

EFFECT OF BRYOPHYLLUM EXTRACT SPRAY ON JUTE

BARUN KUMAR ROY and S. MUKHERJI*

Keywords: *Bryophyllum calycinum* extract, Jute, Gibberellin-like substances.

RINGKASAN

Ekstrak kasar daun dan batang *Bryophyllum calycinum* telah disemur ke atas tanaman jut pada kepekatan yang berlainan. Data-data mengenai perubahan-perubahan morfologi dan beberapa ciri biokimia telah didapati. Satu trend yang menunjukkan kelebihan semua variabel berbanding dengan kajian kawalan telah diperolehi. Jumlah hasil telah melebihi perlakuan kawalan sebanyak 15%. Komponen-komponen pemakanan yang lain di dalam ekstrak seperti unsur gibberellin telah didapati di dalam sampel dengan menggunakan ujian kromatografi dan kromogenik.

INTRODUCTION

Every aspect of plant growth and differentiation is controlled by endogenous hormones – the level of which is likely to change according to the need of a particular stage of development. Although there are numerous reports on the level of hormones in different plant parts both under normal as well as under altered environmental conditions, few attempts have been made to test the possibility of increasing the yield of one plant by directly spraying the extract of another plant which is believed to be a rich source of hormones and other nutrients. In the past, encouraging results were obtained by spraying aqueous extracts of wheat seeds on wheat plants (MOSHEOV, 1938). Similarly by spraying the extract of *Pharbitis nil* seeds on the same plants, OGAWA and IMAMURA (1958) found significant result on flower bud formation. Later SIRCAR and CHAKRAVERTY (1962) demonstrated that aqueous extract of water hyacinth (*Eichhornia crassipes*) could significantly increase the yield of rice and jute plants. In view of the paucity of such information, a study was made to test the growth promoting properties of aqueous extract of leaves and stems of *Bryophyllum calycinum* on growth, yield and quality of fibre of jute plants and the present paper reports such findings. The levels of nutrients and gibberellin-like substances which are assumed to be the possible growth factors present in *B. calycinum*, the spraying material, have also been measured.

MATERIALS AND METHODS

The experiment was carried out for two consecutive years, viz., 1977 and 1978. Jute (*Corchorus olitorius*, cv. JRO-632) was grown under different treatments which comprised of spray application of crude aqueous extract of leaves and stems of *Bryophyllum calycinum*. The experiment was conducted as a randomized complete block design with four treatments and three replications.

The size of the plot was 2.5 x 0.5 m (12.5 sq. m). The jute seeds were line-sown at the rate of 5 kg/ha. The distance between rows was 30 cm, between blocks 1 m and between plots 0.5m. The dates of sowing were 28.4.1977 and 18.4.1978. The dates of harvesting were 18.9.1977 and 7.9.1978. Regarding fertilizer application, 60 kg nitrogen as urea, 40 kg potassium as muriate of potash and 40 kg phosphorus as ammonium phosphate per hectare were applied.

Fresh leaves and stems of *B. calycinum* were homogenized in water and the extracts were made into 3 different concentrations, viz., 5 g, 10 g and 25 g per 100 ml water (5%, 10% and 25%). First spraying was done after 70 days of sowing and this was followed by 5 more sprays at weekly intervals. Tween-20 was added to all the spraying solutions as a wetting agent. Growth data were collected before harvest and 10 plants from each plot were used for growth measurement. Data of

*Plant Physiology Laboratory, Department of Botany, University of Calcutta, Calcutta – 700 019, India.

each were averaged and the observations corresponding to replications were subjected to statistical analysis.

Sugar was estimated by the method of SOMOGYI (1945). Nessler's colorimetric method for nitrogen estimation, complexometric method for the estimation of calcium and magnesium, gravimetric method for sulphur as described by VOGEL (1973) were adopted in the present studies. Estimation of phosphorus was made by colorimetric method of FISKE and SUBBAROW (1925). Lignin and cellulose were assayed according to SAXENA *et al.*, (1961) with some modifications. The results on biochemicals represent the mean of duplicate determinations and the data for 2 years were averaged.

