

ศูนย์บริการเอกสารวิจัยฯ



RP1976/490

Essential oil production in
the highlands of northern

Misc. Invest. No. 85/Rep. No. 4

APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND

ESSENTIAL OIL PRODUCTION IN THE HIGHLANDS
OF NORTHERN THAILAND

BY

KWANYEUN WICHAPAN

INSON KLONG-KARN-NGARN

NARONG CHOMCHALOW

ASRCT, BANGKOK 1976

not for publication

APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND

MISCELLANEOUS INVESTIGATION NO. 85

ESSENTIAL OIL PRODUCTION IN THE HIGHLANDS OF NORTHERN THAILAND

REPORT NO. 4

ESSENTIAL OIL PRODUCTION IN THE HIGHLANDS OF NORTHERN THAILAND

BY

KWANYEUN WICHAPAN

INSON KLONG-KARN-NGARN

WARONG CHOMCHALOW

ASRCT, BANGKOK 1976

ESSENTIAL OIL PRODUCTION IN THE HIGHLANDS OF NORTHERN THAILAND

By Kwanyeeun Wichapan*, Inson Klong-karn-ngarn*,
and Narong Chomchalow*

SUMMARY

This fourth semi-annual report on the "Essential oil production in the highlands of northern Thailand" project covers the work at ASRCT's Essential Oil Research Station at Chang Khian (Site C) which includes the collection of eighteen species of essential oil bearing crops, varietal studies of twelve species, viz. Chrysanthemum morifolium, Eucalyptus citriodora, E. globulus, E. macarthurii, E. piperita, E. smithii, E. staigerana, Lavandula hybrida, L. vera, Mentha cardiaca, M. piperita, and M. spicata. Investigation on the proper cultural practices of Eucalyptus globulus, E. smithii, Lavandula vera, and Mentha arvensis was initiated. Distillation was done at the Station and the oils obtained were sent to ASRCT's Laboratory in Bangkok for the determination of their properties by gas liquid chromatography.

INTRODUCTION

After establishing ASRCT Essential Oil Research Station at Chang Khian, many works on these crops have been going on with progressive results. Among various essential oil crops which are most adaptive to the environment, one promising species is found at present to produce higher income and, consequently, may be able to compete well with opium. The investigation revealed that 'Kek Huai' (Chrysanthemum morifolium) is the best cash crop for that site. Two problems needed to be solved for this crop are: (1) The size of flower which is somewhat smaller than those in the market which are imported from Hang Cho City, the People's Republic of China. This may be due to either varietal or environmental factors. (2) The product which is dried flower is visually different from that of Hang Cho City's. Factors affecting yield and size of 'Kek Huai' flower will be investigated in the next period.

Eucalyptus spp. and Lavendular spp. exhibit satisfactorily performances and are likely to be very promising species for opium substitute. Lavender shows vigorous growth and many of them are early blooming.

* Agricultural Research Department, Applied Scientific Research Corporation of Thailand.

Selection will be made on the desirable spike characteristics for future vegetative propagation.

This report covers the works performed during the period of March 1976 to July 1976.

The research activities at ASRCT's Essential Oil Research Station (Site C) include the followings:

(i) Collection of plant materials

Eighteen species of essential oil bearing crops are now grown at the Station, namely:

<u>Chrysanthemum morifolium</u>	(Kek Huai)
<u>Cymbopogon nardus</u>	(Citronella)
<u>Eucalyptus citriodora</u>	(Eucalyptus)
<u>E. globulus</u>	(")
<u>E. macarthuri</u>	(")
<u>E. piperita</u>	(")
<u>E. smithii</u>	(")
<u>E. staigerana</u>	(")
<u>Lavandula vera</u>	(Lavender)
<u>L. hybrid</u>	(Lavandin)
<u>Mentha arvensis</u>	(Mint)
<u>M. canadensis</u>	(")
<u>M. cardiaca</u>	(Scotch spearmint)
<u>M. piperita</u>	(Peppermint)
<u>M. spicata</u>	(Common spearmint)
<u>Pogostemon</u> sp.	(Patchouli)
<u>Rosa damascena</u>	(Damask rose)
<u>Vetiveria zizanioides</u>	(Vetiver)

(ii) Varietal study on the essential oil bearing crops

The promising varieties and/or species were further investigated with emphasis on their adaptability to soil and climatic conditions, agronomic character, and pest and disease resistance. At present, seven species are under investigation.

