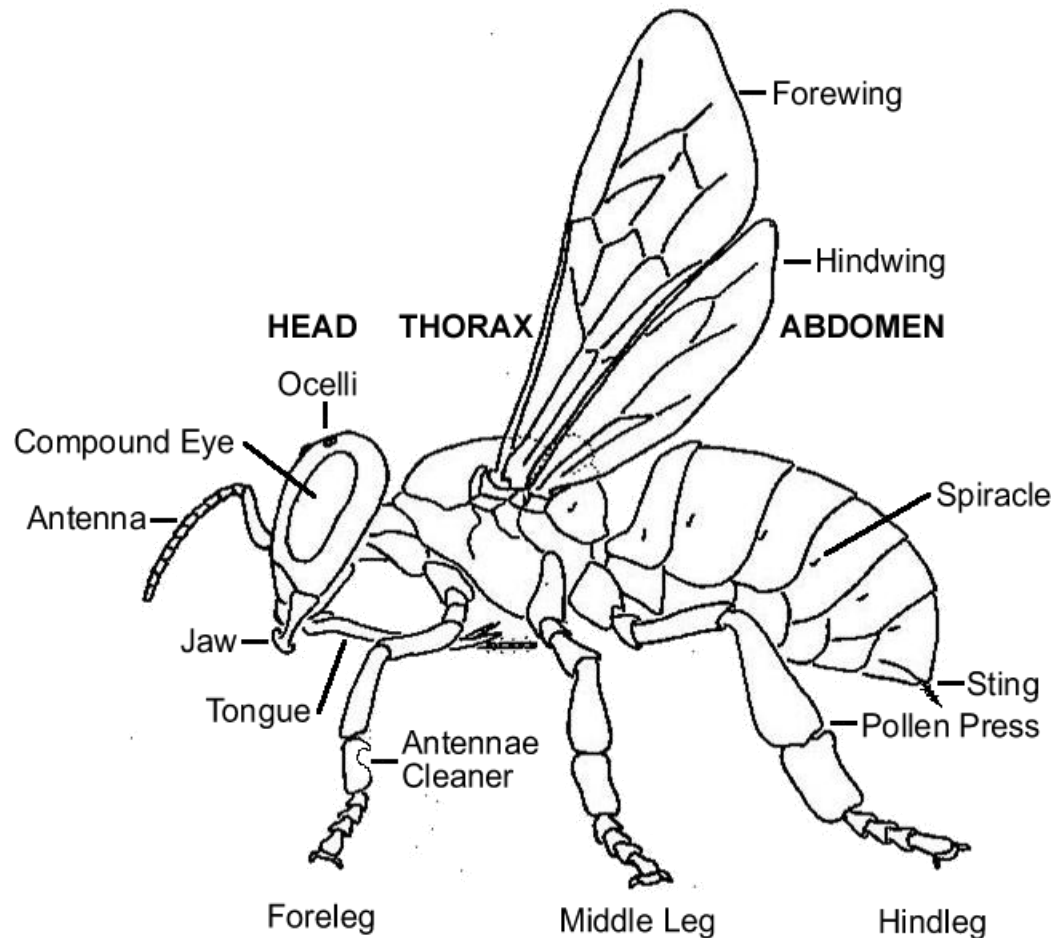




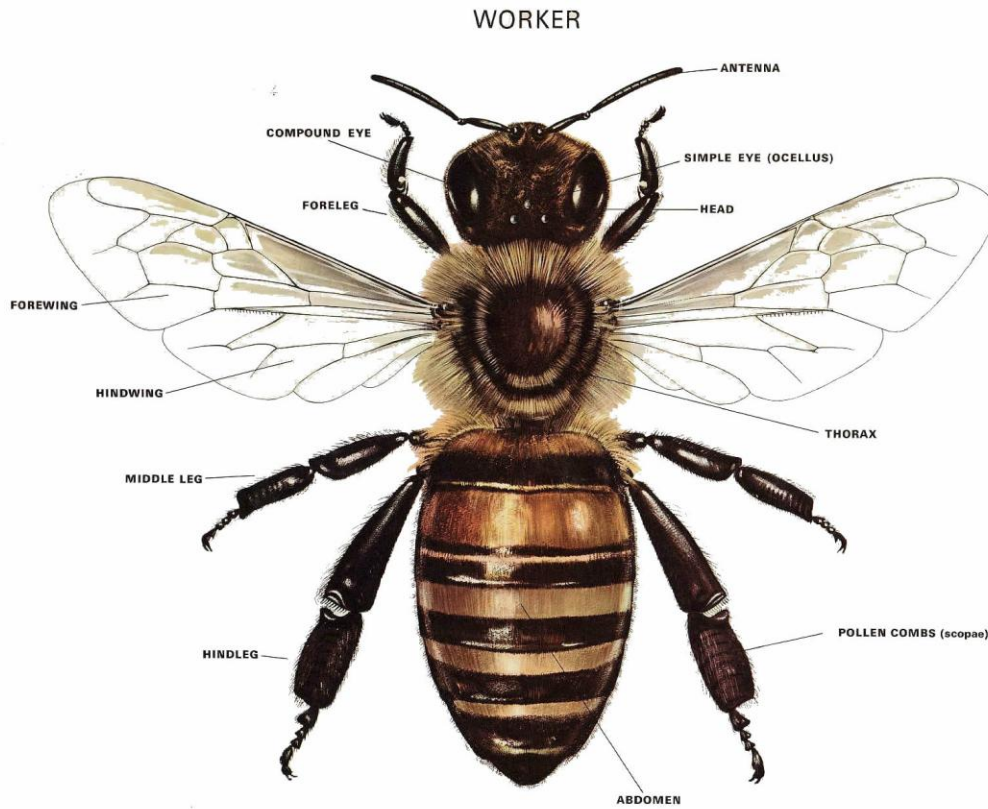
Beekeeping short-course

Visual aids

The photos below can be printed out (and laminated for greater durability) and used to promote discussions about basic beekeeping and bee biology. The order of the photos is such as to allow double sided printing (which can be laminated for greater durability) with related content on the same sheet of paper.

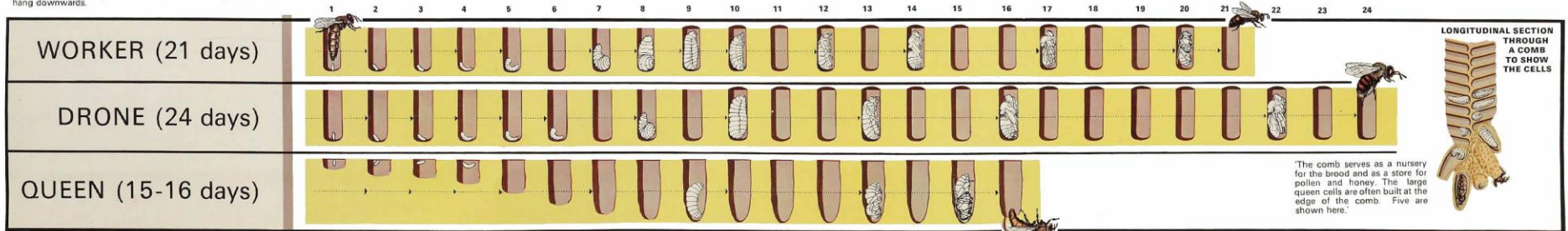


THE HONEYBEE (APIS MELLIFERA)



Development of brood from egg to adult

In the illustration below, daily development is shown diagrammatically from left to right. In fact, workers and drones are reared in cells that lie back-to-back across the comb, as in the drawing on the far right. Queens are reared in large cells that hang downwards.



Drones (male) develop from unfertilized eggs, and workers and queens (both female) from fertilized eggs. Whether any one fertilized egg will develop into a worker or a queen depends on how the young larva

is fed. If it is to become a queen, it is fed profusely on royal jelly (bee milk) for the whole of the larval period, and a supply of this food is left in the cell when it is sealed over. Most female larvae, however, are

given less (and less rich) food after the initial phase, and they develop into workers.

