

Ecology and distribution of mites

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All spiders are predators as well as representatives of most other arachnid groups, in northern Europe Opilionida and Pseudoscorpionida. The only exception consists of mites, a group of minute arachnids with more than 30 000 described species, but the real number of mite species most probably is more than 100 000. Mites include herbivores, fungivores, algivores, saprophages, coprophages, carnivores, and several types of parasitic species, and all these trophic levels have been reached through parallel adaptation by several groups of mites.

The traditional order »Acarina» actually is at least diphyletic, and the detailed discussion about mite groups has been presented here in terms of modern acarology. The eight main groups are listed as suborders of three orders. Seven of these groups include species with confirmed significance in medical acarology, or at least bear essential economic significance in the modern human society.

The practical role of any arthropod groups in allergology is mainly dependent on their occurrence in circumstances, in which they can become in contact with sensitive human individuals. Naturally also the proteins of different species may be highly variable in regard to their allergenic functions. As far as very little empirical information is actually available from different mite groups in this respect, a short survey of mites known to occur in large quantities in human dwellings or elsewhere with exceptional probabilities to close contact with man, might be more useful than simple listing of confirmed cases of allergenic mites.

The mite groups are discussed here as systematic units, not as ecological groups.

OPILOACARIDA — a primitive order with less than 20 species, mainly in tropical region, two species in southern and south-eastern Europe. Only in natural habitats, no medical importance.

ANACTINOTRICHIDA, a large, geographically and ecologically widespread order. Characterized by absence of actinochitin in the setae of body and appendages. One pair of tracheal stigmata on the laterally on the body. Mostly carnivorous and parasitic, exceptionally adapted to other types of food. Three suborders.

— **Holothyridina**, very large, semi-globular, freeliving predatory mites living in restricted areas in the tropics. Only a few species known, but at least one, *Holothyrus coccinella* from Mauritius has been reported to secrete irritating chemicals. Chicken swallowing these mites have been reported to die. Obviously a group of mites that should be investigated for its allergenic functions.

— **Ixodina** or ticks. Some hundreds of species all over the world, all blood sucking ectoparasites of mammals and birds. Many species are known to be main arthropod vectors of arboviruses and pathogenic bacteria. As such they constitute the most important group of mites from the viewpoint of medicinal and veterinary research. Concerning the north European species, *Ixodes ricinus* is the wellknown vector of the Kumlinge sickness, *Ixodes trianguliceps* as the more or less fatal vector of other viral diseases in USSR (several types of

meningitis, including also the one caused by the Uukuniemi virus, and thus possibly a severe threat for people also in south-eastern Carelia).

Allergic reactions caused by ticks are not separately well investigated, as there are always several aspects of irritation (local reactions due to secretions from the mouth parts, local inflammation due to random bacteria, virus infections, etc.). As people repeatedly become in contact with ticks, this group should be investigated also in regard to direct allergic reactions.

— *Gamasina* or predatory mites. Thousands of species from 0.2 mm to ca. 3 mm in all types of environments, including also stored food products, and all kinds of ecosystems, in which large numbers of small arthropods and nematodes, or simply organic debris are available. In all these habitats these predatory Gamasina mainly consume other abundant species of mites (acarid, etc.), but their presence in huge amounts may cause allergic reactions to individuals sensitive to them. Especially rich in gamasine mites are: old hay, e.g., bottom of haybarns, compost and thus also garden mould with compost mould, heaps of Phragmites or kelp along the shoreline of sea and lakes, and often also tussocks of grass in cultivated fields.

Several families of gamasine mites are completely adapted to ectoparasites of mammals and birds, some also of large beetles and other arthropods. Practically all specimens of mammals and birds are infested by some mites, at least, and in many cases, thousands of specimens may be found on a single specimen of fox, mink, or hen. Handling of living or dead specimens of any mammals or birds thus constitutes a risk, not only because of the allergic reactions to the mammal hairs or bird feathers, but also by the mites. Nests of birds and mammals are crowded with species of most groups of mites, in addition to ectoparasitic species also by numerous specialists of nests or nidicoles. In Turku, the most common ectoparasite in human dwellings is

Dermanyssus gallinae. It is abundant in most birds nest, including also the pigeon or dove houses (*Columba livia domestica*), from where it uses to penetrate into rooms, including also the hospitals.

