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Phenogenetic monitoring for vertebrate populations under urban condition

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Abstract

Urban areas are new ecological niches, appropriate for occupation by many species including vertebrates. Urban vertebrates have two sources - directly from wild nature and by indirect human activity. Some of urban species are pests. The number of organisms living within urban biocenosis increases. The assimilation of urban biocenosis by pests is process of microevolution.

Human activity produced new pests both in synanthropic and natural biocenosis. Resistance and homeostasis of every biological system is higher than disruptive possibilities of humankind. Local disasters result in the death of many organisms. The laws of global ecology, however, say that unoccupied places are filled immediately. Even the most considerable ecological disasters are unable to significantly change the mass of the biosphere. A reduction of the mass in the one place is always compensated by an increase in another place. Appearance of a new pests is example of natural resistance against anthropogenic pressure.

Vertebrate pest management and control needs regular monitoring. The cheapest method of monitoring is biological one. The most effective variant of biomonitoring is phenogenetic one. The question within which limits of accuracy it is possible to estimate the future fate of urban vertebrate population using a few number of samples would be considered in article. A mathematical device letting to analysis the state of population using easily measured characters: quantity, sex correlation, the variability of morphological characters, the level of morphological asymmetry, sexual dimorphism.

Introduction

Urban areas are new ecological niches, appropriate for occupation by many species including vertebrates. Urban vertebrates have two sources - directly from wild nature and by indirect human activity. Some of urban species are pests. The number of organisms living within urban biocenosis increases. The assimilation of urban biocenosis by pests is process of microevolution. It has limits. Qualitative limits are determined by Vavilov law. Studying of close species adaptation, we may predict adaptive potencies of all family. Under stress conditions variability increase. Stress conditions may be produced by pesticides, or by physical agents of pesticide activity. Hence, chemical and physical struggle with pests may have negative effect. Biological methods are more perspective

Human activity produced a new pests both in synanthropic and natural biocenosis. Resistance and homeostasis of every biological system is higher than disruptive possibilities of humankind. Local disasters result in the death of many organisms. The laws of global ecology, however, say that unoccupied places are filled immediately. Even the most considerable ecological disasters are unable to significantly change the

mass of the biosphere. A reduction of the mass in the one place is always compensated by an increase in another place. An increase of anthropogenic pressure in Western Europe, e.g. has resulted in a significant decrease in the combined mass of animals and plants. At the same time, the opposite process is taking place in European Russia. The number of animals and plants is increased. Many hidden species and species with new characters including pests are between them.

Appearance of a new pests is example of natural resistance against anthropogenic pressure. We must keep in mind the following ecological principles (Gause, 1934, Vernadsky, 1975 et. al.).

There are no free ecological niches. Every new one made by humankind would be occupied by any species or morphs.

Every specimen of every species suffocated by man would be exchanged by another specimen or species. A new biological object may be more useful or more dangerous than the old one.

The general stability of biosphere doesn't mean stability and prosperity of any concrete species including *Homo sapiens.*

Management of redomesticated vertebrate pests must be based on methods of three sciences:

1. Ecology which suggests for decrease of free ecological niche for pests.
2. Genetics for control of microevolution of pests in dependence of anthropogenic press.
3. Ethology for control of their behavior.

Use of pesticides and physical agents having pesticidical effect needs taking into account the following points:

1. Pesticides and physical agents of the same activity acts not only for pests, but for all ecological systems including human organisms.
2. The agents acts on genetic system of pests and stimulates their adaptation.
3. Decrease of pest's fertility in present generation may be compensated within future generations.
4. Decrease of pest population may be compensating by increase of other species population. These populations may have harmful effect for humans too.
5. Effective struggle against pests need complex approach including chemical, physical, mechanical and biological methods.

Vertebrate pest management and control needs regular monitoring. The cheapest method of monitoring is biological one. The most effective variant of biomonitoring is phenogenetical one. The question within which limits of accuracy it is possible to estimate the future fate of urban vertebrate population using a few number of samples would be considered in report. A mathematical device letting to analysis the state of population using easily measured characters: quantity, sex correlation, the variability of morphological characters, the level of morphological asymmetry, sexual dimorphism. A possibility to estimate the trends of the microevolution process using the minimum data would be illustrated by experimental examples.

