

COMUNICACIONES

The influence of growth regulators on aphid infestation in cotton

Resumo. Estudou-se a influencia da aplicação de reguladores de crescimento (CCC, SADH, GA e IAA) em algodoeiro, *Gossypium hirsutum* L. cv. IAC-RM3, na infestação de *Aphis gossypii* Glover, 1876, em condições de casa de vegetação.

A realização de duas determinações no nível de infestação dos afídios, evidenciou que plantas tratadas com GA (100 ppm) mostram níveis inferiores de infestação com relação às tratadas com CCC.

Os resultados sugerem que GA promove alterações no equilíbrio hídrico da planta hospedeira e provavelmente redução no potencial osmótico diminui a disponibilidade hídrica, desfavorecendo o estabelecimento dos afídios.

Among insects, aphids are considered organisms which adapt more easily to the host plants, therefore physiological characteristics of the host plant have a significant effect on the aphids population (9). Kennedy (3) described the effect of growth, senescence, water status of plants, and resistance of crop varieties to aphid infestation.

Crop irrigation can promote aphid infestation (5). On brussels sprouts, *Myzus persicae* (Sulzer, 1776) colonized old leaves and *Brevicoryne brassicae* (L. 1758) colonized young leaves. Wearing (10) showed that water stress had an effect on the type of aphid that would colonize young or old leaves: the alates forms of *B. brassicae* had a decrease in population but alates forms of *M. persicae* would move out from old leaves to the young top part of the plant.

Kennedy and Mittler (4) estimated that it was necessary to have a pressure of 20 to 40 atm in the phloem to maintain the normal flow of sap through the aphid stylet channel and provide a normal feeding condition to adult aphids. The aphids depend on the turgidity pressure from the host plant to have a normal feeding and this pressure acts in the sense to force sap ascension through the aphid stylet channel (7). The rate of aphid feeding and excretion on several pea varieties were determined by Auclair (1). He suggested that the differences observed could be related to osmotic pressure and turgidity pressure of these varieties and that the feeding rate of the aphids could be partially regulated by the plant.

Growth regulators applied in plants can promote changes in aphid infestation level. Tahori *et al.* (8) observed that leaves of *Nerium oleander* treated with 2, 4-dichlorobenzyltributylphosphonium chloride presented a lower aphid (*Aphis nerii* Bayer, 1841) infestation than plants treated with (2-chloroethyl) trimethylammonium chloride (CCC), N, N-dimethylaminosuccinamic acid (SADH), or control. It was observed that brussels sprouts cultivar 'Wroxton' treated by soil application of CCC solution presented a significant reduction in longevity and fecundity, and an increased population rate in *Brevicoryne brassicae* 15 days after planting (9).

The purpose of this work was to determine the infestation level of the aphid (*Aphis gossypii* Glover, 1876) on cotton plants treated with CCC, SADH, gibberellic acid (GA) and 3-indoleacetic acid (IAA).

Materials and methods

The growth regulators were applied to cotton plants (*Gossypium hirsutum* L. cv. 'IAC-RM3') at the three-true-leaves stage. The growth regulators were sprayed on the plants according to the following concentrations: CCC (500, 1,000 and 2,000 ppm); SADH (2,000, 3,000 and 4,000 ppm); GA (100 and 200 ppm); and IAA (100 and 200 ppm). The level of natural aphid infestation was determined 30 days after the application of the plant growth regulators. At this time, each plant was artificially infested with 10 alates forms from *A. gossypii*. A second aphid infestation level on cotton leaves was determined 23 days after this artificial infestation.

Randomized blocks with 10 replications were used as experimental design. Each plot was represented by one pot with two plants. The average data of aphid infestation levels were transformed to $(X + 0.5)^{1/2}$ and the differences analyzed by Tukey's test at 1 per cent level of probability.

Results and discussion

The determinations of the natural infestation level of aphids 30 days after application of the growth regulators gave a significant F value of 4.06 (at 1% level) and a coefficient of variation of 23%. After

53 days of growth regulators application, the next determination of aphid infestations (natural and artificial) presented a significant F value of 7.48 (at 1% level) and a coefficient of variation of 15%.

There were significant differences on the levels of aphid infestation on cotton plants 30 days after application with GA (100 ppm) and CCC (1,000 and 2,000 ppm). These differences persisted through the second determination of aphid infestation at 53 days after application of growth regulators. At this time, the plants treated with CCC (500 ppm) were also significantly more attacked by aphids than GA (100 ppm)-treated plants (Table 1).