1) Chrysanthemum morifolium. The details on planting system and cultural practice were mentioned in the previous reports. During this period, the plants were pruned in June 1976 after harvesting at the age of 12 months. New buds were sprouting. Yield of fresh flowers obtained in this first year was 337.4 kg per 400 m² (8,435 kg per ha) equivalent to 1,291.75 kg per ha of dried flowers.

2) Eucalyptus spp. Seeds of six Eucalyptus species, viz. E. citriodora, E. globulus, E. macarthuri, E. piperita, E. smithii, and E. staigerana from Australia were sown in the seed beds in March 1975 and were transplanted in permanent plots in June 1976.

3) Lavandula hybrid. Eight lavender plants that have been grown for a year were still growing vigorously but have not yet bloomed. The average height of plants was 31.3 cm and the diameter of bush was 40.1 cm as recorded in April 1976.

4) Lavandula vera. Many of the two thousand lavender plants which have been grown from seeds for nine months were blooming. The first spike was observed on 10 May 1976. Spikes were measured and dried for distillation. The average height of plant was 11.9 cm and diameter of the bush was 11.2 cm as measured in April 1976. The average length of spikes was 17 cm. Flowers were found compacted along the inflorescence axis of about 5 cm at the end of spike. Five to ten spikelets were included in one inflorescence.

5) Mentha cardiaca. Scotch spearmint which was harvested in January 1976 sprouted more vigorous shoots. Flowers were observed on 12 May 1976. Yield of fresh material of the second harvest as of 6 June 1976 was 40 kg per 32 m² (12,500 kg per ha) compared with 2,500 kg per ha of the first harvest.

6) Mentha piperita. Two varieties of peppermint, 'Indonesia' and 'Italy No. 9' which were harvested in January 1976 also sprouted many vigorous shoots and bloomed on 12 May 1976. The fertilizer formula 15-15-10 was applied at the rate of 312.5 kg/ha. The fresh weight yield of peppermint 'Indonesia' in the second harvest (30 May 1976) was 114.73 kg per 38.4 m² (29,877 kg per ha). Distillation was done after the herb was air-dried for 48 hours. Low oil content was obtained (0.37% on free moisture basis).

Oil of peppermint 'Italy No. 2' was distilled and found to be different from the true peppermint oil produced commercially elsewhere.

7) Mentha spicata. Three varieties of spearmint 'Israel', 'U.S. No. 1', and 'U.S. No. 2' which were harvested on 20 January 1976 produced vigorous shoots and bloomed at the time of the second harvest.

Spearmint 'Israel' bloomed on 10 May 1976. The second harvest was done on 2 June 1976. Fresh weight yield was 65 kg per 38.4 m² (16,927 kg per ha). The property of oil was the same as that of a Japanese mint variety designated as "Taiwan Red" and the percentage of oil was 1.86% on free moisture basis.

Spearmint 'U.S. No. 1' had not bloomed yet, resulting in prolonged harvesting date.

Spearmint 'U.S. No. 2' bloomed on 14 May 1976. The second harvest was done on 3 June 1976. Fresh weight yield was 48.4 kg per 38.4 m² (12,604 kg per ha). The percentage of oil was 1.21% on free moisture basis.

(iii) Investigation on cultural practices

1) The effect of fertilizer application on Japanese mint 'So Wo 1' was initiated since 14 June 1975. The crop was harvested three times during the growing season. Yield of fresh material obtained from the fertilized plots was 289.7 kg per 144 m² (20,104 kg per ha) per year and 174.3 kg per 144 m² (12,104 kg per ha) per year from the non-fertilized plots.

