

Growth promoting activity was evident in the Dowex 50 eluate of both the treated and untreated materials. An aliquot of this eluate of both the treated and untreated material was taken up separately in 1.5 ml of 35% ethanol and fractionated through Sephadex LH-20 column. Following fractionation, three different zones of cytokinin activity in the untreated material could be evident, eluting at fraction 6-7, fraction 9-10 and fraction 12-13 (figure 1). The last two peaks were eluted at fractions corresponding to elution volume of zeatin riboside and zeatin respectively. With all the probability the cytokinin activity of fraction 6-7 seems to be cytokinin glucoside presumably zeatin glucoside since after treating it with  $\beta$ -glucosidase<sup>9</sup> the conversion product shifted to the position of synthetic zeatin. Following treatment with ABA, the cytokinin activity of leaves was considerably reduced. The reduction in growth activity was more prominent with respect to the latter two peaks than the former one (figure 2). Thus it seems that the effect of ABA has been more pronounced on the factors having the elution volume corresponding to those of zeatin and zeatin riboside and less in cytokinin glucoside.

In some cases a direct antagonism between cytokinin and ABA has been demonstrated while in others these hormones have opposite effects. Exogenous ABA has been reported to suppress the degradation of kinetin to adenine in *Rumex* leaves<sup>10</sup>. This seems to support the conclusion of Mullins and Osborne<sup>11</sup> who suggested that ABA has a "cytokinin sparing" effect and thereby stimulate a plant process. This is supported by the promotive effect of ABA in some systems<sup>6,10</sup>. In the present study the reduction in cytokinin activity following ABA treatment was very much pronounced on the substances having the elution pattern of zeatin and zeatin riboside and to lesser extent on the cytokinin glucoside. It is noteworthy that ABA suppressed the reduction of zeatin side chain in bean axis and the amount of dihydrozeatin riboside and nucleotide formed being greatly reduced<sup>12</sup>. The interaction between cytokinin and ABA may also take place at the level of translation and enzyme synthesis. The  $\alpha$ -amylase synthesis in the cereal grains mediated by gibberellins paralleled coleoptile growth and both these processes have been shown to be inhibited by ABA and reversed by cytokinin but not by gibberellins<sup>13,14</sup>. Thus ABA affects both nucleic acid and protein metabolism by exerting its primary response at the nucleic acid level and then by translation and transcription on protein synthesis<sup>15,16</sup>.

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### PRELIMINARY STUDY OF THE HANDEDNESS IN FIRST LEAF AND SUCCESSIVE LEAVES, FLAG LEAVES AND SPIKELETS IN TRITICALE AND ITS PARENTS.

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COMPION<sup>1,2</sup> studied the seedling handedness in *Secale cereale* and several other cereals. Seedling characters in flowering plants in general and monocotyledons in particular have been studied in recent years but seedling handedness has not been recorded<sup>3</sup>. Recently, Bahadur *et al.*<sup>4</sup> have studied the seedling handedness in *Bambusa arundinacea* and several Gramineae (unpublished). Bahadur and Rama Swamy (unpublished) reported the seedling handedness in *Triticale* and its parents. In continua-

tion of our studies, we describe handedness in successive leaves, flag leaves and in spikelets (L/R) in a given ear borne on the same spike, on a particular plant developing respectively from the left- or right-handed seedlings.

For this study four varieties of *Triticale* viz., DTS-42-3, DTS-642, DTS-47-1 and DTS-280-7; five varieties of *Triticum* viz., NI-5439, NI-747-19, UP-215, Kalyanasona, Sonalika and *Secale cereale* were used (table 1). Seeds of *Triticale* and its parents were sown in petri-dishes and the germination stages were noted for 4-6 days. The seedlings were sorted out for their handedness as described by Bahadur and Rama Swamy (unpublished). Seedlings (25) of *Triticale*, *Triticum* and *Secale cereale* (neutral seedlings only) representing both right- and left-handed, were transplanted into the field for observation of handedness in the subsequent leaves including the flag leaves and the spikelets as shown in figures 1-4.

