Often it was used for infusions of other ingredients. The milk from young coconuts (Air Kelapa Muda (Bl), Santen Kelapa Hijau (Bl)), mixed with chicken egg yolk was taken as a cure for fevers. With the addition of kemenyan (see *Styrax benzoin),* this remedy was also said to be effective against measles and coughs with associated vomiting. Milk from young coconuts was also used externally for rashes and childhood fevers. Milk from old cocnuts was used to make an infusion of *Piper* sp leaves (Sirih Merah (Bl)) used for visual defects. Milk from coconuts of unspecified age was included in oral remedies for central chest pain, indigestion, appendicitis, fevers, measles, abdominal pain. bloody and simple diarrhoea (with or without vomiting) and infertility in women. Externally it was used in a lotion applied to fractures.

Coconut oil (Minyak Kelapa (Bl)) was made by reducing coconut milk by boiling. Oil from young coconuts was reserved as a constituent of poultices applied to sprains but oil from coconuts of any age was said to be adequate for fractures.

A decoction of the roots of the coconut palm with bamboo shoots was taken for insomnia.

Coconut milk is a diuretic, becoming more so with age (Burkhill 1935). Its chemical constituents are listed by Perry & Metzger (1980). The roots of the coconut palm are known as an anthelmintic in Indonesia (Lewis & Elvin-Lewis 1977).

109. ***Nypa fruticans*** **Wurmb**, Nipa (Bl), Bekas (G).

A palm of tidal mud, distributed from India to Australia. The leaves were imported into the Alas valley and sold at markets as cigaratte wrappers. Medicinally the leaves were included in a decoction taken as a remedy for bloody diarrhoea. The leaves together with those of *Hedychium* sp and garlic were used to make a paste applied to snake and centipede bites and scorpion stings. In the Malay Peninsula, a decocotion of the leaves is also applied to centipede bites (Perry & Metzger 1980).

PINACEAE

110. ***Pinus merkusii*** **Jungh. & de Vriese**, Tusam (G).

A pine tree native to Burma and Sumatra. Charcoal made from the wood of this species was included in an oral remedy for dysentery.

PIPERACEAE

111. ***Piper betel*** L, Sirih Biasa (Bl).

This climbing vine was cultivated in the Alas valley. It's leaves were included in the betel quid (see *Areca catechu).* The crushed leaves were included in a pessary used routinely by mothers 4-11 days after childbirth. Burkhill (1935) mentions the application of the leaves of this species to various parts of the body after childbirth. Essential oil extracted from the leaves has a bacteriostatic action and contains phenols (mainly chavicol) (Perry & Metzger 1980).

112. ***Piper nigrum*** L, Pepper, Merica (Bl).

A woody climber, native to India, cultivated in Sumatra. Pepper was a frequent addition to medicinal preparations. It was commonly included in tonics and body

powders used by mothers after childbirth and was also included in oral remedies for fevers, bloody diarrhoea, headaches, colds and flu, coughs and indigestion. Externally it was applied in complex poultices for sprains and leprous sores. It was also mixed with chicken excrement and applied to the eyelids to treat trachoma.

Burkhill (1935) lists three references to the use of pepper in preparations administered after childbirth in Malaysia. He also referred to its use in indigestion mixtures. Several authors claim that, in sufficient quantities, pepper has abortifacient properties. Pepper contains the alkaloids, piperine and piperidine.

113. ***Piper*** **sp**, Sirih Hutan (Bl, G).

A climbing vine of lowland forests. Burkhill (1935) gives sirih hutan as the malay name for *P. caninum* and *P. curtisii.*

The leaves were macerated and applied to boils, bee stings, sprains and various skin irritations, including scabies. Their main effects was claimed to be pain relief. The leaf sap mixed with that of *Pogostemon cablin* was taken to relieve vague symptoms such as dizziness in old people, believed due to hypertenion, but not confirmed by measurement of blood pressure.

114 ***Piper*** **sp**, Sirih Merah (Bl), Belo Udang (G), Sirih Pedas (Al).

A vine cultivated for food and medicine. The leaves were included in a remedy for visual defects.

POLYPODIACEAE

115 ***Microsporium nigrescens*** **(Bl.) Copel**, Sorpe Lompat (Al), Parkis Lompat (Bl), Keluang Lompat (G).

See *Lomagramma sumatrana.*

PONTEDERIACEAE

116. ***Monochoria hastata*** **Solms.**, Kerkerlen (Bl, G), Keteme (Bl, G), Oppu Oppu (Bt).

A herb of rice fields. This plant was recommended as a cure for malaria and other fevers. A decoction of the whole plant was used together with the bark of *Alstonia scholaris, Cinnamomum burmanii* and *Magnifera indica* and the leaves of *Glochidion* sp and *Leea* sp. The leaves were also sometimes wrapped around sprains and fractures and as a decoction taken by mothers as a tonic after childbirth.

The leaf sap of *M. vaginalis* is also taken for fevers in Indonesia (Perry & Metzger 1980).

RANUNCULACEAE

117. ***Nigella sativa*** **Linn.**, Jira Hitam (Bl), Yira Hitam (Ac).

A cultivated shrub. The seeds were sometimes sold at traditional medicine stalls at Kutacane market. The seeds, ground with those of *Cuminum cyminum* and the leaves of *Citrus aurantium*, were applied to the forehead for headaches. The remedy was said to have a cooling effect. The seeds were also an ingredient in an oral remedy for rheumatoid arthritis and other joint diseases. Perry & Metzger (1980) also record the used of the seeds in poultices for headaches in the

Malay Peninsula.

ROSACEAE

118. ***Rosa*** **sp**, Bunga Ros (BI).

An ornamental rose. The juice from the flowers was an optional ingredient in a complex oral remedy for anaemia associated with gastro-intestinal bleeding and epigastric pain. An infusion of the flowers was also dripped into the eyes to relieve soreness and swelling of the eyelids.

119. ***Rubus alceifolius*** **Poir.**, Bunga Cekaner (G).

A prickly rambling shrub of forest edges with edible fruits. A cold infusion of the flowers was an optional ingredient in an oral remedy for anaemia associated with gastro-intestinal bleeding and epigastric pain.

RUBIACEAE

120. ***Coffea*** **spp**, Coffee, Kopi (BI).

The flowers of the coffee bush were sometimes included in infusions taken for mental disorders

121. ***Ixora*** **spp**, Bunga Jarum Putih/Merah (BI).

Common shrubs in the lowland forest of the Alas valley. Two species were present, one with red and one with white flowers. The red flowered species was also cultivated as an ornamental. A cold infusion of the flowers was an optional ingredient in an oral remedy for anaemia associated with gastro-intestinal bleeding and epigastric pain.

122. ***Morinda citrifolia*** **L.**, Mengkudu (BI), Cengkeru (G), Bunga Teratae (BI) (Fig. 5).

A small tree native to Sumatra. Sometimes encouraged to grow near villages. The seeds were mashed with water and eaten as a remedy for diarrhoea. The fruits were boiled in water and the resulting decoction drunk for abdominal pains, back ache and as a tonic for mothers after childbirth. The leaves were heated, spread with cooking oil and applied to the skin for fevers. The skin of the root was included in a complex preparation taken orally and applied externally for mental disorders.