The method of extraction of gibberellins from plant material was largely based on that of BADR *et al.*, (1971). Paper chromatography was carried out on Whatman No. 1 paper using descending

method with isopropanol : ammonia : water (10:1:1) as the solvent system. Thin layer chromatography was also carried out using silica gel G and n-butanol: 4.5N ammonia (3:1) as the solvent system. The gibberellin like substances were located with the help of chromogenic test using 70% sulphuric acid and UV light. Bioassay was performed by using elongation of *Brassica* hypocotyl test and second leaf sheath test of Taichung Native-I (TN-I), a dwarf rice cultivar.

RESULTS AND DISCUSSION

The present investigation deals with the evaluation of fibre yield response in relation to yield components of jute plant as well as other morphological traits associated with the spraying of crude aqueous extract of *B. calycinum*. The growth pattern of the jute plant was definitely affected by the extract and stimulating response was the result in general (*Table 1*).

TABLE 1: EFFECT OF SPRAYING CRUDE AQUEOUS EXTRACT OF THE LEAVES AND STEMS OF *BRYOPHYLLUM CALYGINUM* ON MORPHOLOGICAL CHARACTERS OF JUTE PLANT IN TWO DIFFERENT YEARS

Treatment	Height (cm)		Basal diameter (cm)		Leaf area (cm)		Dry wt. of leaf (cm)	
	1977	1978	1977	1978	1977	1978	1977	1978
Control	251	245.6	1.6	1.6	32.33	34.92	0.311	0.308
5%	260.3*	267.8*	1.8*	1.7	38.48*	48.03*	0.290	0.301
10%	271.6*	279.6*	2.2*	1.9*	39.41*	50.67*	0.369	0.369
25%	258.3*	254.6	1.6	1.5	34.70	43.04	0.335	0.334
S.E. \pm	0.867	3.33	0.051	0.040	1.35	2.61	0.026	0.032
C.D.	3.15	12.10	0.178	0.148	4.92	9.48	—	—

* Significant at 5% level.

The height of the plant increased significantly at 10% dose, whereas the effects produced by the other doses were less. This was borne out by the fact that although a small increase was obtained at 5% and 25% concentrations, the highest concentration i.e. 25% was almost ineffective. Such observations, i.e. promotion at low and inhibition at high concentrations speak of the growth reaction being hormonal in nature.

The basal diameter was also found to be influenced by the spray. Application of 10% extract increased the basal diameter to a significant level.

Treatments that increased plant height were generally found to increase the number of nodes.

Just like its effect on stem growth, *Bryophyllum* spray produced largely modifying effects on total leaf area. The significant effect was observed by spraying 5% and 10% doses, of which the latter being still more effective. Concurrent with increase in area the dry weight of leaves was also promoted in response to spray.

Bryophyllum spray increased the fibre yield of the plant at all the concentrations tried here, the maximum increase in fibre yield to about 15% over control was obtained at 10% dose (Table 2).

It is also evident from the data that the spraying had a pronounced effect on cellulose and lignin content of jute fibre (Table 3). These two important chemical constituents of fibre appear to respond differently to the extract. Cellulose content was lowered to a small amount whereas considerable increase in lignin content resulted from treatments. Such opposite effects of extracts on cellulose and lignin formation were responsible for lower cellulose/lignin ratios which indicate that lignification is presumably the major function which controls cellulose/lignin ratios.

Levels of sugar, nitrogen and different minerals viz., Ca, Mg, P and S present in the aqueous extract of *Bryophyllum* are shown here (Table 4). From the bioassay experiments it appeared that a number of active zones were present.

TABLE 2: EFFECT OF SPRAYING CRUDE AQUEOUS EXTRACT OF THE LEAVES AND STEMS OF *BRYOPHYLLUM CALYGINUM* ON FIBRE YIELD OF JUTE PLANT IN TWO DIFFERENT YEARS

Treatment	Fibre weight/ plant (g)		Fibre weight hectare (kg)		% increase over control	
	1977	1978	1977	1978	1977	1978
Control	9.0	7.66	2270	1989	—	—
5%	8.8	7.33	1893	1960	—	—
10%	10.6*	10.0*	2592*	2293*	14.18	15.56
25%	9.6	8.43	2409*	2144	6.12	8.06
S.E. \pm	0.116	0.404	4.29	62.04	—	—
C.D.	0.419	1.467	15.57	225.49		

* Significant at 5% level.

