

CHAPTER IV

RESULTS AND DISCUSSION

Quantitative examinations of the four main alkaloids presented in the latex of *Papaver somniferum* L. are shown in Tables 9-12.

Table 9

Weights of latex and percentage yields of alkaloids of P & TP/W

| Sample No. | Wt. of latex (g/10 capsules) | % of Alkaloids | | | |
|----------------------|---------------------------------|----------------|---------|----------|-----------|
| | | Morphine | Codeine | Thebaine | Narcotine |
| 1-60/1 [*] | 0.732417 | 7.32 | 2.01 | 1.92 | 3.12 |
| 1-10/2 ^{**} | 0.590012 | 3.72 | 1.60 | 1.92 | 3.17 |
| 11-20/2 | 0.300640 | 4.58 | 2.09 | 2.50 | 3.01 |
| 21-30/2 | 0.448212 | 5.09 | 1.96 | 2.19 | 2.51 |
| 31-40/2 | 0.530949 | 4.42 | 2.00 | 2.09 | 3.34 |
| 41-50/2 | 0.345874 | 5.88 | 2.10 | 2.09 | 3.34 |
| 51-60/2 | 0.227756 | 6.67 | 3.75 | 2.09 | 3.34 |

* first lancements

** second lancements

Table 10

Weights of latex and percentage yields of alkaloids of P & TP/R

| Sample No. | Wt. of latex (g/10 capsules) | % of Alkaloids | | | |
|------------|---------------------------------|----------------|---------|----------|-----------|
| | | Morphine | Codeine | Thebaine | Narcotine |
| 1-60/1 | 0.890883 | 7.54 | 2.56 | 2.83 | 4.34 |
| 1-10/2 | 0.287145 | 5.74 | 2.23 | 3.32 | 4.20 |
| 11-20/2 | 0.536635 | 4.32 | 1.70 | 3.37 | 3.81 |
| 21-30/2 | 0.474235 | 3.62 | 1.86 | 3.35 | 4.95 |
| 31-40/2 | 0.378300 | 4.24 | 2.25 | 3.01 | 3.09 |
| 41-50/2 | 0.475419 | 5.59 | 3.04 | 2.82 | 4.17 |
| 51-60/2 | 0.412552 | 5.31 | 2.08 | 3.47 | 4.63 |

Table 11

Weights of latex and percentage yields of alkaloids of BP & HS/W

| Sample No. | Wt. of latex (g/10 capsules) | % of Alkaloids | | | |
|------------|---------------------------------|----------------|---------|----------|-----------|
| | | Morphine | Codeine | Thebaine | Narcotine |
| 1-100/1 | 1.055277 | 4.55 | 1.06 | 0.81 | 2.61 |
| 1-10/2 | 0.643839 | 3.47 | 1.04 | 0.84 | 2.26 |
| 11-20/2 | 0.781828 | 2.59 | 0.82 | 0.57 | 1.32 |
| 21-30/2 | 0.583299 | 3.40 | 1.12 | 0.82 | 2.41 |
| 31-40/2 | 0.361217 | 3.80 | 1.11 | 0.74 | 2.34 |

Table 11 (continued)

| Sample No. | Wt. of latex (g/10 capsules) | % of Alkaloids | | | |
|------------|---------------------------------|----------------|---------|----------|-----------|
| | | Morphine | Codeine | Thebaine | Narcotine |
| 41-50/2 | 0.537674 | 4.50 | 1.25 | 1.07 | 3.34 |
| 51-60/2 | 0.592029 | 4.85 | 1.21 | 1.40 | 3.67 |
| 61-70/2 | 0.541667 | 5.12 | 1.04 | 1.30 | 2.90 |
| 71-80/2 | 0.404860 | 5.34 | 1.39 | 1.10 | 3.34 |
| 81-90/2 | 0.443542 | 6.01 | 1.48 | 0.85 | 3.34 |
| 91-100/2 | 0.592158 | 5.84 | 1.32 | 0.73 | 2.51 |

