



REVIEW

regarding the competition for the administrative position of an “Associate Professor” in the field of higher education 4. Natural Sciences, Mathematics and Informatics; professional direction 4.5. Mathematics, science speciality: Mathematical Modelling and Mathematics Application, promulgated in State Gazette, issue 7/23.01.2024 with candidate Chief Assistant Neli Todorova Keranova- Ivanova, PhD from the Agricultural University - Plovdiv

Reviewer: Prof. Nikola Petkov Zyapkov, PhD., Shumen University “Ep. Konstantin Preslavski”, field of higher education 4. Natural Sciences, Mathematics and Informatics, professional direction 4.5. Mathematics, science speciality: Algebra and Theory of Numbers, assigned as a member of the scientific jury by order № ПД—16-405/20.03.2024 of the Chancellor of Agricultural University, Plovdiv

1. General information regarding the career and topic development of the candidate

Chief Assistant Neli Keranova, PhD was born in 1977 in the town of Asenovgrad. In 2000 she completed her higher education at the Faculty of Mathematics and Informatics of Plovdiv University “Paisii Hilendarski” with the academic degree Master and speciality: Mathematics and second speciality Informatics. She defended her doctoral dissertation in professional direction 4.5. Mathematics at Plovdiv University (2016). The topic of the dissertation is “Group algebras of finite p-groups with a minimal commutator subgroup”. From 2001 to 2004 she was a teacher of Mathematics, Informatics and Information Technologies to students from 5 to 12 grades. During the period from 2004- 2008 she was a teacher of Mathematics at Professional High School of Electrical Engineering and Electronics - Plovdiv. She has worked at Agricultural University since 2008 as an Assistant and Chief Assistant consecutively.

2. General description of the presented materials

At the competition for an “Associate Professor” Chief Assistant Keranova participates with a total production of 23 pieces of work, grouped in the following way:

- ❖ Scientific publications under the nomenclature speciality- 21 pieces, from them:
 - Publications, related to the doctoral dissertation- 4 pieces, which are not a subject of review;
 - Publications with impact factor- 5 pieces;
 - Publications in reviewed and referred scientific journals- 4 pieces;
 - Publications in collections from conferences- 8 pieces;

One of the publications is independent and the participation of the candidate in the mutual ones is the following: in 3 of them she is first, in 3 she is second and in the other 2 she is a third author. For the mutual articles there are division protocols presented in which the contribution of each of the participants is reflected.

❖ Textbooks – 0 pieces.

❖ Study manual – 1 piece.

Published monograph – 1 piece.

9 pieces of publications, one study manual and one monograph are a subject to analysis in order to prepare the review.

Keranova, PhD has also provided a list of 61 publications, written after her doctoral dissertation defence.

In order to fulfil the requirements to occupy the academic position of an “Associate Professor” in professional direction 4.5 Mathematics

Chief Assistant Keranova presented a reference for the fulfilment of the minimum requirements to occupy the academic position of an “Associate Professor” in professional direction 4.5. Mathematics

Indicator A- a diploma of defended doctoral dissertation was presented for the acquisition of the academic and scientific degree of a “Doctor of Philosophy /PHD/”- 50 points.

Indicator C- a monograph was presented – 100 points

Indicator D- 9 publications were presented which are referred and indexed in a worldwide famous databases of scientific information (Web of Science и Scopus)- 318 points (the minimum requirements- 200 points).

Indicator E- citations in scientific publications were presented, which are referred and indexed in a worldwide famous databases of scientific information (Web of Science и Scopus)- 64 points (the minimum requirements- 50 points).

After a check of the compliance of each of the publications with the relevant database and the indicated quartiles, I established that the total number of points is reduced to 282 which exceeds the required minimum of 200 points. Thus, the total number of points in field 4. Natural Sciences, Mathematics and Informatics, 4.5. Mathematics of the candidate is 496 points with minimum required of 430 points. The candidate has presented complete proofs for all the criteria.

Therefore, Chief Assistant Neli Keranova, PhD satisfies the minimum requirements of the Law of the Academic Staff Development /LASD/, the Regulations on the Implementation of the Law on the Academic Positions Development /RILAPD/ of Agricultural University- Plovdiv to occupy the academic position of an “Associate Professor” in direction 4.5. Mathematics.

