ISBN 971-9081-03-1

FIELD GUIDE

ON HARMFUL AND USEFUL ORGANISMS IN PHILIPPINE RICE FIELDS

(INSECTS AND NON-INSECTS)

DEPARTMENT OF AGRICULTURE 1898 PHILRICE

RICE COMPETITIVENESS RCEF ENHANCEMENT FUND EXTENSION PROGRAM

REVISED EDITION 2021

CREDITS

Subject Matter Specialists
Genaro S. Rillon
Gertrudo S. Arida[+]
Ravindra C. Joshi

Editors
Roger F. Barroga[+]
Constante T. Briones
Rodolfo A. Fernandez[+]

Managing Editors
Sarah Joy N. Ruiz (2021)
Hanah Hazel Mavi M. Biag (2012)
Karen Eloisa T. Barroga (1999, 2002, 2005)

Assistant Managing Editors
Theresa Aurora B. Cosico
Olive Rose M. Asis

Layout and Graphic Artists
Alfred Franco T. Caballero[+]
Carlo G. Dacumos
Ryan P. Cacayan

Illustrator
Carlito N. Bibal[+]

Photographers
Arleen Robert E. Baclit
Nestor M. Aldemita
Xuan Hoai Truong

Editorial Advisers
John C. de Leon
Karen Eloisa T. Barroga
Ronan G. Zagado
Charisma Love B. Gado-Gonzales
Eufemio T. Rasco Jr.
Santiago R. Obien
Leocadio S. Sebastian

*Revised Version 2021; printed in 2012 and 2002

Readers are encouraged to give feedback on the impact of the recommendations contained in this booklet, particularly as pest response to management tactics is likely to vary in different varieties, environments, and farming systems. Suggestions, comments, and photographs from readers for additions and alterations to future editions are also welcome.

ISBN 971-9081-03-1

FIELD GUIDE

ON HARMFUL AND USEFUL ORGANISMS IN PHILIPPINE RICE FIELDS

INSECTS AND NON-INSECTS
REVISED EDITION

Rice is the most important cereal staple crop in the Philippines. It is attacked by many harmful organisms throughout the country at its different stages of growth, but only a few of these organisms are of national and location-specific importance. This field guide provides diagnostic information, short descriptions of the most important species, their identification marks, the ecosystem they dominate, the nature of damage inflicted, their biology, and the management options to employ.

These information will help extension workers, farmers, and nonspecialists identify the harmful and useful organisms in rice fields. Colored photographs are provided for easy identification of the organisms. Appropriate control measures are suggested. It is clear that most pest outbreaks are induced by poor management practices. Close monitoring and early recognition of potential pest species will be useful in future pest management programs.

ISBN 971-9081-03-1

INTRODUCTION

This field guide is designed to assist agricultural technologists, farmers, students, and nonspecialists identify the most common harmful and helpful organisms found in Philippine rice fields.

Not all organisms are pests; many are useful because they feed on pest species. Some of the more easily visible useful organisms are described in this guide to emphasize that it is important to determine the roles of organisms found on crops, rather than to assume that all organisms are harmful and so must be eliminated! In fact there are more species that are helpful than harmful ones.

As this guide is aimed for use by nontaxonomists, we have strived to use nontechnical terms, as it is not always easy to identify living organisms from photographs.

For the harmful organisms, the most characteristic identification marks, the ecosystem they dominate, the damage they inflict, and their life cycles are illustrated and described together with suggestions or management options, where appropriate.

This reference will be a useful tool to contribute further to the application of Integrated Crop Management (ICM) technologies to raise production levels, maximize profits, and reduce populations of harmful organisms through nonchemical methods. Chemical control should be used only where essential, and preferably with the advice of a local crop protection specialist.

The users of this field guide are advised to have the diseased specimens/tissues further examined under the microscope and by laboratory tests conducted by crop protection specialists to confirm the field diagnoses.

HOW TO USE THIS FIELD GUIDE

Decision-making is the backbone of ICM. Correct and timely decision in ICM is only possible when the nonspecialist has a thorough knowledge of both living and nonliving organisms in the rice ecosystem. An individual entering a rice field usually encounters living organisms, which are either harmful (those feeding on parts of the rice plant) or useful (those feeding on harmful organisms). One should take note of the following: the plant growth stage, the plant part where it is found, and its activity (feeding on the plant or feeding on other organisms). Integrated Pest Management (IPM) is an integral component of ICM, which looks at the ecosystem in totality. The major emphasis is on weekly monitoring of the rice fields, taking into account the abundance of useful organisms along with the numbers of harmful organisms, plant growth stage, water status, leaf color, and general crop growth status.

