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Synanthropization, veterinary epidemiology and zoonoses

Key words: synanthropy, synanthropization, wild animals, veterinary epidemiology, zoonoses

Introduction

The rise of new extremely dangerous epidemic zooanthroponoses in anthropurgic environment, such as West Nile Fever (WNF), severe acute respiratory syndrome (SARS, "atypical pneumonia"), avian flu (H5), swine flu (H1), a variant of Creutzfeld-Jacobs disease and other emerging pathogens and infections of man and animals at the turn of the century is one of the most significant in many respects and at the same time enigmatic problems of veterinary epidemiology. Besides, there are neglected infectious diseases included by the World Health Organization (WHO) to a separate category, its basic list contains more than thirty infections, mycoses, parasitic diseases, common for animals and humans under natural conditions, reemerging and wide-spread, but receiving no proper attention in veterinary and epidemiology; their most important examples are rabies, bovine tuberculosis, brucellosis, cystic echinococcosis (hydatiosis), cysticercocis (finnosis) (Makarov et al. 2004, 2008; Sergiyev et al. 2006; Deplazes et al. 2004; Dobson 2005; 9th Conf. 2010). Similar epidemic phenomena of this particular historic period together with large scale and consequences of frequent natural and technogenic disasters, recent challenges of real terrorist attacks by Islamic extremists bring back to creationism of the Book of Revelation.

No doubt, the most common mechanisms of appearance and distribution of emerging zoonoses, cycle activization of their pathogens, pathogen traffic from natural zoonotic pools to agro- and urbocenoses are various kinds of transformations in systems "pathogen + host + environment" due to various circumstances, the most important of which are natural and/or anthropogenic phenomena. The present article is an attempt to consider one of such phenomena – synanthropization as an element of ecological dislocation of natural parasitic systems, their approaching and interflowing into anthropurgic systems, from the point of view of its veterinary and epidemiologic significance.

Materials and Methods

The research was carried out in the format of systematic review, its object was the results of original works and primary publications on ecologic and veterinary-epidemiologic peculiarities of contextually important animals (see below) acting as hosts in zoonotic parasitic systems with participation of their populations. The evidentiary information was searched for in selected data base and scientific publications

(ProMED, WAHID, EMPRES, OIE Publications, OIE Working Group of Wildlife Diseases, Wildlife Disease Association, USGS, J. Wildlife Diseases, Theriogenoligy, and others), all sources are available in the World Wide Web, the principle ones are given in the reference list. For statistical generalization of data included in the systematic review we have used qualitative and quantitative meta-analysis, a scientific systematic method which makes it possible to combine the results of independent studies (Pokrovsky et al. 2008).

Results and discussion

Anthropurgic environment. From the point of view of veterinary epidemiology, anthropurgic environment, in contrast to natural environment, includes cities, towns, villages and lived-in territories which are one way or another modified by man and connected with human activity. This environment takes a particular part of biosphere transformed into socio-bio-ecosystem set of specific agro- and urbocenoses. Originally anthropurgic landscapes developed due to humanization of territories, the process of human invasion to natural environment and, thus, its considerable disturbance. Therefore, they are unstable and extreme for biosystem relationship of flora and fauna representatives, they can be inhabited only by ecologically plastic organisms which can adapt to anthropogenic factors, domestic and synanthropic animals in particular (Klausnitzer 1990).

The species composition of animal population depends on geographic location, administrative-territorial status, social and cultural level, national, religious and professional peculiarities of population. In fact, it includes useful animals of different domestication degree, companions, religious and working animals etc., obligate synanthropes – from the animals protected and tolerated by man (e.g. pigeons are an inseparable part of city landscape) to various kinds of pests (rodents, insects) and migrating wild species (Klausnitzer 1990).

The role of annthropurgic environment under current conditions is complicated by social-demographic trends of recent years – changing standards of living, further urbanization and decrease in the influence of administratiuve borders. Progressing city development and extensive humanization of territories in general are essential features of the current period. According to Bulletin of the WHO (2000), during the last 200 years the city population in the world grew from 5 to 50 %. If this tendency continues, the urban population will make up two thirds of the earth population in the nearest 20 years (7 billion people). Even now there are metropolitan cities with population of about 20 million people (Mexico, Sao Paolo, Mumbai).

