

OCCURRENCE AND PROPERTIES OF THE HOUSE-DUST MITE *DERMATOPHAGOIDES PTERONYSSINUS*

F. Th. M. Spijksma, Leiden, Holland

According to Dr. Voorhorst the mite *Dermatophagoides pteronyssinus* produces an allergen indistinguishable from the house-dust allergen. Before going into details about this house-dust mite, I would like to give a short information about mites in general.

The Acari, or mites and ticks, form an important division of the great Arthropodan class Arachnida. The Arachnida also include such animals as scorpions, spiders and harvestmen. The Acari are about as closely related to insects as birds to mammals, and they are easily distinguished from them by the possession of eight, instead of six, legs in the adult stage.

The distribution of the Acari is world-wide and they rival the insects in the extent to which they have colonized both terrestrial and aquatic habitats. They live in salt and fresh water, and the habitats of freelifing terrestrial forms extend from the lowest intertidal zones to the tops of mountains.

Unlike other Arachnida, many mites are found living in intimate association with other animals. These associations range from commensalism to true parasitism, and both vertebrate and invertebrate animals may act as hosts.

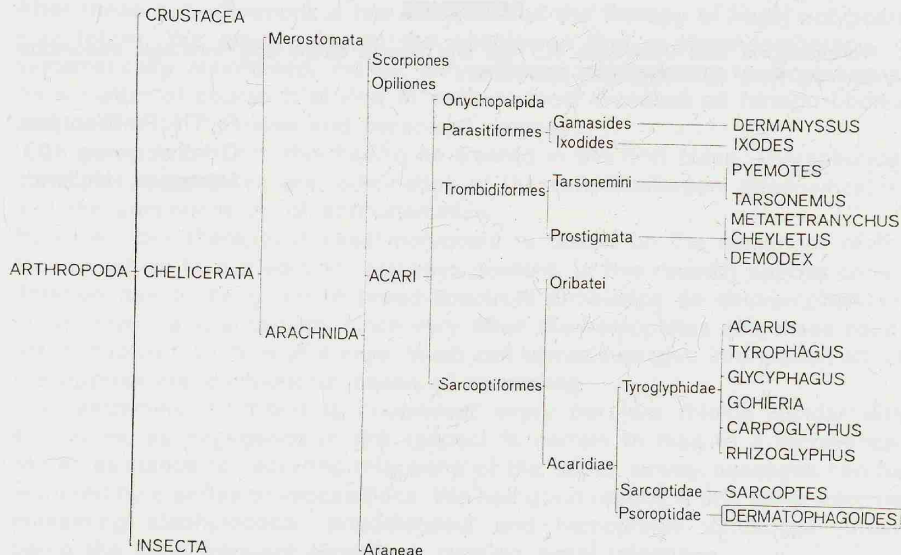


Figure 1. Classification of some of the best known Acari (mites and ticks) in the phylum Arthropoda (jointed-legged animals).

The primitive life-cycle may include an egg, a six-legged larva, a protonymph, deutonymph, tritonymph, and adult males and females. So many families deviate from this scheme, however, that it is the exception rather than the rule.

Many of the well-know Acari (fig. 1) are of considerable economic significance. The Fruit Tree Red Spider Mite is the most important pest of orchard fruit. Other forms are of medical and veterinary importance. The Chicken Mite (**Dermanyssus**) occurs on birds but may also attack man. Mites of the genus **Demodex** burrow into hair follicles. The scabies or itch mite (**Sarcoptes**) infests a wide variety of mammals. Members of the family Psoroptidae are skin parasites of mammals. The Ticks (Ixodides) are parasites of terrestrial vertebrates feeding on the blood and tissue fluids of the host.

The mites most commonly associated with stored food products are members of the family Tyroglyphidae, and under suitable conditions they multiply rapidly to form extremely dense populations.