QUEEN

WORKER
actual size 13 - 17 mm

DRONE

compound eye, 3 ocelli, antenna, mandible, 2 maxillae, labium, SHORT PROBOSCIS

head with proboscis extended

MANDIBLES USED FOR BITING AND GRASPING

THE LABIUM IS INTEGRATED WITH THE TWO MAXILLAE TO FORM A LONG PROBOSCIS OR TUBE THROUGH WHICH NECTAR IS DRAWN UP INTO THE MOUTH

THE MANDIBLES SUPPORT THE BASE OF THE EXTENDED PROBOSCIS

LONG PROBOSCIS

COMPOUND EYE VERY LARGE PUSHING OCELLI FORWARD

antenna

SHORT PROBOSCIS

NO WAX GLANDS

wax glands

VENTRAL SURFACE OF ABDOMEN SHOWING THE 8 WAX PLATES COVERING THE GLANDS

DIAGRAMMATIC SECTION TO SHOW 2 WAX GLANDS

NO WAX GLANDS

NO POLLEN-COLLECTING APPARATUS ON HINDLEG

pollen load

spinelle hair (secures pollen load)

tibia, tibiae, pollen press, femur, tibiae, tarsus, claw, spur

HIND

MIDDLE

FORE

antenna cleaner (similar to worker's)

POLLEN LOAD CARRIED ON OUTER SURFACE (CORNICULA) OF TIBIA

pollen rate (resisture)

antenna cleaner

MIDDLE

FORE

antenna cleaner

antenna cleaner (similar to worker's)

NO POLLEN-COLLECTING APPARATUS ON HINDLEG

HIND

MIDDLE

FORE

antenna cleaner (similar to worker's)

sting CURVED

STRAIGHT, BARBED

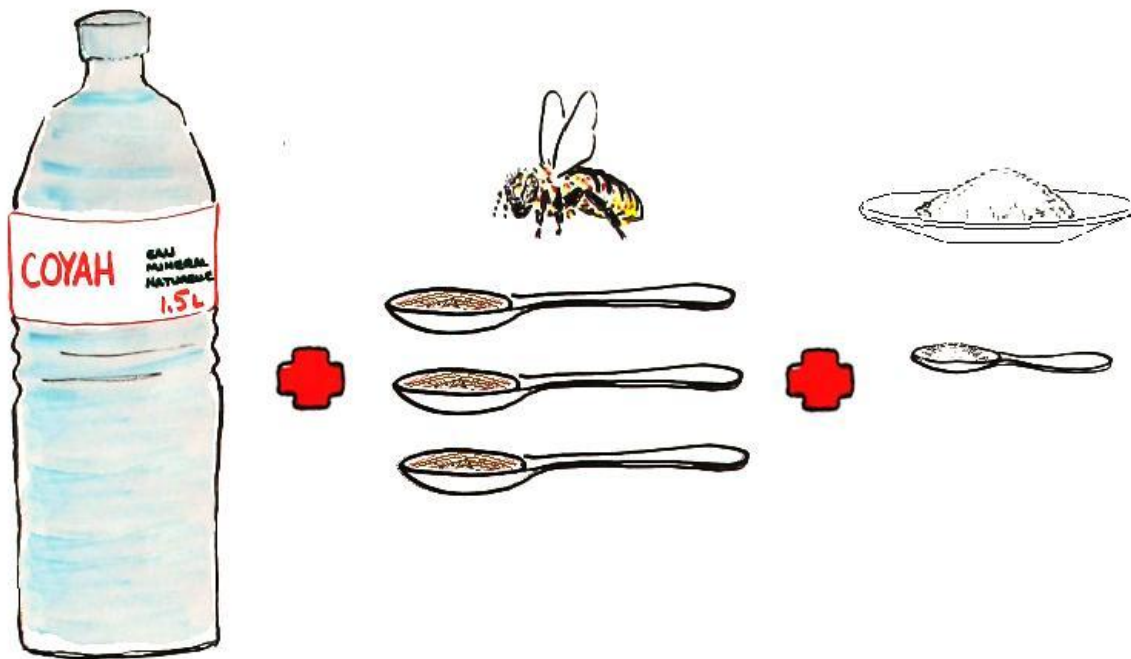
NO STING

The queen and worker honeybees are female and the drone is male. There is normally only one queen in a colony, and she lays all the eggs. There are many workers (say 50,000 in summer) and they do almost all the work. In summer there may be a few hundred drones, but these die before winter.

What each worker bee does depends on her age and on the varying needs of the colony. Young bees work in the hive, first cleaning out used brood cells, and later feeding the brood, the queen and the drones. Some secrete wax for building or repairing the combs, process the nectar into honey, and pack pollen in the cells. Other bees guard the colony, using their stings, if necessary.

The older worker bees go out of the hive, first on orientation flights and then to forage for what the colony requires: nectar, pollen, water or propolis (bee glue). Nectar is the carbohydrate food of bees, whereas pollen is a protein food, important for young workers, larvae, and the queen. Water may be needed by the bees feeding brood; also, in hot weather, bees collect and evaporate it to cool the hive. Water and nectar are carried in the honey sac, and so cannot be seen; pollen and propolis are brought home on the hindlegs. The legs, as well as the four wings, are attached to the thorax, which contains the muscles that enable the bee to walk and fly. The head contains several important glands, and the abdomen contains the honey sac as well as digestive and stinging organs.

The comb serves as a nursery for the brood and as a store for pollen and honey. The large queen cells are often built at the edge of the comb. Five are shown here.



Honey is easier to digest than table sugar and can be of benefit in feeding people with intestinal distress or stomach disorders. If someone is sick and losing a lot of fluids from vomiting or diarrhea you can use honey to make a

REHYDRATION DRINK

In **one and one half liters of clean water** (a bottle of mineral water or water that has been boiled and cooled-- instead of water you can also substitute tea made from lemon grass/fever grass (*Cymbopogon citratus*)

mix in **three tablespoons of honey** and

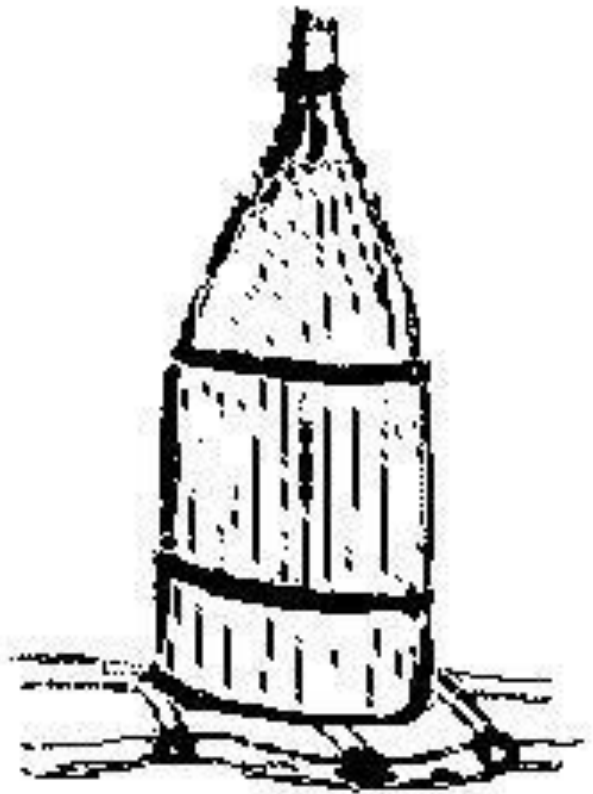
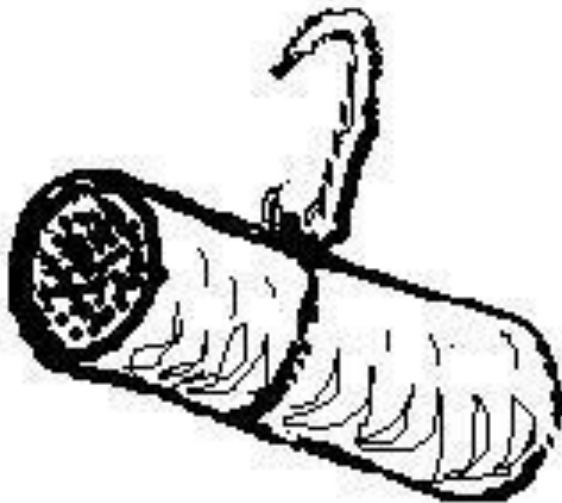
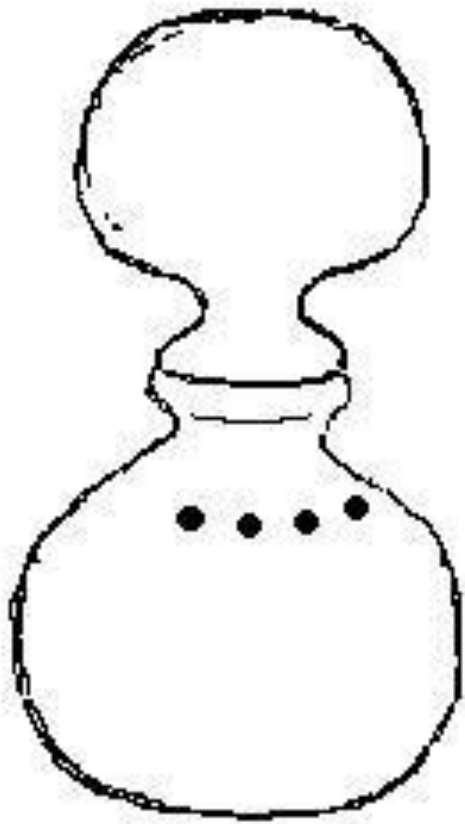
3/8 teaspoon of salt and

3/8 teaspoon of baking soda (bicarbonated soda)

[if baking soda is unavailable use another 3/8 teaspoon of salt, i.e. 3/4 of a teaspoon in total].

Remember, however, that honey is not a miracle cure for anything. But it does have some real medicinal uses.