Harmful organisms can be broadly grouped further into two categories: insects (six-legged) and non-insects, which comprise those without a backbone (e.g., earthworms, snails) and those with a backbone (e.g., rats, birds). The harmful insects are further grouped based on two criteria: plant part they feed on (root, leaf, stem, sap, grain) and the degree of economic importance (color-coded as follows: red for most harmful, orange for harmful but location-specific, and yellow for less harmful). Useful organisms have either six legs (insects), eight legs (web and non-web-forming spiders), or no legs (white/green fungus, viruses). They can be grouped further based on the following criteria: habitat occupied (color-coded as follows: green for aerial-borne organisms, blue for water-borne organisms, and white for insect-killing fungus, bacterium, and virus) and visible mobility (mobile are insects and spiders; mobility not visible in insect-killing fungus, bacterium, and virus).

On establishing the identity of the harmful organisms, refer for more detailed information on the local name, identification marks, rice ecosystem it dominates, nature of damage inflicted, life cycle, and management strategies. Similarly, for useful organisms refer for details on the local name, identification marks, rice ecosystem, food as prey, and life cycle.

The last section of the field guide provides information on:

- cultural practices useful in the management of harmful insects;
- scientific and local names of the organisms;
- pest abundance and rice susceptibility;
- popular Philippine rice varieties and their agronomic characteristics and pest and disease reactions; and
- glossary of terms used in this field guide.

TABLE OF CONTENTS

Introduction v
How to use this field guide vi
Harmful organisms
• *Category : Insects (six-legged organisms)*

ROOT FEEDERS
Mole Cricket 1
LEAF FEEDERS
Leaffolder/Leaf Roller 3
Caseworm/Case Bearer 4
Skipper 6
Short-horned Grasshopper/Locust 8
Armyworm/Cutworm/Taro Caterpillar 10
Whorl Maggot 12
STEM FEEDERS
Yellow Stem Borer 14
White Stem Borer 16
Pink Stem Borer 17
Striped Stem Borer 18
SAP FEEDERS
Brown Planthopper 22
White-backed Planthopper 23
Green Leafhopper 25
Zigzag Leafhopper 26
GRAIN FEEDERS
Seed Bug/Paddy Bug/Rice Bug 28
Black Bug 30

• *Category : Non-insects*

ORGANISMS WITHOUT BACKBONE
Golden Apple Snail 32
Earthworm 35
ORGANISMS WITH BACKBONE
Rat 38
Sparrow 41

Useful organisms
• *Category : Insects (Mobile, six-legged organisms)*

AERIAL-BORNE
Mirid 42
Ground Beetle 42
Lady Beetle 43

Damselfly 43
Dragonfly 44
Cricket 44
Long-horned Grasshopper 45
Small Wasp 45
Big Wasp 46
Tachinid Fly 46
WATER-BORNE
Ripple Bug 47

- *Category : Spiders (Mobile, eight-legged organisms)*

NON WEB-FORMING
Wolf Spider 48
Lynx Spider 48
Jumping Spider 49
WEB-FORMING
Long-jawed Spider 50
Orb Spider 50
Dwarf Spider/Space-web spider 51

- *Category : Non-insects (Mobility not visible)*

Green Fungus 52
Light Brownish Fungus with Projections 52
White Fungus 53
Virus 53

TABLES: Cultural practices, scientific and local names of organisms, pest occurrence and rice susceptibility, popular Philippine rice varieties **54 60**
GLOSSARY OF TERMS **65**
REFERENCES **72**

HARMFUL ORGANISMS

CATEGORY: INSECTS (SIX-LEGGED ORGANISMS)

