ABSTRACT

This investigation was undertaken to study the effect of varying numbers of treatments with resorcinol (resor), tannic acid (TA) and gibberellic acid (GA₃), singly and each phenol in combination with GA₃ on growth and flowering of the qualitative short day plant Impatiens balsamina L. var. Rose exposed to varying numbers of 24-hr and 8-hr photoperiodic cycles. Quantitative and qualitative changes in endogenous phenols, peroxidase, IAA oxidase and polyphenol oxidase and in the contents of sugar, protein and nucleic acids were also studied.

The results are as follows:

Experiment 1

1. Plants grew taller under short than under the respective number of long day cycles.
2. Resor and GA₃, singly and together accompanying long as well as short day cycles increased stem elongation,
the increase being more when accompanied by short day cycles. 25 treatments with the combination GA$_3$+Ieso accompanying 50 long day cycles increased the height of plants considerably more than the same number of treatments with Ieso or GA$_3$ accompanying the same number of long day cycles.

3. More leaves were produced on plants receiving long day than on those receiving the respective number of short day cycles.

4. The rate of production of leaves decreased earlier in plants receiving more short day cycles, the number ultimately being the highest on plants receiving 1 SD cycle and the lowest in those receiving 20 or 50 SD cycles.

5. Floral buds were initiated on plants receiving 25 treatments with Ieso or 8 treatments with GA$_3$ or GA$_3$+Ieso under strictly non-inductive photoperiods. Floral buds were produced earlier in plants receiving treatments with GA$_3$ than in those receiving treatments with Ieso and still earlier in plants receiving the respective number of treatments with the combination GA$_3$+Ieso.

6. GA$_3$ increased the number of floral buds more than Ieso, the number being the highest in plants receiving the respective number of treatments with the combination GA$_3$+Ieso.
7. Floral buds were produced on plants receiving even 1 SD cycle when accompanied by a single treatment with GA3 or GA3 + Reso and their initiation was hastened with the increasing number of SD cycles and more when these were accompanied by treatments with GA3 or Reso or GA3 + Reso, the effect of GA3 alone or together with Reso being more pronounced than that of Reso alone.

8. Number of floral buds increased with the increasing number of short day cycles reaching the highest in plants receiving 20 or 50 SD cycles. The number was more when SD cycles were accompanied by treatments with GA3, Reso or GA3 + Reso, the effect of 8 GA3 + Reso treatments accompanying 16 SD cycles being most pronounced.

Experiment 2

9. Plants receiving treatments with GA3, TA or GA3 + TA accompanying long day cycles were shorter than those receiving the same number of treatments with the respective number of short day cycles, the effect being more pronounced in plants receiving treatments with GA3 or GA3 + TA than TA which did not affect plant height significantly.

10. Both GA3 and TA, singly or together increased the number of leaves slightly, the increase in general being more in plants receiving long than the respective
number of short day cycles.

11. While 25 treatments with TA were required to induce floral buds under 24-hr photoperiods, just 3 treatments were adequate when it was used in combination with GA₃. Floral buds were initiated earlier in plants receiving 8-25 treatments with GA₃ (100 mg/l) than in those receiving 25 treatments with TA (100 mg/l). The initiation of floral buds occurred earlier in plants receiving treatments with the combination GA₃+TA than each alone.

12. Floral buds were not initiated in plants receiving 1 SD cycle even when it was accompanied by a single treatment with TA, but were initiated when it was accompanied by a single treatment with GA₃ or GA₃+TA.

13. Treatment of plants with GA₃ or TA or GA₃+TA accompanying SD cycles hastened the initiation of floral buds, the hastening effect being more pronounced with GA₃ than with TA or GA₃+TA.

14. The number of floral buds produced on plants receiving treatments with TA was lower than on those receiving treatments with GA₃, it being the highest in plants receiving the respective number of treatments with the combination GA₃+TA under LD cycles.

15. The number of floral buds increased with the increasing number of SD cycles and more so when accompanied by treatments with GA₃, TA and GA₃+TA, the effect of the
respective number of combination $GA_3+TA$, being more pronounced than that of each.

**Experiment 5**

16. Phenol content of the leaves in general was higher than that of the stem and in plants that received long than short day cycles.

17. Phenol content of the leaves of plants receiving 1-8 treatments with $GA_3$ or $TA$ or $GA_3+TA$ accompanying long day cycles was higher than that in water treated controls receiving the respective number of 10 cycles but that of plants receiving 25 treatments accompanying 50, 10 cycles was lower than the control.

