

**COMPARATIVE STUDIES ON MORPHOLOGICAL CHARACTERS,
YIELD OF OPIUM AND SEEDS IN DIFFERENT VARIETIES
OF *PAPAVER SOMNIFERUM* CULTIVATED AT PESHAWAR.**

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S U M M A R Y .

Studies on morphological characters yield of opium and seed were conducted on the white black and red seeded varieties of Papaver somniferum for the years, 1969-70, 1970-71 and 1971-72 at the Medicinal Plant Farm Peshawar. Results achieved are presented in this paper. Suggestions have been made to eliminate red seeded variety as it is poor in yield of opium and seed. Excise Department should increase the rate of procurement of opium to attract the cultivators to hand over their opium produce to the Department. Cultivation of Papaver somniferum on state owned farms or by private firms under the supervision of Excise Department has been recommended.

INTRODUCTION.

Papaver somniferum (Opium poppy) is being cultivated since ages in the N. W. F. P. area of Shabqadar, Swat, Dir, etc., especially in the tribal belt. Since the tribal belt is being administered by the Government as "special area", there is, therefore, no control of Excise Department on cultivation and production of opium. Consequently it has resulted in large scale smuggling of opium to the settled areas of Pakistan mainly for addicts. Further the rates offered by the Excise Department for the procurement of opium are unattractive and to fetch more price a lot of adulteration is done in opium by the cultivators of settled areas or a large quantity of good opium is smuggled outside by hoodwinking the excise officials.

Opium grown in this province is a good source of morphine, codeine, narcotine and papaverine. These products are being imported in large quantities for use in hospitals and for medical purposes. According to the latest figures of imports, morphine worth Rs. 2455740.00 was imported during the year, 1970-71 (I). It is evident that morphine if produced in this province can meet the needs for home consumption easily. Thus the foreign exchange on account of its procurement from abroad could be saved. Moreover,

this product can be a good source of earning foreign exchange if it is exported to the R.C.D. countries even at cheaper rates. In this connection a firm named "Sharax limited" has been granted a licence for the manufacture of morphine in Peshawar by the Government of Pakistan. They have acquired a process for the manufacture of morphine from P. C. S. I. R. Laboratories, Peshawar.

At present three types of poppy viz. white, black and red seeded are being cultivated in this province. Among them white seeded variety (*papaver somniferum* Var. album) is more popular.

According to some authors black seeded variety (*papaver somniferum* var. nigrum) yields more opium and the percentage of morphine is also greater (6). These results are based on the experiments conducted in the United Provinces (Now Utar Pradesh) and other parts of India. No comparative studies have however been conducted in the N. W. F. P. on *Papaver somniferum* to find the suitability of these varieties keeping in view the climatic conditions of this region.

In the present study all the above mentioned varieties were cultivated at Peshawar Farm and data on the morphological characters, yield of opium and seeds were recorded to find out the most suitable variety for cultivation. Results achieved in this respect are presented in this paper.

Review of literature. Papaver is the Latin classical name of poppy (6). Decandoll reported that opium yielding poppy is a cultivated state of *Papaver setigerum* which is wild at the shores of Mediterranean (6).

Kritikos and Papadaki (1967) reported that ancient Greeks portrayed the divinities Hyponos (Sleep) Nyx (Night) and Thanatos (death) wreathed with poppies or carrying poppies in their hand (4). Legened has that Demeter, in despair over the seizure of her daughter Persephone by Pluto ate poppy in order to fall asleep and forget her grief (4).

Scott stated that poppy plant was apparently first introduced into India by Arab traders at Bombay and Malva (6).

Watts reported that in India the cultivation of opium poppy was confined to three main centres viz. Patna, Banares, Malva and certain parts of Rajputana (6).

North Western Frontier Provinces used to export largest quantities of poppy oil as is evident from the export figures for the year, 1888-89 i. e., 498223 mds. to Bombay and 2,10,328 mds. to Calcutta (6).

