What is Non-insect animal pest

A group of animals other than insects, which cause considerable yield losses to agricultural crops and are commonly called as non-insect pests. It includes mammals (such as rodents, birds) and molluscs, mites. crustacea, myriapods and etc…

General characters of Myriapods - Centipedes and millipedes

Centipedes and millipedes are **myriapods** (Ancient Greek: *murias* = ten thousand, *pod* = foot)

1- Terrestrial animals, have a segmented body,
2- A pair of antennae and breathing holes called spiracles.
3- Centipedes and millipedes are myriapods not insects.
4- Myriapods and insects belong to the largest group of animals on earth, the arthropods.
5- Arthropods are animals with hard exoskeleton and jointed limbs.
6- Centipedes and millipedes are not insects as they have more than six legs, but the names centipede meaning 100 legs and millipede meaning 1,000 legs is a bit misleading.
7- The number of pairs of legs in centipedes is always an odd number and the known range is between 15 and 191 pairs.
8- The number of pairs of legs in millipedes arranged around 400-700

Classification
Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Myriapoda
Class:1.Diplopoda
2.Chilopoda

Millipedes

Arthropods that were not Crustacea, Arachnida or Insecta, but they are now treated as a separate class. A group of arthropods that are characterised by having two pairs of jointed legs on most body segments; they are known scientifically as the class Diplopoda, the name derived from this feature. Each double-legged segment is a result of two single segments fused together.

Most millipedes have very elongated cylindrical or flattened bodies with more than 20 segments, while pill millipedes are shorter and can roll into a ball. Although the name "millipede" derives from the Latin for "thousand feet", no species was known to have 1,000

There are approximately 12,000 named species classified into 16 orders and around 140 families, making Diplopoda the largest class of myriapods, an arthropod group which also includes centipedes and other multi-legged creatures.

The reproductive organs have their apertures on the ventral side of the fore part of the body near the head, whereas in the Chilopoda these open on the last abdominal somite as they do in insects. Millipedes have a distinct head bearing a pair of short, unbranched antennae, at least two pairs of jaws and usually eyes. Spiracles leading into tubular tracheae open above the coxae of the legs and the dorsal plates of the segments are greatly developed as compared with the ventral.

To Millipedes and to the other myriapods, humidity is the most important factor of the environment, these animals are not able to find their way directly to damp places instead, they are merely repelled by drought. There are a number of cases on record of millipedes, sometimes accompanied by centipedes, and woodlice migrating in vast armies. conditions, followed by drought and possibly accompanied by abnormal physiological conditions of reproduction.

An explanation of the problem of how dispersal can take place has been suggested as a result of recent work in which it has been shown that millipedes are markedly nocturnal and show a diurnal cycle of rhythmic activity. This is primarily a response to light and darkness, but is also correlated with the stimulus of falling temperature in the evening.

Locomotory activity is stimulated by increases or decreases of temperature, and it is probable that in tropical forms temperature fluctuations are of primary importance in the initiation of diurnal rhythms. Perhaps in their natural gloomy habitat in tropical forests, light is an insignificant environmental factor. Thus it is at night that millipedes, like other myriapods and woodlice, are able to disperse themselves and overcome the restrictions inherent in the physiology of their integuments.

Suggested that millipedes are distributed at various depths in the soil according to their water-relations and body forms. Nematophora and Polydesmoidea which are most susceptible to desiccation and wetting tend to inhabit thick leaf-litter which is proof against flood and drought, while many of the Iulidae and Blaniulidae penetrate deeply into the soil.

Food and feeding habits

Millipedes are vegetarian and feed on a wide range of plant substances, although on account of their weak mouthparts many species tend to prefer soft or decomposing tissues.

They have also been recorded as eating dead worms, molluscs, insects and vertebrates. As already mentioned, a number of species are well-known agricultural and glasshouse pests. of these, without doubt the worst offender in temperate climates is the 'spotted snake millipede, *Blaniulus guttulatus*, which has long been regarded as a pest of sugar beet, potatoes, mangolds, oats, wheat, strawberries and other agricultural crops and fruit.

It has been shown that outbreaks of this species often tend to be stimulated by a dry spell following a period suitable to the reproduction of the species, when the soil is damp, undisturbed and rich in humus. They usually occur on medium or heavy soil and are inhibited or destroyed by extreme drought. Breeding is probably inhibited by moderately dry weather. The species may be beneficial in aiding the breakdown of humus, but is a potential danger to growing crops and may even attack potatoes and mangolds if wireworms and other agricultural pests are present to make an initial entry.

Enemies

Millipedes, on occasion, are eaten by a wide range of predatory animals. These include spiders, some species of which will feed reluctantly on the common black *Tachypodoiulus nige*r, *Oxidus gracilis* and other small forms; amphibians, reptiles, mammals and birds.

Millipedes comprise a proportion of the food of birds as millipedes average eat up to 11 - 71 % of this bird's yearly diet. however, millipedes are condensed of their tough integument and by the irritant exudates secreted by the repugnatorial glands. In most cases the secretion is exuded fairly slowly from the pores of the glands but in some of the larger tropical forms it can be discharged to a considerable distance in the form of a fine jet or spray.