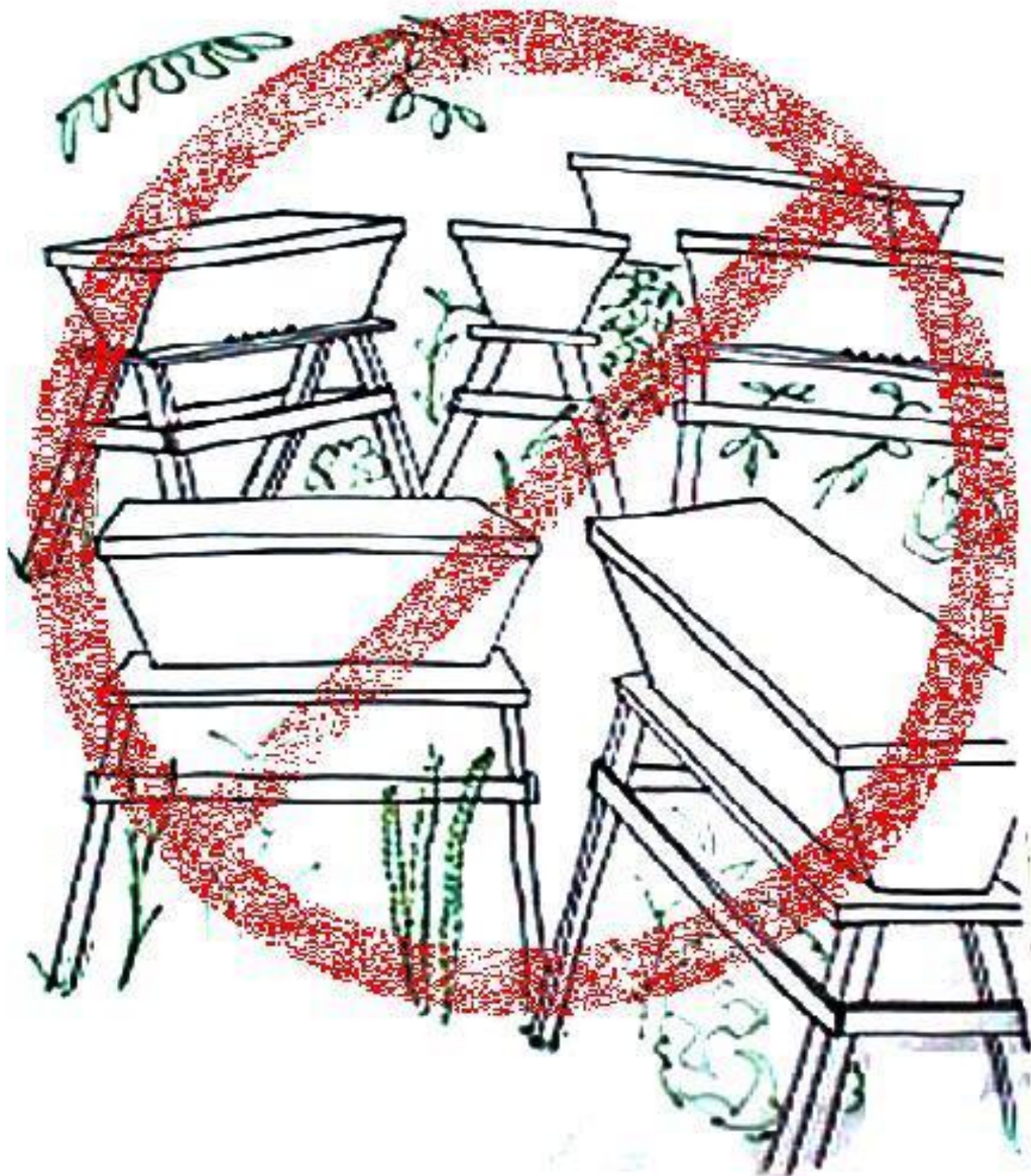
It can also be used as a **WOUND DRESSING** for cuts and burns when antibiotic ointments are not available--the high sugar content of honey sucks the water out of micro-organisms that can cause infection and stops them from growing. Honey will also feed the damaged cells of the wound. To use: first wash the wound with soap and clean water (preferably boiled water that has been cooled or a good quality bottled water). Then smear a thin coating of honey on the wound just as you would use an ointment. Cover the wound with a clean bandage. Repeat cleaning, honeying and covering each day until the wound is healed.



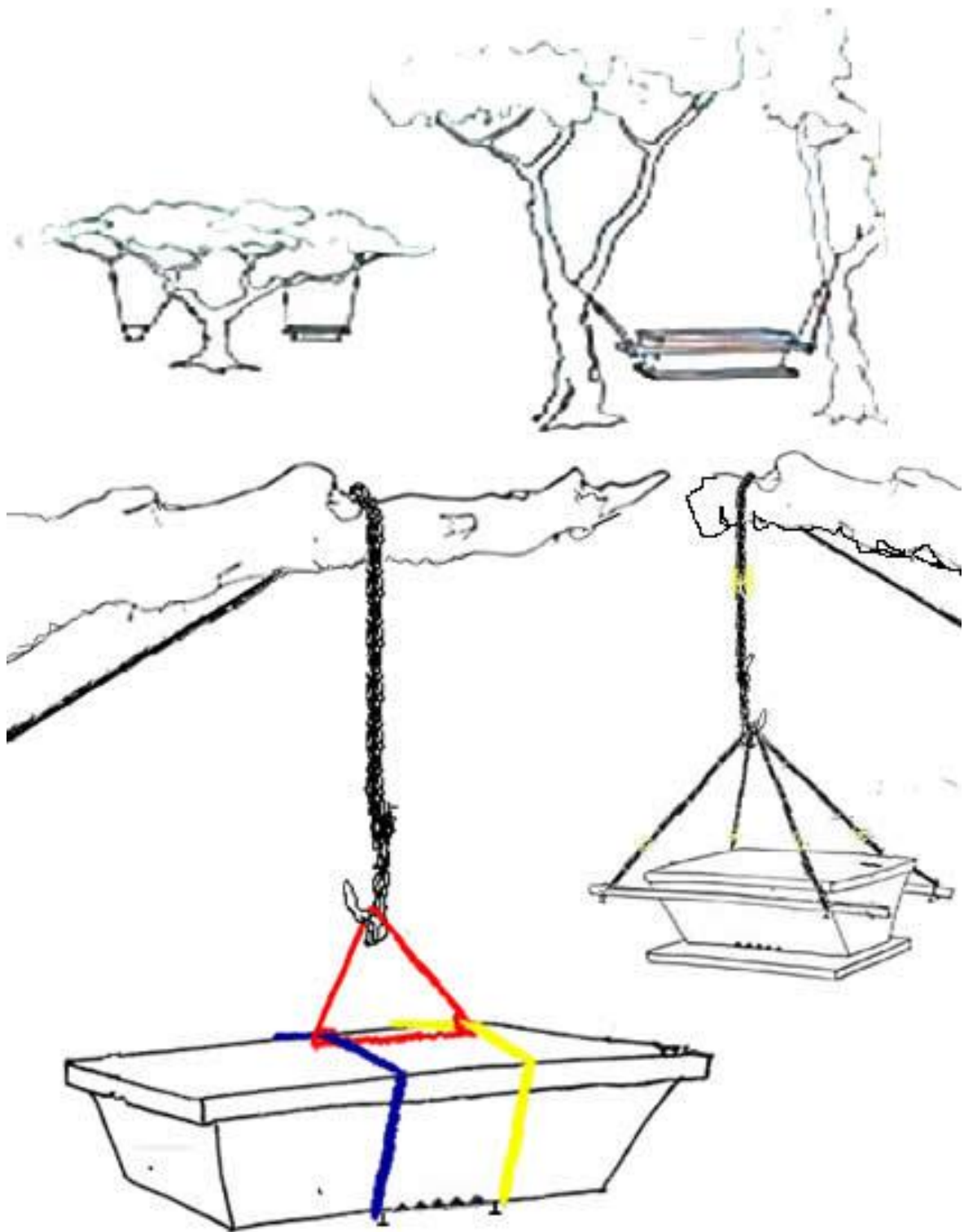
Bee products have been harvested from wild nests and a variety of traditional hives in Africa for millennia. Local apiarists or harvesters of wild hives can often be a good source of knowledge particularly about when to put out bait hives and which areas are best suited for placement of hives and apiaries.



