PROLIFERATION AND ROOTING TESTS OF *Prunus avium* ROOT SEGMENTS CUTTINGS: EFFECT OF AUXIN AND CUTTING DATE

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Abstract.- Prunus avium *(Rosaceae) is a component of biodiversity in forest ecosystems: its fruits are eaten by many birds and its early flowering gives it a high aesthetic value. In northwestern Tunisia,* Prunus avium *is a species exploited as a rootstock for cherry trees and as wood for cabinet making by local populations. The natural stands, which have been steadily decreasing for several decades, are threatened by various anthropic pressures, which are increasingly strong, reducing the species' natural regeneration capacity. The natural renewal of the wild cherry ecosystem in Tunisia is difficult, which makes it possible to advance the techniques of artificial vegetative propagation to improve the distribution of this species. The present study focuses on the production potential of rooted seedlings from root segment cuttings. The study shows that this type of cuttings is significantly influenced by the sampling date and the use of a growth hormone (IBA). The best results (60% rooting), were obtained for the January cutting and 50 mg/l of IBA. Rooting of 10% of the cuttings was achieved in the absence of the AIB treatment for the in month of January.*

Key words: *Prunus avium, AIB, root segment cuttings, cutting date, Tunisia.*

ESSAIS DE PROLIFERATION ET D'ENRACINEMENT DU BOUTURAGE DE SEGMENTS DE RACINES DE *Prunus avium*: EFFET DE L'AUXINE ET LA DATE DE BOUTURAGE

Résumé.- Prunus avium *(Rosaceae) est une composante de la biodiversité dans les écosystèmes forestiers. Ses fruits sont consommés par de nombreux oiseaux et sa floraison précoce lui confère une grande valeur esthétique. Au nord-ouest tunisien,* Prunus avium *une espèce exploitée comme porte-greffe pour le cerisier et comme bois pour l'ébénisterie par les populations locales. Les peuplements naturels, en constante diminution depuis quelques dizaines d'années, sont menacés par diverses pressions anthropiques, de plus en plus fortes, réduisant les capacités de régénération naturelle de l'espèce. Le renouvellement naturel d'écosystème merisier en Tunisie est difficile ce qui permet de faire progresser les techniques de multiplication végétative artificielle pour améliorer la répartition de cette espèce. La présente étude porte sur les potentialités de production de production des plants enracinées à partir des boutures de segments de racines. L'étude montre que ce type de bouturage est sensiblement influencé par la date de prélèvement et l'utilisation d'une hormone de croissance (AIB). Les meilleurs résultats (60% d'enracinement), ont été obtenus pour le bouturage Janvier et 50 mg/l d'AIB. Un enracinement de 10% des boutures a été obtenu en absence du traitement d'AIB pour le mois de Janvier.*

Mots clés : *Prunus avium, AIB, bouturage de segments de racines, date de bouturage, Tunisie.*

Introduction

Yellow birch is a fast growing semi-shade species [1]. According to Thibaut et al (2009) [2], this species requires a good mineral content combined with a good water supply.

In Tunisia, this species is adapted to the humid climate. The species is found at medium altitudes up to 620 m. The cherry tree can withstand temperatures ranging from

3°C to -2°C. It can withstand average annual temperatures of over 13°C.

This species requires a relatively average rainfall of around 750 to 1200 mm per year. It is very sensitive to summer drought [3]. *Prunus avium* is a highly endangered species despite its importance as a timber, which is highly valued in sawing, cabinet making and even veneering. It is also of great agronomic interest because of its use as a cherry rootstock, and is of great interest to cherry growers [4]. Natural regeneration of seedlings is currently very low or even absent because the seeds are characterized by embryonic and integumentary dormancy. The number of seed trees is very low in northwest Tunisia. Young seedlings from seedlings and suckers are systematically used by the local population as rootstocks for cherry [3]. In order to better protect and restore these cherry trees, it is very useful to have a thorough knowledge of the mechanisms of vegetative propagation by cuttings of the root segments of this species. This propagation technique is the best adopted method for producing true genetic copies of the original mother tree with the same wood and fruit qualities.

In this context, it seemed interesting to us to undertake a study on the influence of the date of cutting and the concentration of IBA on the development of the aerial part and the root formation of cuttings of cherry root segments in northwestern Tunisia.