3. Main directions of the research work of the candidate

The research work of Chief Assistant Keranova is in the field of the Application of mathematical and statistical methods in agrobiological testing. The directions are the following:

- Application of mathematical and statistical methods in testing in the sphere of agriculture;
- Application of mathematical analysis elements (and the differential calculus in particular) in agrobiological testing;
- Algebra and theory of numbers and application in the coding theory.

Chief Assistant Keranova has participated in three projects of the Faculty of Mathematics and Informatics (Plovdiv University) which are related to the direction of the competition. It shows that the candidate is able to work in a team and to take part in multidisciplinary researches.

4. Evaluation of the pedagogical training and work of the candidate. Her role for the training of young future scientists.

From the provided documents, it is evident that Chief Assistant Keranova has 15 years and 6 months of pedagogical experience as a lecturer at the department of Mathematics and Informatics at Agricultural University – Plovdiv. She has had a high teaching workload during the last five academic years: 872 course hours of lectures and 1288 course hours of seminars. She delivered lectures and seminars to students for the academic degree of “Bachelor” of Agricultural University- Plovdiv in the following academic disciplines: Further Mathematics, Optimization Methods, Mathematical analysis, Modelling of Regional Systems, Applied Mathematics, Financial Mathematics, Linear algebra and Analytical Geometry, Statistics, Biostatistics etc.

Chief Assistant Keranova is a co-author of the handbook: A Handbook of Further Mathematics for the students from agricultural specialities and the speciality “Stock- breeding” of Agricultural University. The analysis of the pedagogical work of Chief Assistant Keranova shows that she has significant contribution to the students’ education at Agricultural University – Plovdiv.

5. Significance of the achieved results, proven by citations, publications in prestigious journals, awards, membership in international and national scientific bodies etc.

The significance of the achieved results for the science and practice is confirmed by the fact that five of the articles are published in journals with impact-factor and the total IF is 6,338

Data of 8 citations in journal is presented with impact factor or impact rank of six of the publications.

Chief Assistant Keranova participated with reports in 12 international and national scientific conferences, which contribute to the popularization of her scientific work.

6. Significance of the contribution to the science and practice

6.1. Significance of the contribution to the science

After getting to know in detail the content of each of the publications included in the competition, as well as with the monograph, I consider that the achieved results and their consequent contributions from them to the science could be classified in the following directions:

1. Evaluation of the contribution of the monograph work to the science

In a short and systematic way there are presented the theoretical foundations and the essence of different mathematical and statistical methods: dispersional, correlational, regressional, cluster and factor analysis. The terms of their use and their application are described.

Single- factor, dispersional analyses are conducted as well as comparative evaluations of the relevant tested objects, which gives an opportunity to prove statistically significant differences between them. It gives opportunity to establish the influence of a concrete factor over a given indicator.

The main agglomerative methods for clustering are presented, the formulas for calculation of the relevant distances between the objects within the frames of the formed cluster are presented. The ways of calculation of the differences between the units in interval metred variables, called distance meter are described.

In the fourth chapter of the monograph, devoted to the correlation analysis, there are presented the ways of calculation Pearson correlation coefficient, the empirical rules for its interpretation, as well as the factors that influence its value.

The essence, the terms of application, the specifics and the significance of the regression analysis are presented. As a result of the applied regression analyses the relation between the relevant indicators is modelled and the statistical significance of the received models is analyzed. Multiple regression models were built. The direct and circumstantial influence of different indications is analyzed by the application of Path- analysis.

The structure of the newly formed factors is clarified in the relevant analyses through factor analysis and the principal components method.

Mutiple examples from the area of agriculture are included. In this way it is achieved a visualization of the application of each type of analysis on the one hand and the other hand the opportunities for the interpretation of the achieved results with the terms of the relevant area is demonstrated.

It enables every reader to make an association among the theoretical formulation of a given method, its application and the adequate interpretation of the results.

2. *Contribution to the area of Viticulture*

A method based on a logistic model of determining the time of the occurrence of the main events in the growth processes of living organisms was developed. The growth metrics are defined according to the method of Zhang et al. and for this purpose the speed of the change of the growth curve curvature is examined- curvature change rate (CCR).