The world urbanization leads to increase of anthropogenic pressure on nature and destruction of many ecological systems. But general biological diversity is recurrent and biosphere as general appeared to be stable. Both animals and plants adapt for urban area and occupied all possible ecological niches. The increase of biological diversity takes place within all urban systems. Many species introduced into cities are unprofitable and danger for human population. Biodeteriorations are produced by bacteria, mushrooms, lichens, high plants, arthropods, birds and

mammalia. World loss of pest activity is 70 billions USD. 50 billions is a pay of the process within urban biocenosis (Ilychev, 2003). The quota of urban area will increase. 47% of world population lives within cities. In 15 years this quota will get 60%. Struggle against pests is complicated because any biological pattern of pests within cities is stable and inevitable. The use of pesticide leads to ecological changes and following evolution of urban biota. The evolution may go to bad direction for human interests. Every use of pesticides and physical agents having pesticide activity (PAPA) suggests population stress for pests. Stress is adaptive reaction increasing adaptive possibilities of population. Hence, any struggle against pests can't go to significant victory. The victory may be only temporal. General direction of such a struggle is getting of optimal relation between humanity and pattern of pests. The present paper is step toward getting of theory of such a relations.

Needful theoretical remarks

The general theory of biosphere surviving was suggested by of Vernadsky (1926, 1975). According to theory,

1. The mass of biosphere is constant. According to modern data (Kamshilov, 1975), this wet mass is:

M_b = 250 000 000 000 ton.

2. Biosphere is organized as ecological pyramid. It describes relations between producents and consuments. Every following flow has mass less 10 - 100 times (Reimers, 1991)

3. The range distribution of species within orders and classes is asymmetrical (Mikhailovsky, 1988). That is, majority of species belongs to some orders. The distribution of specimens within species is asymmetrical too.

The theoretical figure of such a distribution is demonstrated in fig.1 and accorded to formula:

$f(n) = A + B e^{-Cn}$, where A, B, C - constants (Sapunov, 1999).

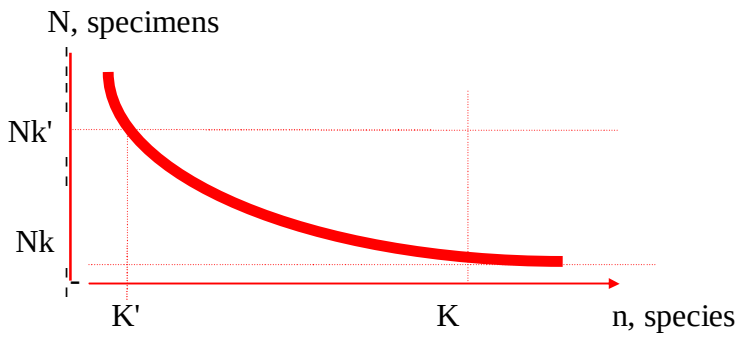

Fig.1. Theoretical distribution specimens-species.

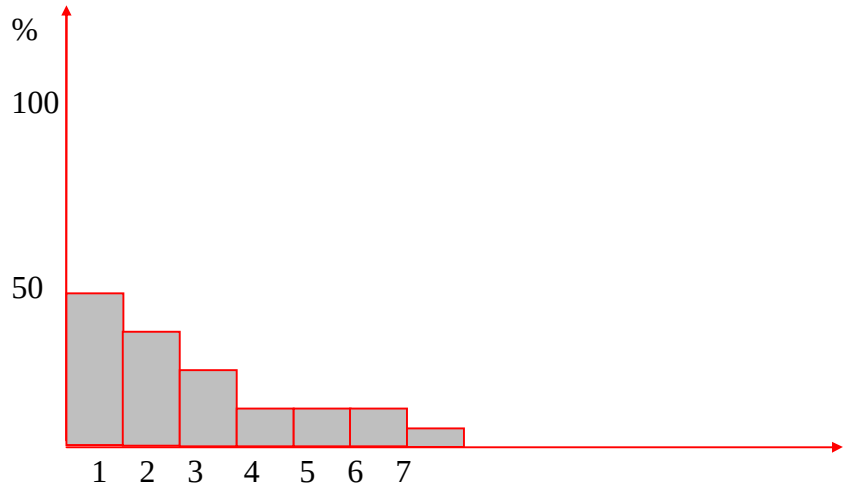

Fig.2.Percents of different orders insects in field catching - own data.