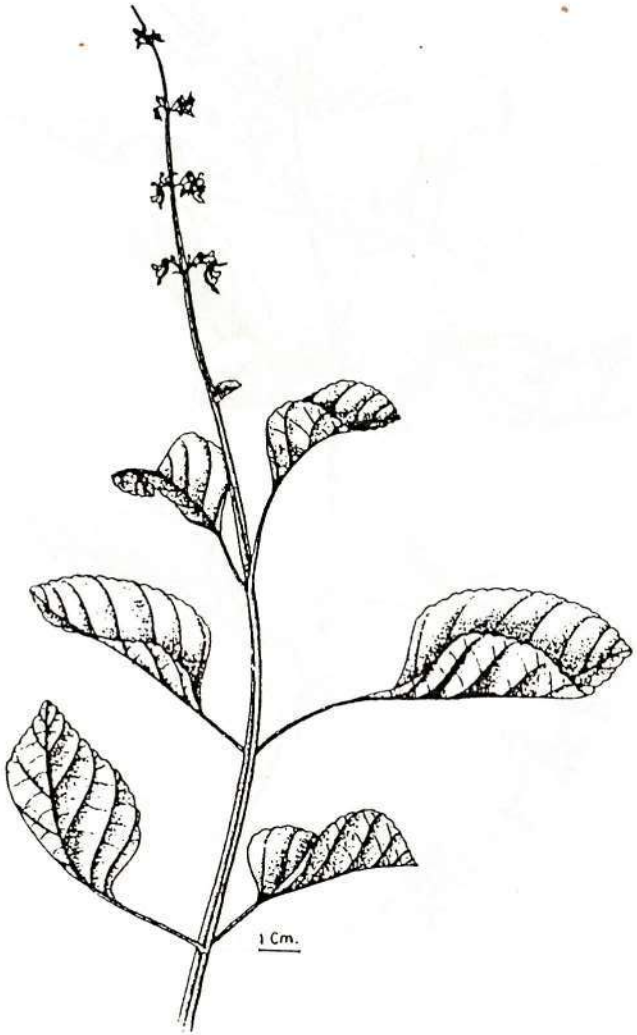
123. ***Psychotria*** **sp (probably** ***malayana*****)**, Berahin Bapak (AI).

A tree of lowland forests. A decoction of the leaves, sometimes together with those of *Eurycoma longifolia*, was taken as a remedy for fevers.

124. ***Uncaria gambir*** **(Hunter) Roxb.**, Gambir (BI), Kacu (G).

A climbing shrub found from Sumatra to Borneo. Cultivated in some areas. A solidified extract of the leaves, called gambir, is one of the ingredients of the betel quid (see *Areca catechu)* and is also a common ingredient in 'obat jamu' (packaged traditional remedies). In the study area gambir was sold at markets. It was used in a wide range of medicinal preparations.

The production of gambir probably originated in Malaysia in the 16th century (Burkhill 1935). Bundles of leaves are steamed and boiling water poured through



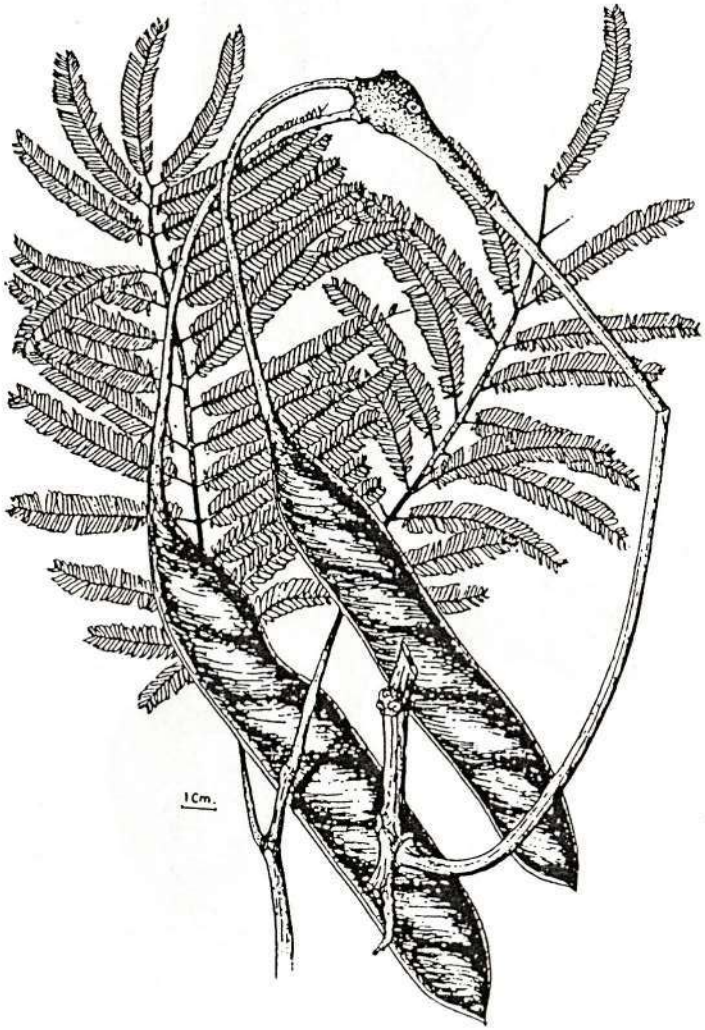


FIG. 4. *Coleus scutellaroides* (62) - a treatment for diarrhea.

Parkia roxburghii (77) - the seeds were eaten to cure colic.

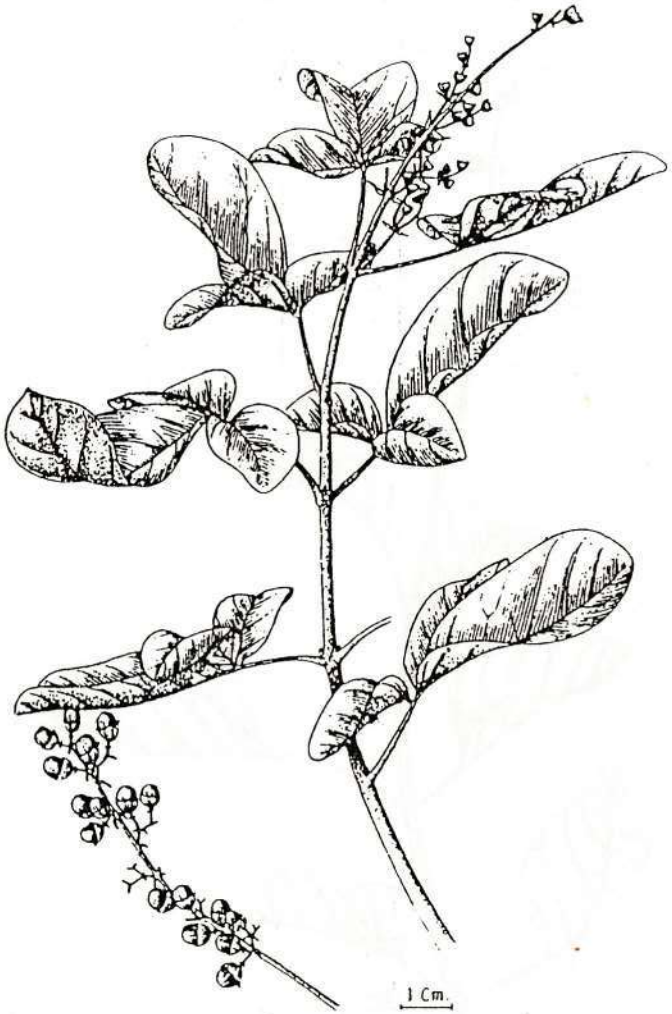


FIG. 5. *Morinda citrifolia* (122) – the fruits were a tonic for mothers after childbirth.

Vitex trifolia (145) – the leaves were used to cure fevers.

to extract catechin, the active ingredient, which crystallizes when the solution is cooled. The crystals are dried and moulded into cakes with a little rice bran.

The most common use of gambir was in remedies for disorders of the gastro-intestinal tract. For non-specific abdominal pains or vomiting with diarrhoea, gambir was taken crushed in a glass of water. Gambir was included in several oral remedies for both bloody and simple diarrhoea. Together with the juice of *Coleus scutellaroides* leaves, gambir was taken to cure flatulence. A decoction of gambir was taken as a treatment for peptic ulcers.

