

Information of www.infonet-biovision.org

Okra

Images



Okra (*Abelmoschus esculentus*) with flower

CTC/Zeneca/CAB

17/10/2011

www.infonet-biovision.org - Okra

**International, 2005. Crop
Protection Compendium,
2005 Edition. Wallingford,
UK**

Cotton aphids on okra flower



A.M. Varela, icipe

**Parasitised aphids
(mummies) and aphids
killed by fungus**



A.M. Varela, icipe

**Damage on Okra due to
feeding by aphids**



A.M. Varela, icipe

Spiny bollworm moths on okra



A.M. Varela, icipe

Thrips on okra flower



A.M. Varela, icipe



Okra roots damaged by root-knot nematodes. Note galls or root-knots (left) and healthy roots (right)

A.M. Varela, icipe

Bacterial blight on young okra pod



A.A. Seif & A.M. Varela, icipe

**Bacterial blight
blackening of veins**



A.M. Varela & A.A. Seif, icipe

Black mould leaf spots

**on the top side of an
okra leaf**



A.A. Seif & A.M. Varela, icipe

**Black mould on lower
surface of okra leaf**



A.A. Seif & A.M. Varela, icipe

**Flea beetle feeding on young
okra pod**



A.M. Varela, icipe



Okra seedling damaged by cutworm caterpillar (right). Note healthy seedling on the left. Close-up of cutworm (inset)

A.M. Varela, icipe

Okra seedlings affected by damping-off



A.A. Seif & A.M. Varela, icipe

**Wilting of okra plant due to
fusarium wilt**



A.M. Varela & A.A. Seif, icipe

Young caterpillar of African bollworm feeding on okra leaf and a moth (inset).



A.M. Varela, icipe

Young grasshopper feeding on okra leaf



A.M. Varela, icipe

**Young okra pods
damaged by caterpillar
of the spiny bollworm**



A.M. Varela, icipe

**Caterpillar of a spiny bollworm on okra.
Note damage on seeds.**



A. M. Varela, icipe

**Caterpillar of the leafroller
(*Haritalodes derogata*) on okra leaf.**



A. M. Varela, icipe.



**Nymphs (two to the left)
and adult cotton stainer
on okra.**

A.M. Varela, icipe

**Brown stink bug (*Halydicoris* sp.)
on okra.**



A. M. Varela, icipe.

Cotton seed bugs on okra



A. M. Varela, icipe



Powdery mildew on upper surface of an okra leaf.

A. M. Varela, icipe

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Eggplant Images



Solanum melongena

Arnoldo Mondadori Editore SpA,

(www.ecoport.org)



Eggplant flower

Pembroke perennials

Eggplant



**Close-up of an adult of
the eggplant lace bug.
Real size: 3 mm in
length.**



M. Billah, icipe

Thrips damage on eggplant



J. Guyot, INRA, Pointe-à-Pitre, bugwood.org



Epilachna beetles larvae and pupae on eggplant. Larvae are about 6 mm long.

**O.P. Sharma, NCIPM, New Delhi. India,
Bugwood.org**

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Information of www.infonet-biovision.org

Cabbage/Kale, Brassicas

Images



Cabbage (*Brassica oleracea* var. *capitata*)

www.ecoport.org / B.French

Kale (*Brassica oleracea* var. *capitata*)



acephala)

<http://botit.botany.wisc.edu>

Cauliflower (*Brassica oleracea* var. *botrytis*)



**Pankaj Oudhia (Courtesy of EcoPort,
www.ecoport.org)**



Kale

Monique Hunziker, BioVision

Cabbage black spot - Cabbage leaf with early stage of alternaria black spot



(*Alternaria brassicae*)

**David C. Novell, Courtesy of
EcoPort (www.ecoport.org)**

**Cabbage black spot -
The spots darken with
age, and the centers**



may become thin and papery or drop out, to produce a shot-hole effect.

**Gerlach W. Courtesy of EcoPort,
(www.ecoport.org)**

**Cabbage webworm
caterpillar (*Hellula
undalis*) and damage on**

a kale leaf.



A. M. Varela, icipe

**Caterpillar of the
cabbage webworm
(*Hellula undalis*) feeding**

**in the stem of a kale
plant.**



A. M. Varela

**Cabbage webworm
(*Hellula undalis*) feeding
on a cabbage head**



A. M. Varela, icipe

**Moth of the cabbage
webworm (*Hellula***

undalis)



A. M. Varela, icipe

**Full grown larva of cabbage looper
(*Trichoplusia ni*)**



**USDA-ARS Reproduced from
the Crop Protection
Compendium, 2005 Edition.
CAB International,
Wallingford.**



Caterpillar of the cabbage looper

A. M. Varela, icipe

**Damage caused by
cabbage looper on kales**



A. M. Varela

Cabbage looper



A. M. Varela

**Diamondback moth
caterpillars feeding on
kales**



A. M. Varela, icipe

**Cabbage damaged by
diamondback moth**



A. M. Varela, icipe



F. Haas, icipe

**Damage caused by the
bagrada bug on
cabbage**



B. Loehr, icipe

**Colony of the cabbage
aphid (*Brevicoryne***

***brassicae*) on kales.**



A. M. Varela, icipe

**Damage by cabbage aphids
on kale.**



A. M. Varela, icipe



**Damage caused by the
cabbage aphid on
cabbage**

A. M. Varela, icipe

**The false cabbage aphid
(*Lipaphis erysimi*) on a**

kale leaf.



A. M. Varela, icipe

**The green peach aphid
(*Myzus persicae*) on
kales**



A. M. Varela, icipe

Cutworm (*Agrotis* sp.)



A. M. Varela, icipe

**Mines cause by
maggots, and a pupa of
leafminer flies**



A. M. Varela, icipe

Sawfly



A. M. Varela, icipe

**Sawfly larva and
damage on raddish**



A. M. Varela, icipe

Thrips damage on lower



**surface of cabbage leaf.
Note rough brown
patches and small dark
spots (*thrips faeces*)**

A. M. Varela, icipe

**Thrips damage on upper
surface of cabbage leaf**



A. M. Varela, icipe

The Western flower thrips (*Frankliniella occidentalis*). Close-up,



**very much enlarged.
Real size (0.9 to 1.1 mm)**

M. Billah, icipe

**Caterpillars of the
cabbage moth
(*Crocidolomia binotalis*)
feeding on cabbage**



A. M. Varela, icipe

**Damage caused by
caterpillars of the**

cabbage moth
(*Crocidolomia binotalis*)



A. M. Varela, icipe



**The cabbage moth
(*Crocidolomia binotalis*)**

A. M. Varela, icipe

**Heavy attack of the
cabbage whitefly
(*Aleyrodes proletella*)
on kales.**



A. M. Varela, icipe

Adults and eggs of the cabbage whitefly (*Aleyrodes proletella*).



A. M. Varela, icipe

Adults and immature stages of the cabbage whitefly (*Aleyrodes proletella*).



A. M. Varela, icipe

**Bacterial black rot on
kales**



A. M. Varela, icipe

**Bacterial black rot on
kales**



A. M. Varela, icipe

**Bacterial black rot on
cabbage**



A.A. Seif, icipe

Bacterial black rot. Note blackening of water-conducting tissues of the stem



A. M. Varela, icipe

Bacterial soft rot. Note slimy rot (whitish) of the centre of the cabbage head



A. M. Varela, icipe

Black rot on cabbage.



Note blackening of veins.

A.A. Seif, icipe

Club-root. Note warty growth in the root system



A. A. Seif, icipe

Cauliflower mosaic virus



A. M. Varela, icipe

**Rhizoctonia disease:
wirestem of seedlings.
Diseased plant (right),
healthy plant (left)**



A. A. Seif



**White rust on kales.
Note pustules on the
lower side of the leaf**

A. M. Varela

Downy mildew on

cabbage. Symptoms of the lower leaf surface



A. A. Seif

Powdery mildew on a cabbage plant



A. M. Varela, icipe

Ring spots on cabbage



A. M. Varela, icipe

Cottony rot (*Sclerotinia sclerotiorum*) on a kale plant



A. M. Varela

**Black leg
(*Leptosphaeria
maculans*)**



**Sheppard JW (Courtesy of EcoPort,
www.ecoport.org)**

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Beans

Images



**Flowers and leaves of
common bean**

**Arnoldo Mondadori Editore SpA. Courtesy
of Ecoport (www.ecoport.org)**

Common bean (*Phaseolus vulgaris*)