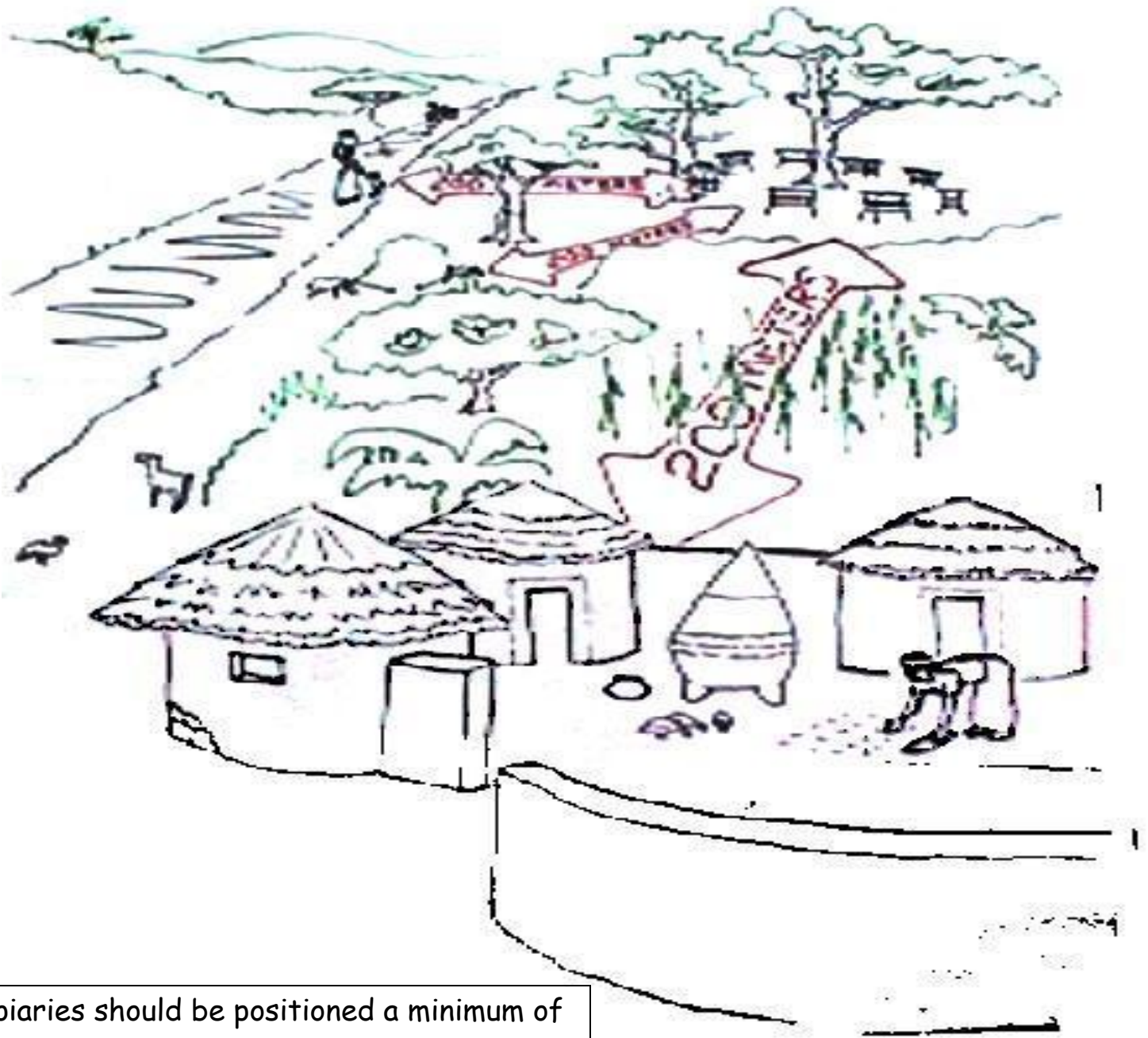
The Kenya Top-Bar Hive is often the most appropriate hive for the economy, environment and characteristics in many parts of the developing world.



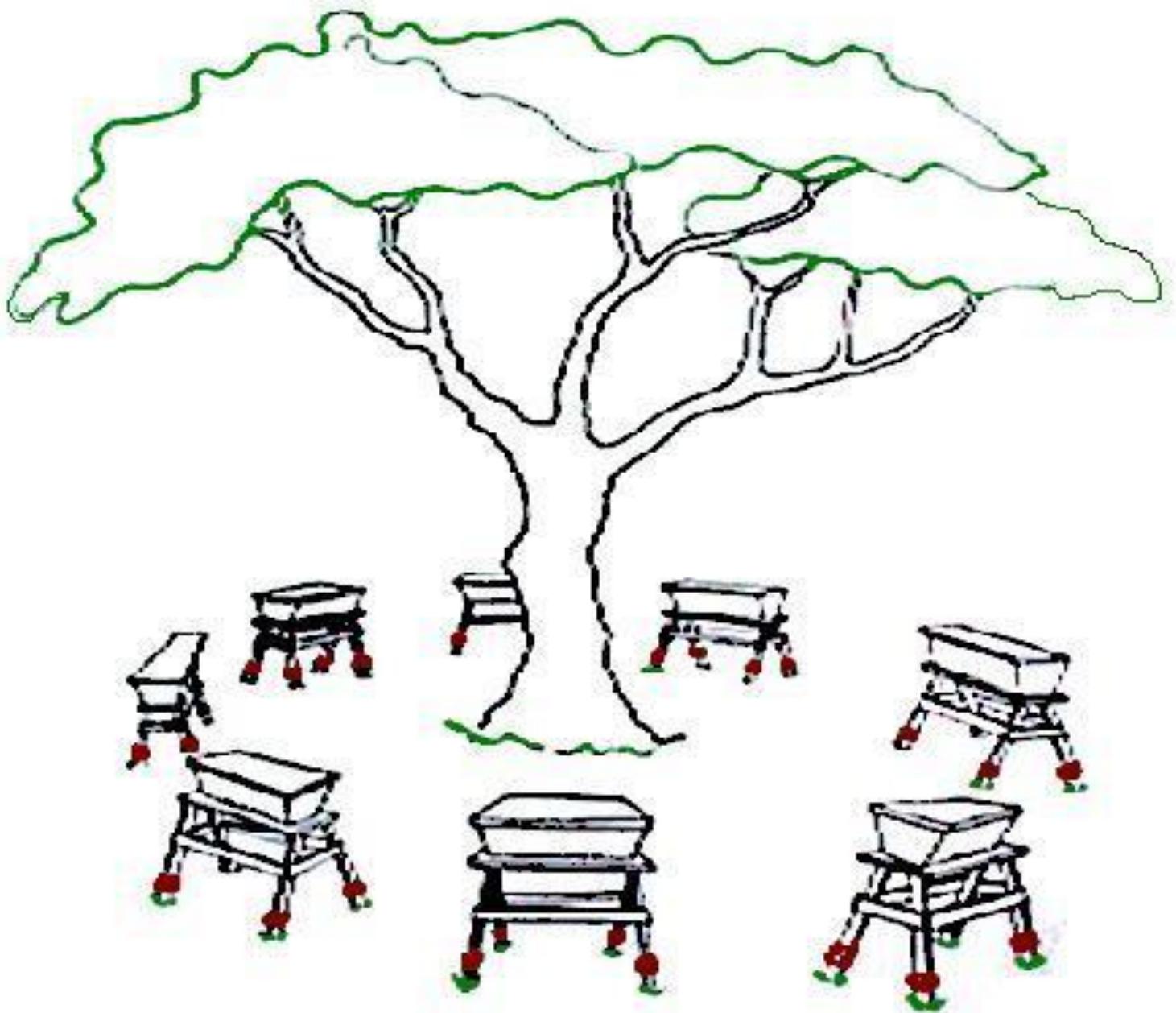
Hives should not be too close together, be haphazardly arranged or be placed in areas with minimal shade..