2) Trial on proper spacing of Eucalyptus grown for essential oil production was conducted. Seedlings of two species of Eucalyptus viz., E. globulus and E. smithii, were grown on 2 June 1976 in three spacings: 25, 50 and 150 cm within row, and 100 cm between rows. A split-plot design with four replications was employed. Leaves and young twigs will be harvested and distilled to determine the oil percentage and oil yield per unit area when the trees are six months old.

3) Trial on rate of nitrogen fertilizer application for lavender was conducted. Germination of Lavandula vera seeds in the seed beds was attempted in January 1976. A randomized complete block design was used with four replications, using three rates of nitrogen fertilizer, viz.

31.25, 62.50, and 93.75 kg per ha, to be applied at four month intervals together with 62.5 kg per ha each of P and K. The plants were spaced at 45 cm within and between rows. After a year in the plots, alternate plants and rows will be removed to give a spacing of 90 cm in both directions.

(vi) Plan for future work

1) Trial on spacing and planting material of Chrysanthemum morifolium.

The experiment will be started in July 1976 and will be finished in June 1977. A split plot design will be employed with four replications. Four spacings, viz. 10, 20, 30, and 40 cm within row will be investigated in main plots of 4 x 8 m, using the same distance between rows of 50 cm. The two sub-plots, 4 x 4 m, will be splitted out from each main plot by setting the different planting materials, viz. cutting and runner. Yield of fresh and dried flowers will be recorded.

2) Study on the effects of planting dates on yields and other characters of Chrysanthemum morifolium.

The experiment will be started in August 1976 and will be finished in December 1977. A Latin-square design will be employed with four replications. Four dates of planting will be done at 15-day intervals, beginning from 10 August 1976 and ended on 24 September 1976. Area used in this experiment is 10 x 25 m², which will be divided into 16 plots of 2 x 5 m each. Spacing will be 30 cm for both between and within rows. Yield and size of flower, weight of 100 flowers, date of flowering, and blooming period will be recorded. Conditions of temperature and relative humidity during the cultivation will be observed.

3) Study on the compatibility and congeniality of damask rose (Rosa damascena) on various rootstocks.

A randomized complete block design will be employed with four replications. Two local varieties from Chiang Mai, together with Rosa multiflora and R. indica will be selected and used as rootstocks to compare with its own root. The plants will be spaced at 50 cm within row and 100 cm between rows. Size of plots will be 2 x 4 m and blocks size will be 2 x 6 m. Number of plants used in this experiment is 192. Yield of

flower in each treatment will be recorded. Distillation will be done at Chang Khian Station and the oil will be analyzed at ASRCT's Laboratory in Bangkok to determine their quality.

(v) Distillation

Two portable steam stills are now installed at ASRCT Essential Oil Research Station, Chang Khian, one, made of 200 l steel drum, with a capacity of 100 kg fresh material, the other, made of stainless steel, has a capacity of 10 kg.

Essential oils obtained will be sent to ASRCT's Laboratory to determine their properties by gas liquid chromatography.

CONCLUSION AND DISCUSSION

During this period all field works were continuing smoothly at ASRCT Research Station, Chang Khian, and laboratory works were done at ASRCT Head Office in Bangkok. Eighteen species of essential oil bearing crops were collected. The newly introduced species were Eucalyptus citriodora, E. macarthurii, E. piperita, and E. staigerana. Their germination percentage was high and the seedlings grew vigorously. Yield of Chrysanthemum flower which was obtained from the second harvest was higher than that of the first; after that, all plants were pruned. About 30% of lavender plant population which have been grown for nine months were blooming. As a result of sexual reproduction, Lavandula vera seedlings exhibited great variation in characters of leaf, growth, flower spike, age of flowering, and yield of flower per individual plant. Selection of early flowering plants for vegetative propagation will be done. Four species to be used as rootstock for Rosa damascena have been prepared for the investigation of their congeniality and compatibility. Distillation had been done, on peppermint, spearmint, Scotch spearmint, and Japanese mint 'So Wo I'.

Chrysanthemum morifolium. Multiplication plot.