Continued observations as to handedness upto sixth leaf both in *Triticale* and *Triticum* showed that most of the right-handed plants show the sequence R L R L R L with regard to veneration either to the left or right (figure 4). Occasionally this sequence gets altered to R L L R L R or the change may be in the third, fourth or fifth leaf. In the left-handed plants, the sequence was found to be the reverse i.e., L R L R L R (figure 2). The left-handed plants like the right-handed plants occasionally showed altered sequence i.e., L R R L R L. In *Secale cereale* though the seedling handedness is generally absent, the handedness in the successive leaves was common as observed in *Triticale* and *Triticum* described above.

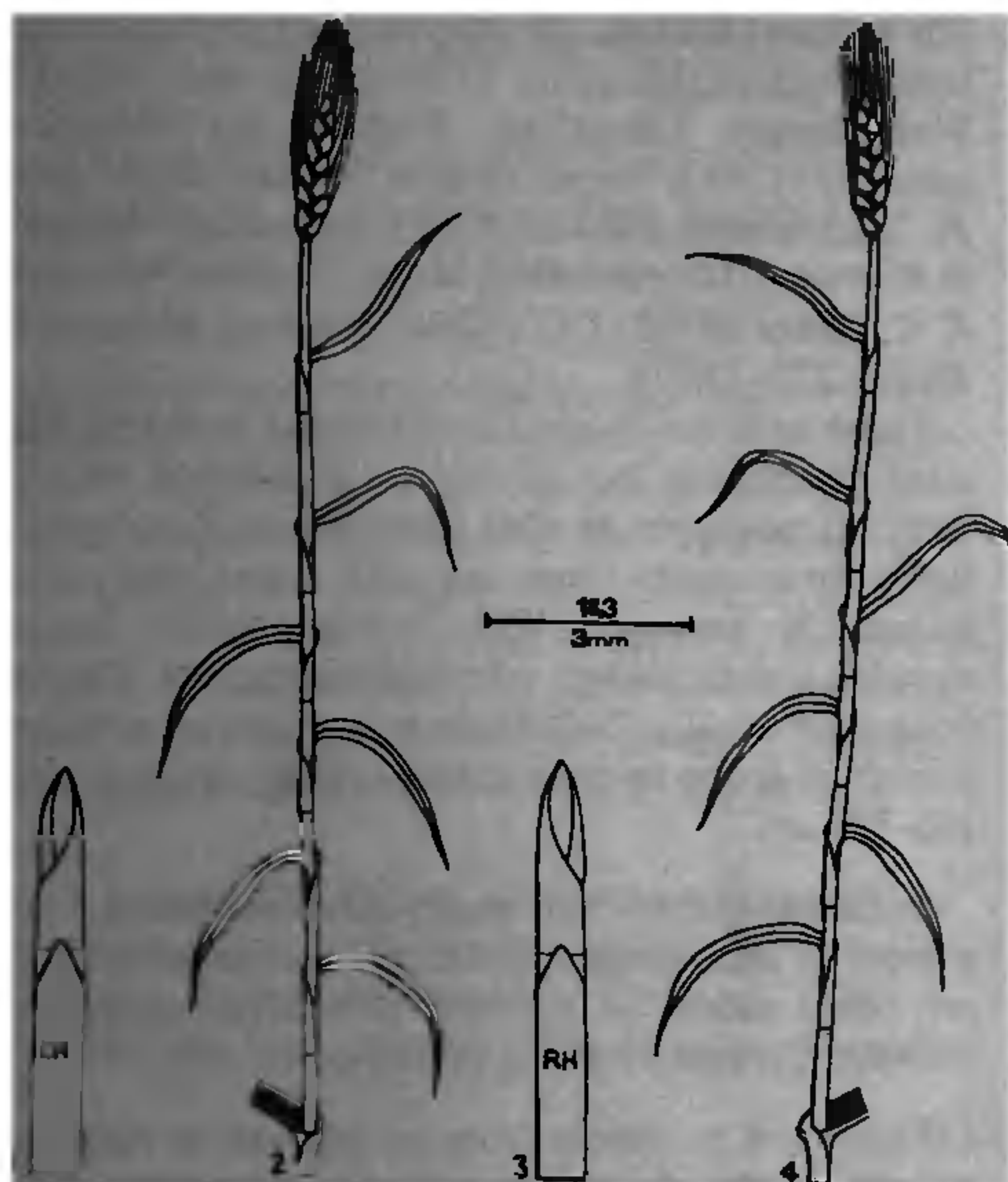
With regard to flag leaves, in the right-handed plants showed left-handed flag leaf and in the left-handed plants this was reversed (figures 2 and 4). The percentage of the left-handed flag leaves in the right-handed plants, in general was higher in *Triticale* (64%) as also in *Triticum* (75%) whereas in left-handed