The CCR method, applied for logistic growth, allows to determine the following metrics: beginning of growth (t_0); growth stabilization (t_{inf}); end of growth (t_f). The metrics t_0 and t_f are determined as the moments of the time, at which CCR of the logistic curve reaches extreme values (maximum and minimum respectively) and t_{inf} is the inflex point of the logistic curve. In other words, at the moments of t_0 and t_f the growth processes happen with maximal acceleration. At the moment t_{inf} the growth processes are stabilized and the growth speed remains constant. In the present research work a new method of determining the growth metrics is developed which uses the approximation of CCR of the logistic curve, which presents the growth metrics as formulas that makes them easy to be apprehended by specialists who do not do researches in the field of Mathematics.

While examining the content of the antioxidants and antioxidant activity in raisins from hybrid seedless kinds of vines with painted grape juice, mathematical models are created, which give opportunity of theoretical research of the chemical composition of raisins from different kinds of vines. The composed regression equations allow to determine the theoretic value of the relevant dependent variable without conducting the relevant scientific experiment while preserving the objective factors that have influence over the dependent variable. The results from the regression analysis give opportunity to present the proved relations among the indicators analytically. The hierarchical cluster analysis is applied, a complete and accurate interpretation of the received results is made, which results

correspond to the presented dendrogram. The experiment data are also processed with single-factor dispersion analysis, which allows the candidate to explain the statistically significant differences between the examined objects and to substantiate the received clusters of kinds. The applied correlation analysis gives information on the relations among the examined indicators.

3. *Contribution to the area of Pomology*

In the area of Pomology genotypes of cornel-tree are examined on the basis of their pomology features. Hierarchical cluster analysis and factor analysis are applied. The formulas for the calculation of the distance between two clusters are indicated. By using factor analysis the examined indicators are transformed to two factors which explain 88,798 % of the total dispersion. The significance (factor weight) of each of the examined indicators during the factors' forming is denoted. It is interesting that the candidate always combines the use of cluster analysis with another method, in which there is a statistical significance of the received results, having in mind that there is not such test in the clustering.

The relations between the yield from a tree and from one acre are established on the one hand and the relations between the number of trees and their age on the other hand by correlation analysis. The received statistically significant correlation coefficients are a prerequisite of the creating of multiple, linear, regression models that reflect the influence of age and density of the planting over its productivity.

By single-factor dispersion analysis and Duncan test the most susceptible to freezing kinds of peaches are found out. The grouping in clusters that was performed illustrates the similar as to resistance to low temperatures genotypes.

4. *In tobacco- growing*

The spreading of a new virus TEV was studied in groups of kinds of tobacco Virginia, Burley and Basmi, grown in the central part of Southern Bulgaria. Single-factor dispersion analysis is applied as well as variance analysis. The values of the standard deviation show that the tobacco from variety group Burley is not only the least infected by TEV, but this stability is preserved in time. The high sensitivity to the virus of Variety group Basmi however is unstable in time.

5. *In Poultry-raising and bee-keeping*

A grouping of lines of hens is performed by hierarchical cluster analysis and the significance of each indicator over the received clustering is explained by factor analysis. The drawn up dendrograms give opportunity to evaluate the similar lines as well as the ones which in maximum degree differ from the others. An adequate substantiation is made of the application of the principal components method and the required conditions for this are denoted (and checked).

The influence of the index of the egg shape and its mass over different incubation indicators are analyzed. Polynomial regression models of second degree are composed for this purpose, the level of statistical significance of each of them is determined as well as the relevant coefficients of determination.

Comparative evaluation of the countries from the European Union is performed for the period 1961-2014 according to the average quantity of bee honey, produced by the relevant country. Graphic images are presented on the basis of which the average production of bee

honey in Bulgaria and the EU is analyzed as well as the average amount of bee honey per bee family in the different regions inside the country.

6. *In the area of the application of group algebras in the coding theory*

Binary code, is examined. The binary code is defined by group algebra of a cyclic group from line 15 over the field $GF(2)$, derived from idempotent, representing the sum of two minimum idempotents, each one with dimension 4. The parameters of this code are defined as well as its weight spectre. The group of automorphisms is examined and it is established that it is isomorphic of the alternative group A_5 .

6.2. Contribution of applied nature

Both in Section 6.1 and here, I consider it reasonable to summarize the contribution in the same as the above areas.

