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NOTE

ENDOGENOUS GROWTH PROMOTORS AND INHIBITORS IN TAHITI LIME (CITRUS LATIFOLIA TAN.)[1]

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ABSTRACT

Experiments were conducted with Tahiti lime to study the physiology of flowering. Both GA-like and inhibitory substances were present in extracts of leaves collected from either flower-induced or non-induced plants. However, the level of GA-like substances decreased and inhibitory compounds increased after induction of flowering. It was concluded that both gibberellic acid (GA) and abscisic acid (ABA)-like substances are involved in Tahiti lime flowering.

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مواد تسهیل کننده و بازدارنده رشد درون زا در لیموی تاهیتی

عنایت الله تفضلی
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خلاصه

جهت مطالعه فیزیولوژی گلدهی آزمایش‌هائی برروی لیموی تاهیتی انجام گرفت. درعصاره برگهای برای گل انگیخته شده و انگیخته نشده مواد شبه جیبرلین و بازدارنده‌هائی مشاهده گردیدند، ولی پس از گل انگیزی از میزان مواد شبه جیبرلین کاسته و برمیزان بازدارنده‌ها افزوده شد. چنین نتیجه‌گیری شد که در گل انگیزی لیموی تاهیتی هم مواد شبه جیبرلین وهم مواد شبه آبسایزیک وجود دارند.

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INTRODUCTION

The identification of flower stimuli is an unsolved problem in plant physiology. The stimuli is thought to be produced in the leaves and transmitted in the phloem to the stem apices, where they initiate the process of flower induction (2). The concept of flower stimulation was first noticed about 50 years ago by Chailakhyan (1). Additional evidence for the existence of a flower stimulus also comes from other lines of investigations (10). In many cases successful graft union between an induced donor plant and a vegetative receptor plant causes the latter to flower (2, 11, 12).

Despite abundant evidence for the existence of the flower stimulus, numerous efforts over the years to isolate flower stimuli have so far not been completely successful. Studies of endogenous growth substances can be regarded as complementary to those used upon exogenously supplied growth regulators for better understanding or developmental processes involved.

The work presented here involves characterization of growth substances from flower induced and non-induced Tahiti lime leaf extracts and descriptions of changes that occurred due to induction.

MATERIALS AND METHODS

Fifty Tahiti lime (*Citrus latifolia* Tan.) plants were potted in plastic pots filled with potting media (1:1:1 sand, peat and vermiculite). Plants were allowed to grow for two months allowing a vegetative flush of growth to ensure that they would not be producing flowers initiated by some previous regime. The plants were grown in a glasshouse maintained at about 24° ± 2°C. Half of the plants which were intended to induce flowering, were subjected to water stress for a period of four weeks, by withholding water until some wilting occurred. A volume of 50 ml water was added daily to the plants to maintain evaporation rate. This rate was based on weighing the plants daily after initial water application to serve as a basis for further application to characterize plant transpiration. Induced plants normally flower about 10 weeks after induction.

Hormones were extracted from 10 g fresh leaves in 80% ethanol. The material was homogenized and stirred overnight at 5° C. The filterate was centrifuged, the pellet reextracted with 80% ethanol and the washing added to the supernatant. The extract was reduced at 36° C to about 10 ml of aqueous solution adjusted to pH 8.8 with 10% NaOH and extracted three times with equal volume of ethyl acetate. The aqueous fraction was adjusted to pH 2.4 with 1M HCl and again partitioned into ethyl acetate. The acidic ethyl acetate fraction was reduced to dryness at 36° C and taken up into 2 ml absolute ethanol. A 0.2 ml of extract was applied to pre-washed Merk silica gel T.L.C. plates which were developed in isopropanol: 1.5 N ammonia (80:20 v/v). Gibberellin was assayed by the lettuce hypocotyl test (3). Growth inhibitors were assayed by the wheat embryo test (7).

RESULTS

Each histogram of the data from bioassays shows a mean value obtained from three replicated chromatograms (Figs. 1 and 2). At least three zones of GA-like activity were present in both extracts of induced and non-induced leaves (Fig. 1). The major difference was a marked decrease in GA-like activity at Rf 0.1-0.3 and 0.6-0.7 after induction. Inhibitory compounds were present in high concentration in both extracts, however, a sharp increase occurred in the zone at Rf 0.4-0.7 of the induced leaves (Fig. 2).

