ПЕДАГОГИЧЕСКИЕ НАУКИ

THE ROLE OF MONITORING OF A SPECIFIC VARIETY OF LIVE ORGANISMS IN TRAINING OF AGROECOLOGY OF STUDENTS-BIOLOGISTS

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АННОТАЦИЯ. В статье приводятся материалы по математической обработке данных, получаемых при мониторинге видового разнообразия живых организмов при воздействии антропогенного или техногенного пресса на биоценозы, а также расчеты концентраций техногенных загрязнителей. Обосновывается необходимость и своевременность включения их в программу обучения студентов-биологов.

ABSTRACT. In the article materials on the mathematical data processing, received are resulted at monitoring of a specific variety of live organisms at influence of an anthropogenous or technogenic press on biocenose and also calculations of concentration technogenic soilers. Necessity and timeliness of their inclusion for the program of training of students-biologists is proved.

Ключевые слова: экология, почва, почвенный покров Земли, антропогенная.

Key words: ecology, soil, Earth`s soil cover, anthropogenic.

On the boundary of the XX - XXI centuries «the problem of ecological safety was beyond national and regional and became a global problem of all mankind. The Mankind really has felt, before what threat it costs, in what result has issued anthropogenous influence on environment» (1; 108). Intensive economic activities of the person have put the world on a side of ecological catastrophes. The influence of the person on environment has many-sided character. The basic anthropogenous factors destroying an inhabitancy, are: growth of cities, a mining operations, motor transport, the industry, agriculture chemicalixation.

Chemical influence wins first place in deterioration of a condition of environment. The role of chemical means in human life is difficult for overestimating. It takes away one of the important places in pest control, illnesses and weeds of agricultural crops, however actions of pesticides never happen unequivocal. Pesticides which used in agriculture, represent the organic connections possessing toxicity not only for harmful organisms, but also the person, animals. The person uses pesticides for destruction of the limited number of the organisms making no more of 0,5 % from the general number of kinds, occupying biosphere while pesticides at their application influence all live organisms. At carrying out of protective actions pesticides are always directed against populations.

Besides, pesticides extend far outside of those agroecosystem where they are applied. Even in case of use of the least flying components more than 50 % of active substances at the moment of influence pass directly in atmosphere (fig. 1).

It is established also, that to 25 % of the pesticides applied in agriculture, gets in water of agroecosystem. The water drainage from the fields processed by pesticides, pollutes not only small reservoirs, the rivers, but also estuary (the wide mouth of the river running into the sea or ocean). This problem sharply enough costs and in our region.

Thus, application of pesticides has negative consequences for separate kinds and biocoenosis as a whole. Therefore they bear danger to all environment. Pesticide causes radical changes of all ecosystem in which it have introduced. Quite often the situation becomes complicated that apply much more pesticides, than it is necessary for destruction of the wrecker: deliberate surpluses of processing of fields explain "reliability".

In the created conditions the problems of regulation of the influence rendered by the person on biosphere became more and more actual, search of not less effective and at the same time safe and natural means of pest control, creation a favorable environment, balance a chievement in system «a society - environment». At the same time became obvious, that without the objective information on a condition of environment and tendencies of its change practical realisation of measures of protection is impossible. In this connection special value has local monitoring on which basis necessary data about a region and flora condition and faunae in this region are obtained, and also ability to do exact of concentration and activity technogenic contaminaters. We were guided by it at inclusion of materials on data processing of monitoring and conducting calculations in the program of training of agroecology of students-biologists.

1. The mathematical data processing, received at monitoring of a specific variety of live organisms at influence of an anthropogenous or technogenic press on biocoenosises. In connection with influence of negative factors a specific, structural and genetic variety in communities of live organisms is broken.

Kinds of live organisms in communities subdivide on dominating, semiprepotent and rare.

Sometimes dominating kinds are absent, and many kinds are characterised by an intermediate abundance.

A specific variety develops of two components:

- Specific riches or density of kinds which is characterised by the general number of available kinds;

- The uniformity based on a relative abundance or other indicator of the importance of a kind and its position in structure of domination.

A specific variety can grow with increase in the sizes of the surveyed area.

At influence of negative influence on community a specific variety can decrease, that takes place in agrocenoses, exposed to pesticidal processings, or in biocenoses, technogenic emissions being under a press, including motor transport.