That gives rise to several negative problems. The number of city animals of all groups is increasing to a critical level, which is accompanied by *zoomania* – a serious psycho-social anomaly, mainly due to the lack of proper culture level and adequate requirements for animal breeding, ignorance of social standards and communal hygiene. This circumstance is exacerbated by large amounts and availability of food wastes, and excessive and uncontrolled charity – these are the main reasons for the increase in the number of abandoned, stray, homeless, feral animals in residential, recreational and suburban areas. Besides, "non-use" of domestic animals for their intended purpose turns hunting and guard dogs and working horses into fancy animals with severely perverted psychics and health in general.

The ecological peculiarities of anthropurgic, chiefly urban environment, as to its animal population are formulated rather fundamentally (Klausnitzer 1990), especially in works on zoopsychology of synurban species (Meshkova et al. 1996). Among these features are diversity of habitats, their mosaic distribution and unpredictability of changes, high level of variability, flexibility of urban environment and diversity of its components, human vicinity, and application of various means and methods to affect animal population in cities. Besides, humanization and urbanization, as socio-ecological processes are certain to influence infectious pathology phenomena considerably, irrespective of the subject, be it man or animals.

Generally speaking, potential risk for the health of man and useful animals, as well as for destruction of the environment by synanthropic fauna is in transmission of zoonotic infections, infliction of injuries (physical and, which is

also important – psychological), occurrence of wound contamination, pollution of habitat, damage caused by various kinds of biodeterioration (Animals in the city 2003, Klausnitzer 1990, Guidelines 1981, 9th Conf. 2010). A full range of spontaneous animal pathology is typical for synanthropic fauna.

Among specific features of anthropocenoses in this respect there are two most important elements. The first one is "socialization" of development and manifestation mechanisms of epizootic process. It is this precondition that determines all other important attributes – reservation, amplification, sources, pathogen transmission, character and types of parasitic systems, factors and mechanisms for their regulation, nosological profile. In fact, determining the influence of anthropogenic factors of environment, in the broad sense, turns the parasitic system into a single inseparable unity – pathogen population, susceptible men and animals, exchanging the functions of the latter as infection sources, vectors, and other motive forces of epizootic / epidemic process, components of the single parasitic system, an elementary unit, and pathogen transmission chain. Secondly, anthropogenic pressing almost completely rejects biological (particular ecological, to be exact) start up of epizootic process as distribution of pathogenic microorganisms in animal populations, subordinates it to social regularities, thus, eliminating "biological boundaries" between epizootic and epidemic processes. In urban areas there are quite favourable conditions for occurence, distribution and even radication of many zoonotic infections. The means of their transmission and exchange between animals and men can be various – through bites and injuries, faeces, direct and indirect household contacts, air and food.

Anthropurgic environment and habitable areas are *a priori* quite attractive for wild animals and non-obligate synanthropes. First of all, it is true for representatives of specific categories which are characterized by behavioral tolerance and opportunistic feeding habits (stealing, foraging, cadging), which is a precondition to their synantropization (except the species considered below, they include bears, crows, gulls and others) (Klausnitzer 1990).

The fox (*Vulpes vulpes*). Under natural conditions the fox is a solitary nocturnal animal, extremely cautious, and is an ideal carnivore, hardly ever contacting other animals except its prey species. These animals become synanthropic under various circumstances changing their biotope preferences, and if they are attracted by limitless abundance of food (fig. 1 and 2). Historically, for the first time foxes were recorded in urban landscapes in 1930 in London and later in other cities of Great Britain. During the following years foxes began to invade big cities of Europe (Copenhagen, Paris, Berlin, Stuttgart, Rome, Oslo, Genève, Zürich etc.), they also appeared in the cities of Australia (Adelaide, Melbourne, Sidney), the USA (Los-Angeles, New York, Washington), Japan (Sapporo). In the Western Europe during the last 25–30 years they extensively occupy urban areas, so that it resulted in formation of the specific and rather significant *urban fox phenomenon*. In spite of control measures taken, urban