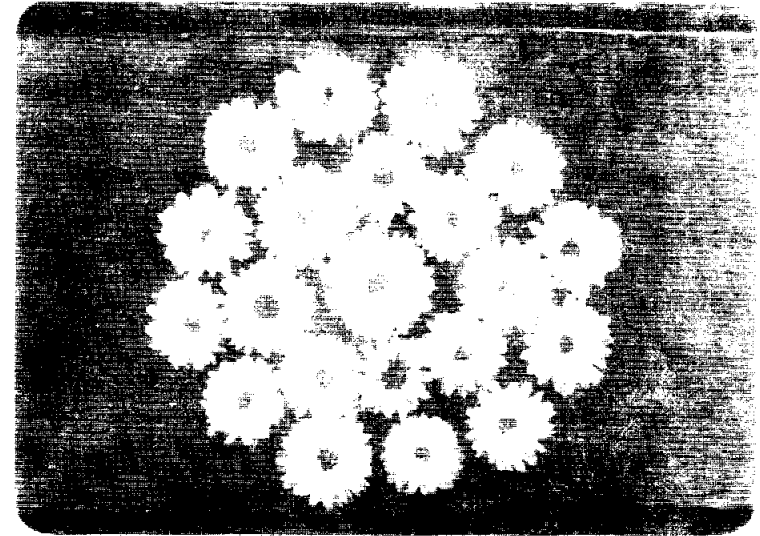
Chrysanthemum plants after harvest.



7



Close-up of Chrysanthemum flowers.



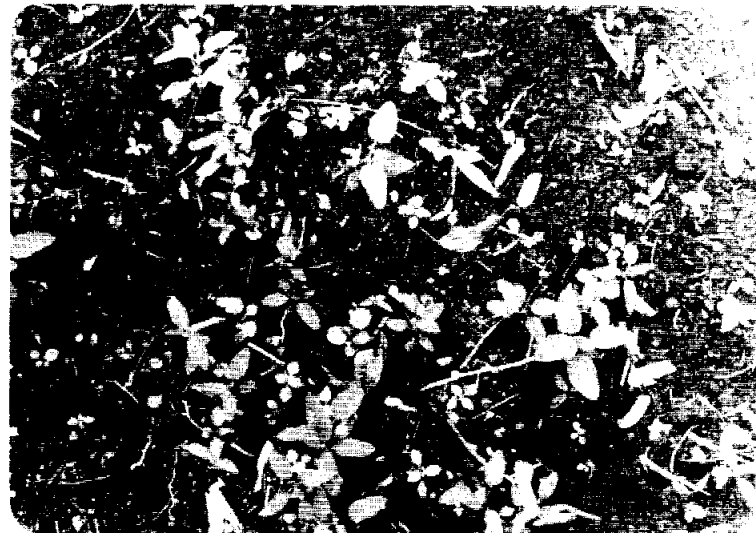
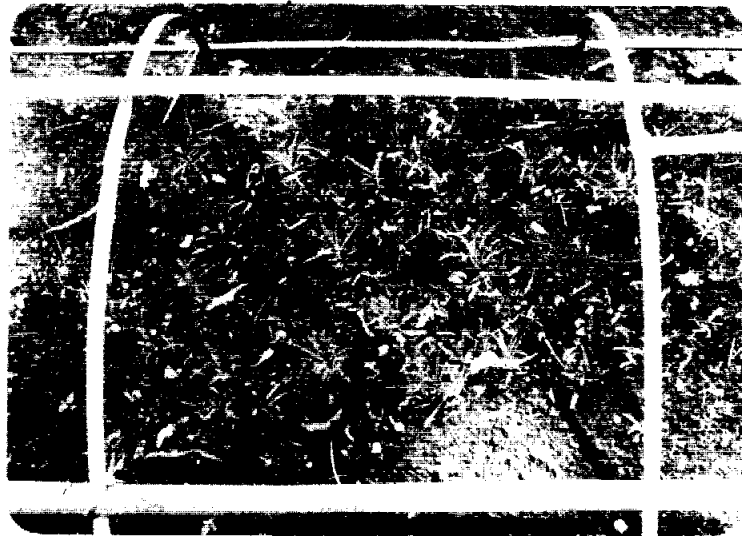
Harvested Chrysanthemum flowers.