**Brücher H., Trop.
Nutzpfl., Springer
Verlag 1977; Wolf-
Garten**

Beans (*Phaseolus*) sp. - colour

illustration



**Wilhelm Valder/CAB
International, 2005. Crop
Protection Compendium, 2005
Edition. Wallingford, UK**

Anthraconose on bean

Pods



A.M. Varela, icipe

Anthracnose on beans



**Jim Sheppard. Courtesy of Ecoport
(www.ecoport.org)**

**Anthrachnose on young
French bean plant**



A.M. Varela, icipe

Common blight on beans



**Jürgen Kranz. Courtesy of Ecoport
(www.ecoport.org)**

**Mexican bean weevil - the
Mexican bean weevil is
about 2-3cm long.**



**Georg Goergen, Courtesy of EcoPort
(www.ecoport.org)**

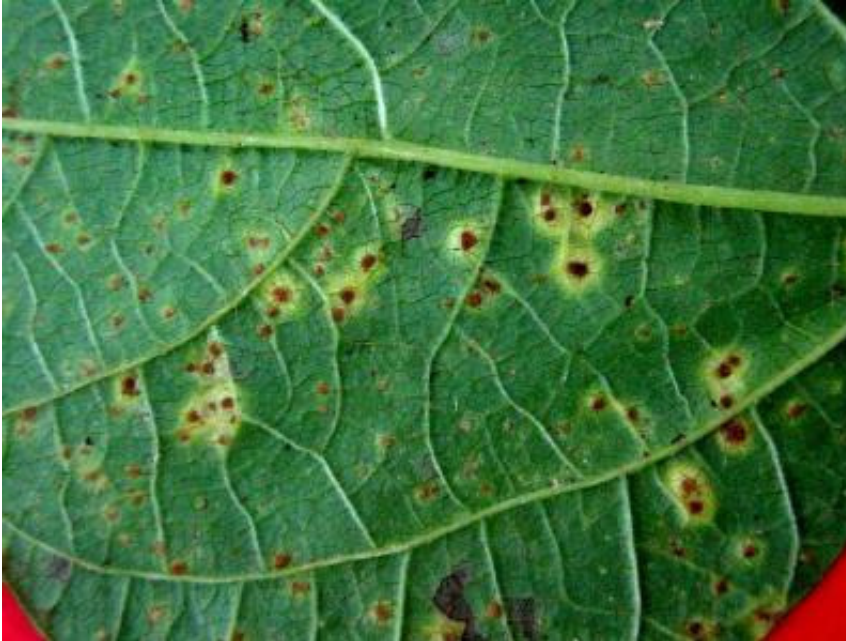


Spiny brown bugs measure about 1cm in length.

A.M. Varela, icipe

Rust on lower leaf surface of French beans. Symptoms are

similar on green grams.



A. M. Varela, icipe

Bean rust on upper leaf surface



A.A.Seif, icipe

**Fusarium wilt on French
beans**



A. M. Varela, icipe

**Stripped bean weevil on
beans**



A.M. Varela, icipe

Foliage beetles damage

on French beans



A.M. Varela, icipe

African bollworm on french beans - Fully grown caterpillars are 3-

4cm long.



A.M. Varela, icipe

**African bollworm
feeding on flower of
French beans - African**

**bollworm caterpillars are
3-4 cm long**



A.M. Varela, icipe

17/10/2011

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Bean fly on French beans

A.M. Varela, icipe

**Bean seed fly damage on
French beans**



A.M. Varela, icipe

Bacterial blight on beans



A.M. Varela, icipe

Angular leafspots on beans



A.M. Varela, icipe

Angular leafspots on

French bean pods.



A. M. Varela, icipe

**Fusarium root rot on
beans**



A.M. Varela, icipe

Halo blight on beans



A.M. Varela, icipe

Leafhopper - Adults are 2-2.5mm long.



**Ooi P. (Courtesy of EcoPort,
www.ecoport.org)**



Root-knot nematode damage on beans

A.M. Varela, icipe



**Common mosaic virus
on beans**

A.A. Seif, icipe

Bean fly maggot in a French bean stem.



A.M. Varela, icipe

Bean fly pupa in a French bean stem.



**A.M. Varela,
icipe**

Damage to French bean plants by larvae of the striped bean weevil. Note larva inside stem. Inset- close-up of larva.



A. M. Varela

**French bean plants
damaged by larvae of
the striped bean
weevil.**



A. M. Varela

**French bean pods heavily attacked
by black bean aphids.**



A. M. Varela.



Heavy attack of black aphids on a French bean plant.

A. M. Varela

Whiteflies on French beans.



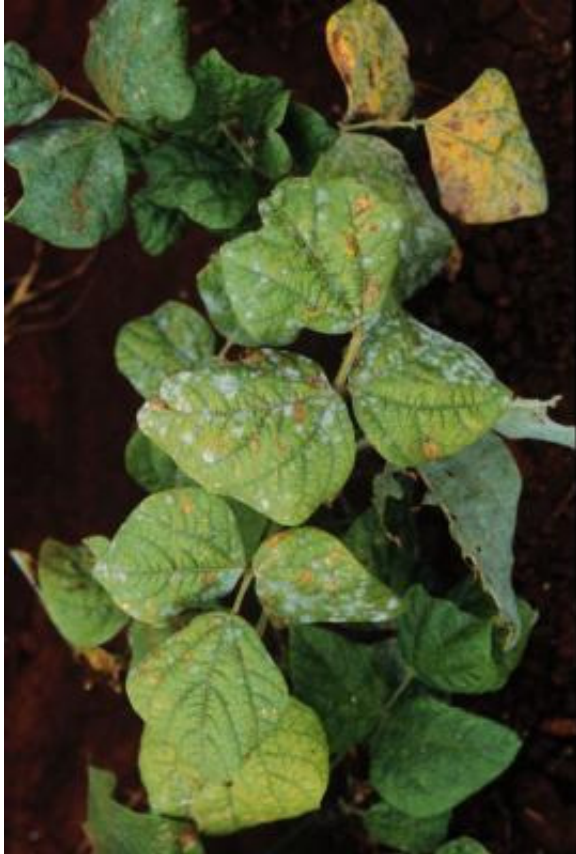
B. Loehr

**French bean pods with
powdery mildew.**



GTZ-IPM Horticulture Project. Kenya.

Powdery mildew on French beans.



**GTZ- IPM Horticulture
Project. Kenya.**

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Peppers

Images

**Bell pepper (*Capsicum
annuum*)**

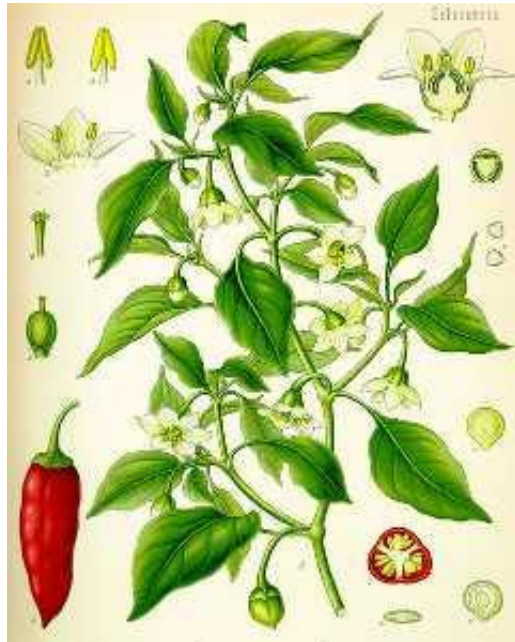


**Bodie Pennisi, University of Georgia,
Bugwood.org**

Chili fruit



A.M. Varela, icipe



Drawing of bell pepper (*Capsicum annuum*)

Prof. Dr. Otto Wilhelm Thomé

**Bacterial spot of pepper
(*Xanthomonas vesicatoria*)**



**Volcani Center Archives, Bet Dagan,
Israel, www.insectimages.org (Courtesy of
EcoPort, www.ecoport.org)**

Antracnose (Colletotrichum capsici)

on sweet pepper (*Capsicum annuum*)



**Jürgen Kranz, Courtesy of
EcoPort, www.ecoport.org**



Blossom end rot on chillies

B. Nyambo & A.A.

Seif, icipe



Bacterial wilt on chillies

A.M. Varela, icipe



Bacterial wilt on chillies

A.M. Varela, icipe

Bacterial wilt on chillies



A.M. Varela, icipe

Bacterial wilt on chillies



A.M. Varela, icipe

Fusarium wilt on chillies



A.A. Seif & B. Nyambo, icipe

Chilli field infected with *Fusarium* wilt. Note gaps due to death of

plants.



A. A. Seif & B. Nyambo, icipe

Root infected with fusarium wilt. Note brown discolouration of vascular tissues.



**A. A. Seif & B. Nyambo,
icipe**



**Damping-off disease in
chilli field**

A. A. Seif & B. Nyambo, icipe

**Damping-off disease in
chilli nursery**



A. A. Seif & B. Nyambo, icipe

**Initial symptoms of
powdery mildew on a
chilli leaf.**



A. M. Varela & A. A. Seif, icipe.

Powdery mildew on leaves and fruit of chilli. Note fungal growth on pod.



**A. A. Seif & B. Nyambo,
icipe**



Tomato spotted wilt virus on chilli

A. A. Seif & B. Nyambo, icipe

Whiteflies on chilli leaf



**B. Nyambo & A. A. Seif,
icipe**



Fruit fly (*Daccus bivittatus*) on a chili pod.

