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Essential oil production in
the highlands of northern

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APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND

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OF NORTHERN THAILAND

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By Kwanyeun Wichapan,* Inson Klong-karn-ngarn,*
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SUMMARY

This fifth 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) and ASRCT workshops at its head office in Bangkok. It includes the collection of twenty species of essential-oil-bearing crops, varietal study of seven species, five experiments on cultural practices, and design of a warm-air-oven for use in local areas.

INTRODUCTION

The works on this project have been going on since 20 May 1974. Four semi-annual reports have been submitted. This fifth one is the last semi-annual report. The final report which includes all works done in this project with full detail will be prepared. Since the main purpose of this project is to investigate the essential-oil crops for hill-tribes to substitute opium growing, many experiments on these crops have been set at ASRCT's Essential Oil Research Station to find out the most suitable ones. The result showed that Chrysanthemum morifolium is a promising crop which may be able to compete with opium. It grew vigorously producing prolific flowers and the yield of dry flower was 200 kg/rai (1,250 kg/ha) at a value of about 20,000 Bht/rai/year (\$6,250/ha/yr), compared with 6,000 Bht/rai/yr (\$1,875/ha/yr) of opium. However, research on this crop has to be further continued to solve some problems affecting flower quality such as flower rot during the rainy season, and periodical occurrence of unmarketable sized flowers, and to minimize the cost of production.

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This report covers the works performed during the period August to December 1976.

The research activities at ASRCT's Essential Oil Research Station include the followings:

(i) Collection of plant materials

Twenty 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>	(Eucalyptus)
<u>E. smithii</u>	(Eucalyptus)
<u>E. staigerana</u>	(Eucalyptus)
<u>Lavandula hybrida</u>	(Lavandin)
<u>L. spica</u>	(Lavender)
<u>L. vera</u>	(Lavender)
<u>Mentha arvensis</u>	(Mint)
<u>M. canadensis</u>	(Mint)
<u>M. cardiaca</u>	(Scotch spearmint)
<u>M. crispa</u>	(Mint)
<u>M. piperita</u>	(Peppermint)
<u>M. spicata</u>	(Common spearmint)
<u>M. Viridis</u>	(Mint)
<u>Pelagonium sp.</u>	(Geranium)
<u>Pogostemon sp.</u>	(Patchouli)
<u>Rosa damascena</u>	(Damask rose)
<u>Vetiveria zizanioides</u>	(Vetiver)

(ii) Varietal study on the essential-oil-bearing crops

The agronomic characters and adaptability of these crops were described in Report No. 4 of this series. The yield of each crop and the details of studies will appear in the Final Report. Seven crops were investigated during this period.

1) Chrysanthemum morifolium. Among the essential-oil-bearing plants grown at the Station, C. morifolium is the best adapted crop. Dried flower yield of the first year growing was 200 kg/rai (1,250 kg/ha) as mentioned in the previous reports. In the second year, plants grew more vigorously, and much more flower production was obtained. To avoid crowding, pruning has been done. Flowering season and yield of flower in the second year is being investigated.

2) Eucalyptus spp. Many of Eucalyptus seedlings died after transplanting in June 1976, except some of E. globulus, E. smithii, E. citriodora and E. staigerana which are still survived. The average height of E. globulus and E. smithii plants were 41.3 and 26.7 cm respectively as measured in December 1976.

3) Lavandula hybrida. Lavandin plants which have been grown from cutting since 21 April 1975 were growing vigorously and highly resistant to diseases. One of the eight plants bloomed in September 1976. Three spikes with 2-4 cm of flowers, compacted at the end, were observed. The average plant height was 51.75 cm, and the bush diameter averaged 71.86 cm as recorded in December 1976.

4) Lavandula vera. Two thousand lavender seedlings which have been transplanted since May 1975 grew vigorously until rainy season (August - October), quite a few of them were damaged by shab, a fungal disease, and 33% died during this period. The diseased plants were pulled out and burnt. The average height and diameter of survived bushes were 27.63 and 34.48 cm, respectively, as recorded in December 1976. About 25% of them bloomed during May to October 1976. The average length of spikes was 17 cm, with 5 cm of flower compacted at the end. The number of spikes was 13.50 per plant, and 6,603 spikes were collected.