ROOT FEEDERS

Mole Cricket

Tagalog name: susuhong

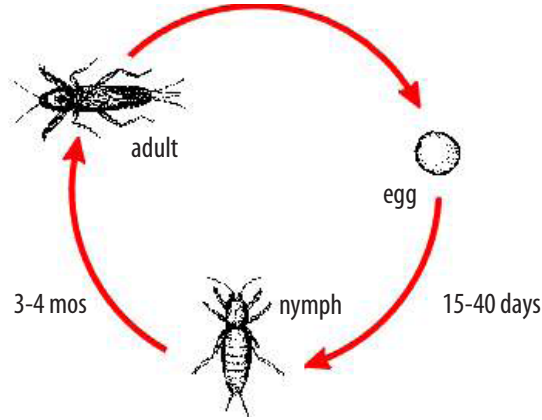
Mole cricket damage (inset) to rice at early vegetative stage

Identifying marks:
The insect is light brown; its wings are folded and do not cover the full length of the abdomen. The forelegs are broad, curved, with strong teeth-like structures for digging soil. The hind legs, eyes, and antennae are small and almost invisible. The adult is 25-35 millimeters (mm) long.

Where to find:
They live in all rice environments but are most prevalent in non-flooded upland rice fields with damp soil. They are usually found in burrows along the levees or shelter in seedbeds during daytime. Heaps of soil mark the entrances to extensive burrows in the soil. They prefer moist soils with high organic matter. In areas where the dry season is short, they can multiply in unusually large numbers. They cannot survive in the rice fields after flooding.

Damage:
Mole cricket damage is greater near the field borders where they relocate after tillage operations. Susceptible growth stages are from seedling to tillering. At night, adults and nymphs feed on sown seeds and roots of rice plants either in the seedbed or of young seedlings, causing bare patches in the field. In older plants, tillers near the soil surface may be chewed on, but the damage can generally be tolerated. Young and newly planted seedlings are most commonly attacked in the early part of the season before fields are flooded.

Life cycle:
Females burrow bunds and construct hardened cells in which eggs are laid. Each cell contains 30-50 eggs. Depending on the temperature, eggs hatch in 15-40 days. Their capacity to migrate is limited. They also eat each other. Nymphs become adults in 3-4 months. Adults are attracted to light traps.



Life cycle of a mole cricket

Management options:

Cultural
- Bund-shaving and plastering with fresh wet soil kills their eggs.
- Levelling fields provides better water control, which can limit mole cricket invasions.
- Collecting nymphs and adults during land preparation, bund repairs, and seedling pulling in nursery beds reduce their population.
- Maintaining standing water in the field prevents their damage.
- After rains, they are attracted to light sources during nighttime. They can then be collected, destroyed, and even eaten.
- Varieties with long and dense fibrous root systems like many of the modern varieties tolerate damage better.

Biological
- They eat each other when they are together. Hence, they regulate their own numbers.
- Nymphs and adults have many natural enemies such as big wasps and nematodes.

Chemical
- Poisoned baits made of mixed moistened rice bran and insecticide, placed along rice bunds or drier areas of the field, kill night-foraging mole crickets.
- Granular insecticides are effective but expensive; foliar insecticides are ineffective.

Leaf folder

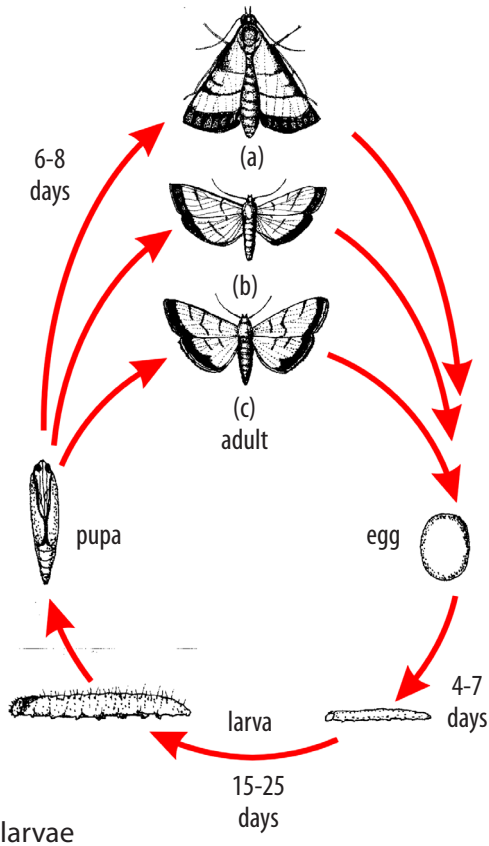
Tagalog names: mambibilot, maniniklop

Identifying marks:
The adults are light brown moths with a wingspan of 12-20mm. A dark terminal band characterizes the outer margins of the wings. Larvae are transparent green and measure up to 2.5 centimeters (cm) in length. Adults are attracted to light at night; at daytime, they are mostly found in shaded or grassy areas.