Scott. stated (1887) that with judicious cultivation, more manure and deep ploughing combined with careful selection of seeds, the yield and quality of drug can be considerably improved. He further said that different varieties vary considerably in their relative richness in alkaloids. There is a remarkable difference in the drug producing

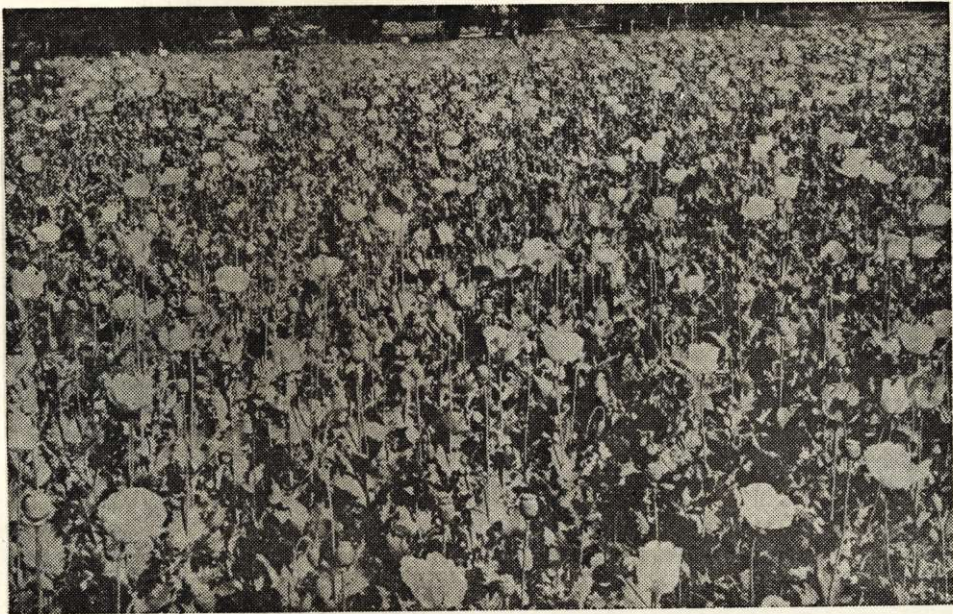


Fig.1 Poppy flowering at the Medicinal Plant Farm, Peshawar.

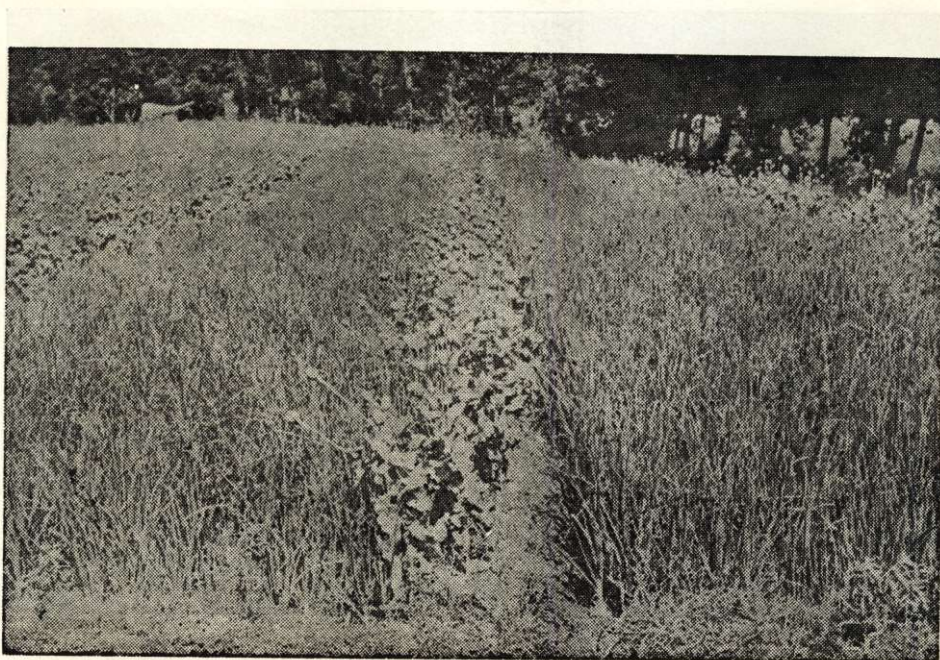


Fig.2 Poppy grown on ridges with onion in the Malakand Agency.

functions of different individual capsules of certain plants, some producing scarcely one grain of drug while others yield 18-30 grains per capsule (6).

Dr. Lyell stated that only the white variety of poppy is grown in Patna and Banares Agencies (6). Trials made in Germany had shown that of the three varieties white, red and purple, white poppy yielded least opium and the purple more, while opium from purple variety contained three times as much morphine as the white one, but only 1/8th part of its narcotine. The opium from red poppy is intermediate between the two (6). Fleming is of the view that white poppy is preferred for cultivation because it suits the climatic conditions (2). According to Watts the variety generally cultivated in India is *P. somniferum* Var. album with white flowers and white seeds but red flowered and black seeded variety is met within Himalayas. He described in detail fourteen varieties of poppy grown in India. According to Duthie and Fuller the varieties grown in N.W.F.P. are all white flowered because they are better suited to the local climate than the purple flowered grown in Malva (6).