1. *Evaluation of the contribution of the monograph in practice*

The results in the monograph work, received by mathematical and statistical analyses give opportunity to the scientists of the agricultural science and practice to continue their theoretical researches without the need of a real experiment. I consider the received results as important because of the opportunity they provide to optimize the agrobiological processes and the related to them features of the examined objects. Part of the results could be used for future selection activities and for the improving of the qualities of the examined object. The applied factor analyses give opportunity to the agricultural specialist to direct his/ her attention to the optimization of the values of a given indicator as well as to eliminate another one. The results received in the poultry- raisin represent important information from the point of view of the losses that could endure the farmer in case of longer period of storage of the egg production. Last but not least I would like to denote the possibility to use examples from the monograph work in different Master degree programs in the field of Agriculture as well as while teaching statistical methods of data processing to PhD students.

2. *In viticulture*

The created model in the research of growth processes allows to determine the maximum amount and the specific speed of accumulation of biomass in the beginning of the period of active development, as well as to examine the changes in their shape and thickness. This model is applied in the research of the change of the size and the mass of the grains of the seedless kinds of vines: Sultanina, Rubin and "Rusalka" from their blooming to their gathering. The fruit undergo two stages of development, which explains the necessity to develop a double logistic model, on the basis of which the growth metrics for each of these stages are determined. Probably the developed method could be used to examine the growth processes in other areas of Biology by offering well-defined metrics for the determining of the main moments of development of the living organisms.

During the analysis of the antioxidant activity of raisins from hybrid seedless kinds of vines it is proved that the antioxidant activity has the most significant influence over their distribution in clusters. The received result turns this quantitative feature a significant selection goal in the future work for the creation of new dessert and wine vine varieties.

3. *Contribution in the area of pomology*

Similar genotypes of cornel-tree are established according to their pomology features. The factors that are significant for the received groups are defined and the received results have important agricultural significance for the agricultural producers.

As a result of the applied correlation and regression analyses for the establishment of the influence of age and density of the planting of cornel-tree over its productivity qualities, it is proved that in case of short-term growing, the planting should be with bigger amount of trees since they increase their productivity at an earlier stage. The producers that plan a long-term growing of cornel-trees may expect optimal yield with less trees for a period of at least 20-25 years.

The most resisting to low temperatures kinds of peaches are established which make them to be preferred to be grown in microregions with dynamic climate features.

4. *In tobacco- growing*

As a result of the applied mathematical and statistical methods of processing of the experimental data, it turns out that the most resistant to the virus is Burley tobacco and the most susceptible to illnesses is Basmi. Every tobacco producer should evaluate the crop illness risks for the relevant kind and to compare them to the set goals.

5. *In poultry- raising and bee-keeping*

The results from the received tests give opportunity to the farmer (poultry- breeder) to determine the similar in their characteristic lines birds and on the basis of this similarity to find out the preferred by him/her type of growing in his/her farm.

A survey of the honey production in Bulgaria and the countries of the European Union was performed by which there are established similar tendencies in the change of the average production quantity. This gives the argument to consider that the factors that influence this sector are of global nature.

7. Critical notes and recommendations

I have no critical notes to Keranova, PhD. I recommend that she does not slow down the rate of her scientific and education work and to publish as an independent author.

8. Personal opinion and statement by the reviewer

I have known Keranova, PhD since 2016 when I reviewed her dissertation thesis for the award of the academic degree of "Doctor of Philosophy". I have a very good opinion of Keranova PhD as a scientist and a lecturer.

CONCLUSION

Based on the analysis of the pedagogical, scientific and scientific-applied work of the candidate I find that Chief assistant Neli Keranova, PhD meets the requirements of LASD, RILASDRB /The Rules on the Implementation of the Law on the Academic Staff Development of the Republic of Bulgaria/ and the Rules of the Agricultural University on its implementation.

The presented by the candidate scientific production, her participation in contracts and science forums and the opinion she is a good lecturer give me the reason to evaluate as **POSITIVE** her work in general.

I allow myself to suggest the honorable Scientific Jury to vote positively as well and the Faculty council of the Faculty of Economics at Agricultural University- Plovdiv to elect Chief Assistant Neli Todorova Keranova- Ivanova for an “Associate Professor” in the scientific speciality **Mathematical Modelling and Application of Mathematics**.

Date: 15.07.2024r.
City of Plovdiv

REVIEWER

(Prof. Nikola Zyapkov, PhD.)