

DELIVERING HIGH
QUALITY TRAINING

ENTOMOLOGY


Killgerm®
TRAINING

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Introduction

Although the layman may think of insects as a rather insignificant group of animals, in fact they are one of the most successful and enduring forms of life on earth.

The first insects appeared about 500 million years ago and have exploited almost every habitat with the exception of the marine and polar environments. It is not known how many species of insects there are in the world today as many still remain undescribed; over 1 million species have been described, which is many more than all other types of animal put together.

The study of entomology is therefore a vast topic which perhaps explains its continued appeal to many zoologists.

The key to the success of the insects has been their incredible adaptability which has given rise to a vast range of forms fitted to many niches.

By comparison to the insects, Man is very much a newcomer to the earth. *Homo sapiens* evolved less than half a million years ago and Man was immediately exploited by the insects who utilised his dwellings, food stores, crops, his body and its waste products and finally his corpse as a food source.

However, it should be remembered that the vast majority of insects are beneficial, less than 0.5% of species can be classed as pests.

What is an insect?

In order that we can understand the insects we need to appreciate where they fit into the animal kingdom and in order to understand this, we need to understand how animals are classified.

The common names by which animals are known varies confusingly from place to place. The world's largest deer for instance, when it occurs in Europe is known as the elk, but in North America the same species is known as the moose, the name elk being used for another deer. Some animals have an even longer list of alternative names: the puma, cougar, mountain lion, panther and catamount are one and the same animal.

With a proper system of classification, this confusion does not arise. To a zoologist, the moose or European elk is *Alces alces*, and the puma, cougar, mountain lion, panther or catamount is *Felis concolor*.

TAXONOMY HAS TWO PURPOSES:

- i) It names animals and plants.
- ii) It arranges them in groups based on how we believe they are related.

HOW ANIMALS ARE CLASSIFIED SCIENTIFICALLY

A species defined as an interbreeding population producing fertile offspring. Closely related species are grouped in a single genus, related genera are grouped into a family, related families into an order, related orders into a class, related classes into a phylum and related phyla into a kingdom. These divisions may in turn be subdivided. Every living thing can be placed in such a classification scheme.

Level of classification

For example: Man - *Homo sapiens*.

Kingdom - Animalia (animals)

Phylum - Chordata (animals with a notochord (primitive spinal column))

Sub-phylum - Vertebrata (animals with backbones)

Order - Primates (five digits on limbs - eyes on front of head)

Family - Homonidae

Genus - *Homo*

Species - *Homo sapiens*

WHERE DO INSECTS FIT INTO THIS SYSTEM?

Level of classification

For example: the common housefly, *Musca domestica*.

Kingdom - Animalia (animals)

Phylum - Arthropoda (segmented bodies, jointed legs)

Class - Insecta (insects)

Order - Diptera (true flies, ie: one pair of wings)

Family - Muscidae (houseflies and relatives)

Genus - *Musca*

Species - *Musca domestica*

From this it can be seen that the insects belong to the phylum ARTHROPODA and are therefore related to the other classes of animals grouped within the arthropods. The name arthropod literally means jointed feet - in addition to this characteristic arthropods also have a segmented body and an external skeleton, which serves as protection and also allows muscle attachment. Some of the body segments bear appendages such as legs or wings, and there is a head bearing sense organs and paired appendages. Examples are scorpions, spiders, mites, ticks.

The arthropods include the following classes of animals:

Arachnida

4 pairs of legs. No antennae. No wings.

Chilopoda

Centipedes. One pair of legs per body segment. Active. Usually predatory.

Diplopoda

Millipedes. Two pairs of legs per body segment, circular in cross section. Slow moving, plant feeders.

Crustaceans

Several pairs of legs. Two pairs of antennae. No wings.

The Orders of insects

The insects are split into a number of orders, based largely on the structure of the wings and the mouthparts.

The names of the orders generally end in -ptera, meaning wings:

Lepidoptera = scale wings

Coleoptera = sheath wings

Diptera = two wings, and so on.

Some of the 29 orders recognised are listed below. There is much variation in the size of the orders: some contain only a handful of species, while the Coleoptera (beetles) are represented by more than 300,000 different kinds.

Primitive wingless insects, which have never had wings at any stage of their evolutionary history.

Thysanura - Bristletails (silverfish and allies)

Diplura - Two-tailed bristletails

Protura - Minute soil-dwelling insects

Collembola - Springtails

PTERYGOTES

Essentially winged insects, although some orders have lost their wings during their evolution. There are also wingless species or forms scattered through most of the other orders.

EXOPTERYGOTES

Insects with 'incomplete' metamorphosis. Young are nymphs. Wings develop externally from wing buds.

Ephemeroptera - Mayflies

Odonata - Dragonflies

Plecoptera - Stoneflies

Orthoptera - Crickets & grasshoppers

Phasmida - Stick and leaf insects

Dermaptera - Earwigs

Dictyoptera - Cockroaches & mantids

Isoptera - Termite

Psocoptera - Booklice (all wingless)

Anoplura - Sucking lice (all wingless)

Hemiptera - True bugs

Thysanoptera - Thrips

ENDOPTERYGOTES

Insects with "complete" metamorphosis and pupal stage. Young are larvae. Adult characteristics develop at the pupal stage from imaginal discs present in the larvae.

