International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 9; Issue 06(A); June 2020; Page No.22393-22396
DOI: http://dx.doi.org/10.24327/ijcar.2020.22396.4413

Research Article

GEOGRAPHICAL DISTRIBUTION OF THE PREVALENCE OF BACTERIAL FALLINITY IN THE MARKET SITES OF BRAZZAVILLE IN THE REPUBLIC OF CONGO

NGUINDA-AKANY Christian Ilitch[1], OLLANDET Innoçent [2], KOUBA NKOUAMOUSSOU Cyriac[1], ATTIBAYEBA Paul[3], ATOA Romaric Dianana Preston[1], EYONDO NGASSAKI Stael Wiston[1] and BIZANGUI Ben[1]

[1]Plant production laboratory of the National School of Agronomy and Forestry (ENSAF), BP: 69 Brazzaville Republic of Congo
[2]Plant Selection and Improvement Laboratory, National Institute of Agronomic Research (IRA)
[3]Lab of Physiology and Plant Productions, Faculty of Sciences and Techniques (FST) Corresponding author,

A R T I C L E I N F O

Article History:
Received 06th March, 2020
Received in revised form 14th April, 2020
Accepted 23rd May, 2020
Published online 28th June, 2020

Key words:
Bacterial wilt, cartography, market gardening, Brazzaville

A B S T R A C T

One hundred and thirty-two plots, including twelve per market gardening site, were surveyed in Brazzaville to assess the prevalence of bacterial wilt. The latitude and longitude data collected on the plot samples and treated with Arc View GIS 3.2a, made it possible to produce a map of the geographic distribution of the prevalence of bacterial wilt in Brazzaville. The bacterial wilting index is on average 24% and varies significantly depending on the market gardening site considered and its altitude. The intra-urban vegetable production area has the lowest prevalence of bacterial wilt with an average of 17% index. The peri-urban market gardening production areas group together the sites with high prevalence with an average of 29% index of bacterial wilt, that is 30% in the northern periphery and 27% for the southern periphery of Brazzaville. In addition, the indices of bacterial wilt increase with altitude. Altitudes between 560m and 590m have the highest bacterial wilt indices, from 25% to 40%.

INTRODUCTION

In Congo Brazzaville, urban market gardening is a form of agriculture which plays an important role in the food availability of the populations of the city and the professional integration of several people (Van Veenhuizen, 2006; Moustier P. 2006). Among the vegetable speculations, the solanaceae species are the most cultivated there because of their high demands by the populations. However, of all the parasitic constraints, the bacterial wilt caused by the intra-parasitic complex Ralstoniasolanacearum, constitutes an important threat. It is capable of causing yield losses of up to 90% of production. Nsika M., (2015) reports that this bacteriosis limits the choice of crop rotation for market gardeners in Congo. Technical assistance from market gardeners in Brazzaville in the management of bacterial wilt, therefore requires knowledge of its geographic distribution.

MATERIAL AND METHOD

Study site

To present the geographic distribution of the prevalence of bacterial wilt, 132 vegetable plots were surveyed from June 11 to September 11, 2018, in 11 main market gardening sites in Brazzaville. During the prospecting period, the average monthly temperature varied between 27 and 31 ° C and the average monthly humidity was 73.6%. The vegetable plots are on average 250 m².Irrigation is mainly done at the bottleneck on fruit vegetables. In general on market gardening sites, the soils are clay-sandy.

Equipment

The main equipment used in the field was a Garmin GPS 12XL which was used to assess the geographic coordinates used to establish the map in Figure 4 and the altitudes reported in Figure 5.

METHOD

Field data collection

The vegetable plots chosen are those on which the cropping activity was carried out for 3 years without interruption, showing the tomato crop and the signs of the disease at the time of prospecting. To this end, 12 plots were visited per market gardening site, in other words 132 plots were concerned by the study. The degree of attack of bacterial wilt or index of bacterial wilt in the field was evaluated as a

Corresponding author:* **NGUINDA-AKANY Christian Ilitch
1Plant production laboratory of the National School of Agronomy and Forestry (ENSAF), BP: 69 Brazzaville Republic of Congo

percentage (%) of the number of sick plants regardless of the extent of the symptoms, compared to the number of plants observed in a plot.

Field diagnosis

The plant with the symptoms of bacterial wilt (Figure 1.a) is dug up with a spade.A 1 cm segment of the stem at the neck is melted longitudinally using a blade to check if the internal coloring has turned brown (Figure 1.c).Then another fragment is put in a glass of water.The flow of a milky white macerate and the internal brown coloration in the stem characterize the presence of the intra-parasitic complex Ralstoniasolanacearum in the vascular system of the plant (Figure 1.b).

