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CONTROL OF TEAK MISTLETOE THROUGH TRUNK INJECTION OF CHEMICALS

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CONTENTS

INTRODUCTION

Dendrophthoe falcata var. pubescens Hook. f. Ettingsh. is the only phanerogamic parasite attacking teak throughout Kerala. A preliminary study on the phenology and distribution of the parasite in Kerala and severity of infection in Nilambur forest division had been carried out previously (Ghosh *et. a/.* 1984). Reduction in host girth (GBH) and deterioration in wood quality due to parasite infection and gain in girth after parasite removal by lopping the infected branches were also assessed.

Lopping the parasite-infected branches has been in practice ever since the parasite was noticed in Nilambur teak plantations as early as in 1866. However, this method has certain disadvantages mainly because of the considerable loss of host branches or the loss of crown which leaves the tree disfigured. Microbial infection occurring through injury caused by pruning is another drawback. Cuts inflicted to the bole of the tree during tree climbing often lead to fungal decay and borer attack. Moreover, the increasing cost of labour has made this practice prohibitive.

During the last few decades parasite removal has become erratic or partially discontinued because of economic and administrative reasons. But, to save the teak plantations from destruction, parasite removal has been again taken up by the Kerala Forest Department. The preliminary studies carried out by KFRI earlier which brought out the destructive capability of mistletoes, were useful in understanding the magnitude of the problem.

As mistletoe attack is a continuous menace and as the conventional method of its removal has several drawbacks, search for a new method of control has been initiated. Controlling the parasite without harming the host through infusion of selective weedicides into the trunk of infected trees has been recognised as a new approach for the management of teak mistletos (See Ghosh *et. a/.,* 1984). The techniqe of tree infusion precludes the disadvantages of pruning the infected branches. Only a small quantity of the weedicide is necessary, and since it is directly infused into the conducting tissues of the tree at about I m above the ground level, there is no danger of poison contaminations. The instruments used are not sophisticated and hence can be handled by any unskilled labourer.

During the preliminary experimenrs 19 herbicide formulations had been screened against the mistletoes. Of these herbicides, Afalon (linuron). Dalapon (dichloropropionic acid), Gramoxone (paraquat), Sencor (metribuzin) and Tolkan (isoproturon) had given encouraging results. However. the results were not conclusive because only a small number of parasite infected trees were utilised for the experiment. Hence, it became necessary to infuse these five herbicides into large number of parasite infected trees to conclusively prove its selectivity, that is, selective killing of the parasite clumps without harming the host. The present report gives the results of experiments conducted using metribuzin (Sencor) with and without adjuvants. Three more herbicides viz. Atrazine, Simazine and Glyphosate were also screened for their suitability for infusion.

METHODS OF STUDY

Tree infusion device : A similar tree infusion device as described by Ghosh *et. a/.* (1984) was used in the present work (Fig. 1). It consists of locally fabricated metallic nozzles which are tightly screwed in holes drilled in sapwood of the tree trunk at a height of 1 m above the ground. Nozzles are connected to a distributor through pressurised polythene tubes, which are in turn connected to plastic reservoir of 500 ml capacity through plastic tubes provided with dripping device and a regulator cock. The reservoir is tied up about 0.5 m above the nozzles so that the weedicide solution flows down to the nozzle through distributor and tubes.

The experimental plots

The experiments were conducted in a teak plantation planted in 1967 at Kayampoovam under Machad Range of Trichur Forest Division. More than 90% of the trees in the area were infected with 1 to 12 clumps of the parasite per tree.

Weedicides used

The following 4 weedicide formulations were used for the tree infusion experiments.