5) Mentha cardiaca. Scotch spearmint which has been grown since 26 July 1975 was harvested on 16 October 1976. Due to the occurrence of mint rust during rainy season, the yield of fresh material in this third harvest was decreased to 8 kg/32 m² (2,500 kg/ha) compared with 12,500 kg/ha of the second harvest, and 2,500 kg/ha of the first. All plants and stolons were rogued out after the third harvest.

6) Mentha piperita. Two varieties of peppermint, 'Indonesia' and 'Italy No. 2' which have been grown since 26 July 1975 were harvested on 16 October 1976. Due to the occurrence of mint rust, yield of fresh material in this third harvest was the lower, 16.5 kg/38.4 m² (4,296.87 kg/ha), compared with 29,877 kg/ha of the second harvest and 1,171.87 kg/ha of the first of 'Indonesia' while the yield of third harvest of 'Italy No. 2' was 10.0 kg/38.4 m² (2,604.12 kg/ha) compared with 31,171.8 kg/ha of the second harvest recorded on 20 August 1976 and 2,291.6 kg/ha of the first. The oil content of the current harvest was 0.20%. All plants and stolons were rogued out after the third harvest.

7) Mentha spicata. The third harvest of the two varieties of spearmint, 'Israel', and 'US. No. 2' which have been grown since 26 July 1975 were 10.7 kg/ 38.4 m² (2,786.4 kg/ha) and 24.1 kg/38.4 m² (6,276.04 kg/ha), respectively, as recorded on 16 October 1976, compared with 16,927 kg/ha of the second and 3,906.25 kg/ha of the first harvest of 'Israel' and 12,604 kg/ha, 1,302 kg/ha of the second and the first of 'US. No. 2', respectively.

The second harvest of spearmint 'US. No. 1' was done on 21 October 1976. Fresh weight yield was 17.8 kg/32 m² (5,562.5 kg/ha) compared with 2,656.25 kg/ha of the first harvest. Essential oil content was 0.13% as determined by ASRCT portable steam still which was installed at the Station.

All plants and stolons were rogued out after the second harvest.

(iii) Investigation on cultural practices

Five experiments have been set during this period.

1) Trial on proper spacing of Eucalyptus grown for essential oil production.

Many of the seedlings transplanted on 2 June 1976 died. Then the remainders had to be carefully reset by employing three replications of split-plot design. Two spacings, 50 and 100 cm within row and 100 cm between rows, were employed in main plots and two species, E. globulus and E. smithii, were treated as subplots.

2) Trial on rate of nitrogen fertilizer application for lavender.

Lavandula vera seedlings germinated in January 1976 were transplanted in the experimental plots in September 1976. The design and method of this experiment were mentioned in Report No. 4 of this series.

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

Chrysanthemum stem cuttings which were well rooted for 2 months in burnt-rice-hull were planted in experimental plots at the same time as the shoots which were planted immediately after pulling from the ground on 24 August 1976. Four replications of split plot design were employed with different spacings: 10, 20, 30, and 40 cm within row and 50 cm between rows in the main plots of 4 x 8 m, the two sub-plots 4 x 4 m were split out from each main plot and planted two different planting materials, viz. cutting and shoot. Flowers were observed on 11 October 1976. Number of flowers and shoots were also recorded.

4) Study on the effect of planting date on yields and other characters of Chrysanthemum morifolium.

A Latin-square design with 4 replications was employed. Four dates of planting were set at 15-day intervals beginning from 10 August and ended on 24 September 1976. Area used in this experiment was 10 x 25 m, which was divided into 16 plots of 2 x 5 m each. Shoots were planted at spacing 30 cm for both between and within rows. Fertilizer formula 15-15-10 was applied at the rate of 625 kg/ha at 15 days after planting. Number of flowers and number of new shoots in each treatment were recorded. Date of first flower which was harvested was recorded.

<u>Planting date</u>	<u>Harvesting date</u>	<u>Number of days after planting</u>
10 Aug. 1976	12 Sep. 1976	33
25 Aug. 1976	1 Oct. 1976	37
9 Sep. 1976	10 Oct. 1976	31
24 Sep. 1976	15 Nov. 1976	52

5) Study on the compatability and congeniality of danask rose (Rosa damascena) on various rootstocks.