Shulgin (1969) a Russian Scientist describes three most recent varieties grown in Russia based on the time of ripening i. e., early ripening 222m., middle ripening D-250 and late ripening 133. He further suggests that the capsule should be lanced only three times as further lancing becomes uneconomical. He has recommended sandy loam brown soil and three types of fertilizers i. e., Super phosphate, Nitrogen and Potash to be applied for better growth and maximum yield of opium (5). However Imam (1964) claimed yield of 14% morphine in white seeded variety of opium. He further said that the exudation of opium latex is at maximum in the fifth lancing (3).

Material. Seeds of different varieties of *Papaver somniferum* were collected from various localities of N. W. F. P., Care was taken that all shades of seeds were collected. Later on only three shades of seeds i.e., white seeds, black seeds, and reddish white seeds were selected for sowing at Peshawar Farm for multiplication. Constant selection of healthy and large capsules was carried out in all the varieties for two years to obtain the most viable and healthy seeds for experimental purposes.

Method. Cultivation trials were conducted on the above mentioned three varieties at the Peshawar Farm of Medicinal Plants Branch of Pakistan Forest Institute, during the years, 1969-70, 1970-71 and 1971-72. Following methods were used for cultivation and record of morphological and yield characters.

1. Experimental plot size was 1/32 of an acre.
2. Sowing was done on the same date for three years to equalise the effect for climatic conditions.
3. Seed rate was 6.6 lbs. per acre i. e., three ounces of seeds were used per plot.

4. Four replications in each variety were made to balance the soil factors for yield.
5. Sowing was done in twenty four inches wide rows and later on thinning was done to maintain a distance of six inches from plant to plant. It was made sure that there was a uniform growth in lines and no gap existed in any replication.
6. Time taken for germination was recorded when fifty percent seeds had germinated.
7. Time taken for flowering was recorded when fifty percent buds in the plots opened.
8. Colour of flowers and seed was recorded with the help of Wilson colour chart.
9. Period taken for maturing was recorded when the capsules matured and acquired straw colour.
10. Lancing of the capsules was done eight times in each replication to record the yield of fresh opium per plot. The number of lancing was fixed to eight as our past experience in cultivation of poppy, showed that after the eight incision there was no latex oozing out from the capsule.
11. Average yield of opium and seeds per plot for three years was multiplied with thirty two (32) to record the yield per acre.
12. Data on the morphological characters were recorded on one hundred plant selected at random i. e., twenty five plants in each replication. For randomisation, plants from each line were numbered away from the field and later on that number was located in line and measurements were recorded.
13. Height of the plant was recorded in centimeters with the help of meter rod from the surface of the soil to the top of the plant.
14. Length of the capsule was recorded in centimeters from the basal ring upto crown of the capsule with the help of calliper. Breadth of capsule was measured from the middle of the capsule.
15. Number of capsules per plant was recorded by counting the capsules of one hundred plants selected at random. Number of large, medium and small capsules per plant was also counted and later on their ratio percentage was calculated.
16. Chemical analysis of opium obtained from different varieties was carried out by the Chemistry Branch of the Pakistan Forest Institute, Peshawar.
17. To find out whether there is any significant difference in the characters of three varieties under trial, "t" test was applied.



Fig.3 A Close up of capsules of white poppy.



Fig.4 A close up of capsules of red seeded variety of poppy.

Results.

(a) *Presentation of Data* : Morphological and yield characters of three varieties of *Papaver somniferum* are presented in Table I and II alongwith "t" test.

(b) *Interpretation of results* : It is clear from the tables that there are significant differences in most of the characters of all the three varieties while the differences are non significant in some of the characters. Characterwise interpretation of results is given as under :—

AVERAGE HEIGHT OF THE PLANT AND GIRTH OF THE STEM

There is no significant difference in the height of plant of all the three varieties under trial. Height of the plant ranges from 40 to 46 centimeters in different varieties. Similarly there is no difference in girth of stems of all the three varieties.

COLOUR OF FLOWER AND SHAPE OF CAPSULE

All the three varieties have marked difference of colour in their petals. White seeded variety produces white petals or reddish white flowers. Black seeded variety bears mauve coloured petals with deep maroon blotch near the base of petal while red seeded variety produces mauve coloured petals with light maroon blotch near the base of petal.