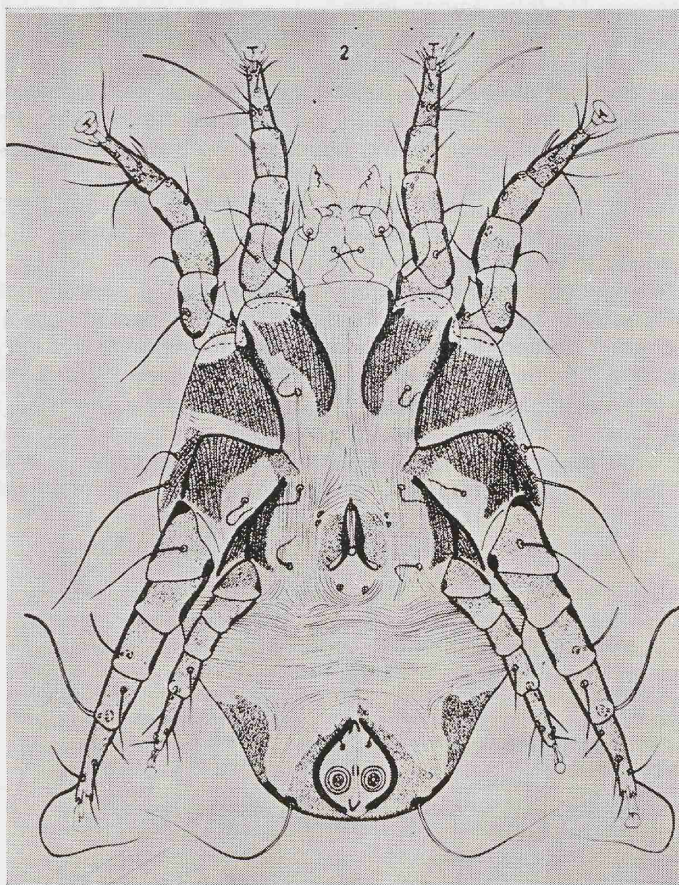


Figure 2. *Dermatophagoides pteronyssinus* (Trouessart, 1897). Ventral view of male. After Fain, 1966.

Several species of this family can give rise to dermatitis in people handling infested material. In some occasions **Glycyphagus domesticus** and **Acarus siro** have been associated with symptoms of asthma, as is also the case for **Pyemotes ventricosus**.

In our search for the biological source of the house-dust allergen it seemed reasonable to assume that a mite could be responsible for the production of it. To prove or disprove this assumption required first of all investigations of the mite fauna of house dust. These investigations were carried out in the years from 1962 to 1965.

A poorly known species of mite, **Dermatophagoides pteronyssinus** (fig. 2) was found occurring in house dust in considerable, although varying numbers constituting 70—90 per cent of the total number of mites found. In laboratory and clinical experiments this mite appeared to be the source of the house-dust allergen.

It is most astonishing that, although the house-dust allergen has been known since 1922, its producer was not found until 40 years later. There are several possible reasons for this, among them:

1. Medical research workers were not acquainted with any of the isolation techniques used in biological studies.
2. Biologists had no interest in a habitat as disturbed and inconstant under the influence of human living as is the case for house dust. Productive cooperation between medical and biological workers has grown up only in recent years.
3. Properties of the mite itself, namely its smallness and the fact that the population never reaches dense proportions but lives spread all over the house, cause it to escape notice.

For the determination of the mite fauna in house dust, a special method has been developed (fig. 3). From a house-dust sample, collected with a vacuum cleaner, a 5 gram portion is sieved in dry state, to separate out very coarse and fine material. The middle sieve fraction (sizes between 2.4 and 0.0075 mm) is boiled in lactic acid (specific gravity ± 1.2), to make the mites swell, and then centrifuged. Most of the dust material sinks, and the mites float. The supernatant fluid with the mites is then decanted on a filter paper in a Buechner funnel and the filter paper is examined for the presence of mites with aid of