A. M. Varela, icipe



**Thrips damage on a
chilli pod.**

A.A. Seif & B. Nyambo, icipe

**Caterpillar damage in
chilli fruit**



A.M. Varela, icipe

**Caterpillar damage on
chilli fruit**



A.M. Varela, icipe

**Broad mite damage on
chillies**



A.M. Varela, icipe

Broad mite damage on chilli fruit



A.M. Varela, icipe



Chilli plant affected by a virus disease

A. A. Seif, & B. Nyambo, icipe

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Cowpea

Images

Cowpeas with green leaves and dry seed pods harvested simultaneously for green leaves and seed pods.



A. Bruntse (Courtesy of Meru Herb Farmers)



Cowpeas ready for threshing.

A. Bruntse (Courtesy of Meru

Herb Farmers)



**Cowpeas, healthy crop.
Multiple disease
resistant variety,
Nigeria.**

Rob Williams/CAB International

**Cowpea (*Vigna unguiculata*) -
Flower, pods and leaves.**



**van Wik Ben-Erik, Courtesy of
Ecoport (www.ecoport.org)**

**Cowpea being grown as
a cover crop in a
conservation**



agricultural project in Swaziland. This vigorous biomass production is ideal for this farming method forming mulch to improve soil fertility and restrict weed growth.

**Roger P. Ellis, Courtesy of Ecoport
(www.ecoport.org)**

Aphids on cowpea



A.M. Varela, icipe

Bean flies on cowpea



A.M. Varela, icipe

Cowpea aphids tended by ants



A.M. Varela, icipe



**Legume pod borer
(*Maruca vitrata*)**

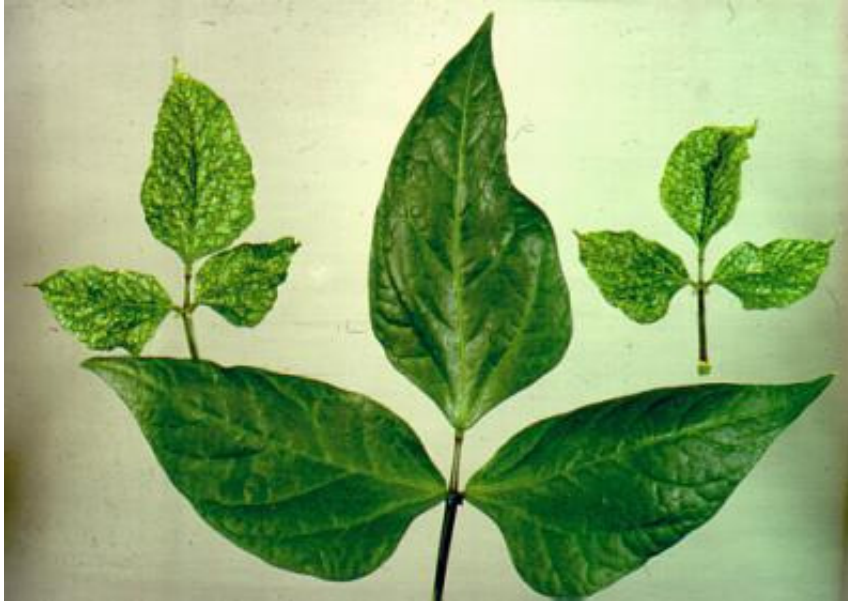
**Ooi P. Courtesy of EcoPort,
www.ecoport.org**

**Cowpea seed weevil on
cowpea**



**Peter Credland, Reproduced from CABI
2006**

Cowpea mosaic virus



Thorben Lundsgaard, KVL, Denmark

**Rust on cowpea
(*Uromyces vignae*)**



**Jackson G. (Courtesy of EcoPort,
www.ecoport.org)**

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Information of www.infonet-biovision.org

Groundnut Images



Groundnut

French B., www.ecoport.org

**Groundnut plant with
flowers**



Groundnut -(*Arachis hypogaea*) - colour illustration



**Koehler's Medicinal-
Plants 1887**

Groundnut plant



French B., www.ecoport.org

**Early leaf spot
(*Mycosphaerella
arachidis*)**



**Jürgen Kranz (Courtesy of EcoPort,
www.ecoport.org)**

**Rust (*Puccinia
arachidis*)**



**Gerlach W. (Courtesy of EcoPort,
www.ecoport.org)**

Corticium rolfsii



**Gerlach W. (Courtesy of
EcoPort, www.ecoport.org)**



**Thrips damage on
groundnut**

**Steve L. Brown, University of Georgia,
Bugwood.org**



Two-spotted spider mites (*Tetranychus urticae*) on groundnut. Females are about 0.6mm long, males are smaller.

**Richard Sprenkel, University of Florida,
Bugwood.org**

Rust (*Puccinia arachidis*)



**Gerlach W. Courtesy of EcoPort,
www.ecoport.org**



**Aspergillus crown rot
(*Aspergillus niger*)**

**Jürgen Kranz, Courtesy of EcoPort,
www.ecoport.org**

**Groundnut blight
(*Sclerotium rolfsii*)**



**Clemson University - USDA Cooperative
Extension Slide Series, Bugwood.org**



**Caterpillar of the
groundnut leafminer
(*Aproaerema modicella*)**

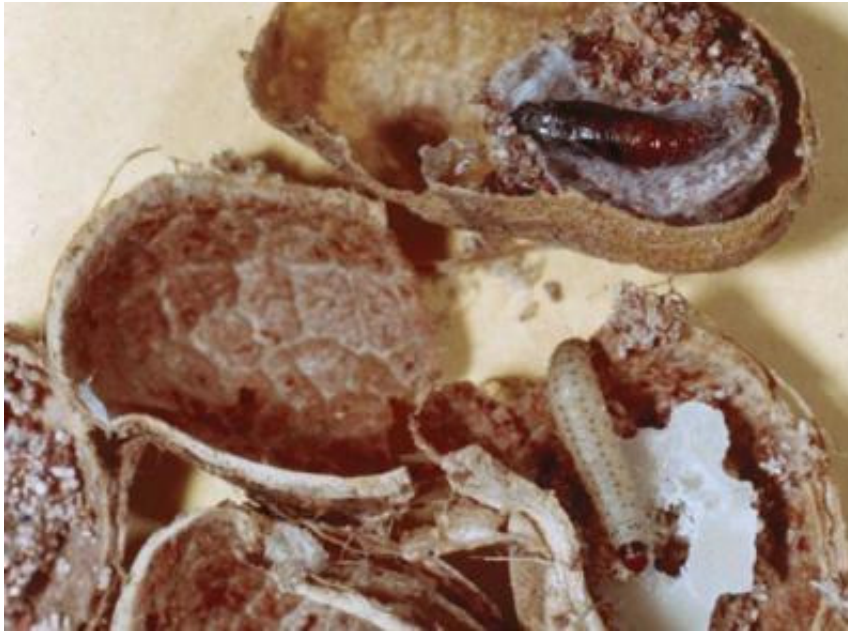
**E. Neering. Reproduced from the Crop
Protection Compendium, 2006 Edition. ©
CAB International, Wallingford, UK, 2006**

**Groundnut rosette
disease. Symptoms in a**



**field-infected groundnut
plant in Malawi.**

**Scottish Crop Research Institute.
Reproduced from the Crop Protection
Compendium, 2006 Edition. © CAB
International, Wallingford, UK, 2006**



Dried currant moth (*Cadra cautella*) - The larvae range from 1.5 mm to 1.5 cm (15 mm) in length and are light brown in colour with dark brown spots on the skin (cuticle).

Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org

Chafer grub



A. M. Varela.

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Green gram

Images

Green gram seeds



**Pankaj Oudhia (Courtesy of EcoPort,
www.ecoport.org)**

**Bacterial blight on beans.
Symptoms are similar on green
grams.**



**Sheppard JW (Courtesy of
EcoPort, www.ecoport.org)**

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Information of www.infonet-biovision.org

Maize

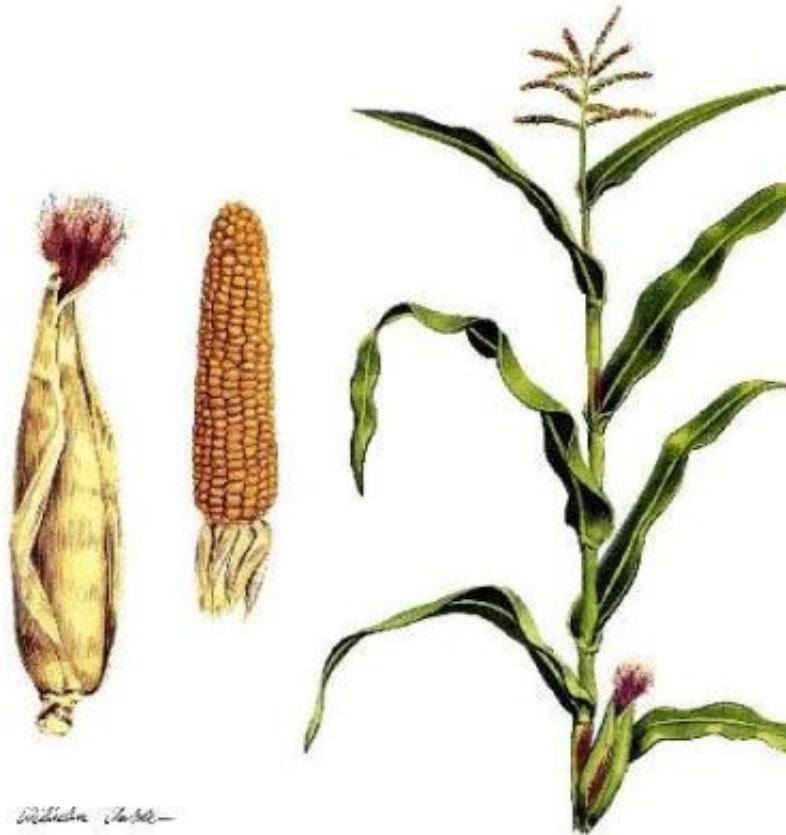
Images

Varieties of maize



Keith Weller, USDA

***Zea mays* - color
illustration**



**PROSEA Foundation/CAB International,
2005. Crop Protection Compendium,**

2005 edition. Wallingford, UK

Type of animal	production	%dry matter	Content of Nitrogen kg	Phosphorous kg	Potassium kg
One freesian Cow zero-grazing yearly	11.2 tons manure slurry	22	61.6	20.2	33.6
100 chicken housed for egg production 448 days	3 tons	39	42	54	36
1000 broilers 42 days	1.1 ton	36	28.6	13.1	18.7