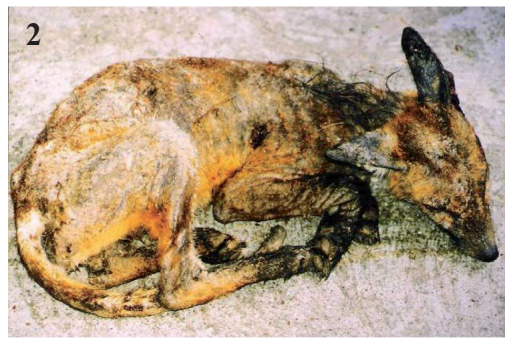

Fig. 1 Fox in the wild (1) and urban foxes, sick sarkoptic scabies (2, from Fischer et al., Proc. Int. Conf. Moscow 2009)

fox population density is growing everywhere. For example, in Zürich in 1985–1997 the numbers of foxes increased twentyfold, in Geneve fox population density is 3 heads per km^2 and in England city populations comprise 33 thousand heads – 13 % of city population in the country (fig. 3) (Proc. Int. Conf. Moscow 2009, Harris et al. 2001).

The foxes of present urban populations are characterized by two extraordinary features. Genetic comparison of natural and urban environment has shown that genetic drift, differences and divergence are greater in the latter, which indicates adaptation processes under new habitation conditions (Wandeler et al. 2003). Sarcoptic mange (*Sarcoptes scabiei* var. *vulpes*) has been found to play regulating role diminishing urban populations selectively (for example, infestations in Bristol in1994 reduced their numbers by 95 % during two years) (fig. 1) (Proc. Int. Conf. Moscow 2009; Harris et al. 2001).

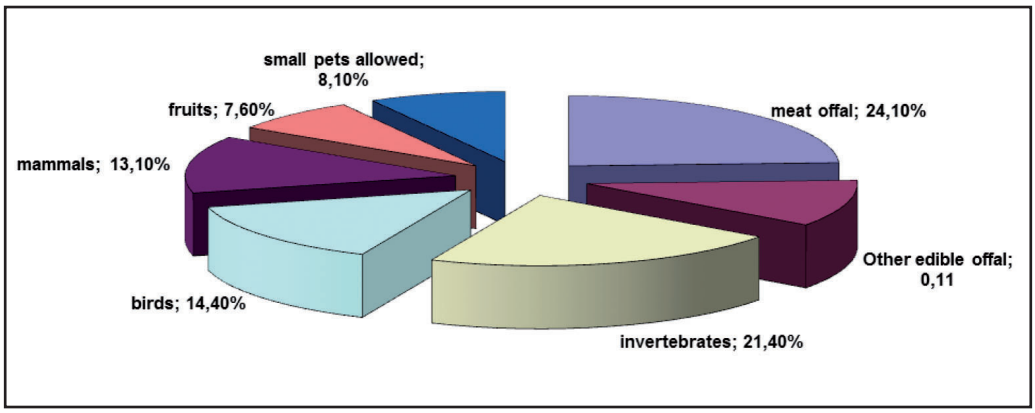

Fig. 2 Food resources of foxes in London (Harris et al. 2001)

Fig. 3 Fox on the street in London [Bigpicturesphoto.com]

According to our systematic observations of recent years in the central part of Russia foxes also tend to occupy anthropogenic areas (mostly those near municipal waste landfills), loosing cautiousness as the basis of their behaviour pattern, which affords ground for considering it the initial precondition of synanthropization.

Urban fox phenomenon is of great significance in veterinary epidemiology, since this is the way zoonotic invasions enter urbocenoses (fig. 4), among them the most significant are alveolar cystic echinococcosis (*Echinococcus multilocularis*) of man, and rabies. Earlier the synanthropic cycle of echinococcosis with participation of dogs as definitive hosts infected from wild rodents existed only in focal rural communities. Within the *phenomenon,* fox-mediated invasion obtains the character of intensive urban cycle; since the beginning of the new century such infestation has been registered in big cities of Europe (Copenhagen, Stuttgart, Genève, Zürich etc.) (Proc. Int. Conf. Moscow 2009, Deplazes et al. 2004).

