https://doi.org/10.29321/MAJ.10.A02705

Madras agric. J. (3): 171-179, March 1982

Effect of Spraying Crude Aqueous Extract of the Fruits of *Lantana camara* L. on wheat plants

BARUN KUMAR ROY[1] and S. MUKHERJI[2]

Crude aqueous extract of the fruits of *Lantana camara* was sprayed on the field grown wheat plants at different concantrations, viz., 25%, 50%, 100%. Data were collected on the morphological changes of the plants together with grain yield. It was evident that due to spray, more or less all characters of the treated plants showed better result over untreated control. The ear emergence was about 10-15 days earlier in the treated plants. The total yield was enhanced by about 19% over control due to the spraying of 100% extract.

Besides different nutritional components present in the spraying material i. e., in the crude extract of the fruits of *Lantana camara*, gibberellin A_3-like substance was also detected from this sample.

The plants are the sources of naturally occurring hormones. In aqueous extract of plant meterials bound forms of hormones are expected to remain as such, but free forms of auxin, auxin precursor, GA, kinetin inhibitors, amino acids, soluble protein, sugars and organic acids-all the substances soluble in water will be available in the solution. The crude extract after filtration and necessary dilution may be sprayed on cultivated plants.

Some earlier workers like Mosheov (1938) obtained encouraging results by spraying aqueous extract of wheat seeds on the same plants. Seed extract of Pharbitis *nil* when applied on the same plant showed significant effect on flower bud formation (Ogawa and Imamura, 1958). Sircar and Kundu (1959) treated seedlings of rice, wheat and maize with aqueous extract of roots of water hyacinth and found significant stimulation of shoot growth. Alfalfa (*Medicago sativa* L.) meals and chloroform extracts of the meal have recently been reported to increase the growth and yield of several plant species including rice, corn, barley and tomato (Ries *et al.*, 1977). The active substance has been identified as Triacontanol which when applied in nutrient culture solution to rice seedlings has caused an increase in dry weight, leaf area and total nitrogen content of the whole plants (Ries and Wert. 1977).

Based on the fact that major bulk of work done in the area of hormone research has been devoted to isolation and characterization of growth substances from plants and comparatively less attention has been paid to assess the quantum of improvement they can elicit in the economically important

1 and 2. Plant Physiology Laboratory, Department of Botany, University of Calcutta, Calcutta-700 019.

plants. The object of present experiment has been confined to make aqueous extract of fruits of *Lantana camara* and to spray on field grown wheat plants to test the possibility of improving their growth and yield. *Lantana camara* has been used in this experiment in view of its vigorous vegetative growth as well as an abundant distribution and growth substances have been found to be largely present in different organs of this plant (Paul and Mukherji, 1974). It is presumed that spraying crude aqueous extract of fruits of *Lantana camara* on the cultivated plants may obtain greater yield with minimum expense and consequently may serve as a potential source of hormones.

MATERIAL AND METHODS

Under randomized block design, wheat (*Triticum aestivum* cv. Sonalika) was grown under different treatments comprised of spraying of crude aqueous extract of the fruits of *Lantana camara*. The experiment was carried out for two consecutive years viz., 1976-77 and 1977-78. Detailed layout of the experimental design was as follows: Total number of treatments: 4 (including one control); Variety: 1; Block or replication 6; Size of the plot: 4.1 × 1.8m (7.38 sq m.); Spacing: 30 cm between rows; 1 m between replication and 0.5 m between plots; Nature of sowing: line sowing @ 78 g seeds per plot Date of sowing: 14.12.76, 15.12.77; Date of harvesting: 18.3.77, 20.3.78. Regarding fertilizer application normal basal dose was applied to each plot.

Fresh fruits of *Lantana camara* were crushed in water and the extracts of the fruits were made in 3 different concentrations, viz., 25g, 50g, 100g per 100ml of water (25%, 50% and 100%). After 30 days of sowing, first spraying was done followed by 5 more sprays at weekly intervals. Tween 20 was added to all the spraying solution as a wetting agent.