Example of production and plant nutrient content of animal manure (standard)

Handbook for farm Planning (LIK, Denmark 1983)

Pupa of grain moth. The final-instar larva spins a silken cocoon and changes to a reddish-brown pupa.



**Clemson University - USDA Cooperative
Extension Slide Series,
www.insectimages.org (Courtesy of
EcoPort, www.ecoport.org)**

Bird and fusarium

damage on maize



A.M. Varela, icipe

Stink bug nymph on maize



A.M. Varela, icipe

Chafer grub (with

French bean plant)



A.M. Varela, icipe

**Streaked foliage damage caused
by maize leafhopper (*Cicadulina***

mbila)



**Agricultural Research Council of
South Africa (Courtesy of
EcoPort)**

**Satintail (*Imperata
cylindrica*)**



**Chris Evans, The University of Georgia,
www.insectimages.org**



**Satintail close-up.
Identification: The
whitish midribs are
often off-center.**

**Chris Evans, The University of Georgia,
www.insectimages.org**

**Damage by plant-feeding
ladybird beetle on maize
leaf. Note close-up of
beetle (inset).**



A. M. Varela

Maize streak virus



A.A. Seif, icipe

Information of www.infonet-biovision.org

Information of www.infonet-biovision.org

Mango

Images



Mango (*Mangifera indica*)

A. M. Varela & A.A. Seif, icipe

**Powdery mildew on
young mango leaves**



A. M. Varela & A.A. Seif, icipe

**Powdery mildew on
mango**



**Jürgen Kranz, Courtesy of EcoPort,
www.ecoport.org set invisible**

**Powdery mildew on
mango fruitlet**



A. M. Varela & A.A. Seif, icipe

**Flower stalk and young
fruit affected by
powdery mildew.**



A.M. Varela & A. A. Seif, icipe

Mango panicle affected by powdery mildew. Note white powdery growth and low fruit set.



A.M. Varela & A. A. Seif, icipe.

**Bacterial black spot
(*Xanthomonas campestris*)**



pv. *mangiferaeindica*) on mango leaves

**Jürgen Kranz, Courtesy of EcoPort,
www.ecoport.org**

Bacterial black spot symptoms on mango fruit. Note star-like

cracks on the fruit.



A.A.Seif, icipe

**Mango seed weevil
adult, after emerging of
a mango. Realsize: 8**

mm long.



Monique Hunziker, Biovision

**Typical fruit damaged by
mango seed weevil larva.**



**Peter A. Follet. Reproduced from the
Crop Protection Compendium, 2005
Edition. © CAB International, Wallingford,
UK, 2005.**

Egg of mango seed weevil on mango



fruit. The very small egg laying scars are barely discernable at harvest.

The State of Queensland, Australia, Department of Primary Industries and Fisheries, 2007. Reproduced with permission. Contact ipcu@dpi.qld.gov.au.

Soft brown scale



(*Coccus hesperidum*).
Scales are small, they
attain a length of 1-
7mm.

Jeffrey W. Lotz, Florida Department of
Agriculture and Consumer Services,
Bugwood.org

Mango stem end rot



A. M. Varela & A.A. Seif, icipe

Mango rose flower beetle feeding on panicle.



A. M. Varela, icipe

Mango fruits and farmers inspecting mango tree



A. M. Varela & A.A. Seif, icipe

Anthracnose damage on young mango fruits



A.M.Varela, icipe

Mango leaf damaged by leaf gall fly.



A. M. Varela, icipe

**Close-up of galls
caused by gall flies on
mango leaf.**



A.M.Varela, icipe

Mango leaves showing symptoms of leaf-coating mite attack.



A. M. Varela, icipe

Mealybugs on a mango fruit.



A. M. Varela, icipe

Close-up termites on mango stem.



A. M. Varela, icipe



Damage caused by tip wilter on young mango shoot.

A. M. Varela, icipe

Fruit fly maggot in mango fruit.



A. M. Varela, icipe

Fruit fly pupae.



A. M. Varela, icipe

Grub of mango seed weevil.



A. M. Varela, icipe

Mango seed weevils



A. M. Varela, icipe

Information of www.infonet-biovision.org

Information of www.infonet-biovision.org

Onion Images



Onion bulbs

Oregon State University, Dept of Nutrition

**& Food Management. Reproduced from
the Crop Protection Compendium, 2005
Edition. © CAB International, Wallingford,
UK, 2005.**



Onion nursery

A.A.Seif, icipe



**Thrips symptoms on onion
- typical silvering and
blotching of leaves.**

Whitney Cranshaw (www.ecoport.org)

**Purple blotch on onion. Leaf-tip dieback is a
typical symptom of infection by *Alternaria
porri* on onion and shallot.**



Gerlach W.
(www.ecoport.org)

Onion smudge. Small, round, dark blotches develop on bulbs, with a zonate pattern on

the outer scale leaves.



**Denis Persley and Tony Cooke,
Department of Primary Industries
and Fisheries, Queensland,
Australia (Courtesy of EcoPort,
www.ecoport.org)**

Rust on onion



A.M. Varela, icipe

Fusarium basal rot on onions



**David B. Langston, University of Georgia,
Bugwood.org**

Downy mildew on onion



**Cornell University, Courtesy of EcoPort
(www.ecoport.org)**

Sour skin of onion.



**David B. Langston, University of Georgia,
Bugwood.org**

**White (bulb) rot
(*Sclerotium cepivorum*).**



Symptoms on onion bulbs. Infected onion bulbs displaying sclerotia (black) and hyphae (white) on the base.

Dean A. Metcalf. Reproduced from the Crop Protection Compendium, 2006 Edition. © CAB International, Wallingford, UK, 2006.



Purple blotch on onions.

A. M. Varela

Close-up of advanced purple blotch spot.



A. M. Varela.

Thrips damage on onions. Note silvering and blotching of leaves.



Information of www.infonet-biovision.org

Information of www.infonet-biovision.org

Sweet potato

Images



Sweet potato

**French B., Courtesy of Ecoport
(www.ecoport.org)**

**Mild mottle virus
symptoms on sweet
potato leaf**



**Alan A. Brunt. Reproduced from the Crop
Protection Compendium, 2006 edition.
Wallingford, UK**

**Sweet potato butterfly
(*Acraea acerata*) with
orange and black wings**



**with brown margins; 3-4
cm wingspan**

**David Agassiz. Reproduced from Crop
Protection Compendium 2006 edition.
Wallinford, UK.**

**Sweet potato vine borer
larva on sweet potato
(2.5-3 cm long)**



**AgrEvo. Reproduced from Crop
Protection Compendium 2006 edition.
Wallinford, UK.**

**Sweet potato hornworm larvae (*Agrilus
convolvuli*).**



**Matthew Cock. Reproduced
from Crop Protection**

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Compendium 2006 edition.

Wallinford, UK.

**Tortoiseshell beetle
(*Aspidomorpha* sp.).**



**Ooi P. / Shepard B.M. Courtesy of
EcoPort (www.ecoport.org)**

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Information of www.infonet-biovision.org

Sorghum

Images

Sorghum bicolor head



**Li Dajue, Courtesy of
Ecoport (www.ecoport.org)**



**Sorghum field with
purple witchweed**

**USDA APHIS Archives,
www.insectimages.org**

**Sorghum grain heads
are dried in the sun on
the threshing floor until
the seeds drop easily.
Threshing is done with**



a patole - a hand held flattened instrument made from torchwood.

J. van den Berg (Courtesy of EcoPort, www.ecoport.org)

A sorghum rust infection at this level can

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cause substantial reduction in yield.



