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# USING THE RESEARCH METHOD IN AN ENTOMOLOGY COURSE FOR UNDERGRADUATE STUDENTS MAJORING IN AGRONOMY

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*The main difference between the new standards is their reliance on the active component of the educational content, which defines novelty and modernity. Currently, the educational coverage of students is carried out under the guidance of a teacher, including active activities. Partial search activity of students, which can be implemented in the form of problem-based learning and laboratory classes with the participation of a teacher during seminars; independent research under the guidance of a teacher during writing when conducting research in scientific circles and industrial laboratories; writing term papers and graduation projects. Diptera are major contributors to the maintenance of plant diversity through their participation in pollination systems and networks. Diptera are rich in species with specific microhabitat or breeding-site requirements, conferring a high potential for habitat-quality assessment and conservation planning. As expected for a ubiquitous group with diverse habits and habitats, the Diptera are of considerable economic importance. Pestiferous groups can have significant effects on agriculture, animal and human health, and forestry. Other groups can be a general nuisance when present in high numbers or because of allergic reactions to detached body setae. Despite these negative effects, flies have a valuable role as scavengers, parasitoids and predators of other insects, pollinators, food for predators, bioindicators of water quality, and tools for scientific research.*

***Keywords:*** *educational program, agronomist, research method, entomology, diptera, Tachinidae, tachinin, parasites.*

## Introduction

The fundamental difference between the standards of the new generation is their reliance on the activity component of the educational content, which determines its innovativeness and modernity. Nowadays, it is increasingly necessary to organize training sessions involving active independent activity of students under the guidance of a teacher. Acquired skills contribute to the development of logical thinking, motivation of educational activities, the ability to independent creative research and the acquisition of professional skills [1].

The methods by which students search and explore problems, creatively acquire and apply knowledge, include heuristics and research. When using a similar construction of the material, structural elements, the order of questions, instructions, questions, tasks in the process of implementing the heuristic method, they perform a guiding function and are proactive. Thus, the essence of the heuristic method is that cognition

The new material is learned not by the teacher, but by the students themselves, under the guidance and with the help of the teacher. When using the research method, questions are asked at the end of the stage, after most students have solved the problem. Thus, search and research methods are variants of problem-based learning. There are several levels of problem-based learning, among which the highest is the level of creative activity, in which students are able to perform independent work, find a new way to solve learning problems, make independent generalizations and invent [2].

Currently, the population of our planet is approaching 7 billion, and by 2020 its number may reach 8 billion people. On the other hand, the effectiveness of plant protection in the world is on average less than 50%, and in the Russian Federation – 30%. Currently, it is known that only about 10,000 species of harmful insects and 120,100 species of fungi and bacteria live on the planet. Despite modern methods of combating harmful organisms, in recent years the cost of losses from them has been almost the same - about 1/3 of the cost of the resulting plant products. There are many reasons why it is possible to obtain an appropriate amount of food, one of which is, first of all, the long-established trophic relationship of cultivated plants with bursitis [3].

Agricultural entomology is very closely related to many agronomic disciplines, such as soil science. It is known that the soil environment is a habitat and food for many soil-forming pests; agricultural and scientifically based crop rotations prevent the accumulation of pests such as bread flies, grain beetles, legumes, yellow tychius, etc.; crop production - many plants are a source of food for pests. ; agrochemistry Some fertilizers indirectly or directly hinder not only the growth and development of plants, but also the development of certain plants such as boron and succinic acid, which reduce the number of aphids. Examples can be given from other agronomic disciplines related to entomology [4].

The main task of beekeeping is to manage the factors affecting the productivity and viability of the bee family in order to obtain maximum production from bees with minimal labor and money and to achieve effective work of families on pollination of entomophilic crops.

The methodological foundations of the research are the development of skills in determining the object and subject, the formation of goals, objectives, clarification of terms and concepts. It is necessary to learn how to draw up a research plan, choose methods for collecting and processing material, and present the results for use in teaching and scientific activities. The inclusion of software in research activities makes it possible to identify the essence of the phenomena being studied and determines growth, both professional and personal. Teachers need to instill research skills in students – to determine the formulation of relevant tasks, the scientific value and importance of research results for practical activities [5].