1 - Heteroptera, 2 - Diptera, 3 - Homoptera, 4 - Coleoptera, 5-Hymenoptera, 6 - Orthoptera, 7 - Lepidoptera

Let minimal number of specimens needed for stable population is Nk. According to population genetics, it may be 150 - 200 (Dobzhansky, 1970). Let $N_{k'}$ would be minimal number of specimens needful for recurrent detection of species in nature. Species from K' to K would be hidden species. Between hidden and dominant species rare species exist too.

The species, which population close to extinction (K - the size of population) must be listed in Red Book. The number of organisms per generum is

$$N = Mg/m_{av} \qquad (1)$$

where M_g - biomass of generum, $m_{.av}$ - average mass of organism within taxon . General number of specimens according to fig.2

$$Ng = \int_0^K f(n)\, dn \qquad (2)$$

According to general ecology, we may predict some phenomena connecting with pest introduction. Having 100 units of plant mass unit, we will get 1 unit of plant eating pests in biocenosis. Having 1 unit of animal mass we will have 1 unit of animal eating mass pests.

Let us applied this basis of model to consideration of process of pest adaptation for urban environment.

THE EFFECT OF PESTICIDES ON EVOLUTIONARY ECOLOGY OF PESTS

Pesticides (P) - from Latin - killers of plague - are chemical compounds for struggle with pests - dangerous plants or animals. More than 800 pesticides has legal use in the world (Reimers, 1991). But chemical P, physical agents of pesticide activity (PAPA) exist. They are: radiation, ultraviolet, ultrasound and so on. All living wold has the same principles of genetic and biochemical organization. That 's why every P and PAPA have any effects for all organisms including man. But different organisms have different resistance for different pesticides. The resistance of pests for P increase because of natural selection. There are about 1 000 insect species resistant for any insecticides. 150 microorganism species are resistant to any P. There are 60 mosquito species caring malaria. 51 of them are resistant to wide spread insecticides. Resistance for P may appear during some years (Reimers, 1991, Insects.., 1995).

According to medical and veterinary rules, every pesticide needs two expertises: physiological (toxity for pests) and medical (damage for human health). The physiological tests deal with the rate of suffocation of the pests: mortality and reproductive potencies. Medical studies the rate of toxity of P for man taking into account possible ways of getting human organisms by P. Indirect effects of use of P and PAPA are out of the consideration. At the same time P may induce complicated complex of ecological pathology (Slepyan, 1998). The aim of present work is study of the ways toward modeling of complex direct and indirect effects of P and PAPA on biota.

Every effect on organisms has both specific and unspecific components. Specific is accorded to effectors. Unspecific is general reaction for every nocuous agent. Let us list most typical unspecific reactions. Para necrosis is unspecific reaction at the cellular level (Nasonov, Alexandrov, 1940). Stress is unspecific reaction at the organism level (Selye, 1936). Increase of variability is unspecific reaction at population level (Sapunov, 1991). There is generalized reaction at the level of ecological systems (Sapunov, 1986). There is no theory of such a reaction. We are toward such a theory. According to global ecology (Vernadsky, 1926), this reaction must be dynamically resistant. That is, relation between species must be changeable and the changes may be accompanied by stability of general structure of ecological systems. Let us consider some examples of both specific and unspecific reactions of organisms on nocuous agents.

Reaction of insects on Juvenile hormone analogs (JHA). during many years JHA were considered as perspective insecticides (Novak, 1971 et.al.). Last years they began to exchange for insecticides of antihormone actions and others (Insects.., 1995).

JHA is P with specific effects on insects. Having ontogenic effect, they destroy individual development, increase mortality and sterility. There is no well detectable physiological effect on mammalia. That’s why there is opinion, that JHAs are not dangerous for man and biota. My previous study (Sapunov, 1991) contradicted to such an opinion. Unspecific effect of JHA consists of induction of some mutation. Table 1 demonstrates genetically effect of JHA (entacon, concentration 20%) treatment on *Drosophila melanogaster* - classic model insect (Line Canton - S). More detailed methods are described in literature (Sapunov, 1981, 1991). The data means that JHA has genetic effect mainly dealing with mutation on chromosome 2. This chromosome possesses any important regulatory genes. Increase of mutability is effect by such agents but JHA as viruses, DNA and so on (Sapunov, 1981).