To the analysis of a specific variety apply two approaches:

- Comparison of curves of a relative abundance or variety domination;

- The comparison based on indexes of a variety, representing dependence relations between number of kinds and their importance.

One of the main components specific riches (variety) or density of kinds is general number of kinds which in the comparative purposes is usually expressed as the relation of number of kinds to the surveyed area or numbers of kinds to number of individuals.

The second prominent aspect of a variety - uniformity of relative distribution of individuals by kinds. For example, in the field of a cotton is available two systems: caterpillars a scoop and pincers vegetable poisonous and predatory, each system consists of ten kinds and 100 individuals. These systems can have various indexes of uniformity depending on distribution of 100 individuals between ten kinds.

That it is better to imagine both components of a variety, it is necessary to construct the schedule, on which in logarithmic scale to postpone number of individuals (either a biomass, or efficiency) each kind for axes Y, and on axes X - ранжированная sequence of kinds from the most numerous (plentiful) to the least plentiful. The line which is connecting points or passing close from them, is named Whittaker, 1965 by a domination-variety curve, and Pianka, 1978 - the curve importance of kinds (fig. 1).

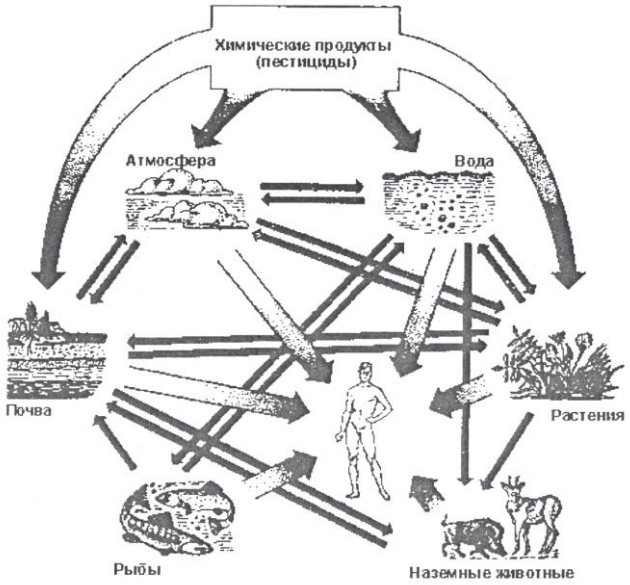

Fig. 1 Curves of domination-variety for conditional sample, Consisting of 1000 individuals concerning 20 kinds a scoop in the field of a cotton.

The note: the number of individuals of each kind is postponed for axes of ordinates, and on an axis of abscisses - a kind serial number in sequence from more plentiful (convolvulus a scoop) to less plentiful (corn a scoop). I - less plentiful, II - more plentiful; III - intermediate (intermediate system).

At other approach variety indexes are used. They are characterised by independence of sample and relative simplicity of calculation.

1. An index of specific riches (d).

This index pays off under the formula:

$$d = \frac{S-1}{\lg N}$$ (and also S/N and S on 100 individuals),

Where: S - number of kinds,

N - number of individuals.

2. Index of Shennon ().

The above this index, the above a specific variety. Index of Shennon pays off under the formula:

$H = - У n_i / N \log (n_i / N)$ or $H = - У P_i \log P_i$,

Where n_i or P_i - the relative abundance of a kind reflecting a share of individuals, concerning to P_i-виду in sample N or the number of individuals of a kind concerning other kinds with use of points of an abundance, that is is a synonym of "relative number» on J.A.Pesenko (1982); n_i - an estimation of the importance of each kind or where N - total of individuals in sample; n_i - quantity of individuals of each kind;

3. An index of uniformity Peelow.

$$e = \frac{H}{\log S},$$

Where: H - index of Shenon;

S - number of kinds.

4. Simpson's index (a domination index) () which reflects a domination concentration in separate kinds. The above its size, the there are more than copies from the given sample belongs to one or several kinds. The domination index pays off under the formula:

$$\text{With} = \text{У}\ (n_i / N)^2$$

Or

$$\text{With} = \text{У}\ \frac{n_i\ (n_i - 1)}{N\ (N - 1)}$$ — a domination index

$$1 - \text{У}\ (n_i / N)^2$$

$$\text{With} = \frac{1}{\text{У}\ (n_i / N)^2}$$ — an index of a variety,

Where: n_i - an estimation of the importance of each kind (number, a biomass, etc.)

