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Experimental Culture of Averrhoa Carambola in Environmental Application

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Abstract

The *A. carambola* adapts better to the tropical climate in spite of his water requirements.12 seeds were planted in almond-flavored holes of the compost. The seeds were placed in one to germoir, then, of the seedbed, the seedlings mended in a perforated ground of three Kilogrammes of the organic matter. Watering with water 1.500mL per day and three times per week boosté the growth which was followed while taking measurements of diameter, the height and the counting of a number of sheets and ramifications. 10 plants survived after 12 monts of flight face the Bad water and one new the los of 2 plants. Thèse cultures were carrier out with an aime of créatine a source of juive provisionné of carambola, one bio coagulant for the trématent of the lâchâtes produced in this Mpasa with Kinshasa, in Democratic Republic of Congo. The output was 83 %.

Keywords: culture; *A. carambola;* application.

1. Introduction

The plants contain properties sought for the biological treatment of the complex effluents without producing major disadvantages in the environment. Many compounds phytochimic and phytobiological following the example alkaloids, terpenes or glucosinolates present in various families of plants, act directly on the growth, the development, the reproduction or longevity [11. 29] and in the discolouration of ink and during formation of the new molecules.

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Other species synthesize sulphur secondary compounds which are at the origin of the particular odor which emerges some during degradation [29]. The sulphur amino acids nonproteinic are produced by the secondary compounds and are stored in the cytoplasm of the cells in the form of dipeptides. They are released thereafter under the influence of the γ - glutamylpeptidase [17]. Indeed, at the time of the destruction of the vegetable cells, plants such that *A. carambola* contain enzymes located in the vacuoles, the alliinase or alliinealkyl-sulfinate lyase which induces the synthesis of a whole series of volatile sulphur compounds [17]. These characters were enough within the framework to this research, that *A. carambola* is retained to purify worn water and to reduce the impurities of a mineral and organic matter liquid charged. The study of role played by *A. carambola* in the treatment of the leachates will be quite thereafter illustrated through the titles of the continuation of research as a whole. The climate is a considerable factor on certain phenomena expressed by the plants, during the appearance of first stems and roots, at the moments of falls of the leaves and the flowers. With that are added the ecological conditions which proved to be favorable or unfavourable with the life of plants [23].

2. Classification

The *A. carambola* is greedy out of water and tends to rarefy in the gardens with the least deficiency in moisture. He does not support the direct radiations of the sun. The plant of *Averrhoa carambola* adapts better in the mediums to hot and wet climate. It belongs to *the Plantae* Reign, in *Magnoliophyta* Division, the class of *Magnoiopsita*, the order of *Geraniales*, the family of *Oxalidaceae*, *the Averrhoa* Kind and Species *A. carambola* [3]. The objective was to cultivate on a small scale seeds of *A. carambola* under the experimental conditions of the Garden JEEP of the Department of biology, Faculty of Science of the University of Kinshasa. Twelve fruit seeds of carambola were put in culture, on the blotting papers (papers absorbents) humidified beforehand in limp of Petri. After fourteen days of germination, the lifting of the seedlings had also been observed around fourteen days.

3. Material and methods

3.1 Material

The fruit of carambola can contain with maturity a significant number of seeds. Those are flattened and of whitish color. The seeds were put in culture in limp of Petri, which were covered with the blotting papers soaked with water. Ground on which was cultivated 12 seeds of *A. carambola* was sandy of a surface of 12 m^2.