Table 1.
Effect of JHA treatment on mutability of Drosophila melanogaster

type of mutations	Dominant lethal mutations	Recessive lethal mutations on X-chromosome	Recessive lethal mutations on chromosome 2
Control	0.8+-0.21	0.5+-0.23	0.5 +-0.22
Experiment	4.4+- 0.04	0.7+-0.17	4.8 +- 0.70

Such a mutability increase variability at population level.

Quantitative rate of variability increase was studied in aphids (***Megoura viciae)*** experiments (Table 2). Methods of such an experiments were described earlier (Sapunov, 1984). These experiments are model of real field situation after JHA treatment of the biota. Hence, unspecific action of JHA is variability increase under population stress. The same may be reaction on every stressor (Sapunov, 1991). Specific reaction is mutability increase on chromosome 2.

Reaction of insects on PAPA - ultrasound. Ultrasound is perspective agent for two purpose:

- suffocation of insect population,
- change of reproduction time.

Flies *D. melanogaster (*Canton-S strain) and clone of aphid *M.viciae* were selected as an objects. The effect was studied under ultrasonic pressure 0.05, 0.2, 0.4, 0.7 and 1 wt/cm^2, frequency 0.88 Mgz. Regime was discontinuous. Correct methods are described earlier (Resaving et.al., 1998). Table 3 demonstrates mortality of drosophila in dependence on effect of ultrasound. Mortality of eggs increases after PAPA. The effect is pressure dependent. The more is pressure, the more is mortality. It is unspecific effect because mortality increases under every nocuous agent. E.g. external temperature has the same effect. Specific effect of ultrasound is chronovariability (time variability) increase. General variability increase is unspecific effect. New peaks apporation is specific one. The new peak has coordination's: mean = 15.1, square deviation = 1.5. There is no such a peak under control condition. Hence, every P and PAPA may suffocate pests and induce unpredictable biological reactions.

Both P and PAPA kill parts of pest specimens. Some organisms got the stress state. Stressed organisms produce progeny having high variability of every characters (Sapunov, 1991). Every population adopt for environment. Every environment has to change. Population follows this exchange. Every P and PAPA change environment. Such a terrible change is lethal for some organisms. Adaptation for such a change is complicated biological task. There are two variants of adaptation at the population level. The first is moving selection. The second is adaptation through genetic destabilization. Under last situation majority of organisms would get uncomfortable state. They would be dead or decrease their fertility. If anybody will make offspring, this offspring would have a high variability. Stress state will induce genetic destabilization of progeny. Natural selection will have possibility to select adopted for P and PAPA organisms between them. The quantitative characters of such population adoptation was described above (Sapunov, 1991).

Table 2. Effect of JHA treatment of plant (pea) on phenotypical variability of aphids *M.viciae*

Variability measure	Var.coef.lenght of body	Var. coef. of width of body	% of organisms with color abnormality

Variant			
Control	0.06	0.06	5+- 1
Treatment	0.18	0.13	30+-4

Table 3. % of suffocated Drosophila eggs in dependence of ultrasonic effect

Variant	Per 0	es 0.05	sur 0.2	re 0.4	wt / 0.7	cm2 1.0
Control	2.9+-0.5					
Treatment of the eggs		14.3+-3.4	14.7+-3.4	12.0+-3.2	28.6+-4.5	53.5+-4.9

Adaptive potencies of every population are high but limited. Stress state increases variability and adaptive potencies of population. Example is effect of ultrasonic stress at population of aphids (Krasavina et.al., 1998). During some generations depression is followed by increase of fecundity. Hence, use of P and PAPA may have results reciprocal to needful. Fertility of pests may increase after human efforts. Hence, any struggle against pests needs take into account any direct or indirect ecological results of P and PAPA use. Modern population biology and ecology may help us to make such a prediction.

Every population is element of ecological system. Decrease of number of any pest doesn't closes ecological niche of the pest. It may be occupied by other species. They may be unprofitable too. So, proliferation of ragweed *Ambrosia* sp. at Caucasis leads some medical and agricultural problems (Sapunov, Kovalev, 1987).One of the results of the struggle against Ambrosia was making prerequisite for distribution of the ragweed Cyclachaena (*Iva)*, that is more dangerous species.

