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TOBACCO, PYRETHRUM,
SPICES AND DRUGS

Tobacco

Pyrethrum

Pepper

Chillies

Quinine

Tobacco

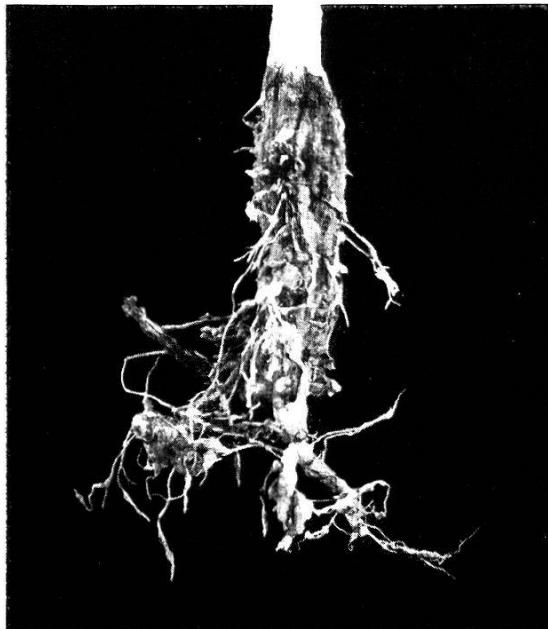
In many countries with warm and temperate climates tobacco as an annual crop plays an important part. A great many pests are known which destroy tobacco leaves by eating the tissue or sucking the sap, thus reducing their value. As well as insect pests, virus diseases also occur very frequently. As *sucking insects* are one of the main *vectors of viruses*, a brief mention of virus diseases and their transmission must be made. Tobacco mosaic reduces the yield and lowers its quality. Infection of a plant is recognized by curled leaves stained yellow or by light and dark mottlings as well as blistering and malformation. Leaf roll disease manifests itself by misshapen and curled leaves, while wilt disease causes foliage to become flaccid. The two latter diseases, although occurring less frequently than mosaic virus, also reduce yield and quality. The symptoms of viroses depend on the causative agent, host plant, local conditions and temperature, as well as air humidity. Characteristic symptoms are often evident on all parts of a plant; sometimes, however, there are no distinct external signs so that infection can easily be overlooked. One virus may attack one variety of plant and leave other varieties almost or completely untouched.

Viruses, so small that they cannot be seen under the ordinary microscope, invade the cell protoplasm where they multiply. Translocating from one cell to another, they finally infest the plant more or less completely. Disease can be caused by an extremely small number of viruses. In the field transmission may occur mechanically by infected plant sap entering another plant through damaged tissue. This may happen when plants touch each other or when wind causes injuries on the leaves by rubbing them together or breaking off the hairs. The same may happen when workers or animals go through the field. The more frequent and probably most important transmitters are sucking insects such as aphids, plant bugs, thrips, coccids and others. When feeding, the insects take up the pathogenous organisms and when piercing another plant, they introduce some infected saliva into the wound. The extremely high virulence of the smallest amounts of aphid saliva was shown by tests in which tobacco mosaic virus was transmitted from an infected to a healthy plant by one single infested aphid; the dreaded swollen shoot disease of cocoa was transmitted by three infested mealybugs. An efficient control measure against virus diseases is the extermination of sucking insects, especially the winged forms of aphids. Both tobacco seedbeds and fields should be frequently treated with insecticides as a preventive. Disinfection of knife blades with formaldehyde or washing soda when cutting the plants is a further precaution against the spreading of virus diseases.

Tobacco

(*Nicotiana sp.* = various species and varieties)

Most important pests: 677, 678, 679, 682, 683, 684, 685, 686, 690, 701, 702, 703, 707, 708, 711, 712, 714, 715, 716, 717, 718, 722, 724



Plants turn yellowish, grow reluctantly or wilt and die. Roots beset with spherical galls of various sizes or elongated ones, set in close rows. Roots shaggy, broom-like. Yields seriously reduced.

root

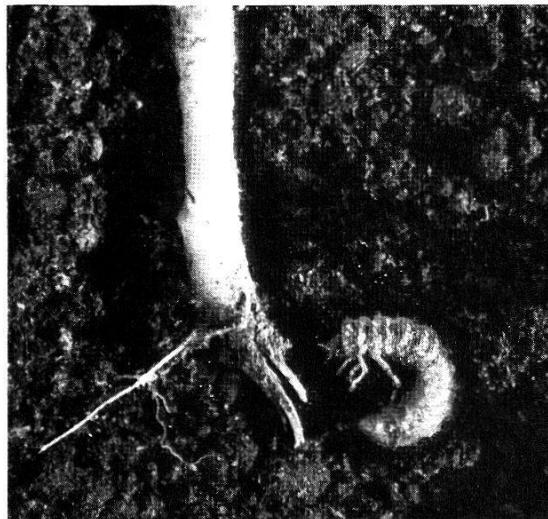
Meloidogyne sp.
Root knot nematode.

NEMATODA

677

Root-knots contain pear-shaped female endoparasitic nematodes (see page 37).

Distribution: widespread



Plants wilt and die. Roots destroyed by white grubs found near the roots.

Various species of:
Melolonthinae and Rutelinae
Larvae = white grubs.

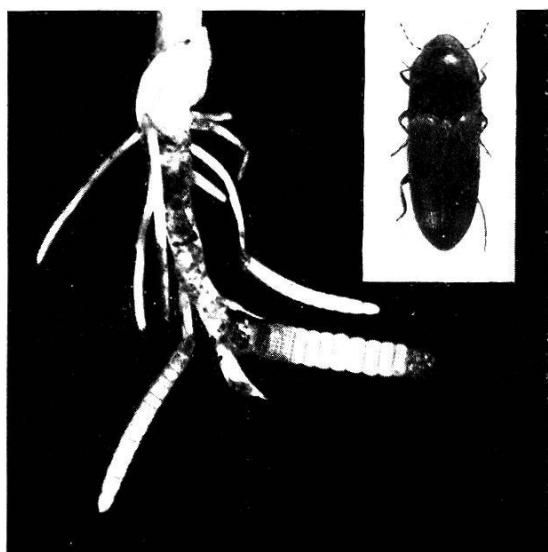
COLEOPTERA; Scarabaeidae

678

Robust, large, usually brown to dark beetles (see No. 117), which feed on foliage and deposit their eggs in the ground. The halfmoon-shaped larvae, provided with well developed legs, feed on roots. The pest is on the wing during and after the rainy season.

Distribution: widespread

root



679

Plants wilt and die. Roots eaten away; root neck below the soil surface traversed by fine channels, in which yellow larvae are visible.

Drasterius sp.

Heteroderes sp.

Agriotes sp.

Clickbeetle larvae = Wire worms.

COLEOPTERA; Elateridae

Generally dark coloured, fusiform and more or less flattish beetles of various sizes. The antennae are saw- or comb-like. A click on the underside of the prothorax enables them to jerk from dorsal to ventral position. The eggs are laid in the ground. The larvae are light yellow to reddish-brown, almost round, elongated cylindrical and heavily chitinized. The last abdominal segment ends in a point and bears 2 jagged appendages. The pest attacks the roots and the lower portions of the stem. Development period of larvae: several months.

Distribution: widespread

stem

Young plants topple over and wilt. Roots eaten away or separated from the stem. Galleries of up to 1 cm in diameter within the area of the root system.

Gryllotalpa africana Pal.

African mole-cricket.

ORTHOPTERA; *Gryllotalpidae*

680
7, 422

Cylindrical mole cricket, about 30 mm long with strikingly broadened fore-legs (developed for digging). The thorax and abdomen are dark brown, the legs lighter. The greyish-brown wings are short and folded over the body. The insect bears two long, tail-like appendages at its rear end. It lives underground, making burrows in which it breeds. Each female may lay 150-200 yellowish-white eggs. Damage is done through gnawing off the roots when making burrows and galleries. One generation a year. Peak in April/May.

Distribution: Africa

Young plants topple over, stem below the soil surface bitten off.

Scapteriscus vicinus R. & Heb.

West Indian mole cricket.