Sl. No.	Common name	Trade name	Manufacturer/Dealer
1.	Metribuzin	Sencor 70 WP	Bayer Levarkusen, Germany
2.	Glyphosate	Round up 41%	Monsanto Chemicals of India Ltd.
3.	Simazine	Tafazine 50 WP	Rallis India Ltd.
4.	Atrazine	Atrataf 50 WP	Rallis India Ltd. India

Infusion of metribuzin (Sencor)

The concentrations of metribuzin infused were 10 (0.01% a. i.), 25 (0.025% a. i,), 50 (0.05% a. i.) and 100 (0.1% a. i.) mg a. i./l. Each concentration was infused in three quantities viz. 100, 300 and 500 ml solutions constituting 12 treatments. Each treatment was replicated in 6 trees. Observations on the effect of treatments were taken after 15 days, one month, 3 months and thereafter every 6 months of infusion. The observations included effect on parasite clumbs, including defoliation and death, and reinfection, yellowing and defoliation of the host.

Infusions of Metribuzin in combination with adjuvants

The quantity of aqueous solutions of metribuzin were 100 and 300 ml with the four different concentrations viz. 10, 25, 50 and 100 mg a. i./l of solution. The two adjuvants used were Ethokem (Midkem Ltd., Northampton, England) and Ethomeen HT/60 (Akzo Chemie, Netherlands). Ethokem is a cationic surfactant which also accelerates the rate of translocation to the centre of activity. Ethomeen is reported to cause swelling of transport channels in leaves improving herbicide uptake. Irrespective of the concentration of the herbicide, only 1 ml of either of the adjuvants were added to the aqueous solution. Each treatment was infused into 3 infected trees selected at random.

Sereening of atrazine, simazine and glyphosate

These herbicides were not screened during the previous study. The quantity of the solutions infused were 100 and 300 ml and each contained the herbicides in the concentrations 10, 50, 100 and 200mg a. i. / l of water. Two trees were infused with each solution.

Combined application of glyphosate and adjuvants

The quantity of the solutions was 100 ml and the concentration of glyphosate was 10,100,200 and 500 mg a. i. / l of water. One millilitre of either Ethokem or H T 60 was added as adjuvant. Each solution was infused into two parasite infected trees.

RESULTS AND DISCUSSION

Effect of metribuzin infusion

Table 1 shows the effect of metribuzin infusion on host and parasite. The herbicide has shown encouraging results when 100, 300 and 500 ml aqueous solutions containing 25 and 50 mg a. i. l were infused into parasite infected trees. However, it cannot be considered as very safe and ideal for

tree infusion against parasites because it is phytotoxic at 100 mg a. i./l concentrations. Besides, even 25 and 50mg a. i. / l strength, the level of tolerance of teak against the herbicide varied, indicating the necessity of a carefully planned large scale trial. The infusion of different doses of the herbicide has indicated that their efficiency to kill the parasite is not proportionate to the quantity of herbicide infused (Fig. 2).

Nature of the effect of herbicide on parasite

The destructive effect of the herbicide, if any, was shown within 3 to 4 days after infusion as defoliation of leaves and flowers, if present. This is followed by dryness of tender branches, the main branches, and later, the main stem. The reinfection of the host by new clumbs probably shows that the residual level is no longer sufficient to give protection against fresh infection.

Effect of herbicide on host

During the first 4 months after infusion yellowing was shown by treatment nos. 8 to 10. During the subsequent years, yellowing was shown by some additional trees. However, they usually recovered if the toxic symptoms were not severe. The branches which had shown yellowing during the first year usually died during subsequent years. Phytotoxicity is not unexpected because both the host and the parasite are broad leaved species. Theoretically, the herbicide entering the host system should be transported to the parasite immediately so that there is no residues left in the host to create harmful effect on the host. It should be practicable in teak, which is deciduous, and the parasite leaves are intact when the host sheds its leaves. In future trials infusion of safeners like daminozide and triapenthenol at appropriate time to reduce the phytotoxic symptoms could be worthwhile because in agricultural crops, safeners have been reported to give promising results, (Vavrina and Phatak, 1988).