In order to study the effect of treatments on growth and yield the following observations were made, Plant height, total number of tillers, total number of effective tillers, number of leaves, area of leaves, dry matter accumulation in leaves, length of the flag leaves, length of the panicle, dry matter accumulation in panicle, number of seeds per panicle, 1000 grains weight, total yield per hectare. Estimation of carbohydrates, total nitrogen, calcium, magnesium, phosphorus, sulphur was performed with the spraying material, i. e., the extract of the fruits of *Lantana camara*. Sugar estimation was done according to the copper reduction method of Somogyi (1952) and nitrogen was estimated by colorimetric method using Nessler's reagent (Vogel, 1973). Phosphorus estimation was performed according to the method adopted by Fiske and Subbarow (1925). Calcium and magnesium was estimated by the standard method of Vogel (1973). The estimation of sulphur was performed by gravimetric analysis (Vogel, 1973).

The method for extraction of gibberellin from plant material was largely based on that of Badr *et al.* (1971). Paper chromatography was carried out on

Whatman No. 1 Chromatography paper using descending method with isopropanol : ammonia : water (10:1:1) as solvent system. Thin layer chromatography was also carried out using silica gel G and n-butanol : 4.5 (N) ammonia (3:1) as solvent system. The gibberellin-like substances were located by the help of chromogenic test using 70% sulphuric acid and UV light. Presence of fluorescence spot on the chromatograms and comparing with Rf values of authentic gibberellin help in detecting the gibberellin-like substances in plant materials. Bio-assay was performed by using *Brassica* hypocotyl test (Laloraya and Rai, 1962) and second leaf sheath test of Taichung Native-1 (TN-1), a dwarf rice cultivar. This method is very sensitive to GA and was adopted by Radley (1956), Murakami (1957), Hashimoto and Yamaki (1960).

RESULTS AND DISCUSSION

The present investigation deals with the evaluation of grain yield response in relation to yield components of the wheat plants as well as other morphological traits associated with the spraying of crude aqueous extract of fruits of *Lantana Camara*.

Height:

Progressive increase in height is noted is commensurate with the levels of spraying extracts. The significant effect is obtained in case of 100% dose under whose influence the plants become the tallest.

Tillers.

It is also to be noted that the taller plants are more active in tillering which obviously has been shown to be affected by the extract. In consonance with the increased capacity regarding tiller production, number of effective tillers are promoted remarkably which suggest a desirable effect in relation to the bearing capacity of the plants.

Leaf characters:

The effect of spraying on leaf characters are of particular interest. The area of leaf at 100% concentration increases enormously and proves to be most effective (Table 1). It is to be mentioned here that increased leaf area is directly related to corresponding increase in plant height caused by sprav. The ear emergence in the treated plants has occurred at least 10-15 days earlier than untreated control plants. Such condition is likely to be associated with higher photosynthetic rate thus keeping the leaves in a relatively juvenile condition. This is also borne out by fresh and dry weight increase in most treated sample. Natr (1966) found a positive relationship between photosynthetic rate and yield and that leaves in the higher yielding cultivars tend to senesce later.

Yield characters:

The timing of the reproductive cycle in wheat is an important determinant of yield. The wheat plants display at least some respones to spraying extract during both the inititation and development of inflorescence by shortening the flowering time by about 10-15 days. It is evident from Table 2 that the total number of panicles per

plant, length of individual panicle and number of grains per panicle are increased to variable extent under different treatments. The direct cause of increase in grain yield can be attributed to these factors. The number of grain formed in an ear has been largely affected by spraying of extract. It appears that the grain formation apart from light and temperature depend on the hormones and nutritional component of the extract. The final grain size as reflected by 1000 grains is the result of spraying extract. The increase in the amount of total yield is the result of spraying extract at different concentrations of which 100% dose proves to be most beneficial and the percent of increase is about 19.