Shape of capsule in case of white seeded variety is oval, while black and red seeded varieties produce oblong capsules, but the capsules of black seeded variety are a bit longer as compared to red seeded variety.

AVERAGE NUMBER OF CAPSULES PER PLANT

White seeded variety produces less number of capsules per plant as compared to black seeded variety, there is no difference in the number of capsules in black and red seeded varieties.

AVERAGE LENGTH OF LARGE, MEDIUM AND SMALL CAPSULES

Differences in length of large capsules of all the varieties is significant. Black seeded variety produces largest capsules, while the white seeded variety produces capsules which are shortest. Red seeded variety produces capsules which are intermediate in length.

There is no significant difference in the length of medium capsules of white and black seeded varieties. Similarly the difference in length of capsule is insignificant in black seeded and red seeded varieties. However, when the white seeded and red seeded varieties are compared for this character, the difference is very significant.

Black seeded and red seeded varieties produce longer capsules as compared to white seeded variety and the difference is significant, while there is insignificant difference when red and black seeded varieties are compared with each other in the length of small capsules.

AVERAGE WIDTH OF LARGE, MEDIUM AND SMALL CAPSULES

There is a significant difference in the width of capsule as the diameter of white seeded capsule is more as compared to black and red seeded varieties. Difference in the red and black seeded varieties is insignificant.

PERCENTAGE OF LARGE, MEDIUM AND SMALL CAPSULES

All the three varieties were compared with each other for the above mentioned characters and it was found that the difference is insignificant as regards percentage of capsules in different varieties.

COLOUR OF SEED

White seeded variety produces white seed, while the colour of seeds in case of black seeded variety is bluish grey and black. Red seeded variety produces reddish white seeds.

AVERAGE NUMBER OF DAYS TAKEN FOR GERMINATION, FLOWERING AND MATURITY.

Statistically there is no significant difference in time taken for germination, flowering and maturity of all the three varieties except that white seeded variety produces flowers and capsules nine days earlier as compared to black and red seeded varieties. This difference is very important for a cultivator as he can cultivate both the varieties at a time and there would be no difficulty at the time of lancing due to gap of nine days in maturity.

AVERAGE YIELD OF OPIUM

White seeded and black seeded varieties have insignificant difference as regards yield of opium per acre. Both the varieties yield more opium as compared to red seeded variety and the difference is highly significant.

AVERAGE YIELD OF SEEDS.

As regards yield of seed per acre, black seeded variety yield significantly more seed as compared to red seeded and white seeded varieties. There is no significant difference in the yield of seed of red and white seeded varieties.

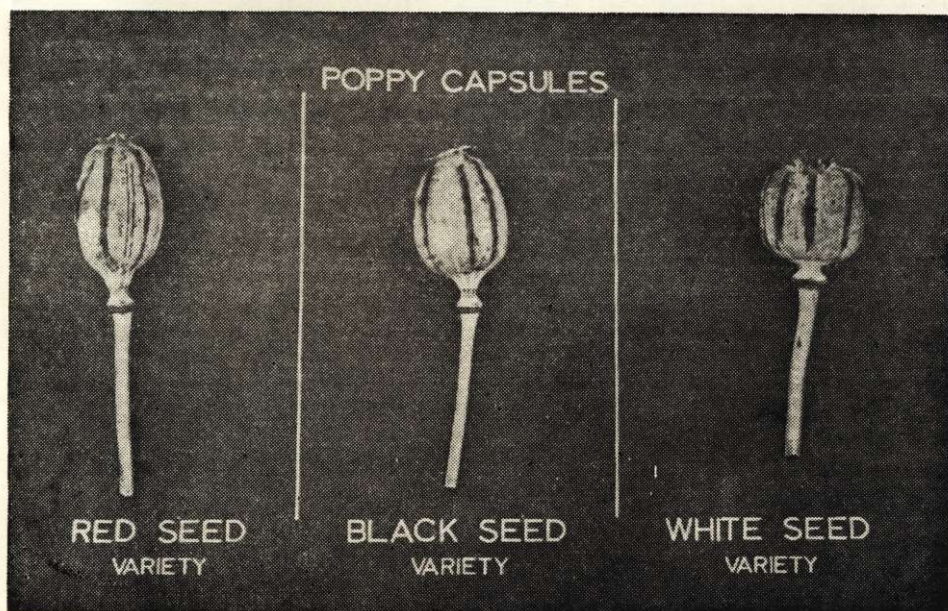


Fig. 5 Distinction in shape of poppy capsules of three varieties.