The chief compounds of physiological interest in the secretions are hydrocyanic acid, iodine and quinine. Small amounts of chlorine which give the substance its characteristic odour have been determined experimentally. The fluid of the large tropical species has a strong burning action and causes blackening on contact with the human skin. Later the affected part peels, leaving a wound which heals only very slowly. It is dangerous to the eyes and is responsible for numerous cases of blindness among chickens.

The animal curl up into a ball when disturbed and members of the other orders form a more or less compact spiral. These defensive reactions also are effective in reducing water-loss by evaporation when the millipedes are in dry surroundings.

An interesting case of aggressive parasitism of a millipede by a fly of the family Phoridae which battled with a huge black lulus sp. for several hours has been recorded, and larvae of another species of Phoridae, Megaselia juli, have been found in a number of species of lulus and Spirobolus. Planidium larvae of parasitic Hymenoptera have been found on Gymnostreptus parasitarius.

Tachypodoiulus niger

Most millipedes are slow-moving eating decaying leaves and other dead plant matter. Some eat fungi or drink plant fluids, and a small minority are predatory. Millipedes can be unwanted especially in greenhouses where they can cause severe damage to emergent seedlings.

Most millipedes defend themselves with a

1-variety of chemicals secreted from pores along the body, although the tiny bristle millipedes are covered with tufts of detachable bristles.

2- Its primary defence mechanism is to curl into a tight coil, thereby protecting its legs and other vital delicate areas on the body behind a hard exoskeleton.

Centipedes

In these animals, the body is divided into a variable number of somites, each of which is provided with a pair of limbs used for locomotion. The head bears a pair of multi-segmented antennae and three pairs of mouth-parts. The first of these post-oral appendages

are toothed mandibles, the second are foliaceous maxillae, while the third are leg-like palps.

Behind the head is the first segment of the body, known as the basilar segment. Its appendages are the maxillipedes or taxocognaths. These are poison claws with which the prey is captured and killed. At the tips of their strong, piercing terminal segments are the orifices of the ducts of the paired venom-glands. Where present, the eyes are in the form of clusters of ocelli. The number of legs varies from fifteen to over a hundred pairs, but however many there may be, the number is always odd.

Centipedes always live in damp, dark and obscure places under stones, fallen leaves, logs, under bark and in crevices of the soil, from which, like woodlice and millipedes, they issue forth at night. the sense organs of centipedes take the form of hairs connected with nerve fibres; the animals find their prey by means of these hairs which are sensitive to touch. They are also very sensitive to moisture and contact stimuli.

Food and feeding habits

Centipedes are primarily carnivorous but certain of the Geophilomorpha will on occasion feed upon plant tissues and may even be positively injurious to crops if present in sufficient numbers. Scolopendras have been known to kill and eat small birds especially the voracious centipede (*S. gigantea*) and even small snakes

Under laboratory conditions *S. heros* feeds freely upon the agriculturally noxious insects provided: it prefers to remain underground on warm days but is restless on the surface in cloudy and wet weather S. *viridis* refuses woodlice and earthworms but is partial to flies; the prey, of which the hard parts are rejected, is held firmly to the mouth by the poison claws whilst the mandibles and maxillae tear it to pieces. large *S. subspinipes* feeding on a slug.

Enemies

Centipedes are carnivorous and will eat one another if an opportunity presents itself. *Lithobius forficatus* must not be overcrowded in captivity, or cannibalism will result, particularly if one of the animals is smaller than the others or has been injured.

Centipedes tend to escape and their poison also protects them from enemies and might be eaten by scorpion, *Scolopendra cingulata* is said to cause painful oedema and real discomfort to humans, but *S. heros* and *S. viridis* produce, at most, only temporary sharp pain. The large *S. subspinipes* of Brazil produces intense pain, blistering, swelling, local inflammation, bubos and subcutaneous haemorrhage and this species may reach a length of 25 cm. two species of Tachinid flies. The average parasitism was only 5-7 %, and almost half the parasitised centipedes contained more than one larva.

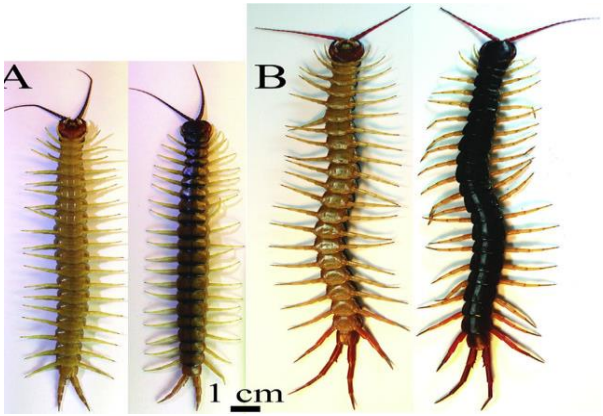
Examples

An Australian native, the House Centipede, scientifically known as ***Allothereua maculata,*** is the most common centipede throughout southern Australia.