TABLE I

Comparison of data on flag leaf folding, handedness in first spikelet of right- and left-handed plants in *Triticale* and its parents

Species/varieg	Folding of flag leaf	LH%	Folding of first spikelet	LH%	Folding of flag leaf	LH%	Folding of first spikelet	LH%
<i>Triticale</i>								
DTS-42-3	13L:12R	52	18L:7R	72	15R:10L	40	20R:5L	20
DTS-642	15L:10R	60	20L:5R	80	7R:18L	72	18R:7L	28
DTS-47-1	16L:9R	64	15L:10R	60	20R:5L	20	19R:6L	24
DTS-280-7	20L:5R	80	19L:6R	76	14R:11L	44	21R:4L	16
Total	64L:36R	64	72L:28R	72	56R:44L	44	78R:22L	22
<i>Triticum</i>								
NI-5439	18L:7R	72	17L:8R	68	21R:4L	16	19R:6L	24
NI-747-19	17L:8R	68	13L:12R	52	18R:7L	28	21R:4L	16
KALYANASONA	16L:9R	64	19L:6R	76	13R:12L	48	20R:5L	20
SONALIKA	23L:2R	92	—	—	16R:9L	36	18R:7L	28
UP-215	20L:5R	80	—	—	21R:4L	16	15R:10L	40
Total	94L:31R	75	49L:26R	65	89R:36L	29	93R:32L	26
<i>Secale cereale</i>								
(Neutrals only)	15R:10L	40	18L:7R	72				





Figures 1&3. Camera lucida drawings of left and right-handed seedlings of *Triticale* var. DTS-47-1 showing vernation of the seedling leaf.

Figures 2&4. Semi-diagrammatic representation of mature plants developing from the left and right-handed seedlings showing the distichous arrangement. The vernation can be clearly seen in the petiole region. Note also the handedness in spikelets.

plants, the percentage of left-handed flag leaves was less in *Triticale* (44%) and *Triticum* (29%) except in DTS-642 and in Kalyanasona. Left-handed plants similarly follow the sequence of LRLRLR—R. Rarely, however, the sequence gets altered to LRRLRL—L. In *Secale cereale* out of 25 neutral plants, 10 plants showed left-handedness and 15 plants showed right-handedness flag leaves (table 1).

The folding of the first spikelet in most of the plants with right-handed flag leaves, showed right-handed first spikelets while the left-handed produces left-handed first spikelets (table 1). The percentage of first spikelets folding to left-handed is higher in *Triticale* (72%) and 65% of left-handed flag leaves in right-handed plants in *Triticum*. It was also observed in left-handed plants that the high percentage of right-handed first spikelet in right-handed flag leaves of *Triticale* (78%) and *Triticum* (74%). Thus, the flag leaf and the first spikelet showed tendency for the R/L character. On the other hand, the second spikelet showed a strong tendency in the opposite direction

from that of the first one, while the third spikelet repeats the R/L character of the first one. These observations are comparable with those of Kihara *et al.*<sup>5</sup> who observed handedness in spikelets of Einkorn wheats.

According to Latting<sup>6</sup>, the vegetative and floral meristems are fundamentally alike and accordingly the leaves and floral organs have homologous structures. In the light of this observation the handedness in subsequent leaves, flag leaves and in first spikelets presently observed represent mirror image not only at the seedling stage but also at the maturity. It is thus obvious that the handedness in the flag leaves and spikelets represent stereo-isomeric forms and constitute a case of bio-isomerism<sup>7,8</sup>. Further work on the handedness of seedlings and successive leaves as also spikelets in relation to grain yield would give a better understanding of the naturally occurring variation.

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## FOLIAR MACROTRACHEIDS IN *ILEX DIPYRENA* WALL. (AQUIFOLIACEAE)

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DURING the course of detailed systematic investigation on the idioblasts, after clearing the leaves by the customary process<sup>1</sup>, the authors came across an interesting occurrence of macrotracheids<sup>2</sup> at the very tips of the free veinlets in the leaves of *Ilex dipyrena*