1.- Material and methods

1.1.- Plant material

The root segment cuttings used in this work were taken from mature trees located in the locality of Ain Saida in Ain Draham (N36°52'25"; E008°41'47"). The latter, located in the northwest of Tunisia, belongs to the humid bioclimatic stage.

1.1.2.- Methodology taking of cuttings

The root segment cuttings were taken from young, healthy and vigorous trees. To study the influence of the date of cutting on the development of the aerial and root parts, two harvest dates were chosen, with a three-month interval between them (09 September 2019 and 07 January 2020).

A total of 200 root fragments of 15 cm length and 2 to 3 cm diameter, at a depth of 20 cm from the secondary roots of cherry trees were taken (100 cuttings per sampling date). As soon as they were taken in the Ain Saida forest, the cuttings were placed in black polyethylene bags containing cotton impregnated with water to prevent the plant material from drying out and taken to the laboratory of the Institut Sylvo-pastoral in Tabarka.

1.1.3.- Preparation of cuttings

In the laboratory of the Institut Sylvo-Pastoral in Tabarka, during each sampling date, the root segment cuttings were then treated with different concentrations of Indole Butyric Acid (IBA). The soaking in IBA was for 24 hours at an immersion height of about 7 cm. Furthermore, to study the effect of auxin on the root formation of cuttings from birch root segments, different concentrations of IBA was used for each date: 10 mg/l (T_2), 50 mg/l (T_3) and 90 mg/l (T_4). A control (T_1) without IBA was also carried out.

This greenhouse is shaded at 80% during the spring and summer period. The experimental set-up is a randomized block design with four replicates, each type of treatment and each sampling date consisting of 20 cuttings.

1.1.4.- The parameters studied

Based on daily observations of aerial development and root formation of cuttings, we determined the percentage of dedication, survival rate, average height growth, average number of roots per cutting and average root length. The different length and diameter measurements were made with a ruler and a caliper with an accuracy of 1/100 cm.

1.2.- Statistical analysis

To determine the effect of the date of cutting and the concentration of IBA on the development of the aerial part and the root formation of birch root segment cuttings, we performed a Tukey's LSD test using the XLSTAT 2020 software.

2.- Results and discussion

2.1.- Influence of cutting date and IBA on dedication and survival rate

A significant interaction ($P<0.001$) was noted between the percentage of bud break, survival rate, IBA concentration and date of cutting. For the September cutting, the percentage of dedication after 25 days varies from 50% and 70% for both concentrations 50 mg/l and 90 mg/l. The bud break rate decreased in the absence of the IBA as well as in the case of 10 mg/l IBA, respectively 10% and 30% (fig. 1). During the second cutting date (January), the bud break rate varied from 90 to 100% after 18 days for the two concentrations 50 mg/l and 90 mg/l, respectively and from 30 to 50% for the control and 10 mg/l respectively (fig. 1).

During the period from the end of August to the end of November (first sampling date), this species is in a state of total dormancy, with total leaf drop and growth arrest.
The recovery of the rooting water conditions, by the carbonate reserves contained in the roots of the cherry tree during the winter period (second sampling date).

The survival rate is influenced by the date of cutting and the concentration of IBA. The survival rate varies from 5% (control) to 45% (90 mg/l) for the September cuttings and from 20% (control) to 70% (90 mg/l) for the January cuttings (fig. 1).

The most favorable IBA concentrations for bud break and cuttings survival are 50 mg/l and 90 mg/l, respectively for the two cutting dates of September and January.

As for the effect of IBA on bud break and survival of cuttings, the results of our work do not confirm those of ANTUNES *et al.* (2001) [5] and KARADENIZ (2001) [6] who found that this product, an auxin derivative, can become harmful and negatively affect the recovery of cuttings when applied at high doses.