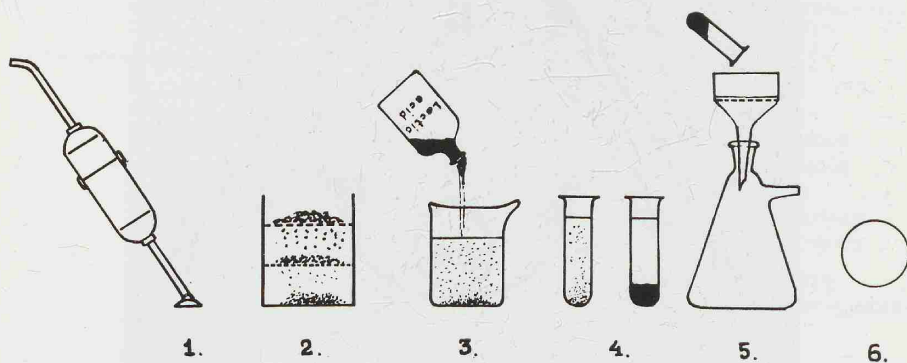


Figure 3. Drawing representing the steps of the isolation method.

a stereoscopic microscope. The mites are counted and classified under the common microscope.

This method was used to study hundreds of house-dust samples. The results of these investigations show that all house dust throughout the world contains the mite **Dermatophagoides pteronyssinus**, the number varying from 1 up to 500 per gram dust for The Netherlands, Belgium, Germany, England, Switzerland, Iran, Pakistan, Australia, Brasil, Suriname. Samples from the asthma centre in Davos appeared to be the poorest, with about 1 mite per gram of dust.

Dust samples were collected in three houses in Leiden during an entire year. The mite population was found to increase to a maximum in the months of August, September, and October, and to decrease to a minimum in the months of February, March, and April (fig. 4). It also became clear that there are conspicuous differences in the numbers of mites in the dust from one house to another, in which the degree of dampness of a house is thought to play an important role. Therefore a comparative study of the mite fauna in house-dust samples from a number of houses of dissimilar dampness was required.

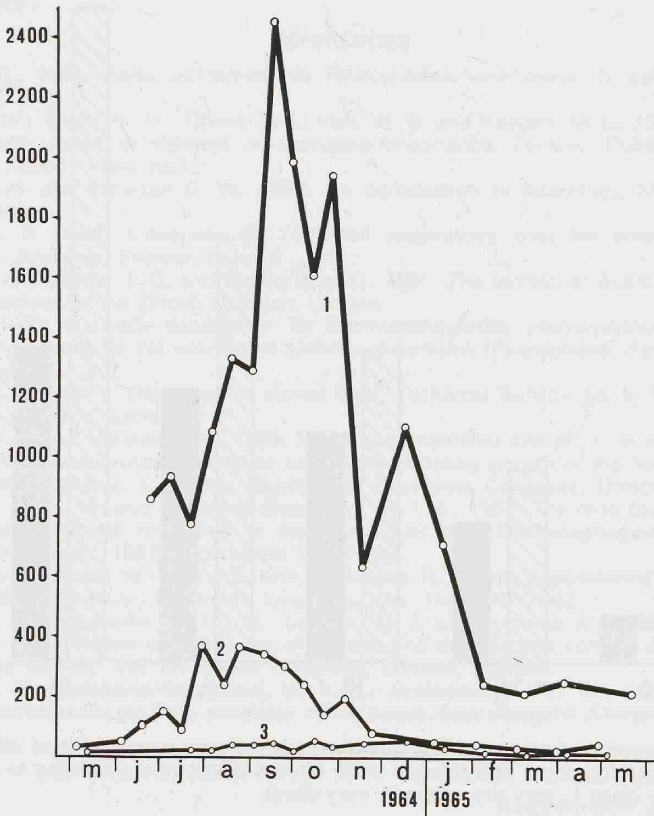


Figure 4. Numbers of *Dermatophagoides pteronyssinus* per 5 gram of house-dust from three houses in Leiden, May 1964—May 1965.

In 150 houses distributed over 5 classes of different degrees of dampness from very dry tot very damp, dust was collected, and the number of mites in each dust sample was determined (fig. 5). It is very clear that there is a consistent rise in the number of mites from class I (very dry) to class V (very damp). The damper the house the higher the number of mites.