Rabies, as "zoonosis No. 1" under urban conditions is the most potentially dangerous consequence of the *phenomenon*. Western Europe is free from rabies, in its central part eradication of the disease is almost completed by means of proven and highly effective strategy (oral vaccination of foxes) with promising results, so there are no problems with the *phenomenon* in this respect. In the central part of Russia the outlook is different: if epidemiology and veterinary services continue treating sylvatic rabies as pseudo problem with growing infestation rate, the situation may develop step-by-step using the vector "*urban fox phenomenon* formation → retransformation from sylvatic cycle (fox ecotype of infection) to urban cycle (dog ecotype)".

Undoubtedly, this outlook is quite disputable. Classical urban (dog) rabies is unlikely to take roots quickly even provided the phenomenon is established, as the reversion of the fox cycle to classical urban type is the process of complicated and time-consuming evolutional transformations, and most of dogs are subject to vaccina-

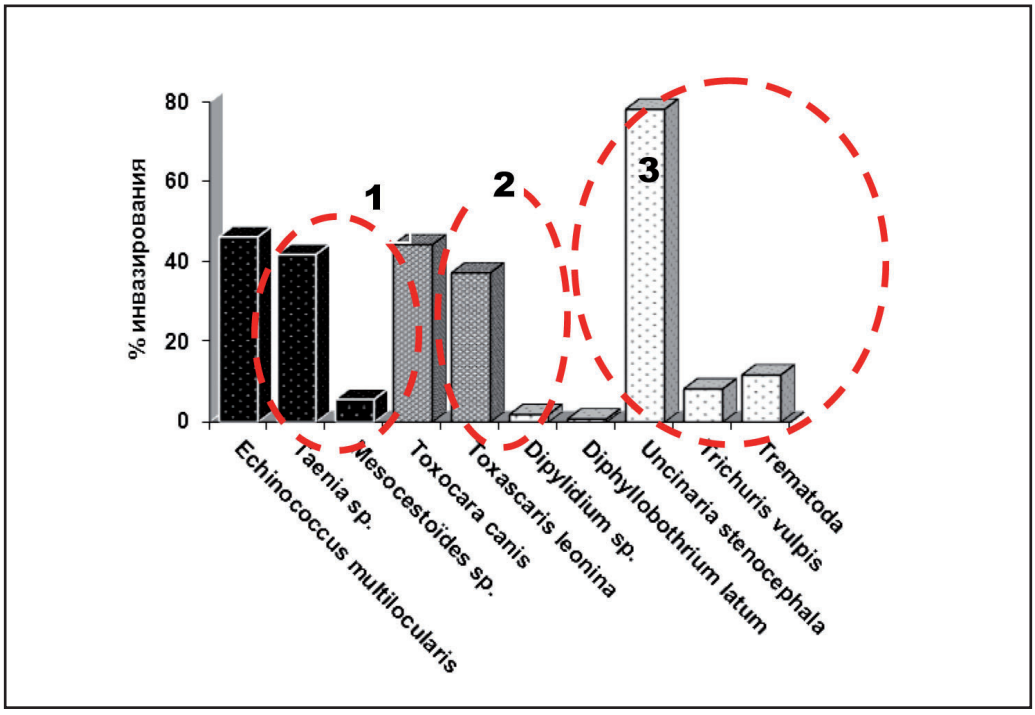

Fig. 4 Helminth of urban fox populations, obligately associated with rodents (circle one), having casual sex (circle 2) and is not related to rodents (round 3) (Geneva, from Fischer et al. Proc. Int. Conf. Moscow)

tion. At the same time, the fox remains dangerous for urban fauna as a reservoir and source of sylvatic rabies. Formation of the *phenomenon* at any stage will, certainly, create conditions for establishment of synanthropic foci of fox rabies, and intensified inevitable contacts will result in higher infestation rate of domestic animals, which was frequently observed in urban areas with deeply penetrating wild nature landscapes or adjacent to them (Makarov et al. 2009, Theriofauna of Russia 2011, 9th Conf. 2010).