Figure 1 Diagnosis of bacterial wilt in the field

a: Tomato plant showing bacterial wilt **b**: Flow of a milky white macerate in a glass of water, **c**: internal brown coloration of the tomato stem (photo credit: NGUINDA-AKANY C.I., 2018)

Data processing and analysis

The geographic coordinates (Latitude and Longitude) of each sampling point were processed using Arc View GIS 3.2a software to map the bacterial wilt attacks in Brazzaville. Using the XLSTAT software version 2015.6.01.25740, the independence Chi-square test and the Dun test were used to compare the bacterial wilting means of the different market gardening sites. The correlation between the latitude and the index of bacterial wilt on the sites was determined with Excel.

RESULTS

Assessment of the bacterial wilt index in Brazzaville

The average bacterial wilting index covers 132 plots, 12 of which per market gardening site. It is 24% in Brazzaville. The Chi-square independence test revealed that in Brazzaville, the average index of bacterial wilt varies significantly depending on the market garden site (Table 1).

Table 1 Independence test for bacterial wilt index according to the site considered.

Chi-square (Observed value)	Chi-square (Critical value)	DDL	p-value	Alpha
1273,775	186,146	156	< 0,0001	0,05

The comparison of means of index of bacterial wilting of plots carried out from the test of Dun structure the market gardening sites in 5 classes (Figure 2).

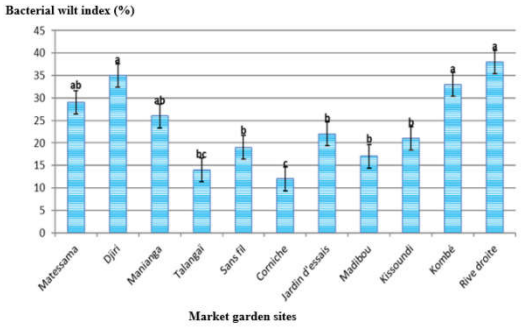

Figure 2 Average index of bacterial wilt on market gardening sites in Brazzaville

The market garden sites of Djiri (35%), kombé (33%) and right bank (38%) have the most significant signs of bacterial wilt in Brazzaville. On the other hand, the weakest bacterial wilt indices are those of cornice (12%), talangaï (14%), madibou (17%), wireless (19%), test garden (22%) and Kissoudi (21%). The matessama and manianga sites are infested with intermediate Bacterial Wilt Indices of 29% and 26% respectively.

Geographical distribution of bacterial wilt through Brazzaville

The bacterial wilt index in Brazzaville is between 12% and 38%.The market gardening sites in the districts of Djiri, M'filou often have the most significant signs of bacterial wilt, greater than 20%.On the other hand, the sites with a prevalence of less than 20% are mainly located in the districts of Talangaï, poto-poto and ouenzé (Figure 3).

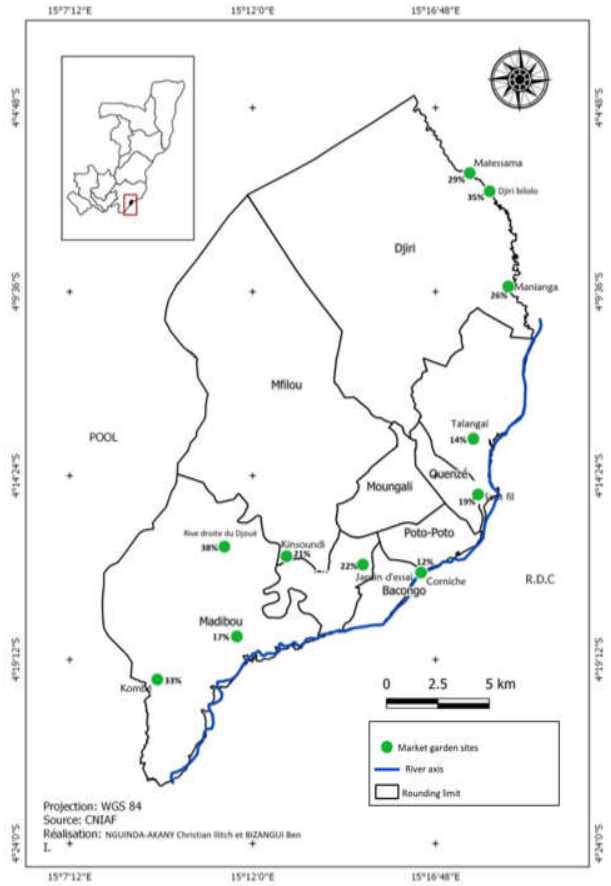

Figure 3 Map of the Average Index of bacterial wilt observed in Brazzaville in 2018

An assessment of the bacterial wilt index based on the distance from market gardening sites to the city center, highlights 3 production zones in Brazzaville: the northern peri-urban zone, the intra-urban zone and the peri-zone. urban south.The northern peri-urban market gardening production area, with a bacterial wilting index of 30%, includes the market garden sites of Matessama, Djiri and manianga.On the other hand, the market gardening sites of Talangaï, wireless, cornice and test garden constitute the intra-urban market gardening production area.