Neuroptera - Lacewings, alder flies & snake flies

Mecoptera - Scorpion flies

Lepidoptera - Butterflies and moths

Trichoptera - Caddis flies

Diptera - True flies

Siphonaptera - Fleas (all wingless)

Hymenoptera - Bees, wasps, ants, sawflies, ichneumons & others

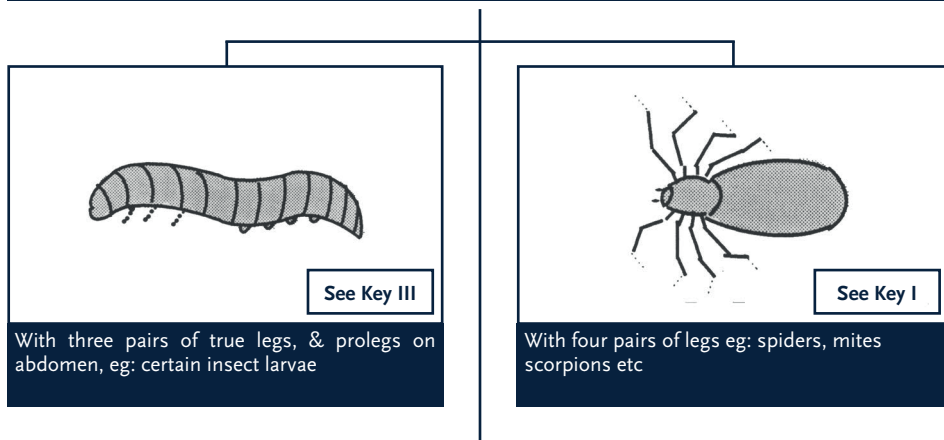
Coleoptera - Beetles



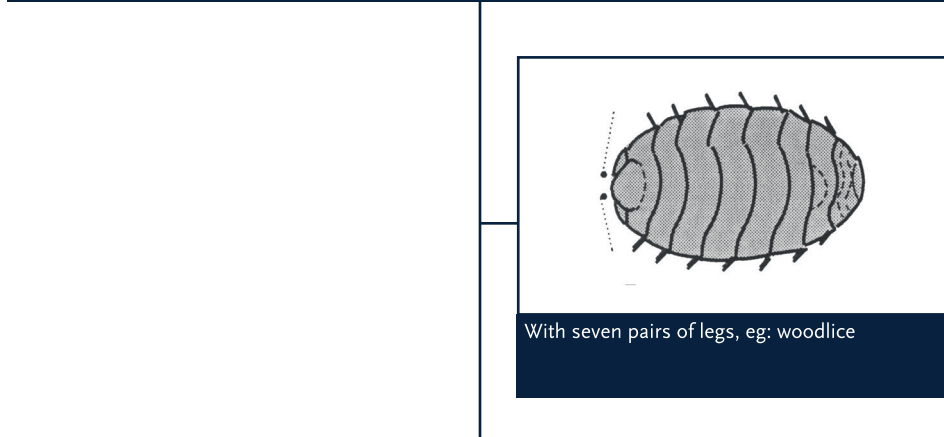
Identification key

From this it can be seen that the insects belong to the phylum ARTHROPODA and are therefore related to the other classes of animals grouped within the arthropods. The name arthropod literally means jointed feet - in addition to this characteristic arthropods also have a segmented body and an external skeleton, which serves as protection and also allows muscle attachment. Some of the body segments bear appendages such as legs or wings, and there is a head bearing sense organs and paired appendages. Examples are scorpions, spiders, mites, ticks.