The Racoon dog (*Nyctereutes procyonoides*) is rather a new species for central Russia, little familiar to people. Racoon dogs, introduced from the Far East to the western regions of the USSR in 1930, easily adapted to their new habitats thanks to high ecologic plasticity and quickly settled over the East European Plain and outside the country, their range continues to extend towards the West and the East (Khlyap et al. 2008, Introduced species). This is an opportunistic feeder, the size of an average dog (fig. 5). The raccoon dog is a taxonomic but not ecological carnivore, since due to morphological, physiological, ecological preconditions does not present a link in the system "beast of prey ↔ prey" and does not depend on such system of interspecies relationship as fox and other obligate predators do (Makarov et al. 2009, Proc. Int. Conf. Moscow 2009). The raccoon dog is extremely adaptable to various habitats: it is omnivorous (from vegetable matter, mesofauna, nestlings, fish, etc. to carrion, depending on the season and requirements), polytocous (15 pups and more), monogamous, insensitive to pain and can be an excellent pretender to escape danger, a good swimmer and can wander extensively within a biotope searching for new living resources. Unlike other forest carnivores, the raccoon dog, thanks to hibernation, can survive for 2–3 critical months of low temperatures, frozen soil, and food deficiency (Introduced species).

In accordance with their feeding type, especially in extreme situations, raccoon dogs are also subject to synanthropization, they concentrate near settlements, livestock farms, municipal waste landfills, dump sites and other places, where they are attracted by food and feed wastes etc. Under especially unfavourable conditions in 2010–2011 they were reported to settle in utility rooms, and even in doghouses.

Veterinary and epidemiological significance of the raccoon dog is limited to its occasional, "non-systemic" participation in the cycle of sylvatic rabies as the spillover is usually deadlocked on the prey animal, as well as rabies in other susceptible species, except the fox, though the cases of people's infestation from sick raccoon dogs, usually provoked, are not excluded. Synanthropic preferences of the raccoon dog with habitat shift towards agro- and urbocenoses will naturally intensify its various contacts with domestic animals and people and transmit rabies by the chain "foxes → raccoon dogs → man or domestic animals" with

Fig. 5 Raccoon dog (Nyctereutes procyonoides)[animal world]

index-incidences of hydrophobia (Makarov et al. 2009, Proc. Int. Conf. Moscow 2009, Introduced species, 9th Conf. 2010).

The Wild Boar (*Sus scrofa*). It is a well-known multivariate, adaptive species, inhabiting half of civilized areas of the world, chiefly the North of the Eastern Hemisphere. Within the context wild boars are classified as invasion species, most dangerous for the ecosystems of Russia which is distributed both by self-settlement and reintroduction (Khlyap et al. 2008, Intoduced species). In wild boars' biology and ecology there is a number of specific features distinguished at individual and population levels (physiology, ethology, phenology, distribution in biotopes), which can be considered *epizootologic characteristics of the species* (Makarov et al. 2010, Theriofauna of Russia 2011).

Thus, thanks to family way of life with association of their stations to biogeocenotic conditions, wild boars as a species are separated, and form territorially discrete, stable and compact clusters-foci of animal groups susceptible to infectious diseases. Wild boar populations grow everywhere and occupy new territories, which is due to some particular reasons (diminishing the role of predators in the biosystem "wolves-wild boars", lack of biotope competition, supplementary food given on a systematic basis, trends in natural-social and climatic changes, increased global ecological requirements), which *a priori* increases their epizootic, reservoir and other importance (Makarov et al. 2010; Khlyap et al. 2008; Introduced species).

Wild boars are well-known for such behaviour pattern as agrophilia, – an acute urge to invade agrocenoses, which preconditions various contacts between natural and anthropurgic biotopes, and their populations. Finally, it results in real contacts of wild boars and domestic swine with different consequences – from direct and indirect infection and parasite exchange, contamination of farms by them, to mating of domestic sows with wild boars and producing hybrid offspring.