The above results indicated that cotton plants treated with GA (100 ppm) presented a smaller aphid infestation than plants that received CCC. Castro (2) observed a lower (more negative) leaf osmotic potential on tomato plants sprayed with GA when compared with plants treated with CCC. GA would promote the stomate opening (6), whereas CCC would promote an increase in the number of cells in the palisade tissue and reduce the intercellular spaces. This CCC effects results in an increase in the efficiency of the water movement in the tissues. Another possible mechanism for CCC action would be by an increase in the tolerance of plants to water deficit due to its interferences with GA biosynthesis and therefore on the stomate opening.

The dynamic of aphids colonization on plants and its feeding rate were directly affected by the osmotic potential of the host plant (1, 10). Since GA promotes

Table 1.—Average data of the aphid (*Aphis gossypii*) infestation on cotton plants 30 and 53 days after growth regulators applications; data transformed to $\sqrt{X + 0.5}$.

Treatments	Infestation Levels	
	30 days**	53 days**
Control	1.15 ab*	1.48 ab
CCC 500 ppm	1.27 ab	1.74 b
CCC 1,000 ppm	1.40 b	1.84 b
CCC 2,000 ppm	1.36 b	1.78 b
SADH 2,000 ppm	1.08 ab	1.49 ab
SADH 3,000 ppm	1.09 ab	1.40 ab
SADH 4,000 ppm	1.17 ab	1.54 ab
GA 100 ppm	0.85 a	1.21 a
GA 200 ppm	1.13 ab	1.51 ab
IAA 100 ppm	1.03 ab	1.45 ab
IAA 200 ppm	1.16 ab	1.47 ab

* Mean separation within columns by Tukey's test, at 1% level

** Data based on 10 replicates.

a decrease in the osmotic potential of plants in relation to CCC-treated plants, it is reasonable to admit that GA-treated plants would have less water available in the phloem causing an unfavorable environment to aphids feeding. GA-treated plants may show a higher degree of water stress due to the higher transpiration rates than plants that received CCC. Another factor to be considered is that CCC-treated plants, contrary to that GA-treated plants, presented a dwarf architecture due to the smaller internodes and this architecture may create a microenvironment more favorable to *A. gossypii*. The physiological effects of CCC and the micro-environmental condition can lead to an increase on the attack of other aphids which were not previously important to the crop.

Summary

The effect of growth regulators on the infestation of aphids (*Aphis gossypii* Glover, 1876) on cotton (*Gossypium hirsutum* L. cv. 'IAC-RM 3') was studied under greenhouse conditions. The following growth regulators were applied by spraying: (2-chloroethyl) trimethylammonium chloride (CCC), N, N-dimethylaminosuccinamic acid (SADH), gibberellic acid (GA), and 3-indoleacetic acid (IAA).

In two determinations of the infestation level of aphids, a difference among treatments was found: GA-treated plants presented less aphid infestation when compared to the CCC treatments. The results suggested that GA (100 ppm) promoted differences in the water status of the host plant, probably decreasing the osmotic potential and consequently reducing the ease of aphid feeding.

Resumen

Se estudió la influencia de la aplicación de reguladores de crecimiento (CCC, SADH, GA e IAA) en el algodón, *Gossypium hirsutum* L. cv. 'IAC-RM3', en la infestación de *Aphis gossypii* Glover, 1876, en condiciones de invernadero. Dos determinaciones del nivel de infestación de áfidos evidenciaron que las plantas tratadas con GA (100 ppm) muestran niveles inferiores de infestación en relación con los tratados con CCC. Los resultados sugieren que el GA promueve alteraciones del equilibrio hídrico en la planta hospedante y probablemente disminuyendo el potencial osmótico y consecuentemente reduciendo la facilidad con que los áfidos se alimentan.

August 19th, 1977.

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REFERENCES

- 1 AUCLAIR, J. I. Developments in resistance of plants to insects Annual Report of the Entomological Society of Ontario 88:7-17 1958
- 2 CASTRO, P. R. C. Effects of growth regulators in tomato (*Lycopersicon esculentum* Mill.). Ph.D. Dissertation. S Paulo University. Piracicaba, Brazil 1976 148 p
- 3 KENNEDY, J. S. Physiological condition of the host-plant and susceptibility to aphid attack Entomologia Experimentalis et Applicata 1:50-65 1958
- 4 ——— and MITTIER, T. E. A method of obtaining phloem sap via the mouth-parts of aphids Nature 171:528 1953
- 5 IEES, A. H. Insect attack and the internal condition of the plant Annals of Applied Biology 13:506-515 1926
- 6 IIVNE, A. and VAADIA, Y. Stimulation of transpiration rate in barley leaves by kinetin and gibberellic acid Physiologia Plantarum 18:658-664 1965
- 7 MITTLER, I. E. Studies on the feeding and nutrition of *Tuberculolabus salignus* (Gmelin) (Homoptera: Aphididae). I. The uptake of phloem sap. Journal of Experimental Biology 34: 334. 1957
- 8 YAHORI, A. S., HALEVY, A. H. and ZEHLER, G. Effect of some plant growth retardants on the oleander aphid *Abhis nerii* (Boyer). Journal of the Science of Food and Agriculture 14: 568-569 1965
- 9 Van EMDEN, H. F. Effect of (2-chloroethyl) trimethylammonium chloride on the rate of increase of the cabbage aphid (*Brevicoryne brassicae* L.) Nature 201: 946-948 1964
- 10 WEARING, C. H. Selection of brussels sprouts of different water status by apterous and alate *Myzus persicae* and *Brevicoryne brassicae* in relation to the age of leaves Entomologia Experimentalis et Applicata 15: 139-154 1972