**Materials and methods**

Insect sampling is also sometimes referred to as scouting or monitoring. Why is sampling for pest and beneficial insects so important? Because it is of utmost importance for farmers and pest managers to understand insect activity in their crops and fields before they can make cost-effective and environmentally sound pest management decisions. Remember the underlying concept of Integrated Pest Management (IPM) is that no action is taken against a pest unless the pest is present and poses a threat to the crop. Thus, the main objectives of insect sampling (pest and beneficial) are to:

- Detect species that are present
- Determine their population density
- Determine how they are distributed in the field

Insect Sampling Techniques

There are many different insect sampling techniques and sampling equipment that can be used to detect insects in the air, on plants, and even on and beneath soil. Check the Appendix at the end of this article for references that provide a thorough overview of the various insect sampling techniques.

Row crop growers often use sweep nets to sample insects on plants like soybeans and cotton, because sweep sampling (i.e. a given number of sweeps per sampling location) is quicker and more cost effective for larger fields than inspection of individual plants. Small-scale vegetable growers more commonly sample a given number of individual plants per sampling location in the field. In this module we'll focus on sampling methods that will provide a "relative" estimate of insect population density based on the sampling unit (i.e. numbers per leaf, per plant, etc).

Tachinids are found in almost all terrestrial habitats around the world, including deserts, forests, meadows, mountains, and can sometimes make up a significant proportion of flies observed in certain habitats. Tachinids are mouse-like straight-winged diptera belonging to the

superfamily estroideae along with such groups as blowflies (Sarcophagidae), bottle flies (Calliphoridae) and bot flies (Oestridae) [6].

Looking at all these tricks, it immediately becomes obvious that there are species that lay eggs in the host, the so-called direct oviposition, while others lay their offspring away from the hosts, indirect oviposition. With direct oviposition, we have species that lay eggs on the host, and others that do so by injecting them into the victim's body. The latter, since they do not have perforated ovipositors (homologous to the stings of wasps and bees), have developed a structure of sternites (body segments) that replaces one of them. The origin of these perforating structures may be related to the evolutionary advantage that eggs are not destroyed by the host and are not lost when they attach to the old cuticle immediately after molting of the host [7].

Many different insect characteristics are used by taxonomists to identify and classify insects including wing number, wing shape and venation, structure of antennae, legs or tarsi, mouthparts, and internal structures like genitalia. You are in luck that a course on insect taxonomy is well beyond the scope of this article. However, with some practice and knowledge of available resources you will soon become an “expert” at identifying insects in your field [8].

Tools to aid in identification:

- Hand lens – aids in identification of tiny insects and arthropods like thrips, minute pirate bugs and mites
- Digital camera – you can use a digital camera to take and record insect images that can be sent to the local extension office for identification. Once the insect is identified the digital image can be labelled and saved for future reference
- Small vials with alcohol – useful for preserving specimens that are sent off for identification

**Results and discussions**

As holometabolous insects that undergo complete metamorphosis, all Diptera have a life cycle that includes a series of distinct stages or instars. A typical life cycle consists of a brief egg stage (usually a few days or weeks, but sometimes much longer), three or four larval instars (usually three in Brachycera, four in lower Diptera, and more in Simuliidae, Tabanidae, Thaumaleidae, and a few others), a pupal stage of varying length, and an adult stage lasting from less than two hours (Deuterophlebiidae) to several weeks or even years (some Pelecorhynchidae) (Figure 1).