Recently, there have been reports of wild boar invasions to anthropurgic environment and their successful assimilation. In particular, mass media provide extensive coverage of wild boar behaviour in agro- and urbocenoses both in highly developed rural and urban cultures, and in exotic ones (Europe and Middle East respectively). As it turned out, the permanent population of wild boars in Berlin amounts up to 10 000 heads (approximately, this number is equal to that of Moscow Region, the average population density is 10 heads per km^2 of urban area), and their number is growing annually. The reasons for urbophilia, occupation and population increase are obvious – relative safety and abundance of food wastes in residential areas, near numerous restaurants and cafes, soft, easy-to-dig soils of open areas, available water sources and shelters, and excessive charity. Hundreds of wild boars are killed in car accidents; their digging activity causes damage to parks, squares, cemeteries, stadiums. They feel comfortable and remain active not only in twilight and in the suburbs, but also in the day time and in central parts; they are not afraid of people and appear on playgrounds, in the underground, in shops, i.e. the local population of wild boars in Berlin is quite synanthropic. Such dynamics is similar to formation of *urban fox phenomenon* that happened half a century ago, and in the nearest outlook it is possible to establish yet another urbocenotic reality (fig. 6). Wild boar sightings in cities are also recorded on the territory of Russia, especially in extreme situations (large-scale forest fires in summer of 2010, severe winter season 2010–2011 with unusually deep snow and thick crust formation).

Wild boars are looked upon as harmful and problematic animals. According to "Agroecological Atlas of Russia" (2003) wild boars are considered pests for agriculture because of the damage caused by them (spoilage of potatoes and grain crops, damage at fields and forests). While moving and occupying new territories they provoke accidents (car accidents, aggressiveness to people) (Makarov et al. 2010, Khkyap et al. 2008, Introduced species).

Wild boars present a real epizootic threat to pig-breeding in Western and Eastern Europe, the USA and Japan as they reserve numerous infections, not only swine-associated but also polypathogenic ones, among which are transboundary classical and African plague, Aujeszky's disease (porcine pseudo-rabies), brucellosis, many polyhostal invasions, even those which have been eradicated and are under

Fig. 6 Family of wild boars on the streets of Berlin [nytimes.com]

control in domestic pig-raising (Makarov et al. 2010, Theriofauna of Russia, Meng et al. 2009). Potential risk to public health is due to the fact that severe zoonotic pathogens are wide-spread among wild boars and there are numerous cases of their direct transmitting to man. In particular, in wild boar populations the prevalence of hepatitis E virus reaches 25–42 % (Spain, Italy), circovirus TTV, associated with hepatitis of man – more than 80 %. Flu A H1, Japanese encephalitis, tularemia, leptospirosis, Q-fever, brucellosis, tuberculosis (up to 57 %!), plague, intensive *Trichinella sp* и *Toxoplasma gondii* invasion have been tested positive (Makarov et al. 2010, Meng et al. 2009). It is principally important that enumerated infections in wild boar populations are reserved in the wild focally (in families), and this possibility is not excluded in synanthropic foci.

Bats (Chiroptera). This is the most representative group, it includes almost a quarter of all known species of mammals, and their total number is countless. The size of bats can vary but all of them live in large "families" in their biotopes, under unfavourable conditions they concentrate into enormous colonies (tens of thousands) in enclosed spaces (caverns, farm buildings, etc.). Their lifespan is rather long (representatives of some species live 10 years and more. Chiropterans, irrespective of the kind of food eaten, feed and hunt in large groups. Their biotopic distribution and lifestyle in general are *a priori* favourable for effective contact re-infestation and parasite exchange, formation of clustered susceptibility and epizootic focality, they facilitate "successful development" of epizootic processes and formation of parasitic systems in their populations.

Bats can extensively occupy anthropurgic environments. It is well-known that agrocenoses are populated by them. Some populations prefer cities for their stations (recreational areas and country houses, lofts, sheltered places of various types; bat colonies have been known to raid some architectural structures). For some species of bats people's houses – are their main habitat and these chiropterans have become house-associated animals (for example in Russia – common serotine, common pipistrelle, Savi's pipistrelle and others), like rodents (house mice and rats) and some birds (pigeons, sparrows and swallows) (s. Introduced species).

Since the end of the 20th century the representatives of this specific taxonomic group (insectivores, herbivores, vampires and other bats), having no proper notice in veterinary epidemiology, have demonstrated their significant role as reservoirs and amplifiers of new emerging zoonotic pathogens with unpredictable potential. Zoonotic pools of lethal to man natural infection *Australian bat lissa virus* (ABLV) have been formed in Australia, spreading in populations of many species of chiropterans through bites and in other possible ways with injection infestation, seroconversion and low lethality rate, similarly to sylvatic European chronical rabies of fox type. Ecological contacts with chiropterans became the reasons for outbreaks of *Australian horse morbillivirosis – Hendre disease*, affecting men and horses under natu-

Fig. 7 Serotine (Eptesicus serotinus) [bg-znanie]

ral conditions with lethal outcome (1994, 1999 and further), and mass malignant infection in swine caused by a new paramyxovirus Menangel which was also associated with flu-like syndrome in people (1997).

