CHAPTER III

RESULTS AND DISCUSSION

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Before Spray The Insecticide :-

Aphid is the important sucking type of pest. It is a polyphagus pest. Aphids are smaller insects measuring about 2mm in size. They are yellowish or dark green or black in colour. Aphids are soft bodied insects on the abdomen there are 2 outgrowths known as cornicles. The winged forms are produced late in the season. The Nymphs are smaller.

Aphid is sucking type of insect. The mouth parts are modified into a sharp hallow tube known as stylet. Through the stylet aphid suck the cell sap. As large number of aphids are present crowded on the stem and lower surface of the leaf. Due to excessive sucking plant loose their vigour, they are stunted in growth.

Both the winged and wingless forms are reproduce viviparlously and parthenogenetically. Each female produce about 8 to 22 nymph. The rate of reproduction is fasty the number is increases rapidally. Some times female lay eggs after muting (ovipurous). The nymphs feeds on the plant for about 5 to 6 days. The life cycle is completed in 7 to 9 days.

FIG. II: APHID INFESTATION ON SAFFLOWER
[CARTHAMUS TINCTORIUS L.] VARIETY-7

FIG. 1 : HEALTHY SAFFLOWER
[CARTHAMUS TINCTORIUS L.] VARIETY -9

FIG. II: APHID INFESTATION ON SAFFLOWER
[CARTHAMUS TINCTORIUS L.] VARIETY-7

Table No. 4

Effect of Aphid Infestation on the physical properties of Safflower (Carthamus tinctorius L.) Varieties

Parameters	Healthy	Infested
1) Average leaf area (Cm^2)	7.65	4.09
2) Plant height (Cm)	14	13
3) Biomass (gm)	23	20
4) Leaf moisture %	60	55

Recently experiment have been done to control the aphids by introducing lady bird betle's insect. The larva and adult betle's feeds on aphids and control the aphids.

1) Effect of aphid infestation on physical properties:-

1) Leaf Area :- The leaf area is decreased in infested plant. The values are depicted decreased in Table No.4.

2) Plant height is also decreased in infested plant.

3) Biomass is also decreased. The values depicted in Table No.4 due to aphids infestation the biomass is decreased. The aphids sucks cell sap from leaves and stem. Bahadue et al (1989) reported that due to industrial effluent on growth of pisum sativum. Leaf area, Biomass is decreased, plant height is also decreased.

4) Leaf Moisture :- Leaf moisture is also decreased due to aphid infestation Adams et al (1978) have observed that a decrease fresh weight and dry weight due to nitrogen deficiency.

Effects of Aphid infestation on organic constituents:-

1) Chlorophylls :- Chlorophyll is decreased in aphid infested plant. The chlorophyll in safflower is depicted in Table 5. Chlorophyll 'a' is decreased and chlorophyll 'b' is increased in aphid infested plant, The total chloro. is also decreased in aphid infested plant Mehrota et al (1989) studied on Fe deficiency on chlorophyll in maize. Iron depressed chlorophyll

in plant. Mehta et al (1991) reported that chl.'a', chl.'b' and total chl.a reduced due to Mg deficiency in Salvinia molesta. Mg is only metallicion present in chlorophyll the size of photosynthesis Umesh Kumar et al (1990) reported that due to leaf spot disease on Ferminalia chlorophyll content is decreased.

2) Effect of aphid infestation on polyphenols:-

Polyphenols are commonly known as tannins. They take part in growth metabolism and act like, phytoharmones from the present investigation (Table 5) it appears that in aphid infested plant the polyphenols are decreased. Decrease in polyphenols content in the plant is succeptible variety. In resistant variety polyphenols is more Umesh Kumar et al (1990) in Terminalia infested by leaf spot they observed decreased in polyphenols, content suggests that they have no role to play in imparting resistance to host plant.

3) Carbohydrates :- The carbohydrates also increased the values are depicted in Table No.5.

Mehta et al (1991) reported that due to deficiency the sugars are reduced in salvinia molesta mg increases sugars are increased. Umesh Kumar et al (1990), reported that in Jemminalia infected by leaf spot reducing sugars and starch levels were considerably increased. Umesh Kumar et al (1990) reported that in morus alba under pathogenesis reducing sugars and starch is increased in fected mulberry leaves.

