ANIMALS, PARASITES AND ZOONOSSES
IN DIFFERENT TYPES OF URBAN AREAS

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Abstract. The paper gives a survey of health risks associated with the occurrence of animals in urbanized areas. The author distinguishes the following animal categories involved: 1. food-producing animals; 2. pets; 3. synanthropic mammals; 4. synanthropic birds; 5. wild mammals and birds; 6. synanthropic arthropods. From the aspect of animal occurrence and zoonoses or other diseases associated with animals he proposes the following classification of urban areas: a) centre of town, b) pericentral part of town, c) residential areas, d) peripheral part of town, e) suburban recreation areas.

On the global scale, contemporary towns represent most remarkable areas from the parasitological, epidemiological and epizootological aspects. The advance of urbanization in all continents requires the necessity to face health risks arising from the adaptation of various animal groups to diverse conditions in urban areas.

The adaptation of animals to urbanized areas is associated with symbiosis, parasitism and other ecological phenomena connected with the existence of man. I shall confine myself to an analysis of the present state of urbanized landscape in relation to zoonoses and attempt to describe its global characteristics. There are a number of papers of modern towns but very few that analyse them for health risks associated with animals. Before going further I propose the following classification of urban areas:

a) Centre of town, characterized by an agglomeration of buildings used for economic and administrative purposes—mostly without parks, often without trees.

b) Pericentral part of town, containing continous blocks of buildings but already interspersed with greenery, larger areas covered with storehouses, workshops, factories, water reservoirs and streams.

c) Residential areas or sites covered with other buildings with adjoining greenery.

d) Peripheral part of town, characterized mostly by buildings and small houses mixed with various small industrial, agricultural—industrial, or purely agricultural estates, interspersed with fields.

e) Suburban recreation areas, often quite large, directly connected with the town, and surrounded by fields, woods, etc. and different types of agricultural activities.

The animal species found in the urban areas depend on the main occupations of their inhabitants and the size of the town. Contemporary towns in different continents, as divided into areas (a) to (e), are inhabited by many different animal species, which may be carriers of zoonoses. The definition of zoonoses as "those diseases and infections which are naturally transmitted between vertebrate animals and man" (Wld Hlth Org. techn. Rep. Ser., 1959) suggests that an infected animal may also be an indicator of a potential epidemiological situation or of sporadic occurrence of human infection. Zoonoses in urban areas vary according to the different groups and types of animals that live in various parts of towns.

Even in a number of modern towns in western Europe, for example, in Geneva, cattle or sheep graze in pastures in residential areas (type b). Green areas are used most effectively in this way. A similar situation may be seen in many international airfields, on the grass strips between runways.
Many towns in different continents are still centres for animal markets, pet exhibitions and sporting events. Even today a number of towns are visited by caravans from remote regions. All these link natural foci of diseases in rural and urban areas. Today meat, dairy and other food products of animal origin are imported into towns not only from the immediate neighbourhood but also from other continents. The importation of fish has also increased enormously.

Zoonotic and parasitic infections are difficult to detect in many urban areas especially those under (c), (d) and (e), mostly in tropical and subtropical zones. Diagnosis is complicated by multiple infections and the advanced stages of chronic parasitic diseases. Naturally the higher the concentration of different animals and the higher the number of different domestic, synanthropic and wild species, the greater is the risk of outbreaks and spread of zoonoses among the human population. The health of animals kept in towns, mainly those which can be directly influenced by man (i.e. domestic animal and pets) is a prerequisite for human health. The public health service registers primarily common diseases, but medically less known or sporadically occurring diseases such as many zoonoses, require constant surveillance. Well established methods and techniques for zoonoses surveillance programmes have been recommended many times by WHO. The detailed division by Rosicky (1978a) into survey of fauna, ecological investigation of ecological and socioeconomic conditions, estimation of natural foci and their structure and final analysis of all data evaluation of anti-epidemic measures, also applies to urban areas.

Veterinary public health services should therefore take care of animals bred in towns and medical services should be concerned with health protection of breeders and persons who are in contact with animals. The public health situation in towns is still more influenced by tourism, the transport of domestic animals and the importation of different pets.