ORTHOPTERA; *Gryllotalpidae*

681

Reddish-brown to yellowish-brown mole cricket, about 30 mm long (see Fig. 10). Its biology is similar to that of *Gryllotalpa africana*. One generation a year. Injurious also to sugar cane and sweet potato.

Distribution: The West Indies

Young plants topple over. Stems gnawed off immediately above the ground, causing deep wounds. Often leaf base also injured. stem

Gonocephalum acutangulum Fairm.

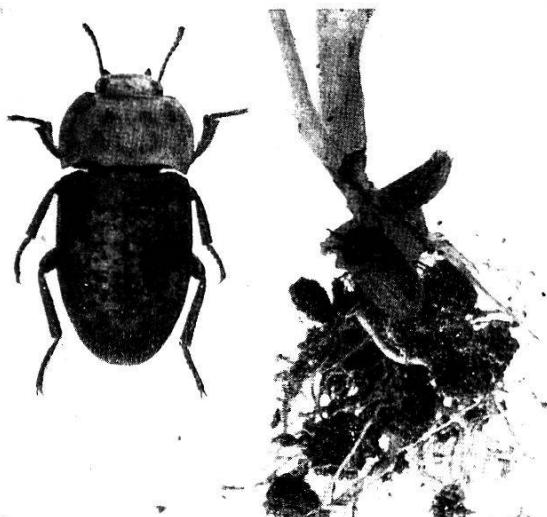
Larvae = false wireworms.

COLEOPTERA; *Tenebrionidae*

Broad-oval, reddish-brown to black beetle, 7-9 mm long, the elytra of which are clothed with short grey hairs and usually covered with earth debris. The beetle has a long life span and is sexually mature only after several months. It feeds on the stem base. Oviposition takes place in the ground. The brown, lustrous, wiry larvae are about 15 mm long when full grown. They live underground on decayed plant material or eat the most tender rootlets of tobacco. Larval development: about 4 months. Pupal stage: 6-8 days. Development period of one generation: 10-12 months.

Distribution: Africa

682



Young plants topple over due to stem base being eaten off immediately above or below the ground.

Opatrium sabulosum L.

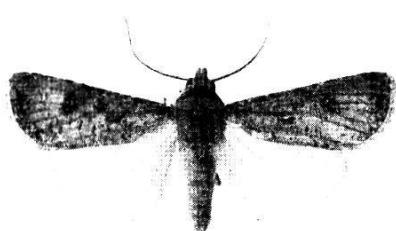
Larvae = false wireworms.

COLEOPTERA; *Tenebrionidae*

683

Black, dull, broad-oval, flat beetle, about 8 mm long, which deposits its eggs in the ground. The larvae are round, light-brown, heavily chitinized (not to be mistaken for wireworms). They live on plant material of various kinds. The adults gnaw the stem base. Development cycle of one generation: 1-2 years. Long life span of adults.

Distribution: Europe



Stem of young plants gnawed off above the ground. Plants toppled over. At the stem base, 1-2 cm below the ground, a greyish-brown, hairless caterpillar is found. Leaves often irregularly eaten away by numerous small, dark green caterpillars living gregariously on the underside.

684

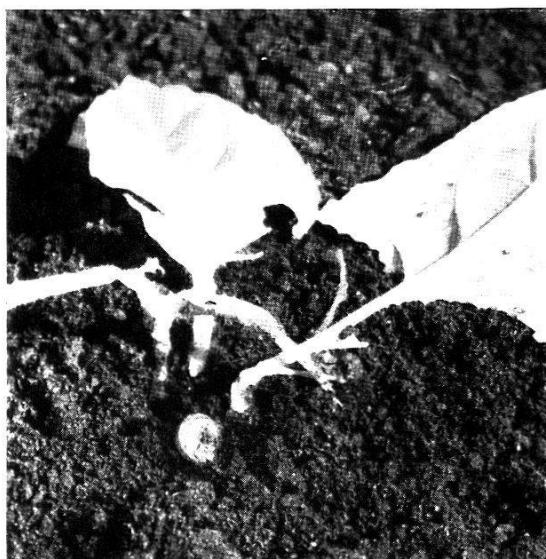
9, 108

Euxoa (Agrotis) segetum Schiff.

LEPIDOPTERA; *Noctuidae*

see page 66 (Coffee)

stem



685

375, 805

Young plants topple over and wilt. Stem gnawed off above the ground. Presence of brownish-grey, hairless, halfmoon-shaped, curled up caterpillars, 1-2 cm below the ground.

Scotia (Agrotis) ypsilon Hufn.
Greasy cutworm.

LEPIDOPTERA; Noctuidae

Moth with greyish-brown forewings, marked with a kidney-shaped spot in the centre and 3 wedge-shaped, dark spots as well as indistinct faint crosslines. The hindwings are pale and plain. The wings expand to 40-50 mm. The eggs are deposited on damp soil. The caterpillars are first greenish-grey, changing later on to brownish-grey; they are hairless and bear pale lateral lines. Development period of one generation: 5-6 weeks. Several generations.

Distribution: widespread

Stems of young plants gnawed off at ground level. Older plants have the midrib of leaves near the stem destroyed. Leaves droop.

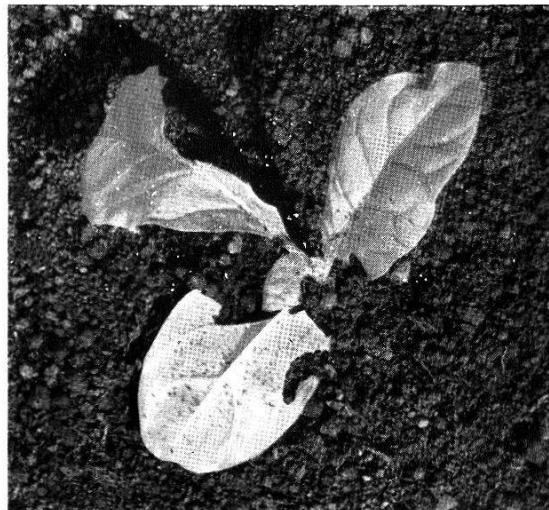
Feltia subterranea F.
Granulate cutworm, Cachazudo.

LEPIDOPTERA; Noctuidae

686

The adult moth has yellowish-brown forewings and white hindwings, while the abdomen is grey. The eggs are deposited singly or in groups on the leaves. The caterpillars are dull brown with lighter yellowish subtriangular areas irregularly outlined along the back on either side. Their skin is granulated. Development period of one generation: 5-6 weeks.

Distribution: North, Central and South America



Stem base and smallest leaves of young plants devoured. stem

Brachytrypus membranaceus Drury
Tobacco cricket.

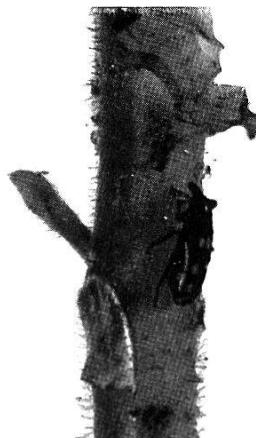
ORTHOPTERA; *Gryllidae*

687

64, 150

Very strong, brownish-yellow cricket, 50-60 mm long (see Fig. 9), which lives in burrows underground, where it also deposits its eggs. It becomes very active at night and is attracted by light. It attacks young plants, appearing mainly in May. One generation a year.

Distribution: Africa



Growth of young plants depressed. Stems with signs of gnawing and often deformed.

Paralixus truncatulus F.

COLEOPTERA; *Curculionidae*

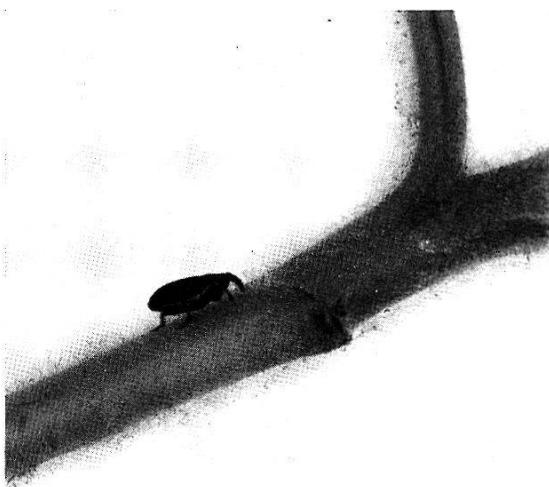
688

858

Slender, dark brown weevil, about 10 mm long, with 4 yellow dots near the seam of the elytra, and irregular grey dots on the sides. The snout is short and round. The weevil attacks the stem and root stock, producing small hollows by its feeding.