Several dukuns referred to the use of gambir in remedies for disorders of the urinary tract. Gambir, mixed with honey and the resin of *Parashorea lucida*, was taken for urinary tract infections. A decoction of gambir with the leaves of *Eurycoma longifolia* was taken to treat haematuria and a decoction with the leaves of *Centella asiatica* was taken for urinary tract calculi.

Gambir was spread on the leaves of *Piper* spp with cooking oil and lime juice and applied to sprains to reduce swelling. Mixed with the macerated rhizomes of *Kaempferia galanga*, gambir was applied to wounds to prevent infection.

Perry & Metzger (1980) quote references to the use of an infusion of the fresh leaves of this species being taken for diarrhoea and dysentery. According to Burkhill (1935) several species of *Uncaria* are used in preparations applied to wounds in Malaysia.

RUTACEAE

125. ***Citrus aurantifolia*** **(Christm.) Swingle**, The Lime, Jeruk Tipes (Bl), Assam Tipes (Bl), Limau Kapas (Al).

A fruit tree grown domestically in Malaysia and Indonesia. Lime juice was a frequent addition to many medicinal preparations including poultices applied to sprains, a pessary used routinely by mother 4-11 days after childbirth and oral remedies for epigastric pain, anaemia, fevers, cough with vomiting, bloody and simple diarrhoea and tuberculosis. Use of the bark was recommended in a remedy for fever. The bark was pounded with the bark of *Lansium domesticum* and the leaves of *Carica papaya* and the resulting juice drunk.

Perry & Metzger (1980) list several dozen medicinal uses for this plant in S.E. Asia.

126. ***Citrus aurantium*** **Linn.**, The Orange, Assam Kelele (Bl, G).

A domestic fruit tree. Originally a native of S.E. Asia but now widely cultivated elsewhere. Oranges were used in an oral remedy for chest complaints especially infection. They were also included in a complex oral remedy for infertility in women.

127. ***Citrus hystrix*** **D.C.**, Jeruk Perut (Bl), Limau Mungkur (A, Al), Boh Krut (Ac).

A domestic fruit tree indigenous to Sumatra. The leaves were an ingredient in a paste applied to the forehead as a remedy for headaches. The very young fruits were eaten whole (including the skin) as a treatment for sore throats. The fruits were also an ingredient of 'obat luar', a body powder used by mothers after childbirth. The fruit juice was included in a complex preparation used both internally and externally to treat mental disorders and in a lotion applied to muscular aches and pains. A decoction of the bark together with that of *Lansium*

domesticum, Magnifera indica and *Citrus aurantifolia* was taken for bloody diarrhoea.

128. ***Citrus* sp**, Jeruk Hutan (BI), Melelang (G).

A lowland forest tree. Its fruits were sometimes gathered from the forest for sale in Kutacane market. The skin and aromatic centre of the fruit were used in remedies for mental disorders.

129. ***Ruta graveolens* Linn.**, Inggu (BI), Hinggu (G).

A brown sticky solid called inggu was sold at traditional remedy stalls at Kutacane market. This product did not originate locally and was said to come from "negri lain" (another country). It's most probable origin was *R. graveolens,* since inggu is the Javanese name for this plant. In Sundanese it is called minggu. *R. graveolens* is indigenous in S. Europe and N. Africa. It is cultivated in Java because of its medicinal properties.

In the study area inggu, boiled with garlic and the bark of *Vernonia arborea,* was claimed to be a remedy for epigastric pain and disorders of the urinary tract. Inggu was included in a complex lotion applied to various muscular aches and pains and in external remedies for mental disorders. It was also included in an oral remedy for menstrual disorders in adolescent girls.

The essential oil of *R. graveolens* (from which the inggu sold in markets was probably prepared) contains a glucoside, rutin and a cumarin-like odoriferous principle (Burkhill 1935). It stimulates the nervous system, has antispasmodic properties, and in large doses it is an irritant poison, sometimes lethal. It is also one of the principle abortifacients used by the chinese (van Steenis-Kruseman 1953).

SAPINDACEAE

130. ***Nephelium lappaceum* L.**, Rambutan (BI), Bulung Uso (Al, G) Rambut (Ac).

A domestic fruit tree indigenous to Sumatra, commonly cultivated in the Alas valley. The leaf sap was taken as a remedy for coughs with vomiting.

SCROPHULARIACEAE

131. ***Scoparia dulcis* L.**, Rumput Patimah (G).

A herb of roadsides and fields, native of tropical America, naturalized in Sumatra. The whole plant ground with the bark of *Sindora sumatrana* and alum was taken as a remedy for infections of the urinary tract. Burkhill (1935) records the use of this plant by Malays to treat syphilis. The plant contains amellin (possibly therapeutic for diabetes) (Perry & Metzger 1980).

SIMAROUBACEAE

132. ***Eurycoma longifolia* Jack.**, Tunkat Ali (BI), Tunket Ali (G, Al), Gagaten Harimau (Karo Batak).

A small tree of lowland forests found in Sumatra, Malaysia and Borneo. Very rare in the study area. Several dukuns recommended that a decoction of the leaves or bark of this species was the best traditional remedy available for malaria. One dukun claimed it to be equally as effective as chloroquine tablets and that it

had been used successfully as a substitute for antimalarial drugs during the Japanese occupation. A decoction of the leaves was taken as a remedy for back ache, vague abdominal pain, infections of the urinary tract and for joint disorders.

This species has a long history of use against fevers and at one time it was imported into Singapore from Borneo for that purpose (Burkhill 1935).

SOLANACEAE

133. ***Capsicum annuum*** L., Red Chilli, Cabe (BI).

Chillis were cultivated throughout the Alas valley, sometimes as a cash crop. The skin of the root was included in a complex preparation rubbed on the skin as a treatment for mental disorders.

134. ***Cestrum nocturnum*** L., Bunga Sedap Malam (G).

A flowering shrub. The flowers were included in a complex remedy for mental disorders. Other species in this genus are known to contain hallucinogens and are reportedly used as a substitute for marihuana in Brazil (Lewis & Elvin-Lewis 1977).

135. ***Nicotiana tabacum*** **Linn.**, Tobacco, Tabako (BI).

Tobacco was a common crop in the Alas valley. The leaves were finely ground and applied to cuts and lesions etc. Burkhill (1935) records that in Indonesia tobacco leaves are applied to counter infection.

136. ***Solanum torvum*** **Sw.**, Rimbang Pahit (G), Ungke Pahit (G).

A prickly creeping shrub of open places throughout the tropics. The berries were used as a cure for malaria and other fevers because of their bitter taste. They were pounded with the fruits of *Artocarpus integra* and the rhizomes of *Curcuma* sp (kunyit gajah) and the resulting juice drunk. Mashed with the leaves of *Curcuma domestica*, the berries were applied to the eyes to cure trachoma and , mixed with the fruits of *Gmelina elliptica,* they were taken for beri-beri. They were also included in a complex oral remedy for diarrhoea or abdominal colic.

The fruits contain alkaloids, a fatty oil (sterolin) and a glycoalkaloid (solasonine) (Perry & Metzger 1980).

137. ***Solanum verbascifolium*** L., Neki (G).

A shrub of lowland forest edges throughout the tropics. A decoction of the leaves with those of *Eurycoma longifolia* was taken for joint disorders. The leaves were also eaten to cure abdominal pain and diarrhoea.

This plant is also prescribed for dysentery and intestinal pain in Taiwan. In the Philippines the roots are used for the same purpose (Perry & Metzger 1980).

STERCULIACEAE

138. ***Abroma angustifolia*** L., Lenga (G).

A robust tall herb of lowland forests. The stem sap with the macerated rhizomes of *Zingiber purpureum* was applied to sprains to relieve pain.

STYRACACEAE

139. ***Styrax benzoin*** **Dryand.**, Kemenyan (Bl), Keminjin (Al).