3.2 Methodology

The experiment consisted in creating a plantation of caramboliers using the cultivated seeds, which would be used to produce the juice of carambola. 12 fruits seeds of carambola were dried safe from the light during 7 days. The setting in culture consisted in spreading out over papers absorbents soaked with water in limp of Petri of 10cm of diameter and 1 çm of depth in January/2017, with the darkness. Limp being closed by the lids, these conditions do not cause the evapotranspiration, not either the desiccation. Germination and the lifting consumed each one 14 days after the setting limps about it. The seeds were burst and pushed in a seedbed by line of 4

seedlings during. With this embryonic stage, the seedlings nourished endosperm contained in seeds. The seedlings were mended in 12 holes of 20 depth cm 10cm of diameter and dug on a surface of sandy ground of 12 m^2. In each hole, it was placed 3 kg of humidified composts. They were arranged in three lines including 4 holes by line. Plant *A. carambola* likes water excess, the seedlings were sprinkled at 3 days regular intervals per week with 1,500 liters of water twice per day except the days that it could rain. The quantity of water of 2,500 liters per day allowed the development individually plants. What comes down to saying that the growth was not automatic from one plant to another. However, after each month, the follow-up of the growth was founded to the measure of the diameters using a slide caliper of mark DIGITAL CALIPER 150mm (6 ' '), of a manual counting of a number of leaves and ramifications. The height was then measured using a slat of 30cm. The growth observed for one twelve months period made it possible to reveal the results which are included in the point below.

4. Results and discussion

The results of the phenology of the plant of *A. carambola* are established in the tables and graphs below.

Table 1: Culture and germination of the carambolier:Phenology

Seeds of *A. carambola*	Phenology		
	Seed no.	Germination	Lifting
Ground setting	12	14 jrs	14 jrs

Table 2: Index of Germination (IG)

Seeds of *A. carambola*	Index of Germination (IG) after 14 days				
	Nmgg	Nmggt	Lr (cm)	Lrt	IG
Germinated seeds	12	5	3,01	2,72	2,7

Caption:Nmgg:A number of germinated seeds; **Lr**:length means of the root; **Nmggt**:A number of germinated seeds of the witness; **Lrt**:length means of the pilot root.

Table 3: Averages of the phenologic values of the plantation of A. carambola of February 2016 in the month February 2017.

	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9	P_{10}	P_{11}	P_{12}
height	8,25	20,49	20,97	27,79	26,89	183,1	45,35	31,69	42,31	28,78	18,26	19,31
leaves	7,14	10,55	11,9	10,73	8,82	13	14,91	13,41	12	10,75	10,55	10,64
ramifica.	0,86	2,18	2	1,89	2,64	4,82	5,18	2,8	4,91	4,1	1,45	1,36
diamèter	1,22	3,62	3,49	5,46	4,56	6,79	8,33	5,28	6,96	6,13	3,94	3,34

The figures below give the details on the phenology of *A. carambola* after 12 months of culture. In comparison with the results obtained in table 1, the P1 plant had weak the 3,2 cm height growth per P7 report/ratio, who knew the highest growth (16,2 cm) height. Contrary to the horizontal growth, it is the P3 plant which knew the largeest diameter of 6,6 mm all other feet. The P4 plant was carrying several leaves:13 on the whole. This stage, it does not have there ramifications. After two months of maintenance, the greatest growth in height, the development of sheets and diameter are recorded at the P7 plant with respectively (22,5 cm, 19 and 3,34 mm). The always null ramification elsewhere, but the first branches pushed on the principal stems of plants P7 and P10.As for the P1 plant, its growth is always delayed with 5,5 cm height and 0,84 mms in diameter. Period the three months having passed, the plants P7 (29,9 cm), P9 (29,0 cm) and P12 (29,5 cm) knew the high level of growth compared to the other seedlings. The development of the leaves is more noticed at the seedlings P5 (22 leaves) and P6 (20 leaves) and is followed young plants P7 and P9 which had each one of it 19 leaves. The number of branches increased more on the principal stems of the seedlings P7 (07) and P9 (06). The known largest diameters at this stage were respectively 4,99 mm for P7 and 4,49 mm for P9.With 0,7 cm height and 1,56 mms in diameter, the P1 seedling still connait a deceleration in its growth.

