***Article***

***Bean common mosaic virus* and *Alternaria alternata* epidemiological behavior in 12 *Phaseolus vulgaris* genotypes**

**Agustín Gonzalez-Cruces1**, **Esly Arista-Carmona1**, **Karen Vianey Díaz-Arias1**, **Karina Ramírez-Razo1, Adrián Hernández-Livera1**, **Gustavo Mora-Aguilera1,2\*, Gerardo Acevedo-Sánchez2 and Coral Mendoza-Ramos2**. 1Colegio de Postgraduados, Km 36.5 Carretera México-Texcoco, Montecillo, Texcoco, Estado México, CP 56230, México, Campus Montecillo. 2Laboratorio de Análisis de Riesgo Epidemiológico Fitosanitario (CP-LANREF).

|  |
| --- |
| ***\*Author correspondence:***  Gustavo Mora-Aguilera [morag@colpos.mx](mailto:morag@colpos.mx)  ***Section:***  This article was submitted to Special issue “COVID-19 and Plant Health” of this journal.  ***Received***: 28 Jul. 2020  ***Accepted***: 05 Aug. 2021  ***Published***: 01 Sep. 2021  **Citation:**  Mora-Aguilera G and Acevedo-Sánchez G. 2021. A retrospective analysis of plant and human epidemics for COVID-19 comprehension. *Mexican Journal of Phytopathology* 39(4). <https://doi.org/10.18781/R.MEX.FIT.2021-27> |

**ABSTRACT**

**Objective/Background.** Research objective was to assess phytosanitary response and epidemiological behavior associated with *Alternaria* spp. and virus symptoms among 12 *Phaseolus vulgaris* genotypes.

**Materials and Methods.** During 2020, assessments were conducted at flowering (June) and fructification (August). Severity was evaluated *in situ* with a 6-class logarithmic-diagrammatic scale setup in App-Monitor® v1.1. Genotype health was determined using Integrated Damage Index (IDI), weighted and adjusted for disease intensity and plant vigor (IV), which was estimated with images (RGB, 14mpx) captured with Phantom-3 at 5 m from genotype centroid. In SAS v9.4, an ANOVA (Tukey, *p*<0.05) in randomized blocks was performed. In SURFER v10, spatial patterns were obtained with kriging and omnidirectional variograms. Forty-three total samples for isolation, pathogenicity testing and molecular identification were performed with universal primers ITS-*Alternaria* and NIb/BL1-Virus. Final data matrix included 22 variables, 859 observations and 18,898 metadata.

**Results.** *Alternaria alternata* (AL) and *Bean common mosaic virus* (BCMV) with 99% homology were identified in 100% of samples analyzed. *Vaquita Negro*, *Garrapato* and *Canario* were statistically (*p*<0.05) most susceptible genotypes (37.3-58%) for BCMV, meanwhile *Canario* and *Tipo Flor de Mayo* (41.4-42.7%) for AL. Spatially, random and aggregate spreading patterns were reported for BCMV. *Vaquita Negro* showed uniform spread at high-intensity, associated with transmissibility by seed. AL, in contrast, reported multiple or aggregate foci patterns. *Tipo Flor de Mayo* and *Canario* exhibited coalescent aggregate foci since flowering due to climatic inductivity optimal for mycelial growth and sporulation. *Oti* and *Negro Perla* had higher climatic adaptability and sanitary tolerance with IV > 0.7 and IDI < 0.43.

**Conclusion**. This approach allows the generation and validation of tools capable of integrating a comprehensive multidisciplinary strategy to improve genetic improvement programs for *P. vulgaris*.

**Keywords:** *Alternaria alternata*, *Bean common mosaic virus*, severity, genotype, common bean

**Guide for Template**

The template details the sections and overall considerations that should be used in a manuscript. Details given are for ***Original Articles*** Verify the manuscript's characteristics and select the right one. Remove this paragraph and start in the section Introduction. Please check Authors Guide specific details (https://rmf.smf.org.mx/Documentos/RMF\_GuiaparaAutores.pdf). For doubts, contact the editorial RMF committee through revmexfitopatologia@gmail.com.