Table 12

Weights of latex and percentage yields of alkaloids of BP & HS/R

| Sample No. | Wt. of latex (g/10 capsules) | % of Alkaloids | | | |
|------------|---------------------------------|----------------|---------|----------|-----------|
| | | Morphine | Codeine | Thebaine | Narcotine |
| 1-100/1 | 1.454542 | 5.12 | 1.43 | 1.32 | 2.91 |
| 1-10/2 | 0.750211 | 2.38 | 1.07 | 1.13 | 2.15 |
| 11-20/2 | 0.531784 | 2.97 | 1.22 | 1.06 | 1.94 |
| 21-30/2 | 0.933549 | 2.92 | 1.60 | 0.83 | 1.88 |
| 31-40/2 | 0.962738 | 3.22 | 1.28 | 0.70 | 2.02 |
| 41-50/2 | 0.785968 | 3.50 | 1.38 | 0.88 | 2.10 |
| 51-60/2 | 0.860689 | 3.30 | 1.04 | 0.82 | 1.96 |
| 61-70/2 | 0.928942 | 3.28 | 1.32 | 0.93 | 1.67 |

Table 12 (continued)

| Sample No. | Wt. of latex (g/10 capsules) | % of Alkaloids | | | |
|------------|---------------------------------|----------------|---------|----------|-----------|
| | | Morphine | Codeine | Thebaine | Narcotine |
| 71-80/2 | 1.061611 | 3.22 | 1.31 | 0.91 | 2.03 |
| 81-90/2 | 0.742089 | 3.76 | 1.63 | 0.88 | 2.13 |
| 91-100/2 | 0.684662 | 4.59 | 1.62 | 0.88 | 2.03 |

The investigation of alkaloidal patterns in the latex of *Papaver somniferum* L. shows that the most dominant alkaloid was morphine, the lessers were narcotine, codeine and thebaine which were not significantly different. It was suggested that, since the plant could transform thebaine to codeine and finally to morphine, so the amount of morphine was higher than codeine and thebaine. Opium poppy is the only one species in *Papaver* which produces a high yield of morphine. The percentage yield of morphine presented in the latex from the first lancing was 4.5-8; narcotine, 2.5-4.5; codeine, 1-3 and thebaine, 1-3. The first lancing yielded the highest weight of latex and so the percentage of alkaloids. Generally, the following lancements yielded lower percentage of alkaloids than the first one. This situation depended on the time of resting.

It should be noted that in the first lancements, the red flowered plants yielded more latex and higher percentage of the four main alkaloids than the white flowered ones. But in the secone lancements,

the percentage of the four main alkaloids from the latex of white flowered plants were high. In northern part of Thailand, the hill tribes often grow both red and white flowered opium poppies in the same place and combined their collections. The above result is suggested that in order to get higher yield of the alkaloids the latex of the two varieties should be collected separately.

In the second lancing, the variation of percentage yield of each alkaloid depends on the resting state between the first and the second lancing. The variations of the percentage of each alkaloid are described below.

Narcotine

If the capsules were incised on the next day after the first lancing, the latex yielded about 80 % of narcotine relative to the amount found from the first lancing. Incising on the second or the third day gave a lower percentage yield of narcotine, but a higher weight of latex. The percentage yield was increased on the fifth day and reach to maximum on the seventh or eighth day, relatively close to that from the first lancing.

Thebaine

On the first two days after the first lancing the percentage of thebaine remain unchanged but would be decreased if incisions were made after that. The percentage began to increase during the sixth and seventh day and was highest on the eighth or ninth day.

Codeine

On the first to third day, the latex yielded a low percentage of codeine. The percentage yield increased when the capsules were incised after the third day, and the yield on the fifth day was close to that from the first lancements.

Morphine

The percentage yield of morphine was low in the early days after the first lancements. It increased on the third to fourth day and was close to the yield of the first lancements on the seventh to eighth day. The highest yield was obtained on the eleventh or twelfth day.

Considering the percentage yields of thebaine, codeine and morphine, it was shown that thebaine firstly reached highest percentage yield, followed by codeine and morphine respectively. These finding supported the biosynthetic pathway of morphinane alkaloids which is thebaine transformed to codeine and finally to morphine.

It should also be noted that the second lancements should be done in the seventh to eighth day after the first lancements, because it was the earliest day on which percentage yields of the four main alkaloids were close to the yields of the first lancements and it was not too long to make the third incision.