Nowell DC, EcoPort



**Ergot (*Claviceps africana*)
on sorghum crop**

**Odvody G. (Courtesy of EcoPort,
www.ecoport.org)**

**Sorghum ergot
(*Claviceps africana*).
Syrupy honeydew**

**covering inflorescence
of male-sterile forage**



**Odvydy G. (Courtesy of EcoPort,
www.ecoport.org)**

Covered kernel smut on sorghum



J. Kranz,
www.ecoport.org



Loose kernel smut on sorghum

Kranz J., www.ecoport.org

Leaf blight on sorghum



**Nowell DC, Courtesy of EcoPort,
www.ecoport.org**

Green stink bug on pearl millet



Russ Ottens, University of Georgia, Bugwood.org

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Information of www.infonet-biovision.org

Citrus plants

Images

Citrus fruits (*Citrus limon*)

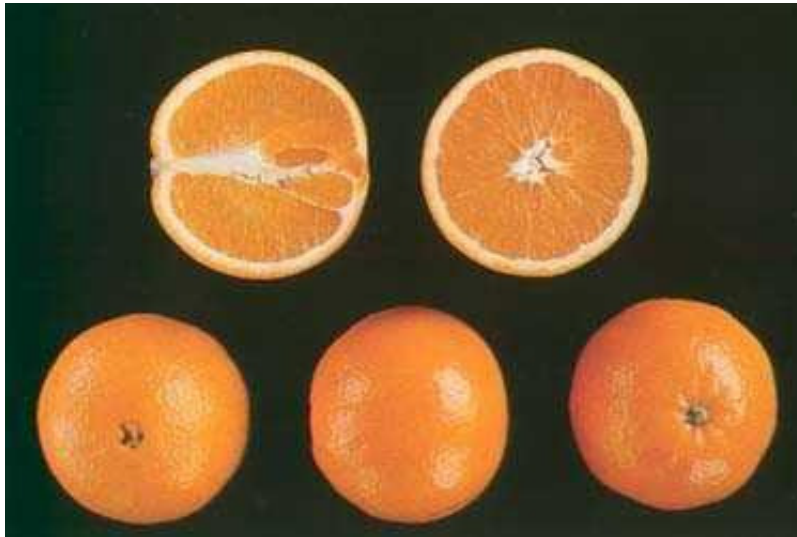


**Arnoldo Mondadori Editore SpA
(Courtesy of EcoPort,
www.ecoport.org)**

Citrus sp. - colour illustration



**Wilhelm Valder/CAB
International, 2005. Crop
Protection Compendium,
2005 Edition. Wallingford,
UK**



Oranges (*Citrus sinensis*)

R. Ubeda, J.S. Aznar and L. F. C. O'Connor (Courtesy of EcoPort, www.ecoport.org)

Citrus tristeza virus



**Richard Lee (Courtesy of EcoPort,
www.ecoport.org)**

**Feeding by citrus rust mite
causes the fruit to turn silvery,
reddish or black.**



**AgrEvo, CAB International, 2005.
Crop Protection Compendium,
2005 Edition. Wallingford, UK
www.cabi.org**

African citrus psyllid -



Characteristic bumps on the underside of sweet orange leaves caused by the feeding of the citrus psyllid (*Trioza erytreae*) (South Africa).

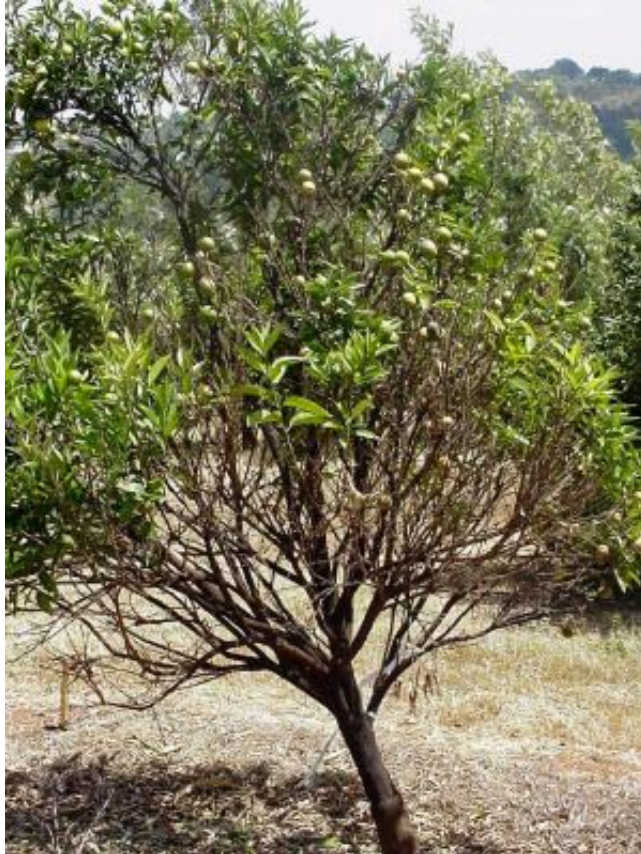
Chester Roistacher (Courtesy of EcoPort, www.ecoport.org)

Red scale on orange fruit



A. A. Seif, icipe

Damage caused by armoured



scales on an orange tree. Note yellowing of leaves, leaf drop, and dieback of branches,

A. A. Seif icipe



**Damage caused by
armoured scales on an
orange tree**

A. A.Seif, icipe

**Larvae of ladybird
beetles (*Cheilocorus sp*)
feeding on red scales on**

an orange fruit



A. M. Varela, icipe



**Ladybird beetle
(*Cheilocorus sp*) a
predator of scales on
citrus**

A. M. Varela, icipe

**Immature stages of the
citrus woolly whitefly**



B. Loehr, icipe



Damage caused by the citrus woolly whitefly on citrus. Note leaves covered by sooty mould

Immature stages of

**blackflies on a citrus
leaf**



A. A. Seif, icipe

**Heavy attack of the citrus
aphid**



A. A. Seif, icipe



The parasitic wasp (*Cales noacki*) is a natural enemy imported into East Africa for control of the citrus woolly whitefly

B. Löhr, icipe



**African citrus psyllid on a citrus tree.
Note bum-like galls on the upper leaf
surfaces.**

A. A. Seif, icipe

**Immature stages of the
African citrus psyllid.**



Note healthy nymphs (yellow) and parasitised nymphs (black)

A. A. Seif, icipe

Adult of the African citrus psyllid (*Trioza erytreaea*)



A. A. Seif, icipe



Damage cause by the false codling moth in a citrus fruit

A. M. Varela, icipe

Caterpillar of the false codling moth



A. M. Varela, icipe

Damage by the false codling moth. The initial symptom on the fruit is a yellowish round spot



with a tiny dark centre where the caterpillar entered the fruit. In a later stage brown patches appear on the skin,

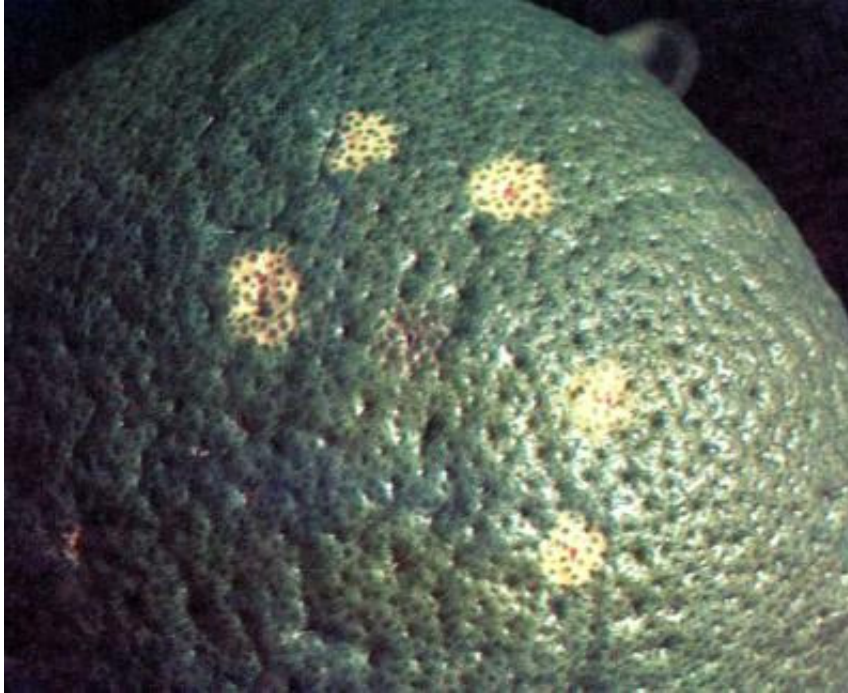
A. M. Varela, icipe

Damage by the citrus rust mite on an orange fruit



A. A. Seif, icipe

**Egg laying marks by
fruit flies on an orange
fruit**



A. A. Seif

**Phaeoramularia fruit and
leaf spots**



A.A. Seif, icipe

Phaeoramularia fruit and leaf spots



A.A. Seif, icipe

Phytophthora-gummosis



A.A. Seif, icipe

Greening disease



A.A. Seif

Greening disease



A.A. Seif

Citrus bud mite damage



A.A. Seif, icipe

Citrus leafminer damage on leaf



A.A. Seif, icipe

**Leafminer damage on
citrus**



A.A. Seif, icipe

Mealybugs on citrus



A.M. Varela, icipe

Weaver ant nest on a citrus tree

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A.A. Seif, icipe

**Orange dog mature
caterpillar**



A.M. Varela

Orange dog moth



A.M. Varela, icipe

Orange dog moth



A.M. Varela, icipe

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Bananas

Images



Bananas (*Musa* sp.)