FOOD-PRODUCING ANIMALS AND ZOONOSES

As recently as the last century, food-producing animals were kept even in the centre of many towns. Today, this is rare, but needs to be mentioned because it still occurs in some smaller places in Europe. According to the above classification, and in the areas (b), (c), (d) and even in the centre (a), there are farms keeping one or more domestic animals (cattle, sheep, goats) which are daily driven to pasture and returned to their sheds in the evening. In other cases food-producing animals are driven from such an urban area to a pasture for a season where they remain under the supervision of a herdsman. In both cases the pastured animals are in contact with ecosystems from which they may become infected with different pathogens which they in turn may bring directly into the town. This may be designated as an agricultural type of urban area (semiurban), as seen in some countries in Africa and Asia.

In the type of agricultural town cattle zoonoses (brucellosis, tuberculosis, actinomyces, dermatophilosis, etc.) occur. In tropical and subtropical regions diseases affecting buffalos should be considered. In Bubalus bubalis Sarcocystis fusiformis is common. Sarcocystosis and other toxoplasmid coccidia should be studied thoroughly, primarily to find out to what degree they can cause disease in man.

In the agricultural type of town a special attention should be paid to sheep and goats as possible carriers of serious zoonoses (Q-fever, Maltese fever, listeriosis, etc.). On a global scale, these species are more important carriers than cattle in urban areas as they have greater contact with man. A lesser role on a global scale is played by pigs, although in several regions, e.g. in tropical south-east and southern Asia they may be a source of viral infections (Bunyamwera group of viruses), Japanese schistosomiasis, sarcocystosis etc. Camels and horses kept both for work and pleasure are also important as sources of human dermatothypes, and in ecologically or epidemiologically suitable regions they may be carriers of serious zoonoses, disseminating them in towns on market days and during the passage of caravans. Poultry is primarily a source of avian tuberculosis, ornithosis and occasionally of some mycotic and viral zoonoses of man. The incidence of infection with microsporidia Encephalitozoon cuniculi in domestic rabbits reaches a high percentage (up to 100%). The role of this pathogen in human diseases is still not clear.

PETS AND ZOO NOSES

With the technological development of civilization, the inhabitants of highly industrial and economically advanced countries tend to keep various animals as pets.
For some years the public health importance of pets has attracted the interest of epidemiologists and parasitologists (Karstad and Trainer 1970).

Although many dogs and cats are used for working purposes, and in some cases for food, as was originally intended by their domestication, on a global scale, these two species represent the most popular pets which live in close contact with man and other domestic or synanthropic animals.

Dogs fall into the following categories: a) working dog (army and police dog, watchdog, hunting dog, gun-dog, sledge or draught dog); b) farm dog (including sheep dog, cattle dog); c) pet dog; d) stray dog (homeless dog); and e) wild dog. Each of these categories plays an important role in the epidemiology and epizootology of some zoonoses occurring in urban areas. Cats do not fall into such clear-cut categories and may be generally divided in a) home pets and b) stray cats. It should be borne in mind that most cats, even with an owner or a permanent place to live, are vagrant to a certain extent.

In an urban environment dogs and cats as pets may be normally in a balance. They represent an economic investment to their owners, and are under their control. But in many countries the problem of uncontrolled dogs and cats is now recognized at the national or global level. There are troublesome feral animal populations in some urban and suburban areas and represent a major problem from the veterinary public health point of view. In many towns dogs and cats breed outside human dwellings.

Other pets kept in urban areas include some laboratory rodents (e.g. guinea pigs, hamsters, mice) and a number of wild animals, including various rodents of attractive appearance (squirrels, chipmunks, dormice) and also some species of carnivores, monkeys, marsupials, etc. An important group of pets are birds, primarily parrots, canaries, turtledoves and jackdaws. Tortoises are also kept as pets in many countries. Less popular are different reptiles, snakes and lizards being rather a special hobby. Over the years pets have become fashionable and this has inevitably led to the establishment of organizations and shops for their sale, with attendant public health problems. Pets are kept in most types of urban areas (a) to (e) and are in contact with all types of people. Information on pets should therefore always be an integral part of epidemiological and parasitological investigations.