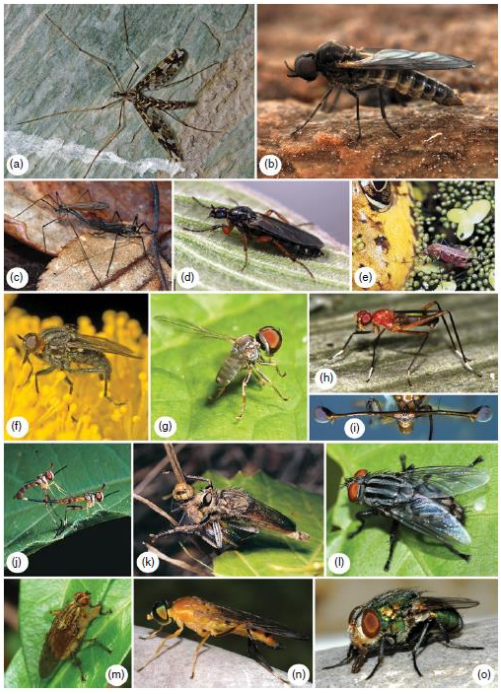


**Figure 1** – Adult Diptera

(a) Tanyderidae (Araucoderus) habitus, dorsal view. (b) Axymyiidae (Axymyia), lateral view. (c)Limoniidae (Prionolabis) mating pair, oblique-dorsal view. (d) Bibionidae (Bibio) habitus, oblique-lateral view. (e) Culicidae (Culex) feeding on ranid frog. (f) Empididae (Empis) habitus, lateral view. (g) Pipunculidae taking flight, oblique-lateral view. (h) Micropezidae (Grallipeza) habitus, lateral view. (i) Diopsidae (Teleopsis) head, frontal view. (j) Conopidae (Stylogaster) mating pair, lateral view. (k) Asilidae (Proctacanthus) feeding on dragonfly, oblique-dorsal view (l) Sarcophagidae (Sarcophaga) habitus, dorsal view. (m) Scathophagidae (Scathophaga) habitus, oblique-lateral view. (n) Stratiomyidae habitus, lateral view. (o) Calliphoridae (Hemipyrellia) habitus, frontolateral view. Images by G.W.C. (a–c, h, i, m), S. Marshall (e–g, j, k), M. Rice (d), and I. Sivec (l, n, o). (See color plate section for the color representation of this figure).

As expected for a ubiquitous group with diverse habits and habitats, the Diptera are of considerable economic importance. Pestiferous groups can have significant effects on agriculture, animal and human health, and forestry. Other groups can be a general nuisance when present in high numbers or because of allergic reactions to detached body setae. Despite these negative effects, flies have a valuable role as scavengers, parasitoids and predators of other insects, pollinators, food for predators, bioindicators of water quality, and tools for scientific research.

The taxonomic and ecological diversity of the lower Diptera is reflected in their wide range of larval feeding habits, which encompass nearly every trophic group. Many groups consume live plants (e.g., Cecidomyiidae and some Tipuloidea) or decomposing plant fragments or fungi (e.g., Mycetophilidae, Sciaridae, and many Tipuloidea). Others feed on decaying, fine organic matter and associated microorganisms (e.g., many Chironomidae). The larvae of some aquatic families (e.g., Blephariceridae and Thaumaleidae) use specialized mouthparts to graze on the thin film of algae and organic matter on rocks and other substrates.

Many families contain a few predaceous species, whereas the larvae of some groups (e.g., Ceratopogonidae) feed primarily or exclusively on other animals [9].

Nearly all of these trophic groups are represented in the diverse family Chironomidae (more than 7000 species) and superfamily Tipuloidea (more than 15,000 species). Their trophic diversity and numerical abundance make the lower Diptera an important component in aquatic and terrestrial ecosystems, both as primary consumers and as a food resource for other invertebrates, fish, amphibians, reptiles, birds, and mammals. Chironomidae, which in aquatic ecosystems are often the most abundant organisms in both numbers and biomass, can be especially important in ecosystem functioning [10].

We believe that sciarids are susceptible to game, by which we mean the directional movement of many species of this species (in particular, larvae) from one place to another. When the "larval bands" move, the sciarides disperse, thereby thinning out the clusters and reducing competition for food resources.

But at the same time, we must not forget about resettlement, which most often means the removal of some individuals from the population of others. Settlement in sciarids is most often associated with the active movement (running and flying) of the imago over various distances. At the same time, dissipating sciarid imagos can move to a habitat where their continued existence will be possible. Therefore, when studying sciarids as representatives of small diptera, we do not make clear distinctions between migration and settlement.

Studying the biology of Bradysia fenestralis Ztt. and Bradysia dalmatina species, and also by observing sciarids in natural conditions, we noticed that females and males behave differently when they are disturbed. When people walk on the ground, inspect woody and shrubby vegetation, fallen leaves or mushrooms, males run away from the source of danger. The females either crouch to the ground and fold their wings, or try to fly as far away as possible. Usually, mowing with an entomological net when catching sciarids is carried out at a height of 1-2 cm from the ground surface to a height of 50 cm. The height of the honeycombs reaches 50 cm. However, sciarids can fly much higher. The study of detritus shows that the number of individuals in a population varies

and depends on the biotope, year and month. The number of individuals may depend on the influence of environmental conditions on the population. An increase in the number of females in a population leads to the stability of the population in the environment and its prosperity, while a decrease in the number of females leads to a decrease in the number of individuals and the population itself.