Monique

Hunziker/BioVision

Banana (*Musa acuminata* and

***Musa balbisiana*)- colour illustration.**



Wilhelm Valder. Reproduced from the Crop Protection Compendium, 2005 Edition. CAB International, Wallingford, UK, 2005.



The cigar end rot disease (*Trachysphaera fructigena*).

Monique Hunziker, BioVision

Black leaf streak



INIBAP. International Network for the Improvement of Banana and Plantain (www.inibap.org)

Toppled bananas due to root damage caused by *Radopholus similis*, the

burrowing nematode.



**John Bridge/CABI BioScience.
Reproduced from the Crop Protection
Compendium, 2005 Edition. CAB
International, Wallingford, UK, 2005.**

Burrowing nematodes



on banana roots. Note brown lesions (patches) caused by the nematodes.

A. A. Seif, icipe

Banana with yellowing symptoms on lower leaves, caused by Fusarium wilt.



David Jones. Reproduced from the Crop Protection Compendium, 2005 Edition. CAB International, Wallingford, UK, 2005.

Fusarium wilt on banana



A. A. Seif, icipe

Pith discolouration of banana pseudostem caused by Fusarium wilt.



A. A. Seif, icipe

Anthracnose fruit rot on Banana



A. A. Seif, icipe

Thrips damage on banana fruits



A. M. Varela, icipe

Black leaf streak on

banana leaf



A. M. Varela, icipe.

**Fruit fly attack on green
banana**



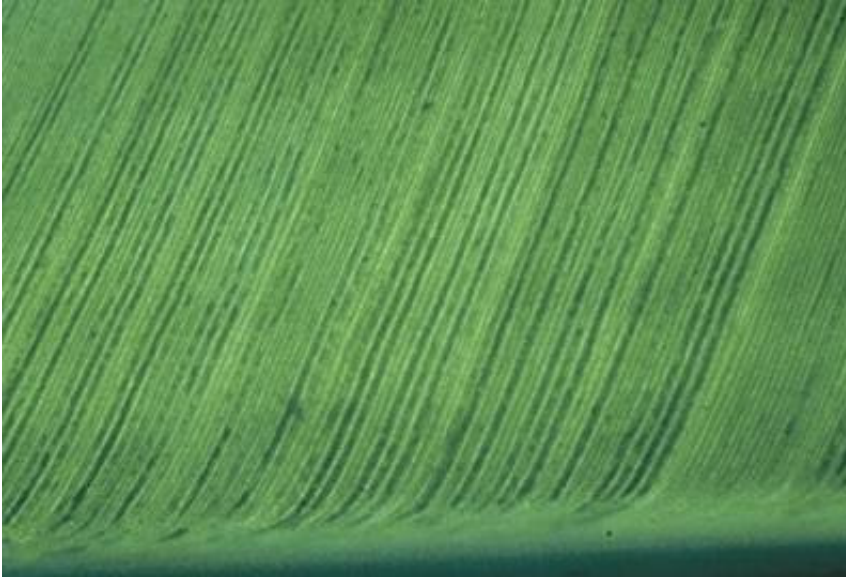
M. K. Billah, icipe

Banana weevil



A.M. Varela, icipe

**Banana bunchy top
virus**



**Denis Persley and Tony Cooke,
Department of Primary Industries and
Fisheries, Queensland, Australia
(Courtesy of EcoPort, www.ecoport.org)**

Banana bunchy top virus



**Pearson, M.N. Courtesy of
EcoPort, www.ecoport.org**

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Pigeon pea

Images

Pigeon pea (*Cajanus cajan*). Ripening pods



**Cornell University (Courtesy
of EcoPort,**

www.ecoport.org)



Pigeon pea (*Cajanus cajan*). Cultivated forms have larger seeds than their wild relatives and have been subjected to selection for larger seed. Larger seed used as fresh vegetables and medium sized genotypes for split pea production and milling.

Ellis RP (Courtesy of EcoPort, www.ecoport.org)

Pigeon pea used as green manure cover



crop in Conservation Agriculture. On this smallholder's farm, pigeon pea is used solely as a green manure cover crop in a soil recovery process. The next crop entering is maize.

Dirk Lange (Courtesy of EcoPort, www.ecoport.org)

Lima bean pod borer



**Clemson University, USDA,
www.ipmimages.org**

***Phytophthora* blight on pigeon pea**



**Y.L. Nene (EcoPort,
www.ecoport.org)**



***Cercospora* leaf spot on soybean**

Clemson University, USDA (EcoPort, www.ecoport.org)

***Macrophomina* stem canker (*Macrophomina phaseolina*)**



**D. C. McGee/Iowa State University
(Reproduced from CABI 2006)**

Powdery mildew of pea



AgrEvo (Reproduced from CABI 2006)



Rust on beans

**Dongxin Feng, Courtesy of EcoPort,
www.ecoport.org**



Bruchids

**Ferris IF, Courtesy of EcoPort,
www.ecoport.org**

Pod fly damage on pigeon pea



**Jeffrey Lotz, Florida
Department of Agriculture and
Consumer Services.**

Apion species on bean pod.

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**Frank Peairs,
Colorado State
University**

**This is a male giant
coreid bug / Tip wilter, its
about 2cm.**



A.M. Varela



Blister beetle (*Mylabris oculata*)

**Botha AD (Courtesy of EcoPort,
www.ecoport.org)**

Leafhopper. Adults are small, about 2.5 mm long. Picture shows *Empoasca fabae* (related species).



**Steve L. Brown, University of Georgia,
Bugwood.org**

**Caterpillar of the legume
pod borer (*Maruca
vitrata*). Fully-grown**

**caterpillars are about
15mm long.**



GTZ-IPM Horticulture Project. Kenya

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Information of www.infonet-biovision.org

Pumpkin

Images



Pumpkin (*Cucurbita maxima*)

**Arnoldo Mondadori Editore SpA
(www.ecoport.org)**



**Choanephora fruit rot
(*Choanephora cucurbitarum*) on
Cucurbita maxima.**

**Clemson University - USDA Cooperative
Extension Slide Series,
www.insectimages.org**

Zucchini yellow mosaic



potyvirus on *Cucurbita pepo*. ZYMV provokes in cucurbit crops very severe symptoms of stunting, yellowing, necrosis (occasionally), mosaic, leaf deformations, fruit discolorations and deformations.

Pone S. (Courtesy of EcoPort, www.ecoport.org)

Water melon damage by fruit fly



A.M. Varela, icipe



Epilachna larvae and damage to water melon

A.M. Varela, icipe

Epilachna adults and larvae feed on the leaf surface of water melon, scraping away cells to form open windows, causing the leaf to wither. Extensive



feeding can completely skeletonize the leaf. They can sometimes also feed on the fruit causing surface damage through which secondary infection may occur.

A.M. Varela, icipe

Water melon leaves

**damaged by Epilachna
beetles**



A.M. Varela, icipe

Mosaic virus on water melon



A.M. Varela, icipe

Foliage beetle feeding on water melon



A.M. Varela, icipe

**Foliage beetle feeding
on pumpkin leaf**



A.M. Varela, icipe

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Millet Images

**Close-up of Millet (*Panicum miliaceum*)
ready for harvest**



Proso millet (*Panicum miliaceum*) flower(s)

**Steve Dewey, Utah State University,
Bugwood.org
Jan Breithaupt
(www.ecoport.org)**

Millet (*Panicum*

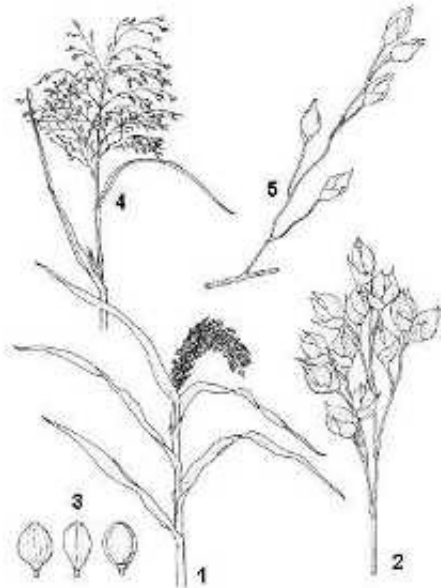


miliaceum). The small creamy-yellow seeds are edible and used as a cereal.