Cultivation of mites to be used for test-extracts and for studies on the ecology and life-cycle is carried out in a climate chamber to insure control of the temperature and relative humidity. Some preliminary results of these investigations are the following.

Mating, which takes place two or three times during adult life, is followed by the production by the female of 20 to 40 eggs which hatch after about 6 days. The three immature stages, viz. larva, protonymph, and tritonymph (no deutonymph existing) take about 6 days each, the total immature life lasting about 25 days.

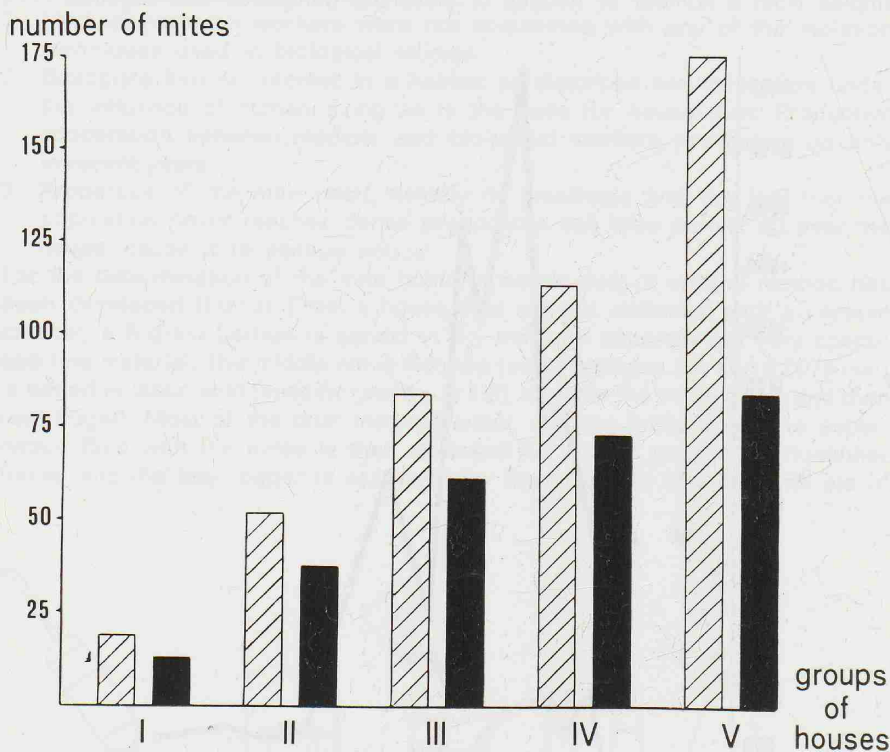


Figure 5. Average numbers of *Dermatophagoides pteronyssinus* and of all mites (including *D. pteronyssinus*) in 5 classes of 30 houses distributed according to the degree of dampness; class I: very dry; class V: very damp.

▨ : all mites

■ : *D. pteronyssinus*

The adults reach ages of 2 to 3½ months. These figures pertain to mites growing under optimal conditions: a temperature of 25°C and 80 per cent relative humidity.

With the finding of this house-dust mite we are at the beginning of a series of important and interesting studies from allergological as well as from biological point of view.

RÉSUMÉ

Pendant des recherches sur le source de l'allergène de poussière de maison il paraissait nécessaire d'étudier les acariens qui se trouvent à l'intérieur des maisons dans la poussière. Pour cette étude nous avons développé une méthode pour isoler le matériel désiré. Plusieurs échantillons de poussière ont été étudiés et le résultat le plus important est que l'espèce **Dermatophagoides pteronyssinus** est de beaucoup dominant, pas seulement en Hollande, mais aussi dans les échantillons d'autres pays et même d'autres continents. A cause de son importance médicale, par la production de l'allergène de poussière de maison, l'auteur propose un nom vulgaire: «l'acarien de poussière de maison».

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F. Th. M. Spieksma,
Academisch Ziekenhuis,
Allergy dept.
Leiden, Holland.