In Malaysia there was high incidence and mortality among swine caused by taxonomically similar paramyxovirus (henipavirus) of fruit-eating chiropterans (1998–1999); the new disease named *porcine respiratory neurological syndrome –Nipah disease* with mortality rate 40 %, was closely associated with epidemic viral flue-like syndrome and encephalitis among pig farm workers with lethality 38 %. Since 2001 henipavirus has caused a lot of severe epidemic outbreaks in Bangladesh and India (Bengal), where dozens of cases of incurable encephalitis were recorded (lethality rate – up to 100 %); people get infected from fruit or palm juice contaminated by excrements of spontaneously infected giant fruit-eating chiropterans (*Pteropus*) (Makarov et al. 2004, 2008; Dobson 2005).

In China with the highest disease incidence, horseshoe-nosed bats (*genus Rhinolophus*) proved to be natural reservoirs for coronavirus, infectious agent of SARS in the chain "bats as reservoirs → Himalayan civets as amplifiers → man", and subclinical carriage of SARS-like coronaviruses has been found among chiropterans in the west of Europe. In Africa sylvatic sycles of Marburg and Ebola haemorrhagic fevers form the chain "filoviruses ↔ fruit-eating bats↔ chimpanzee → man". It should be added that bats are carriers of zoopathogenic bacteria *geni Borrelia* и *Bartonella*, and vampire bats (*geni Eptesicus, Tadarida, Lasiurus* and others.) are the main reservoir and vector of rabies in such a vast region as Latin America.

Rabies of brown bats (*Eptesicus serotinus*), as a new sylvatic ecotype of rabies infection, poses a threat to Europe progressively spreading throughout the continent from west to east (fig. 7). Hundreds of cases have been recorded in the western Europe. In Poland, Russia and Ukraine there are index cases of such rabies, which testifies the invasion of *European bat lyssaviruses* (EBLV-1 and 2) to the eastern Europe. Bat synantropization can potentially become the reason and mechanism of forming synantropic rabies foci of this ecotype (Makarov et al. 2004, 2008; Dobson 2005; 9th Conf. 2010).

Synergizing factors. The present article ignores the cases of introduced epidemic outbrearks or natural propagation of theriozoonoses and sylvatic infections under anthropurgic conditions (e.g. HIV/AIDS, African swine fever, filovirus and arenavirus hemorrhagic fevers). This refers to *synanthropization* as an ecological phenomenon and the element of dynamic and gradual convergence of natural parasitic and anthropurgic systems followed by potential transformation of natural foci into synanthropic ones, and other veterinary and epidemiological consequences (e.g. emergence of WNF and SARS). In this respect, the foregoing premises discredit the four described species rather objectively (distribution, abundance, density, population dynamics, ecological inclination to synanthropization, the

role of a reservoir in circulation of many important infections). The examples of these animals show that the synantropisation phenomenon is not spontaneous, but rather it is influenced by factors of critical synergizing importance. From the point of view of veterinary epidemiology, the most important ones are increasing expansion of human activity and such its particular component as the Green movement.

A textbook example of an awkward human interference into the natural order is the emergence of Nipah disease in Malaysia. The natural reservoirs for the new infection were fruit-eating chiropterans inhabiting the tropical regions of Southeastern Asia, Australia and Oceania and reserving the virus for historically indefinite time. The key point was a wide range of human production activities and natural processes, including anthropogenic intervention and environmental changes such as large-scale deforestation and development of cleared territories, droughts following hurricanes in 1997 and 1998, nation-wide intensification of pig production. Due to exhaustion of natural wooded habitat, bat population moved to rural areas, which preconditioned close contact with a new host, and increased population density of pigs resulted in successful transmission of the infection from bats to pigs and further to man. Though thanks to all these developments Malaysia experienced economic boom and joined the Asian Tigers, the new virus infection, previously unknown to science, caused a severe decline in pig production and was accompanied by not unreasonable mass panic in the country. Within the framework of stamping-out policy several millions of pigs were slaughtered – 45 % of the population (Makarov et al. 2004, 2008).

