
The influence of 2-chlorethylphosphonic acid on the development of *Actinidia kolomikta* shoots

L. Česonienė

Kaunas Botanical Garden of Vytautas
Magnus University,
Žilibero 6,
LT-3018 Kaunas, Lithuania

Investigations have been conducted on the effect of 2-chlorethylphosphonic acid on the growth and development of one-year-old shoots of *Actinidia kolomikta* (Maxim.) Maxim. It has been determined that 0.2% solution hinders the growth of shoots of seedlings and plants propagated by softwood cuttings. During the first 14 days after spraying this effect was significant. Necrosis (clone M3) of buds and upper internodes of shoots, leaf (variety 'Lande') fall were established. Part of shoots were killed. The morphological peculiarities varied considerably. At the end of vegetation the seedlings treated with 0.2% solution formed the greatest number of shoots. The period of vegetation of the plants affected by this growth regulator was shorter.

Key words: one-year-old shoots, ethylene, 2-chlorethylphosphonic acid, growth regulator, vegetation period

INTRODUCTION

In order to maintain the equilibrium between the development and the productivity of horticultural plants, growth regulators are frequently used. 2-Chlorethylphosphonic acid ($C_2H_6ClO_3P$) is of significant physiological activity, which in the cells of plants disintegrates to ethylene [1]. Ethylene takes part in regulating different physiological processes. Investigations have demonstrated that ethylene affects the rate of shoot growth, accelerates the ageing processes, hinders cell partition, promotes female flowering [2].

A number of investigations on the effect of growth regulators on the productivity and fruit quality of *Actinidia deliciosa* (A. Chev.) C. F. Liang et A. R. Ferguson has been carried out [3–5]. Dioecious liana introduced in Lithuania is one of the newest horticultural plants. Its male and female plants do not differ morphologically. Variations occur at the onset of flowering and fruit setting. While introducing *A. kolomikta* a critical period of spring was determined, in which late spring frosts coincide with the onset of shoot growth and flowering [6]. Therefore, in carrying out selection attention is first focused on the phenophases of shoot development and flowering. Vegetative shoots grow vigorously, and yielding plants must be pruned and shoots shortened [7]. The objective of the investigation was to clarify the effect of 2-chlorethylphosphonic acid on

the growth and development of shoots of *A. kolomikta*.

MATERIALS AND METHODS

In 1999, different concentrations of 2-chlorethylphosphonic acid were tested and the effect of this growth regulator on plants of different age assessed. In 2000, for the investigations two-year-old plants propagated by softwood cuttings (male clone M3 and variety 'Lande') and two-year-old seedlings of clone F1 were chosen. The plants were sprayed with water solution of this growth regulator. The spraying was carried out on May 29–31, sunny not windy days were chosen, maximal air temperature exceeded 20 °C [8]. From the standpoint of vegetation, the phase of fast shoot growth was chosen rather than the first completely developed leaves formed. Vegetative shoot length was measured prior to spraying, after 14, 28 days and at the end of the vegetation period. Also, the number of one-year-old shoots and their diameter were determined.

RESULTS AND DISCUSSION

In 2000, the dynamics of meteorological conditions had indicated that at the end of March and in April dry warm weather would prevail. In the last decade of April the average air temperature was 16.6–20.0 °C and maximal 24.2–27.7 °C. It had a crucial effect on

the early onset of vegetation of the plants investigated: March 27 (clone M3 and variety 'Lande'); April 2 (seedlings). Since two-year-old plants propagated by softwood cuttings as well as the seedlings had not yet attained the stage of generative development, further only the phases of the end of shoot growth and vegetation were recorded. The plants treated with 2-chlorethylphosphonic acid solution earlier cast leaves: the vegetation period of the seedlings exposed to 0.2% solution ended on September 31, to 0.1% solution on October 10, that of the control on October 15. The end of vegetation of M3 clonal plants sprayed with 0.2% and 0.1% solution and that of control plants was recorded on September 25, September 28 and on October 7, respectively; the end in variety 'Lande' occurred on October 2, October 7 and October 15, respectively.

The intensity of shoot growth of *A. kolomikta* depends upon the quantity of precipitation [9]. The summer of the year 2000, particularly July, was typical by a large quantity of precipitation (112.9 mm). Till the end of vegetation the effect of a 0.2% solution of the growth regulator on the shoot growth in the male clone M3 and variety 'Lande' was characterised as declining (Fig. 1). During the first 14 days necrosis of the tops (3–4 internodes and buds in this shoot) was revealed, the leaves fell down. The apical leaves of the plants sprayed with 0.1% solution also fell down, however, no necrosis was recorded. After a month the shoots of these plants started growing more intensively. At the end of vegetation it had been determined that the plants of clone M3 and variety 'Lande' exposed to a 0.2% solution had less one-year-old shoots than before spraying (Fig. 2), because part of shoots with necrosis did not recover and dried. The number of one-year-old shoots is of crucial importance for the generative productivity of male and female plants next year, namely, in their buds the rudiments of generative shoots of next year form [10].