Seedlings of Eucalyptus globulus.

E. smithii



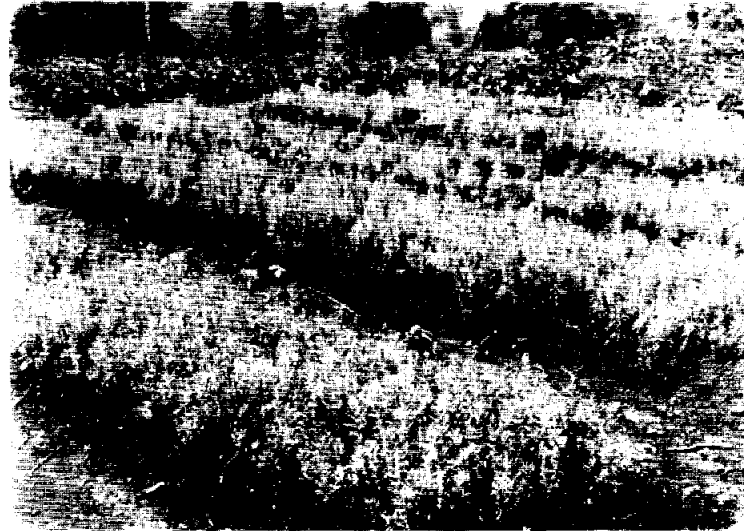
8



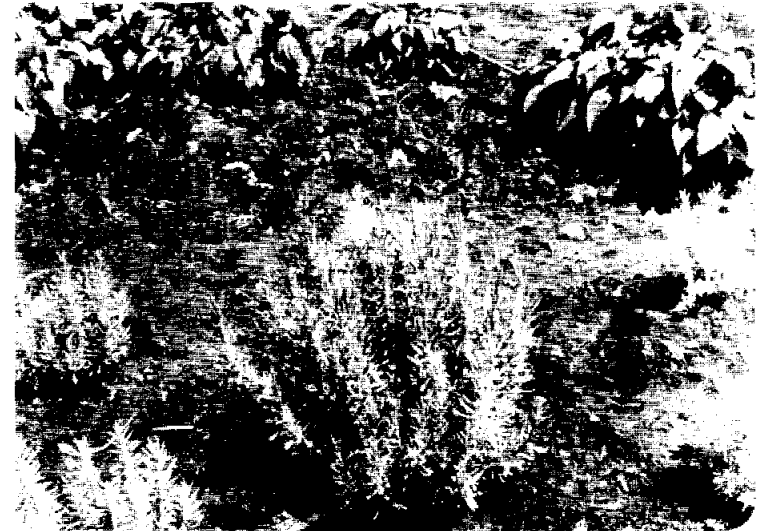
E. staigerana

E. citriodora

Lavender seedlings (Lavandula vera).



Lavender plants before blooming.



6



Lavender spikes.



Lavandin (L. hybrida)

General view of the experimental plots.