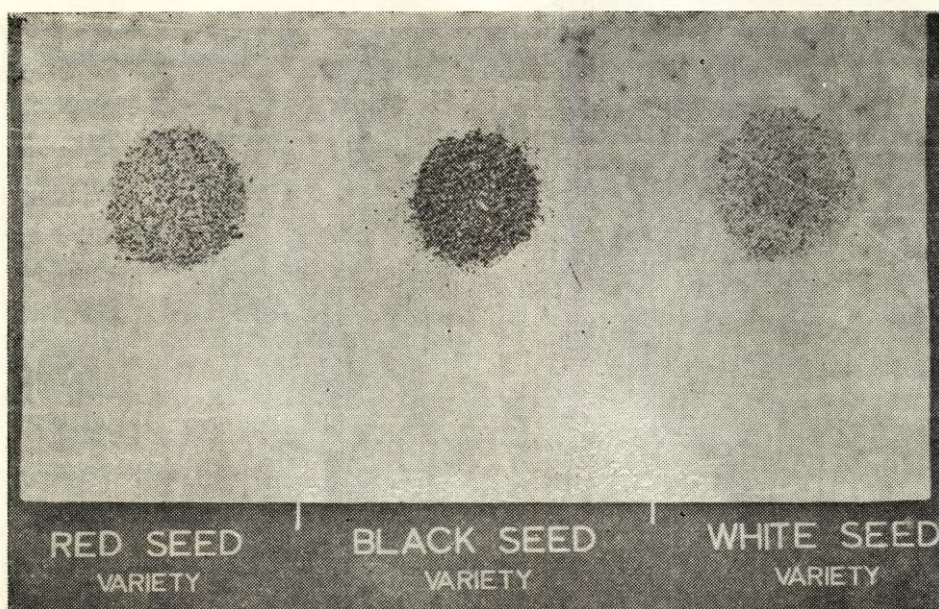


Fig. 6 Photograph showing the difference in colour of seeds of the three varieties.

CHEMICAL ANALYSIS.

Chemical analysis has shown that there is no significant difference in the morphine contents of white seeded and black seeded varieties, while the difference in the morphine contents is significant when both the above mentioned varieties are compared with red seeded variety.

DISCUSSION.

Comparative studies on the above mentioned three varieties have shown that white and black seeded varieties, though different in colour of flowers, size and shape of capsules and other characters yield equal quantities of opium. Moreover, opium obtained from both the varieties shows no significant difference in the percentage of morphine contents *i. e.*, 13.20 and 12.40 percent. Percentage of morphine is very normal in white and black seeded varieties as compared to prescribed pharmacopoeial standards.

Although black seeded variety yields more seed as compared to white seeded variety yet, since, the colour of the seeds is black, it is sold at a very low rate *i. e.*, Rs. 15/- per maund*, while the seed of white seeded variety is sold at Rs. 80/- to Rs. 100/- per maund. However, black seeded variety can become a good source of "Khashkhas oil" if efforts are made to extract the oil for export or home consumption. As regards red seeded variety since it is poor in yield of opium, seed and percentage of morphine contents its cultivation, therefore, should be stopped in the province.

CONCLUSION.

Pakistan is a developing country and is in urgent need of foreign exchange which should be saved to build up our foreign exchange reserves for the purpose of development of the country. At present Pakistan is importing opium derivatives worth three million rupees and due to devaluation this would become a staggering figure of rupees six million per annum. With the implementation of the new "Health Policy" a lot of extension is expected in the number of hospitals in the country. Morphine is an essential part of the modern system of therapy and therefore, production of morphine is a must to meet home consumption and to save foreign exchange spent at present for import of morphine. Raw material is available in this country but it requires a systematic planning and handling of opium and morphine production by the Government as is being done in some countries. This action on one hand would be helpful to stop the smuggling of narcotics and on the other would be helpful to meet the

*(Maund)=82 lb.

demand of morphine for hospital consumption. Following suggestions are made to boost up morphine production in the country.

1. White and black seeded poppy should be cultivated under strict supervision of the Government on state owned farms or contract should be given to a private firm for its cultivation under supervision of Excise Department.

2. A morphine factory should be established in the N. W. F. P. as this area is suitable for cultivation of poppy.

3. Government rates for procurement of opium are very low and thus farmers are compelled to adulterate the stuff or smuggle it out of province. Government should increase price for its procurement to make it attractive for cultivators to hand-over their opium to the Excise Department.

