Scientific research as an important aspect of natural science education

M Yu Romankina, N V Kuznetsova and Yu A Fedulova
Michurinsk State Agrarian University, Michurinsk Internatsionalnaya St. 101, Tambov Region, Michurinsk, 393760, Russia

E-mail: romankina_m@mail.ru

Abstract. Modern higher education makes high requirements on the level of students’ training, which requires a fundamentally new approach to learning. Students’ research work of higher educational institutions is a promising activity that can realize the full personal development of students, reveal their creative potential and individual resources. The organization of research activities will allow to conduct meaningful laboratory and practical classes in an interactive mode, when students develop research, communication and reflexive skills. A competent method of organizing research activities will significantly improve the effectiveness of classroom activities, maintain a high degree of interest and cognitive activity of students, and the use of research training technologies when considering issues of biodiversity will make it possible to identify the essence of the studied processes and ensure professional and personal growth of students. The importance of scientific research in natural science education was evoked. Main directions of the student’s research activity on the base creation for carabidological observations and ecological control are considered. Data received are the case of interest not only for comparative analysis of carabid beetles communities zone changes but also for clarification of carabidofauna spacing under the condition of anthropogenic transformation in the Central part of Russia. The presented information can be used as additional material by teachers of higher and secondary educational organizations and by biology teachers. To arrange the students’ research activity instructional guidelines were worked out which help to form research competence and put into practice research approach in higher education.

1. Introduction

Modern period of the development of national higher education is characterized by changes aimed at having highly competent graduates who can read difficult life situations, analyze them correctly, quickly adjust to new conditions, sufficiently process different information, forecast the sequences of any activity, using their own intellectual and creative resources. Every stage of education implies development of creative thinking, digital literacy, research skills without which it's impossible to continue studying. Scientific research is an important aspect of the vocational training of highly-skilled professional and a key component of educational technology [1].

The research management is especially applicable to the biodiversity topics while studying natural science. Content and structure knowledge of regional fauna let solve not only the theoretical problems of natural resources use, but also evaluate the degree of anthropogenic transformation of fauna and use the data for ecological control. In many European countries as well as in Russia major study of soilinhabiting Invertebrata, especially numerous insects, among which are carabid beetles [2].
The basis of scientific research of high school students includes three interdependent parts:

- teaching the students of scientific research and scientific creation;
- implementation of students' varied scientific research under academic supervision;
- independent scientific research of students, which is the key point of cognition and popularization of achievements of science and technology.

Being a logical continuation and important addition to the process of education, scientific research helps students to acquire scientific cognition methods, systematic and creative absorption of the academic program, logical operations and scientific methods for self-governing scientific-practical tasks solution as well as shaping their own work style in a scientific family. We should mention the earlier the students are involved in scientific investigation, the better they form their leadership role and strong motivation to research work and solid skills of its realization. The degree of high school students commitment to research work depends on curriculum, quality of scientific research organization in the educational establishment as well as on individual characteristics of each student. But it’s important to remember the importance of systematic approach and diversity of activities aimed at students’ creative abilities professional and scientific thinking for maintenance scientific potential of the country [3, 4].

2. Problem Statement
Research problem is the need to improve the research work of students in higher education in connection with their insufficient preparation for its implementation.

3. Research Questions
The subject of research is the organizational foundations of the research work of students at the university.

4. Purpose of the Study
The aim of our scientific research is organization of students’ research activity on developing a base for carabid beetles studying and ecological control.

5. Research Methods
Within the territory of Tambovskaya oblast were registered 203 species of carabid beetles, referring to 53 genus. These data are used in students’ scientific research works [5]. We applied the following methods of scientific investigation:

- theoretical: analysis and interpretation literature and other informative sources;
- experimental: observation, experiment, statistical analysis of the results.

To evaluate the level of students’ competence maturity test and their detailed analyzing were used.

6. Findings
Students of socio-pedagogical institute of Michurinsk state agrarian university have been leading a scientific research activity, studying carabid beetles. The realization of the program «Cadastro-monitoring research in Tambovskaya oblast» being put into practice since 2001, allowed to intensify field studies of cardiologists and students. These collaborative works grasped 17 rayons of Tambovskaya oblast, in 7 rayons the data were fragmental. Preliminary summary of the research on carabid beetles fauna was published in preprint «Species composition of carabid beetles (Coleoptera, Carabidae) of Tambovskaya oblast. The materials received are interested not only for comparative analysis of insect communities zone changes but also for clarification of carabidofauna distribution under the conditions of anthropogenic transformation of Central part of Russia.