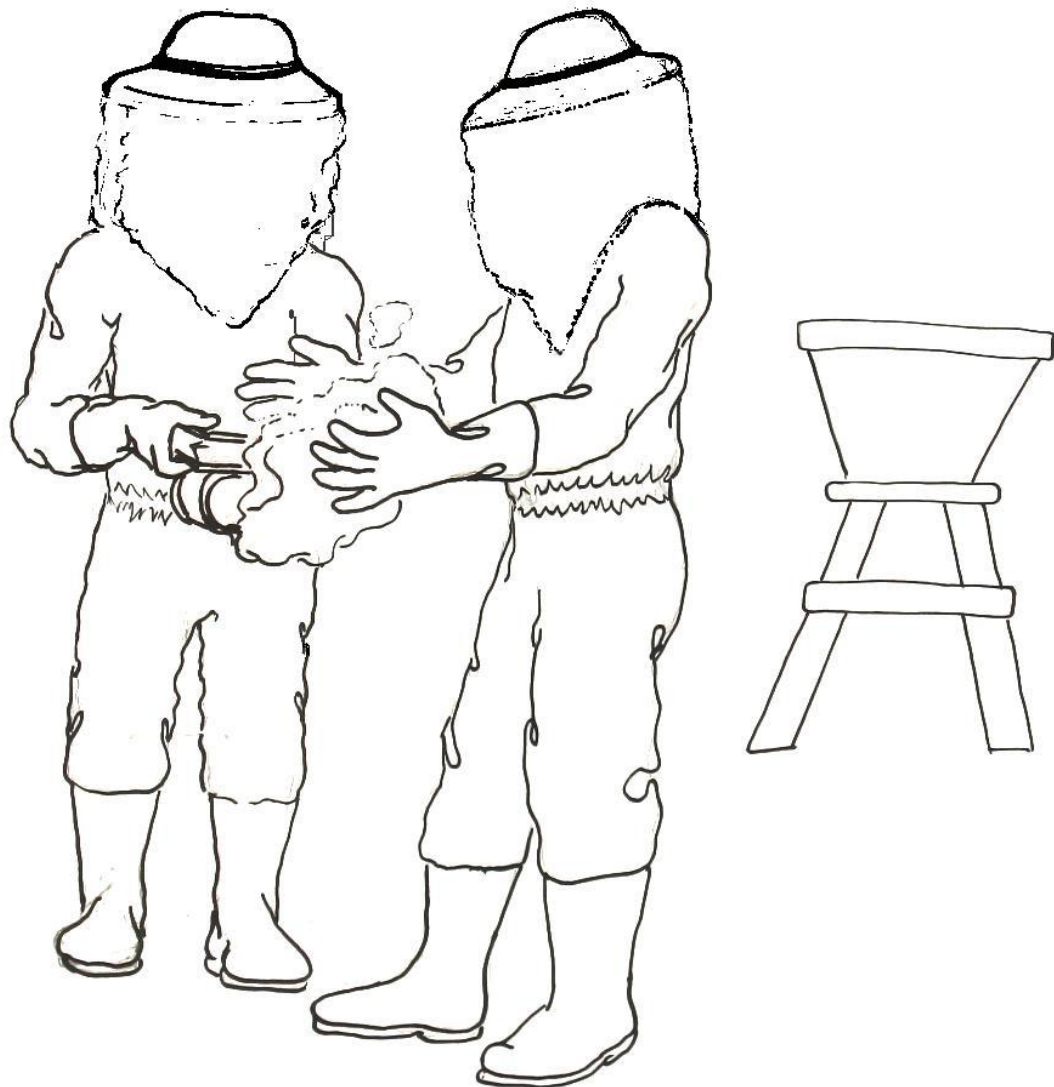
"Stretcher" handles can easily be added to the Kenya Top-Bar Hive as shown in the background images. Such handles can make it easier to carry fully loaded hives and provide a handy resting spot for combs removed from the hive during inspections. Handles and/or ropes also allow the KTBH to be hung from posts or tree-limbs to reduce damage caused by ants and bush fires and prevent knock-down by wind and domestic animals. The image in the foreground shows a more thief-proof tying system with the ropes in different colors to show the separate cords-- and with a pulley system that allows hives to be lowered for management (or even to move to a hive stand once colonized). Small nails can prevent ropes from sliding. Sheep's wool can be wrapped around the rope to prevent pests (mostly ants, they don't like climbing across sheep wool).



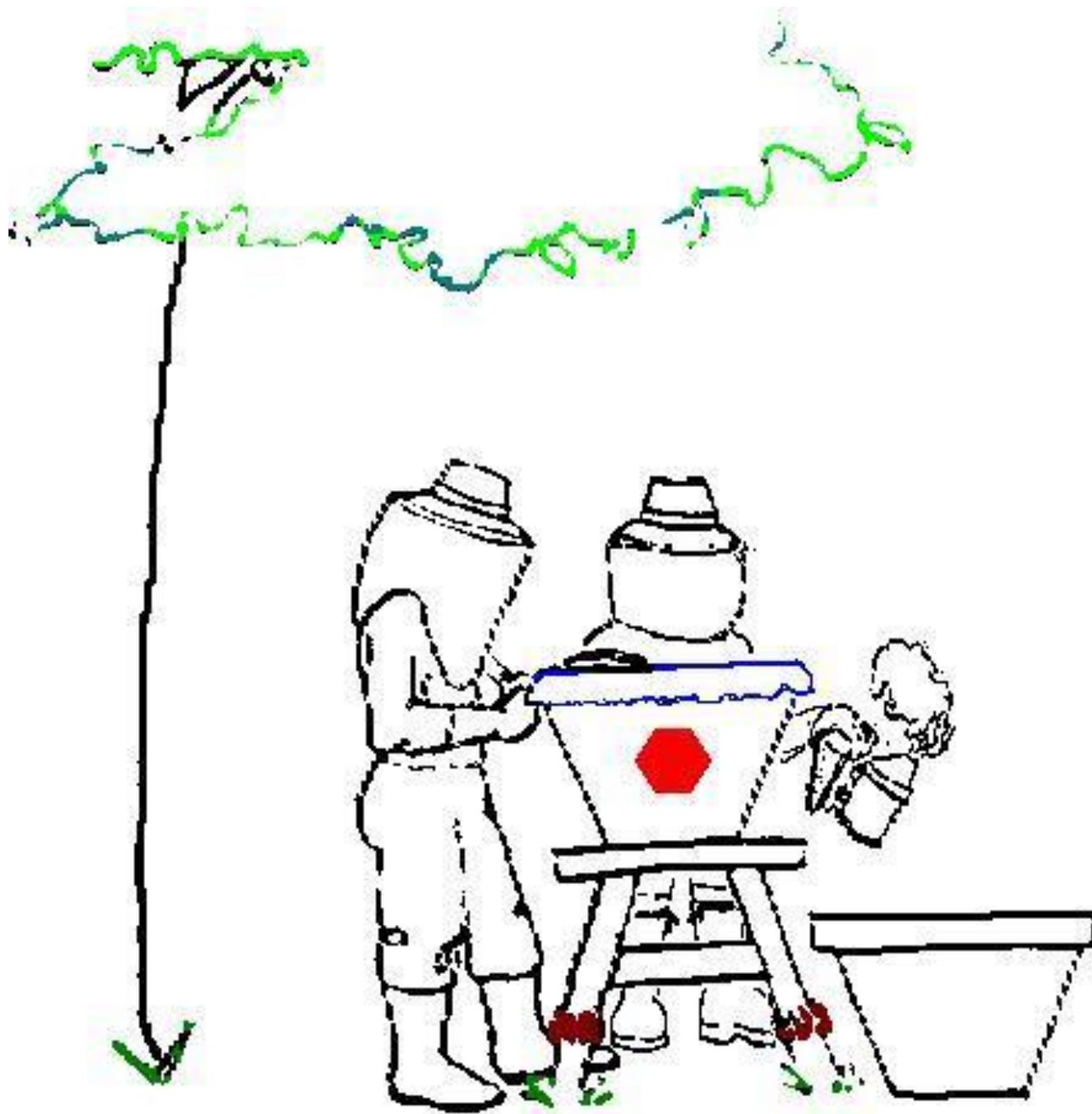
Apiaries should be positioned a minimum of 150-200 meters from habitations, roads or footpaths and locations where animals are staked or enclosed.



Apiaries should be established where hives will receive shade during the hottest portions of the day and where bees will have access to water and nectar and pollen bearing plants. Put hives in the same kinds of places that you would want to sit all day—bee colonies are comfortable in the same kind of locations as people! Hives should be arranged so that entrances all face outwards (or all inwards) so to create a safe zone, out of bees flight paths and the sensory periphery of bees, allowing easier apiary maintenance and hive manipulation. (The reddish bands on the hive stands are shea butter processing residue often used to protect wood and discourage ants from climbing into hives.)



Smoke can be used as a repellent to keep bees from stinging. Smoke your skin before you put on your protective clothing, especially around the face and hands-- then smoke your protective clothing, especially the veil and gloves. Remember to keep your protective clothing clean, it should smell only of smoke-- not of perspiration the smell of which can be tracked by angry bees nor of alarm pheromones that the bees use to mark areas where they have stung to draw other bees there to continue to defend themselves. The crushed leaves of the casava plant also work as a good bee repellent.



Although it is sometimes preferable to work at night, several techniques can be used to reduce stinging incidents if hives must be worked during the day.

After smoking an occupied hive (shown marked with a hexagon on the hive on the left) a wet towel or cloth should be placed on top of the hive.

The hive is then carried away from the original location and placed in a well shaded spot.