N - the sum of estimations of the importance.

Other formula is possible: with = $n_i P_i^2$,

Where: $P_{i\ the}$--relative abundance of a kind reflecting a share n of individuals, concerning to P to an i-kind in sample in volume N; P - it is defined by summation of cubes of indicators concerning an abundance of kinds.

5. Between components of kinds in various variants it is possible to apply ***an index of similarity*** to similarity definition ***Chekanosky-serensena*** and ***the factor of a generality*** offered by Mountphord and applied by T.S.Grigorevoj and T.N.Zhavoronkovoj (1973).

The index of similarity I_{cs} pays off under the formula:

$$I_{cs} = \frac{2a}{(a+b) + (\text{and} +)},$$

Where: and - number of general views in both compared samples;

b - number of the kinds noted only in one sample;

With - number of the kinds noted only in other sample.

The factor of generality of Mountphord pays off under the formula:

$$I = \frac{2\ j}{2\ ab - (a+b)},$$

Where: a, b - number of kinds in compared samples;

j - number of general views.

Monitoring will give objective data on a variety and domination of various kinds of live organisms that is very important, on the one hand, for maintenance of specific balance, and with another, for preservation and increase in useful kinds (insects-entomofagov) by which the important role in pest control now is taken away.

2. Calculations of concentration technogenic soilers at carrying out of experiments. At monitoring carrying out in laboratory conditions quite often it is necessary to define toxicity for components biocenoses (aqgrocenoses) various toxic substances, for example, pesticides to know potential danger of these substances.

Main principles of definition of toxicity of substances and preparation forms of pesticides are more low stated.

For carrying out of experiments it is necessary to pick up concentration of working solutions depending on bio-objects and character of experiences. In the beginning prepare a series from 4-5 concentration with step of cultivation 10. As solvents it is necessary to use acetone, ethyl spirit or water.

On analytical scales take hinge plate substances or means and prepare an initial working solution of certain concentration ($C_{исх}$) which can be calculated under mentioned below formulas.

For substances under the formula (1):

$$\mathbf{C_{исх} = \frac{A \times B}{C}} \quad (1)$$

Where: And - necessary concentration DB, % (mg/l, mg/ml),

In - necessary quantity of a solution (ml),

With - concentration DB in substance, % (mg/l, mg/ml).

For preparation forms: in the event that it is necessary to prepare a solution of the set concentration for processing of the certain area so that to receive the set dosage, calculation under the formula 2 is made:

$$\mathbf{C_{исх} = \frac{D \times S}{C_{преп} \times V} \times 100\%} \quad (2)$$

Where: $C_{преп}$ - concentration DB in means, % (mg/l, mg/ml),

$C_{исх}$ - concentration DB in an initial solution, % (mg/l, mg/ml)

D - the set dose, mg/m^2 (g/m^2),

S - the area of a processed surface, м^2 (sm^2, hectares),

V - Volume of a preparation for processing of this surface, sm^3 (ml,).

Along with definition of concentration technogenic soilers, in laboratory conditions students-biologists also are offered to define инсектоакарицидную activity which is estimated on percent of destruction of arthropods in skilled variants in comparison with the control.

Recently all is offered adaptive system of conducting agriculture which will allow to lower consumption of anthropogenous energy more actively and to make active ability to live of all useful organisms which are a part agrosystem. In decrease in losses of a crop the increasing role is taken away by a useful insect - entomofag so, it is necessary to create conditions for their specific and genetic variety. The mathematical data processing offered by us, received at monitoring of a specific variety of live organisms at influence of an anthropogenous or technogenic press on biocenoses (agrocenoses), and calculations of concentration technogenic soilers will help to avoid undesirable consequences of negative factors, to make application

technogenic soilers strictly proved, to reduce it to a necessary minimum so, to keep balance in the nature. Acquaintance of students-biologists to materials stated in article will raise their professionalism and the general ecological culture, that in further, in the course of teaching of biology by them, will influence formation of outlook of rising generations.

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