A tree of humid lowland forests native to Sumatra, Java and W. Malaysia. This species is tapped for a resinous exudate known as kemenyan, a white or brown crystalline solid sometimes burnt as incense. *S. benzoin* is cultivated in some areas, but in the Alas valley kemenyan was gathered from forest trees. It was sold at traditional medicine stalls at markets in two forms; kemenyan putih (white kemenyan) and kemenyan hitam (black kemenyan). The differences between these two products could not be ascertained, but Burkhill (1935) mentions at least three forms of kemenyan from Sumatra.

Usually white kemenyan was used in medicinal preparations. Kemenyan mixed with egg yolk or the leaves of *Duranta repens* was recommended by several ḍukuns as an oral remedy for measles. Two dukuns described the following remedy for abdominal pain: a tuber of *Curcuma domestica* is cut open and a little kemenyan placed inside. The tuber is then roasted on a fire until black and then eaten. As a remedy for coughs with vomiting, kemenyan was taken with coconut milk. It was also added to complex remedies for menstrual disorders in young women and for bloody diarrhoea. Externally it was applied to snake bites. The bark of *S. benzoin* was included in a complex remedy for severe chest infections.

Styrax resin was the major ingredient in 'Friar's Balsam', a popular preparation taken to make coughs more productive in the 17th and 18th centuries in Europe.

UMBELLIFERAE

140. ***Cuminum cyminum*** **Linn.**, Cumin, Jira Putih (Bl, Ac), Awas Aceh (Al).

A domestic annual herb. The seeds were sold at markets within the study area. They were included in a complex oral remedy for bloody diarrhoea; a paste applied to the forehead for headaches and an oral remedy for rheumatoid arthritis and other joint diseases.

VERBENACEAE

141. ***Clerodendrum fragrans*** **var.** ***pleniflorum*** **Schau.**, Sering Benu (Bl, G).

A small shrub, native of China, naturalized in the Alas valley. The leaves were macerated with lime and smeared on the abdomen to relieve pain. Burkhill (1935) states that the use of this plant is much associated with magic in Sumatra.

142. ***Clerodendrum*** **sp**, Kapas Kecil (Bl).

A shrub of open areas distributed throughout the tropics. In the Alas valley, occasionally grown near houses. The skin of the roots, pounded with coconut milk, was taken as a remedy for coughs with vomiting.

143. ***Duranta repens*** **L.**, Kacar (Al).

A shrub, native of tropical America, cultivated as an ornamental hedge in the Alas valley. The leaves, mixed with kemenyan (see *Styrax benzoin*), infused in coconut milk, were taken orally and applied externally to children with fevers, measles or coughs with vomiting. A decoction of the leaves was also an ingredient in an oral remedy for menstrual disorders in young women. This plant contains saponins (Lewis & Elvin-Lewis 1977) and is used as an antimalarial by the

Chinese (Perry & Metzger 1980).

144. *Gmelina elliptica* **Sm**, Bebulangaan (G).

A shrub of forest borders and clearings, found in Sumatra, Java and Malaysia. The fruits, together with those of *Solanum torvum* were taken as a remedy for beri beri.

145. *Vitex trifolia* **var.** *bicolor* **(Willd) Moldeke**, Segalu Gundi (Al). (Fig. 5)

A climbing shrub indigenous in Sumatra but also occasionally planted near houses. The leaves are aromatic. Mixed with pepper and lime juice, the leaves were claimed to cure fevers. They were also included in a complex lotion for jaundice.

In China a decoction of the leaves is also taken for fevers. This species contains various terpenes (Perry & Metzger 1980).

VIOLACEAE

146. *Rinorea scerocarpa* **Jacob.**, Aging (G).

A large tree of lowland forests. The roots were boiled and included in a preparation applied externally to musculo-skeletal disorders.

VITACEAE

147. *Leea* **sp**, Tingkam (Bl), G).

A tree of lowland forests. The young leaves were included in a complex decoction taken as a remedy for malaria and other fevers. The bark was recommended by several dukuns as an effective remedy against abdominal pain and both bloody and simple diarrhoea.

ZINGIBERACEAE

148. *Alpinia galanga* **Willd.**, Lengkuas (Bl, Al).

A herb indigenous to Sumatra, cultivated in the Alas valley. The tuberous rhizomes were sold at markets and were used to spice food. Medicinally the macerated rhizome was taken for leprosy and was included in a preparation known as 'awas empas' (see footnote).

This species contains the monoterpenes, cineole, pinene and eugenol (Perry & Metzger 1980).

149. *Costus speciosus* **Sm.**, Bekar (Bl, G).

A herb, occurring as a weed in the study area. The stem sap was dripped into eyes to relieve soreness and irritation. In Java this species is also used in the same way (Burkhill 1935).

150. *Curcuma domestica* **Val.**, Turmeric, Kunyit (Bl), Kuning (Al, G), Kunyet (Ac).

A herb, native to S.E. Asia, cultivated since ancient times. Turmeric is used as a flavouring in curries and to produce a yellow dye. It was the second most commonly used plant in medicinal preparations in the study area (after the coconut

palm). The rhizome was used in oral remedies for leprosy, disorders of the urinary tract, headaches, stiffness of the joints, flatulence, central chest pain, epigastric pain, chest infections, anaemia, fevers, coughs, diabetes, diarrhoea and swelling of the mucous membranes of the mouth. It was also an ingredient in a tonic taken by mothers after childbirth and in a pessary used routinely by mothers 4-11 days after childbirth. Externally the rhizome was applied to snake bites. The leaves were included in two oral remedies for bloody diarrhoea.

Dozens of medicinal uses for this plant are recorded for Indonesia and Malaysia. Reported chemical constituents include curcumin (the yellow pigment), turmerone, zingiberene and several other terpenes (Perry & Metzger 1980).

151. ***Curcuma*** **sp**, Kunyit Gajah (Bl), Kuning Gajah (Al, G), Kunyet Gajah (Ac).

A domestic herb with tuberous rhizomes, commonly cultivated in the Alas valley. The rhizome was used in a wide range of medicinal preparations. It was included in oral remedies for leprosy, abdominal pain, anaemia, recurrent fevers, haemoptysis and inflammation of the mucous membranes of the mouth. A decoction of the rhizome was included in a complex tonic taken by mothers after childbirth.

152. ***Hedychium*** **sp**, Cekala Lompat (Al), Cekala Terbang (G).

An herbaceous epiphyte on lowland forest trees. The leaves were an ingredient in a complex preparation taken orally and smeared on the skin as a treatment for leprosy. The stem was ground with garlic and applied to snake and centipede bites and scorpion stings. The roots were eaten as an anthelmintic, possibly in accordance with the doctrine of signatures, because the slightly tuberous rootstock resembled large worms.

Burkhill (1935) records that the roots of *H. longicornutum* Griff. are used as an anthelmintic in Malaysia. Both Heyne (1927) and van Steenis-Kruseman (1953) also suggest its use may be in accordance with the doctrine of signatures.

153. ***Kaempferia galanga*** **L**, Kencur or Kancur (Bl), Kenciwer (Al), Tekur (G).

A herb distributed from India to China and S.E. Asia, cultivated in the Alas valley. The macerated rhizome was used externally for leprosy, skin infections and in body powders used by mothers after childbirth. It was one of the ingredients of awas empas (see footnote).

Burkhill (1935) also recorded the common use of this species in post-partum body powders. Reported chemical constituents include borneol, methyl-p-cumaric and cinnamic aldehyde (Perry & Metzger 1980).

154. ***Nicolaia elatior*** **(Jack) Horan.**, Cekala Biasa (G), Assam Situ (Al), Siala (Bt).

This plant was common in clearings and along river banks throughout the Alas valley. The leaves frequently grew to lengths of 10 m or more. When the forest was cleared for cultivation, this species was left to grow and sometimes encouraged because of its commercial value. The flower buds and the fruits are eaten and were often collected from the forest for sale at Kutacane market. The fruits taste acidic and the flowers have a very powerful odour similar to eau de Cologne. The fruits were an ingredient in an oral remedy for indigestion.