While assessing the state-of-art of seedling no necrosis of one-year-old shoots or buds was ascertained. During the first 14 days after spraying with 0.2% solution of 2-chlorethylphosphonic acid changes occurred: the plants lost flexibility typical of vegetative shoots and ability to climb a pole. The green colour of the leaves was substituted by the reddish green. After 28 days a decrease in these variations was observed. During the first two months after application of the growth regulator the shape of plants differed, too: their shape was not typical of a liana but of a bush. During the first 14 days 0.1% solution suppressed the growth of shoots. No variation in the colour of leaves was observed. Application of the growth regulator (0.2% solution) by far more

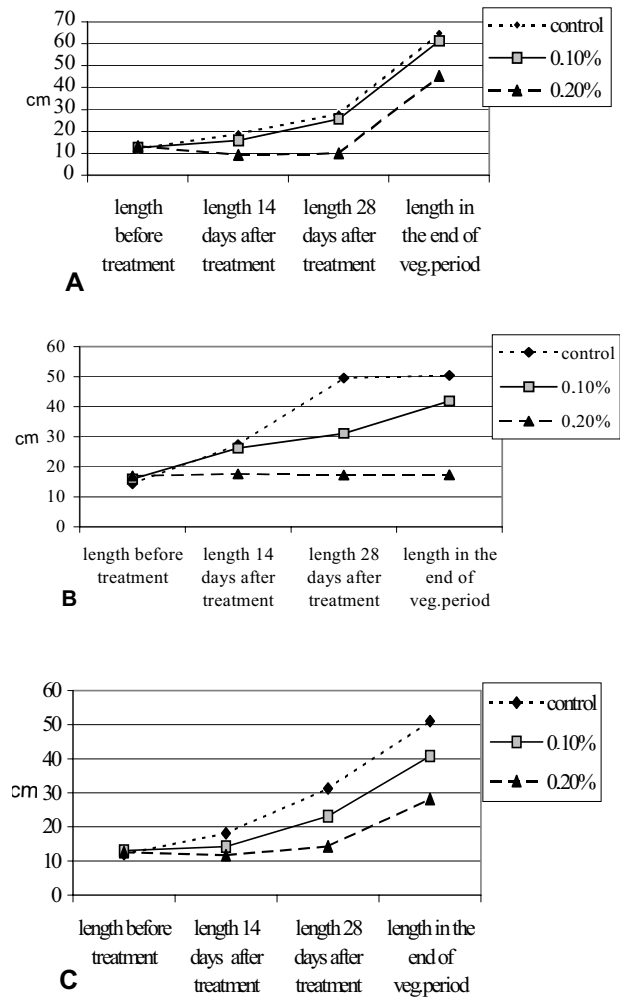


Fig. 1. Changes in the length of shoots (cm): A – variety 'Lande'; B – clone M3; C-seedlings of clone F1

considerably enlarged the number of one-year-old shoots (Fig. 2).

While generalizing the findings of the investigation it has been determined that treatment with 2-chlorethylphosphonic acid as a producer of ethylene changes the growth of one-year-old shoots and of the buds from which the rudiments of generative and mixed shoots of the next year form. 0.2% solu-

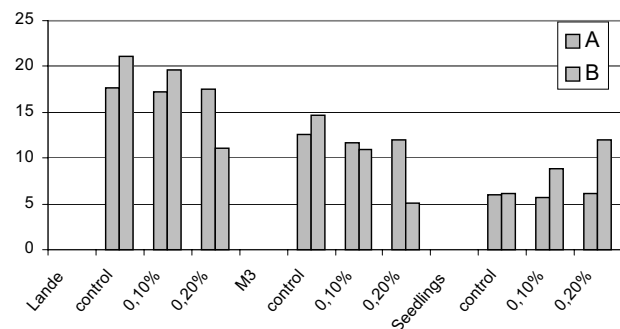


Fig. 2. Number of shoots: A – before treatment, B – in at the end of vegetation period

tion hampers the shoot growth of seedlings and plants propagated by softwood cuttings. This effect is particularly strong during the first two weeks after spraying. No change in the diameter of shoots due to the effect of growth regulator has been determined.

References

1. Дерфлинг К. Гормоны растений. Москва, 1985.
2. Лихолат ТВ. Регуляторы роста древесных растений. Москва, 1983.
3. Bowen J, Lowe R. *Scientia Horticulturae* 1988; 35 (3-4): 251-8.
4. Cruz-Castillo J, Lowes G, Wooley D. *Acta Horticulturae* 1992; 297: 475-80.
5. Henzell R, Briscos M, Gravett I. *Acta Horticulturae* 1992; 297: 345-50.
6. Интродукция древесных растений в лесостепном Приобье. Новосибирск, 1982.
7. Giorgio V, Standardi A. *New Zealand Journal of Crop and Horticultural Science* 1991; 19(4): 349-53.
8. Шумахер Р. Продуктивность плодовых растений. Москва, 1985.

9. Плеханова М. Актинидия, лимонник, жимолость. Ленинград, 1982.
10. Chesoniene L. *Acta Horticulturae* 2000; 538 (2): 769-74.

Laima Česonienė

2-CHLORETYLFOSFONINĖS RŪGŠTIES ĮTAKA *ACTINIDIA KOLOMIKTA* ŪGLIŲ VYSTYMUISI

S a n t r a u k a

Buvo tirtas 2-chloretilfosfoninės rūgšties poveikis *Actinidia kolomikta* augalų vienmečių ūglių augimui ir vystymuisi. Nustatyta, kad 0,2% koncentracijos tirpalas depresyviai veikia žaliais auginiais padaugintų augalų ir sėjinių vienmečių ūglių augimą. Ypač ryškiai šis poveikis pasireiškė per pirmąsias 14 dienų po purškimo: išryškėjo ūglių viršutinių tarpubamblių ir pumpurų nekrozė (vyriškas klonas M3), nukrito lapai (M3 ir veislė 'Landé'). Dalis nekrotizuotų ūglių žuvo. Ypač ryškiai pasikeitė sėjinių morfologiniai požymiai. Vegetacijos pabaigoje daugiausia ūglių suformavo 0,2% tirpalu nupurkšti sėjinukai. Šiuo augimo reguliatoriumi nupurkšti augalai anksčiau baigė vegetaciją.