Where to find:
Leaffolders live in all environments but are abundant during the rainy season. High humidity, shady areas of the field, and excessive use of nitrogenous fertilizers favor their rapid multiplication.

Damage:
Leaffolders inflict damage in the larva stage. Plants are susceptible to attack up to 10 weeks after transplanting (i.e., from seedling to flowering). Infestation usually occurs during early growth stages of the rice crop. The larvae infest the leaves of young plants; they fasten the edges of a leaf together and live inside the rolled leaf. Heavy infestation makes the plant look burnt, sickly, and twig-like.

Life cycle:
The eggs are laid singly or in pairs on the young leaves. They are flat, oval, and whitish yellow. Eggs hatch to larvae in 4-7 days. The transparent green, slender larvae feed inside the folded leaves for 15-25 days before pupation. Adults emerge 6-8 days from pupa. Total life cycle takes 25-52 days. For adult moths, the potential sugar source in the field is the honeydew excreted by planthoppers.



Life cycle of leaffolders
(a) Cnaphalocrocis medinalis
(b) Marasmia exigua, (c) Marasmia patnalis

Management options:
Modern rice varieties and conservation of useful organisms, coupled with location-specific cultural management practices, can regulate leaffolder population without resorting to chemicals.

Cultural
- Clipping tops of bundled seedlings before transplanting removes eggs.
- Removing weeds prevents leaffolder buildup.
- Reducing amount of nitrogenous fertilizer and splitting the application make rice plants less favorable for egg-laying and leaffolder attack.
- Potassium makes cell walls thicker because of greater silica uptake, making the plant more tolerant to leaffolders.
- Higher infestation occurs in shady places.
- Wider spacing reduces infestation.
- Early planting enables plants to escape a high degree of defoliation.
- Most modern rice varieties can compensate for leaffolder defoliation; making insecticides no longer necessary for control.
- Varieties with narrow leaves are more resistant to leaffolders than varieties with wider leaves.

Biological
- Small wasps and crickets kill leaffolder eggs.
- Big wasps, damselflies, ants, and carabid (guitar) beetles prey on larvae.
- During the wet season, frequent moderate rainfall enables pathogens to wipe out the entire larval population. Fungi and nuclear polyhydrosis virus (NPV) kill the larvae.
- Spiders eat adult leaffolders.

Caseworm/Case Bearer
Tagalog names: uod na nasa supot

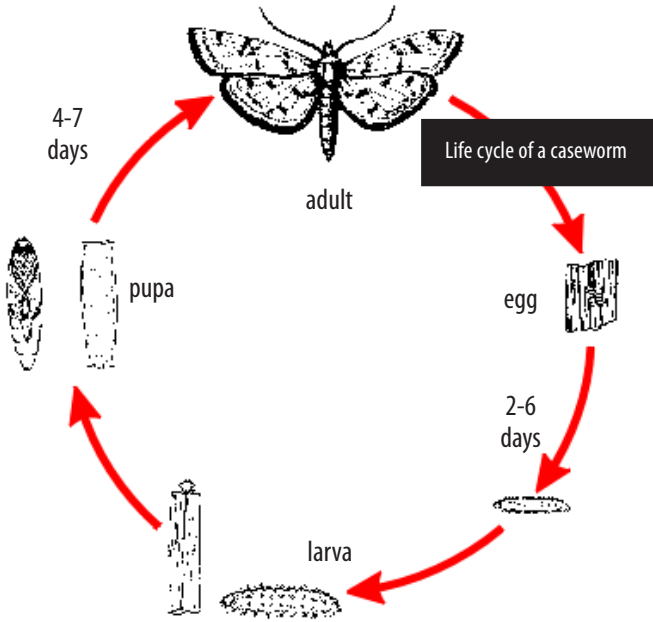
Identifying marks:
The adults are small, delicate, snowy-white moths with pale brown or black spots on the wings. They have a wingspan of 15-25mm. Larvae are pale translucent green, with a pale orange head. There are easy early detection methods to know the pest activity in the area. Moths are attracted to light traps, which also indicate whether there is pest activity in the area.