The dog, as the oldest domestic animal, is a reservoir of several serious zoonoses the first of which is rabies. Town dogs play a double role in its epidemiology: a) in several regions (south-east Asia), in connection with the customs of the inhabitants, rabies is distributed in the populations of town dogs; b) wherever dogs are either as watch-dogs or pets, infection may spread from wild animals, e.g. in Europe from foxes (wildlife rabies). Another serious zoonosis which may jeopardize man is echinococcosis (hydatidosis), which occurs in the Mediterranean towns and in some other regions, including South America. In recent years, whenever veterinary public health rules have not been observed, cases of echinococcosis of man and dog have been recorded in some European cities (Hörning in litt.). The dog is a reservoir of many other, mainly sporadic affictions such as leptospirosis, boutonneuse fever, kala-azar, opisthorchiasis, etc. As the popularity of pet dogs in towns increases, it is likely that visceral larva migrans (canine as well as feline ascarids Toxocara play an essential role) will acquire a greater importance in human pathology.

Like dogs, cats may also be a source of wildlife rabies acquired from wild animals and of several epidemiologically less significant diseases. In recent years cats have been indicated as a source of toxoplasmosis of man. Among other zoonoses that may be acquired from cats is a mycosis caused by Microsporum canis, a zoophilic dermatophyte, which frequently attacks man (e.g. in Rome, Moscow and towns in eastern Bohemia) (Mantovani 1977). It evidently parasitizes primarily cats, although dogs are also frequently infected. The role of various pet birds has been intensively studied (Davis 1971).

A possible mode of infection of some pets mostly in urban areas (a) and (b) is transport of the pathogenic agent through food (meat, fish, corn, water, carrots, hay, etc.). The store rooms of these foods are often inhabited by small mammals and the infection may thus reach pets from great distances.
In urbanized areas the existence of zoological gardens in most cities should be taken into consideration. Keeping exotic animals in cages or enclosures may pose various problems for veterinary public health. The animals, weakened by breeding in unnatural conditions, easily become a source of viral, bacterial, mycotic and parasitic zoonoses spreading to both synanthropic animals and man. Cases have been reported of brucellosis, tuberculosis, psittacosis, etc.

SYNANTHROPIC (DOMICILIATED, COMMENSAL) MAMMALS AND ZOONOSES

Studies on the relationship between animals, man and zoonoses have only recently been undertaken (Rosicky and Kratochvil 1953, Kucheruk 1965). Different species of small mammals and their ectoparasites, mosquitoes and sand-flies affect the epidemiological characteristics of certain zoonoses, particularly in urban areas, where they invade even modern houses and adapt completely to the prevailing conditions. Kucheruk's (1965) definition is as follows: synanthropic animals are those species which regularly inhabit human settlements or human constructions (buildings, living quarters, storehouses, stables, cowsheds, etc. and places for the initial storage of agricultural products), where they form permanent or intermittent independent and semi-dependent populations.

Since the synanthropic mammals are important carriers of zoonoses they represent a grave danger to human health. With regard to penetration into human dwellings, outbuildings and their environment we use the division of mammals after Rosicky and Kratochvil (1953) into easynanthropic, hemisynanthropic and exoanthropic mammals. Synanthropic mammals in urban areas are associated either with human dwellings or with barns of domestic animals giving milk. Thus we may speak about synanthropy conditioned by man or domesticated animals.

Many synanthropic mammals (rodents, lagomorphs, marsupials, insectivores and others) harbour agents of zoonoses with which man may become infected (Hull 1955, Davis and Anderson 1971, Wld Hlth Org. techn. Rep. Ser. 1967). Knowledge of the ecology and behaviour of synanthropic mammals (mostly animal reservoirs of various zoonoses) provides information on how various natural foci (Pavlovsky 1939, 1963, Rosicky 1962) have been maintained in urban areas and on why some foci increase in size. Urban areas are not free from potential vectors like mosquitoes, sand-flies, blackflies or mammal ectoparasites, mites, ticks, fleas) and thereby remain as natural foci of zoonoses (Rosicky 1976b, 1977). Apart from classical transmission from vectors to vertebrate reservoirs in urban areas the spread also occurs by the same routes as in other natural foci: through contact (leptospirosis); food and water (tularemia, dracunculosis); by air (systemic mycoses), and by any combinations of these.