Two local varieties from Chiang Mai, together with Rosa multiflora and R. indica, were planted on 17 September 1976 in the experimental plots of 2 x 4 m which were located in the block of 2 x 16 m of a randomized complete block design with four replications. They will be used as rootstocks. Number of plants used in each plots were 16 and the total plant population was 300. Sten cuttings of Rosa damascena were also planted at the same time as those rootstocks. The plants were spaced at 50 cm within row and 100 cm between rows. They were pruned and their stens trained for budding. It is expected that all stocks would be ready for budding in March.

(vi) Distillation and dehydration

Peppermint 'Italy No. 2' was distilled in August 1976 by using ASRCT's portable stean still, capacity 100 kg of fresh herb. Only 0.2% of oil was obtained.

An oven, size 1 x 1.20 x 1 m was designed and built by the Project Development Department, ASRCT for the dehydration of flowers and herbs in village area. Moist air was suck out through the upper pipe by suction fan which was easily operated by wind. Smoke from economic stove which was developed for nint distillation was suck through the lower pipe which is lining the inner and outer walls to heat up the oven. This stove can be used in distilling nint or other essential oil crops and dehydrating flowers or herbs at the same time.

CONCLUSION

The best adapted crop during this heavy rainy period was Chrysanthemum norifolium, while some other species suffered somewhat. Eucalyptus macarthuri and E. piperita died of rot diseases. The thriving seedlings of E. glubulus, E. smithii, E. staigerana, E. citriodora and Lavandula hybrida grew vigorously while most of L. vera seedlings were damaged, and some died. The varietal study on Mentha arvensis, M. cardiaca, M. piperita and M. spicata had been completely done. The result showed that the highest production was obtained in the second harvest during June to August. The experiments on improving cultural practice were already started, some of the result of which will be obtained by June 1977. While certain other experiments require one more year to be finished. However, Chrysanthemum norifolium was found most suitable to substitute opium growing.

Construction
of road to the
Station.



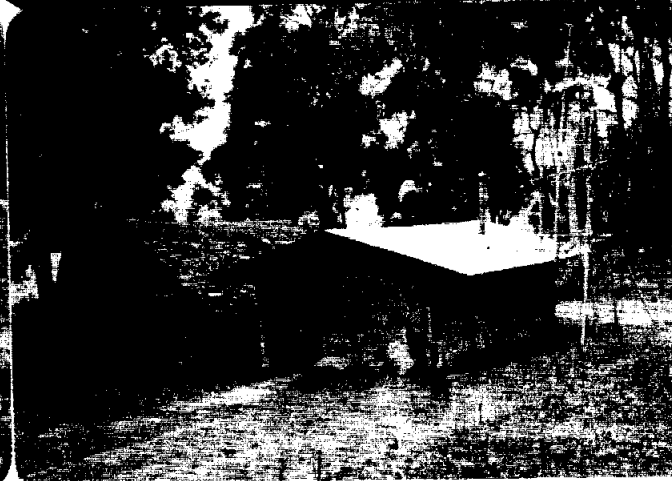
A portable
sprinkler system.



Nursery plot
for germination
purposes.



Dehydration and
distillation
shed.



Outlet smoke
pipe and
suction fan
over the roof
connected with
the oven .



Movable trays
inside the oven.