18. An unidentified phenol designated '28' developed in the leaves and that designated '15' in the stem as well as in the leaves of plants receiving inductive treatments regardless of whether the induction was caused by short photoperiodic cycles or by treatment with $GA_3$ or $TA$ or $GA_3+TA$ under non-inductive photoperiodic cycles.

**Experiment 4**

19. A new isoperoxidase with $K_i 0.59$ developed in the stem as well as in the leaves of plants receiving either inductive photoperiods or treatments with $GA_3$, $TA$ or $GA_3+TA$ under non-inductive photoperiods but not in
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those of water-treated controls under non-inductive photoperiods.

20. Isoperoxidases with \(\text{Rf} 0.78\) developed in the stem of plants receiving a single treatment with \(\text{GA}_3\) accompanying 1 SD cycle or 3 treatments with either TA or \(\text{GA}_3\)+TA accompanying 6 SD cycles. It also developed in plants receiving 3 treatments with \(\text{GA}_3\) or 8 treatments with \(\text{GA}_3\)+TA or 25 treatments with TA accompanying 6, 16 and 50 LD cycles respectively, while band with \(\text{Rf} 0.17\) developed in the stem of water-treated plants receiving 2 SD cycles. It also developed in plants receiving single treatment with \(\text{GA}_3\) or TA or \(\text{GA}_3\)+TA accompanying 1 SD cycle and also in plants receiving 3 treatments with \(\text{GA}_3\) or \(\text{GA}_3\)+TA and 8 treatments with TA accompanying 6 and 16 LD cycles respectively.

21. The activity of IAA oxidase increased in the leaves but not in the stem of plants receiving inductive photoperiodic cycles and in plants receiving treatments with \(\text{GA}_3\) or TA each alone or the two together even under non-inductive photoperiod.

22. Treatment with \(\text{GA}_3\) and TA mimic the effect of SD cycles in the development of some isoenzymes of IAA oxidase. Thus new isoenzymes with \(\text{Rf} 0.48\) developed in the leaves and that with \(\text{Rf} 0.82\), developed in both the stem and the
leaves of all plants receiving inductive treatments — photoperiodic or chemical but not in water treated controls under non-inductive photoperiods.

23. Another isoenzyme with αf 0.68 developed only in the stem of plants receiving inductive treatments.

24. Polyphenol oxidase activity increased in plants receiving either inductive photoperiods or treatments with GA₃ or phenol under non-inductive photoperiods.

25. The involvement of polyphenol oxidase in floral bud initiation is apparent from the fact that a new isoenzyme with αf 0.49 developed in plants under inductive conditions.

26. Band with αf 0.15 appeared in the leaves of plants receiving a single treatment with GA₃ or GA₃+FA accompanying 1 SD cycle and 8 treatments with FA accompanying 16 SD cycles. This band did not develop in plants receiving the same number of chemical treatments accompanying 10 cycles. Another isoenzyme of polyphenol oxidase with αf 0.17 developed in the stem and not in the leaves under inductive conditions.

Experiment 5

27. The gradual decrease in the free amino acid content but increase in protein content of both the stem and
leaves under inductive conditions shows the enhanced incorporation of proteins with floral induction.

28. The decrease in the level of free amino acids started in the plants receiving 1 SD cycle, the increase in protein content of the leaves was observed with 2 SD cycles. The decrease in free amino acids content is more with GA₃ and TA each alone or together accompanying both long and short day cycles.

29. There was an increase in free amino acids content of both the stem and leaves of plants receiving 25 treatments of each chemical accompanying 50 long and short day cycles.

30. There was higher increase in RNA content of both the stem and the leaves of plants under inductive than under non-inductive conditions. It may be due to increased mitotic activity concomitant with floral induction. The continued increase in the content of RNA till the end reflects the continued divisional activity of the cells during initiation and development of floral buds.

31. The marked increase in RNA content of both the stem and the leaves in plants receiving 1 and 2 SD cycles appears to be related to increased mitotic activity that precedes floral bud initiation. The higher RNA
content of plants exposed to LD conditions may be related to increased production of leaves under this photoperiod.

52. The higher increase in the sugar content of the stem and the leaves of plants under inductive than under non-inductive conditions is indicative of increased conversion of polysaccharides into sugars and their oxidation to meet the enhanced energy requirement for the transformation of the meristems from vegetative to reproductive state.