TABLE 3: EFFECT OF SPRAYING CRUDE AQUEOUS EXTRACT OF THE LEAVES AND STEMS OF *BRYOPHYLLUM CALYGINUM* ON CELLULOSE AND LIGNIN CONTENT OF FIBRE OF JUTE PLANT IN TWO DIFFERENT YEARS

Treatment	Cellulose (as % dry wt. of fibre)		Lignin		Ratio Cellulose/Lignin	
	1977	1978	1977	1978	1977	1978
Control	93.0	91.0	6.7	7.4	13.6	12.2
5%	89.0	88.0	10.7	11.2	8.2	7.8
10%	87.0	86.0	11.9	12.6	7.3	6.8
25%	86.5	87.5	11.4	11.9	7.4	7.3

TABLE 4: ESTIMATION OF DIFFERENT COMPONENTS IN THE CRUDE AQUEOUS EXTRACT OF THE LEAVES AND STEMS OF *BRYOPHYLLUM CALYGINUM*

Material	Total sugar (mg/g)	Soluble nitrogen (mg/g)	Calcium (mg/g)	Magnesium (mg/g)	Sulphur (mg/g)	Phosphorus (mg/g)	Growth subs
<i>Bryophyllum calycinum</i>	8.5	0.825	8.015	2.43	trace	1.187	GA-like subs (Please vide Fig. 1 – A, B, C & D)

Among them strip 8, i.e. factor 8 in paper chromatography and strip 4, i.e. factor 4 in thin layer chromatography were shown to correspond to authentic gibberellin A₃ (Figure 1 – A, B, C and D).

CONCLUSION

From the foregoing results there are

good reasons to suggest that *Bryophyllum calycinum* can be utilized economically to achieve yield promotion, since these plants are extensively available at practically no cost. The present investigation has opened up a new vista to explore the possibility of promotion of agricultural products where growth factors present in indigenous plant materials may be profitably exploited.