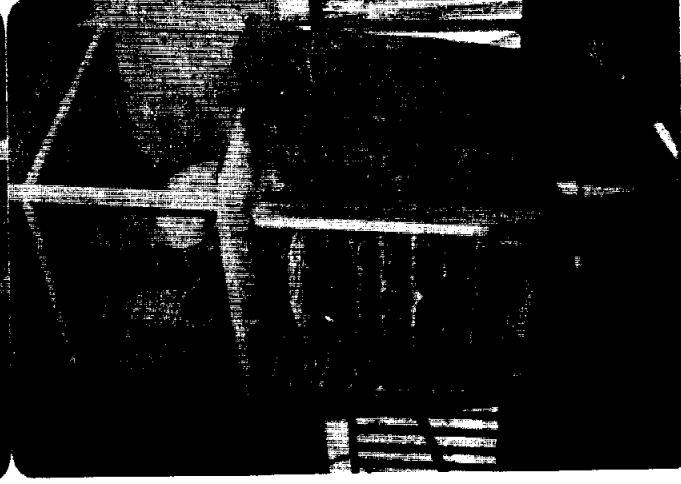


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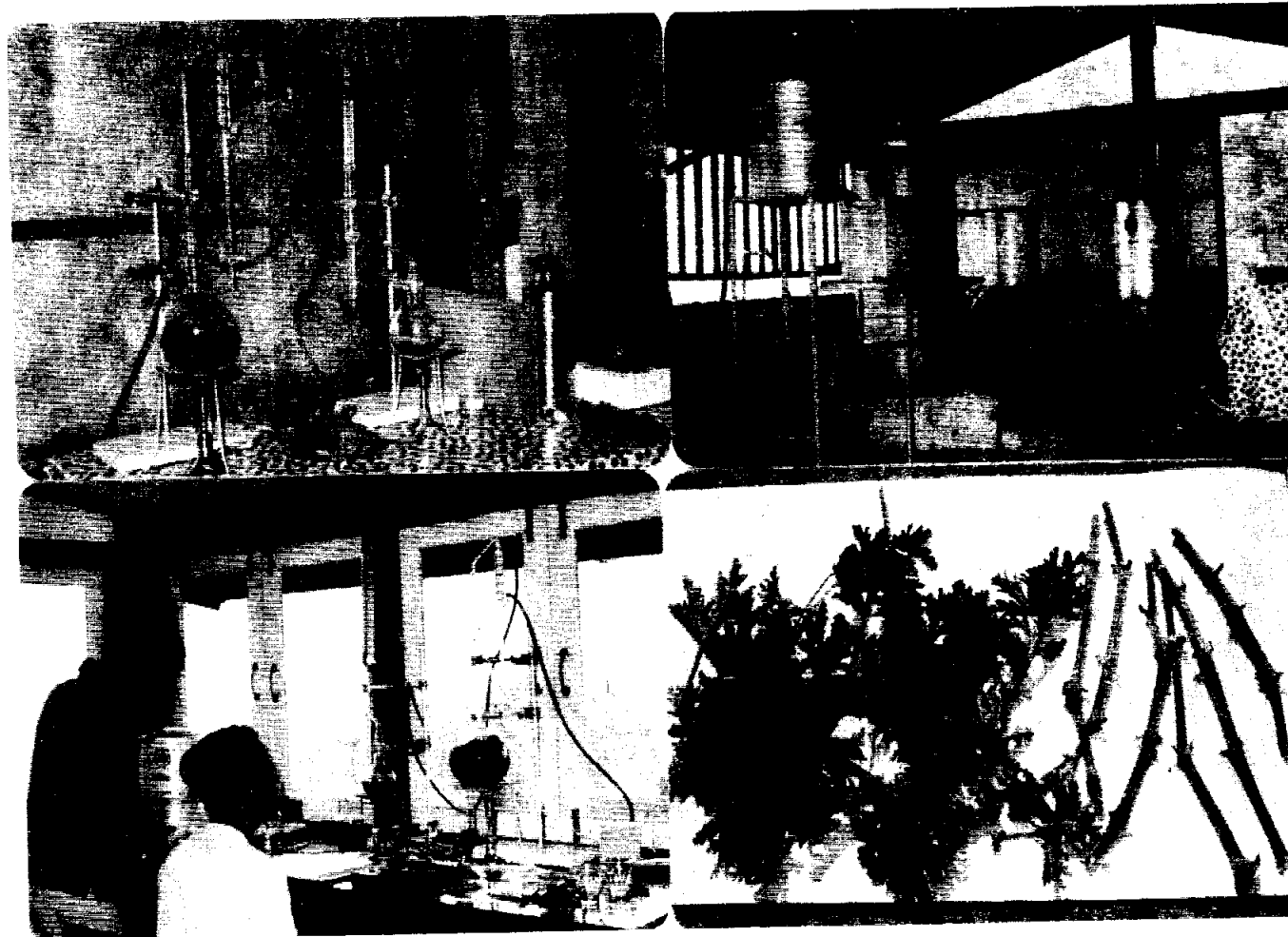
Oven with air
vent tempera-
ture adjustment
at both sides .