Table No. 5

Effect of Aphid Infestation on organic constituents of Safflower (Carthamus tinctorius) Variety

Parameters	Healthy	Infested
* Chlorophyll 'a'	81.09	73.64
* Chlorophyll 'b'	98.68	85.58
* Total chlorophylls	179.77	158.22
* Chl.'a' / Chl.'b'	1.21	1.16
** Polyphenols	1.805	1.452
** Starch	8.47	9.75
** Sugars	3.84	4.12
** Protein	5.2	4.654
** Nitrogen	0.83	0.74

** Values expressed as mg g^{-1} 100 g^{-1} fresh tissue

* Values expressed in Mg $100g^{-1}$ fresh tissue.

FIG.III: IDENTIFICATION OF APHIDS
[CLOSE UP]

4) Nitrogen :-

Nitrogen is also decreased in aphid infested plant. The values depicted in Table No. 7.

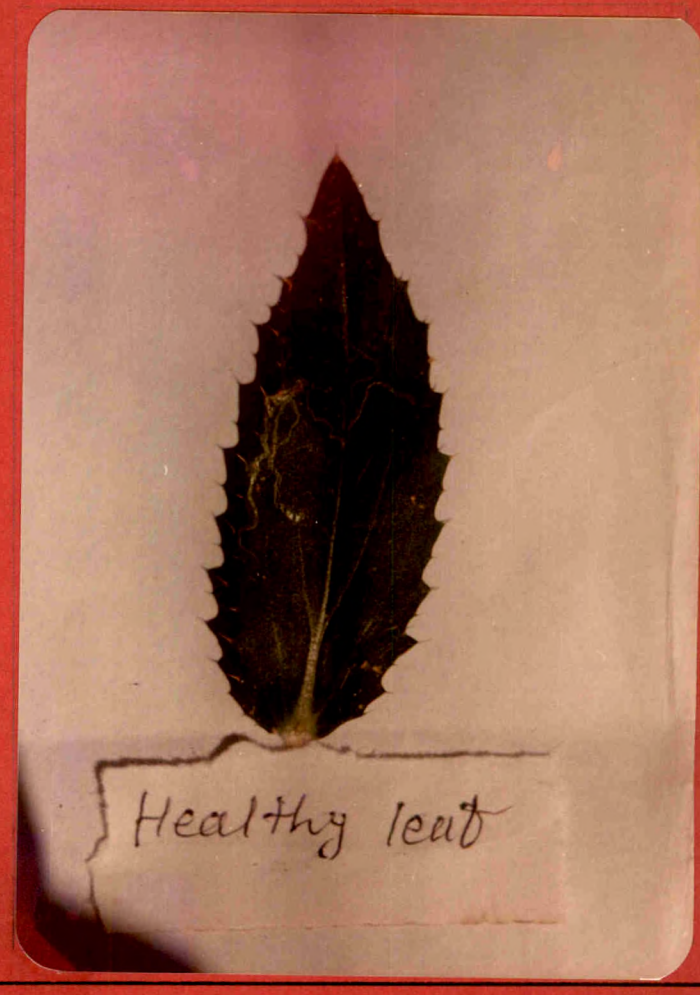
Sinha et al (1991) studied the effect of potassium deficiency nitrogen metabolism in Salvinia molesta. Due to potassium deficiency nitrogen and protein decreases Panda et al (1991) reported that in egg plant due to the infection of little leaf disease protein and nitrogen content is decreased. Sinha et al (1987) studied in Salvinia molesta effect of ca deficiency on nitrogen metabolism. Nitrogen and protein decreased due to calcium deficiency. Umeshkumar et al (1990) reported that in morus alba under pathogenesis nitrogen content is also reduced.

Umeshkumar et al (1990) in Terminalia by leaf mf spot infection. Nitrogen content is reduced. According to Ruskar et al (1985) studied the effect of shootfly in serghum on the basis of bichemical resistance. In them Nitrogen percentage is decreased by the infestation of shootfly.

According to Sinha et al (1987) studied on mineral nutrition of Salvinia molesta effect of calcium deficiency on nitrogen metabolism on them due to ca deficiency nitrogen content is decreased.