Combined effect of metribuzin and adjuvants

While 100ml of the solution of 10 rng a. i. / l concentration of the weedicide did not give any effect on the parasite, 300 ml solution with 25 mg a. i. / l and 50mg a. i. / l, and 100ml (with Ethokem as adjuvant) with 10mg a. i. / l showed 100% death of the parasite. However, it might be premature to conclude anything on this based upon the performance of a small number of herbicide infused trees. But there is an indication that addition of adjuvants has increased the expression of phytotoxicity on the host trees. Since no controls of adjuvants were done, it is not known whether the addition of adjuvants itself is toxic to teak.

Table 1. Effect of metribuzin (Sencor) Infusioh on teak trees infected with the parasite

Treatment No.	Conc. of herbicide (mg a.i./l) of water)	Quantity infused (ml)	% parasite clumps killed	Additional infection/ reinfection (No. of clumbs	Effect on host after 3 years
1	10	100	30.8 (5)*	0	NE (5)**
2	10	300	70.6 (6)	1	NE (6)
3	10	500	73.3 (6)	1	NE (6)
4	25	100	63.6 (6)	0	NE (4),PY(l)[a]
5	25	300	85.7 (5)	1	NE (3),PY(2)[a]
6	25	500	100.0,(4)	1	NE (1),PY(3)[a]
7	50	100	40.7 (6)	6	NE (4),PY(2)[a]
8	50	300	100.0 (5)	1	NE (3),PY(l)[a] TD (1)[b]
9	50	500	90.0 (6)	2	NE (3) ,PY(3)[a]
10	100	100	56.5 (6)	1	NE (2).PY(3)[a] TD (1)[b]
11	100	300	87.5 (5)	1	NE (3),TD(2)[c]
12	100	500	95.0 (6)	3	NE (2),PY(1)[a] TD (3)[c]

a. i. = Active ingredient, NE = No Effect
PY = Partial Yellowing, TD = Top Dead

Numbers in parenthesis indicate the following

* Number of herbicide-infused-trees finally available for observation

** Number of trees showing the respective host effect

a Number of trees showing partial yellowing during second year

b Number of trees showing partial yellowing during first year and death of branches during subsequent years.

c Number of top-dead-trees during first year

Table 2. Effect of infusion of metribuzin (Sencor) with adjuvants in parasite infected teak trees

Treat-rnent No.	Conc. of herbicide (mg a.i./l) of water	Adjuvant	quantity infused (ml)	% parasite clumbs dried*	Additional Infection reinfection (No. of clumps)	Effect on host after 3 years
1	10	ETE	100	0	0	NE (l)[a], DD (2)**
2	10	ETK	100	0	0	NE (3)
3	10	ETE	300	25.0	2	NE (3)'
4	10	ETK	300	75.0	1	NE (2), DD(1)
5	25	ETE	100	33.3	1	NE (2), DD(1)
6	25	ETK	100	50.0	1	NE (3)
7	25	ETE	300	100.0	2	NE(2). DD(1)
8	25	ETK	300	75.0	0	NE (3)
9	50	ETE	100	56.0	2	NE (3)
10	50	ETK	100	71.0	3	NE (3)
11	50	ETE	300	100.0	1	NE (3)
12	50	ETK	300	80.0	0	NE (2).TD(1)
13	100	ETE	100	90.0	3	NE (2).DD(1)
14	100	ETK	100	100.0	1	NE (2).iDD(l)

NE No effect, TD = Top dead, a. i. = Active ingredient
ETE = Ethomeen, ETK = Ethokem, DD = Dead

* from observations on three trees.
Numbers in parenthesis indicate the following