Distribution: India, Ceylon, Neu Guinea

stem



689

Plants chlorotic, their growth checked. Stems often with dark mottlings. Midrib of leaves with deep, often corky scars caused by feeding. Leaves slightly curled downwards and underdeveloped. Young plants die.

Trichobaris trinotata Say
Potato stalk weevil.

COLEOPTERA; Curculionidae

Bluish-grey weevil, about 5 mm long, which lays its eggs in small hollows in the stem, where the hatching larvae mine. Development period of one generation: 6-8 weeks. Several generations.

Distribution: Mexico

690



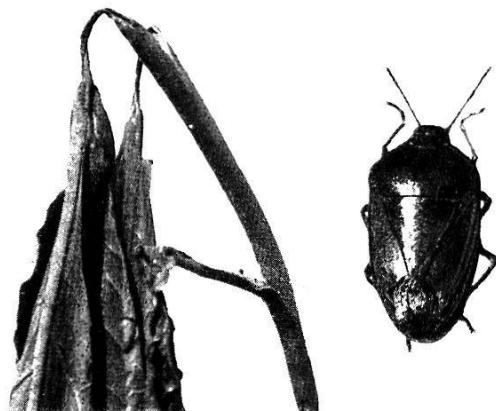
Stem of young plants (in seedbeds) with bulging swellings near the lower leaves. Inside of stem irregularly mined. Plants stunted, their growth seriously impaired. Upper leaves chlorotic and underdeveloped.

Phthorimaea heliopa Low.

LEPIDOPTERA; Gelechiidae

Small moth with ochrous to reddish-brown forewings and silver-grey hindwings, the inner margin of the latter bearing long fringes. The wing span reaches 10-12 mm. The eggs are deposited on the leaves and stems. The whitish caterpillars have a dark brown head and a brown thorax. They either tunnel into the stem from the leaves or penetrate directly into it, causing it to swell. Development cycle of one generation: about 5 weeks, several generations overlapping.

Distribution: Africa, Asia Minor, India, Ceylon, Indonesia, Australia, Fiji Islands



Stems and midribs of leaves with light brown sunken pits. Irregular leaf development. Leaves wilt and droop, due to punctures in the leaf stalk.

Nezara viridula L.
Green plant bug.

HETEROPTERA; Pentatomidae

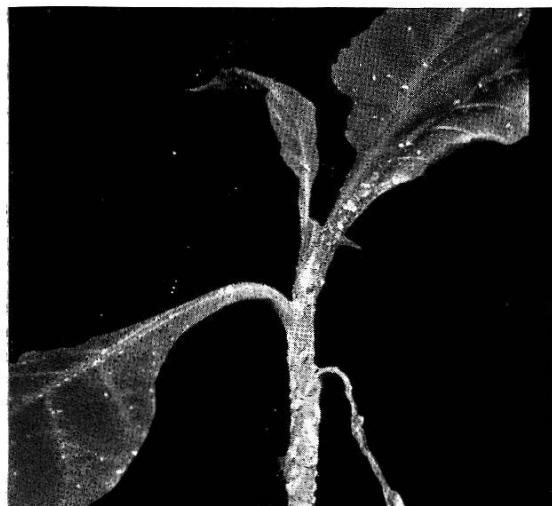
stem

691

250, 312, 480
638, 841

Robust, broad-oval plant bug, about 15 mm long, emerald-green, which lays its eggs in two rows on the leaves and stems. The red and yellow nymphs hatch after about one week. After 5 moults, which take place within 4-6 weeks, the adults emerge. Several (3) generations each season. *N. viridula* also attacks many other crops, such as maize and rice.

Distribution: widespread



Stem, leaf stalks and lower surface of leaves beset with white fluffy bodies. Formation of sooty mould. Young plants stunted.

Planococcus citri Riso
Citrus mealybug.

HOMOPTERA; Pseudococcidae

692

100, 349, 380
423, 530, 779
873

see page 288 (Citrus)

Plants chlorotic. Growth disturbed. Lower leaves turn yellow and fall precociously.

Ditylenchus dipsaci Kühn.
Stem nematode.

NEMATODA

693

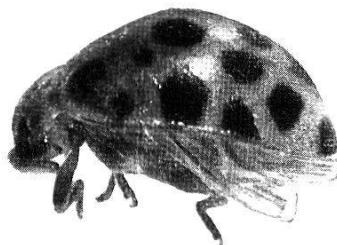
174

Thin, endoparasitic nematode, 1-1.8 mm long, which develops several generations a year (see page 37).

Distribution: widespread

leaves

694



Leaves devoured, plants often stripped completely.

Epilachna 28-maculata Motsch.

COLEOPTERA; Coccinellidae

see page 192

Distribution: Asia, Australia



Leaves more or less devoured, often stripped to the midrib. Seedbeds preferred.

Lema bilineata Germ.
Tobacco slug.

COLEOPTERA; Chrysomelidae

695

Reddish-brown to yellowish-brown beetle, about 10 mm long. Its prothorax is much narrower than the elytra. The latter have a black lateral stripe and a black shoulder hump. The eggs are laid in clusters on the underside of the leaves. The shiny larvae resemble small slugs. Development period of one generation: 3-4 weeks. Several generations each season.

Distribution: South Africa, South America

Plants in seedbeds preferred. Leaves of young plants riddled with holes.

Epithrix hirtipennis Melsh.
Tobacco flea beetle.

696

COLEOPTERA; Chrysomelidae

Small, elongated-oval beetle, 1-1.5 mm long, lustrous dark metallic. The legs and antennae are pale yellow. The eggs are laid in damp soil. The larvae feed on roots or other vegetal material. Two generations a year.

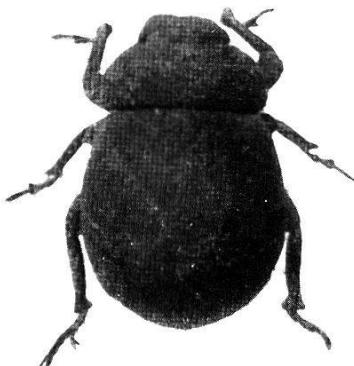
Distribution: tobacco growing areas of U.S.A

Young tobacco leaves eaten away from the margin inward to the midrib, the veins only remaining intact.

leaves

Mimaulus thesii Mshl.

COLEOPTERA; Curculionidae



697

Greyish-brown, round to oval weevil, about 4 mm long, with a short and broad snout. The female lays its eggs in the ground. Development period of one generation: several months.

Distribution: Rhodesia

Several leaves spun together and curled downwards. Signs of feeding as transparent parchment-like patches.

Psara periusalis Walk.

Tobacco leaffolder, Pega-Pega.

LEPIDOPTERA; Pyralididae

698

Greyish-brown moth with a wing span of 25 mm, which fixes its eggs on the underside of the leaves. The greyish-green caterpillars roll the leaf margin up and spin a web. Development cycle of one generation: 5 weeks. Several generations.

Distribution: U.S.A., South America

Leaves with mines of various sizes and drooping. Leaf stalks beset with small caterpillars.

Phthorimaea operculella Zell.

Tobacco leafminer.

LEPIDOPTERA; Gelechiidae

Small moth with narrow, fringed wings. The forewings are greyish-brown with dark and ochrous dots, while the hindwings are plain grey to dirty white; they expand to about 15 mm. The eggs are laid on the leaves. The greenish to yellowish-white caterpillars penetrate into the leaves, feeding on leaf tissue between the upper and lower epidermis. They also eat their way into the leaf stalks and sometimes into the stem. Development period of one generation: about 4 weeks. Several generations.

699

Distribution: widespread

leaves **Leaves heavily attacked, often only midribs left intact.**

Diacrisia obliqua Walk.
Common hairy caterpillar.
LEPIDOPTERA; Arctiidae

700
320, 865

see page 438 (Jute)

Leaves devoured; plants often stripped completely.