FIG. IV: APHIDS ON THE LOWER SURFACE OF THE LEAF OF SAFFLOWER [CARTHAMUS TINCTORIUS L.] VARIETY

AND ALSO HEALTHY LEAF



C) Inorganic Constituents :-

In plants the inorganic elements play an important role in plant metabolism. They required by plant for their different functions. The relative concentration either excess or deficit in plant alters their growth pattern. The leaf is an ideal plant organ which shows major metabolic processes. The results of the effect of aphid infestation on different inorganic elements in the leaves of safflower local variety is depicted in table 6 and discussed below.

1) Sodium :- Safflower shows increased in sodium content under aphid infestation. Werkhoven et al (1966) has shown that increasing sodium upto 30% resulted in increase in yield and seed oil. Pozulla and Felipe (1972) reported the absorption and translocation of sodium in safflower. Generally oil seed crops show low amount of sodium in the leaves e.g. Arachis bypogea 0,08% and Guizotia abyssinica 0.06% (Nalawade, 1983). But safflower leaves show comparitively higher amount of sodium which ranges between 1.00% to 1.4% dry wt. Nagaraja et al (1988) reported that due to infection of phyllosticta on mallotus philippinensis sodium content is increased. According to B.T.M.Patil and S.S.Patil (1991) reported that due to red rot and rust infection sodium content B increased.

II) Potassium :- Potassium is an important element in plant metabolism. It acts as a cofactor in most of the biochemical

Table No. 5

Effect of Aphid Infestation on Inorganic Constituents of Safflower (Carthamus tinctorius L.) Variety.

Inorganic element	Healthy	Infested
Na^{+}	1.1	2.3
K^{+}	1.7	1.2
K/Na	1.546	1.91
Ca^{2+}	5.1	5.45
Mg^{2+}	1.41	1.57
Fe^{3+}	0.56	0.46
Cu^{2+}	0.1316	0.1215
Zn^{2+}	0.24	0.16
Mn^{2+}	0.02	0.019
Cl^{-}	1.64	1.5087

* Values expressed in g $100g^{-1}$ dry tissue.

reactions. In the present investigation potassium estimated in aphid infested safflower and found that potassium is decreased in them. (Table 6) Due to the aphid infestation the potassium is decreased. The potassium content in safflower was studied Bisht et al (1987) According to him potassium deficiency resulted in reduced growth and development and exhibited visible symptoms as brown necrotic spot in the middle of the leaves of safflower potassium, sodium ratio also decreased under aphid infestation. Sinha et al (1991) studied effect of potassium deficiency on nitrogen metabolism, potassium deficience reduces protein, and nitrogen in Salvinia molesta Patil et al (1991) reported that due to infection of red rot and rust diseases on sugarcane potassium is reduced. Nagaraja et al (1988) reported that due to phyllostiota disease on mallotus philippinensis their is decrease in potassium content. The ratio or the sodium, potassium is increased in aphid infested plant.

III) Calcium:- The result of calcium in safflower variety is depicted in Table 6, from this it is clear that in apnid infested plants calcium is decreased.

The calcium is generally regarded as the most immobile element and deposited in leaves (Ferguson and Bollard, 1976). The calcium content differs with plants. The optimum value for terrestrial plants is 0.5% dry wt. (Epstein, 1972).

Nagaraja et al (1983) reported that due to phyllosticta disease on mallotes philippinensi) increases the calcium content. [redacted] Patil and [redacted] Patil (1991) red rot and rust infection in sugarcane the calcium content

IV) Magnesium :- Magnesium content in safflower variety is shown in Table 6. Magnesium is increased in aphid infested plant. Magnesium is a constituent of a chlorophyll molecule an activator of certain enzymes and an osmotic regulator (Sutcliffe 1967). The average values for magnesium in terrestrial plants ranges from 0.05% to 0.79% dry wt. (Ferry and ward 1959). But the plants need about 0.2% Magnesium for the optimum growth (Epstein, 1965). Magnesium deficiency reduces phospholipids phosphotidyl glycerol and galactosylidiglycerides (Kongstrud, 1969). [redacted] Patil and [redacted] Patil (1991) reported that in red rot rust infection in mineral composition of sugarcane mg^{2+} is increased.

V) Iron :- The iron content of the safflower variety is recorded in Table 6. From this it is clear that the iron content is slightly decreased.