In addition to technogenic transformation of nature landscapes, which is of prime synergizing importance, inclination of wild animals to synantropization is also provoked by such anthropogenic factors as low general culture of the population, inadequate social and communal hygiene (favourable conditions and food availability), anomalous population growth of small domestic animals, failure of wildlife conservation measures in extreme situations destroying natural biotopes (forest fires, climatic anomalies).

Similar effects can be produced by the opposite extreme in respect of environment conservation in the regions with a high level of social culture – excessive and thoughtless actions of the greens and animal protection organizations, their spontaneous as well as legislative initiatives relying on public opinion. Only because of their activities finding unreasonable populist support in artistic and parapolitical spheres, in Russian metropolitan cities there is such an ugly anachronism as stray homeless animals – tens of thousands of reservoirs for leptospirosis, trichophytosis, many parasitic zoonoses; there is unnatural phenomenon of "dog bite epidemics". Obstacles to acaricide treatment of vegetation landscapes result in extensive and unlimited increase of ixodic tick populations and even their expansion to urbocenoses of metropolitan cities with higher incidence of sylvatic infections – tick-borne borreliosis (Lyme disease) and babesiosis (there are index-cases of the disease in dogs infected in Moscow parks). In European countries these organizations offer resistance to restrictive measures regarding wild boars, foxes and other animals inclined to urbophilia. All European species of bats are protected by Bern Convention (1979), in many European countries there are chiropterologic societies.

For reasons given, WHO has formed a special category of infectious diseases – Legislation and Regulation Enforcement Associated Diseases (Makarov et al. 2004, 2008, 2009; Sergiyev et al. 2006; Guidelines 1981; 9th Conf. 2010).

Conclusion

1. Under present conditions synanthropization is ecological reality of great veterinary epidemiological significance (Guidelines 1981, 9th Conf. 2010). In some European countries the situation is rather complicated and it acquired the status of independent urbocenotic phenomenon, with examples of typological and topological transformation of dangerous zoonotic cycles (cystic echinococcosis), and uncertain outlook for its control. There are all signs of potential development of this process in respect to the four groups of

animals described above – fox, raccoon dog, wild boar and bats, the most epidemically significant reservoirs of infections and invasions of animals and man.

2. The example of *urban fox phenomenon* demonstrates motive forces of evolution (mutation and selection), microevolutional changes, peculiarities of epizootic processes accompanying synanthropization (synurbanization) of wild animals (Proc. Int. Conf. Moscow 2009, Deplazes et al. 2004, Wandeler et al. 2003). This results in necessity to predict the estimates of evolutional transformations of potential synanthropes (synurbanists), their susceptibility to zoonoses and role in epizootic / epidemic processes under changing conditions of anthropocenoses.
3. Synanthropization is a strong potential vector of infection emergence, resulting from ecological relationship in the system "wild animals + domestic animals + man" with numerous real examples, serious and diverse. Synanthropy, as bioecological phenomenon, has an important aspect in the context of scientific and practical problems of veterinary epidemiology (co-factors, prevention and control measures). "Unconscious threat" (Sergiyev et al. 2006) of the phenomenon can unexpectedly result in extreme situations.
4. It is good to use unlimited potential of multidiscipline approach, and especially the interest of theriological science and practice that archieved serious results (biological invasions, synurbanization, synurban species, adaptation, phenology, behaviour, zoopsychology) in research usually limited to canonic synanthropes (house rodents, birds, insects, stray animals at most, s. Theriofauna of Russia 2011). The studies of target objects (at least those described in this paper) with veterinary epidemiological interpretation of observations are exquisite, in spite of their evident appropriateness.

Summary

The systematic review is devoted to synanthropization as new ecological reality with veterinary and epidemiological significance. Four groups of wild animals (red foxes, raccoon dogs, boars, bats) were considered within the context of the theme as well as the elements of their ecology, zoonoses which they reserve, and synergizing co-factors. The review is followed by some conclusions, main evaluation and recommendations on the phenomenon researched.

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