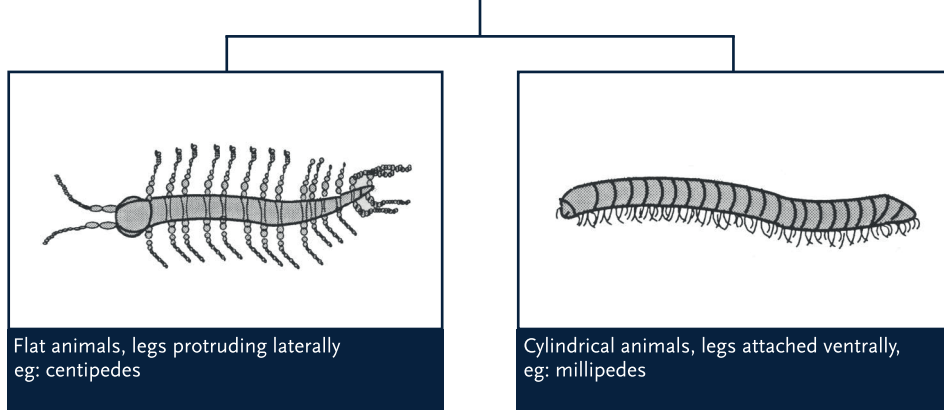
WITH MORE THAN THREE PAIRS OF LEGS



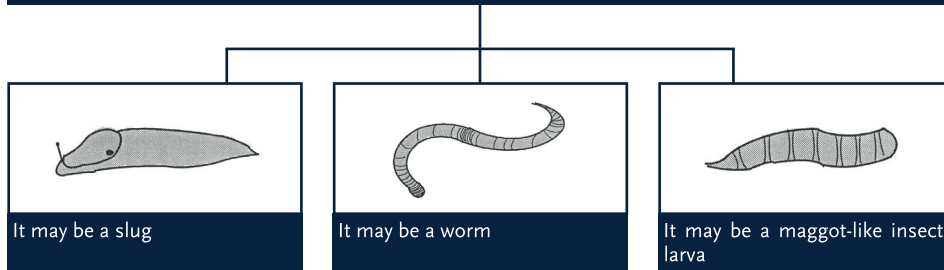
WITH MORE THAN THREE PAIRS OF LEGS



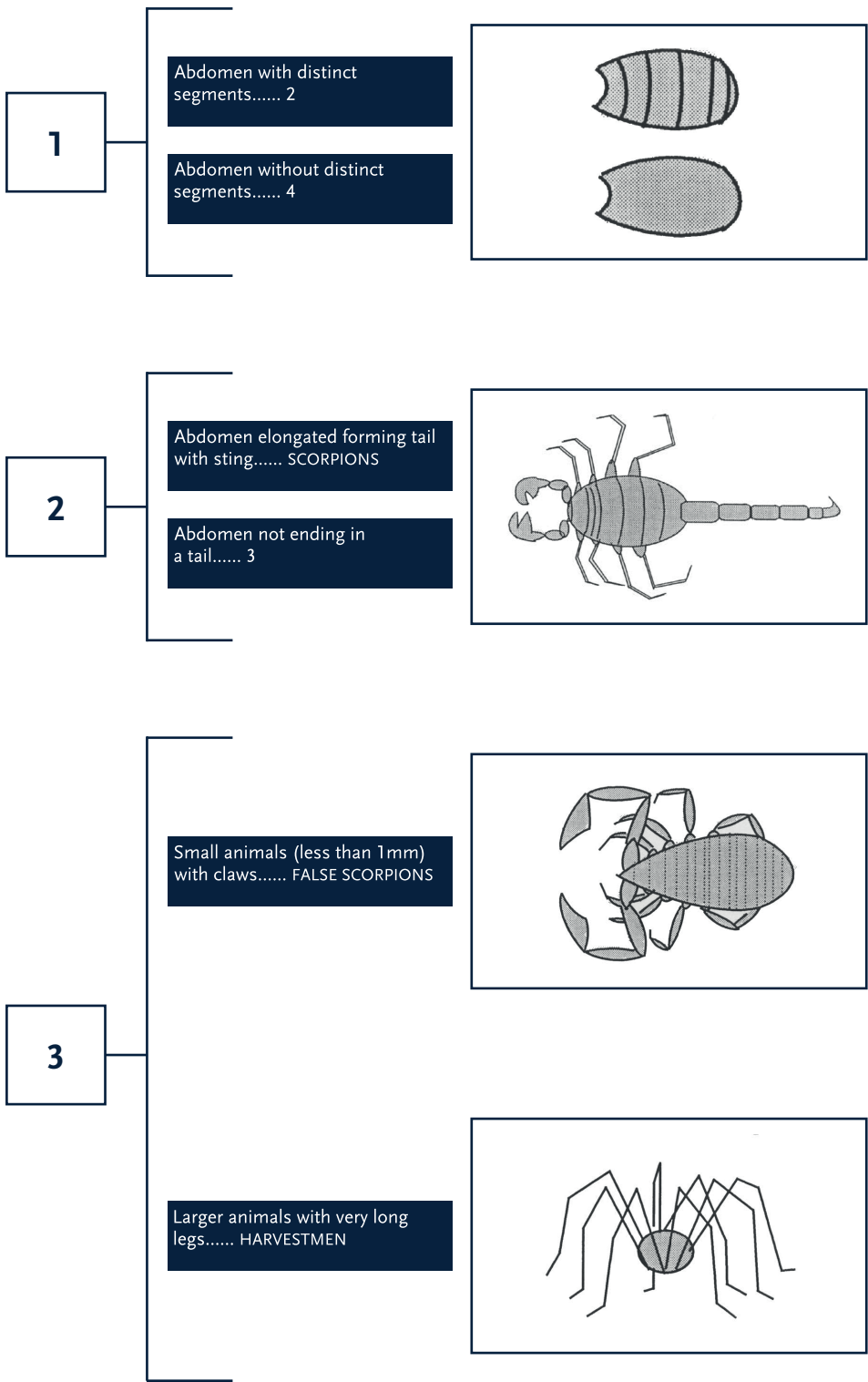
WITH MANY LEGS, MORE THAN 14 PAIRS



WITHOUT LEGS



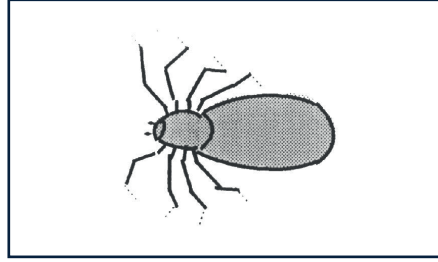
KEY I - ANIMALS WITH FOUR PAIRS OF LEGS; SPIDERS, MITES, SCORPIONS ETC



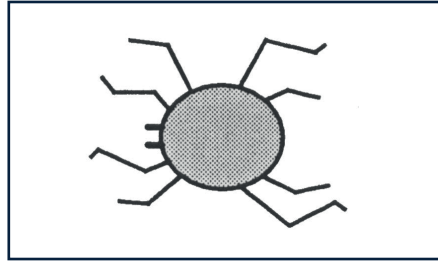
KEY I - ANIMALS WITH FOUR PAIRS OF LEGS; SPIDERS, MITES, SCORPIONS ETC

4

Body clearly divided into two parts..... SPIDERS



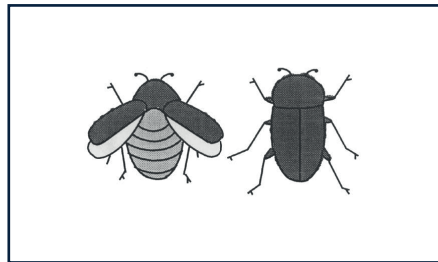
Very small animals with undivided bodies..... MITES



KEY II - ANIMALS WITH THREE PAIRS OF LEGS; INSECTS

1

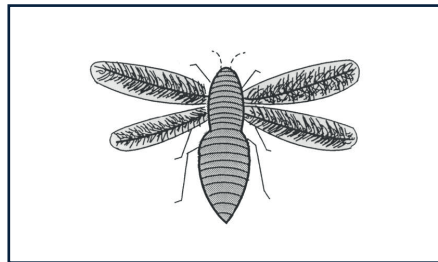
Wings well developed..... 2
NB: Front wings may be developed as "shields", which cover the flight wings when these are not in use.