DISCUSSION

The present research work provides a basis for the study of

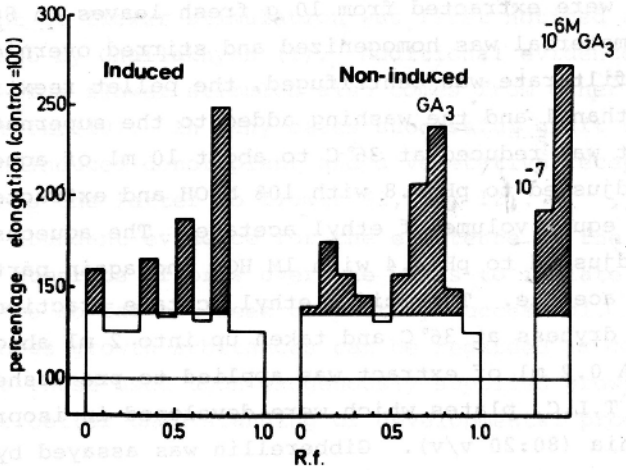

Fig. 1. Growth promoting activity of extracts from flower induced and non-induced leaves of Tahiti lime. Growth promoting activity was assayed by the lettuce hypocotyl test. Shaded bars differ from control at $P < 0.05$.

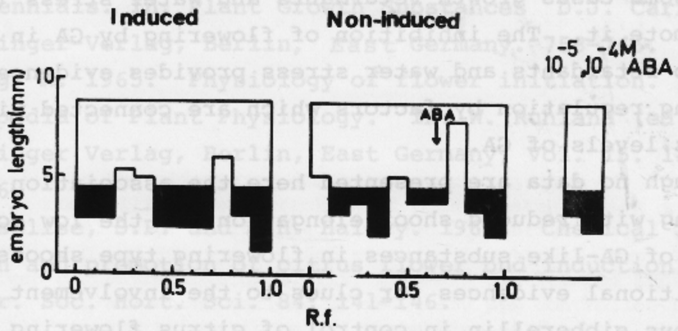

Fig. 2. Growth inhibiting activity from flower induced and non-induced leaves of Tahiti lime. Growth inhibiting activity was assayed by the wheat embryo test. Shaded bars differ from the control at $P < 0.05$.

hormonal control of flowering. A sharp reduction of GA-like substances and rapid rise in ABA-like substances after induction indicate that flowering response in Tahiti lime might be a hormonal control process.

It is well established that GA inhibits flowering in citrus and in some cases growth retardants and water stress (7, 8, 9), promote it. The inhibition of flowering by GA in contrast to retardants and water stress provides evidence of flowering regulation by factors which are connected with endogenous levels of GA.

Although no data are presented here the association of flowering with reduced shoot elongation and the low concentration of GA-like substances in flowering type shoots (4) are additional evidences for clues to the involvement of endogenous gibberellin in control of citrus flowering.

In some plants, however, flower inhibitory substances are involved in control of flowering concomitant with flower inducing substances (4). Adding the extracts of flowering substance to vegetative plants may increase the endogenous level of flower inducing substance; however, such treatment would not reduce the high endogenous flower inhibitor level. Therefore, even if the extract contains flower inducing substances, the test plant may not flower because of the high endogenous flower inhibitor which would over-ride the effect of added flowering substance.

It might be possible that flowering in Tahiti lime is controlled by a balance between some flower inducing and flower inhibitory substances.

LITERATURE CITED

1. Chailakhyan, M. Kh. 1957. Forty years of research on the hormonal basis of plant development. Some personal reflections. Bot. Rev. 41: 1-29.
2. Evans, T.L. 1971. Flower induction and the florigen concept. Annu. Rev. Plant Physiol. 72: 365-394.

3. Frankland, B. and P.F. Wareing. 1960. Lettuce hypocotyl growth as affected by gibberellic acid. Nature 185: 255-256.

4. Goldschmidt, E.E. and S.P. Monselise. 1972. Hormonal control of flowering in citrus and some other woody perennials. In: Plant Growth Substances D.J. Carr (ed.) Springer-Verlag, Berlin, East Germany. 758-766.

5. Lang, A. 1965. Physiology of flower initiation. Encyclopedia of Plant Physiology. In: W. Ruhland (ed.) Springer Verlag, Berlin, East Germany, Vol. 15. 1380-1536.

6. Monselise, S.P. and A.H. Halevy. 1964. Chemical inhibition and promotion of citrus flower bud induction. Proc. Amer. Soc. Hort. Sci. 84: 141-146.

7. Miyamota, T.N., E. Tolbert and H.E. Everson. 1961. Germination inhibitors related to dormancy in wheat seeds. Plant Physiol. 36: 739-746.

8. Nir, I., R. Goren and B. Leshem. 1972. Effect of water stress, GA_3 and CCC on flower differentiation in Eureka lemon trees. J. Amer. Soc. Hort. Sci. 97: 774-778.

9. Oppenheimer, H.R. 1940. How to produce summer lemon in Palestine. Hadar 13: 169-170.

10. Vince-Prue, D. 1975. Photoperiodism in Plants. McGraw Hill Book Co., London, England. 444 p.

11. Zeevaart, J.A.D. 1957. Studies on flowering by means of grafting. II. Photoperiodic treatment of detached *Perilla* and *Xanthium* leaves. Koninklijke Nederlandische Akademie Van WetenSchaffen (Series C). 60: 332-337.

12. Zeevaart, J.A.D. 1976. Physiology of flower formation. Annu. Rev. Plant Physiol. 27:321-348.