As far as iron is concerned it play an important role in chlorophyll synthesis, ferredoxin synthesis, controlling activity of ribulose diphosphate carboxylase the rate of carbon assimilation in sugar phosphates and sucrose formation etc. (Ralph, 1975). Sangale et al (1981) have shown that spraying of iron in the form of 0.4% ferrous sulphate with 0.2% borax and 0.5% Zinc sulphate increases yield

in safflower considerably. The iron values for land plants are 0.011% dry wt. (Epstein, 1972) In present investigation safflower variety show a correlation between the accumulation of iron and chlorophyll in aphid infestated plant. Iron deficiency depressed chlorophyll content (Mehrotra et al 1989). Nagaraja et al (1988) reported that due to infection of phyllosticta on Mallotus philippinensis. Iron content is increased.

VI) Copper :- The result of copper in safflower variety is shown in Table 6. The copper content is slightly decreased in aphid infested plant.

~~Dr.P.M.~~Patil and ~~S.S.~~Patil (1991) in effect of red rot and rust infection on mineral composition of sugarcane tissue. In them no accumulation of cu due to fungal infection. Copper provides metabolic control over ouxin synthesis and is involved in protein and carbohydrate metabolism. Copper is component of several metallo-emymes including ascorbic acid. Oxidase, tyrosinese, and cytochrome oxidase.

VII) Zinc :- The result of zinc content is recorded in Table 6. The zinc content is decreased in aphid infested leaves.

Zinc is a major micronutrient. In safflower the yield is increased by spraying 0.5% Zinc sulphate (Sangale et al 1981). ~~Dr.P.M.~~Patil and ~~S.S.~~Patil (1991) Zinc content is decreased Zinc play an important role in auxin synthesis.

VIII) Manganese :- The manganese content in safflower variety is depicted in Table 6. The manganese content is slightly decreased in leaves of aphid infested plant. The normal value of manganese for growth and development is 0.005% (stout 1961) From the present investigation it is clear that manganese is sufficient in the safflower.

Recently, hewis and Mc Fralane (1986) have shown that the application of manganese significantly increased safflower yield from 1010 to 1050 Kg/ha by increasing number of seeds per plant. Manganese also a micro element Mn deficiency decreases the photosynthetic rate, leaf area, and chlorophyll content etc. chenine (1970) has reported role of Mn in till reaction.

IX) Chlorides :- The chloride content is depicted in Table 6. It has been observed that when present in low concentration stimulates plant growth. But harmful at higher concentration. In present investigation the chloride iron content decreased. The chloride ion shows stimulatory effect on Hill reaction (Izawa et al 1969) Osmund (1968) has reported that Cl content in land plants very from 1 to 3% of dry tissue, (ferry and ward 1959) our results show accumulation of 7.647% chloride in safflower. But under aphid infestation the amount of chloride is reduced which probably inhibits the photosynthetic reaction.

B) After Spray The insecticide :- For the control aphids and other insect pests we can use many types of pesticides.

FIG. V: METHYL PARATHION [BOTTLE]

Table No. 7

Effect of Methyl parathion on the physical properties of Safflower (Carthamus tinctorius L.) Variety

Parameter	Control	0.025%	0.05%	0.1%
1) Average leaf area $(Cm)^2$	7.64	6.60	5.96	5.41
2) Plant height (Cm)	20	19	21	19
3) Biomass (g)	25.5	22.3	27.2	24.5
4) Leaf moisture %	60	71.36	63.22	66.58

* Values expressed as g $100g^{-1}$ fresh tissue.

In the present investigation attempts have been made to study the effect methyl parathion on the physiology of safflower plant. Methyl parathion is a organophosphorate compound. It is superior to organochlorine compounds because of their quick action and it is non persistant i.e. it is easily degraded into simpler and harmless chemicals.