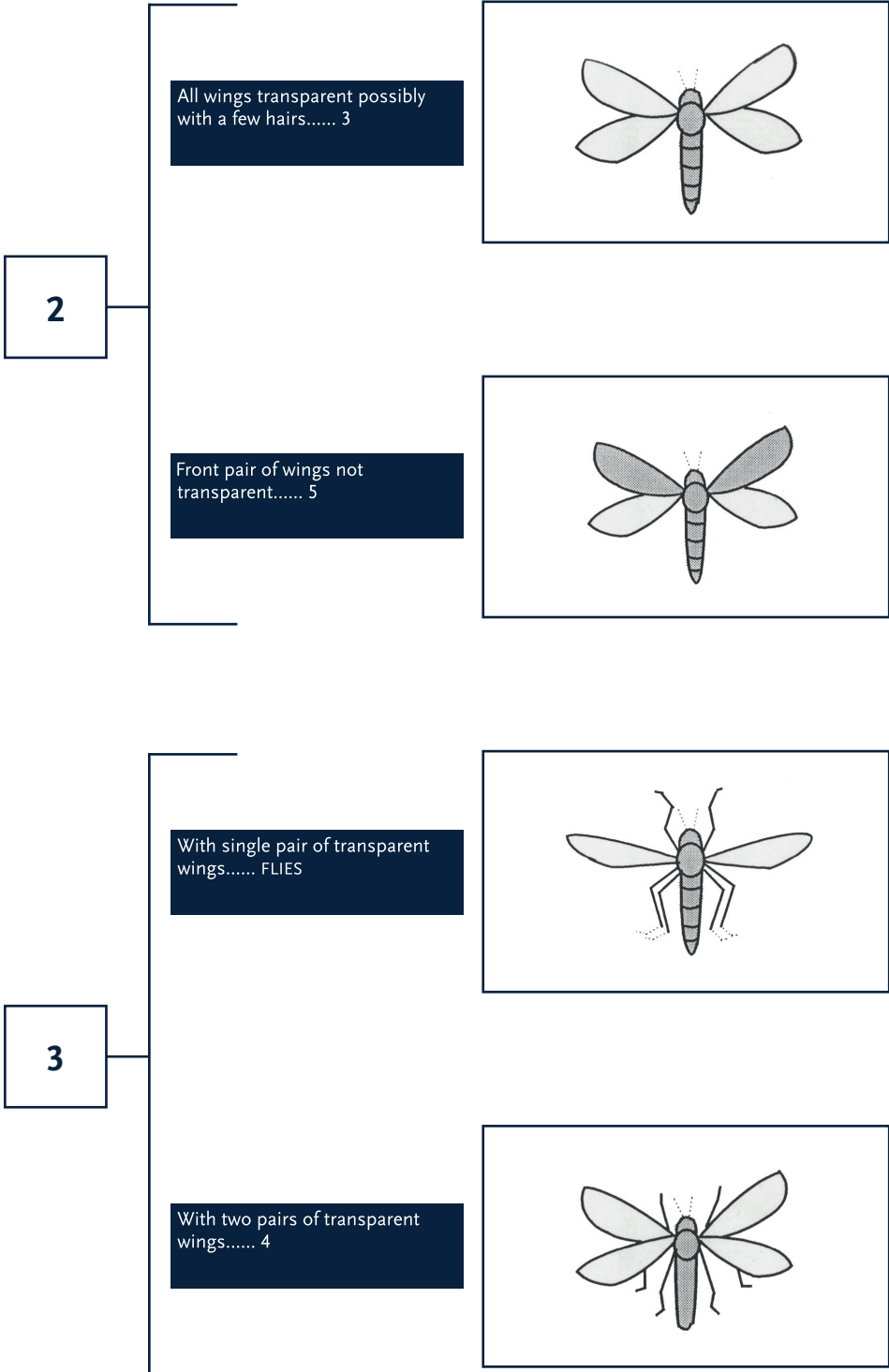
Wings lacking..... 9

2

Wings small with hairy fringes.
Small animals less than 2 mm..... THRIPS



KEY II - ANIMALS WITH THREE PAIRS OF LEGS; INSECTS

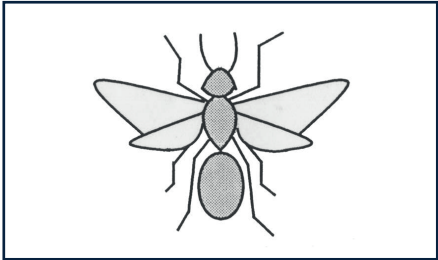




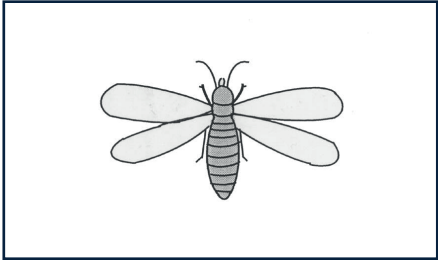
KEY II - ANIMALS WITH THREE PAIRS OF LEGS; INSECTS

4

Front pair of wings larger than back pair..... WASPS, BEES, CHALCIDS, ICHNEUMONS, FLYING ANTS



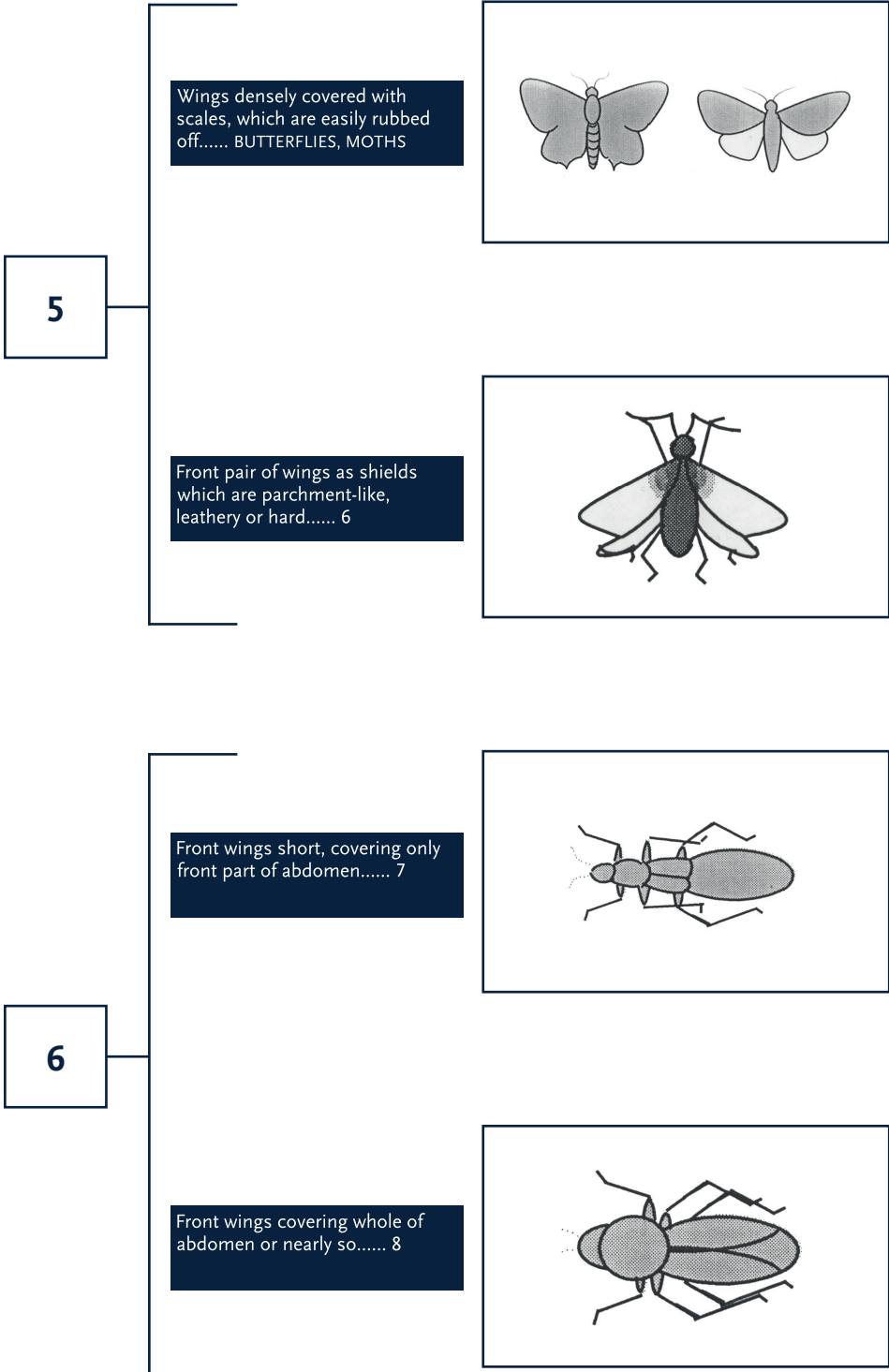
Wings all about the same size, transparent or smoke-coloured..... WINGED TERMITES