SYNANTHROPIC BIRDS AND ZOONOSES

Some species of synanthropic birds inhabiting city, parks and gardens are considered by people as pleasant animals. They are usually fed by them and in various parts of the world encountered as a cultural heritage or natural members of the communities. There are fewer papers (Usakov and Rakhlin 1969) dealing with the synanthropy in birds than in mammals. Due to body structure, habitus and habits, their synanthropy cannot be as close as that of mammals. Despite this, in urban areas we encounter a phenomenon of possibly considerable epidemiological importance, namely, the dissemination of viroses, mycoses and also some protozoanoses.

The first important factor is the settling of buildings by birds in the close vicinity of man. For example, the presence of pigeons in many European cities leads to possible direct infection with bedsoniae, when dust from their nests penetrates directly into apartments (Pavlovsky and Tokarevich 1966) or they become a source of penetration of bloodsucking ectoparasites into apartments
Sparrows, pigeons and crows contaminate food and disseminate ornithosis and other birds may also import house dust mites of the family Pyroglyphidae, causing atopic allergy in man. Rookeries may lead to the formation of synanthropic natural foci of some arboviruses, such as Japanese B-encephalitis, when colonies of water birds become a permanent source of infection for the town’s inhabitants. Rookeries also play another role: the birds’ droppings contain substances stimulating the development of Histoplasma capsulatum (Otčenášek et al. 1967).

The high populations of synanthropic birds in recent years have resulted in new epidemiological and hygienic complications. Large numbers of blackbirds and other synanthropic birds have led, e.g. in the gardens of Prague and even in new housing estates, to seasonal mass occurrence of the chigger mite Neotrombicula autumnalis causing summer trombiculosis. Masses of trombiculid mites have occurred even in sites where deep layers of new soil had been heaped up or moved and yet the trombiculids, which are microcavernicolous at the adult and nymph stages, have rapidly adapted themselves and colonized these new sites.

Synanthropic birds also play a role in the transport of ticks to parks and gardens in towns. Measures to prevent birds penetrating into urban areas are still not taken to the fullest possible extent and birds are regarded as an attraction in towns for tourists. Bird eradication is carried out on a limited scale only and the protection of buildings by nets is confined to the most valuable art monuments.

WILD MAMMALS AND BIRDS AND ZOONOSES

The natural or man-made biotopes (habitats) of peripheral and suburban areas in various geographical regions also harbour wild mammals and birds which may be members of the zoonotic component of natural foci of zoonoses. Natural foci of zoonoses may be localized in the close vicinity or directly on the suburban estates. To this group of animals we range e.g. various species of lower primates, carnivores, ruminants, marsupials, rodents and birds. E.g. colonies of water birds, have become a permanent source of mosquito-borne viruses, colonies of gerbils, permanent source of pappataci fever or leishmaniosis. In many cases the migrations and movements of wild mammals and birds in central parts of urban areas may involve serious epizootological and epidemiological danger.

SYNANTHROPIC ARTHROPODS AND PARASITES

Synanthropic arthropods were among the first animals to colonize the dwellings of man and they have adapted themselves to live in the most modern buildings of today. Therefore, their hygienic importance is of constant concern to the health services. In general, we may divide them into two large groups: a) synanthropic blood-sucking ectoparasites, such as mosquitoes, bed-bugs, fleas, argasid and ixodid ticks; b) hygienically injurious species, such as members of the orders Blattaria, Diptera, Hymenoptera, etc. This group includes flies, which are a serious problem in regard to communal hygiene. It also includes poisonous species, such as some of the genus Latrodectus. In many countries of central Europe the ant Monomorium pharaonis has become a serious problem. It colonizes the most modern houses and has become a scourge in hotels and hospitals.