155. ***Nicolaia rostrata*** **Val. var.** ***singularis*** Cekala Gujang (Al).

Very similar to *N. elatior* but much less common. The leaves were included in a preparation smeared on the skin as a remedy for jaundice associated with upper abdominal pain.

156. ***Zingiber aromaticum*** **Val.**, Lempuyang (Bl, Ac).

A herb, native to Sumatra, Java and Malaysia. In the Alas valley it occurred wild and was also cultivated. The juice from the macerated rhizome was included in complex oral remedies for abdominal pain and indigestion and was dripped into the eyes to relieve pain from eye injuries. The rhizome was also included in a complex oral remedy for leprosy and in the preparation known locally as awas empas (see footnote). Burkhill (1935) mentions the use of this plant in remedies for colic.

157. ***Zingiber officinale*** **Rosc.**, Ginger, Jahe Biasa (Bl), Jahe Putih (Bl), Jahe Merah (Bl).

A herb cultivated throughout S.E. Asia. Ginger was a very common ingredient in medicinal preparations in the Alas valley. Several dukuns included it in oral remedies for non-specific abdominal pain. It was also used in a remedy for coughs and in a skin lotion used by mothers after childbirth. A variety of *Z. officinale* with reddish rhizomes known locally as jahe merah (Bl) or bahing (Al) was preferred in the following preparations: a complex oral remedy for leprosy; a lotion smeared on the forehead for headaches; an infusion with the resin of *Ficus* sp (kayu putih) taken for stomach ache and a complex remedy for diarrhoea. It was also one of the ingredients in a preparation known locally as awas empas (see footnote). Ginger contains a variety of terpenoid compounds (Perry & Metzger 1980).

158. ***Zingiber purpureum*** **Roxb.**, Bunglei (Bl, Al, G).

Originally a plant of teak forests, this herb is now cultivated throughout India, Malaysia and Indonesia. In the Alas valley the rhizomes were sold at markets. They were included in a complex oral remedy for leprosy. Externally they were used in remedies for mental disorders and in poultices applied to sprains. They were one of the ingredients of awas empas (see footnote).

UNIDENTIFIED SPECIES - listed alphabetically according to the most commonly used vernacular name.

159. Abang Abang (Bl, G, Al).

A lowland forest tree characterized by a compact crown and large black seed pods up to 0.5 m long. Common in the Alas valley. The macerated bark was the main ingredient in a preparation rubbed on the skin to treat ringworm. The stems of young saplings of this species were sliced lengthways and the sap dripped into eyes to relieve soreness and irritation.

160. Assam Kenyaran (G).

A domestic fruit tree. The fruit juice, mixed with the juice from the rhizomes of *Curcuma domestica* was taken to treat recurrent fevers.

161. Bunga Jumpa (G)

The flowers were included in a complex infusion in coconut milk used externally to treat fevers.

162. Cicina (Bl, G).

A herb of rice fields. A decoction of the roots was said to be a cure for malaria.

163. Gele (G).

Tree of lowland rain forests. The leaf shoots were included in a complex preparation taken for diarrhoea.

164. Haleba or Halebah (Bl), Lebe (G).

The seeds of this plant were sold at traditional medicine stalls in Kutacane. They were probably imported into the Alas valley from outside, because nobody knew where this species grew locally. A decoction of the seeds was used as a remedy for rheumatoid arthritis and other joint diseases. The whole plant, dried and finely ground was included in a body powder used by mothers after childbirth.

165. Jamu Jawa (Bl)

A vine of lowland forests. The fruit was included in a remedy for back ache.

166. Jerango Hutan (?)

A climbing shrub often growing near houses. The leaves were included in a complex oral remedy for leprosy.

167. Lawang (G)

The dried flowers of this plant were sold at traditional medicine stalls in Kutacane. They were included in a decoction with ginger and the bark of *Ficus* sp (kayu putih) taken for abdominal pain. They were also included in remedies for tuberculosis and indigestion and in a pessary used routinely by mothers 4-11 days after childbirth.

168. Pendang (?)

A dried root sold at Kutacane market. Not grown locally. It was an ingredient in a complex oral remedy for leprosy and was included in a decoction taken for rheumatoid arthritis.

169. Rerurku (?)

A small tree. The leaves were included in an oral remedy for haemoptysis.

170. Seladri (Bl), Daun Sop (G, Bt).

A cultivated herb, used as a flavouring in soups. The leaf sap was taken as a remedy for headaches associated with obesity and old age.

171. Uluati (BI), Celalan (G).

An herbaceous weed of cultivated areas. An infusion of the leaves in coconut milk was taken for indigestion.

Footnote

AWAS EMPAS - was a preparation made locally by mixing the pulped rhizomes of *Kaempferia galanga, Zingiber officinale, Z. aromaticum, Z. purpureum, Curcuma domestica & Alpinia galanga* with water. The sludge was sun-dried until it could be formed into cakes about 2 cm across. The cakes were then further sun-dried until hard. This preparation was sold at traditional medicine stalls in Kutacane. It was used in oral remedies for headaches, stiff knees and various disorders of the urinary tract in men.

WHY PHARMACY NEEDS TROPICAL FORESTS

Our inventory gives some idea of the variety of plants which may be of value to pharmacological research. It should be remembered that the inventory covers a very small geographical area and was compiled in just ten weeks. By the end of the study, our sources of information were by no means exhausted and therefore the 171 species described probably represent only a fraction of the total range of medicinal plants in the Alas valley.

Several of the species listed in the inventory are not native to Sumatra, having been imported as a result of domestication (eg. *Psidium guajava*). Of those species indigenous to Sumatra, some are still collected exclusively from the forest (eg. Konyel bark from *Ficus* sp), whilst others are both cultivated and gathered from the wild (eg. *Arenga pinnata*). Whatever their history however, almost all the species in the inventory originated in lowland tropical rain forest which is threatened with rapid and almost total destruction over the next thirty years.

The medicinal uses of many of the species in the inventory have never been recorded before, but the uses of many are well supported by the observations of other authors. Several of the plants appear to be used for similar purposes throughout S.E. Asia and clearly have a long history of medicinal use. Some have even been analysed chemically by various workers (see Perry & Metzger 1980), but few if any have been adequately investigated by pharmaceutical companies. It appears that at present the pharmaceutical industry is under-estimating the potential contribution tropical plants could make to the search for new drugs and medicines.

Perhaps pharmaceutical companies today believe that medicinal plants belong to the realm of "alternative medicine" and are not worth taking seriously, but in fact there are very sound reasons why plants are a very valuable supply of pharmacologically active compounds. On the evolutionary time scale, plants and animals separated at an extremely remote period (perhaps 1 billion years ago) and therefore it may seem unlikely that any plant compounds should be pharmacologically active in animal systems. Yet plants do produce a wide range of compounds which directly affect animal biochemistry. Why should plants synthesize mammalian sex hormones (eg. the synthesis of testosterone by Scots Pines, *Pinus sylvestris* (Harborne 1982)), or substances such as L-dopa (eg. by *Mucuna* spp (Rehr *et al.* 1973)), a drug well known as a treatment for Parkinson's disease in Man ? Such substances are not essential to the normal metabolic processes of plants and yet plants devote considerable amounts of energy and other resources to their synthesis.

The answer is that these compounds determine the very survival of plant species in the struggle for existence. Ever since the first herbivores chewed on the first leaves 350 million years ago, plants have been evolving the capability to synthesize defensive chemical compounds. Such compounds alter the taste or digestibility of plant tissues or have subtle interactions with the biochemistry of the offending herbivore. Herbivores however are not passive to such defence mechanisms and they have had to evolve mechanisms to detoxify and excrete defensive plant compounds. In order to survive, plants have had to respond by evolving ever more complex and subtle forms of chemical defence. In the tropics, where the diversity of plants and herbivores is the highest on Earth, this evolutionary "arms race" has been greatly accelerated and over an enormous time span it has resulted in a range of plant secondary compounds of staggering diversity.