The latter has a bacterial wilt index of 17%. The southern peri-urban vegetable production area has a bacterial wilt index of 27%.It brings together the market gardening sites of Madibou, kissoundi, right bank of the Djoué and Kombé (Figure 4).

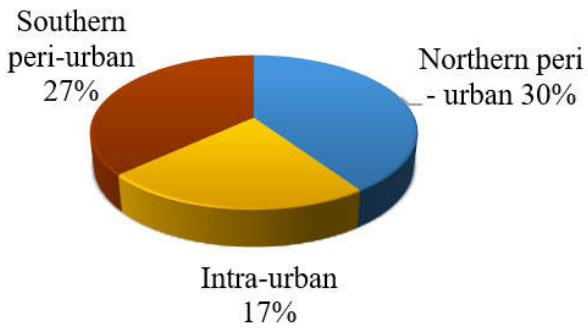

Figure 4 Distribution of bacterial wilt across the vegetable production areas of Brazzaville

The intra-urban vegetable production zone compared to that of the northern and southern periphery of Brazzaville is less infested by the intra-parasitic complex *Ralstonia solanacearum*. The distribution of the bacterial wilt index is positively correlated with the altitude of the market garden site. The most important signs of bacterial wilt are 25% to 40%, and concerns altitudes between 560m and 590m (Figure 5).

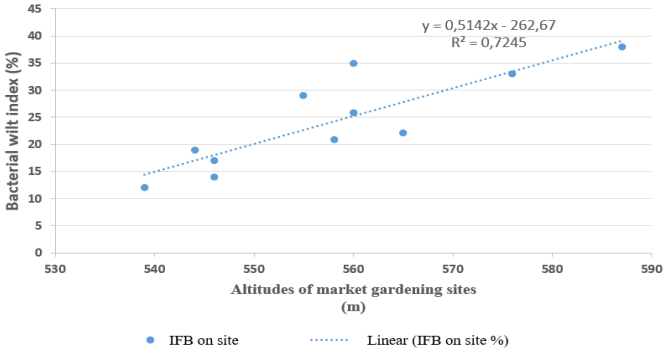

Figure 5 Distribution of the Bacterial Wilt Index according to the altitude of the market garden sites

DISUSSION

Assessment of the bacterial wilt index in Brazzaville

The bacterial wilt index in Brazzaville is on average 24% with disparities between the different market gardening sites. The infestation of all market gardening sites in Brazzaville by the intra-parasitic complex *Ralstonia solanacearum* shows that it can develop in all types of tropical soils. Cariglia (2007) also points out that sandy, loamy and clay soils facilitate the development of *Ralstonia solanacearum*. In addition, the significant difference in the index of bacterial wilt observed between market gardening sites, indicates that the infestation threshold of this microbe depends on the physico-chemical characteristics of a soil. Indeed, according to Van vaerenbergh *et al*. (2006), in sandy soil infections are favored when it has a high organic matter content and is well irrigated.On the other hand, it was reported by Messiha *et al*. (2006) that there is a greater decrease in Ralstonia solanacearum populations in sandy soil compared to clay soil.

Geographical distribution of bacterial wilt through Brazzaville

The grouping of market gardening sites according to location highlights an intra-urban (Corniche, Talangaï, Madibou, wireless, test garden) and peri-urban (Kissoundi Right Bank, Kombé, Kombé, Djiri, Matessama and Manianga) zonation.Unlike sites in an intra-urban area with 17% average bacterial wilt index, that of peri-urban areas is 33%.In other words, the infestation of soil in Brazzaville is greater on the peripheral sites. Such a trend underlies that the phyto-technical conditions that favor or limit soil infestation are similar for sites in the same urban area.In an intra-urban area, given the often reduced market gardening areas, concerns about the profitability of the activity mean that the cropping system favors short-cycle leafy vegetables.This results in low cultivation frequencies of long-cycle vegetables, especially solanaceae with an impact on the reduction of the bacterial population in the soil. In the urban periphery, on the other hand, the areas of market gardening are larger.However, given the high demand for solananceae fruit, the returns to cultivation of the latter are very short-lived. The bacterial density of the soil increases and then accentuates the cases of bacterial wilt in the urban periphery.