1. **Introduction**

This section should briefly place the study in a broad context and highlight why it is important. It should define the hypothesis and purpose of research. The art-state of field should be carefully reviewed and key publications cited. Finally, briefly mention the main aim of the research and highlight the principal conclusions. Please keep the introduction comprehensible to scientists outside your particular field of research. References should be cited according section the end of this document.

1. **Materials and Methods**

It should be described in detail to allow others to replicate the results. New methods and protocols should be described in detail while published methods can be briefly described and appropriately cited. Research manuscripts reporting large datasets that are deposited in a publicly available database should specify where the data have been deposited and provide the relevant accession numbers. They must be provided prior to publication. This section is mandatory.

1. **Results**

This section may be included by subsection or sub-subsections that authors considering. Authors should provide a concise and precise description of results and their overall interpretation. An example with number and format is shown as:

3.1. Subsection

Text…

*3.1.1. Subsubsection*

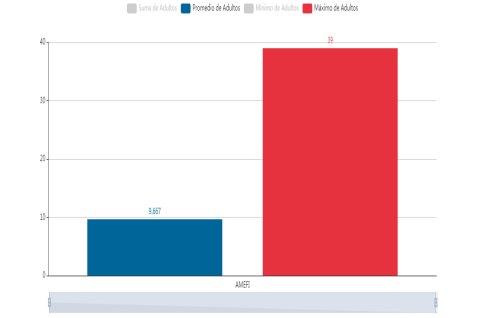
Text…

Examples about bullets and number list for text:

|  |  |
| --- | --- |
| Bulleted lists look like this:   * First bullet; * Second bullet; * Third bullet. | Numbered lists can be added as follows:   1. First item; 2. Second item; 3. Third item. |

Figures, Tables and Schemes

* All figures and tables should be cited in the main text as Figure 1, Table 1, etc.
* Figures or schemes should be inserted in the manuscript after their first citation in the text. High-quality images should be considered, at least 300 dpi or proportional to the sheet size. Figures and Schemes should be sending as JPG or PNG format.
* Tables should be created in MS Word. Please, do not paste from MS Excel.

****

**A**

**B**

**Figure 1.** Figure and schemes example. It should be placed in the main text near to the first time they are cited. If there are multiple panels, they should be listed as capital letters A-Z. Place should be uniform in figure or scheme depending on the structure and content. Black lettering on white background or yellow on dark background can be used.

**Table 1.** This is an example of table. Tables should be placed in the main text near to the first time they are cited.

|  |  |  |  |
| --- | --- | --- | --- |
| **Title 1x** | **Title 2** | **Title 3** | **Title 4** |
| entry 1 | data | data | data |
| data | data | data |
| data | data | data |
| entry 2 | data | data | data |
| data | data | data |
| entry 3 | data | data | data |
| data | data | data |
| data | data | data |
| data | data | data |

xUse The legend must be written in lowercase letters. Identify footnotes of the tables with lowercase letters of the end of the alphabet (in sequence: x, y, z). To identify levels of statistical significance, use asterisks (\*= *p*≤0.05, \*\*= *p*≤0.01). In numbers, use only one decimal place, e. g. 3.2%, not 3.195%.

1. **Discussion**

Please, discuss the results and how they can be interpreted from the perspective of previous studies and contrasting with hypotheses. The findings and interpretations should discuss widely. This section is mandatory.

1. **Conclusions**

Include at the final of paper some conclusions derived from your findings. This section is mandatory.

1. **Limitations**

Please describe a framework of research limitations. It can be about material and methods, results or other considerations. This section is mandatory.

**Conflicts interest**

All the authors must explicitly state that no conflict of interest exists concerning the research. This section is mandatory.

**Funding**

Please in this section add some sentence as: “This research received no external funding” or “This research was funded by NAME OF FUNDER, INSTITUTIONS or ORGANIZATION, with grant/ID number XXX” or “The article processing charge was funded by XXX”. Check carefully that the details given are accurate.

**Acknowledgments**

In this section, you can acknowledge any support given which is not covered by the author contribution or funding sections.