Currently well over 10,000 secondary plant compounds from more than 50 major groups have been described and this list is growing exponentially. For example the number of alkaloids known to science is doubling every 10 years at present (Hansel 1972). Alkaloids in particular are an exceptionally valuable group of plant secondary compounds. The group includes strychnine, cocaine, narcotics such as morphine and nicotine, hallucinogens such as LSD, anti-malarials such as quinine and a host of other medicines such as pain killers, cardiac and respiratory stimulants, muscle relaxants, local anaesthetics and anti-cancer drugs. In 1980 the United Nations identified 400 commercially produced plant drugs and yet since 1978 the WHO has identified over 20,000 species of medicinal plants. Only a small fraction of the world's plant species have so far been examined for pharmacological activity and the scope for further research is clearly immense.

It is sometimes argued that modern methods of drug design and chemical synthesis are more economial and practical than randomly searching the plant kingdom for new drugs. There is a general feeling of optimism in the pharmaceutical industry that biotechnology will provide us with the majority of new drugs in the near future. However at present, biotechnology in drug production has largely been confined to the genetic manipulation of micro-organisms to produce protein-based products especially hormones and enzymes. This is inappropriate for the synthesis of secondary compounds such as alkaloids because they are the products of complex multi-step biosynthetic pathways which would be difficult to construct in micro-organisms by gene manipulation. Recombinant DNA techniques with plants are still in their infancy but once developed, this technique could produce new strains of plants with high yields of valuable drugs, provided of course the original plant sources of such products have not become extinct in the meantime.

There are several areas of medicine where modern methods of drug research are failing to produce effective products. For example doctors still lack effective drugs to combat most forms of cancer and viral disease. There are now also several cases of modern drugs losing their effectiveness. Anti-malaria drugs provide a good example. Since the 1960's, the malaria parasite has become increasingly more resistant to anti-malaria drugs such as chloroquine and Fansidar. Resistance to chloroquine is particularly widespread in S.E. Asia, Africa and South America (Smith & MacKenzie 1985) and deaths from malaria are on the increase in many countries where, until recently, the disease was thought to be under control. At present the long term hope is that an anti-malaria vaccine will be developed, but WHO experts are pessimistic about the time it will take to develop such a vaccine. Our inventory includes fifteen species used in remedies for malaria. In cases where modern techniques of drug development appear to be failing to provide effective products, surely it makes sense to take a fresh look at plants. After all, quinine itself was originally derived from plants (*Cinchona* spp).

Screening plants for new drugs can be a lot cheaper than is sometimes realized. Modern analytical techniques are rapidly becoming more sophisticated and automated. Advances in chromatographic techniques and mass spectrometry are making it possible to analyse plant products more rapidly and cheaply than ever before. Also there are several techniques that can be used to develop plant screening programs which have a much higher probability of yielding new drugs than random searches. One such technique is to examine those species or genera closely related taxonomically to species which are the source of existing drugs (chemotaxonomy). Also the pharmacological activity of some groups of plant secondary compounds can be coupled with other easily established physical properties eg. basicity, lipophilic nature, bitter taste etc. There are often sound physiological and biochemical explanations as to why such correlations between physical properties and pharmacological activity exist (Hansel 1972). However by far the best approach is to base plant screening programs on ethnobotanical

studies such as the one reported here. The literature on the traditional uses of medicinal plants is extensive, but computerized searching techniques can now enable promising candidates for pharmacological investigation to be rapidly identified.

Although plant screening programs appear to be laborious and expensive, the financial rewards from such programs can be very great indeed. For example the roseate periwinkle *(Catharanthus roseus)* yields the alkaloids, vincristine and vinblastine used to treat leukaemia. Total sales of these drugs are worth US$ 100 million per year. This plant provides an excellent example of how research into traditional uses of wild plants can lead to the development of entirely new drugs which are unlikely to have been conceived by synthetic chemists without pioneering research on plants. Another tropical plant which has proved highly profitable to the pharmaceutical industry is the Mexican Yam *(Dioscorea* sp). This plant yields virtually the world's entire supply of diosgenin from which contraceptive pills and cortisone are produced. The retail value of Mexican Yam products is more than US$ 700 million. It is estimated that the commercial value of pharmaceutical products which owe their origins to plants is currently more than US$ 20 billion per year.

Whereas today it may be more economic to develop new drugs by synthetic chemistry, economic conditions are constantly fluctuating, often subject to advances in technology, and in the near future it may well be cost effective to look to plants for the development of many new pharmaceutical products. However unless something is done now to slow the rate at which tropical forests and their plant species are disappearing, the option of developing new drugs from plants will be seriously diminished. The US National Cancer Institute for example, believes that the rapid and widespread elimination of tropical forests constitutes a serious setback in the fight against cancer. If 40,000 plant species disappear before the middle of the next century, as predicted by the World Wildlife Fund and others, we shall lose countless as yet undiscovered drugs and medicines of incalculable value to Mankind.

In short pharmaceutical companies owe a great deal to tropical plants and clearly have much to gain from the conservation of tropical forests. It is time for the pharmaceutical industry to accept some of the responsibility for ensuring that tropical forests are not wiped from the face of the Earth over the next 30 years. It is in the long term financial interests of the pharmaceutical industry to co-operate with organizations such as the World Wildlife Fund in investing in the protection of tropical forest areas which could provide material for future drug development projects.

If interested in tropical forest conservation please write to:

World Wildlife Fund
Avenue du Mont-Blanc 1196
Gland
Switzerland

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APPENDIX - BUDGET

INCOME

	£
Sterling Health	50
Nova Laboratories Ltd.	100
Wyeth Research (U.K.) Ltd.	100
E. R. Squibb and Sons Ltd.	100
Warner Lambert	100
Glaxo Laboratories Ltd.	250
The World Wildlife Fund (Plants Program)	1,620
Royal Geographic Society	500
Percy Sladen Memorial Trust Fund	150
Yapp Education and Research Trust	1,000
Sir Samuel Scott of Yews Trust	500
The Twenty-Seven Foundation	200
Total Income	4,670

In addition HRH Prince Philip donated sum which cannot be disclosed.

EXPENDITURE

Fundraising, postage etc.	81
Insurance	110
Travel	
London-Singapore rtn	820
Singapore-Jakarta rtn (2 journeys each)	464
Jakarta-Banda Aceh	265
Medan-Jakarta (boat)	61
Bus fares in Sumatra	17
Other bus, train taxi fares	168
Field Equipment	268
Medical Supplies	65
Food & Accommodation	1,560
Visa and Administrative 'Fees'	80
Photographic Film	358
Freight	50
Employment of guides etc.	126
Printing and Distribution of Report	350
Total Expenditure	4,843