The index of bacterial wilt through the market gardening sites of Brazzaville is between 12% and 38%. This widespread distribution alerts to the possible possibility that the local strain of *Ralstonia solanacearum* bypasses the resistance of cultivated plant varieties. Such aptitudes of the bacterial strain responsible for bacterial wilt on solanaceae have already been reported by Lebeau *et al*. (2010).

CONCLUSION

The Average Index of bacterial wilt in Brazzaville is 24% with, however, a disparity between the market garden sites. During surveys carried out during this study, even if the index of the disease was found to be more severe in the peripheral sites, all were infested. It is therefore quite possible that the local strain of *Ralstonia solanacearum* bypasses the resistance of the various cultivated varieties. However, the fact that at least one source of resistance is capable of controlling the most virulent strains of *R. solanacearum* (Cellier and Prior, 2010), the prospect of research in agro-ecological control could be based on the use of use of it as a rootstock. Several authors have reported that resistance against *Ralstonia solanacearum* is polygenic (Wang *et al*., 1997b; Deslandes *et al*., 1997).

Bibliographic References

Cariglia, A., Prior P., Pruvost O., Luisette J., Février 2007. Lutte préventive contre le flétrissement bactérien en culture de tomate hors sol. Etat des connaissances et conseils. Pôles de protection des plantes, Saint-Pierre (Réunion) 143p.

Cellier G. et Prior P., 2010. Diversité génétique, phylogénétique et discernement du pouvoir pathogène sur Solanacées des souches de Ralstonia solanacearum: [Résumé]. IN : 9èmes rencontres plantes-bactéries, 18-22 janvier 2010, Paris, AUSSOIS, France, p 39.

Deslandes L., Pileur F., Liaubet L., Camut S., Beynon J., Arlat M. and Marco Y., 1997.Identification and mapping of RRS1, a single recessive locus in Arabidopsis thaliana that confers resistance to Ralstonia solanacearum. In: Bacterial wilt disease, Molecular and ecological aspects. Ph. PRIOR, C. ALLEN and J. ELPHINSTONE (edit.), Gosier, Guadeloupe, France, 22-27 June 1997, pp. 205-254.

Lebeau A., Daunaym C., Palloix A., Wang J.F., Dintinger J., Chiroleu F., Wicker E. et Prior P., 2010. Interactions entre le complexe d'espèces Ralstonia solanacearum et les ressources génétiques pour la résistance au flétrissement bactérien chez la tomate, l'aubergine et le piment : [Poster]. IN : 9èmes rencontres plantes-bactéries, 18-22 janvier 2010, Paris, AUSSOIS, France, p 75.

Messiha, N.A.S., 2006. Bacterial wilt of potato (*Ralstoniasolanacearum* Race 3, biovar 2): Disease management, pathogen survival and possible eradication. Ph. D Thesis, Wageningen University, the Netherlands, 151 p.

Moustier P. *et al*. janvier 1996. Etude de cas de la dynamique du maraîchage péri – urbain en Afrique sub – saharienne. CIRAD-FLHOR, UR Economie des filières, 36 pages

Mpika J., Makollodou A.A. et Minant D., 2015. Influence d'un apport fractionné en potassium et en azote sur la croissance et le rendement de trois variétés de tomate de la zone périurbaine de Brazzaville en République du Congo. Journal of Applied Biosciences 94: 8789- 8800.

Van Veenhuizen, R. 2006. Cities Farming for the Future, Urban Agriculture for Green and Productive Cities.IIRR/RUAF/IDRC

Van Vaerenbergh, J., De Paepe, B., Hoedekie, A. and Tahzima, R., 2006. Persistence and infectivity of *Ralstonia solanacearum* R3bv2 in weeds and crop rotation on a potato farm using contaminated river water. In: The 4th International bacterial wilt symposium: Programme and abstracts book. 17th-20th july 2006, the Lakeside conference center, Central science laboratory, York, United Kingdom, pp. 54.

Wang J. F., Hanson P. and Barnes J. A., 1997b. Worldwide evaluation of an international set of resistance sources of bacterial wilt in tomato. In: Bacterial wilt disease, Molecular and ecological aspects. Ph. PRIOR, C. ALLEN and J. Elphinstone (edit.), Gosier, Guadeloupe, France, 22-27 June 1997, pp. 269-275.

How to cite this article:

NGUINDA-AKANY Christian Ilitch *et al* (2020) 'Geographical Distribution of the Prevalence of Bacterial Fallinity in the Market Sites of Brazzaville in the Republic of Congo', *International Journal of Current Advanced Research,* 09(06), pp. 22393-22396. DOI: http://dx.doi.org/10.24327/ijcar.2020. 22396.4413

****