Botha R. (www.ecoport.org)

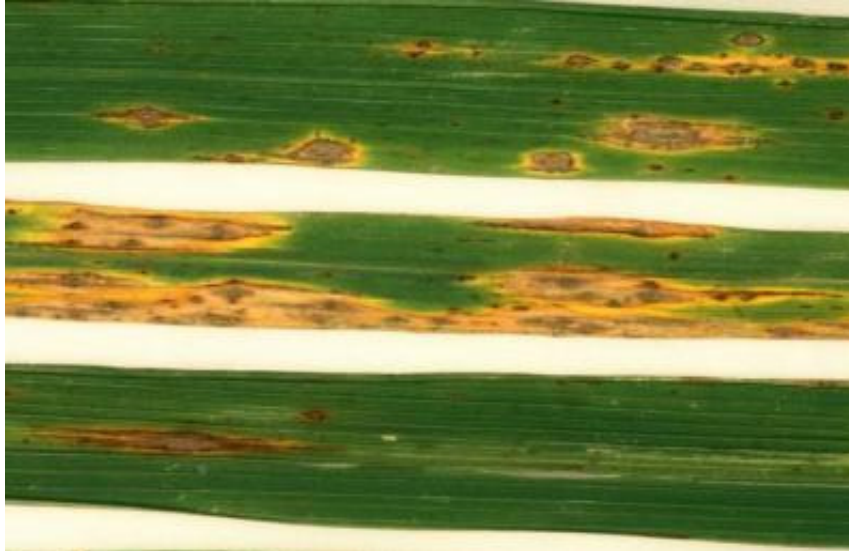
Millet (*Panicum miliaceum*): 1, habit flowering stem; 2, detail inflorescence branch; 3, grains; cv. subgroup Miliaceum:- 4, habit flowering stem; 5, detail

inflorescence branch. Line drawing.



Reproduced from the series 'Plant Resources of South-East Asia', by kind permission of the PROSEA Foundation,

Bogor, Indonesia.



Blast (*Pyricularia grisea*). Lesions on rice plant leaves.

USDA ARS Archive, USDA Agricultural Research Service, Bugwood.org

**Long smut
(*Tolyposporium*)**

penicillariae)



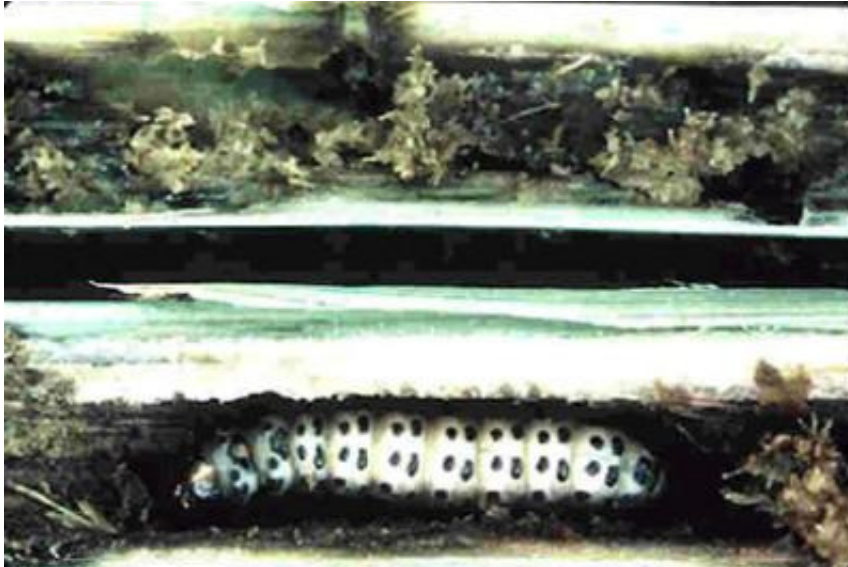
**Kranz J., Schmutterer H., Koch W.
Courtesy of EcoPort, www.ecoport.org**



Crazy top downy mildew (*Sclerospora graminicola*)

Kranz J., Courtesy of

EcoPort, www.ecoport.org



Active full-grown millet stemborer (*Coniesta ignefusalis*) larva (feeding and damage) in millet stem.

**ICRISAT - International Crop Research Institute for the Semi-Arid Tropics.
www.icrisat.org**

Shoot fly (*Atherigona soccata*) The adults are



dark brown, and similar to a housefly, but nearly half the size.

**Georg Goergen, Courtesy of EcoPort,
www.ecoport.org**

**Variegated grasshopper
(*Zonocerus variegatus*).
The size of adult
grasshoppers may vary**



between 300 mm and 520 mm.

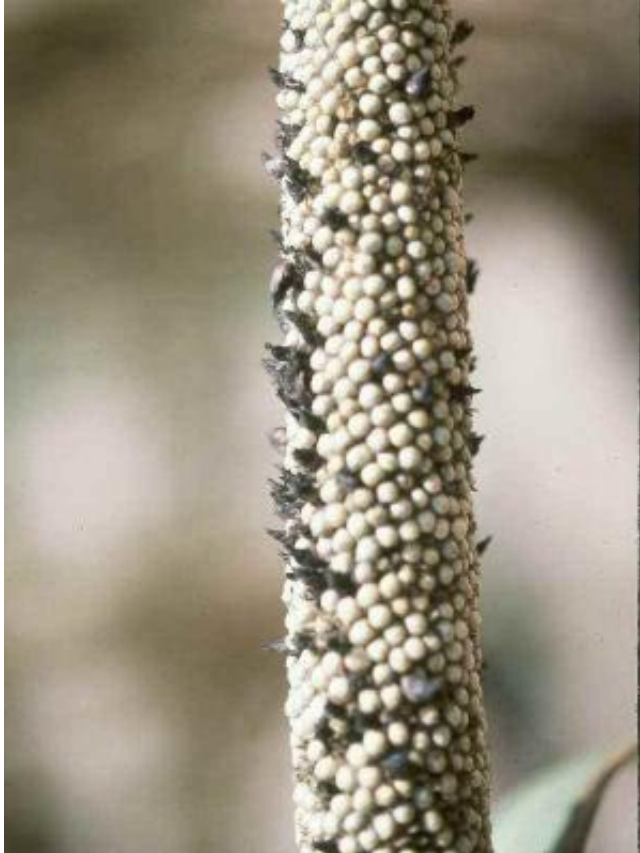
**PRIFAS. Courtesy of EcoPort,
www.ecoport.org**

**Lesser grain borer
(*Rhyzopertha dominica*).
Adults are 2-3 mm in
length and reddish-
brown in colour (shown
on wheat grains).**



**Clemson University - USDA Cooperative
Extension Slide Series, United States,
bugwood.org**

Ergot



**Reproduced from PEARL MILLET DISEASES - A
Compilation of Information of the Known Pathogens**

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of Pearl Millet

(<http://www.tifton.uga.edu/fat/pearlmilletdiseases.htm>)

Blast



**Reproduced from PEARL MILLET DISEASES - A
Compilation of Information of the Known Pathogens**

17/10/2011

www.infonet-biovision.org - Okra

of Pearl Millet

(<http://www.tifton.uga.edu/fat/pearlmilletdiseases.htm>)

Smut



**Reproduced from PEARL MILLET DISEASES - A
Compilation of Information of the Known Pathogens**

of Pearl Millet

(<http://www.tifton.uga.edu/fat/pearlmilletdiseases.htm>)



Crazy top downy mildew

**DFID Plant Sciences
Research**

Programme
**([http://www.dfid-
psp.org](http://www.dfid-
psp.org))**

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Papaya
Images

**Pawpaw (*Carica papaya*) - Tall plant
with mature fruits.**



H. Wilson
(www.ecoport.org)



Pawpaw (*Carica papaya*). Detail of male flowers.

J.R. Manhart (www.ecoport.org)

Pawpaw (*Carica papaya*). Mature fruit cut upen.

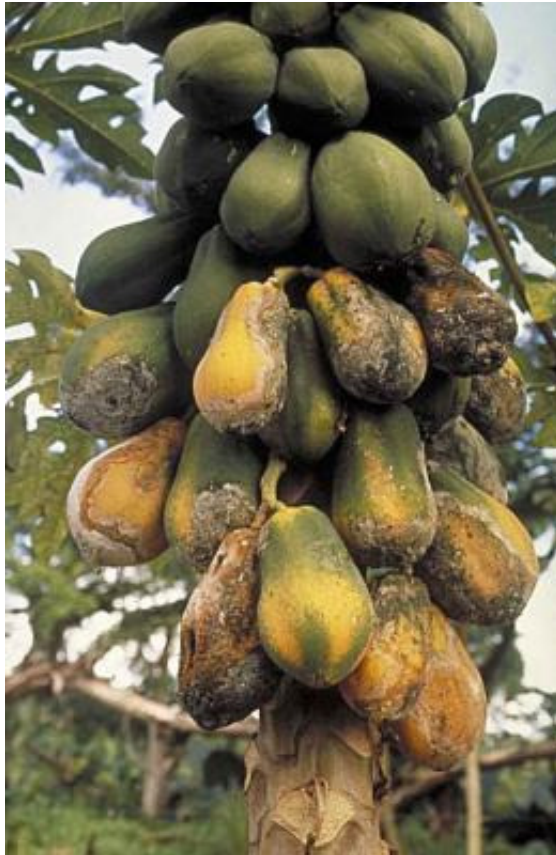


Monique Reed
(www.ecoport.org)

**Papaya ringspot potyvirus -
Severe mosaic and
distortion on young leaves.**



**Mike Pearson (Courtesy of EcoPort,
www.ecoport.org)**



White fungal crusts of white mycelium associated with fruit rot of papaya (*Phytophthora palmivora*).