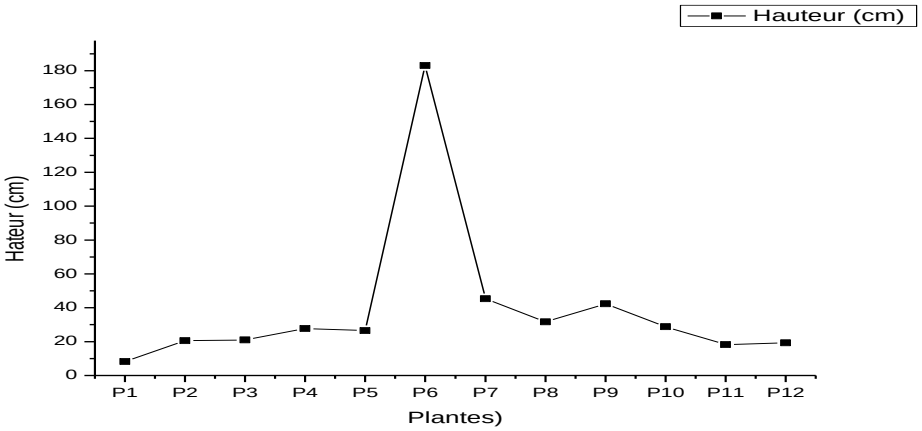

Figure 1: Growth in height of the 12 plants of caramboliers in one year**.**

The growth of the crop plants reached the height of 46,8cm for P7, of 29,0cm for P9, 31,7cm for P11 and 29,5 cm for P12 is respectively 36%, 15%, 44% and 45% of April 2017 in May 2017. The growth of all the remainders of the plants was lower than the rates above. The development of the leaves is more noticed at the seedlings P5 (22) and P6 (20) and is followed seedlings P7 and P9 which had each one of it 19 leaves. The number of branches increased more on the principal stems of the seedlings P7 (07) and P9 (06). The known largest diameters at this stage were respectively 4,99 mm for P7 and 4,49 mm for P9. With 0,7 cm height and 1,56 mms in diameter, the P1 seedling still connait a deceleration in its growth.

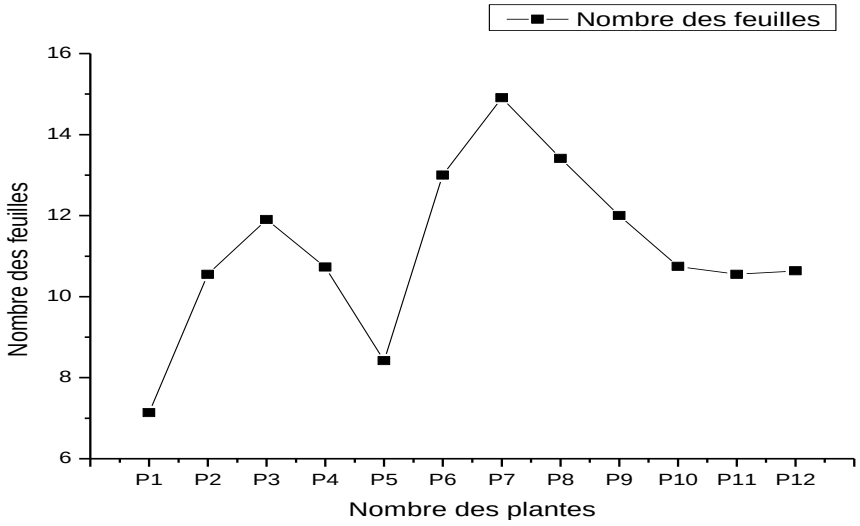

Figure 2: Growth in a number of the sheets of the 12 plants of *A. carambola* in one year.

After one period of five months growth, the heights of P7 seedlings with 29,9 cm, P9 measured 29,0 cm and P12 was 29,5 cm are highest compared to the remainders of the plantation. The development of the leaves is more noticed at the seedlings P5 17 leaves and P6 14 leaves are followed seedlings P7 and P9 which had each one of it 19 leaves.