**Conclusion**

In conclusion, studying the biology of Bradysia fenestralis Ztt. and Bradysia dalmatina species, as well as observing sciarids in natural conditions, we noticed that females and males behave differently when they are disturbed. When people walk on the ground, inspect woody and shrubby vegetation, fallen leaves or mushrooms, males run away from the source of danger. Females.

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## АГРОНОМИЯ БОЙЫНША БАКАЛАВРИАТ СТУДЕНТТЕРІ ҮШІН ЭНТОМОЛОГИЯ КУРСЫНДА ЗЕРТТЕУ ӘДІСІН ҚОЛДАНУ

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*Жаңа стандарттардың басты айырмашылығы-олардың жаңашылдық пен қазіргі заманды анықтайтын білім беру мазмұнының белсенді компонентіне сүйенуі. Қазіргі уақытта оқушыларды білім берумен қамту белсенді қызметті қоса алғанда, оқытушының басшылығымен жүзеге асырылады. Семинар сабақтары кезінде оқытушының қатысуымен проблемалық оқыту және зертханалық сабақтар түрінде жүзеге асырылуы мүмкін студенттердің ішінара іздеу белсенділігі; ғылыми үйірмелерде және өнеркәсіптік зертханаларда зерттеулер жүргізу кезінде мәтіндер жазу кезінде оқытушының жетекшілігімен дербес зерттеулер жүргізу; курстық жұмыстар мен дипломдық*

*жобаларды жазу. Біз зертханалық сабақты проблемаға бағытталған оқыту әдісін-зерттеу агрономиясын, жоғары курс студенттеріне арналған энтомология курсын зерттеудің заманауи әдісін қолдана отырып жасадық. Сабақта студенттерге үлкен топтың мысалында жәндіктердің паразиттерін зерттеу ұсынылды. Diptera, Tachinidae - зиянды топтар ауыл шаруашылығына, жануарлар мен адам денсаулығына және орман шаруашылығына айтарлықтай әсер етуі мүмкін. Басқа топтар көп мөлшерде болған кезде немесе денедегі қабыршақтанған қылшықтарға аллергиялық реакцияларға байланысты жалпы қиындық тудыруы мүмкін. Осы жағымсыз салдарға қарамастан, шыбындар қоқыс жинаушылар, паразитоидтар және басқа жәндіктердің жыртқыштары, тозаңдандырғыштар, Жыртқыштарға арналған азық, су сапасының биоиндикаторлары және ғылыми зерттеу құралдары ретінде маңызды рөл атқарады.*

***Түйін сөздер**: білім беру бағдарламасы, агрономия, зерттеу әдісі, энтомология, диптера, Tachinidae, тахинин, паразиттер.*

## ИСПОЛЬЗОВАНИЕ МЕТОДА ИССЛЕДОВАНИЯ В КУРСЕ ЭНТОМОЛОГИИ ДЛЯ СТУДЕНТОВ БАКАЛАВРИАТА ПО АГРОНОМИИ

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*Основным отличием новых стандартов является их опора на активную составляющую содержания образования, которая определяет новизну и современность. В настоящее время образовательный охват учащихся осуществляется под руководством преподавателя, включая активную деятельность. Частичная поисковая активность студентов, которая может быть реализована в форме проблемного обучения и лабораторных занятий с участием преподавателя во время семинарских занятий; самостоятельные исследования под руководством преподавателя во время написания текстов при проведении исследований в научных кружках и промышленных лабораториях; написание курсовых работ и дипломных проектов. Двукрылые вносят значительный вклад в поддержание разнообразия растений, участвуя в системах и сетях опыления. Двукрылые богаты видами, которые предъявляют особые требования к микрообитаниям или местам размножения, что обеспечивает высокий потенциал для оценки качества среды обитания и планирования природоохранных мероприятий. Как и ожидалось для широко распространенной группы с разнообразными привычками и местами обитания, двукрылые имеют важное экономическое значение. Вредные группы могут оказывать значительное воздействие на сельское хозяйство, здоровье животных и человека, а также лесное хозяйство. Другие группы могут вызывать общую неприятность, когда присутствуют в большом количестве или из-за аллергических реакций на отслоившиеся щетинки на теле. Несмотря на эти негативные последствия, мухи играют важную роль в качестве падальщиков, паразитоидов и хищников других насекомых, опылителей, пищи для хищников, биоиндикаторов качества воды и инструментов для научных исследований.*

***Ключевые слова:** образовательная программа, агрономия, метод исследования, энтомология, двукрылые, Tachinidae, тахинин, паразиты.*