**Grahame Jackson
(Courtesy of EcoPort,**

www.ecoport.org)



**Papaya mosaic
potexvirus - Affected
leaf**

**Dr. Pankaj Oudhia (Courtesy of EcoPort,
www.ecoport.org)**

Papaya ringspot

potyvirus (PRSV)



A.A. Seif, icipe

Bird damage on papaya



A.A. Seif, icipe

Ripe fruit rot



**Illustration courtesy of
<http://www.padil.gov.au> use with
permission.**

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Information of www.infonet-biovision.org

Sugarcane

Images



Sugarcane in bloom

**van Wik Ben-Eric
(www.ecoport.org)**

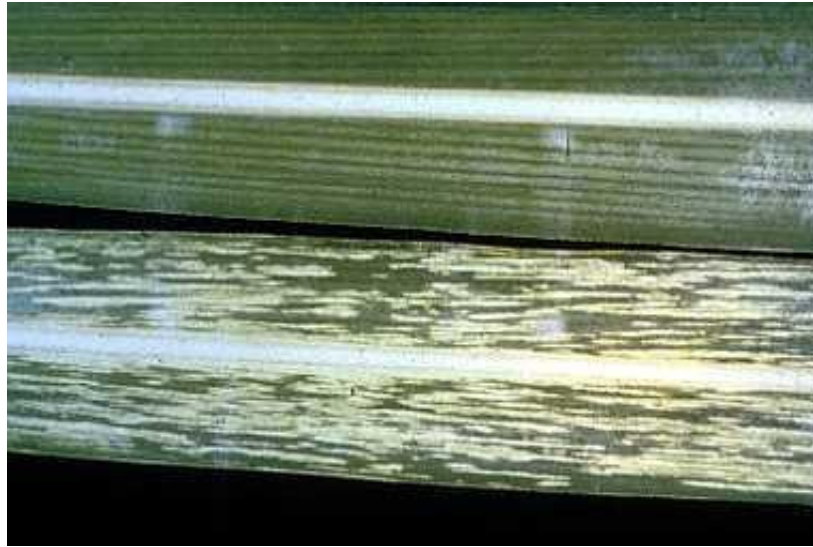
Sugarcane common rust

**(*Puccinia
melanocephala*)**



**Mauritius Sugar Industry Research
Institute**

**Severely strains of
sugarcane mosaic virus
infection on sugarcane
compared to a healthy**



leaf.

**K.C. Alexander (Courtesy of EcoPort,
www.ecoport.org)**

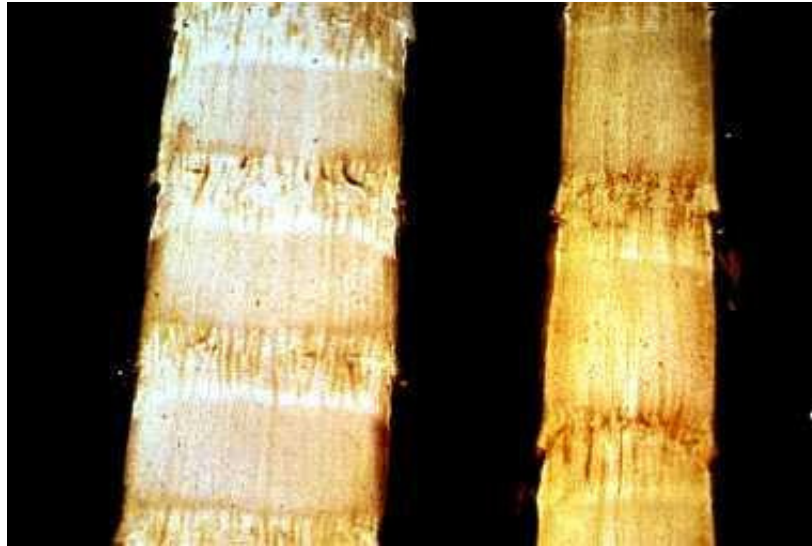
**Sugarcane red rot
(*Glomerella
tucumanensis*) - Red
spots on the midrib of the
upper leaf surface**



develop pale yellow to white centres, merging to cover the length of the leaf. Similar spots also occur on the leaf blades.

LandCare Ltd., New Zealand (Courtesy of EcoPort, www.ecoport.org)

***Clavibacter xyli* ssp. *xyli* -
Discolouration of the
nodal and internodal**



regions of sugarcane stem due to ratoon stunting disease (RSD).

K.C. Alexander (Courtesy of EcoPort, www.ecoport.org)

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Information of www.infonet-biovision.org

Cotton

Images



Cotton (*Gossypium hirsutum*) approaching harvest stage

Duthurburu H.V.
(<http://ecoport.org>)

***Gossypium* sp. - colour illustration**



Wilhelm Valder

Cotton crop rotation strategies

Crop rotation – rotation crops

Rotation Type	1st year	2nd year	3rd year
Pulses + cereals	Cotton (winter crop: wheat or pulses)	Pulses (soya, moong beans, cow pea, black gram, pigeon pea), maize or sorghum	Cotton (winter crop: wheat or pulses)
Vegetable	Cotton (winter crop: wheat or pulses)	Chilli, onion or other intensive vegetable crop	Cotton (winter crop: wheat or pulses)
Sugar cane	Cotton	Sugar cane	Sugar cane
Diverse rotation (from Tanzania)	Cotton	Sesame, safflower, sorghum or maize	Pulses (moong, chick pea, cow pea, pigeon pea, groundnut)
Rotation with herbal plants (from Egypt)	Cotton (winter crop: wheat or pulses)	Herbs (anise, basil, fennel etc.)	Maize with clover intercrop

Frank Eyhorn, Research Institute of Organic Agriculture FibL (www.fibl.org)

Larva of cotton bollworm



USDA-ARS

Cotton bollworm feeding on cotton



Alton N. Sparks
(University of
Georgia)
(<http://ecoport.org>)

Bollworm damage on cotton



Daniel Anand Raj (<http://ecoport.org>)

Pink bollworm larva on cotton.



USDA-ARS

African bollworm on cotton.



**Clemson University,
www.insectimages.org**



Anthracnose on cotton.

**Jürgen Kranz (Courtesy of EcoPort,
www.ecoport.org)**

Aphids on cotton



**Ronald Smith (Courtesy of EcoPort,
www.ecoport.org)**

**Cabbage looper on
cotton**



**David Jones (Courtesy of EcoPort,
www.ecoport.org)**

**Couch grass infestation in
cotton**



**Charles T. Bryson (USDA ARS,
www.insectimages.org)**



Cotton stainer - Nymphs (two to the left) and adult cotton stainer.

A.M. Varela, icipe

Information of www.infonet-biovision.org

Information of www.infonet-biovision.org

Rice

Images



Rice (*Oryza sativa*)

David Nance, USDA Agricultural Research Service, Bugwood.org



Upland rice (*Oryza sativa*), Ivory Coast.

Tran D. (www.ecoport.org)

Farmers do weeding in an irrigated rice field in Burkina Faso.



N. Nguyen (www.ecoport.org)

Symptoms of rice blast disease on leaves



**Jan Breithaupt (Courtesy of EcoPort,
www.ecoport.org)**

**Dried rice tassels
caused by rice blast
disease (*Magnaporthe
grisea*)**



**Jan Breithaupt (Courtesy of EcoPort,
www.ecoport.org)**

**Rice weevil (*Sitophilus
oryzae*)**



**Food Agency and Ministry of agriculture,
forestry (Courtesy of EcoPort,
www.ecoport.org)**

**Bacterial leaf blight on mature
rice plants. Lesions begins as
water-soaked stripes on the
leaf blades and eventually
would increase in length and**



width becoming yellow to grayish-white until the entire leaf dries up.

**T.W. Mew, International Rice
Research Institute, Bugwood.org**



Rice seedlings infected with Bacterial leaf blight (*Xanthomonas oryzae* pv. *oryzae*). Infected leaves wilt and roll up, turning grayish-green to yellow, until the whole seedling dies. Plants which have survived the disease are stunted and yellowish.

T.W. Mew, International Rice Research Institute, Bugwood.org

Root-knot nematode infestation in rice field



**Roger Lopez-Chaves, Universidad de
Costa Rica, Bugwood.org**

Stalk-eyed shoot fly



A.M. Varela, icipe

**Rice miner damage to
rice**



**Boris Castro, Texas A&M University -
Dept. Entomology, Bugwood.org**



Green stink bug (nymphs and adults). Adults are about 1.2cm long. (Host: Pearl Millet)

**Russ Ottens, University of Georgia,
Bugwood.org**



African gall midge - Onion shoot galls on rice

Keith Harris. Reproduced from

**the Crop Protection
Compendium, 2006 Edition. ©
CAB International, Wallingford,
UK, 2006**

**African gall midge - Onion shoot
galls on rice**



**Keith Harris. Reproduced from
the Crop Protection**

Compendium, 2006 Edition. ©

CAB International,

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**Brown leaf spot on rice.
Symptoms on leaves**

**Chin Khoon Min. Reproduced from the
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