Wings all about the same size, greenish..... LACEWINGS



KEY II - ANIMALS WITH THREE PAIRS OF LEGS; INSECTS

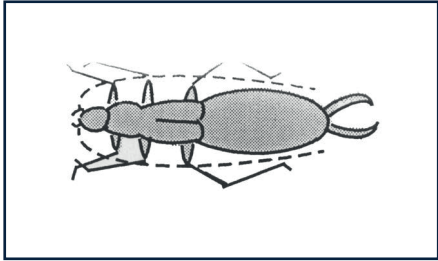




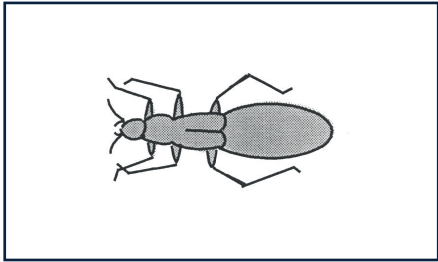
KEY II - ANIMALS WITH THREE PAIRS OF LEGS; INSECTS

7

Abdomen ending in a pair of forceps..... EARWIGS

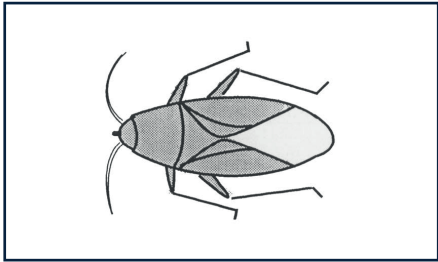


Abdomen not ending in a pair of forceps..... STAPHYLINID BEETLES

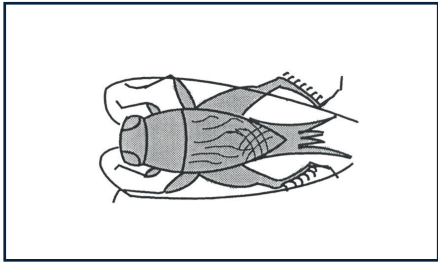


8

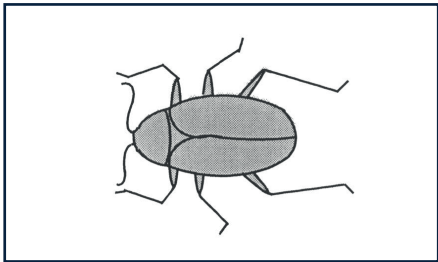
Front part of front wings leathery, rear part clear and transparent..... TRUE BUGS