Oven filled
with packages
of Chrysan-
themum flowers.



Geranium
distillation.



Portable steam
stills with
economic wood
stove (big one)
and gas stove
(small one).

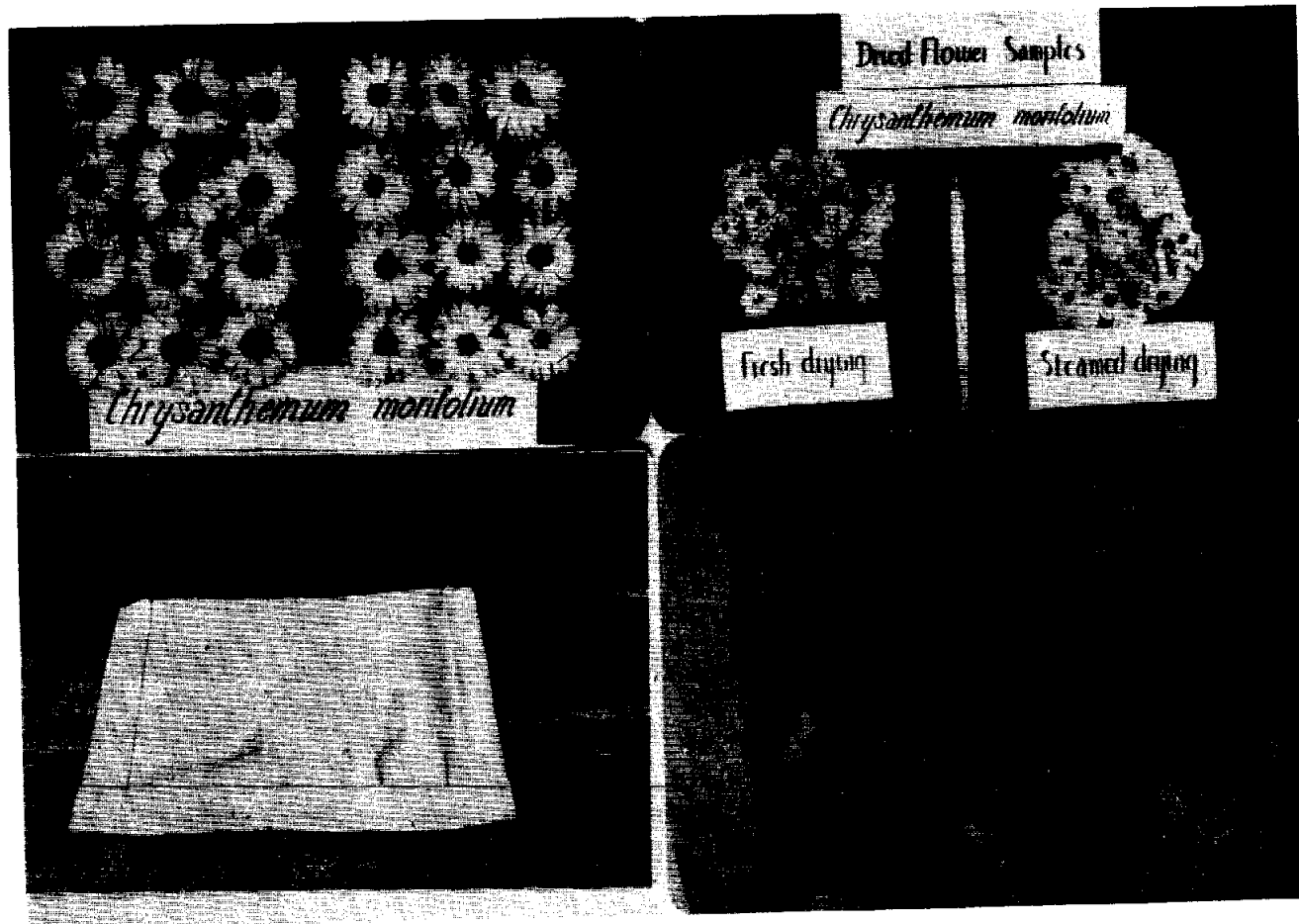
Laboratory
section.