INDEX OF SYMPTOMS, SIGNS AND DISEASE NAMES

Anaemia 20, 54, 70, 74, 85, 90, 102, 118, 119, 121, 125, 150, 151.
Anorexia 82
Appendicitis 108
Backache 107, 122, 132, 165.
Bee stings 113
Beri beri 144
Boils 3, 30, 31, 44, 51, 113.
Chest complaints 126, 139, 150
Chest infections 66
Chickenpox 88, 89, 108.
Childbirth 9, 10, 44, 57, 80, 81, 82, 101, 107, 111, 112, 116, 122, 125, 127, 150, 151, 153, 157, 164, 168.
Colds 15, 25, 42, 112
Colic 11, 56, 77, 91, 136, 156
Constipation 107
Coughs 9, 59, 65, 66, 80, 81, 101, 107, 108, 112, 125, 130, 142, 143, 150, 157
Cuts 34, 59, 65, 77, 135
Diabetes 72, 150, 131, 150
diarrhoea - bloody 2, 5, 38, 47, 60, 76, 80, 81, 92, 93, 98, 100, 107, 108, 109, 112, 124, 125, 136, 139, 140, 147
diarrhoea - simple 5, 11, 48, 56, 59, 64, 65, 81, 82, 91, 94, 97, 100, 105, 106, 107, 122, 124, 125, 137, 147, 150, 157, 163
Dizziness 65, 113
Dysentery 11, 92, 94, 110, 124, 137
Earache 63, 65
Eye complaints 1, 21, 23, 45, 108, 112, 114, 118, 149, 156, 159
Fevers 2, 6, 16, 18, 20, 25, 32, 33, 48, 56, 88, 89, 91, 92, 102, 105, 107, 108, 112, 116, 122, 123, 125, 132, 143, 145, 147, 150, 151, 160
Flatulence 124, 150
Fractures 4, 7, 19, 46, 108, 116
Hair loss 83
Headaches 12, 30, 57, 66, 77, 108, 112, 117,127, 140, 150, 157, 170
Hypertension 69, 105, 113
Indigestion 9, 10, 44, 62, 81, 82, 98, 108, 112, 154, 156, 168, 171
Infertility 59, 82, 108, 126
Influenza 15, 25, 42, 112
Insect bites 28, 82, 109, 152
Insomnia 30, 53, 108
Jaundice 24, 37, 39, 53, 54, 61, 71, 82, 145, 155
Leprosy 9, 10, 17, 28, 33, 40, 41, 44, 49, 56, 66, 78, 91, 101, 106, 112, 148, 150, 151, 152, 153, 156, 157, 158, 167, 169
Lumbago 13
malaria 5, 6, 11, 25, 48, 50, 71, 92, 107, 116, 132, 136, 143, 147, 162
Measles 108, 139, 143
Menstrual disorders 129, 139, 143
Mental disorders 17, 70, 73, 74, 83, 89, 95, 102, 103, 120, 122, 127, 128, 129, 133, 158
Musculo-skeletal disorders 13, 14, 82, 83, 104, 117, 127, 129, 132, 137, 140, 146, 150,
Pain - abdominal 5, 37, 39, 53, 54, 64, 71, 77, 81, 82, 91, 93, 96, 100, 108, 122, 124, 132, 137, 139, 140, 151, 155, 156, 157, 168
Pain - epigastric 20, 27, 62, 66, 70, 74, 80, 82, 84, 85, 90, 102, 118, 119, 121, 125, 129, 150
Paralysis 17, 41, 49, 56
Peptic ulcer 124
Peritonitis 25
Rheumatism 13, 117, 140, 164, 169
Ringworm 42, 44, 71, 159
Scabies 72, 113
Skin infections 55, 58, 124, 135, 153
Skin irritations 6, 65, 72, 88, 108, 113
Snakebites 14, 82, 106, 109, 139, 150, 152
Sores 28
Sore throat 127
Sprains 4, 7, 56, 91, 108, 112, 113, 116, 138, 158
Stomach ache 100, 107, 157
Strokes 17
Syphilis 8, 131
Toothache 26, 29, 54, 93
Trachoma 1, 136
Tuberculosis 10, 25, 66, 107, 125, 168
Urinary tract calculi 8, 24, 50, 124
Urinary tract disorders 8, 22, 24, 27, 35, 43, 59, 64, 79, 82, 87, 108, 124, 129, 131, 132, 150
Vomiting 59 66, 80, 81, 82, 101, 105, 106, 108, 124, 125, 130, 139, 142, 143
Worms 11, 25, 74, 75, 77, 106, 107, 152
Wounds 28, 33, 58, 124, 135

INDEX OF VERNACULAR AND GENERIC PLANT NAMES

Abang Abang, 159
Abroma angustifolia, 138
Acacia farnesiana, 70
Acorus calamus, 13
Aging, 146
Aglaia argentea, 91, 56
Akar Tulang, 104
Aleurites moluccana, 44, 28, 71
Allium cepa, 81
Allium sativum, 82
Aloe vera, 83
Alpinia galanga, 148
Alstonia scholaris, 11, 36, 116
Alyxia sp, 12
Amaranthus spinosus, 3, 30, 31
Ananas comosus, 24
Areca catechu, 106, 97, 111, 124
Arenga pinnata, 107
Artocarpus integra, 93, 136
Assam Jawa, 80
Assam Kelele, 126
Assam Kenyaran, 160
Assam Situ, 154
Assam Tipes, 125
Averrhoa belimbi, 105
Awas Aceh, 140

Baccaurea kunstleri, 45
Bakung Bakung, 4
Balik Angin, 91
Balik Putar, 56
Balik Sempa, 91
Bambu Kecil, 53
Bambusa spp, 53
Bawang Merah, 81
Bawang Putih, 82
Bayam Duri, 3
Bebesi, 2
Bebetu, 2
Bebulangan, 144
Begonia isoptera, 19
Bekar, 149
Bekas, 109
Belimbing, 105
Belo Udang, 114
Berahin Bapak, 123
Beras, 57
Betel Nut, 106
Bicar, 29
Blumea balsamifera, 16
Blumea pubigera, 17, 25
Boh Krut, 127
Bougainvillea glabra, 102
Bulung Uso, 130
Bunga Bebeki, 90
Bunga Cekaner, 119
Bunga Cempa, 85
Bunga Jarum Putih or Merah, 121
Bunga Jejerun, 88
Bunga Jumpa, 161
Bunga Kepias, 103
Bunga Mata Hari, 18
Bunga Mawar, 89
Bunga Melati, 102
Bunga Melur, 102
Bunga Merah, 20
Bunga Merak, 73
Bunga Merul, 102
Bunga Mestu, 70
Bunga Pelelut, 89
Bunga Raya, 86
Bunga Ros, 118
Bunga Sedap Malam, 134
Bunga Selanga, 6
Bunga Selanga,6
Bunge Remungge, 74
Bunglei, 158

Cabe, 133
Camphor, 42, 15, 16
Cananga odorata, 6
Capa, 16
Capsicum annuum, 133
Carica papaya, 25, 71, 125
Cassia alata, 71
Cassia siamea, 72
Ceiba pentandra, 21
Cekala Biasa, 154
Cekala Gujang, 155
Cekala Lompat, 152
Cekala Terbang, 152
Celalan, 171
Cengkeh, 101
Cengkeru, 122
Centella asiatica, 8, 124
Cermeh, 47
Cestrum nocturnum, 134
Chilli, 133
Cicina, 162
Cinnamomum burmanii, 66, 116
Cinnamomum iners, 67
Cinnamon, 66
Citrus aurantifolia, 125, 84, 127
Citrus aurantium, 126, 54, 117

Citrus hystrix, **127**, 25
Clerodendrum fragrans, **141**
Cloves, 101
Coconut, **108**, 11, 18, 11, 53, 71, 88, 89, **142**, 143, 171
Cocos nucifera, **108**
Coffea spp, **120**
Coleus scuttelaroides, 62, 124
Colocasia esculanta, 14
Coriander, 9
Costus speciosus, **149**
Crinum asiaticum, **4**
Cucumber, 35
Cucumis sativus, **35**
Cumin, 140
Cuminum cyminum, **140**, 117
Curcuma domestica, **150**, 16, 28, 72, 98, 136, 139
Cyathea sp, **37**, **38**
Cymbopogon citratus, **54**

Damar Pepening, 43
Daun Sop, 170
Dedalu, 27
Dedining hitam, 33
Dedining putih, 32
Dendrobium sp, **103**
Dipterocarpus sp, **41**
Dryobalanops aromatica, **42**
Dukung anak, 50
Dukut lalah, 58
Duranta repens, **143**, 139
Durian, 22
Durian Belander, 7
Durio zibenthinus, **22**
Durin, 22

Eleusine indica, **55**, 58
Euphorbia tirucalli, **46**
Eurycoma logifolia, **132**, 50, 123, 124, 137

