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Potential Application of the Objective Regression Regressive Methodology

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ABSTRACT

The possibility of having a methodology that allows the modeling and prediction, in the short, medium and long term, of biological, social and natural disaster processes and/or phenomena is something great. The objective of the research consisted in demonstrating the potentialities and real capacity of application of the methodology of the Regressive Objective Regression (ROR) in the different fields and branches of scientific research. In the ORR methodology, in a first step, dichotomous variables DS, DI and NoC are created. Then, the module corresponding to the Regression analysis of the SPSS statistical package (ENTER method) is executed, where the predicted variable and the ERROR are obtained; subsequently, the autocorrelograms of the ERROR variable are obtained, paying attention to the maximum of the significant partial autocorrelations, and the new variables are calculated according to the significant Lag of the PACF. Finally, these regressed variables are included in the new regression in a process of successive approximations until a white noise is obtained. Wide possibilities of modeling and forecasting in the short, medium and long term, which go beyond the modeling of infectious entities of parasitic and viral etiology, Acute Respiratory Infections, Acute Bronchial Asthma crises, forecasting of extreme meteorological disturbances, prediction of latitude and longitude of earthquakes, modeling of climatic variables, and even the own electric consumption of a municipality, province and nation. The ROR methodology has demonstrated potential and real capabilities of application in dissimilar fields and branches of science, so it is a novel contribution to the science of modeling and forecasting of variables to know the future, as well as the impact that different variables contribute to an event or phenomenon, and being universal, it can be applied anywhere in the universe.

KEY WORDS: AUTOCORRELATIONS; AUTOCORRELOGRAMS; ROR METHODOLOGY; POTENTIALITIES; DICHOTOMOUS VARIABLES.

INTRODUCTION

The possibility of having a methodology that allows the modeling and prediction, in the short, medium and long term, of biological, social and natural disaster processes and/or phenomena is something great for modern science (Gore, 2007; Chandra et al., 2008; Fimia et al., 2017a). Throughout history, mankind has suffered the scourge of potentially fatal viral and parasitic diseases, among which Yellow Fever, Dengue, Zika, Chikungunya and Malaria stand out; most of them often involve a mosquito (Diptera: Culicidae) as a common factor (Chandra et al., 2008; Troyo et al., 2008, Dagogo et al., 2020, Ban, 2021).

These diseases are widespread in the tropics, with local variations in risk depending largely on rainfall, temperature and rapid unplanned urbanization, among others (Brenda et al., 2000, WHO, 2019). In addition to these problems, global warming and the intensification of extreme weather disturbances have brought about changes in the behavior of diseases and their transmission, with the establishment of vector species in places never recorded before (WHO, 1998; Xie et al., 2006; Gore, 2007). Efforts to control vector-borne diseases have been hampered in part by the development of drug-resistant etiologic agents, insecticide-resistant mosquitoes, environmental contamination, the residual effect of chemical substances, the high prices of insecticides on the market, operational failures, abandonment of vector control programs, among other causes (Das and Amalraj, 1997, Dagogo et al., 2020, Ban, 2021).

Despite the efforts and resources that have been put into the control of disease-transmitting mosquitoes, they are still not being controlled; on the contrary, the appearance of resistance and the development of defense mechanisms

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against the increasing use of insecticides used for their control are becoming more and more evident (Ayala et al., 2008; WHO, 2014; Fajardo et al., 2016; Real, 2017). The increase in diseases transmitted by vector-borne organisms increasingly commits the scientific community to prioritize the search for much more efficient, economic, feasible and sustainable control alternatives over time, where the use of mathematical modeling, which has been applied in different fields of study, stands out in recent decades.