(a) Effect of Methyl Parathion on physical properties of Safflower:-

Average leaf area, plant height, Biomass and leaf moisture is increased and is depicted in Table 7. Trivedi et al (1990) reported that effect of endosulton on plant growth. Total biomass increases with age of the plant. The height of the plant is also increased also increases the size and shape of the leaves. Endosulton foliar application at 0.01% and 0.05% produced no toxic effect but ØØ 0.1% and 1% visible symptoms are appeared. In higher doses the height of the plant, biomass and size and shape is decreased. As the concentration increased it appeared that there was reduction in the leaf area. The reduction in the leaf area at higher concentration plant height is also increased at recommended dose and at low concentration and nigh concentration slightly increased leaf moisture, content is increased at below recommended dose and moisture content is lower at higher concentration from table 7 it is clear that methyl parathion favoured growth at recommended dose (0.05%) and below recommended dose from this we can safely say that methyl parathion can be used at recommended dose and below recommended dose

Table No. 8

Effect of Methyl parathion on the organic constituents of Safflower (Carthamus tinctorius L.) Variety

Parameters	Control	0.025%	0.05%	0.1%
* Chlorophyll 'a'	98.85	87.47	91.95	76.18
* Chlorophyll 'b'	81.00	77.99	77.06	60.2
* Total Chlorophyll	179.85	165.46	169.01	136.38
* $\frac{\text{Chl.'a'}}{\text{Chl.'b'}}$	1.22	1.133	1.19	1.26
** Polyphenols	1.845	1.489	1.745	1.589
** Starch	11.15	7.86	9.47	7.02
** Sugar	4.57	3.05	3.79	3.45
** Protein	5.83	4.96	6.14	5.985
** Nitrogen	0.93	0.76	0.99	0.9

* Values expressed in Mg $100g^{-1}$ fresh tissue.

** Values expressed as g 100 g^{-1} fresh tissue.

control the sucking pest and favour the crop growth.

B) Effect of methyl parathion on organic constituents:-

I) Chlorophyll :- The results of effect of methyl parathion treatment on chlorophyll are recorded in Table 8. The chlorophyll content is increased the chlorophyll synthesis is stimulated at 0.05% metnyl parathion.

Trivedi et al (1990) reported the effect of endosulforn insecticide on Vigra radiata. Chlorophyll content is increased at all doses or treatment. In higher doses the inhibitory effect was more seriously registered in the chlorophyll a fraction causing lowering of chl a/b ration. Therefore instead of 0.07 to 0.1% dose concentration the foliar spray at 0.05% is recommended dose for mungbean crop as it is non phytotoxic and insecticidally active. Kakalipaul et al (1987) reported that effect of phenoxyacid on costus speciosus (Koenig). chlorophyll content is increased in them.

Our results are also show same pattern i.e. at low concentration (0.025%) stimulate the chlorophyll content and higher concentration (0.1%) inhibits the chlorophyll content and at recommended dose the chlorophyll content is increased. This indicates that insecticide may slowly absorb in the leaf tissue either by symplastic movement through the living tissue or by apoplast movement through cuticular tissue and then possibly it governs the mutabolic activities in the plant such as increase in chlorophyll content.

II) Polyphenols :- Table 8 records the effect of methyl parathion on the polyphenolic content in safflower. It show increased polyphenol content. The safflower show maximum polyphenols at 0.05% Methyl parathion sprayed plant but not above the control value.

The polyphenol content in methyl parathion sprayed plant increased in all concentration. The maximum polyphenol content is in recommended dose (0.05%).

Generally accumulation of polyphenols acts as a mechanism of resistance against the pathogen (Wang, 1961) from the view of wang (1961) because of the stimulation of polyphenols by lower concentration the plant become resistant to pathogen attack. However, it needs further study to elucidate plant pathogen and polyphenol relationship under the influence of pesticidal spray. At present we can say that stimulation of polyphenol by these insecticides may possibly develop resistance against pathogen too.

III) Carbohydrates :- The effect of methyl parathion on the carbohydrate content in safflower is recorded in Table 8. Starch content is increased in recommended dose and stimulation of starch at low concentration and reduction in high concentration. Reducing sugar synthesis is increased at recommended dose and low concentration reduction in sugars content and at high concentration increases sugar content.

According to lalithakumari et al (1984) on the Tikka disease of ground nut systemic fungicide is sprayed. The effect of systemic fungicide in carbohydrates content is reducing sugars are increased and starch is also increased than the other systemic fungicides.

Generally no consistency in the carbohydrate content in oil seed plants under pesticidal spray was noted.

IV) Nitrogen :- Table 8 records the effect or methyl parathion on the Nitrogen content in safflower. It shows increase in Nitrogen content. The maximum nitrogen present in 0.05% methyl parathion sprayed plant but not below the control value. Lalithakumari et al (1984) reported that effect of systemic fungicide on tikka disease of groundnut in them increases protein and total Nitrogen.