Allothereua maculata

The largest centipede in the world, *Scolopendra gigantea*, is a 30 centimetre centipede from South America that is able to eat mice and lizards.

Scolopendra gigantea,



Scolopendra polymorpha

This specie was found in America and meditation region of Asia. Their bodies generally reach 4–7 inch (10–18 cm) in length. Coloration is variable, hence the species name *polymorpha* which means "many forms", and alternative common names like "multicolored centipede". The body segments have one dark lateral stripe, so they are also known as the tiger centipede. Generally, this species has a darker brown-, red-, or orange-

colored head and lighter brown, tan, or orange body segments with yellow legs. However, some populations, such as those in Southern California, may be entirely light blue with indigo stripes, with turquoise legs. Its antennae have seven or more smooth segments.

Sub phylum: Crustacea

Classification and distribution

Woodlice are included in the sub-order Oniscoidea of the crustacean order Isopoda. The majority are between one and two centimetres in length, and the small size.

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Crustacea

Class: Malacostraca

Order: Isopoda

Suborder: Oniscidea

Oniscus asellus is the commonest of all woodlice and is found almost everywhere that damp conditions prevail, particularly beneath half-buried stones and bark. It seems to prefer rather more moist situations than *Porcellio scaber* and may often be found with the latter in the same tree, but usually nearer the ground where the wood is old and rotting.

Porcellio scaber is also very common, particularly beneath the dry loose bark of vertical trunks of living trees. It sometimes inhabits damp houses. Humidity is an environmental factor of prime importance, both to woodlice and to myriapods, as they all lack a waterproof integument. Woodlice are very sensitive to humidity gradients and aggregate in areas of high humidity.

The mechanism by which this occurs is two-fold: firstly, the animals show a decrease in activity and speed in moist air and secondly, they change direction more frequently in damp places so that once they have arrived in a moist situation they tend to remain there. Humidity is an environmental factor of prime importance, both to woodlice and to myriapods, as they all lack a waterproof integument.

This reaction to the relative humidity of the air is also combined with avoidance of light. One of the largest and most common of woodlice is the garden slater *Oniscus asellus* which reaches a length of 15 mm and about half that width. Woodlice are also able to extract water from their food. In this way they can make up part of the water lost by evaporation. the day they normally collect at the moist end of a humidity gradient and avoid the light; it is at night that dispersal to new environments mostly takes place. Changes in behaviour between day and night have recently been demonstrated in *Oniscus asellus*.

Humidity is an environmental factor of prime importance, both to woodlice and to myriapods, as they all lack a waterproof integument. The daily life of woodlice is regulated by the interaction of their diurnal rhythms or 'biological clocks', humidity and light responses. Seasonal changes also occur in the intensity of their humidity responses, which show a marked rise in spring when the rains bring them out of hibernation.

Food and feeding habits

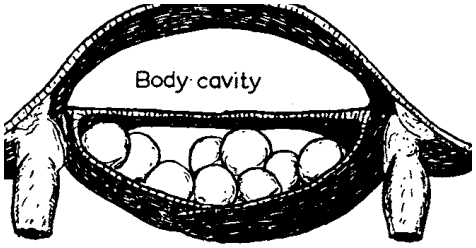
Woodlice are omnivorous and no doubt useful as scavengers. Some species are of economic importance because they do not confine their attention to dead and decaying matter but sometimes attack seedlings, ripe fruit such as plums, peaches or melons, and mushrooms—indeed they will eat anything that is soft and juicy though they do more mischief by disfiguring than by consuming any large quantities. They are sometimes difficult to dislodge from hot houses as they find shelter in every little crevice. *Armadillidium vulgare* requires chalk in its diet, and this may be correlated with its exceptionally thickly calcified integument.

Enemies

Woodlice are eaten by birds, reptiles, amphibia, and many other insectivorous animals including spiders, harvest-spiders, mites and centipedes. Several number of spider species will destroy a woodlouse .

Armadillidium vulgare rolls into a ball directly it is attacked, and its hard, thick integument saves it from injury, even from large species such as *Tegenaria atrica* and *Araneus diadematus*. *Oniscus* spp secure some protection from the chitin with which their dorsal surface is covered so long as they remain dorsal surface uppermost.

At least five kinds of tegumental glands found in woodlouse their function is probably to act as a deterrent to enemies, principally are thus analogous to the repugnatorial glands of millipedes and can harvest-spiders and many insects. Woodlice do not seem to be attacked to any great extent by parasitoidal insects as the average parasitism of *O. asellus* was only3.1%. found that only weather had any profound effect on the mortality of *A. vulgare* in California. During the rainy season the animals live in or near the soil surface but during drought they seek refuge from desiccation by descending deeply into soil fissures.



The period between the first and second moult is the most critical in their lives, because if the soil is dry at this time they die, while if it is too moist they are usually killed by fungi.