"Vapona"* affecting color of a lepidopteron

Sumario. El color de un esfingido se encontró que cambiaba cuando estaba expuesto a emanaciones de "Vapona".

In a Black Light trap run at the University of Maryland, Eastern Shore, Princess Anne, Maryland, it was found that *Enmorpha pandorus* (Hubner) (Lepidoptera, Sphingidae) showed considerable color variations. The killing agent used was a strip of "Vapona" at the bottom of the trap.

Specimens of this sphingid collected alive near security lights and the light trap all had the same green color. Wings from one side of field collected specimens were removed and placed in a box with a strip of the insecticide and the other pair used as a control. After overnight exposure the green color had changed to a mixture of olive green and orange, on exposure for 48 hours the lighter greens had completely bleached while the darker shades had turned to a bright orange.

Specimens of *Manduca sexta* (L.), *M. quinquemaculata* (Haworth), *Agrius cingulatus* (F.), *Dolba hyloeus* (Drury), *Ceratonia catalpae* (Bdv.) and *Xylophanes tersa* (L.) collected alive and compared to those found in the light trap did not show any changes in their colors.

* 2,2 - dichlorovinyl dimethyl phosphate. (Trade Mark. Shell Chemical Co)

Over a two year period a total of 20 different species of sphingidae were collected at the location in Maryland.

The use of this pesticide in collections, because of its corrosive properties and the possible effect on the colors of the preserved material, should be carefully evaluated before it is used routinely.

Abstract The color of a sphingid was found to change when exposed to "Vapona".

February 2nd, 1979.

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Studies on the growth of *Gossypium barbadense* cottons in India. III. Uptake of major, secondary and micro-nutrients.

Sumario. Una comparación de absorción de nutrimentos por 'Sujata', (un algodón desarrollado mediante selección del 'Karnak' de Egipto) y los dos cultivares creados en la India, 'Suvin' y 'PSH', mostró que durante la floración y fructificación, en la parte vegetativa de 'Sujata' permanecía más nitrógeno, fósforo y potasio. En 'Suvin' estos nutrimentos fueron utilizados rápidamente para el crecimiento reproductivo. Tanto el calcio como el magnesio mostraron una tendencia a elevarse en las partes fruteras desde la formación de los "squares" hasta la floración plena. Durante el crecimiento del cultivo, se encontró la máxima concentración de manganeso, de 140 ppm, en las hojas contra 28 ppm en el tallo. A la formación de los "squares" el contenido de zinc fue máximo (70 ppm) y después declinó rápidamente. En las partes fruteras, tanto el zinc como el manganeso mostraron una tendencia decreciente: el primero algo más rápida, alcanzando 30 ppm a la madurez. El contenido de cobre de las hojas y del tallo fue ligeramente más alto durante los primeros 30 días, pero permaneció en 13 ppm en el tallo, 12 ppm en las hojas y 6 ppm en las partes fruteras hasta la madurez. El cultivar enano y compacto 'PSH', sobre la base de unidad de área, removió apreciablemente menores cantidades de nitrógeno, fósforo, potasio, calcio, magnesio, manganeso y zinc, exceptuando el cobre, y tuvo una más alta eficiencia en nitrógeno.

The uptake of nutrients by American cottons (*G. hirsutum*) at different stages of growth have been studied by many workers notably Dastur and Ahad (10), Olsen and Bledsoe (18), and Eaton and Ergle (12) who reported periodic changes in nutrient contents in relation to growth. Bhatt and coworkers (1, 3) have shown how nutrient uptake in cotton is related to plant architecture. In Egyptian cottons Crowther (7) made detailed studies on nitrogen content and its distribution in different plant parts. Jewitt (14) determined major nutrients and calcium content of Egyptian variety 'Sakel' in the Sudan at one stage only and found the yield to