Fennel, 10
Ficus ramentacea, **97**
Ficus variegata, **94**
Flemingia strobilifera, **51**
Foeniculum vulgare, **10**

Gagaten Harimau, 132
Gajah Tengaal, 68
Gala Garu, 95
Galeola altissima, **104**
Gambas, 36
Gambir, 124
Garcinia mangostana, **60**
Garlic, **82**, 109, 152
Gassampinus valetonii, **23**
Geceh, 11
Gele, 94, 163
Gele Gari, **95**
Gelima, 100
Gelinggan, 71
Gelpak, 49
Gelunggung, 16
Gembiri, 44
Gerpa, 67
Ginger, **157**, 11, 96
Glochidion spp, 47, 48, 100, 116
Gmelina elliptica, **144**
Goniothalamus sp, **7**
Graptophyllum sp, **1**
Guava, 100
Gula Aren, 107
Gula Merah, 107,
Gula Panguh, 107,
Gula Pasir, 58

Haleba, 164
Hedychium sp, **152**, 109
Helianthus annuus, **18**
Heterostema sp, **15**, 42
Hibiscus rosa-sinensis, **86**
Hibiscus surratensis, **87**
Hinggu, 129
Homolanthus populifolius, **49**

Inggu, 129
Ipomea aquatica, **30**, 31
Ipomea batatas, **31**, 30
Ixora spp, **121**

Jadam, 83
Jadem, 83
Jahe Biasa, 157
Jahe Merah, 157
Jahe Putih, 157
Jambu Keletuk, 100
Jamu Jawa, 165
Jekkar, 93
Jerango, 13
Jerango Hutan, 166
Jeruk, 127
Jeruk Hutan, 128
Jeruk Tipes, 125
Jintan Manis, 10
Jira Hitam, 117
Jira Manis, 10
Jira Putih, 140
Juhar, 72
Justicia bracteata, **2**
Justicia gendarusa, **2**, 47, 100

Kacar, 143
Kacu, 124
Kaempferia galanga, **153**, 124
Kalanchoe lacinata, **32**

Kalanchoe pinnata, 33
Kankung, 30
Kapas Besar, 21
Kapas Kecil, 142
Kapuk Rimba, 23
Kapur Barus, 42
Kates, 25
Kayu Intap, 43
Kayu Patimah, 41
Kayu Pelasari, 12
Kayu Putih, 96
Kayu Sena, 79
Kayu Tapak Itik, 78
Kedawung, 77
Kekabu, 23
Kekeramilen, 50
Keketah, 28
Keladi, 14
Kelapa, 108
Keluang Lompat, 40, 115
Kemangi, 63
Kembiri, 44
Kemenyan, 139
Kemili, 44
Keminjin, 139
Kemiri, 44
Kenciwer, 153
Kencur, 153
Kerkerlen, 116
Kerpe Belender, 58
Keteme, 116
Ketumbar, 9
Konyel, 97, 98
Kopi, 120
Kulit Manis, 66
Kumis Kucing, 64
Kuning, 150
Kunyet, 150
Kunyet Gajah, 151
Kunyit, 150

Lamtorogung, 75
Lansium domesticum, **92**, 16, 25, 60, 125, 127
Lasun Putih, 82
Lawang, 167
Lebe, 164
Leea sp, **147**
Leluik, 52
Lempuyang, 156
Lenga, 138
Lengkuas, 148
Leptaspis urceolata, **56**, 91
Leucaena leucocephala, **75**
Limau Mungkur, 127
Limau Kapas, 125
Lime, 125
Litsea noronhae, 68
Lomogramma sumatrana, **40**, 115
Luffa acutangula, **36**, 11

Magnifera indica, **5**, 116, 127
Majik, 93
Mali Mali, 76
Mamplan, 76
Mangga, 5
Manggis, 60
Mango, 5
Mangosteen, 60
Melastoma malabathricum, **90**
Melelang, 128
Mendalu, 84
Mengukudu, 122
Meniran, 50
Menit, 48
Merica, 48
Mesua spp, **61**
Michelia champaca, 85
Microsporium nigrescens, **115**, 40
Mimosa invisa, 76
Monochoria hastata, **116**
Monochoria vaginalis, **116**
Monophyllae horsfieldii, **52**
Morinda citrifolia, 122
Murdannia nudiflora, 26
Muda spp, **98**
Myristica fragrans, 99

Nanas, 24
Nangka Kecil, 93
Neki, 137
Nephelium lappaceum, 130
Nggering, 47
Nggepak, 67
Nicolaia elataor, **154**
Nicolaia rostrata, 155
Nicotinia tabacum, 135
Nigella sativa, 117
Nilam, 65
Nines, 24
Nipa, 109
Nutmeg, 99
Nypa fruticans, **109**, 47, 100

Oppu Oppu, 116
Orange, 126
Orthosiphon aristatus, 64
Oryza sativa, **57**

Pala, 99
Papaya,25
Parashorea lucida, 43
Parkia roxburghii, 77
Parkis Besar, 38
Parkis Kecil, 37
Parkis Lompat, 40, 115

Paspulum conjugatum, **58**, 55
Patah Tulang, 46
Pegaga, 8
Pendang, 168
Pepper, 25, 112
Pepulih, 33
Persea americana, **69**
Pertik, 25
Pesol, 28
Pete Cine, 75
Petule, 36
Phyllanthus niruri, **50**
Pinang Matah Megare, 106
Pinang Matah Merah, 106
Pine-apple, 24
Pinus merkusii, **110**, 98
Piper betel, **111**, 106
Piper nigrum, **112**
Pogostemon cablin, **65**, 113
Pokat, 69
Psidium guajava, **100**, 47
Psychotria sp, **123**
Puding Hitam, 1

Raddish, 34
Rambe, 45
Rambut, 130
Rambutan, 130
Rampah, 77
Raphanus sativus, **34**
Rebun Tipes, 53
Reriang, 19, 51
Reringan, 51
Rerurku, 69
Rice, 57
Rimbang Pahit, 136
Rinorea scerocarpa, **146**
Rosa sp, **118**
Rubus alceifolius, **119**
Rumput Patimah, 131
Ruta graveolens, **129**, 29
Rutih, 11

Saccharum officinarum, **58**
Saka, 58
Sari Munia, 61
Scoparia dulcis, **131**, 79
Scurrula sp, **84**
Segalu Gundi, 145
Seladri, 70
Serai Dapur, 54
Sering Benu, 141
Serungkas Sebekas, 17
Sesemuh, 29
Sesusur, 87
Siala, 154
Sibusuk, 15
Sida rhombifolia, **88**
Sindora bruggemanii, 78
Sindora sumatrana, **79**, 131
Sigentut, 15
Sirih Biasa, 111
Sirih Hutan, 113
Sirih Merah, 114
Sirih Pedas, 114
Solanum torvum, **136**, 144
Solanum verbascifolium, **137**
Sorpe Lompat, 40, 115
Spathodea campanulata, **20**
Srie, 54
Styrax benzoin, **139**, 98, 108, 110
Sugar Cane, 58
Sunflower, 18
Syzysium aromaticum, **101**

Tabako, 135
Tamarindus indica, **80**
Tebu, 58
Tekur, 153
Tetegu, 55
Timun, 35
Tingkam, 147
Tobacco, 135
Trangon, 62
Tunkat Ali, 132
Tunket Ali, 132
Tumeric, 150
Tusam, 110

Ubi Rambat, 31
Uluati, 171
Uncaria gambir, **124**, 8, 43, 64, 93, 106, 108
Ungke Pahit, 136
Urena lobata, **89**
Urip Urip, 26
User, 39

Veronia arborea, **27**, 129
Vitex trifolia, **145**

Wedelia biflora, **28**
Wedelia montana, **29**

Yira Hitam, 117

Zingiber aromaticum, **156**
Zingiber officinale, **157**
Zingiber purpureum, **158**, 138