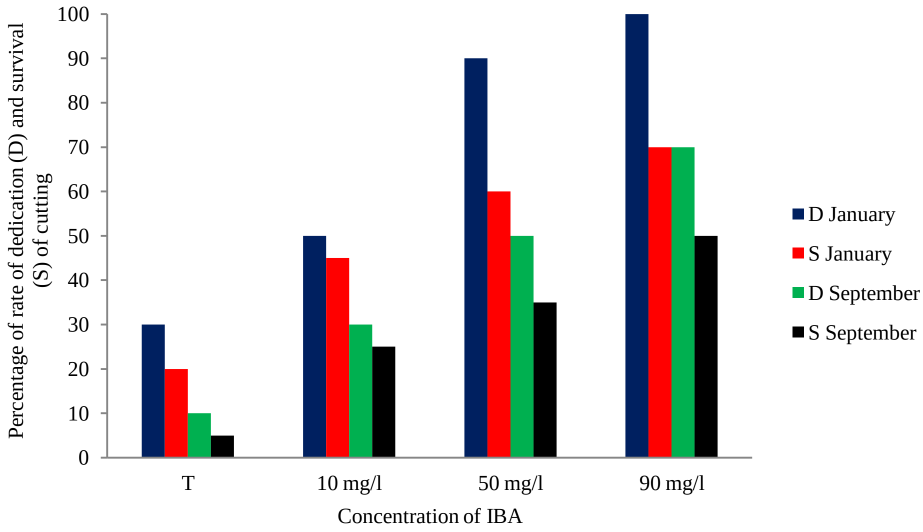

Figure 1.- Influence of cutting date and IBA concentration on the percentage of dedication and survival rate

2.2.-Influence of cutting date and IBA concentration on the growth of the aerial part

Statistical analyses of variance (ANOVA) shows that the average number of leaves is influenced (P<0.001) by the date of cutting after 180 days. The January cuttings gave the maximum number of leaves. On the other hand, the results of the statistical analyses show no significant effect on the number of leaves per cutting at different IBA concentrations.

Figure 2 shows that the maximum number of leaves is observed for the January cutting at concentrations of 50 mg/l and 90 mg/l, respectively 20 and 23 leaves per plant after 180 days of the experiment. In fact, the average number of leaves per plant does not exceed 13 for the September cutting at a concentration of 90 mg/l of IBA.

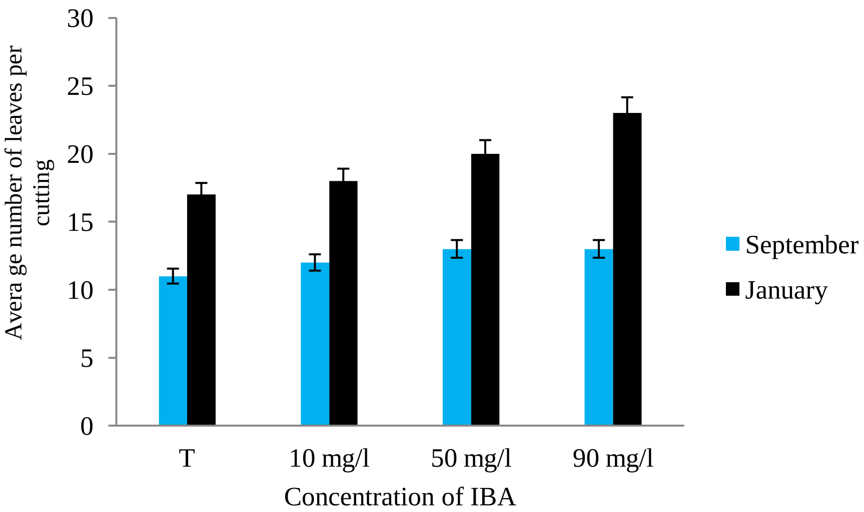

Figure 2.- Variation of the average number of leaves per cutting as a function of the date of cutting and the concentration of IBA

The average growth per stem height was only influenced by the date of cutting (P<0.01). After 4 months of transplanting, the best elongation is obtained with the January cuttings reaching 33.50 cm on average of 180 days.

As with the previous parameter, there was no significant effect of the BIA treatment on the average height growth. For both dates, the concentrations of 50 and 90 mg/l, respectively showed the best growth in height (fig. 3 and photo 1).

On the other hand, the results regarding the effect of IBA on the morphological parameters of the cuttings are similar to those obtained by CHALFUN *et al.* (2001) [7] and AUCLAIR (2009) [8] who noted that the concentration of IBA has no effect on the average length and the average number of leaves per rooted cutting.

The time of year when the cuttings are taken is, according to HARTMANN *et al.* (1990) [9], the factor that has the greatest influence on cutting.