4. As cultivation of poppy cannot be regularised in the tribal area, therefore efforts should be made to introduce alternate cash crops which should provide more income to cultivators to stop cultivation of poppy in tribal belt of Pakistan.

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



































REFERENCES.

1. Anonymous .. 1971 Foreign trade statistics of Pakistan Import July, 1970 to June, 1971, Published by Central Statistical Office Government of Pakistan Karachi pp. 104—105.
2. Chopra R. N. .. 1956 Indigenous drugs of India Published by U. N. Dhur and Sons Private Ldd. 15 Bankim Chatterji Street Calcutta-12-pp; 202-216.
3. Imam S. M. .. 1964 Observation and studies on the morphine contents of opium from *Papaver rhoeas* cultivated under Abbottabad climate Pakistan J. For. Vol. XIV. No. 3. pp. 182-189.

4. Kritikos G. and Papadaki S.P. 1967 "The history of poppy and of opium and their expansion in antiquity in eastern Mediterranean area" (Bulletin on Narcotic, Published by Department of Economic and Social affairs Division of Narcotic drugs United Nations New-York) Vol. XIX. No. 3 pp: 17-38.
5. Shuljgin G. .. 1969 'Cultivation of opium poppy and the oil poppy in the Soviet Union" (Bulletin on Narcotic, Published by Department of Economic and Social affair Division of Narcotic drugs United Nations New York) Vol. XXI No. 4 pp: 1-8.
6. Watts G. .. 1819 The Economic Products of India(W. H. Allens and Co. 13-Waterloo place S.W. Published by the India Office Calcutta) Vol. VI, Part I pp: 16-104.
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TABLE I COMPARATIVE STATEMENT OF MORPHO
IN DIFFERENT VARIET

CHARACTERS AT 5% LEVEL OF SIGNIFICANCE
PAPAYER SOMNIFERUM

VARIETY	HEIGHT OF THE PLANT IN CM	GIRTH OF THE STEM IN CM	COLOUR OF FLOWERS	SHAPE OF CAPSULES	NO OF CAPSULES PER PLANT	LENGTH OF LARGE CAPSULES IN CM	LENGTH OF MEDIUM CAPSULES IN CM	LENGTH OF SMALL CAPSULES IN CM	WIDTH OF LARGE CAPSULES IN CM	WIDTH OF MEDIUM CAPSULES IN CM	WIDTH OF SMALL CAPSULES IN CM	PERCENTAGE OF LARGE CAPSULES	PERCENTAGE OF MEDIUM CAPSULES	PERCENTAGE OF SMALL CAPSULES	COLOUR OF SEEDS
WHITE	80-51 	1-51 	WHITE OR WHITE & PINK	OVAL	3-58 	4-72 	4-49 	3-42 	5-94 	4-95 	3-73 	30 	40 	40 	WHITE
BLACK	105-29 	1-27 	MAUVE WITH A DEEP MAROON BLOTCH ON THE PETAL	OBLONG	5-43 	5-83 	4-91 	3-72 	4-70 	4-14 	3-09 	14 	40 	46 	BLUSH GREY
RED	105-38 	1-30 	MAUVE WITH A LIGHT MAROON BLOTCH ON THE PETAL	OBLONG	4-70 	5-30 	5-09 	3-78 	4-95 	4-33 	3-08 	45 	43 	45 	BROWN

S — SIGNIFICANT
NS — NON SIGNIFICANT

TABLE II SHOWING NUMBER OF DAYS TAKEN FOR GERMINATION,
FLOWERING, MATURITY AND YIELD OF OPIUM, SEED AND
PERCENTAGE OF MORPHINE CONTENTS

VARIETY	NO OF DAYS TAKEN FOR GERMINATION	NO OF DAYS TAKEN FOR FLOWERING	NO OF DAYS TAKEN FOR MATURITY	YIELD OF FRESH OPIUM PER PLOT IN GRAMS.	YIELD OF FRESH OPIUM IN Lbs. PER ACRE	YIELD OF DRY OPIUM IN Lbs. PER ACRE	YIELD OF SEEDS IN Lbs. PER PLOT	YIELD OF SEEDS IN Lbs. PER ACRE	PERCENTAGE OF MORPHINE
WHITE	11	140	191	533.33	37.6	26.6	6.66	213.1	13
BLACK	10	149	199	439.66	31.0	19.0	10.59	335.0	12
RED	10	148	192	264.66	18.7	12.2	5.68	181.7	8

S — SIGNIFICANT

NS — NON SIGNIFICANT

7E