** Number of trees dead due to severe parasite infection

[a] The number of trees showing the respective host effect

Fig. 1 a) A tree infusion set mounted on a teak

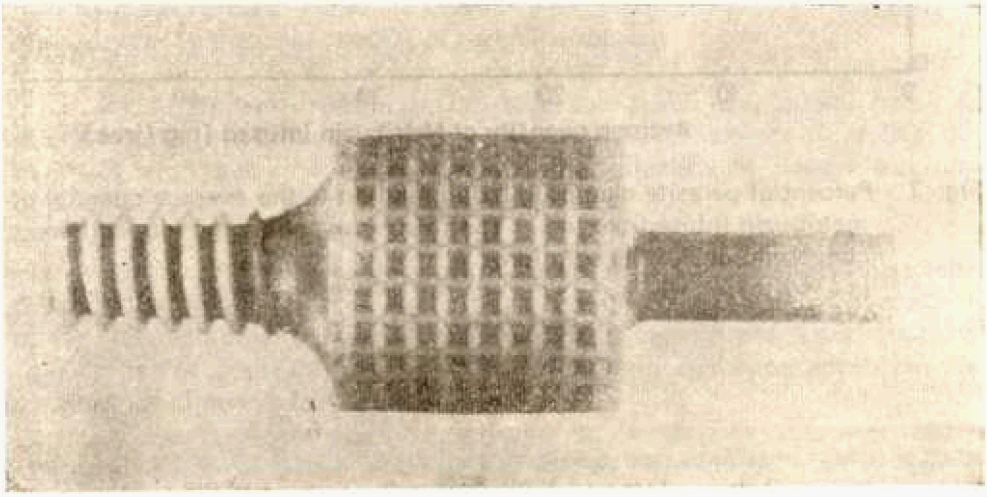

Fig. b) A plastic nozzle fabricated recently

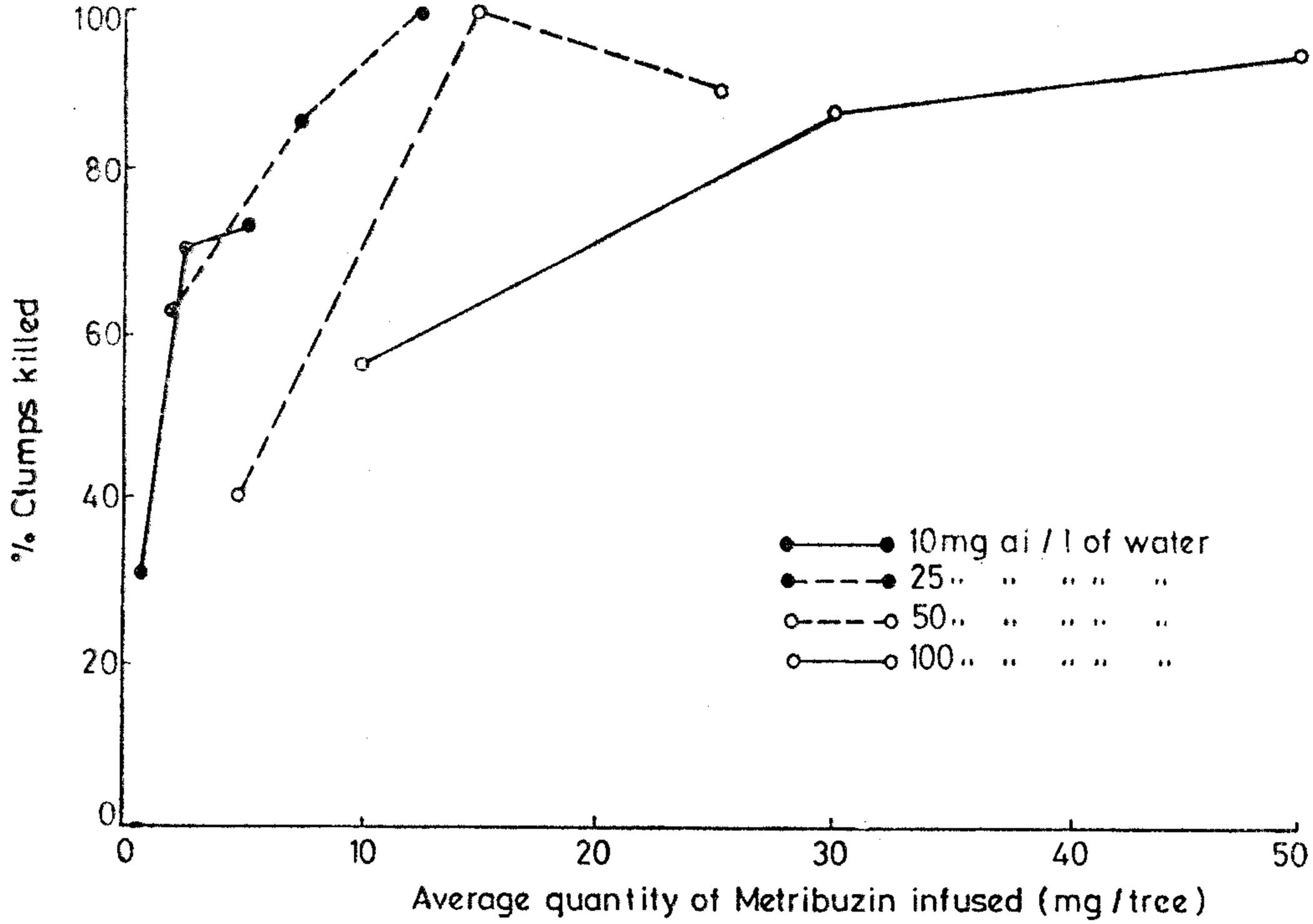

Fig. 2. Percent of parasite clumps killed in relation to the average quantity of metribuzin infused per tree. The four curves show the four different concentrations of the solution.

Effect of atrazine, simazine and glyphosate infusion

It was thought that atrazine and simazine would give some positive results in the experiments since they were also triazine compounds like metrihuzin (Thomson 1970). However, contrary to this they did not show any effect on the parasite or host. Since glyphosate has shown partial defoliation of the parasites, probably it can give a better result at a slightly higher concentration

Effect glyphosate with adjuvants

In this experiment also partial defoliation of the parasite clumps was noticed by infusion with 100 ml solution of 200 and 500mg a.i/l concentration of glyphosate solutions either ethokem or ethomeen.

CONCLUSIONS

A previous study conducted on possible control of teak mistletoe in Kerala has suggested infusion of suitable weedicides into the trunk as a possible method for selective killing of mistletoe without harming teak trees. Further, it also provided positive indication of efficacy of metribuzin out of the 19 weedicides screened against teak mistletoe.