Ecological prognosis of effect of P or PAPA must keep in mined global ecology by Vernadsky (1926). According to such a science no free niche exists. General pattern of biological mass distribution within niches is constant. The general mass of biosphere is constant. The occupation of every free niche is obligate. The occupation prolongs till use of all ecological resources within niche. Biosphere is extremely stable because of :

1. Big adaptive potencies of every organisms,
2. Big potential variability at the population level, that may be bustard by P or PAPA.r
3. Geometrical progression of reproduction of the organisms having maximal fitness for the environment.
4. A big number of biological species. Between them exist species, having preadaptation to almost every possible ecological change including artificial one. For majority of P and PAPA exist resistant species. Some species needs P or PAPA for development. Species within ecological system may be divided into three groups: dominant, rare and hidden (Sapunov, 1996). Hidden species have a population sufficient for regular detection of them by usual ecological methods. Between hidden species exist not described, which number may get many millions (May, 1986, et.al.). Ecological stress changes relation between different species. The mass of ecological system is constant. Global ecology data may help us to predict results of use of P and PAPA. The general struggle against pests is the following. Pests must be change for less dangerous species.

The strategy of P and PAPA use must be based on the following scheme

1. Check of toxity of P or PAPA, study of mortality increase and fertility decrease of pests.
2. Study of sanitation results for man taking into account possible ways of distribution of P and PAPA in nature and possible doses for man.
3. Check of possible genetic effects of P and PAPA using laboratory mutagenis test system (*Drosophila melanogaster* and so on*).*
4. The check of possible microevolution results of use of P and PAPA, taking into account variability increase and natural selection.
5. Check of possible ecological results taking into account interaction of pests with other species within ecological system.

Redomesticated vertebrates as a new pests

Many domestic animals and pets return to natural and urban environment and prolong their evolution. The result of evolution is change of ecological system and apporation of a new xenobionts. Some of them may become as a new pests having negative importance for humanity. Redomesticated animals may attack people and some of the animals may transmit infection decease. Such a problems are actual for modern Russian cities. The ecological niches for redomesticated animals may increase under periods of social instability. The process of a new pests apporation by redomestication may be monitored and controlled by use of approaches based on methods of ecology, ethology and genetics. According to global ecology principles (Vernadsky, 1926) there are no free ecological niche. If urban environment is available for vertebrate pest, this pest will proliferate and niche would be occupied. According to G.Gause law, one species is accorded to one ecological niche. Artificial coexistence of dogs and cats in homes accelerate microevolution of them toward divergence. Redomesticated animals got competition with wild animals and often suffocate the lasts. E.g. far-east fish rotan gotten rivers of Petersburg district from aquariums forced out some useful fishes of the region. According to ethology principles (K.Lorents, 1990), sometimes redomesticated animals have higher intellect than wild ones. It is cause of their win during ecological competition. Occupation of urban and wild environment take place under genetic principles of domestication and redomestication (Belyaev, 1974). Biphyletic animals (having two genetic sources) diverge to directions of both ancestors. Redomesticated dogs in Russia are more close to wolf, in Sinai - to jackal. Under redomestication the level of variability of animals decrease.

Apporation of a new biological objects in urban environment induce many problems that may be resolved by complex biological methods.

Human activity needs of theoretical prediction of its ecological results. The level of population genetics and applied mathematics insure possibility to make such a prediction. Important direction of humankind activity is domestication and redomestication of animals as result of interaction between social and natural processes. This processes may found new pests within both natural and synanthropic environment.

Theory of domestication was suggested by D.K.Belyaev (1974, 1978). According to him, domestication is the process of hereditary reorganization of wild animals and plants into domestic and cultivated forms according to interest of man. In its strictest sense it refers to the initial stage of man’s mastery of wild animals and plants. The fundamental distinction of domesticated animals and plants from their wild ancestors is that they are created by man’s labor to meet his specific requirement of whims and are adapted to the condition he alone maintains for them. Without man’s continuos care and solicitude, domesticated animals and plants could not exist.

At this article I shell consider domestication and redomestication of vertebrate animals (not plants) as source of a new pests. What means domesticated behavior? The main criterion here is the ability of animals to have direct contact with man, not to be afraid of man, to obey him and to reproduce under the condition created by him, which constitutes the necessary condition for the economical use of animals. It is obvious that selection for behavior has been unconsciously carried out by man since the earliest stages of animal domestication. Selection for domesticated behavior seems to result in breaking up previously integrated ontogenic systems and this leads to multiple phenotypic effect that seem genetically unrelated to the selected

character, namely tame behavior. In a genetic and biochemical sense, what may be selected for are changes in the regulation of genes - that is, in the timing and the amount of gene expression rather that changes in the in individual structure genes. Selection, having such an effect is called destabilizing selection (D.K.Belyaev, 1974). The selection becomes destabilizing when it affects, directly or indirectly, the system of neuroendocrine control of ontogenesis. The population result of such a selection is increase of variability. Domestic animal are more varied that wild ones.