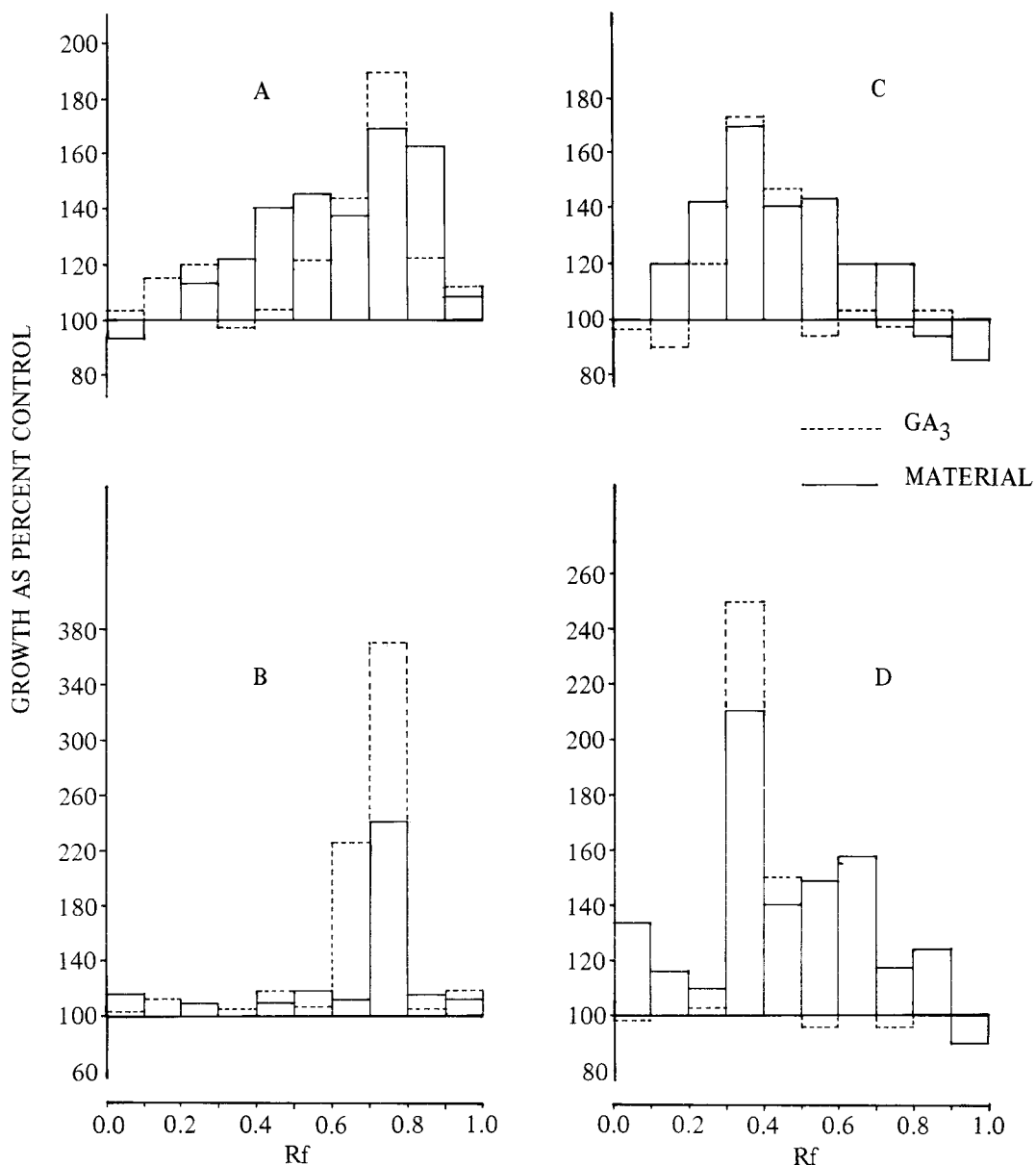


Figure 1. Histogram showing the result from isolated paper and thin layer chromatograms of authentic gibberellin A_3 and plant material.

- A. *Brassica* hypocotyl test from paper chromatogram.
- B. *TN-I* dwarf rice second leaf sheath test from paper chromatogram.
- C. *Brassica* hypocotyl test from thin layer chromatogram.
- D. *TN-I* dwarf rice second leaf sheath test from thin layer chromatogram.

ACKNOWLEDGEMENT

The authors wish to express their thanks to Professor A.K. Sharma, Head of

the Department of Botany, for his interest. Financial assistance from the Indian Council of Agricultural Research, New Delhi is gratefully acknowledged.

SUMMARY

Aqueous extract of leaves and stems of *Bryophyllum calycinum* was sprayed in crude form on field grown jute plants in different concentrations. Data were collected on morphological changes and certain biochemical characteristics. An increasing trend over control was caused by spraying of extracts in almost all parameters studied here. The total yield was enhanced by about 15% over control. Besides different nutritional components present in the extract, gibberellin-like substances were detected in the sample by chromatography and chromogenic tests.

REFERENCES

- BADR, S.A., MARTIN, G.C. and HARTMANN, H.T. (1971). A modified method for extraction and identification of abscisic acid and gibberellin-like substances from olive (*Olea europaea*). *Physiol. Plant.*, 24 : 191.
- FISKE, C.H. and SUBBAROW, Y. (1925). The colorimetric determination of phosphorus. *J. Biol. Chem.*, 66 : 375.
- MOSHEOV, G. (1938). The influence of water extract of wheat seeds upon their germination and growth. *Pol. J. Bot. Jrus. Ser.*, 7 : 86.
- OGAWA, Y. and IMAMURA, S.H. (1958). The accelerating influence of seed extract on flower formation of *P. nil*. *Proc. Jap. Acad.*, 34 : 631.
- SAXENA, K.K., MUKHERJI, R. and MAHADEVAN, V. (1961). A new method for estimation of cellulose in biological materials using Anthrone reaction. *J. Sci. Indus. Res.*, 20.
- SIRCAR, S.M. and CHAKRAVERTY, R. (1960). The effect of gibberellic acid on jute (*Corchorus capsularis*). *Sci. & Cult.*, 26 : 141.
- SOMOGYI, M.J., (1945). A new reagent for determination of sugars. *J. Biol. Chem.*, 160 : 61.
- VOGEL, A.I. (1973). A text book of quantitative inorganic analysis. The English Language Book Society and Longman, London.