In the present study also, metribuzin has shown encouraging resultswith 100, 300 and 500 ml aqueous solutions containing 25 and 50mg a. i. / l infused into parasite-infected trees. However, their efficiency to kill the parasite is not proportionate to the quantity of herbicide infused.

The experiment need to be repeated using 300 and 500ml herbicide solution containing 25 and 50mg a. i. / l with increased number of replications to arrive at a final conclusion regarding the suitability of dosage and time of infusion.

Infusion of Atrazin and Simazine did not show any effect on the parasite. Glyphosate which defoliated the parasite partially at 200mg a. i./ l concentration, requires further confirmation of its efficacy using higher concentrations. The addition of adjuvants did not show any significant improvement in the performance of metribuzin.

Screening more weedicides for selective action against mistletoe is to be continued. Low-cost plastic nozzles were fabricated locally during the course of project work to replace costly metallic nozzles used earlier.

REFERENCES

1. Ghosh, S. K., Balasundaran, M. and Mohamed Ali, M. I. 1984. Studies on the host-parasite relationship of phanerogamic parasites on leak and their possible control. K F R I Research Report 21, 39p.

2. Thomson W. T. 1979. Agricultural chemicals. Book II Herbicides Thomson Publications, Fresno, Ca. 93791. 254p.

3. Vavrina, C. S.and Phatak, S.C. 1988. Efficacy of triapenthenol as a safener, against Metribuzin injury in Soybean *(Glycine max)* cultivars. J. Plant Growth Regul. 7 : 67 - 75.