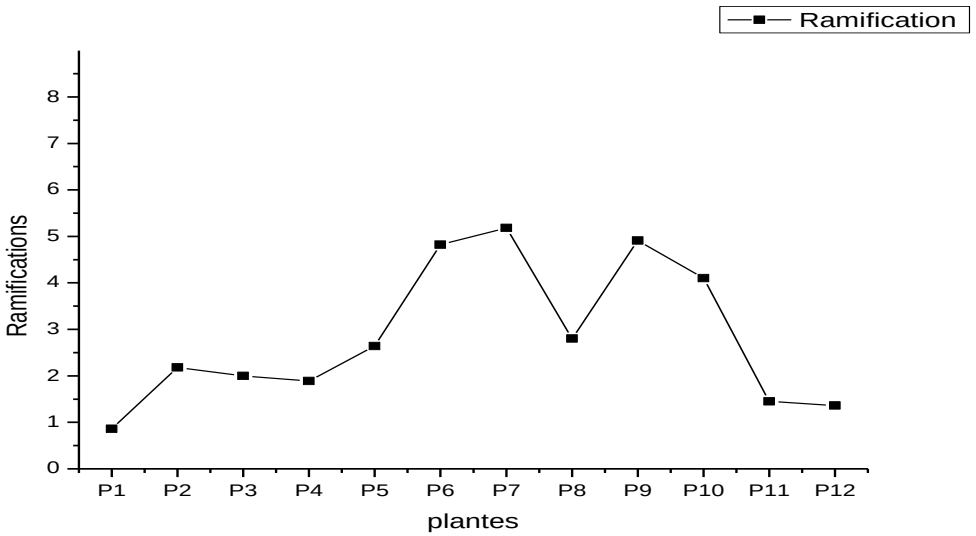

Figure 3: Growth of the ramifications by plant of *A. carambola* in one year.

The number of branches increased more on the principal stems at the P7 seedlings with 07 ramifications and P9 developed 06 ramifications. The known largest diameters at this stage were respectively 4,99 mm for P7 and 4,49 mm for P9. With 0,7 cm height and 1,56 mms in diameter, the P1 seedling still known a deceleration in its growth.

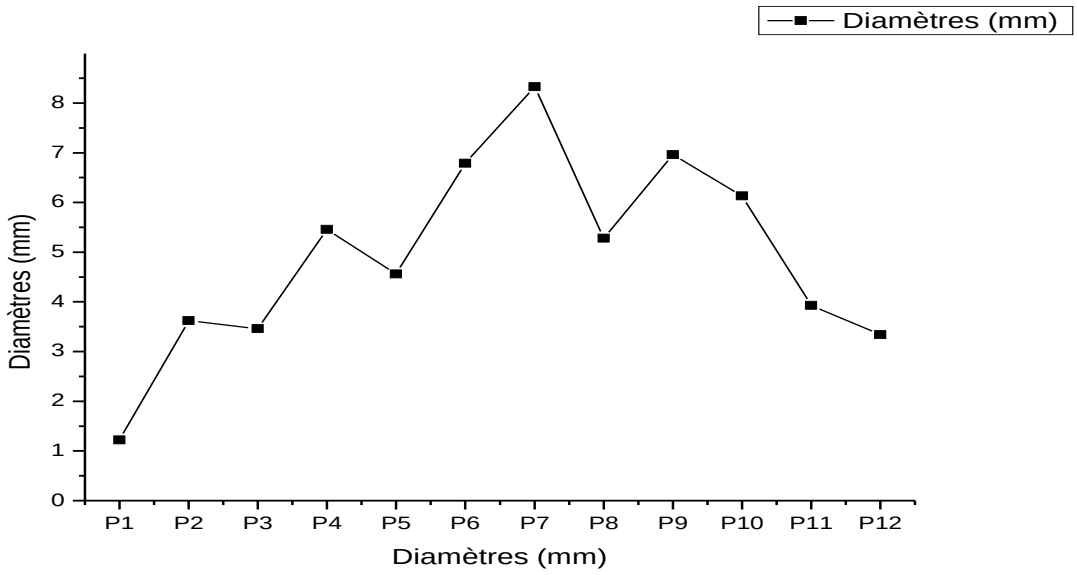

Figure 4: Diameter growth of the 12 plants of caramboliers in one year.

