Module 10

Scrub Typhus – Vectors

At the end of the module, the participant will be able to understand:

- Disease Transmission
- Scrub Typhus Vectors
- Biology
- Life Cycle
- Vector Surveillance
- Entomological Indicators
- Adult Vector Control
- Larval Vector Control

Scrub typhus, also known as bush typhus, is a disease caused by a bacteria called *Orientia tsutsugamushi*. Scrub typhus is spread to people through bites of infected chiggers (larval mites).

Global Scenario

Geographic distribution of the disease occurs within an area of about 13 million km2 including- Afghanistan and Pakistan to the west; Russia to the north; Korea and Japan to the northeast; Indonesia, Papua New Guinea, and northern Australia to the south; and some smaller islands in the western Pacific. Recently, rickettsiosis has been an emerging disease along the Thai-Myanmar border. There are reports of the emergence of scrub typhus in the Maldive Islands and Micronesia.

Indian Scenario

In India, scrub typhus has been reported from Rajasthan, Jammu & Kashmir, Vellore, Sikkim, Darjeeling, Nagaland & Manipur, Mizoram, Tamil Nadu, Maharashtra, Kerala, Himachal Pradesh, Meghalaya.

Incubation Period: 1–3 weeks.

Clinical Picture

A Papule develops at the site of inoculation. The papule ulcerates and eventually heals with the development of a black eschar. General symptoms are sudden fever (>40 [104]) with relative bradycardia, severe headache, apathy, myalgia, generalised lymphadenopathy, photophobia and a dry cough. Approximately one week later, a spotted and then maculopapular rash appears first on the trunk and then on the extremities and blenches within a few days. Complications are interstitial pneumonia (30 to 65% of cases), meningoencephalitis and myocarditis. Symptoms generally disappear after two weeks even without treatment. In severe cases with pneumonia and myocarditis, the mortality rate may reach 30%.

Mites

Mites are minute animals. Most species are barely visible to the naked eye. They are found virtually worldwide. There are over 29,000 species of mites, but only a few of them attack humans. They are medically important because certain species transmit scrub typhus (southwest Pacific and the Orient). In attacking a person, various species of mites cause conditions ranging from mild irritation to severe forms of dermatitis.

The Human Itch Mite, *Sarcoptes scabiei*

This mite causes a disease of the skin known as scabies or the "seven-year itch." The Iife cycle consists of egg, larva, nymph, and adult, with the female undergoing two nymphal stages. The mature female burrows into a person's skin, particularly at the hands and wrists, and other areas of the body where the skin creases or folds. As she burrows, she deposits eggs at a rate of about two per day. Egg laying continues for about 4 to 5 weeks, and a single female lays an average of 40 to 50 eggs. Eggs generally hatch in 3 to 4 days, and the larvae migrate from the maternal burrow to form new burrows nearby. After about 3 days, larvae moult in the burrows to become nymphs. Total development time for females averages 14 to 17 days. After reaching maturity, mating occurs either in the burrows of virgin females or on the surface of the skin after which the fertilised female repeats the process of burrowing and egg laying.

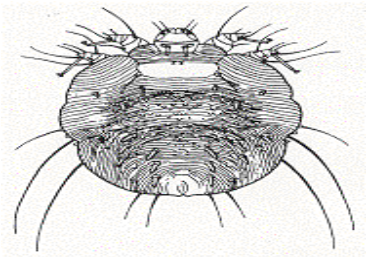

Figure 32.Adult Human Itch Mite

Chiggers (Trombiculid Mites)

This is the common chigger or "red bug." Its bite causes an intense itching and infection can result from scratching the bites. In the Asiatic-Pacific area, certain species of this mite are vectors of scrub typhus. The Iife cycle of the trombiculid mite is very complex. Females lay eggs singly in the soil. In about 2 weeks, the six-legged larva hatches and crawls into nearby vegetation or along the ground in search of a host. Many species feed on a wide variety of vertebrate hosts including reptiles, rodents, large mammals, and humans. The larva feeds at the surface of the host skin, usually requiring 1 to 3 or more days for engorgement. Then the fully fed larva drops off the host, burrows into the soil, and moults into an eight-legged nymph. The nymph and later the adult feed on immature stages of other arthropods, frequently the eggs of grasshoppers. Chigger larvae, the only medically important stage, do not disperse far from the point they hatched in their search for a host. Thus, they tend to be much clumped in distribution, forming what are referred to as "chigger islands," in areas of tall grass, weeds, and brushy vegetation.