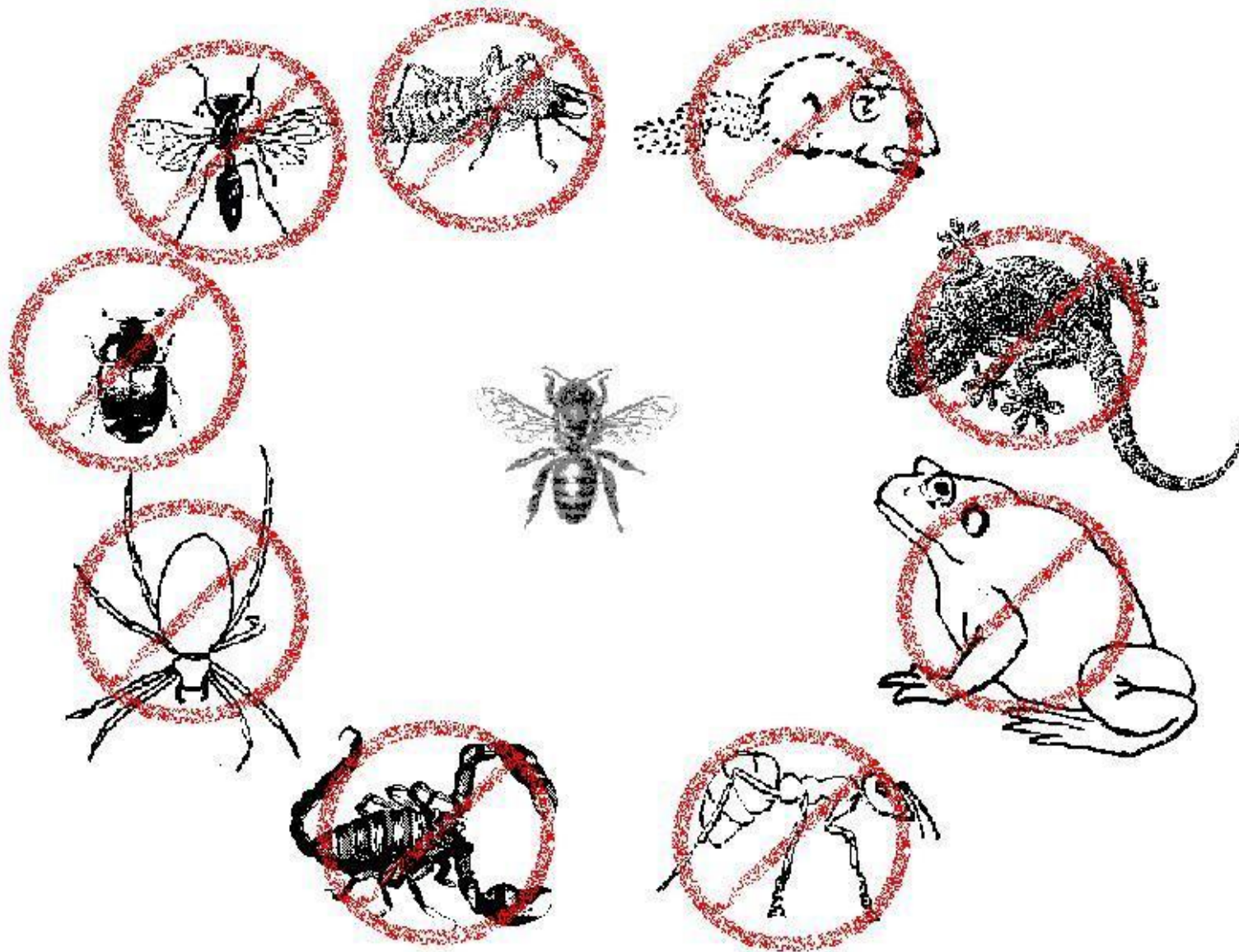
(The reddish bands on the hive stand are shea butter processing residue often used to protect wood and discourage ants from climbing into the hive.)



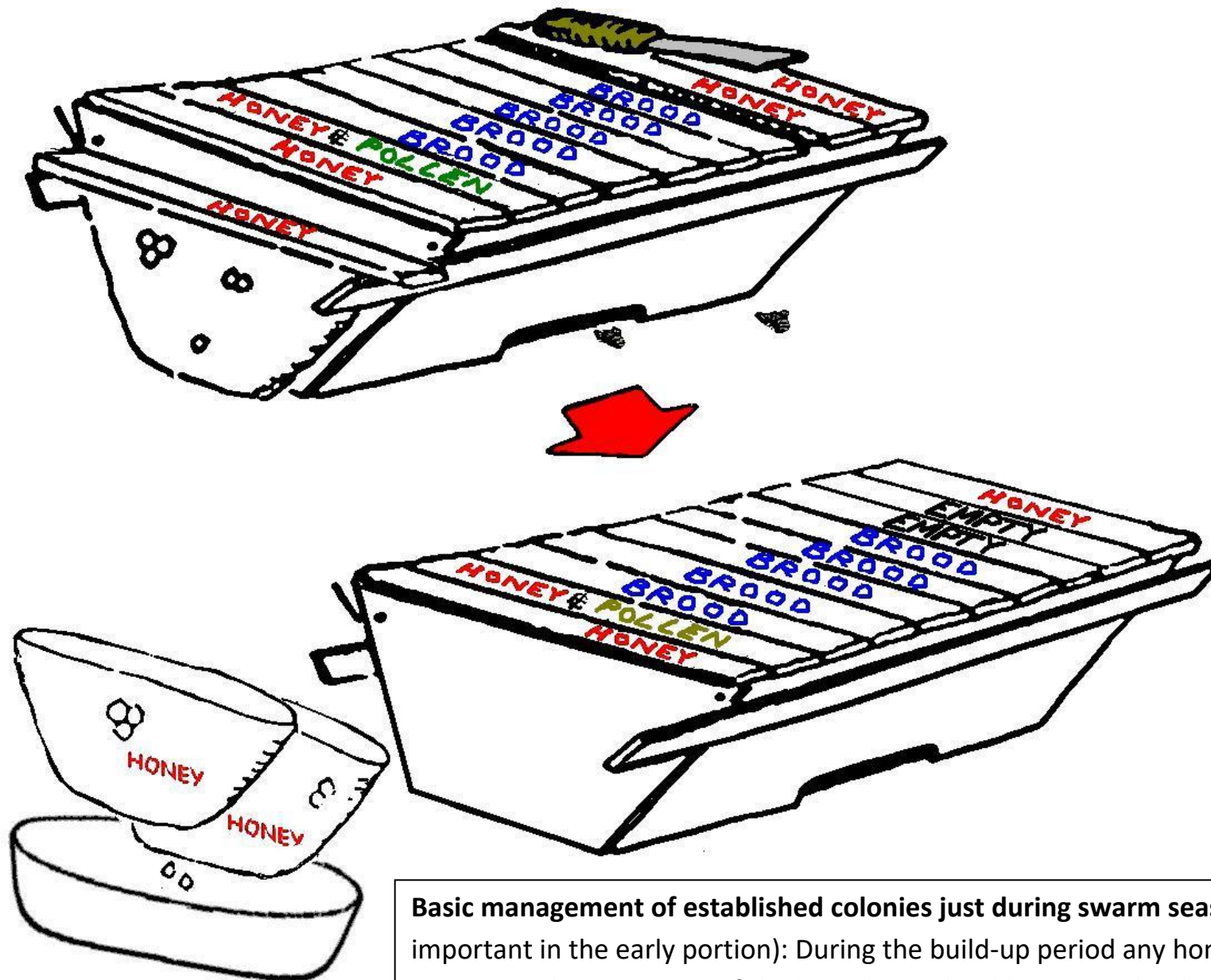
An empty hive is set in the location originally occupied by the colonized box. Bees leaving the hive and returning foragers will return to the original location and enter the empty box.

As combs are removed from the occupied box the wet towel should be draped back over the empty slot left by the removal thus reducing the number of bees leaving the hive.