Several factors can explain the influence of the date of cutting on the development of the aerial part of the cuttings: In the study area, during the September period, the cuttings were subjected to a long photoperiod, but also to higher temperatures during the day and night and to slightly cooler temperatures during aerial development. The January cuttings were subjected to a continuously increasing photoperiod, relatively well-controlled temperatures in the first months and conditions that should be more favorable for aerial development.

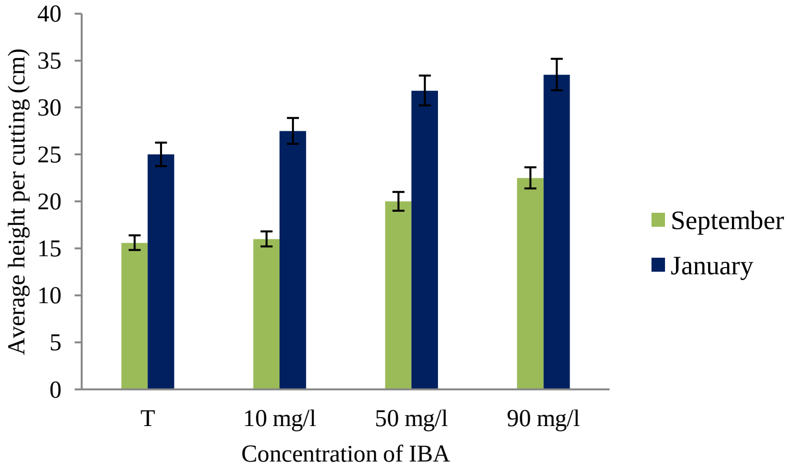

Figure 3.- Variation of average height per cutting as a function of cutting date and IBA concentration

Photo 1.- Cherry root segment cutting after 3 months (September cuttings at 90 mg/l IBA)

2.3.-Influence of cutting date and IBA on root formation

According to the results obtained, there is a significant effect (P<0.001) of the date of cutting and the concentration of IBA on the rooting rate during 180 days of the experiment.

Root segment cuttings from January show the highest rooting rate (30-80%) than cuttings from September (10- 40%). Indeed, the concentrations that seem to give the best results are 50 mg/l and 10 mg/l. There is rooting on 10% of the January cuttings for the Control (fig. 4).

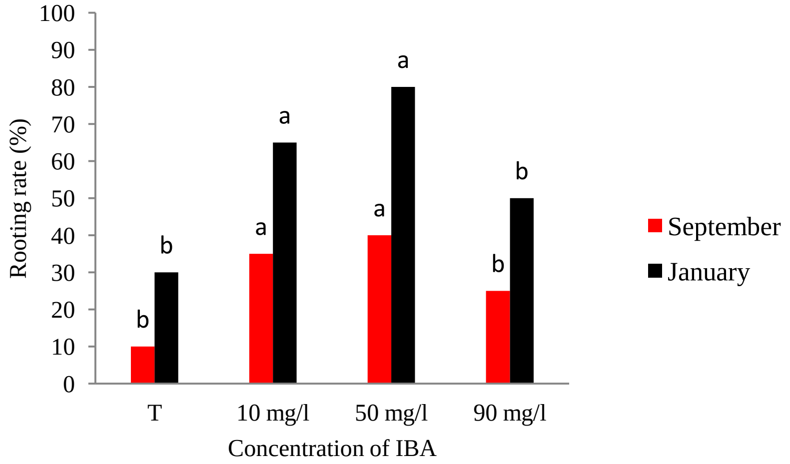

Figure 4.- Influence of cutting date and IBA concentration on rooting rate

The average number of roots per cutting was also influenced (P<0.001) by both the date of cutting and the 180 day IBA concentration.

For the September cutting, the concentrations of 10 mg/l and 50 mg/l favor rooting, with an optimum at 50 mg/l. For the January cutting, all IBA concentrations produce roots, even the control (without IBA), whose number varies according to the concentration, with an optimum at 50 mg/l and 10 mg/l (fig. 5).