Protoparce sexta Joh.
Tobacco hornworm.
LEPIDOPTERA; Sphingidae

701

Hawk moth with a wing span of 80-100 mm. The forewings are greyish-brown, crossed by a faint white zig-zag line, while the hindwings, of the same colour, are marked with 4 dark, wavy crossbands, between which the wings are dirty white. There is a greyish-brown stripe along the dorsal side of the abdomen, while the sides of the segments are yellow. The eggs are deposited on the leaves. The greenish caterpillars have pale, oblique, lateral stripes and a reddish to yellow dorsal horn at the posterior end of the body. They are ravenous feeders. Development period of one generation: about 5 weeks, several generations being possible.

Distribution: U.S.A., South America, the West Indies

Large leaves with holes. Stem and shoots often traversed by mines. Plants turn yellow above bore-holes.

702
197, 826

Heliothis obsoleta F.
False budworm, or American cotton bollworm.
LEPIDOPTERA; Noctuidae

see page 418 (Cotton)



703
32, 194, 321
29, 662, 837
867

Leaves with irregular, brownish-red patches. Numerous small, greenish to brownish caterpillars on the underside of leaves. Leaves devoured by larger caterpillars or stem base gnawed off (see No. 685).

Prodenia litura F.
Cotton worm.

LEPIDOPTERA; Noctuidae

see page 423 (Cotton)

Young plants devoured, often stripped bare. Injury occurs in seedbeds.	leaves
<i>Laphygma exigua</i> Hb.	
Beet armyworm.	
LEPIDOPTERA; <i>Noctuidae</i>	704
see page 409 (Cotton)	195, 660, 807
Several generations during the season.	
<i>Distribution:</i> Europe, Africa, India, U.S.A., Japan	
<hr/>	
Leaves injured by feeding (in seedbeds as well as in the field).	
<i>Zonocerus elegans</i> Thunb.	
Elegant grasshopper.	705
ORTHOPTERA; <i>Acridiidae</i>	35, 344, 808
see page 79 (Coffee)	
<hr/>	
Leaves more or less devoured. Seedbeds preferred.	
<i>Catantops opulentus</i> Karsch.	
ORTHOPTERA; <i>Acridiidae</i>	706
Lustrous green grasshopper, 30-35 mm long, the thorax of which is marked with black central and lateral lines.	
<i>Distribution:</i> East Africa	
<hr/>	
	White to silvery flecks along the veins of leaves; on the underside the flecks are sunken pits. Heavy attacks lead to wilting of young plants.
	<i>Thrips tabaci</i> Lind. Potato thrips.
<hr/>	
<i>THYSANOPTERA; <i>Terebrantia</i></i>	
	707
	727, 810
Small, yellowish-brown thrips, about 1 mm long (see Fig. 13), which lays its eggs in the leaves and stems of young plants. Both nymphs and adults rasp the epidermis of the leaves and suck out the juice. Pupation takes place in the ground. Development period of one generation: about 3 weeks. Several generations.	
<i>Distribution:</i> widespread	

leaves **Leaves along the veins stained grey to yellowish, the underside scored with small, round pits. Growth severely impaired.**

Frankliniella fusca Hinds.
Tobacco thrips.

THYSANOPTERA; *Terebrantia*

708 Small, light-brown insect, 1-1.5 mm long, with fringed wings (see Fig. 13), which inserts its eggs in the leaf tissue. Adult and young thrips suck along the leaf veins. Development period of one generation: 8-10 days. Several generations each season.

Distribution: tobacco growing areas of U.S.A., South America

Leaves stained silvery-grey to reddish, and slightly curled up, the underside marked with small sunken pits close together.

Heliothrips haemorrhoidalis Bouché
Coffee thrips.

709 THYSANOPTERA; *Terebrantia*

528, 766

see page 287 (Citrus)

Distribution: Tropical and subtropical countries

Leaves of young plants speckled yellow to greyish-silvery, with minute black dots on the underside. Leaf tissue on the lower surface wrinkled and marked with sunken pits.

Anaphothrips obscurus Müll.
American grass thrips.

710 THYSANOPTERA; *Terebrantia*

Small, light brown insect, 1-1.5 mm long (see Fig. 13), with fringed wings. Several generations.

Distribution: widespread

Young plants stunted, their leaves misshapen and mottled. Mottled areas of leaves fall out later on. leaves

Cyrtopeltis tenuis Reut.
Tobacco Capsid.

HETEROPTERA; *Miridae*

Small, straight-sided Capsid, reaching 3 mm in size, with pale yellow or pale green eyes. The base of the antennae is black. The eggs are placed in the mid-ribs of the leaves. Both adults and nymphs suck the cell sap of stems and leaves. Development period of one generation: 4-6 weeks. Several generations during one tobacco season.

711
617

Distribution: Africa, India, Indonesia, Australia, Central America



Leaves dwarfed, mottled and brittle.

Dicyphus minimus Uhl.
Suck fly.

HETEROPTERA; *Miridae*

712

Small, slender, greyish-brown plant bug, about 3 mm long, with long antennae. The female lays its eggs in the leaves. Both adults and nymphs suck the cell sap of leaves and stems. Development period of one generation: 3-4 weeks. Several generations.

Distribution: tobacco growing areas of U.S.A. and South America

leaves **Virus disease: tobacco yellow dwarf. Attacks seedbeds in spring.**

Orosius argentatus Evans

HOMOPTERA; *Jassidae*

713 Small, pale yellow to greenish leafhopper. The eggs are not laid on tobacco. The pest attacks tobacco only when no other host plants (weeds) are available. It transmits virus diseases. Several generations.

Distribution: Australia, Philippine Islands, Fiji-Islands



Plants chlorotic and stunted. Leaves slightly mottled, their margin somewhat crinkly.

Empoasca tabaci Pruthi

HOMOPTERA; *Jassidae*

714

Small, pale green to yellowish leafhopper, 2-3 mm long, which lays its eggs in the leaf stalks or midribs. Both adults and nymphs suck the cell sap on the underside of the leaves. Development period of one generation: 3-4 weeks, several generations being possible.

Distribution: India

Leaves with indistinctly outlined areas of discolouring, wrinkled and heavily infested with sooty mould. Development of young plants impaired. Underside of leaves beset with numerous minute, almost transparent, oval, scale-like bodies.

715 *Bemisia tabaci* Genn.

Cotton white-fly.

817

HOMOPTERA; *Aleyrodidae*

see page 413 (Cotton)

Distribution: Africa, India

Leaves with indistinctly outlined discolorations and heavy infestation with sooty mould. Leaf development of young plants impaired. Leaves often wilt precociously.

leaves

Trialeurodes tabaci Bond.

HOMOPTERA; Aleyrodidae

716

Small, very frail insect, only 1.5 mm long, provided with 4 white wings. The eggs are laid on the leaves. The larvae are recognizable as minute, oval, frail, almost transparent shield-like bodies (see Fig. 16). Development cycle of one generation: 4-5 weeks. Several generations may occur.

Distribution: Brazil



Underside of leaves infested with dense colonies of small green aphids. Development of young leaves impaired, the leaves narrow and curled downwards at the tip. Leaf tissue brittle. Infestation with sooty mould. Plant growth severely checked.

Aphid transmits:

Tobacco ringspot virus
tobacco severe etch-virus
tobacco rosette disease
perforation disease of tobacco.

Myzodes persicae Sulz.
Tobacco aphid.

717

619, 728, 875

HOMOPTERA; Aphididae

Egg-shaped, green to yellowish-green or brilliant pink aphids, about 2 mm long. The antennae are never longer than the body. The frontal hump projects towards the centre at the base of the antennae. The siphons are slender, their posterior portion slightly thickened. The caudal process (abdomen) is triangular, with 3 hairs on each side.

In tropical areas anholocyclic races occur, which lay their eggs without an intermediate generation. There is usually parthenogenetic reproduction. Development period of one generation: 8-10 days. Several generations each season.

M. persicae is an important vector of numerous virus diseases.

Distribution: widespread

leaves

Underside of leaves infested with dense colonies of small green aphids. Development of young leaves impaired, the leaves narrow and curled downwards at the tip. Leaf tissue brittle. Infestation with sooty mould. Plant growth severely checked.