Where to find:
Caseworm is found in irrigated and wetland areas where standing water in the field is a prerequisite for larval survival. The infestation is severe on dwarf, compact, heavy-tillering, and high-yielding varieties during the rainy season. Defoliation occurs before maximum tillering of rice.

Caseworm damage. Note the cut leaf cases and standing water.

Damage:
The larva is the damaging stage. The larvae cut the tip of the leaves, as though by scissors, to make floating cases. They use these cases as a reservoir of water, for breathing, and to protect themselves against predators. The cases also facilitate their dispersal through flowing water and wind. During the day, the larvae remain inside the case and float on the water surface. At night, they feed on the lower side of leaves lying flat on the water, or on submerged leaves. In general, a young vigorously growing crop recovers from defoliation, but maturity may be delayed by 7-10 days. In heavily infested crops, however, the loss of photosynthetic tissue can be critical and seedlings may die. Older plants are generally more tolerant to damage, and mature plants are seldom attacked. Susceptible growth stages are from seedling to tillering.

Life cycle:
The eggs are laid singly on the undersurface of the lower leaves touching the water surface. The eggs are pale, yellowish green, and laid in one or two long rows. They hatch to larvae in 2-6 days. After a few days, the first-instar larvae construct floating cases. Their cases are replaced as the larvae grow. Larvae are semiaquatic and can withstand prolonged immersion as they have slender gills along their sides. The fully developed larva is 13-20mm long. Pupation takes place inside the last larval case, which is fastened



Life cycle of a caseworm

to the base of the stem. The adult emerges in 4-7 days from the pupa. Adults can live up to 3 weeks and are attracted to light traps.

Management options:

Cultural
- Transplanting older seedlings limits the period of larval attack.
- Draining the field for several days kills caseworm larvae.
- Sparse planting reduces damage.

Biological
- Big wasps and water beetles kill larvae.
- Spiders, dragonflies, and birds prey on the adults.

Chemical
- Caseworm larvae are highly susceptible to foliar and granular insecticides. Apply insecticides only to fields with standing water and only when larvae are present.

Skipper

Adults of rice skipper

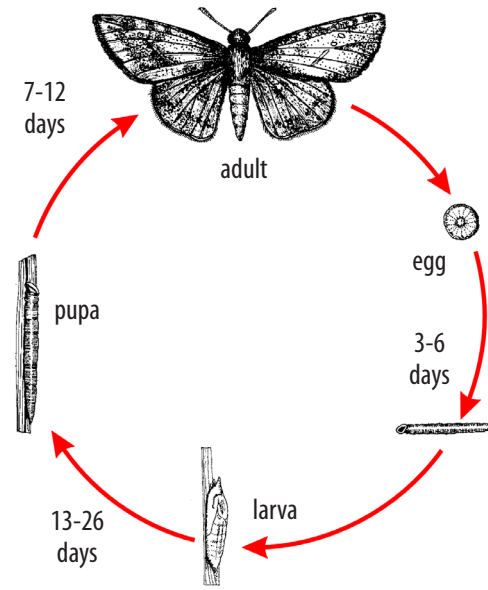
Larva of skipper and its damage on rice leaf

Identifying marks:
The adult is a stout brown butterfly with small white spots on the wings. Adults are active during the day, making darting, erratic movements from which the name skipper was coined. Adults rest in the shade during the day. Larvae are elongated with a constriction behind the head accentuating their flattened shape.

Where to find:
They occur in all rice environments, but prevalent in rainfed rice. Upland environments with their diverse microhabitats can provide more favorable sites than lowland rice plains. In some cases, upland rice is most affected. Droughts, downpours, floods, or misuse of pesticides can cause their outbreaks because useful organisms regulating them get depleted.

Damage:
Defoliation is the first sign of the presence of skipper larvae. The larvae are difficult to see because they hide in the leaf tubes and feed mostly at night. Damage occurs in patches or clusters, around where females lay their eggs. Damage is not uniformly dispersed across a field. The larvae feed on leaves from the margins inwards and then parallel to the midrib. In addition, the larvae tie with silken threads the two edges of the same leaf or two adjacent leaves to form a tube in which they live. Generally one larva is found in a fold. Damage is severe in young transplanted rice seedlings and the attack may continue until the plant matures. In severe cases, the plant does not recover. This pest adversely affects grain quality.