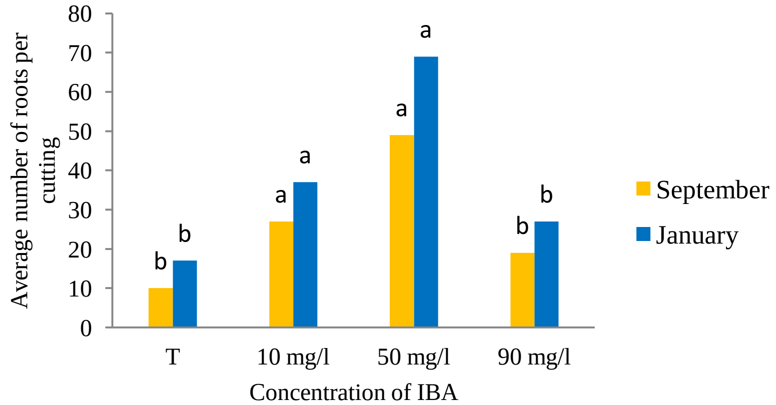

Figure 5.- Influence of cutting date and IBA concentration on the average number of roots per cutting

The results obtained showed that the average root length was influenced by the date of cutting and the IBA concentration (P<0.0001). Roots created on the January (13.5 cm) and September (9.5 cm) cuttings associated with the 50 mg/l concentration develop more vigorously than those produced with the other IBA treatments (fig.6 and photo 2).

Photo 2.- Rooting of a birch root segment cutting after 3 months (January cuttings at 50 mg/l)

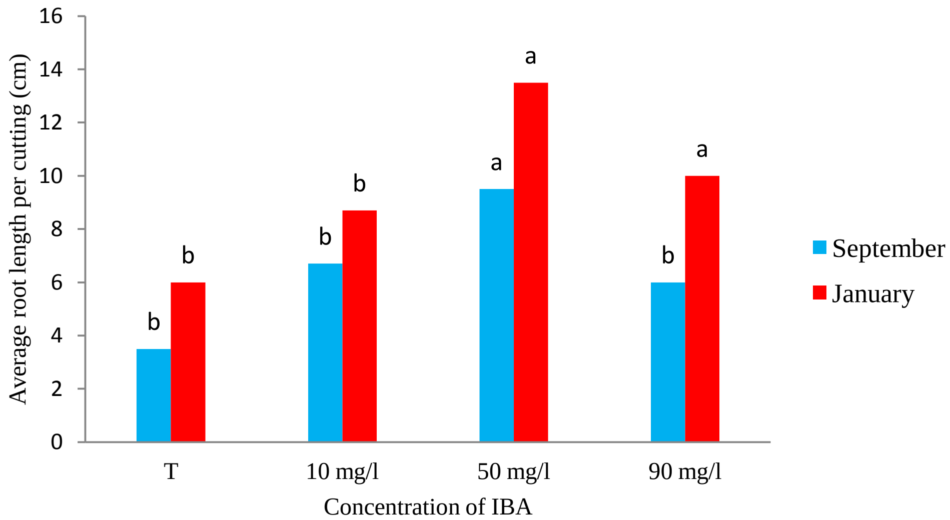

Figure 6.- Influence of cutting date and IBA concentration on average root length growth

In general, the results obtained show that the January cuttings have the best rooting ability. Similarly, the concentration of 50 mg/l also gives the best result for both dates.

Our results are similar to those found by [10], a solution with a higher concentration of IBA (4000 and 12000 ppm of IBA) stimulates the rooting of several hard-rooted species more. Similarly, according to [8], the average number of primary and secondary roots formed by the cuttings is strongly influenced by the auxin treatments (2000 ppm of IBA). Cuttings treated with low or medium concentrations of IBA produced the highest number of roots.

As for the previous parameter, according to [9], the rooting of cuttings is influenced by the date of taking the cuttings. On the one hand, the environmental conditions to which the cuttings will be exposed during rooting will vary greatly according to seasonal conditions. On the other hand, the physiological state of the cutting leading to rooting can change considerably from season to season, from month to month, and even from day to day.

Conclusion

In the present study, the effect on the date of cutting as well as the concentrations of IBA on the growth of the aerial part and the root formation of cherry trees was demonstrated.

From the results obtained, we have shown that the January cuttings are more favorable than the September cuttings. It resulted in a high bud break and survival rate, excellent height growth and thus better root formation.

Indole butyric acid at 50 mg/l improves root formation. This results in a high rooting rate and an increase in the average number of primary and secondary roots.

However, it appears that several other factors can influence the rooting of cuttings of this species. It would therefore be interesting to study this further; as the success of propagation by cutting root segments at low cost is not yet evident.

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