Aphid transmits:

Tobacco ringspot virus

tobacco severe etch-virus

tobacco rosette disease

perforation disease of tobacco.

Macrosiphon solani Kitt.

Potato aphid.

HOMOPTERA; *Aphididae*

718

Dark green, dull aphid, 2.5-3 mm long, with a dark longitudinal stripe in the centre. The body is slender and ovate. The antennae are longer than the body. There is no distinct frontal hump. The siphons are slender, the caudal process sword-shaped and furnished with several bristles. Development period of one generation: 8-10 days. Several generations a year. Potato aphids may transmit a great number of viral diseases to a wide range of plants.

Distribution: widespread



Terminal shoots, stems and leaves injured, flowers also destroyed.

Cyaneolytta pectoralis Gerst.

COLEOPTERA; *Meloidae*

719

Dark blue, metallic shiny beetle, about 30 mm long, which deposits its eggs in small hollows in the ground. The carnivorous larvae feed on eggs and larvae of other insects, such as eggs of grasshoppers.

Distribution: Africa

“Heart” of plants pierced by caterpillars. Youngest leaves with irregular, usually large holes. leaves

Heliothis virescens F.

Tobacco budworm.

LEPIDOPTERA; *Noctuidae*

720

Moth with greyish-green to yellowish-grey forewings, crossed by 3 dark bands bordered with pale lines. The hindwings are pale, their margin reddish-brown. The wings expand to 25-30 mm. The eggs are laid on the leaves or stems. The caterpillars are greenish with well marked stripes. Development period of caterpillars: about 3 weeks. Several generations. (Attacks also maize.)

Distribution: U.S.A. (Southern States), Central America



“Heart” often traversed by feeding galleries. Younger leaves thus showing irregular holes when unfolding.

Heliothis assulta Gn.

LEPIDOPTERA; *Noctuidae*

721

Greyish-brown moth, with a dark, small circle, a kidney-shaped spot, and several zig-zag lines on the forewings. The hindwings are yellowish-grey, their outer margin dark. They expand to about 30 mm. The eggs are deposited singly on leaves or stems. The caterpillars, first yellowish-white with black dots and a black head, turn to dirty olive-green with pale lateral lines later on. After 3 weeks they pupate. The pupal rest lasts 9-12 days. Development period from egg to adult: 4-5 weeks. 2-3 generations in the course of one tobacco campaign.

Distribution: Africa, India, China, Indonesia, Australia

Stored tobacco leaves and manufactured products (cigars etc.) with small circular holes and spiral mines, soiled with excrement.

stored tobacco

Lasioderma serricorne F.

COLEOPTERA; *Anobiidae*

Oval, convex, brown beetle, 2-3 mm long, with slightly hairy elytra. The female deposits its eggs on dried tobacco goods (cigars, bales, etc.). The white larvae are scantily furnished with white hairs and have 3 pairs of legs. The head is brown. Both adults and larvae make circular galleries. Development period of one generation: about 3 months.

722

Distribution: cosmopolitan

stored
tobacco

Stored tobacco leaves with irregular signs of gnawing. Tobacco bales damaged by mines, the latter filled with excrement and webbing.

Setomorpha margalaestriata Keuch.
Tobacco moth.

LEPIDOPTERA; *Psychidae*

723

Greyish-brown to reddish-brown moth, 5-7 mm long. The forewings are without any distinct markings, while the hindwings are greyish-white with yellowish fringes. They expand to 10-12 mm. The female lays numerous eggs on dried tobacco leaves. The greyish-white caterpillars have a yellowish-brown head. They pupate after 4 weeks, building a tubular cocoon, the outside of which is soiled with dark brown excrement. Development period of one generation: 6-8 weeks. Several generations.

Distribution: India, Indonesia

Stored leaves, bales or manufactured products injured by mines. These contain excrement, webbing and small caterpillars.

Ephestia elutella Hb.
Tobacco moth.

LEPIDOPTERA; *Pyralidae*

724

Moth with brownish-grey forewings, crossed by 2 pale, dark-edged lines. The hindwings are greyish-white. The wings expand to 15-20 mm. The eggs are placed on dry tobacco or manufactured goods (cigars). The caterpillars are yellowish-white to faint pink, their head and prothorax light brown. They hatch after a few days and pupate later on inside tubular cocoons. Development period of one generation: 6-8 weeks. Several generations.

Distribution: cosmopolitan

Pyrethrum

(*Chrysanthemum cinerariaefolium* Trev.)

Most important pests: 727, 729

Flowers wilt and wither. Stems below the flower base stained brown and withered. stem



Nysius sp.

HETEROPTERA; Lygaeidae

725

Small, pale greyish-brown plant bug, 2.5-3 mm long, indistinctly marked. Both adults and nymphs feed on the stem, sucking the cell sap. They emerge mainly during the dry season.

Distribution: East Africa



Plants dwarfed. Leaves with silvery-grey mottlings, turning brown and withering. Flower stalks, and thus flowers, fail to develop. Heaviest damage during the dry season.

*Frankliniella
dampfi* Priesn.
Cotton bud thrips.

THYSANOPTERA;
Terebrantia

leaves

726

830

see page 420 (Cotton)

Distribution: Africa

leaves **Young plants stunted. Leaves stained silvery-grey, withering and dying. Flower stalks, and thus flowers, fail to develop. Heaviest damage during the dry season.**

727 *Thrips tabaci* Lind.

Potato thrips.

707, 810

THYSANOPTERA; *Terebrantia*

see page 410 (Cotton)

Plants stunted. Leaves bloated and misshapen, curled downwards. Development of flowers inhibited.

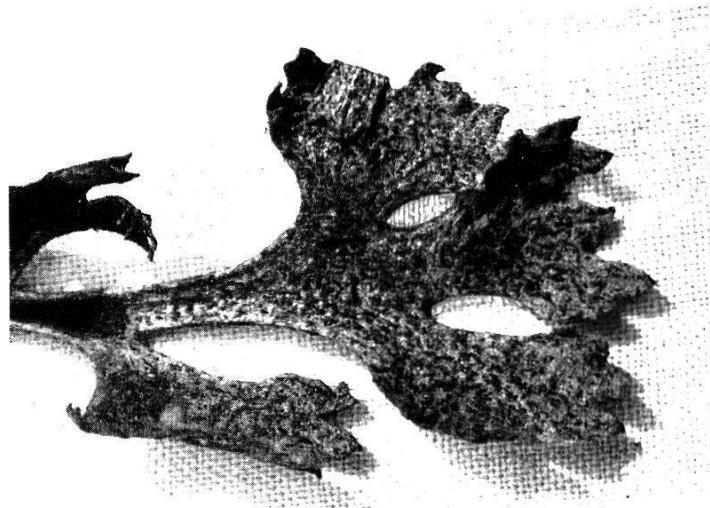
728 *Myzodes persicae* Sulz.

Tobacco aphid.

9, 717, 875 HOMOPTERA; *Aphididae*

see page 371 (Tobacco)

729



Elongate, oval, convex mite, 0.5 mm long, red to reddish-yellow, with yellow legs. The dorsal side is furnished with several rows of bristles. The eggs are fixed to the underside of the leaves. Several generations each season.

Distribution: East Africa

Leaves turn yellow or grey and wither. The underside is covered with fine webbing. Plants become stunted and die.

Tetranychus cinnabarinus Vt.
Red spider mite.

ACARINA;
Trombidiformes

Pepper

(*Piper nigrum L.*)

Most important pests: 735, 741, 742, 743

Reluctant growth of young plants. Many secondary roots. Presence of knots on roots. root

Meloidogyne sp.
Root knot nematode.
NEMATODA

730

The root knots harbour the pear-shaped, swollen females (see page 37).

Plant development stationary. Roots with patches of dark or amber lesions.