A very little known group which has been studied in detail only in the last decade, is mites. Various species may penetrate dwellings from the nest of their host—synanthropic birds or rodents. They may appear in large numbers, especially during their seasonal mass occurrence or when their usual hosts disappear or are reduced (departure of birds after their nests have been destroyed, eradication of rodents after deratization measures have been taken). Therefore, in order to combat them successfully it is necessary to know the source of their occurrence. This group includes the red mite, *Derma-
**N. gallinae**, a bird parasite common throughout the world. It occurs on free-living birds, but primarily attacks poultry (chickens, pigeons, turkeys, ducks), sometimes in great numbers. The mite *Ornithonyssus bacoti* penetrates into houses from synanthropic rodents (genera *Rattus*, *Mus*). It is a ridiculous parasite which can migrate over long distances. Of the blood-sucking mites transferring to man from synanthropic rodents the species *Liponyssoides sanguineus*, known in the literature as *Allodermanyssus sanguineus*, should be mentioned. It is widespread in a mosaic pattern in the different countries of Europe, Asia, Africa and North America. Its epidemiological importance consists primarily in its transmission of the causative agent of rickettsial pox, *R. akari*.

Under certain circumstances soft ticks of the family Argasidae may enter human dwellings. In central Europe the tick *Argas reflexus* penetrates into houses in large towns, particularly from nests of half-wild pigeons built on the cornices near windows, facades, lofts, etc. In recent years this tick has attacked man, largely because intensive eradication of large numbers of half-wild pigeons has deprived it of its natural host (Dusbábek and Rosický 1976). Finally, ticks of the medically important family Ixodidae may also be passively imported into human dwellings. The active mode of penetration is typical of the families Dermayssidae and Argasidae. It is connected with their search for new hosts, due either to peak densities of mites or a decrease in the number of hosts. The passive mode of penetration is by transport of organic material infested with mites (insulating material, upholstery, wood, etc.), by foodstuffs, or on dust particles in the air stream. Transport by other animals should also be considered, whether in feathers or hair of vertebrates or on the surface of arthropods.

Human dwellings are also inhabited by several species of predacious mites and some other species which are ectoparasites of insects. After attacking man some of them may cause acute affections of the skin. Most important are mites of the genus *Pyemotes* belonging to the supercohort Tarsonemini, as described by Voukassovitch (1947).

A special kind of mite colonizing human dwellings is that causing various allergic reactions of respiratory organs in man, such as atopic asthma. For example in Czechoslovakia from allergies of different types about 20% are allergies to house dust, the most widespread respiratory allergy after pollinosis (Samšinák et al. 1974). As late as the beginning of the 1960s, Spiektsma, after introducing flotation methods, succeeded in recovering from house dust the mite *Dermatophagoides pteronyssinus*, of which the extract had a similar response in a skin test as house dust allergen. The genus *Dermatophagoides* belongs to the family Pyroglyphidae, including minute mites (170–500 μm). They are common in birds’ nests, and thus get into the air while carried on the body surface of their hosts. Findings exist in town dust whenever pigeons are present. Of the synanthropic mites the best known are those living in stored products. They are primarily the following genera: *Acarus*, *Glycyphagus*, *Tyrophagus*, *Cheyletus*. They are also quite abundant in apartments.

The control of insects and mites occurring in homes is very difficult. On one hand, the mites continually build up their populations in cleaned rooms by import from outside and on the other, the choice of insecticides suitable for use in human dwellings is relatively limited.

In all continents the poorer areas of towns are not always connected to the main water supply system. This results in a number of parasitic diseases (malaria, schistosomiasis, filariasis, amoebiasis, etc.) (Sasa 1976). Constant care about clean water wells in such regions is one of the principal prerequisites of health. Another problem connected with water is the formation of breeding places of various mosquito species that are vectors of malaria, filariasis and arboviruses, and snails as vectors of schistosomiasis (Sasa 1970). Epidemics of malaria, dengue, Chikungunya virus infection are well-known after monsoon rains in Indian cities. In the tropical rain zone in south-east Asia some diseases associated with abundant water may become a permanent phenomenon (dengue, mosquito-borne haemorrhagic fever, Japanese schistosomiasis in the Philippines, etc.).