The plants P1 and P12 know already in this estival period vegetated, a weak growth appears on the height level of 10,9cm with 08,5cm for P1 and 38,8cm with 36,7cm for P12. The number of leaves fell for P12, the diameter of P1 atrophied 0,5mm, that of P12 narrowed of 2,15mm. Regular waterings could not satisfy the requirements out of water for the plants which are in growth. The ground on which they were cultivated is inclined, it does not absorb enough water at the time of fallen from the rains. The plants P1 and P12 are forwarded slowly to the end of their life. This confirms the character of the greediness of *Averrhoa carambola* out of water.

4.1 The output on the culture of 12 seeds

$$Rt\ (\%) = \frac{Pfc - Pp}{Pc} \times 100$$

Table 4

Sample	Output on the culture of *A. carambola*		Output
Seeds of *A. carambola*	PC	Pp	83,33%
	12	2	

Caption: *PC = crop plants;Pp = lost Plants*

5. Conclusion

The culture of *Averrhoa carambola* is a hard work whose fight is against the behavioral whims of the plant. This last A of the virtues which are revealed for the scientific uses. But, the climate and the care which it is necessary for its growth are the factors determining for better making a success of the growing. In other words, the speed of growth can be comparable with that of the plants with fast growth depending on these vital conditions. The

plantation of 12 seedlings in January 2017 gave results convincing and successfully, in spite of the slope of the ground and the very narrow space of 12 m^2. The follow-up was controlled starting from four parameters of growth the height, the ramification, the number of sheets and the diameter. So that at the end of the first year of put in culture, 10 plants out of 12 pushed very well whose output is 83%. By considering these results, June, July, August and September one period of absence of the rains constitutes, 2 plants under these conditions perished (P1 and P12) in spite of efforts which were provided with waterings. On the other hand, the abundance of the rains of November and December of the same year revitalized the growth of many plants which were in suffering. It is thus possible to create plantations of *A. carambola* on a large scale. Science must continue to dig in the nature which does not cease of offer to the researchers its marvellous resources for the durable applications in the environment.

Bibliography

[1]. Agrawal, A.A. & Kurashige, N.S., 2003. A role for isothiocyanates in plant resistance against the specialist herbivore Pieris rapae. J. Chem. Ecol. 29: 1403- 1415;

[2]. Alain dit philippe Bidie, Banga B. N'Guessan, Adou F. Yapo, Jean David N'Guessan et Allico Joseph Djaman, 2011. Activités antioxydantes de dix plante medicinales de la pharmacopée ivoirienne, Article, Sciences & Nature Vol. 8 N°1 :1-11 ;

[3]. Anonyme, 2008. Intoxiqués au Carambole, Clicanoo.com | Publié le 24 juillet;

[4]. Baldwin, I.T., 1988a. The alkaloidal responses of wild tobacco to real and simulated herbivory. Oecologia 77: 378-381.

[5]. Bartlet, E., Kiddle, G., Wiliams, I. & Wallsgrove, R., 1999. Wound-induced increases in the glucosinolate content of oilseed rape and their effect on subsequent herbivory by a crucifer specialist. Entomol. Exp. Appl. 91: 163-167.

[6]. Benslama A., 2016. Substances d'origine végétale, Université Mohamed Khider-Biskra Faculté des sciences exactes et des sciences de la nature et de la vie, Maroc ;

[7]. Bolter, C.J. & Latoszek-Green, M., 1997. Effect of chronic ingestion on the cysteine proteinase inhibitor, E64, on Colorado potato beetle gut proteinases. Entomol. Exp. Appl. 83: 295-303 ;

[8]. Borel, Maquart, Le Peuch, Randoux, Gillery, Bellon et Monboisse, 1997. Biochimie Dynamique P_{65}, De Boeck, Paris, Bruxelles ;

[9]. Cicolella A., 2007. Les composés organiques volatils (COV) : Définition et propriétés, Vemeuil Haltte, France ;

[10]. Constabel, C.P., 1999. A survey of herbivore-inducible defensive proteins and phytochemicals. In Induced plant defense against pathogens and herbivores, biochemistry, ecology and agriculture, eds, A.A. Agrawal, S. Tuzun, & E. Bent, the American Phytopathologist Society, St Paul, pp. 137-166.