Radopholus similis Cobb.
Burrowing nematode.
NEMATODA

731

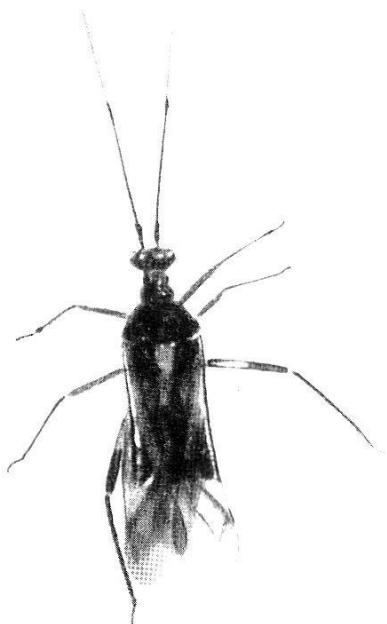
2, 353, 382, 403
466, 625, 746

Endoparasitic nematode (see page 167) (Sugar cane)

Malformation of young shoots. Punctures on stems or leaves, causing tissue to turn dark and decay.

Disphinctus maesarum Kirk.

HETEROPTERA; Miridae



stem

732

Slender, dark brown plant bug, about 10 mm long. The head, thorax and abdomen are dark brown, the ventral side of the latter yellow with 2 dark crossbands. The wings are transparent, marked with a dark brown fleck in the centre and a dark edge along the outer margin as far as the membrane. The legs are reddish-brown, the hindlegs black, the upper part of their femora yellow. The eggs are introduced into the stem. Development period of one generation: 4-5 weeks.

Distribution: India, Ceylon

stem **Mealy, shield-like bodies on leaves, stems, and spikes. Shoots deformed and dis-coloured. Fruit formation impaired.**

Ferrisia virgata Ckll.

Mealybug.

HOMOPTERA; *Pseudococcidae*

733

72, 113, 444
780, 819

Ovate-bodied mealybugs, about 4 mm long. Their back is covered with wax, leaving a few small patches free. At the sides of the body are fine and long white waxy filaments. Several generations a year. Development period of one generation: 4-6 weeks.

Distribution: widespread

Stems, spikes and berries covered with sooty mould. Development impaired.

Saissetia coffeae Walk.

Hemisphaerical scale.

734

21, 350, 455

Light to dark brown, convex scales, 2-4 mm by 1.5-3 mm in size, occurring in dense colonies. When the larger scales are removed, masses of minute pinkish eggs become visible. Parthenogenetic reproduction.

Distribution: almost geopolitical

Stems infested with scales; main stems showing signs of wilting and dieback.

Lepidosaphes piperis G.
Pepper scale.

HOMOPTERA;
Diaspididae

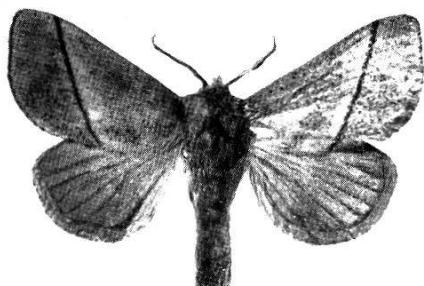
735



Small, grey, boat-shaped scale which attacks the main stem and leaves.

Distribution: India

Leaves very severely attacked, plants leaves often completely defoliated.



Thosea sinensis Walk.

LEPIDOPTERA; *Limacodidae*

736

318, 585

Moth with a wing span of 30-40 mm. The forewings are beige to brown with a dark crossband and a dark dot near the centre. The remainder of the wings is marked with minute dark dots. The hindwings are plain greyish-brown. The eggs are deposited on the leaves. The green to yellow caterpillars are shaped like a woodlouse; they have a distinct dorsal line, edged on both sides with green and red spines, 2 mm long. Development period of one generation: 10 weeks.

Distribution: India, Indonesia, China

Leaves heavily attacked, plants often stripped bare.

Cricula trifenestrata Helf.

Mango hairy caterpillar.

737

441

LEPIDOPTERA; *Saturniidae*

see page 246 (Mango)

Distribution: India

Young leaves curled up and discoloured. Small black spots on leaves (excrement).

Gynaikothrips Karny Bagn.

Thrips.

738

THYSANOPTERA; *Tubulifera*

Small, light brown thrips, about 2 mm in size.

Distribution: India

leaves **Brown patches along the midrib of leaves. Leaf-shedding.**

Elasmognathus greeni Kby.
Lace bug.

HETEROPTERA; *Tingidae*

739

Mainly dark grey to black plant bug, 5-6 mm long, with a striking pronotum (see No. 411). Both nymphs and adults live on the underside of the leaves. Several generations.

Distribution: Ceylon, Indonesia

flowers **Flowers misshapen and discoloured. Fruits fail to set.**

Diplogomphus hewitti Dist.
Lace bug.

HETEROPTERA; *Tingidae*

740

Small plant bug, only 4 mm long, the body itself measuring only 2 mm. The wings are hyaline, with reticulate veins, extending far beyond the body (see No. 411). The pronotum has a smooth, broad margin. Both nymphs and adults feed on young leaves and flowers. Several generations.

Distribution: Indonesia

berries

Berries pale, with a small hole, harbouring a small white larva.



Longitarsus nigripennis Motsch.
Pepper flea beetle or Pollu-beetle.

COLEOPTERA; *Chrysomelidae*

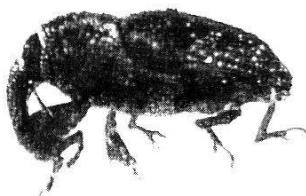
741

Small, yellow and blue beetle, 2-3 mm long. The first tarsal segment of the hind legs is strikingly long. The female inserts its eggs into the berries which are hollowed out by the larvae, one larva being capable of injuring several berries. Several generations.

Distribution: India

Fruits and leaves with localised feeding marks. Stem nodes discoloured. Presence of white, footless larvae in galleries under the bark.

berries



Lophobaris piperis M.

COLEOPTERA; Curculionidae

742

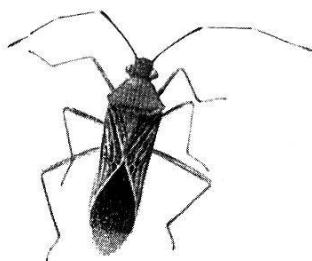
Oval, dark brown to reddish-brown weevil, about 3 mm long, with a relatively long, slightly curved snout. The base of the elytra is marked with faint, yellow flecks. The weevils feed especially at night on young fruits. They lay their eggs on the stems, and the larvae tunnel into the bark.

Distribution: Indonesia

Peppercorns shrivel and fall.

Dasynus piperis Chin.
Pepper bug.

HETEROPTERA; Coreidae



743

Dark, slender plant bug, about 20 mm long, which has long, black legs and antennae and a small head with glassy, protuberant eyes. The eggs are placed on the underside of the leaves. Both nymphs and adults feed on the leaves and fruits. Several generations each season.

Distribution: Indonesia, Bangka Islands.

Flowers and young berries discoloured and deformed. Fruit formation impaired.

Elasmognathus hewitti Dist.

HETEROPTERA; Tingidae

744

Similar to *Elasmognathus greeni* Kby. (see No. 739).

Distribution: Indonesia

Chillies = Red Pepper

(*Capsicum sp.* = various species and varieties)

Most important pests: 748, 749, 750, 754

Growth of young plants stunted. Seedlings misshapen. Roots beset with knots.

root

Meloidogyne sp.

Root knot nematode.

NEMATODA

745

see page 37

Distribution: widespread

Roots with dark or corky patches. Plant growth impaired.

746

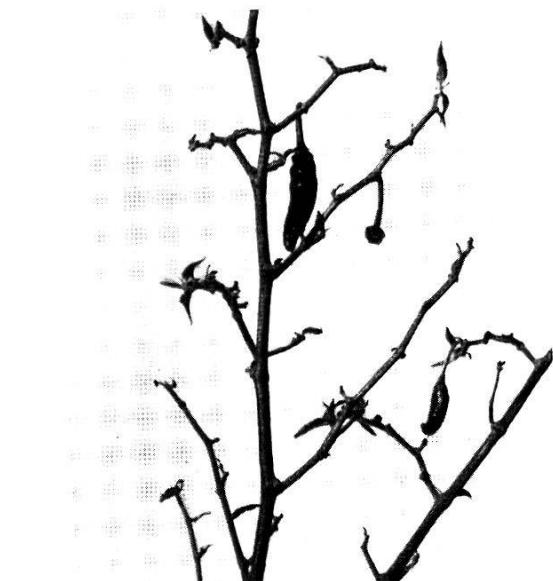
Radopholus similis Cobb.