Well organized research activity of students takes on the following roles:
• educational, which is realized through scientific facts acquisition and methods of their creative processing, scientific research methods and experimenting methodology;
• organizationally-oriented, which is carried out by means of shaping skills to work with different informative resources. It makes sense to plan and arrange your own activity, choosing valid methods of data handling;
• analysis and correctional, which is connected with the students’ reflection of their activities, self-examination and perfection;
• motivational, which implies strong motivation to scientific search, scientific competency acquisition, needs for self-education and self-development;
• developing, which lets to reveal the creative potential, takes part in critical thinking formation, helps to develop skills for unconventional solutions, teaches to defend one’s point of view reasonably;
• disciplinary, which means the moulding of scientific outlook, ethic consciousness, highness of responsibility, determination and will activity [6, 15].

The main peculiarity of the scientific research in natural science education is its individual and distinctive character and its complexity lies in longtime and detailed objects consideration, their interrelation and interdependence. Data on carabid beetles studying are listed below. Literature analysis showed that major number of works is devoted to the studying of carabid beetles in the European north, forest-steppe Volga region, Elton region, East Sayans, Novosibirskaya oblast, Belarus, South Baikal area, Ural [7, 8]. As a result of excessive grazing on stepped meadow phytocoenosis was reduced and leveled down on major spaces, complexity was destroyed, density xerophytization happened, topsoil packed and its hydrophysical characteristics went down. Too much smashed slopes became bare, trodden path there were spreading miles away, because of hill wash humus level in soil was reduced in the ratio 2–5. According to scientists’ estimates there’s a decline in carabid beetles species diversity on these soils [9, 10].

In 19th century with the growth of population and region reclamation the scale of deforestation and number of forest fires rose exponentially hence soil microclimate and its hydro-temperature condition changes dramatically. As a result of deforestation representatives of soil fauna inhabited in forest floor (which is humid habitat for species Agonum, Pterostichus, Trechus, Leistus and others) became extinct. Then due to water and river imbalance semi-aquatic fauna (Bemidion and other) turns pale and vanishes. Being an essential part of forest community, soil is also influenced by fires that change their hydrothermal and trophic conditions as well as microbiological and biochemical processes [11].

Numerous data of the influence of fires, deforestation, forestry practice, live-stock grazing on forest complex of carabid beetles are stored in literature. It is known that carabid beetles respond to fauna recreation, density and population composition. With the recreation amplification species composition and alpha insect selection is depleted; the number of typical forest stenoecic species goes down and the share of nesting material decreases [12, 13, 14, 15, 16].

One of the horticulture environmentalization trend is biotechnical measures on gardens protection. It is understood that carabid beetles species diversity, their great number in garden agrophytocenosis is indicative of their sound condition [17].

M.I. Shishkova has undertook a detailed ecological-fauna study of carabid beetles fauna in local forests. It should be mentioned that many scientists pay their scientific attention to studying of ecological-fauna structure of phytocoenosis and afforestation. The studying of seasonal insect abundance is also of great importance as it allows to elicit their life cycle and migration peculiarities, succession stages in natural and anthropogenic landscape [18].

7. Conclusion
Carabid biodiversity studying allowed to raise students’ research competency, that was proved by numerous tests conducted after research part of practical activity, student also demonstrated excellent results of term papers and graduation thesis. They showed great knowledge of research method and
methods of mathematical statistics as well as confident manipulation of theoretic material. Thus, main directions of application and implementing forms of students scientific research were defined. They include: research tasks introduction into the education process; students’ involving into the active scientific activity by means of writing articles, reports for scientific conferences; participation in different grants competitions, scientific seminars and research activity.

Data received are the case of interest not only for comparative analysis of carabid beetles communities zone changes but also for clarification of carabidofauna spacing under the condition of anthropogenic transformation in the Central part of Russia.

To arrange the students’ research activity instructional guidelines were worked out which help to form research competence and put into practice research approach in higher education.