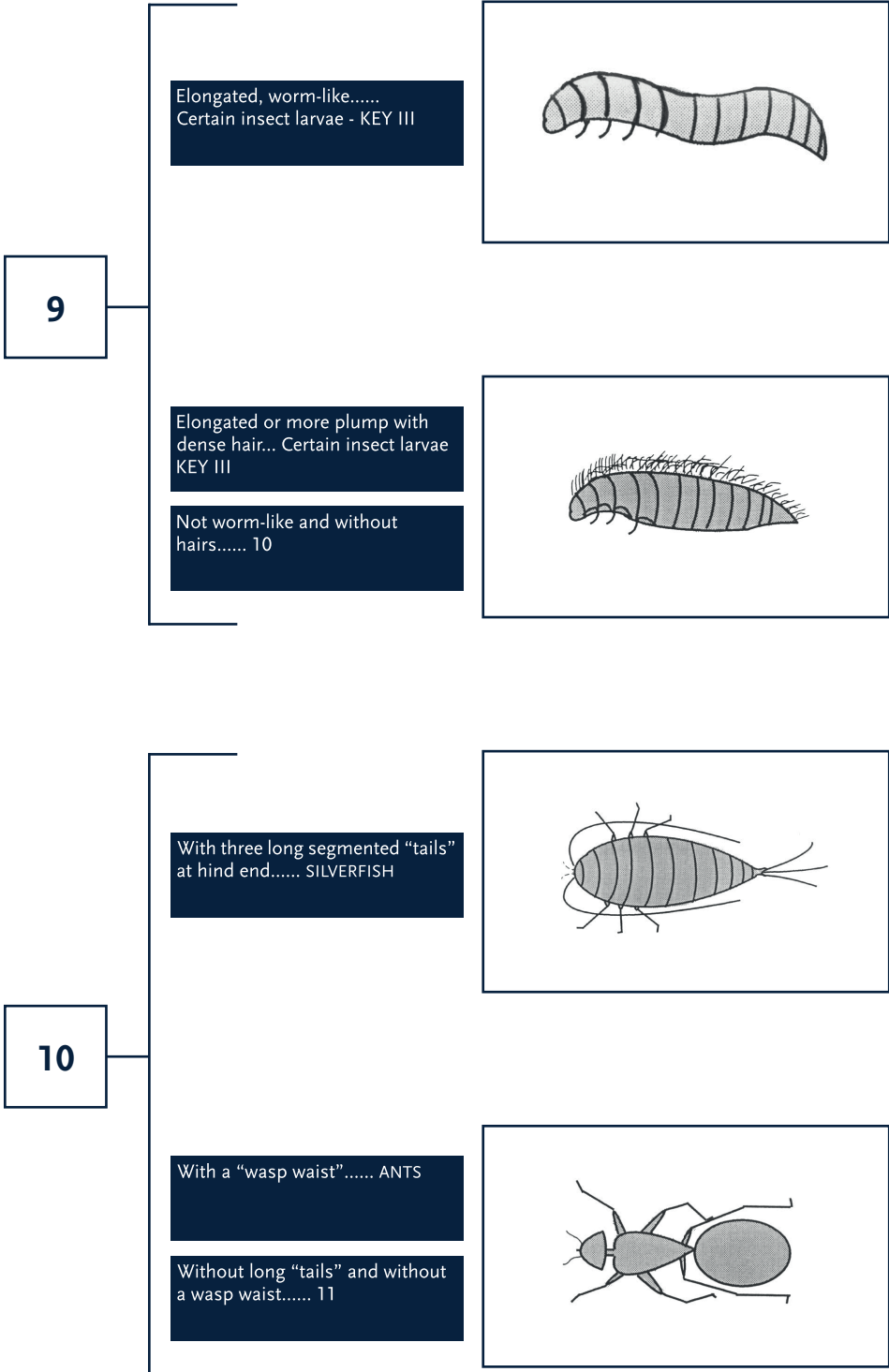
Front wings (tegmina) leathery with distinct veins. Antennae long, whip-like..... COCK-ROACHES OR CRICKETS



Front wings (elytra) forming hard shields, without distinct veins. Antennae normally short, never whip-like..... BEETLES



KEY II - ANIMALS WITH THREE PAIRS OF LEGS; INSECTS

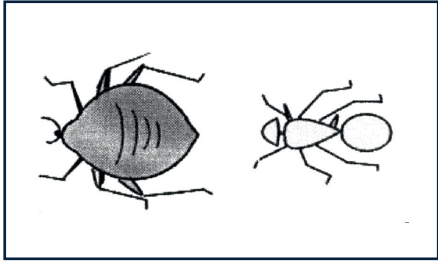




KEY II - ANIMALS WITH THREE PAIRS OF LEGS; INSECTS

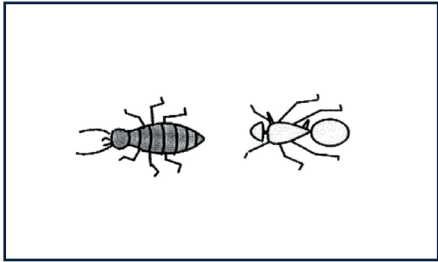
11

Large animals, ie: the adults are larger than an ordinary black garden ant..... 12



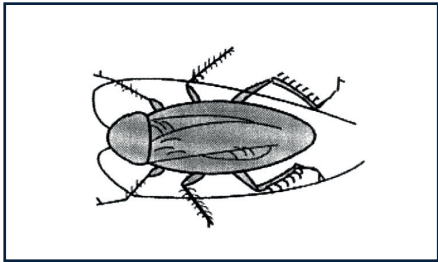
About the size of a black ant, but pale..... TERMITES