Geranium leaves
ready for
distillation .

Flowers of two
Chrysanthemum
varieties .

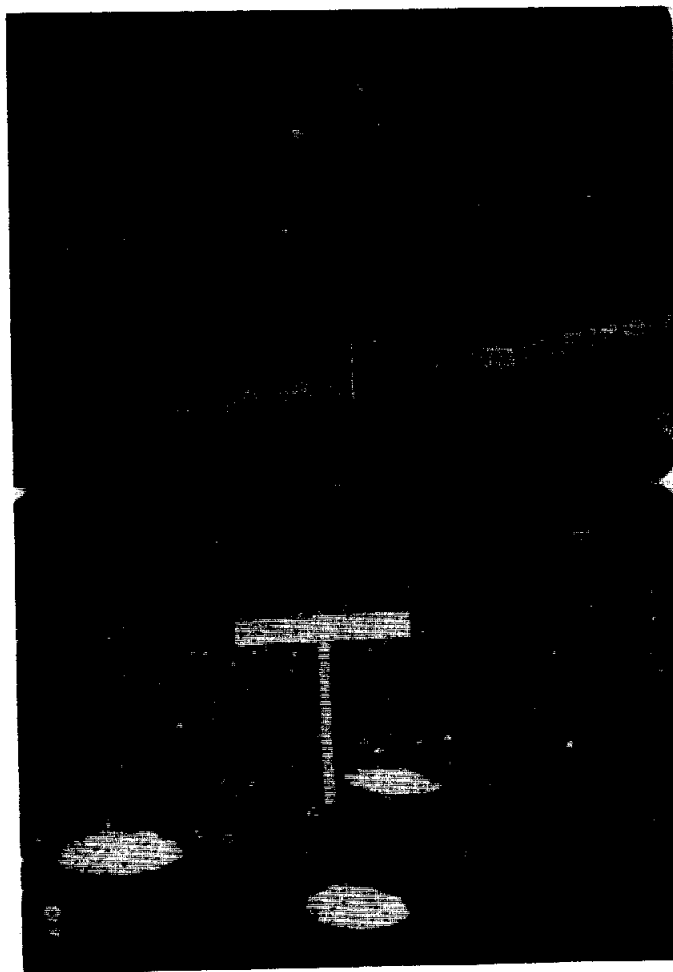
11

Wrapping flowers
with paper before
steam drying .



Finished pro-
duct of Chry-
santhemum tea .

Chrysanthemum
yield trial
plot.



Chrysanthemum
experimental
plots .

12

Collected flowers
in bamboo trays.

Close-up
Chrysanthemum
flower.

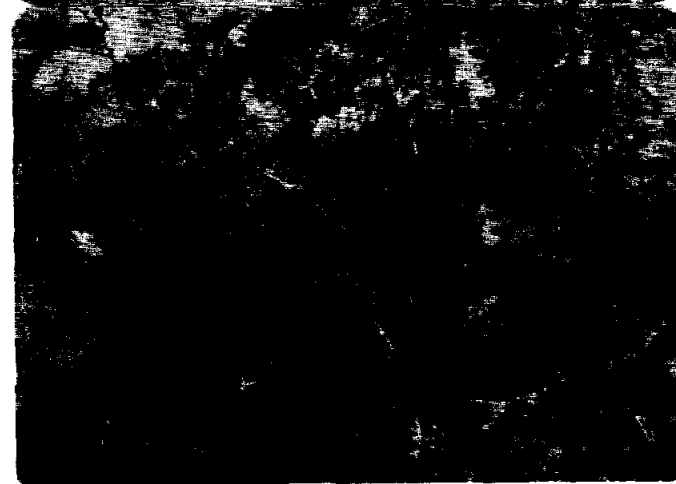
Geranium plant
at blooming.