References
[1] Korepanova E V and Elovskaia E V 2018 The Problem of research activity in the system of training future teachers European social science journal 12-1 371
[2] Fedulova Yu A, Popova E E and Korepanova E V 2019 Development of students cognitive activity in the context of a competence-based approach Questions of modern science and practice. V. I. Vernadsky University 4(74) 165
[3] Rudneva N I, Korotkova G V, Sinepupova O S and Belyakova S V 2019 Balint technology in pedagogy: Innovations or transfer of psychological experience International Journal of Engineering and Advanced Technology 9(1) 4508
[4] Solopov V A, Verkhovtsev A A, Korotkova G V, Voropayeva V A and Chernyeva T N 2018 Legal and professional competence in the preparation of agrarians: Autonomy or synergy? International Journal of Engineering and Technology (UAЕ) 7(4) 530
[5] Kassandrova L I, Popov A A, Romankina M Yu, Shalamov T V and Shishova M I 2007 Species composition of coleoptera, carabidae (Coleoptera, Carabidae) (Tambovskoy oblasti: Preprint. Michurinsk: MSPI) p 10-4
[6] Romankina M Y and Fedulova Y A 2019 Ecological and faunistic structure of ground beetle population (Coleoptera, carabidae) of forest belts in the Tambov region (Russia) International Journal of Innovative Technology and Exploring Engineering 9(1) 3849
[7] Romankina M Y and Sharova I H 2011 Complexes of ground beetles of forest phytocenoses of the Northern forest-steppe Bulletin of Tambov University. Ser. Natural and technical Sciences (Tambov) 16 950
[8] Okolelov A Yu, Romankina M Yu and Sukharev E A 2013 The Stages of anthropogenic transformation of natural - territorial systems in the North and a typical subzone forest-steppe zone of East European plain (on the example of Tambov region) Bulletin of Tambov University. Series: Natural and technical Sciences 6(2) 3210
[9] Romankina M Yu 2010 Ecological and faunistic structure of population of ground beetles (Coleoptera, Carabidae) upland meadows in the centre of the European part of Russia and their role as bioindicators of soil and vegetation conditions Bulletin of the Chelyabinsk state pedagogical University (Chelyabinsk) 2 305
[10] Sharova I H and Romankina M Yu 2001 Population of ground beetles (Coleoptera, Carabidae) in Apple orchards and adjacent agricultural landscapes of the Northern forest-steppe of Russia Monograph (Moscow-Michurinsk: Publishing house: Michurinskiy city printing house) p 12
[11] Sharova I H, Popova A A, Romankina M Yu 1998 Ecological differentiation of mass species of ground beetles (Coleoptera, Carabidae) in agroecenes Zoological journal 77(12) 165-7
[12] Beyer R 1981 Vergleichende Beobachtungen an der Carabidenfauna einer Obstplanago und benachbarter Kulturwiese in Lieberwolkowitw bei Leipzig (Insecta, Coleoptera) Faunist. Abh. Staatl. Mus. Tierk 9(1-11) 82
[13] Fazekas J, Kadar F and Lovei G L 1992 Comparison of ground beetle assemblages (coleoptera, Carabidae) of an abandoned apple orchard and the bordering forest Acta phytopatol. et
entomol. Hung 1-4 235

[14] Glorges A 1989 Les coleopteres carabiogues: nindicateurs biologiques dans les ecosystèmes du marais Poitevin (France) Conserv. et dev: ge stion inbegree zones humides: 3 eme Cont. Int. zones humides Rennes 19-23 sept. vol 88 (Paris) p 211

[15] Gzechowski W 1982 Occurrence of carabibids (Coleoptera, Carabidae) in the urban greenery of Warsaw according to the land utilization and cultivation Mem. Zool 39 25

[16] Kuznetsova N V 2016 Research activity of students as an important link in the educational process of OBZH School of the future 3 15

[17] Jepson P C 1994 Fild margins as habitats, refuges and barriers of vamable permeability to carabidae Field Margins: Integr. Agr. and Conserv.: Proc. Symp., Coventry (18-20 Apr. Tarnham) p 72

[18] Shishova M I 1994 Dynamics of the structure of the population and populations of mass species of ground beetles (Coleoptera, Carabidae) in the forests of the Northern forest-steppe of Russia (Russia) pp 4-14