Homeostasis of biological systems suggests resistance to human domestication activity. Under decrease of human selective and destabilizing press the back process of redomestication begins. The processes are reciprocal but not symmetrical. Redomestication consists of the following processes:

Genetical stabilization and getting phenotype close to natural ancestor.

Getting a new character including increase of fitness and intellect.

Divergency to ancestors in their number was more that one. E.g. redomesticated dogs (*Canis familiaris)* in Europe and North Asia are evolve to wolf (*Canis lupus),* in Asia - to jackal (*Canis aureus).*

Occupation of a new ecological niche having a new relation with man an other biological species. Some of redomesticated species appear to become a new serious pests. The same species may be useful or pest in dependence on situation.

1. The fish Rotan (*Perccotus glehni, Perciformes)* from Far East of Russia was domesticated as aquarium fish. At aborigine region it existed in nature under system of stable ecological connections and relations. Getting by redomesticated from aquariums synanthropic water ecosystems of Petersburg region it distorted here ecological connections. Fitness of redomesticated fish appeared to be higher that of aborigine fishes. Competition with here aborigine fish species (*Perca fluvuatilis* et al.*)* decreased fish resources. Hence, process of domestication - redomestication of usual fish produced a new pest.

2. Migrating pigeon (*Ecopistes migratorius*) is a species disappearing in XIX century. The proclamated cause of extinction to be intensive hunting. Ecologists have no significant testimonies of absolute disappearance of high populated small size animals by anthropogenic pressure. The most probable cause of species extinction is competition with European pigeon (*Columba livia)* that took place according to Gause (1934) law. Higher fitness of European pigeon suggested suffocation of aborigine species in both synanthropic and natural landscapes.

Hence the same species may be both domesticated and redomesticated, both useful and pest.

3. Feral cat (*Felis catus*) population in synanthropic ecological systems. Adaptation for a new ecological niche is accompanied by genetically reconstruction (Dobzhansky, 1937, Sapunov, 1990). The coefficient of variation (CV) of quantitative traits of domesticated cats is 0.15 - 0.25. Redomesticated cats have data 0.1 - 0.15 (own measure on St. Petersburg population). The coefficient of qualitative morphological variability

$$V_{QL} = (\sum_{i=1}^{m} \sqrt{p_i})^2$$

where m - number of morphs. Wild cats have mean V_{QL} equal 1 - 1.4, domesticated one - 1.4 - 2.0. Redomesticated animals have intermediate mean. Population of such a cats in St.Petersburg is between 50 000 - 200 000 (own measure).

Adaptation of population for synanthropic environment suggested the following problems:

competition and predation of useful animals.
Transmission of decease.
Induction of allergy.
Contamination of city.
Rare - direct aggression against man.

4.Redomesticated dogs (*Canis familiaris).* Their evolution is going into two directions - restoration of wolf and jackal characters. Restoration is accompanying by increase of intellect and complicated social behavior (Lorentz, 1990). The most aggressive are specimens having intermediate state between domesticated and redomesticated state because of their ethological instability and absence of pattern of environment adaptation. Under wild nature redomesticated dogs began struggle for existence in ecological niche against wild animals. Unique adaptive possibility insure success of such an animals under this struggle. They appear to become a new pests both for synanthropic and natural ecological systems.

Phenogenic indication

Vertebrate pest management and control needs regular monitoring. The cheapest method of monitoring is biological one. The most effective variant of biomonitoring is phenogenetical one. The question within which limits of accuracy it is possible to estimate the future fate of urban vertebrate population using a few number of samples would be considered in report. A mathematical device letting to analysis the state of population using easily measured characters: quantity, sex correlation, the variability of morphological characters, the level of morphological assymetry, sexual dimorphism.

There are 2 types of ecological models available for prediction – dynamic and static. Dynamic ones are based on temporal line of data, modeling trends and prognosis. Static are based on one moment analysis of population or ecological system. Phenogenic indication is variant of static modeling. Analysis is based on check of phenogenic criteria.