Life cycle:
Eggs are smooth and creamy white, laid singly on the upper surface of leaves. They are semispherical with a flat base, and hatch in 3-6 days. Larvae are pale green with a vertical streak on either side of the head. Full-grown larvae measure 30-35mm in length and covered with powdery white wax. They become pupae in 13-26 days. Pupae that stay in the leaf are fold-spun by the larvae. The adult butterfly emerges in 7-12 days after pupation. The adults mate in the morning.



Life cycle of a skipper

Management options:
Good agronomic practices and biological control are key to skipper management. They have low reproductive potential and colonization of rice fields is low compared with most harmful organisms. Because of these characteristics, useful organisms can keep skipper numbers at non-damaging levels.

Cultural

- Dense cropping and good fertilization are important. Do not overuse or underuse nitrogen fertilizer. The experience of progressive farmers in the area can provide guidelines on the amount and number of fertilizer applications.

- Early plantings will normally escape colonization and significant damage.
- Larvae and pupae can also be hand-collected.
- Hitting the foliage with bamboo sticks will dislodge larvae to drown in the water.
- Modern rice varieties can normally tolerate relatively high levels of leaf loss.

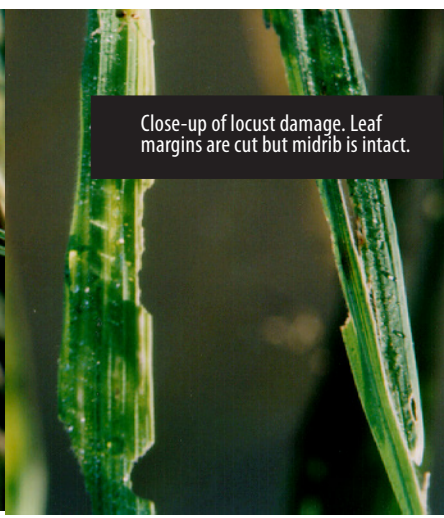
Biological
- Small wasps kill skipper eggs.
- Big wasps and tachinid flies kill larvae.
- Orb spiders (web spinners) capture and eat the adults in flight.

Chemical
- Same as green-horned caterpillar.
- Application of contact insecticides in late afternoon results in high efficacy. This is because most larvae come out at this time of day to feed on foliage.

Short-horned Grasshopper/Locust

Tagalog names: balang, lukton

Short-horned grasshopper on mature rice panicles. They cut rice panicle stalks.



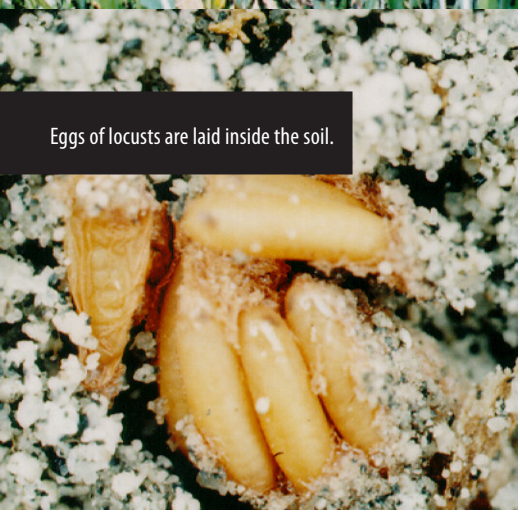
Close-up of locust damage. Leaf margins are cut but midrib is intact.

Identifying marks:
The adults are small, yellow and brown, about 3cm in body length, with conspicuous, broad, brown stripes running laterally through the eyes and extending posteriorly along the wings. The antennae are short, much less than the length of the body. When in swarms, they are in their migratory phase and are called locusts.

Where to find:
They are found in all rice environments but are prevalent in rainfed areas. They tend to localize in dry areas and rice fields adjacent to grasslands where they breed. They cannot be found along rice field margins during early hours of the morning and after sunset.

Pampanga and Mindanao are areas where they have caused havoc to cultivated crops, including rice.