There are about 77 known equations referred to sigmoidal growth models, which are used in epidemics, bioassays, agriculture, engineering fields, tree diameter, forest height distribution, etc. (Dagogo et al., 2020), and where growth models accumulate and accumulate in a variety of ways, and where cumulative growth models over time have played an important role, as well as many researchers who have contributed to the knowledge of models developed in a relevant way, with emphasis on some non-linear models, among the most common are (Gompertz, Weibull, negative exponential, Richard's model (logistic, mono-molecular), Brody, Mitcherlich, von Betalanffy, S-Shaped, among others) (Ivorra and Ramos, 2020; Zhao et al., 2020; Min, 2021).

diameter, forest height distribution, etc. (Dagogo et al., 2020), and where growth models accumulate and accumulate in a variety of ways, and where cumulative growth models over time have played an important role, as well as many researchers who have contributed to the knowledge of models developed in a relevant way, with emphasis on some non-linear models, among the most common are (Gompertz, Weibull, negative exponential, Richard's model (logistic, mono-molecular), Brody, Mitcherlich, von Betalanffy, S-Shaped, among others) (Ivorra and Ramos, 2020; Zhao et al., 2020; Min, 2021). There is the possibility of making high quality, precise and accurate forecasts using several methodologies, among which the methodology of Regressive Objective Regression (ROR) stands out (Osés and Grau, 2011), which due to its simplicity and accuracy can open an important window to know the future of climatic variables or daily data, years in advance and even many more (Osés et al., 2014a; Osés et al., 2014b; Osés et al., 2017a; Osés et al., 2017b; Osés et al., 2018).

This cycle can be extended to the 11 years of the solar cycle, or to higher cycles that are known in nature; the population dynamics of mollusks and insects, such as culicidae and their interactions with certain environmental variables, can also be modeled in order to establish prophylactic and timely control measures in epidemiological surveillance programs. Consequently, there is a growing need to develop and implement other strategies and alternatives for the control of infectious entities and their vectors, which can complement existing methods in a more effective and efficient way (Osés et al., 2018; Fimia et al., 2017a; Fimia et al., 2017b; Fimia et al., 2020).

Fields of application of the ROR methodology

The ROR methodology as a function of the control of culicidae larval populations: In the specific case of culicidae, it was possible to apply the ROR methodology to larval densities, both general (DLG) and specific (DLE) (mosquitoes of the Anopheles genus), as well as for the Aedes aegypti mosquito species, involved in the transmission of the arboviral entities Dengue, Yellow Fever, Chikungunya and Zika; it was also possible to apply this methodology to the population dynamics of culicidae in the provinces of Sancti Spíritus and Villa Clara (Ivorra and Ramos, 2020; Zhao et al., 2020; Min, 2021). On the other hand, this methodology made possible the modeling of some climatic variables (Temperature, Precipitation, Atmospheric Pressure, Relative Humidity, and Wind Speed, among others) with the mosquito population densities, and made possible the realization of mathematical modeling in the short, medium and long term. The analysis and processing of all these databases has allowed both researchers to publish more than 18 scientific articles related to this topic, from 2012 to the present, in prestigious journals with high impact factors, indexed in first level/group 1 databases and even in the Web of Science (WoS).

ROR methodology and its impact on fluvial and terrestrial malacofauna with veterinary medical interest: For the mollusks group, research was specifically focused on the fluvial and terrestrial malacofauna of Sancti Spíritus and Villa Clara provinces, with emphasis on the following aspects: modeling and prediction of the infectious entities fasciolosis and angiostrongilosis by means of the ROR methodology in Villa Clara province; influence of some climatic variables on the fluvial and terrestrial malacofauna with zoonotic importance in Villa Clara and Sancti Spíritus. Studies on distribution and abundance of fluvial and terrestrial gastropods with meteorological variables by means of mathematical modeling, as well as the application of this methodology to the population dynamics of the fluvial and terrestrial malacofauna of Villa Clara and Sancti Spíritus.

The analysis and processing of the databases on fluvial and terrestrial malacofauna has allowed both researchers to publish six scientific articles related to this topic, in prestigious magazines with high impact factors, indexed in first level/group 1 databases and even in the Web of Science (WoS), as well as two degree theses, in the specialties of Biology and Veterinary Medicine, of the Central University "Marta Abreu" of Las Villas.