**Author contributions**

A short paragraph specifying their individual contributions must be provided. The following statements should be used “Conception, X.X.; conceptualization, X.X. and Y.Y.; methodology, X.X.; software, X.X.; validation, X.X., Y.Y. and Z.Z.; formal analysis, X.X.; investigation, X.X.; resources, X.X.; data curation, X.X.; writing—original draft preparation, X.X.; writing—review and editing, X.X.; visualization, X.X.; supervision, X.X.; project administration, X.X.; funding acquisition, Y.Y. All authors have read and agreed to the published version of the manuscript.” Authorship must be limited to those who have contributed substantially to the work reported.

**Supplementary Materials**

This section is not mandatory but may be added if there are supplementary materials necessary for manuscript support, e.g., protocols, databases, appendix, and others.

**References**

References must be listed individually at the end of the manuscript. Include the digital object identifier (DOI) for all references is mandatory. Citations and references in the Supplementary Materials are permitted provided that they also appear in the reference list here.

In the text, reference should be placed in brackets ( ) and placed before the punctuation. Sort from the most recent to the oldest. For example: (Gutiérrez *et al*., 2021) or (Gutiérrez *et al*., 2021; Flores-Hernández *et al*., 2020).

Examples:

1. Author 1, A.B. et al. Title of the article. *Journal Name* **Year**, *Volume*, page range. DOI.
2. Author 1, A.B. et al. Title of Unpublished research. *Journal Name* **Year**, *Volume*, page range. DOI. (Indicate: under review; accepted or in press).
3. Author 1, A.B. et al. Title of the chapter. In *Book Title*, 2nd ed.; Editor 1, A., Editor 2, B., Eds.; Publisher: Publisher Location, Country, year; Volume X, pp. x–xxx. Available online: URL (accessed on Day Month Year)
4. Author 1, A.B. et al. *Book Title*, Num. ed.; Publisher: Publisher Location, Country, Year; pp. x–xxx.
5. Author 1, A.B. (University, City, State, Country); Author 2, C. (Institute, City, State, Country). Personal communication, 2012. Available online: URL (accessed on Day Month Year)
6. Author 1, A.B. et al. Title of Presentation. In Title of the Collected Work (if available), Proceedings of the Name of the Conference, Location of Conference, Country, Date of Conference; Editor 1, Editor 2, Eds. (if available); Publisher: City, Country, Year (if available); Abstract Number (optional), Pagination (optional). Available online: URL (accessed on Day Month Year)
7. Author 1, A.B. Title of Thesis. Thesis grade, Degree-Granting University, Location of University, Date of Completion. Available online: URL (accessed on Day Month Year)
8. Title of website. Available online: URL (accessed on Day Month Year).

**Table.** Features and components allowed by RMF manuscript type. The numbers indicate the number of elements.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Component** | **Original Article** | **Review** | **Phytopath.**  **notes** | **Phytopath.**  **report** | **Letter editor** | **Methodologies or Protocols** |
| **Words** | 4000 | 5000 | 1500 | 1500 | 1000 | 4000 |
| **Number of Figures, Tables, Schemes** | 3-6 | 6-10 | 3-4 | 3-4 | 1-3 | 3-6 |
| **Abstract** | Structured;  300 | No Structured; 300 | Structured;  300 | Structured;  300 | - | Structured;  300 |
| **Introduction** | SM | SM | SM | SM | - | SM |
| **Materials and Methods** | SM | - | SM | SM | - | SM |
| **Results** | SM | - | SM | SM | - | SM |
| **Discussion** | SM | - | SM | SM | - | SM |
| **Conclusion** | SM | - | SM | SM | - | SM |
| **Limitations** | SM | Optional | SM | SM | - | SM |
| **Conflicts interest** | SM | Optional | SM | SM | - | SM |
| **Funding** | SM | Optional | SM | SM | - | SM |
| **Acknowledgments** | SM | Optional | SM | SM | Optional | SM |
| **Author contributions** | 10 | 5 | 5 | 5 | 3 | 10 |
| **Supplementary Materials** | Optional | Optional | Optional | Optional | X | Optional |
| **References** | 30-40 | 30-60 | 20-30 | 20-30 | 20 | 30-40 |