ANACTINOTRICHIDA, another very large and widespread order with highest variation in size, shape, degree of sclerotization, habits, and type of food. Characterized by presence of actinochitin or actinopilin in the setae, presence of a welldefined transverse dorsal furrow of the body, location of tracheal stigmata in the anterior part of the body, when present, etc. Four suborders.

— *Actinedida*. Thousands of species in terrestrial environment as well as in inland and brackish waters. This suborder includes both the smallest mites (gall mites, Eriophyidae 0.1–0.4 mm) and the largest mites (some tropical velvet mites exceed 2 cm). The majority of actinedid group consist of soft-bodied, red, orange, yellow, greenish, or white mites, but a few group may be strongly sclerotized with nice ornamentation.

The larval forms of family Trombiculidae, widely known as chigger mites, have essential medical importance in world scale, although in most parts of North Europe they don't occur in large numbers. Some species simply bite and secrete irritating fluids, but the most harmful American, Mediterranean, and African species penetrate to small cavities of skin and may cause both strong allergic reactions and constant pain and itching for weeks. The most common species in Central Europe is *Trombicula autumnalis*, a species also found in North European countries.

Representatives of the family Tetranychidae are known as serious pests of fruit trees, vegetables, strawberries, etc. As they may occur in large quantities on any plants, also on indoor plants, sensitive persons may get allergic reactions caused by them.

Species of Cheyletidae and Stigmaeidae occur in very large numbers anywhere together with Acaridids and Gamasids.

— *Acaridida*. This group of mostly minute, whitish mites with long hairs and no tracheae is by far the most abundant indoors. Several quantitative studies in Poland, England, and other countries show that all kinds of stored food is regularly infested by *Glycyphagus domesticus*, *Tyrophagus putrescentiae*, *Acarus siro*, *Carpoglyphus lactis*, and various less common Acaridid mites. These species are found also in practically all possible types of habitats within human dwellings in variable number. They are all more or less cosmopolitan, and also occur in low numbers in various natural habitats. Most probably an essential part of allergic reactions counted for the house dust mite are partly or more or less completely due to other very common acaridid species of dwellings.

The house-dust mite, *Dermatophagoides pteronyssinus* and probably other species of *Dermatophagoides* has been an object for intensive allergological research during the last twenty years, and it has become an universal guilty for mite allergy. As this species is able to survive even in exceptionally dry environment in the house dust (within mattresses of all kind, etc), it certainly is the most important mite allergen in the best hygienic conditions, but most samples from house dust actually include also essential amounts of remnants of the other common acaridid species, and there are no reasons to believe that only *Dermatophagoides* spp. would cause allergic reactions. However, much detailed research on the other common species is necessary.

The itch mite, *Sarcoptes scabiei*, is the human specialist of the universal parasitic mite family *Sarcoptidae*. Its medical importance is generally known and need not be repeated here. However, it must be stressed that hundreds of acaridid species of various families (*Listrophoridae*, *Analagidae*, etc., etc.) are regular ecto- or even entoparasites of various mammals, birds, and reptiles. Many of the species are specialized to a certain part of the feather or hair covering of the host animal.

— *Tarsonemida* constitute another herbivorous group of mites, economically very important as serious pests of various cultivated plants. Some species of *Pygmephoridae* are saprophagous of fungivorous and live in huge numbers in places rich with organic debris, e.g., in composts.

— *Oribatida* or moss mites constitute the most abundant group of microarthropods in soil of natural habitats, forests, bogs, natural meadows, etc. They seldom occur in large quantities in or around human dwellings and therefore most probably don't constitute generally a risk for allergic reactions. Most of the moss mites are strongly sclerotized and they feed on fungal hyphae. Their role in the decomposition of organic debris in forest soils is quite important. *Oribatida* is the best known group of North European mites with almost 300 known species.

Summarizing the facts, it is evident that any group of mites may cause allergic reactions, when sufficient numbers of them become in contact with people. In practice, the most problematic species are those permanently living in close contact with the people in their sleeping or dwelling rooms. However, some other sources of rich mite populations are essential in farming of poultry and fur animals, in various contexts also in other agricultural practices, handling of stored food, especially meal and fruits. The mite populations of some natural habitats, too, may be exceptionally abundant, especially nests of mammals and birds, as well as piles of reed or kelp.

Much work is necessary for clarification of details of these risks.

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