M. arvensis var. piperascens



10



M. cardiaca



M. canadensis

M. piperita 'Germany'



M. piperita 'Italy No. 1'



II



M. piperita 'Indonesia'



M. piperita 'Italy No. 2'

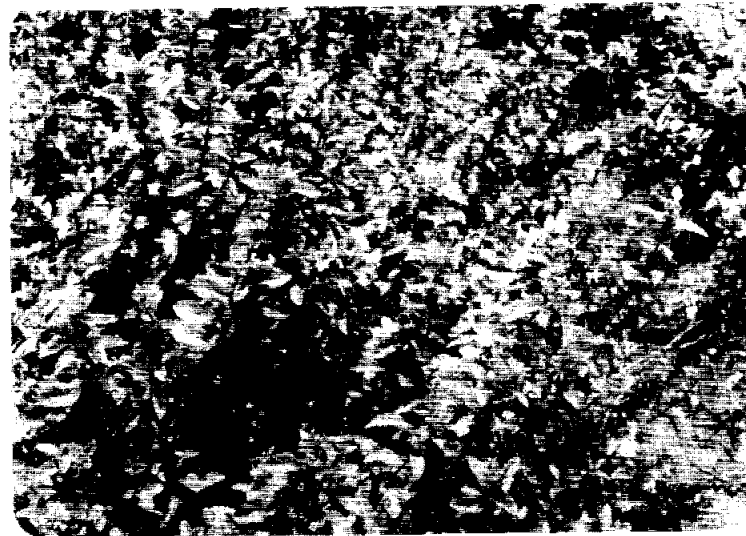
M. spicata



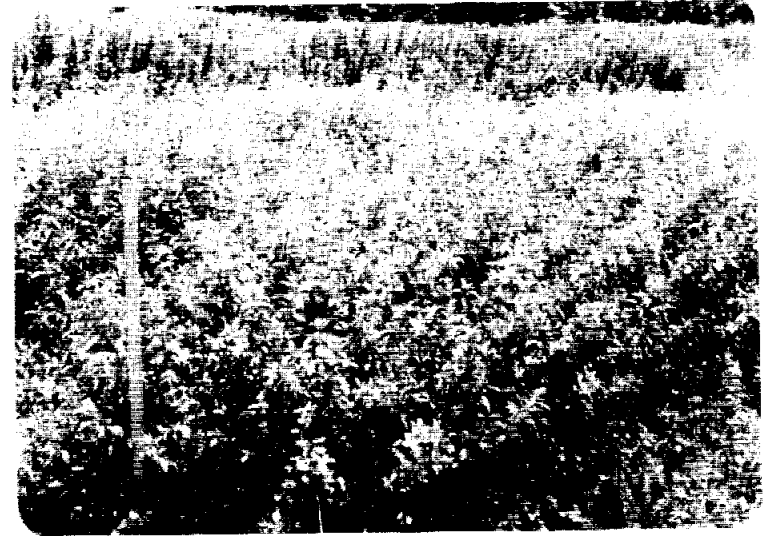
M. spicata 'Italy No. 1'