Isolation of hormones and minerals from the extract:

It is evident that the fruits extract of *Lantana camara* contains different minerals like calcium, magnesium, phosphorus, sulphur (Table 3). Beside these a number of growth regulating substances are present of which gibberellic acid is thought to occupy the most important status. The increased height and other morphological characters may be ascribed to the stimulating effect of either any one of the growth factors or the interaction of several growth substances present in the extract in both free and bound forms.

It is evident from the bio-assay that a numbers of active zones were detected in the extract of plant materials in both the mustard hypocotyl test and TN-1 second leaf sheath test. Strip 8, i. e., factor 8 in paper chromatography and strip 4, i. e. factor 4 in thin layer chromatography correspond to authentic gibberellin A_3 (Fig. 1-A, B, C, D). So GA^3-like substances are present in the material. Other promoting zones detected in both the bio-assay did not elicit identical responses. This variation in the relative responsiveness is due to the fact that mustard hypocotyl may be sensitive to some factors to which TN-1 may not be sensitive or vice versa.

Plant growth substances are costly materials which may limit the studies on the possibility of their use as foliar spray to increase quality and quantity of yield. Hence the present work has opened up a profitable aspect of research to exploit beneficial effect of growth regulators on the production of higher yield.

The authors wish to express their sincere thanks to Prof. A. K. Sharma, Head of the Department of Botany, for his interest. Financial assistance from the I. C. A. R. New Delhi is gratefully acknowledged.

REFERENCES

BADR, S. A., G. C. MARTIN and H. T. HARTMANN. 1971. A modified method for extraction and identification of abscisic acid and gibberellinlike substances from the Olive *(Olea europaea)*. *Physiol. Plant* 24: 191-98.

FISKE, C. H. and Y. SUBBAROW. 1925. The colorimetric determination of phosphorous. *J. Biol Chem.* 66: 375-400.

HASHIMOTO, T. and T. YAMAKI. 1930. Comparative effectiveness of gibberellins A_1, A_2, A_3 and A_4 with special reference to that of A_4 *Bot. Mag. (Tokyo)* 73: 64-68.

LALORAYA, M. M. and V. K. RAI- 1962. Promotion of hypocotyl growth with gibberellic acid in epigealy growing seedlings. *Physiol. Plant*, 15: 649-55.

MOSHEOV, G. 1938. The influence of water extract of wheat seeds upon their germination and growth. *Pol. J. Bot. Jerus. Ser.* 7: 86-92.

MURAKAMI, Y. 1957. The effect of extract of immature bean seeds on the growth of coleoptile and leaf of rice plants. *Bot. Mag.* (Tokyo) 70: 376-82.

OGAWA, Y. and S. H. IMAMURA 1958. The accelerating influence of seed extract on flower formation of *P. nil. Proc. Jab. Acad. Sci.* 34: 631-6.

PAUL, A. K. and S. MUKHERJI. 1974. Growth regulating properties of the aqueous extracts of leaves and fruits of *Lantana camara* L. *Acta agron. Acad. Sci. Hungariae* 23: 166-73.

RADIEY, M. 1956. Occurrence of substances similar to gibberellic acid in higher plants. *Nature*, 178: 1070-1071.

RIES, S. K and V. WERT. 1977. Growth responses of rice seedlings to Triacontanol in light and dark. *Planta*, 135: 77-82.

RIES, S. K., V. WERT, C. C. SWEELEY and R. A. LEAVITT. 1977. Triacontanol-a new naturally occurring plant growth regulator. *Science*, 195: 1339-341.

SIRCAR, S. M and M. KUNDU. 1959. Effect of root extract of water hyacinth (*Eichhornia speciosa*. Kunth.) on growth and flowering of rice. *Sci. & Cult.* 24: 332-33

SOMOGYI, M, J. 1952. A new reagent for determination of sugars. *J. Biol. Chem.* 2002: 145-54.