Other problems arise from mining activities which result in suitable breeding sites of blood-sucking arthropods, in the occurrence of small mammals as reservoirs of zoonosis in habitats in dumps, water surface and town garbage pits.
Soil pollution in suburban and peripheral areas primarily by eggs and larvae of different parasitic helminths and with cysts of protozoans is a scourge of some towns (Beaver 1961, Wld Hlth Org. techn. Rep. Ser. 1967b). A problem associated with sewage, has become important even in highly urbanized and industrial regions of Europe. This is the increase in taeniasis cases in humans and in cysticercosis in cattle (Engelbrecht 1976).

The problem of the occurrence of pathogenic and non-pathogenic amoebas of the genera Naegleria and Hartmanella in urban thermically and organically polluted water reservoirs or in sewage (Jenkins 1977) has been little studied. Histoplasmosis, cryptococcosis, etc., as well as dermatophytoses, caused by pathogenic fungi in soil are being studied anew as emerging new zoonoses.

The advance of urbanization thus poses many public health problems which need to be systematically analysed and the consequent animals, parasites and zoonoses monitored and controlled. Based on the occurrence of animals in urban areas and the evolution of their diseases, the present situation provides a valuable tool for the prognosis of zoonoses in towns in different parts of the world.

ЖИВОТНЫЕ, ПАРАЗИТЫ И ЗООНОЗЫ В РАЗНЫХ ТИПАХ ГОРОДСКИХ АРЕАЛОВ
Б. Розицкий

Резюме. В работе дан обзор угрожающих здоровье человека рисков, связанных с наличием животных в городских ареалах. Автор различает следующие категории животных в городских ареалах: 1. промысловые животные; 2. любимые животные; 3. синантропные млекопитающие; 4. синантропные птицы; 5. дикие млекопитающие и птицы; 6. синантропные членоподобные. С точки зрения наличия животных и зoonозов и других связанных с животными заболеваний автор дает следующую классификацию городских ареалов: а) центр города б) периферия города в) жилые кварталы г) периферийная часть города д) пригородные районы отдыха.

REFERENCES


AMBUSH FUMIGANT AGAINST MOSQUITOES IN ROOMS

Ambush (3-phenoxybenzyl (+)-cis, trans-2,2-dimethyl-3-(2,2-dichlorovinyl) cyclopropane carboxylate) is a synthetic pyrethroid with an extremely high level of activity against a broad spectrum of insect pests. Unlike most other pyrethroids, the compound is comparatively stable (e.g. in ultraviolet light), and hence is relatively persistent on plant materials. The compound is not systemic. It is both an oral and contact insecticide, and it is quick-acting. In addition to lethal effects at very low rates of application Ambush is a useful repellent of Diptera. Due to its broad-spectrum activity, it is expected that Ambush will be useful for the control of Diptera. Acute oral LD50 to rat is 1000 mg/kg. It is miscible with most organic solvents.

For our experiments we caught females of *Culex pipiens* in a collar of the hospital in Hodonín. Twenty females were placed in a silon cage (25 x 25 x 25 cm) in a room sized 6 x 5 x 2 m. We fum ed the room with frankincense, a 5 cm pyramid of charcoal with mastic materials, produced by Tatrachema, Trnava, ČSSR. For fumigating mosquitoes the frankincense was impregnated with 15 droplets (0.035 ml) or 10 droplets (0.0234 ml) or 5 droplets (0.0117 ml) of Ambush and without Ambush as control. Three experiments with each application were made. The effects of the insecticide fumes were checked after half an hour, one hour and two hours. The air temperature in the room was 20 — 21 °C and humidity was 46 — 57 %.

The results of the experiments are given in Table 1. The experiments show that the fume of frankincense impregnated with 10 and 15 droplets of Ambush killed all mosquitoes within one hour.

It seems that this method can be used for mosquito control in closed rooms, because the fumigant is only very little toxic to man.

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<th>Ambush ml</th>
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Table 1. Effect of Ambush fume on *Culex pipiens* female mosquitoes.