Burrowing nematode.

NEMATODA

2, 353, 382, 4
466, 625, 731

see page 167 (Sugar cane)



Plants stripped bare. Leaf stalks gnawed off. Fruits ripening prematurely, shrivelled. Injury particularly severe during dry season.

Hodotermes mossambicus Hag.

ISOPTERA; Hodotermitidae

leaves

747

170, 307, 645
796

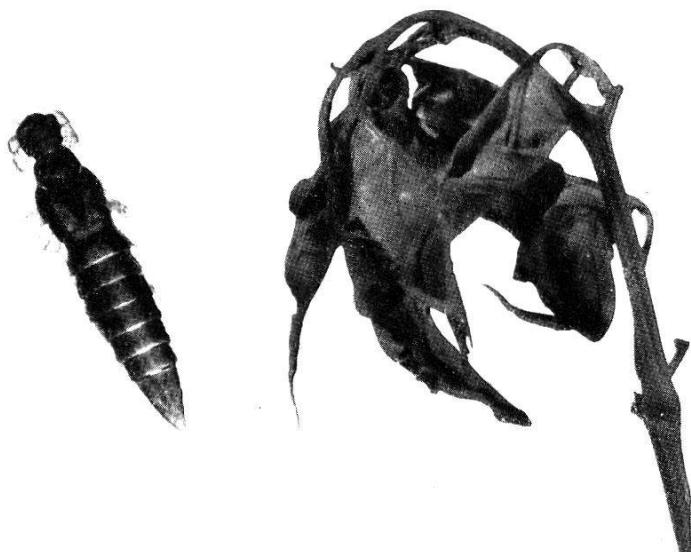
Termite, 8-10 mm long, with a strong, dark brown head, long antennae and dark femora. The body is pale brown, the back darker near the head. Earth galleries are about 5-8 mm in diameter.

Distribution: South and East Africa, as far north as Abyssinia

leaves

748

664



Yellow and black coloured thrips, 2-2.5 mm long. The body and legs are clothed with hairs. The pest is found on the underside of the leaves.

Distribution: India

749



Small, frail, pale-green leafhopper, 3-4 mm long, the body of which is tapered towards the posterior end (see No. 241). The eggs are inserted in the veins on the underside of the leaves. Several generations.

Distribution: Africa

Young shoots misshapen and leaves wrinkled. Underdeveloped chillies. Seedbeds frequently damaged.

Scirtothrips dorsalis Hood
Chillie thrips.

THYSANOPTERA;
Terebrantia

Leaves turning yellow, shrivelling and falling.

Emoasca lybica de Berg.

HOMOPTERA; *Jassidae*

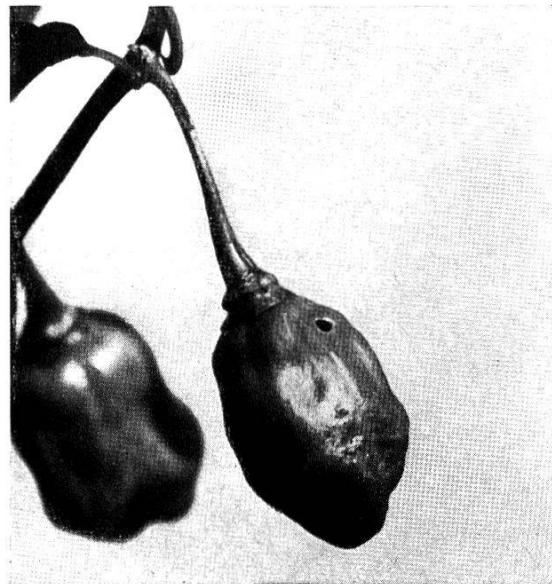
Foliage stained brownish to greyish. Leaves curled downwards, falling off. leaves

Tetranychus sp.
Red spider mite.

ACARINA; *Trombidiformes*

750

see page 415 (Cotton)



Flower-buds wither and die. Pods with small holes and stained black inside. Presence of white, footless larvae.

Anthonomus Eugenii Cano
Pepper weevil.

COLEOPTERA; *Curculionidae*

pods

751

Small, highly convex, longish-oval weevil with an unusually long rostrum. The dark body is clad with light, scanty scales. The eggs are placed in unripe fruits or buds (bore holes in pods). Both adults and larvae are injurious. Time of development: eggs 2-3 days, larvae 8-10 days, pupae 6 days. Pupation takes place inside the pod or bud. Up to 2 generations a year.

Distribution: Texas, New Mexico, Florida, Arizona, Georgia, California

Flowers eaten off, hollowed out and soiled with excrement. Surface and inside of pods gnawed. Presence of creamy-white, hairless caterpillars.

Phthorimaea gudmanella Wals.

LEPIDOPTERA; *Gelechiidae*

752

Greyish-brown, inconspicuously marked moth with a wing span of 20-25 mm. The forewings are large and fringed at the tip, while the hindwings are greyish to beige. The palpi are long. Oviposition takes place in the flowers which are destroyed consequently by the emerging caterpillars. These are creamy-white to dirty white and dark-headed.

Distribution: U.S.A., Mexico, the West Indies

pods **Fruits misshapen, partially rotting. Blotch mines with maggots.**

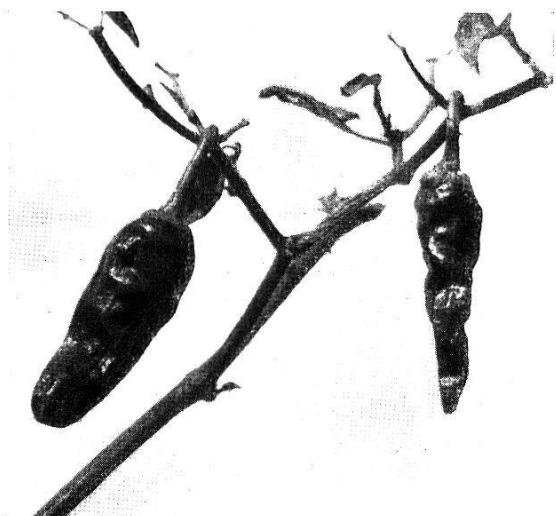
Zonosemata electa Say.

Pepper maggot.

DIPTERA; *Trypetidae*

753 Small, dark fly, only a few millimeters long, which deposits its eggs under the skin of the pod where the newly hatched maggots mine. Pupation takes place in the ground.
Z. electa also attacks egg-plants.

Distribution: U.S.A.



754

Fruits ripening prematurely, misshapen. Pods with swellings.

Helopeltis westwoodi White

HETEROPTERA; *Miridae*

Slender plant bug, 8-10 mm long, excellent flier. The head and thorax are black, the underside of the latter red. The abdomen is also red to reddish-brown. The antennae are dark, the legs brown (see No. 95).

Distribution: Africa

Quinine

(*Cinchona succirubra* R. + R.)

Most important pests: 757, 758, 769

Young plants stunted. Leaves leathery, their margin undulating. Roots bushy, root bearing small knots. Abundant development of secondary roots.

Meloidogyne sp.

Root knot nematode.

755

NEMATODA

The root-knots harbour endoparasitic, pear-shaped female nematodes (see page 37).

Distribution: widespread

Leaves chlorotic. Plants underdeveloped. Trunks, leaf stalks and main venation beset with oval, yellowish scales. trunk

Coccus viridis Green

Green coffee scale.

756

HOMOPTERA; *Lecaniidae*

20, 75, 115
456, 781

see page 72 (Coffee)



Young plants stunted. Leaves chlorotic. Trunks infested with scales.

Howardia biclavis Comst.

HOMOPTERA; *Diaspididae*

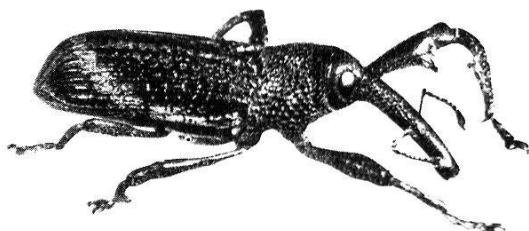
757

76

Greyish-white to yellowish-white, convex scales, 2.5-3.5 mm in size. Several generations.