Field view of damage by locust



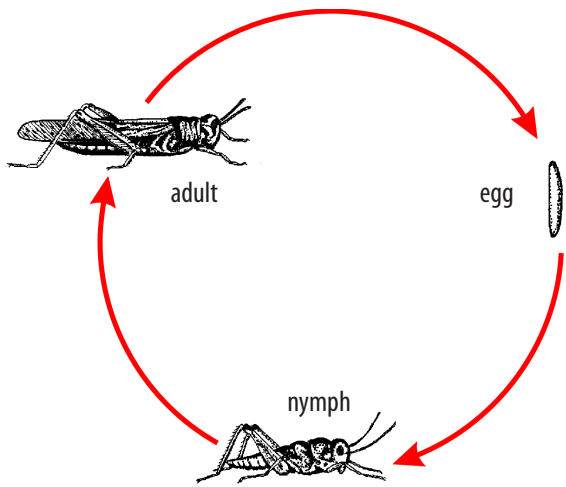
Eggs of locusts are laid inside the soil.

Damage:
Grasshoppers can damage rice at all stages of crop growth. Nymphs eat newly germinated rice seedlings and cause them to wither. Adults feed on the leaves and shoots, and may eat the base of the panicle causing it to wither and die.

If the emerging flowers are attacked, the resulting grains become chaffy. Swarming locusts can remove most of the foliage in a rice field leaving only the base of tillers.

Life cycle:
They lay their eggs on the rice foliage or inside the soil and their nymphs are semiaquatic.

Life cycle of a short-horned grasshopper



Locust in gregarious stage

Management options:

Cultural
- Flooding the stubbles drowns grasshoppers.
- Shaving of bunds kills egg pods.
- Sweeping along the bunds reduces their numbers.
- Adults are sluggish at night, and can be picked directly from the foliage.

Biological
- Small wasps attack eggs.
- Parasitic flies, nematodes, and fungal and bacterial pathogens kill nymphs and adults.
- Birds (house sparrow), frogs, and web-spinning spiders are major predators of nymphs and adults.

Armyworm/Cutworm/Taro Caterpillar

Tagalog names: arabas, harabas, tagustos

Armyworm larva feeding on flag leaf when rice is at its maturity.

Identifying marks:
The adult moth has dark purplish brown forewings with numerous spots and light-colored lines. The hind wings are whitish, narrowly banded along the outer margin. The wingspan is about 30mm. Larvae are soil-dwelling or hide underground to avoid predation by birds. They become active at night and emerge from the ground. Larvae come in various colors, ranging from creamy white to green or dark purple, with or without stripes.

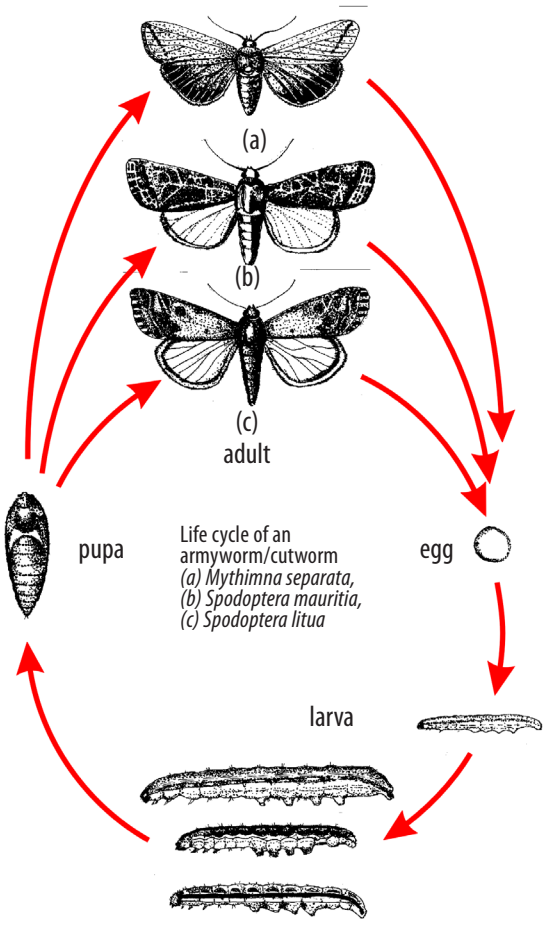
Where to find:
They live in all rice environments, but are serious in upland rice as they need dry soil for pupation. Lowland fields also occasionally

suffer damage when the larvae move from one field to another. Armyworms are usually abundant in rice crops grown after a long dry spell.