Vetiveria
zizanioides

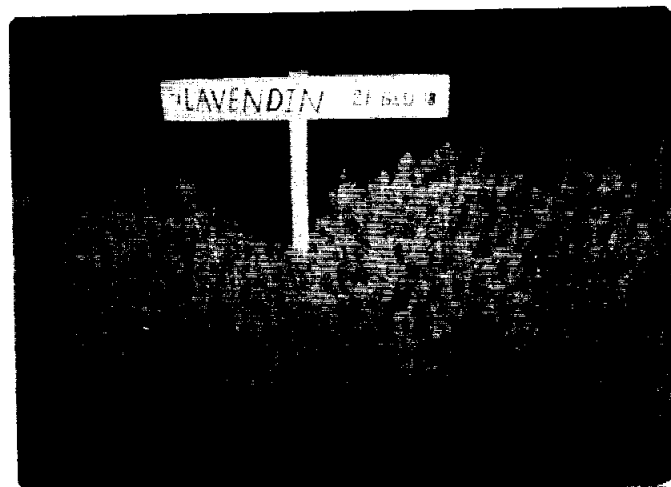
13

Close-up
geranium plant.



Abundant
vetiver roots.

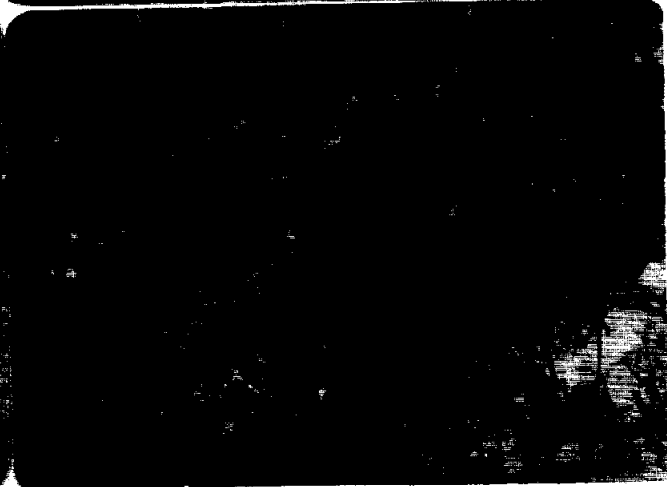
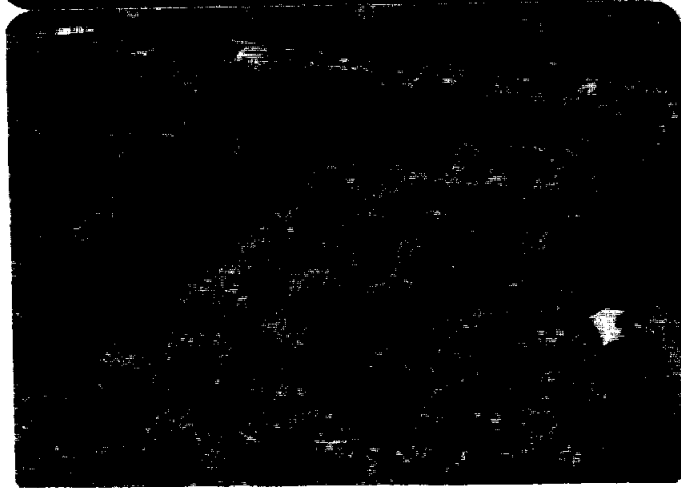
Lavandula
hybrida



Eucalyptus
globulus

14

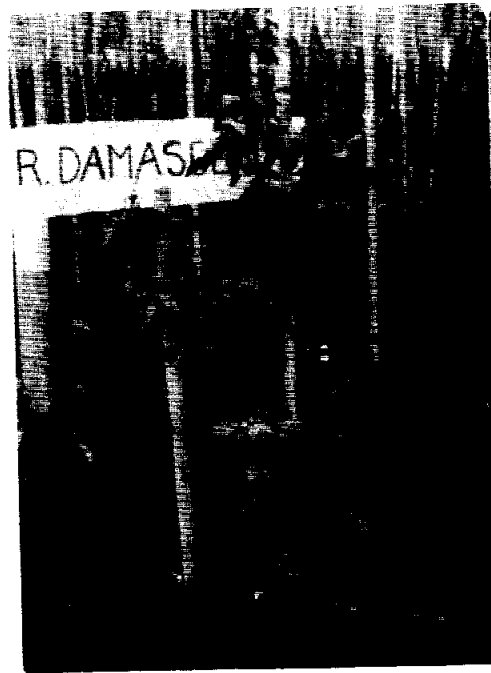
Lavandula vera



E. smithii

Rosa damascena

15



Shrub at the age of 5 months .