Nitrogen content is increased in recommended dose (0.05%) and nigher concentration (0.1%) and in low concentration it is slightly increased. Protein content is also increased in recommended dose (0.05%) and in high concentration (0.1%) and in low concentration it is slightly increased.

Increase in nitrogen content increases the plant height.

(C) Effect of methyl parathion on the inorganic constituents:-

In the present investigation the accumulation of different elements in the leaves of safflower variety and the results are depicted in Table 9. The supply of absorption of these inorganic constituents is needed for growth and metabolism

Table No. 9

Effect of Methyl parathion on Inorganic constituents of Safflower (Carthamus tinctorius L.) Variety.

Inorganic element	Control	0.025%	0.05%	0.1%
Na^{+}	1.1	1.80	1.42	1.08
K^{+}	1.7	1.5	2.2	1.05
K^{+}/Na	1.54	1.21	1.54	1.78
Ca^{2+}	5.1	5.75	5.65	4.50
Mg^{2+}	1.41	1.12	1.10	1.06
Fe^{3+}	0.56	0.47	0.53	0.47
Cu^{2+}	0.13	0.13	0.14	0.13
Zn^{2+}	0.24	0.19	0.12	0.21
Mn^{2+}	0.02	0.019	0.022	0.02
Cl^{-}	1.84	1.50	1.67	1.86

* Values expressed in g $100g^{-1}$ dry tissue.

In order to overcome pest and disease attack, plants are oftenly subjected to pesticidal treatment.

1) Sodium :- Sodium is an important micronutriant which control plant growth and development. The values of sodium in the leaves of safflower (table 9) ranging from 1.0 to 1.8% dry wt. Heikal (1976) has reported the accumulation of sodium which shows many harmful effects such as reduction in leaf number, leaf length and leaf area.

Werkhoves et al (1966) have reported that, due to accumulation of sodium the safflower yield and growth is reduced. Pozuelo and Felipe (1972) have shown that accumulation of sodium is restricted to root so that leaves are kept away from the toxic effect of sodium. Sodium content is increased in recommended dose and below recommended dose to (0.025%) over control. Among the three concentrations used, 0.05% methyl parathion appeared to be favourable for Na^+ up take in safflower.

2) Potassium :- The results of the effect of methyl parathion on potassium content in the leaves of safflower variety, is depicted in Table 9. The potassium content is increased and the ratio of potassium sodium is also increased in recommended dose and at high concentration.

Potassium is a monovalent cation required by the plant for many metabolic processes such as osmatic regulation (Okanenko et al, 1978) growth initiation and regulation. But a major role of potassium is to activate enzymes. Evans and sorger (1966) have recorded 46 enzymes activated by potassium. The average value of potassium is 1%

dry wt. (Epstein, 1972) from our results it seems that safflower is rich in potassium content. Bisht et al (1987) have shown the effect of potassium deficiency on growth and development and exhibited necrotic spots on the middle of the safflower leaves. Potassium content is increased in recommended dose (0.05%) and high concentrations (0.1%) Humble and Hsiao (1969) have revealed that K+ plays a significant role in stomatal opening and closing. Low water loss of plants well supplied with K^+ is due to a reduction in transpiration rate (Brag 1972). The ratio of sodium potassium is increased in recommended dose (0.05%) and high concentration of methyl parathion (0.1%).

3) Calcium :- The results of effect of methyl parathion on calcium content are recorded in Table 9. It is clear that calcium content is increased in 0.05% and 0.1% methyl parathion sprayed plant.

Calcium is generally regarded as the most immobile element (Ferguson and Bollard, 1976) Marinos (1962) has suggested that calcium involves with membrane system. Rains et al (1964) have reported that calcium is essential for ion transport mechanism calcium also stimulates the activity of enzym ATP- are, adenylkinase, succinic dehydrogenase and arginineki-nase, ~~succinic~~ (Mc Flory and Nasan, 1954).

Calcium content is increased in low concentration (0.025%) and recommended dose (0.05%) and consistency is

noticed in plants sprayed with the above recommended dose (0.1%).