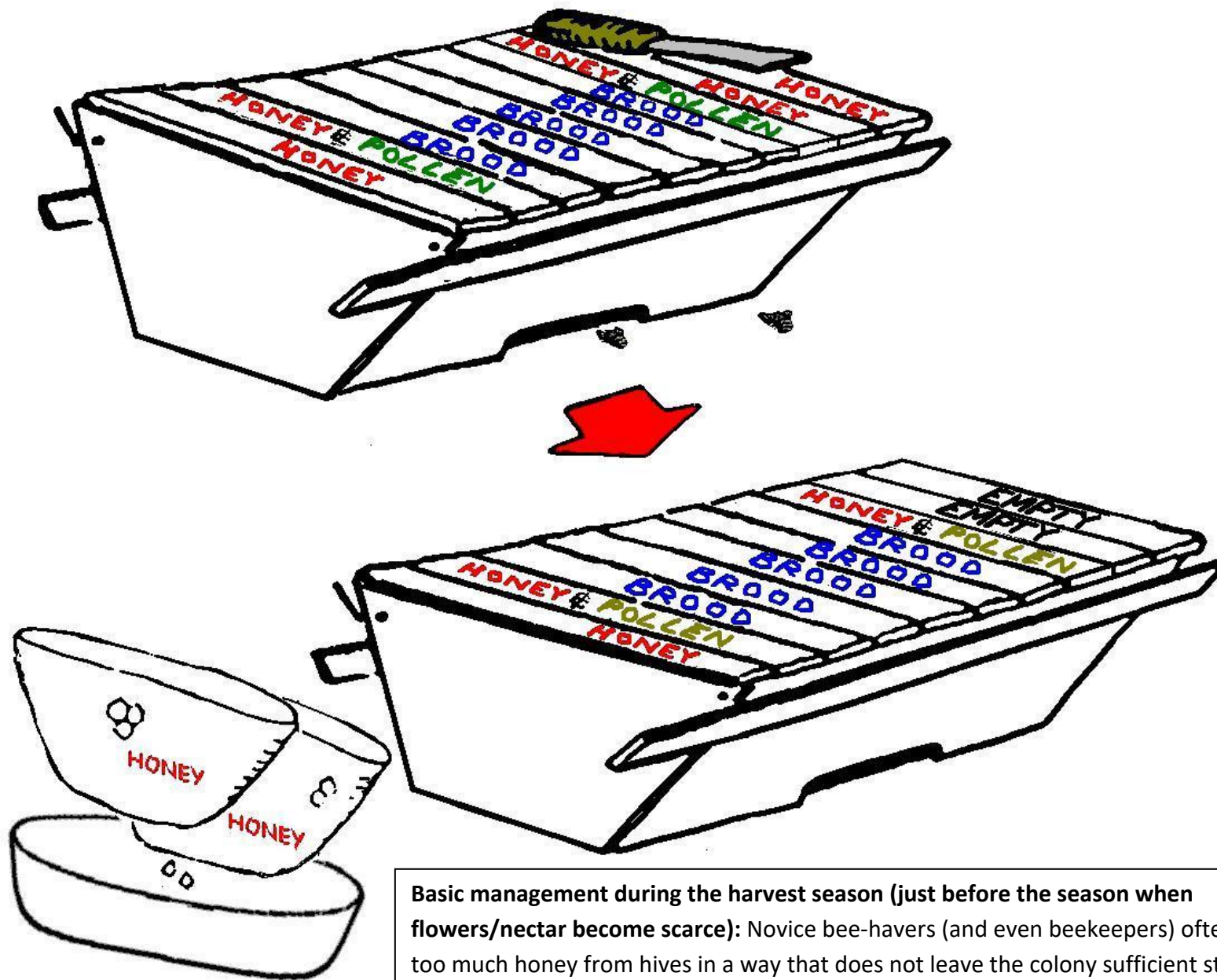
When revisions are complete the hive is returned to its original position and the originally empty box (which should now have many bees in it) is opened and the bees inside smoked or brushed out at a convenient location so they can fly home.



Ants, wasps, spiders, scorpions, lizards, and rodents may occupy hives and prevent bees from taking up residence. During the swarm season regular visits should be made to apiaries to ensure that hives unoccupied by bees are free of pests. Wood-destroying termites can cause damage to the structure of hives or hive stands. African hive beetles can consume honey and foul combs. Toads can consume great numbers of bees but often go unnoticed since they are nocturnal in habit.

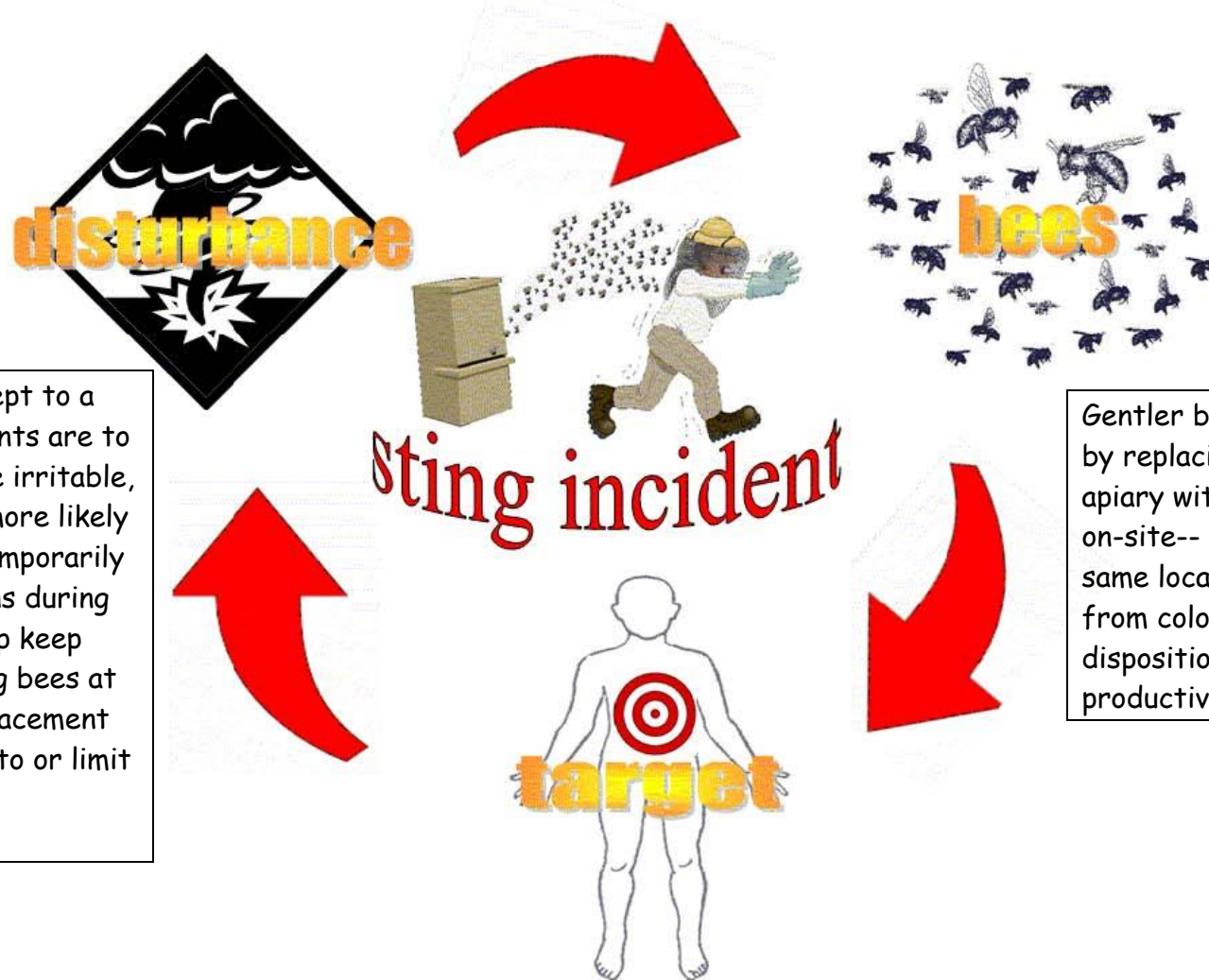


Basic management of established colonies just during swarm season (especially important in the early portion): During the build-up period any honey stores restricting the expansion of the brood nest should be moved or harvested to supply room for the queen's increased laying. Empty topbars or those from which honey was cut should be placed on the outside of the brood combs but inside insulating combs that contain some honey.



Basic management during the harvest season (just before the season when flowers/nectar become scarce): Novice bee-havers (and even beekeepers) often remove too much honey from hives in a way that does not leave the colony sufficient stores to support them through periods of minimal nectar availability. To better provide for the bees' needs during dearth periods it is suggested that comb only be harvested from one end of the hives (to establish a standard it is recommended that this always be the right side, as one is facing the entrance of the hive). At this time of year if there are any empty combs or top bars from which honey has been cut put them on the outside of the combs of honey (and pollen) left for the bees to get through the dearth period.

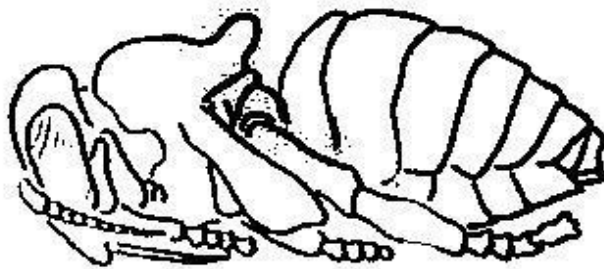
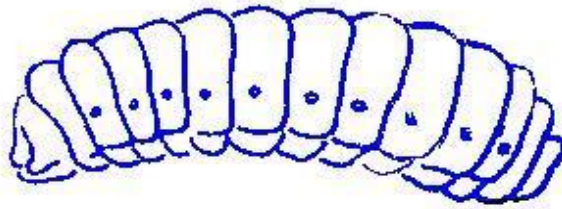
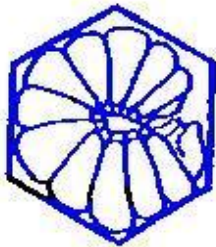
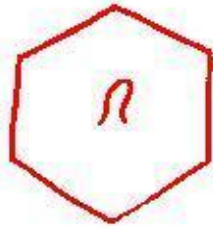
It is important for beekeepers to learn how to avoid major sting incidents by controlling the components of the "stinging triangle".



Disturbances should be kept to a minimum if stinging incidents are to be avoided. Hot bees are irritable, defensive bees that are more likely to sting. Moving hives temporarily into shady, cooler locations during hive manipulations will help keep bees manageable. Working bees at dusk, and proper apiary placement will also reduce exposure to or limit the reaction of bees to disturbances.

Gentler bees can be produced by replacing queens within an apiary with queens reared on-site-- from colonies of the same locally proven stock-- from colonies with a gentler disposition, but of at least equal productivity.