1. Sex ratio. The quota (part) of males (Pm) under normal condition must be 0.5 – 0.55. The mean 0.55 – 0.65 suggests on genetic unstability of population. Under Pm more than 0.65 the adaptive possibilities of species are over. Organisms with such a characters are not serious pests.
2. Quantitative variability is measured by variation coefficient

$$CV = \sigma / \mu$$

Where σ is square deviation, μ – the mode. Under normal ecological conditions CV is between 0.05 and 0.1 (Sapunov, 1988, Skvortsov, 1996). The mean equal to 0.1 – 0.2 suggests to unstable state of population. Under CV overtaking 0.2 adaptive possibilities of population are over. Some animals, e.g, dogs have CV more than 0.2. But this species is persisted only by human artificial selection. Redomesticated dogs decrease CV to 0.1. During redomestication pattern of dogs phenotypes distributed into two stable phenotypes. The first of them is close to wolf, the second to jackal. City garden pest – aphid *Megoura viciae* have CV on length of body and other morphological characters close to 0.1 – table 2. Under introduction to urban state the mean increase to 0.2 – 0.3. During adaptation to urban state the mean return to 0.1 (Sapunov, 1991).

3. Variability on qualitative traits. Under control state wild population has about 5% of abnormal specimens (Sapunov, 1991). The fact is accorded to use of significant probability 0.05 (0.95) within biological statistics. That is 95% of of organisms are normal under control state. Increase of mean to 0.1 – 0.2 suggests that population is toward suffocation.

4. The rate of genetic damage of population may be checked by float asymmetry:

$$Sd^2 = \Sigma(a_{ri} - a_{li})^2 / N\text{-}1$$

Where a_{ri} and a_{li} are means of symmetrical characters at right and left sides of organisms. The overtaking of standart data for species (Sapunov, 1991) suggests that species is under high ecological press.

5. Sexual dimorphism is a compass of evolution (Geodakyan, 1978). The low dimorphism suggests on stability of population. High dimorphism suggests on quick adaptation for environment change. The use of mathematical models described in previous works (Sapunov, 1991) is a way toward prediction of fate of any organisms including urban population.

Conclusion

Human activity produced a new pests, both in synanthropic and natural biocenosis. Resistance and homeostasis of every biological system is higher than disruptive possibilities of humankind. Local disasters result in the death of many organisms. The laws of global ecology, however, say that unoccupied places are filled immediately. Even the most considerable ecological disasters are unable to significantly change the mass of the biosphere. A reduction of the mass in the one place is always compensated by an increase in another place. An increase of anthropogenic pressure in Western Europe, e.g. has resulted in a significant decrease in the combined mass of animals and plants. At the same time, the opposite processes is taking place in European Russia. The number of animals and plants is increased. Many hidden species and species with new characters including pests are between them.

Human-made disasters are such smaller in scale that natural ones. Appearance of a new pests is example of natural resistance against anthropogenic pressure. We must keep in mind the following ecological principles (Gause, 1934, Vernadsky, 1975 et. al.).

There are no free ecological niches. Every new one made by humankind would be occupied by any species or morphs.

Every specimen of every species suffocated by man would be exchanged by another specimen or species. The structure and size of ecological pyramid (Fig.2) is constant. A new biological object may be more useful or more dangerous than the old one.

The general stability of biosphere don't mean stability and prosperity of any concrete species including *Homo sapiens.*

Management of redomesticated vertebrate pests must be based on methods of three sciences:

Ecology (Gause, 1934, Vernadsky, 1975 et.al.) which suggests for decrease of free ecological niche for pests.

Genetics (Dobzhansky, 1937) for control of microevolution of pests in dependence of anthropogenic press.

Ethology (Lorentz, 1990) for control of their behavior.

Use of pesticides and physical agents having pesticidical effect needs taking into account the following points:

6. Pesticides and physical agents of the same activity acts not only for pests, but for all ecological systems including human organisms.
7. The agents acts on genetical system of pests and stimulates their adaptation.
8. Decrease of pests fertility in present generation may be compensated within future generations. –
9. Decrease of pest population may be compensate by increase of other species population. This populations may have harmful effect for humans too.
10. Effective struggle against pests need complex approache including chemical, physical, mechanical and biological methods.

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