12

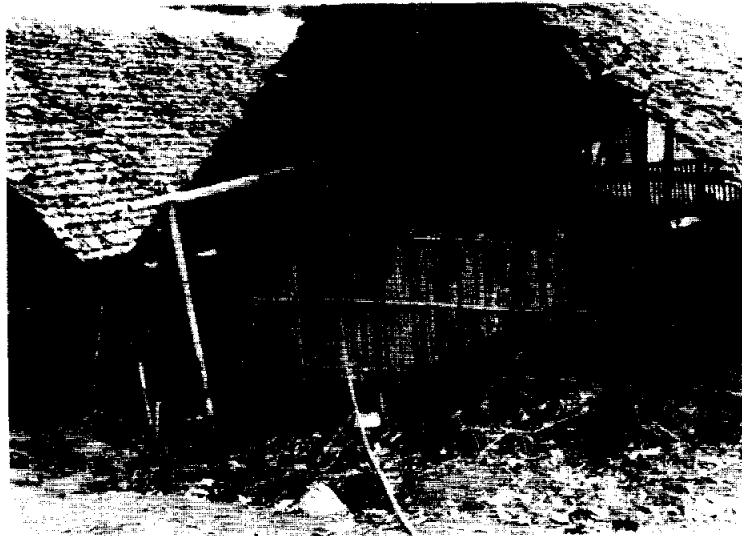


M. spicata 'Italy No. 2'



M. spicata 'Israel'

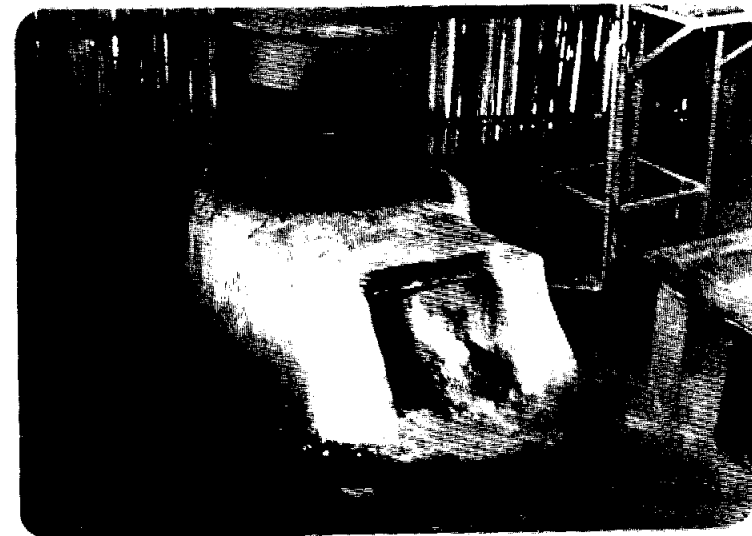
Essential oil distillation shed.



Portable steam still.

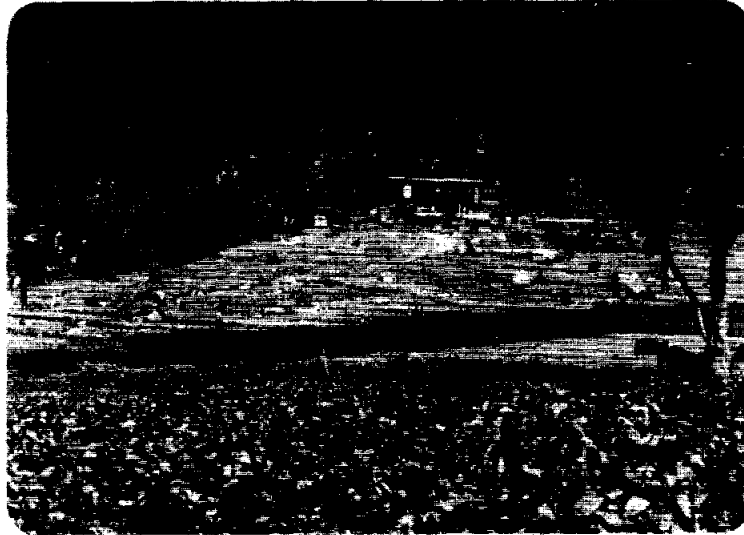


Packing the herb for distillation.

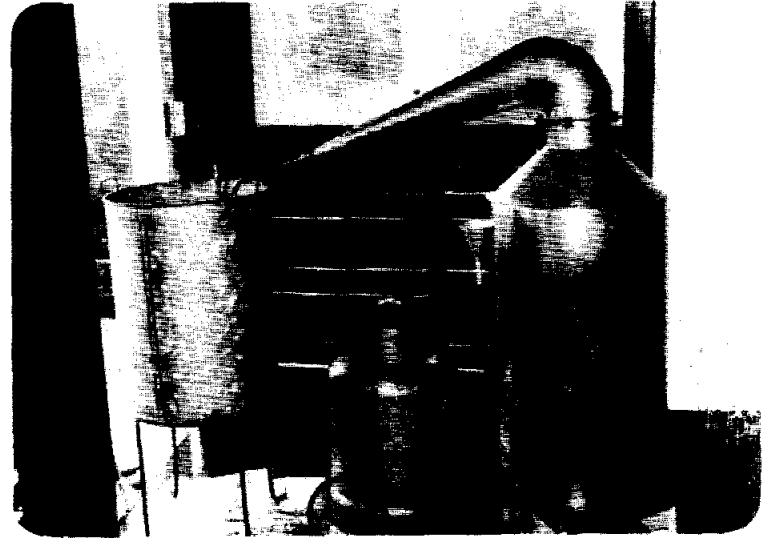


Stove for distilling tub.

The resident-office-laboratory-building.



Stainless steel, steam still in the small laboratory room of the building.



Preparation for distillation.



Distilling.