Distribution: widespread throughout the Tropics (especially Puerto Rico)

shoots



Young twigs and shoots shrivel, wither and die. Punctate feeding marks or small, round holes or elongate, tumoured lesions. Leaf-shedding.

Alcides cinchonae Marsh.

COLEOPTERA; Curculionidae

758

Weevil, about 10 mm long, with a strikingly long snout and long legs. The adults are dark, with a pale, narrow crossband on the posterior portion of the elytra. The sides also have pale stripes. The female bores into the tips of shoots, where it inserts its eggs. The whitish, footless larvae have a dark head-capsule. They pupate inside feeding mines. Development period of one generation: several weeks.

Distribution: Indonesia

buds



Buds with dark, sunken spots or completely discoloured and withered. Young leaves often also flecked dark.

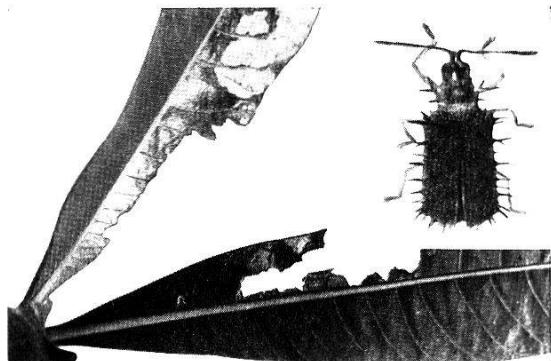
Helopeltis cinchonae Mann.

HETEROPTERA; Miridae

759

Dull grey to blackish-brown, slender plant bug, 6-7 mm long. The outer margin of the wing membrane is fire red, while the legs and antennae are yellowish-red. Development period of one generation: about 8 weeks. Several generations (see also No. 95).

Distribution: India, Formosa



Leaves with brown mines, the leaf margin perforated with small holes. leaves

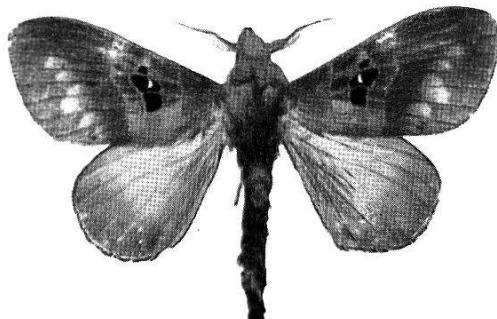
Dactylispa manteroi Gestw.

COLEOPTERA; Chrysomelidae

Beetle, 4.5-5 mm long. The head, prothorax, ventral abdomen and tarsi are orange, while the elytra are black and armed with numerous sharp spines. The flat, yellowish-white larvae measure 6 mm by 2 mm. The sides of the abdomen are provided with yellow spines. The beetles eat small flecks in the leaves, leaving the lower epidermis intact. The eggs are laid on the leaves, where the larvae mine.

Distribution: Indonesia

760



Leaves eaten away to the midrib. Plants often stripped completely.

Metanastria hyrtaca Cram.

LEPIDOPTERA; Lasiocampidae

761

Moth with dark brown forewings, a kidney-shaped, dark spot in the centre, surrounded by a light brown area. The hindwings are plain light brown; they expand to 40-60 mm. The antennae are comb-like. The grey caterpillars bear two dark zig-zag lines on the back. The first segments are furnished with pale, lateral hair tufts, the other segments each with 2 dark, shorter tufts of stinging bristles on the back. The caterpillars live usually in large colonies. Full grown they may be up to 70 mm in length.

Distribution: India, Ceylon, China, Indonesia

leaves

Leaves devoured; young trees often stripped completely. Contact with caterpillars causes skin irritation.

Odonestis plagifera Walk.

LEPIDOPTERA; *Lasiocampidae*

762

Large, robust butterfly with a wing span of 80-100 mm. The forewings are red-dish-brown with a dark, flame-shaped design. The hindwings are yellowish with dark dots on the lower surface. The body is densely clothed with hairs. Clusters of eggs are laid on the underside of the leaves. The caterpillars are densely hirsute, brownish-grey with dark markings. The anterior segments are furnished with two tufts of red stinging hairs. Pupation takes place between the leaves.

Distribution: India, China, Indonesia

Leaves eaten away. Complete defoliation of young trees when heavily attacked.

Deilephila nerii L.

LEPIDOPTERA; *Sphingidae*

763

Robust sphinx moth with a wing span of 60-80 mm. The forewings are green, decorated with white, red, purple and brown. The hindwings are brownish-grey, edged with green and crossed by a white, curved line. The body has also green and reddish-brown markings. The eggs are deposited on the leaves. The caterpillars are green to ochrous, with a pale line on each side and a lateral oval spot, edged with blackish-blue, on the third segment. The abdomen bears an anal horn. Full grown the caterpillars are up to 70 mm long. Development period of one generation: about 5-6 weeks. Several generations. At the end of the rainy season the caterpillars may be found everywhere.

Distribution: Europe, Africa

Leaves destroyed from the margin inward, often stripped to the midrib.

Boarmia crepuscularia Hb.

LEPIDOPTERA; *Geometridae*

764

Moth with a wing span of about 40 mm. The forewings are whitish-grey and brown, with indistinct, dark, serrated lines. The hindwings are of the same colour and marked with wavy lines. The eggs are deposited on shoots and branches. The brownish-grey to brownish-green caterpillars, decorated with a dark dorsal and light lateral line, pupate in the ground. Development period of one generation: 6-8 weeks. Several generations.

Distribution: Europe, Russia, India, Indonesia

Leaves more or less eaten away. Presence of caterpillars causes skin irritation (urticaria) among the harvesters.

leaves

Euproctis varia Walk.

LEPIDOPTERA; *Lymantriidae*

Brownish moth with a wing span of 40-50 mm. The forewings are edged with yellow and bear a black dot on the costal margin. The head, abdominal end and antennae are yellow. The eggs are deposited in clusters on the underside of the leaves and covered with fluff. The caterpillars are dirty brown with a large, pale yellow head. They bear a tuft of brown stinging hairs on the 4th, 5th and 11th segments. Full grown they are about 25 mm long.

765

Distribution: India, Sunda Isles

Leaves with small, grey to rusty-red spots, causing them finally to wilt and fall.

Heliothrips haemorrhoidalis Bouché

Coffee thrips.

THYSANOPTERA; *Terebrantia*

766

528, 709

Dark brown to black, winged thrips, 1-1.5 mm long, with pale legs and wings. The larvae are greenish to yellowish. *H. haemorrhoidalis* attacks mainly young trees and prefers shady areas. Several generations.

Distribution: widespread

Young leaves curled up, turning brown and falling off.

Anaphothrips orchidii Moul.

THYSANOPTERA; *Terebrantia*

767



Small, brown thrips, about 1.5 mm long, which attacks the small plants in seed-beds, infesting the upper surface of the leaves. Several generations.

Distribution: Puerto Rico

leaves



768

Young leaves with dark mottlings, often completely misshapen.

Pachypeltis vittiscutis Bergr.

HETEROPTERA; Miridae

Slender plant bug, 10-12 mm long, pale brown with dark wing tips. The head is small, the antennae long and dark. The legs are hirsute, decorated with light and dark rings. The abdomen of the larvae is obtuse and rounded off (that of the larvae of *Helopeltis* tapers to a point). *Pachypeltis* favours areas of low altitude.

Distribution: Indonesia

Young leaves dwarfed, stained greyish-brown to reddish and slightly curled up. Leaf-shedding. Internodes shortened. Growth of shoots impaired. Damage occurs mainly in young plantations.

769

Tetranychus urticae Koch

Common red spider.

ACARINA; *Trombidiformes*

874

see page 415 (Cotton)

Distribution: widespread

Leaves dwarfed, discoloured or brown and withered. Leaf-shedding. Lower surface of leaves infested with mites.

Hemitarsonemus lata Bks.

Yellow mite.

770

ACARINA; *Trombidiformes*

147, 821

Minute, brilliant yellowish mite, about 0.2 mm long, elongate, which favours young crops. Development period of one generation: 8-10 days. Several generations.

Distribution: Europe, India, Ceylon, Indonesia, U.S.A., Central America