ROR methodology and its application in transmissible infectious entities: Mainly in the application to a group of transmissible infectious entities, both of viral and parasitic etiology, such as HIV, Leptospirosis, Cholera, Dengue, Chikungunya, Yellow Fever and Zika, and the case of Malaria, as the main parasitic entity. The analysis and processing of the databases on transmissible infectious entities, allowed both researchers to publish eight scientific articles related to this topic, in prestigious and impact journals, indexed in group 1 and 2 databases, and even some of them in the Web of Science (WoS), as well as two master's theses, one defended at the University of Medical Sciences (UCM-VC), and the other at the Central University "Marta Abreu" of Las Villas.

The ROR Methodology Applied to Acute Respiratory Infections and Bronchial Asthma Crises: The possibility of mathematical modeling one year in advance for Acute Respiratory Infections (ARI) and Acute Bronchial Asthma Crises (CAAB), as well as the impact of temperature on the appearance of respiratory infections in birds in a tropical country. All of which gave us the possibility of publishing four scientific articles related to this topic, in prestigious journals of recognized prestige and impact, indexed in group 1 and 2 databases, and even some of them in the Web of Science (WoS).

Applicability of the ROR methodology to disasters of natural origin: In the case of natural disasters, the ROR methodology also showed its application potential: forecasting of Hurricane Irma; modeling of cold fronts and tropical cyclones for Cuba; prediction of the latitude and longitude of earthquakes at a global level, forecasting possibilities for earthquakes up to the year 2050 and forecasting of earthquakes in Haiti up to 2096. Results that made possible the publication of five scientific articles related to this topic, in prestigious and impact magazines, indexed in group 1 and 2 databases, and even some of them in the Web of Science (WoS).

ROR vs COVID-19 Methodology: The modeling of SARS-CoV-2, virus causing COVID-19 was carried out by means of the methodology of Regressive Objective Regression (ROR), both in Santa Clara municipality and Villa Clara province and for Cuba, which allowed us to make short, medium and long term forecasts according to COVID-19. On the other hand, with this methodology we were able to make prognoses of deaths and new cases with an advance of 105 days in Cuba, as well as prognoses for deaths, critical, severe, confirmed and new cases of COVID-19 in the Santa Clara municipality and at the national level; in addition to the application of this methodology to vaccination against COVID-19 in Cuba, and the comparison of the ROR methodology as a linear model with the non-linear Weibull model for COVID-19. Results that made possible the publication of ten scientific articles related to this topic, in prestigious and impact magazines, indexed in databases of groups 1 and 2, and even, several of them in the Web of Science (WoS).

CONCLUSION

The ROR methodology as a linear mathematical methodology has demonstrated potential and real capabilities of application in various fields and branches of science. The ROR methodology allows not only to mathematically model the larval densities of mosquitoes, as well as the population dynamics of mollusks, but goes beyond (possibility of modeling infectious entities of different etiologies (parasitic and viral), such as HIV/AIDS, Cholera, Chikungunya, Dengue, Influenza, and Acute Respiratory Infections (ARI), Acute Respiratory Infections (ARI), Acute Bronchial Asthma (CAAB), Zika, Angiostrongylosis, Fasciolosis, Malaria and even in the estimation of the longitude and area of the universe, monthly forecast of precipitation and extreme temperatures, forecast of extreme meteorological disturbances (cyclones and hurricanes); prediction of the latitude and longitude of earthquakes, search for information on white noise, modeling of the Equivalent Effective Temperature (TEE) and Atmospheric Pressure (PA), and even the electricity consumption of a municipality, province and nation. The methodology in question is a contribution to the science of modeling and forecasting variables to know the future, as well as the impact of different variables, and what they contribute to an event or phenomenon; so it is a powerful tool to explain the phenomena of nature and society, since being universal, it can be applied anywhere in the universe.

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