VOGEL, A. I. 1973. *A text book of quantative inorganic analysis.*

Table 1. Effect of spraying cruda aqueous extract of the fruits of *Lantana camara* on the morphological characters of wheat plants in two different years.

Treatment	Height (cm)		Tillers (number)		No effective tilers		Length of the flag leaf (cm)	
	76-77	77-78	76-77	77-78	76-77	77-78	76-77	77-78
Control :	90.5	83.9	5	4	3	3	19.0	15.6
25% :	94.8	86.5	6	5	4*	4*	19.7	16.3*
50% :	94.1	87.5*	6	5	4*	3	19.5	15.9
100% :	101.6*	92.5%	7*	6*	5*	5*	22.4*	18.1*
S. E. .	±1.63	0.93	0.4	0.44	0.27	0.23	0.78	0.22
C. D : at 5% af level	5.09	2.82	1.35	1.34	0.81	0.68	2.38	0.66

* Significant at 5% level.

TABLE 1. Contd.

Treatment	Number of leaves/plant		Leaf area/leaf (sq. cm.)		Dry weight of leaves (mg/g)	
	76-77	77-78	76-77	77-78	76-77	77-78
Control :	16	10	10.5	7.7	0.489	0.394
25% :	17	10	17.2*	10.8*	0.476	0.375*
50% :	20	10	15.3*	12.2*	0.393	0.368*
100% :	20	14*	26.2*	17.2*	0.670	0.383*
S.E. :±	1.74	0.78	1.46	0.52	0.05	0.005
C.D. : at 5% level	–	2.26	4.42	1.58	–	0.017

* Significant at 5% level.

TABLE 2 Effect of spraying crude aqueous extract of the fruits of *Lantana camara* on yield characters in two different years.

Treatment	Length of the panicle (cm)		Dry weight of the panicle (mg/g).		Number of seeds per panicle	
	76-77	77-78	76-77	77-78	76-77	77-78
Control :	13.6	14.2	0.610	0.574	25	29
25% :	14.0	17.0*	0.625*	0.594	27.3	33*
50% :	15.0	16.4	0.618	0.560	26.6	32
100% :	16.0*	19.1*	0.635*	0.622*	33*	35*
S. E. : ±	0.54	0.38	0.003	0.01	1.29	1.0
C. D. : at 5% level	1.64	1.15	0.010	0.032	3.91	3.01

Treatment	1000 seeds weight (g)		Total yield/hectare (Kg)		Per cent increase over control	
	76-77	77-78	76-77	77-78	76-77	77-78
Control :	49.76	48.95	1754	1567	–	–
25% :	51.49	51.87	1717	1698	–	8.0
50% :	52.06*	52.82*	1877	1696	7.0	8.0
100% :	54.79*	53.74*	2103*	1860*	19.0	18.6
S. E. : ±	0.81	0.71	69.56	51.96	–	–
C. D. : at 5% level	2.42	2.61	117.23	157.24		

* Significant at 5% level

TABLE 3 Presence of different components in the crude aqueous extract of the fruits of *Lantana Camara*

Material	Total Sugar mg/g	Soluble nitrogen mg/g	Calcium mg/g	Magnesium mg/g	Phosphorus mg/g	Sulphur
Fruits of *Lantana Camara*	20.0	0.875	4.007	1.125	0.850	trace

LEGEND OF THE FIGURE

Fig. 1.

Histograms showing the result isolated from paper and thin layer chromatograms of authentic gibberellin A_3 and plant material.

A. *Brassica* hypocotyl test from paper chromatogram.

B. TN-1 dwarf rice second leaf sheath test from paper chromatogram.

C. *Brassica* hypocotyl test from thin layer chromatogram.

D. TN-1 dwarf rice second leaf sheath test from thin layer chromatogram.