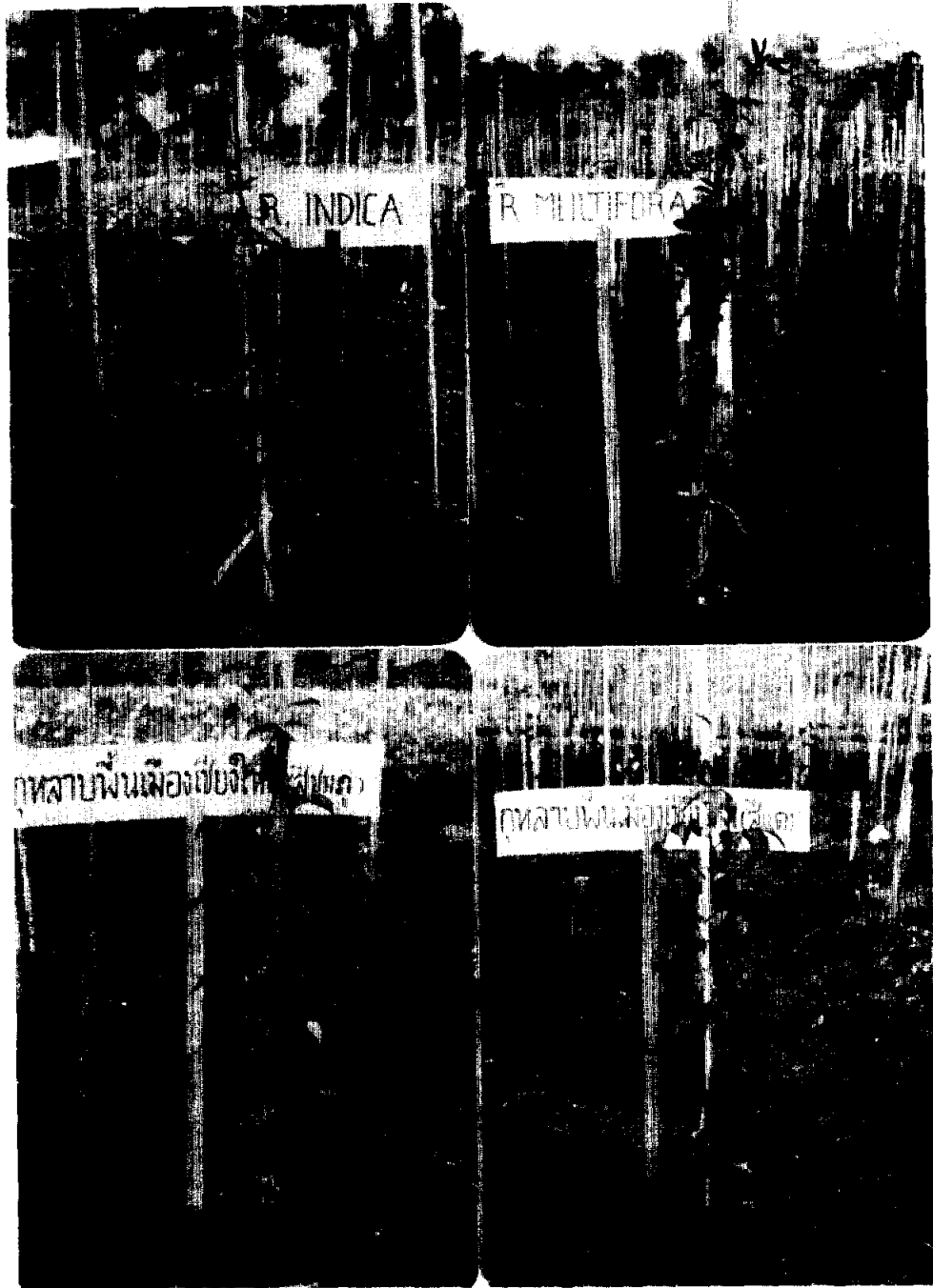
Shrub with flowers .



Close-up of damask flower .

Rootstocks for damusk rose
R. indica .

R. multiflora



Local pink variety .

Local red variety .