Apiarists can prevent themselves from becoming targets through the use of smoke to mask one's body odours and by properly using personal protective equipment. In addition, apiaries should be positioned a minimum of 150-200 meters from habitations, roads or footpaths and locations where animals are staked or enclosed.

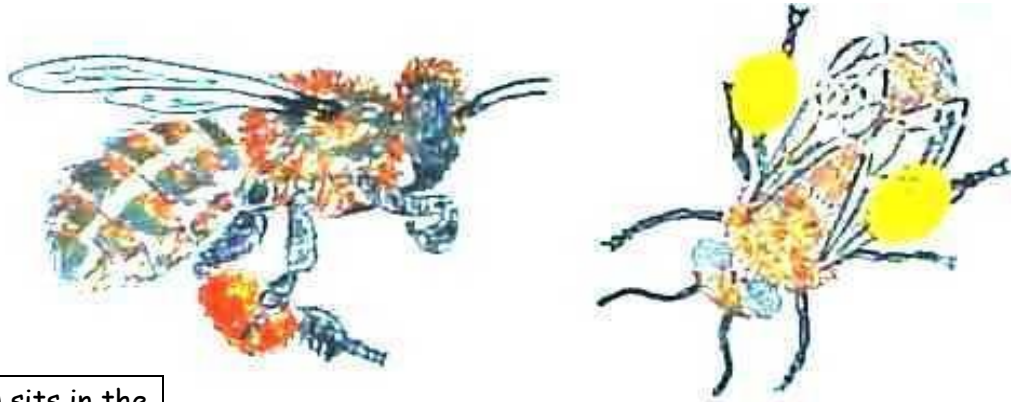


The three immature phases of bees are egg, larva and pupa.

The time it takes for honey bees to grow from egg to adult is different for queens, workers, and drones. Queens grow the fastest, taking only 16 days to develop completely, because the colony needs to replace a queen quickly if something happens to her. Workers take 21 days to develop, which is a medium amount of time that gives the colony a steady supply of new workers. Drones take the longest time at 24 days because they are bigger and their bodies need more time to form properly. The reason bees develop into different types is because of what they are fed as larvae—future queens eat only royal jelly (a special rich food), while workers and drones eat royal jelly for only a short time before switching to a mixture of pollen and honey. This shows that what baby bees eat and how long they grow determines whether they become a queen, worker, or drone.

Bees are very important in the pollination of many domesticated plants.

Can you identify the main parts of the plant and their function?



A complete flower has four main parts that work together for reproduction.

The pistil (female part) sits in the center and has three sections —the sticky stigma at the top that catches pollen, the style which is a tube connecting to the ovary at the bottom where seeds form after pollination occurs.

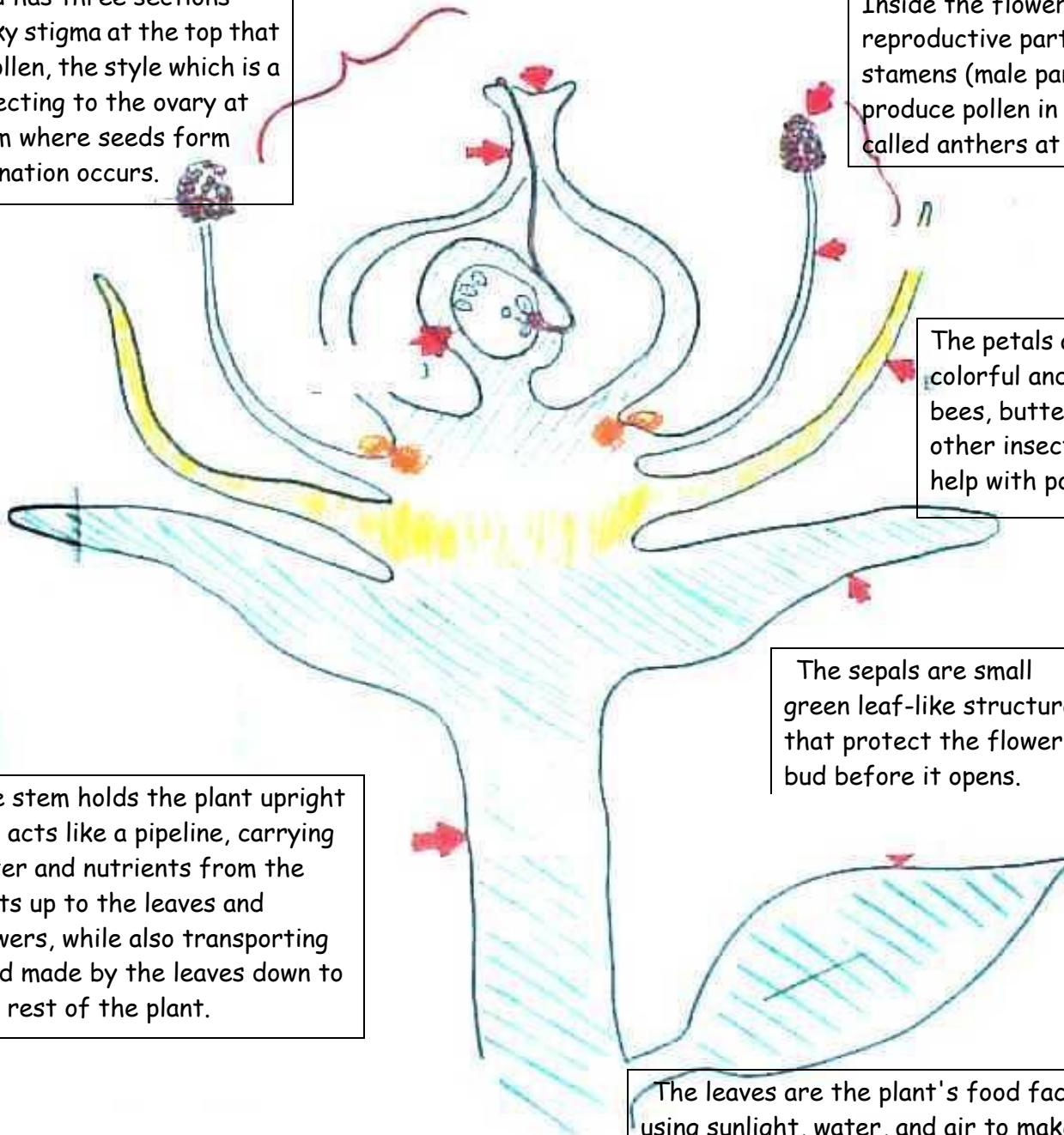
Inside the flower are the reproductive parts: the stamens (male parts) produce pollen in small sacs called anthers at their tips,

The petals are usually colorful and attract bees, butterflies, and other insects that help with pollination.

The sepals are small green leaf-like structures that protect the flower bud before it opens.

The stem holds the plant upright and acts like a pipeline, carrying water and nutrients from the roots up to the leaves and flowers, while also transporting food made by the leaves down to the rest of the plant.

The leaves are the plant's food factory, using sunlight, water, and air to make food through a process called photosynthesis, and they also have tiny holes that allow the plant to breathe and release excess water.





Drones, such as that above shown beside a worker for comparison, are often mistaken by novice beekeepers as queens. Drones can be distinguished by its large eyes that touch in the center of the head when viewed from above. The abdomen of the male bees is rounder at the end than for the workers or queens. The abdomens of drones are usually darker than that of the queen or workers and have less noticeable banding.



Drones are male bees that are bigger than workers and have very large eyes that help them see queens flying in the air. They have no stingers, no pollen baskets, and cannot make wax because their only job is to mate with queens from other hives. After mating just one time, the drone dies. Drones do not collect food or do any work in the hive—they only exist to mate and help create genetic diversity in the bee population.



The queen is most easily located amongst the seething masses of her daughters not by her size but by her color. She is usually of less varied and lighter coloration, and her legs are slimmer and usually an orange-blonde color-- as compared to dark brown for drones and workers. The top of the thorax of the queen is usually smooth and shiny which, as shown here, allows beekeepers to glue small tags to them to make them easier to find and to track their age and performance.





The queen bee has a long, large abdomen because she needs space for her egg-laying organs. She can lay up to 2,000 eggs every day during the busy season. Unlike worker bees, she does not have pollen baskets on her legs or the ability to make wax, because she does not collect food or build honeycomb. Her main job is to lay eggs and produce special scents that control the behavior of all the other bees in the hive.





Worker bees conduct all the duties of hive maintenance and food gathering for the colony. The top of the thorax of the workers is usually hairy (until they are old and running down). The worker above is relatively young. Why does her thorax appear shiny? Because a parasitic Varroa mite is sitting there.



Worker bees have special body parts that help them do many different jobs. They have small baskets on their back legs to carry pollen, and they can produce wax from their bodies to build the honeycomb. They have stingers to protect the hive from enemies, but they die after stinging. Worker bees also make a special food called royal jelly to feed baby bees and the queen. They do all the work in the hive—collecting food, building, nursing babies, and guarding the colony.