Smaller than an ordinary black ant..... 14



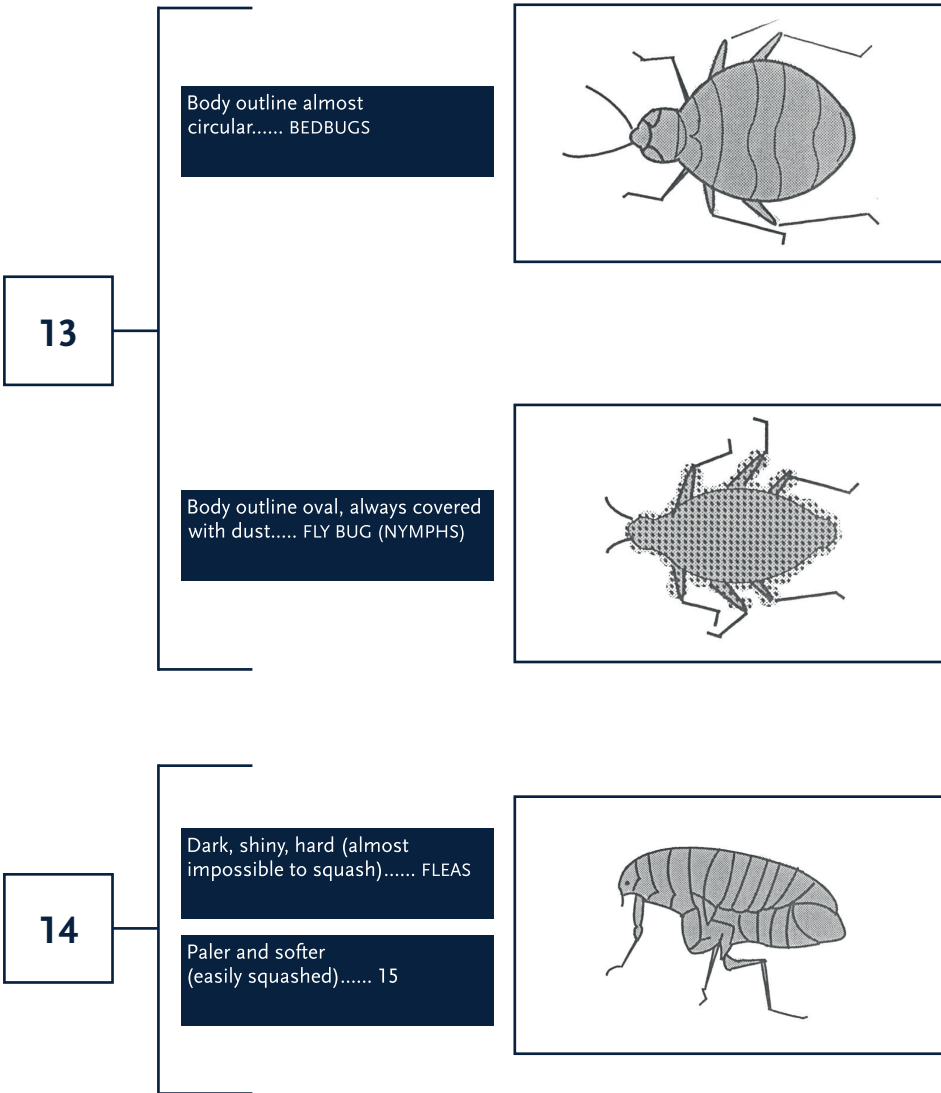
12

With biting mouthparts and very long whip-like antennae..... COCKROACHES



With sucking proboscis, folded in beneath head..... 13

KEY II - ANIMALS WITH THREE PAIRS OF LEGS; INSECTS

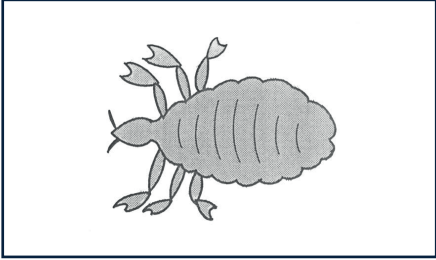




KEY II - ANIMALS WITH THREE PAIRS OF LEGS; INSECTS

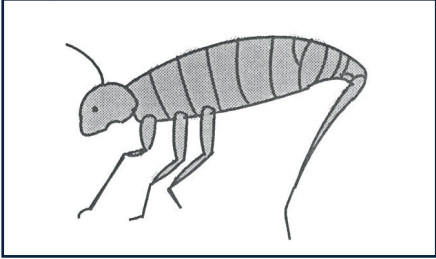
15

- Sluggish, living as parasites on man and animals..... LICE
- Active, free-living..... 16



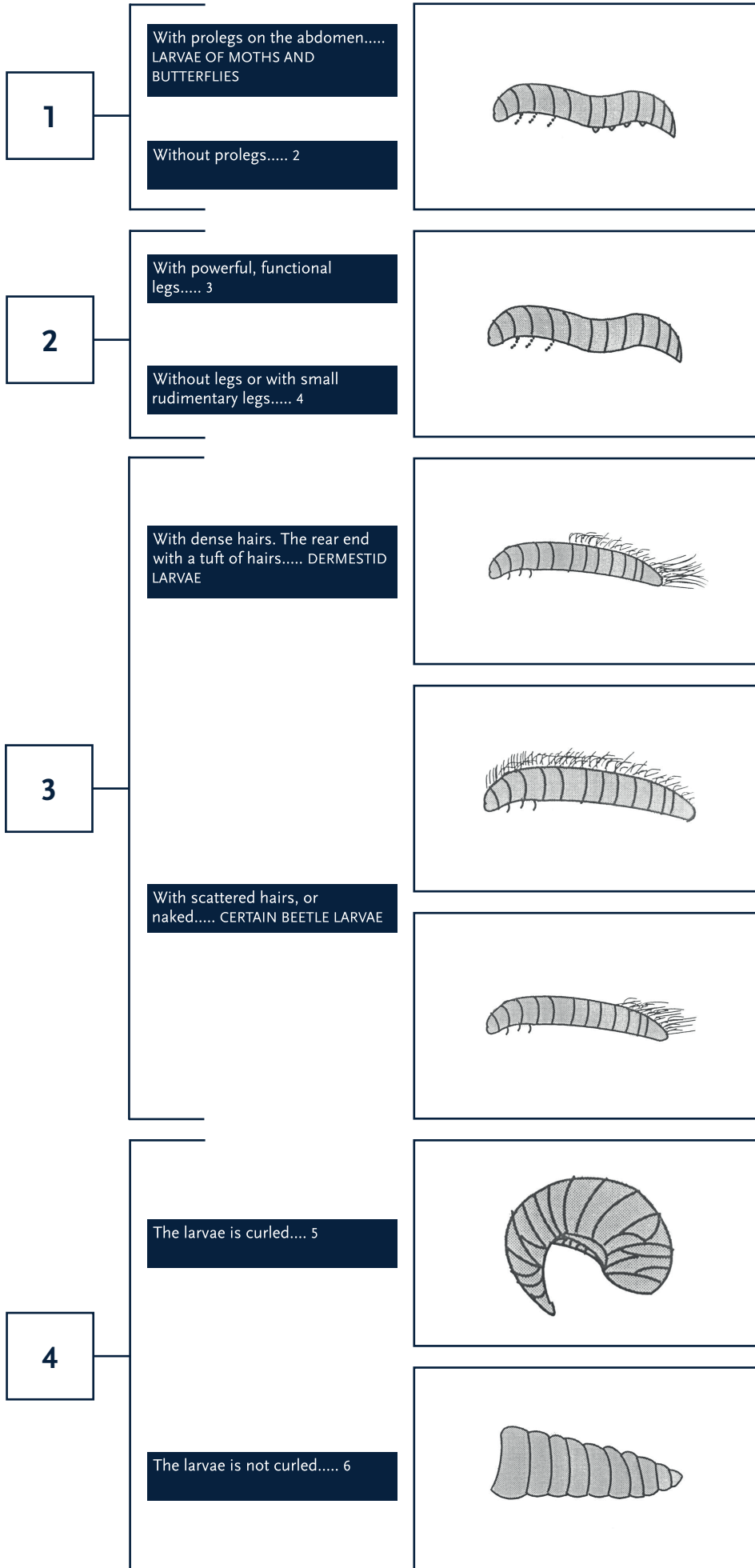
16

- With a forked springing organ at rear end..... SPRINGTAILS



- Without a springing organ..... BOOKLICE



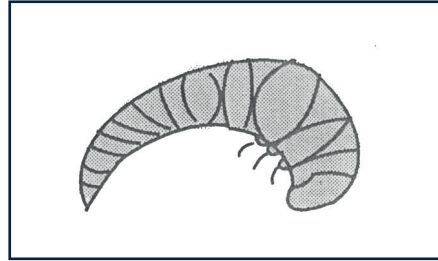




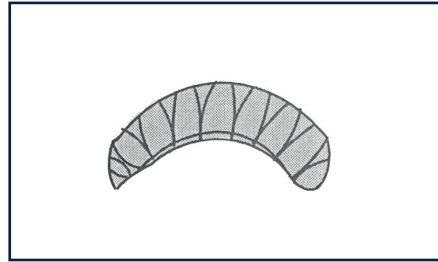
KEY III - INSECT LARVAE

5

With small legs..... CERTAIN BEETLE LARVAE (including powder post beetles, furniture beetles and spider beetles).