[11]. Duffey, S.S. & Stout, M.J., 1996. Antinutritive and toxic components of plant defense against insects. Arch. Insect. Biochem. Physiol. 32: 3-37;

[12]. Ehrlich, P.R. & Raven, P.H., 1964. Butterflies and plants: a study in coevolution. Evolution 18: 586-608.

[13]. Gravot Antoine, 2009. Support de cours sur le métabolisme secondaire (Equipe pédagogique Physiologie Végétale, UMR 118 APBV), Université de Rennes 1 – L2 UE PHR) ;

[14]. Jaillais, B., Cadoux, F. & Auger, J., 1999. SPME-HPLC analysis of Allium lacrymatory factor and thiosulfinates. Talanta 50: 423-431.

[15]. Karban, R. & Baldwin, I.T., 1997. Induced responses to herbivory, ed, J.N. Thompson, Univ. Chicago Press, Chicago, 319 pp.

[16]. Koritsas, V.M., Lewis, J.A. & Fenwick, G.R., 1991. Glucosinolate responses of oilseed rape, mustard and kale to mechanical wounding and infestation by the cabbage stem flea bettle. Ann. Appl. Biol. 118: 209-221

[17]. Lancaster, J.E. et Collin, H.A., 1981. Presence of alliinase in isolated vacuoles and of alkyl cysteine sulphoxides in the cytoplasm of bulbs of onion (Allium cepa). Plant Sci. Let. 22: 169-176 ;

[18]. Latham Paul et Konda ku Mbuta, 2006. Quelques plantes utiles du Bas-Congo province, République Démocratique du Congo, Deuxième édition ;

[19]. Metcalf and Eddy, 1991. Waste water engineering. Treatement/Disposal/Reuse 3rd Montréal : McGraw-Hill ;

[20]. Montrichard Estelle, 2013. La carambole, mes recettes, éd… France ;

[21]. Par, P.W. & Tumlinson, J.H., 1999. Plant volatiles as a defense against insect herbivores. Plant Physiol. 121: 325-332.é

[22]. Petter P. et Chudoba J., 1990. Biodegradability of organic substances in the aquatic environment. CRP press 5, Boca, Raton, Ann Arbor) ;

[23]. Ramade François, 2010. Dictionnaire encyclopédique des sciences de la nature et de la biodiversité, DUNOD, France ;

[24]. Ramade François, 2003. Eléments d'écologie fondamentale, 3ème éd. DUNOD, Paris ;

[25]. Rosenthal, G. & Berenbaum, M.R., 1991. Herbivores: their interactions with secondary plant metabolites, eds, G. Rosenthal & M. Berenbaum, Academic Press,Vol. 1, N.Y.

[26]. Taiz, Lincoln & Eduardo Zeiger, 2006. Secondary metabolites and plant defense in: plant physiology, fourth edition ;

[27]. Turlings, T.C.J., Loughrin, J.H., McCall, P.J., Röse, U.S.R., Lewis, W.J. & Tumlinson, J.H., 1995. How caterpillar-damaged plants protect themselves by attracting parastic wasps. Proc. Natl. Acad. Sci. USA 92: 4169-4174.

[28]. Turlings, T.C.J., Tumlinson, J.H. & Lewis, W.J., 1990. Exploitation of herbivore- induced plant odors by host-seeking parasitic wasps. Science 250: 1251-1253.

[29]. Virtanen, A.I., 1965. Studies on organic sulphur compounds and other labile substances in plants. Phytochem. 4: 207-228.

[30]. Weinzerl, R., 1998. Botanicals insecticide, soaps and oils. In: Biological, Biotechnological control of insect pest, eds, J.E. Rechcigl & N.A. Rechcigl. Boca Raton, Florida, pp. 101-121.