Mites infect men, horses, goats, sheep, cattle, dogs etc. They are very tiny, about 0.1 mm, oval in shape and pale to greyish in colour. Adults possess 8 stubby legs while larvae are 6-legged. Eyes are absent. Mouth parts are piercing and sucking type. Some species burrow in skin and make galleries or wounds which cause intense itching. Later, fluid-filled pimples are formed which are covered with scabs. These contain abundant mites and are the chief sources of infection by contact. The host may lose hair due to infection.

Mites are very small, ranging from 0.5 to 2.0 mm in length; there are thousands of species, of which many live on animals. Like ticks, they have eight legs and a body with little or no segmentation. In most species, there are egg, larval, nymphal and adult stages. The immature stages are similar to the adults but smaller.

Distribution

Mites have a very patchy distribution over small areas because of their special requirements. The nymphs and adults need certain soil conditions for their survival and development while the larvae require host animals, such as wild rats, other small rodents and birds. Suitable habitats are found in grassy fields, shrubby areas, forests, abandoned rice fields and cleared forests. The mites are also found in parks, gardens, lawns and moist areas alongside lakes and streams.

The larvae wait on leaves or dry grass stems until an animal or human passes by. People usually become infested after walking or standing in mite-infested areas. Bamboo bushes are favoured by the mites in the tropics and subtropics.

Mites

Mites can be surveyed using the “black plate” method. The “black plates” (~12-inch square) dark-coloured construction paper, paper plates, rigid plastic, or similar objects) are placed on the ground in mite habitats such as grassy or brushy areas with high rodent populations. The mites are primarily rodent parasites and run around in these areas when not feeding on the rodents. Plates should be placed directly on the ground or ground cover. The plates have no particular attraction for the mites, but they crawl randomly on the plates and can be seen against the dark surface.

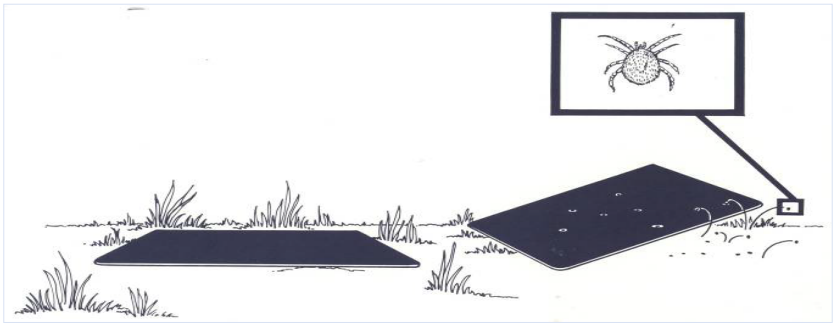

Figure 33.An illustration of the black plate method of sampling mites

The plates should be deployed for no more than one hour. Upon retrieval, examine both sides of the plates for small (smaller than a pin head), rapidly moving white, yellow, orange or red spots.

A hand lens or magnifying glass is useful for seeing the mites. Observed mites can then be removed with a small camel-hair (or similar) brush and placed in alcohol for subsequent identification. Mites may be removed from an inflexible surface by wetting a small paint brush in alcohol, touching it to the mite, and then dipping the brush with the adhered mite into a vial of alcohol. The mite will float free in the alcohol. If construction paper or other flexible material is used, roll in a cone, place the small end of the cone over the vial and tap sharply. Mites will fall into the vial.

Another efficient method of sampling chiggers is to trap their rodent hosts and examine them for the presence of these mites. Chiggers are usually yellowish or orange and concentrated in the ears or in the groin area of their hosts.

The density of tick chigger on a host species is evaluated in terms of tick index, which represents the average number of ticks per host individual examined and may be calculated by the following formula.

$$\text{Chigger Index} = \frac{\text{Total Number of chiggers collected}}{\text{Total number of hosts examined}}$$

The chigger index has relevance to the presence of vector trombiculid mite i.e. *Leptotrombidium delicense* gp.

Mites Control

One or two treatments of forest floor with the insecticide lindane, which is considered highly effective in killing ticks.

Control measures consist of spraying **malathion dust** within a radius of approximately 100 meters around the monkey death spot. Spraying should also be done along the forest tracks used by the villagers. if the human dwelling is adjacent to the infested forest spraying should be done in the vicinity of the dwelling also. Wherever possible people should be advised to use tick repellents before going out in the forest. Long-term measures include control of *Haemaphysalis* ticks on cattle populations in the area. This can be achieved by spraying animals with bhc. Ticks control on cattle can be undertaken by dipping the animals in an acaricidal death.