Legs completely lacking..... CERTAIN BEETLE LARVAE (weevils and bark beetles).



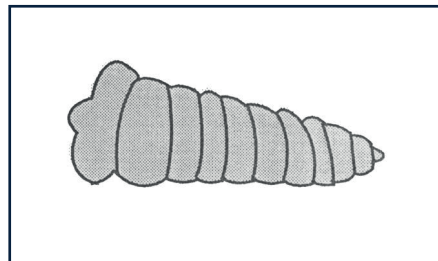
6

Found in timber, sometimes under bark..... 7

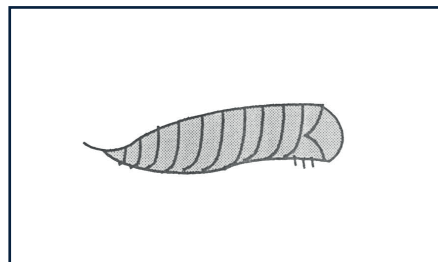
Found in other places..... 8

7

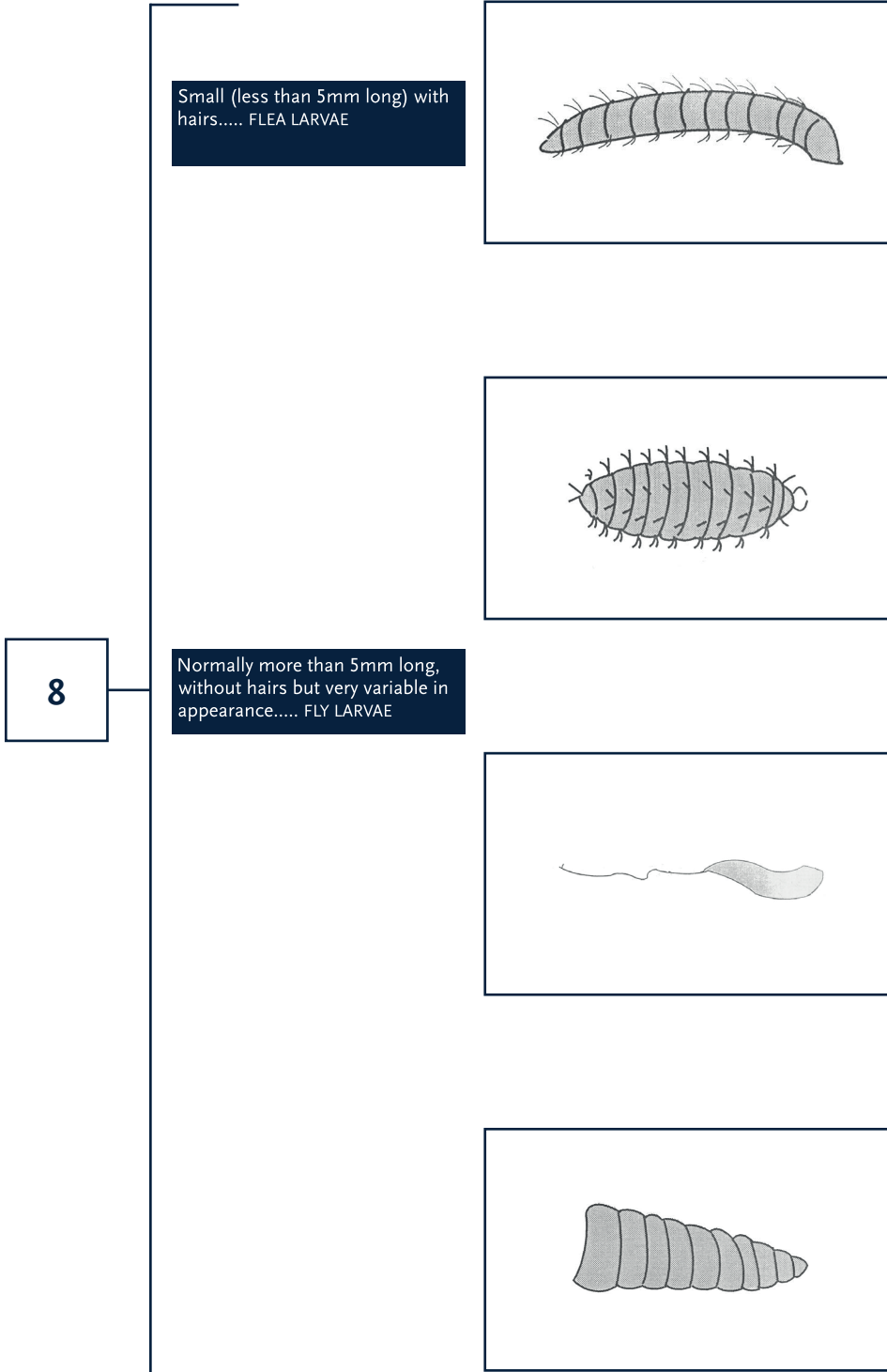
Broadest in front..... CERAMBYCID LARVAE



Not broadest in front, with spine at rear end..... WOODBORING WASP LARVAE



KEY III - INSECT LARVAE





KILLGERM CHEMICALS LIMITED

PO Box 2, Ossett, West Yorkshire, WF5 9NA

TELEPHONE: 01924 268 445 **FAX:** 01924 268 556 **EMAIL:** training@killgerm.com

www.killgerm.com

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