4) Magnesium :- The magnesium content in the leaves of safflower is depicted in Table 9. Magnesium content is reduced, in 0.05% amd 0.1% methyl parathion sprayed plant. Magnesium is a constituent of chlorophyll molecule and hence it plays an important role in the synthesis of chlerophyll and in many enzymatic reactions loss of magnesium is probably because of calcium which inhibit magnesium absorption. Moore et al (1961) have reported that magnesium absorption is checked by calcium. Magnesium is generally taken up in safflower in lower quantities than Ca^{2+} and K^{+} one major role of Mg_2+ is as a cofactor in almost all enzymes activating phosphorylation process. (Mg^{2+} forms a bridge between pyrophosphate structure of ATP or ADP and enzyme molecule). A key reaction of Mg^{2+} is the activation of RuBP case. Irrespective of control values, the Mg^{2+} level appeared to be good at lower concentration (0.025%) methyl parathion.

5) Iron :- Iron is an immobile micronutrient. The result of effect of methyl parathion on iron content is recorded in Table 9. Iron content is increased in safflower. But maximum iron present in 0.05% methyl parathion sprayed plant. But not above the control value.

Iron is a vital microelement involved in many metabolic processes (Nason and McElory, 1968). Iron is essential in

photosynthesis as being a constituent of non-heme iron protein, ferrodoxin as well as in nitrogen fixation (Epstein, 1972 and Ralph, 1975). The growth is enhanced with increases in iron content (ivan and Drev, 1979).

Epstein (1972) has recorded as average of 0.011% dry wt. of iron in many plants. The values of iron in other oil seed crops are lesser than in safflower recommended dose (0.05%) of methyl parathion in case of safflower is good for Fe^{2+} uptake.

6) <u>Copper</u> :- The effect of copper content in safflower show slight change (Table 9) only in 0.05% methyl parathion sprayed plant copper content is slightly increased.

Copper is component of several metallo enzymes including ascorbic acid oxidase, tyrosinase, and cytochrome oxidase (sutcliff and Baker, 1981). But lower plants likes chlorella affected adversely due to application of copper. The high accumulation of copper adversely affected growth pattern. However in the higher plants copper inhibition is an elastic reversible strain. Our result show a slight increase in copper content in methyl parathion sprayed plant. Copper generally participates both in protein and carbohydrate metabolism further, there is a specific requirement for Cu^{2+} in symbiotic nitrogen fixation. It is a constituent of chloroplast protein plastocyanin which forms parts of electron transport chain linking two photochemical systems of photosynthesis (Bishop 1966 and Boardman 1975).

7) Zinc :- Zinc is a microelement required in plants. It is associated with number of enzymes including dehydrogenases and peptidases but recently it was discovered that xzinc specifically activate carbonic inhydrase. Its deficiency was associated with distubbance in ouxin metabolism (IAA) (sutcliffe and Baker, 1981).

The results of effect of methyl parathion on safflower in zinc content is recorded in Table 9. Zinc content is increased in safflower. In 0.1% w methyl parathion sprayed plant zinc, content is more but below the control value. In high concentration 0.1% methyl parathion in safflower Zn^{2+} content response is good zinc deficiency shows sharp decrease in the level of RNA and the ribosome content of cells. (Price et al 1972).

8) Manganese :- Manganese is also a micro element. The accumulation of manganese due to methyl parathion in the leaves of safflower is depicted in Table 9. Manganesium content is slightly increased.

Chesnin (1970) has reported that the role of manganese in Hill reaction Manganese deficiency decreases the photosynthetic rate, leaf area, chlorophyll content etc. like that of Mg^{2+}, Mn^{2+} is also equally important mineral element. It activates decarboxylase and dehydrogenase of ICA cycle and brings about oxidation of DAA by activating IAA oxidase. In recommended use (0.0.5%) and high concentration (0.1%) methyl parathion maximum Mn^{2+} content.

9) Chlorides :- The values of chlorides in the leaves of safflower are recorded in Table 9. The chloride content is increased in safflower.

Although chlorides acts as an electron transporting agent in photophosphorylation, its accumulation affects various aspects of plants. The normal values of chlorides in land plants very from 1 to 3% dry wt. (Perry and Ward 1959). Black (1956) has reported the more accumulation of chlorides than sodium in the leaves which might be mainly due to passive flow of chlorides. The transpiration increases passive uptake of chlorides (Green way 1965). Chloride content is increased in recommended dose and high concentrations (0.1%) methyl parathion.