Damage:
Larva is the damaging stage. Young rice plants are often cut at ground level while older plants are only defoliated. Newly hatched larvae usually feed together on the leaf surface. The older larvae are night-feeders and are usually found in the soil around the base of the plants. Susceptible growth stages are from seedling to ripening.

Groups of young armyworm larvae on taro leaves in gregarious stage. Note their feeding injury.

Life cycle:
Eggs are laid in clusters of several hundreds, usually on the leaves. These egg masses, which measure about 4mmx7mm, appear golden brown because they are covered with the body scales of the female. The eggs take 3-4 days to hatch; the larvae disperse quickly from the egg batch. Young larvae are light green. The later instars are dark green to brown on their backs, lighter underneath, and have prominent black spots on the thorax. There are often thin, light-colored lines along the body. There are black crescent spots next to the stripes. The head is black to dull brown with a yellow V-shaped marking. Larvae can be 50-mm-long before they pupate. Larval duration is 20-26 days. The pupae are reddish brown and are found in the soil in individual earthen cells under upland conditions. In wetland fields, larvae pupate in the rice plants or in grassy areas along the field borders. Adults are attracted to light traps.



Life cycle of an armyworm/cutworm
(a) Mythimna separata,
(b) Spodoptera mauritia,
(c) Spodoptera litua

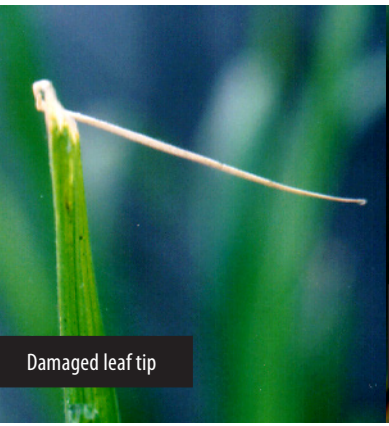
Whorl Maggot

Tagalog names: langaw palay, langaw bukid

Identifying marks:
Adult flies are dull grey. Females are 1.8mm-2.3mm long. Males are slightly shorter.

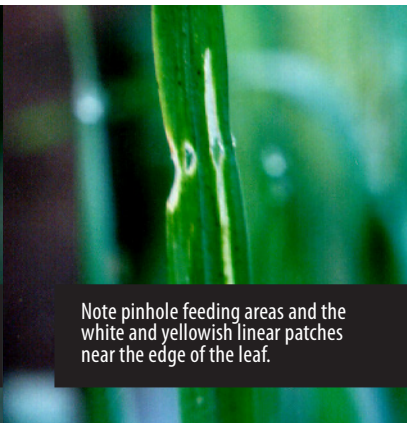
Where to find:
It is a pest of rice seedlings only under irrigated and rainfed conditions. Adults prefer ponds, streams, lakes, and irrigated rice fields for their breeding. This is because the adults locate rice fields by reflected sunlight from the water surface. Hence, direct-seeded fields or seedbeds are not seriously damaged. Rice crop with a mat of azolla on the water surface repels egg-laying of adult flies. In addition, once the plant canopy closes, they can no longer find the rice crop. Rice plants grown under continuous standing water in the first 3-4 weeks after transplanting have more damage than plants in fields where the soil is only saturated. When the young plants are simultaneously stressed with either soil mineral deficiencies or toxicities and other biotic stresses (caseworm or stem borer), the plants damaged by whorl maggots cannot recover; and thus, yield loss will be high.

Damage:
The larva that causes damage is called the maggot. It feeds on unopened leaves, nibbling the inner margins. When the leaves emerge from the whorl, damage can be seen as pinhole feeding areas on the leaves, with conspicuous white and yellowish linear patches near the edge of leaves. Severely damaged leaves become distorted and may break from the wind. Infested plants are stunted with few tillers. Susceptible growth stages are seedling to tillering. However, the pest can cause damage to the boot leaf and developing panicles, which can lead to only partial filling of the grains. Crop maturation may be delayed up to 2 weeks; thereby, increasing the risk of crop exposure to typhoons and other stresses.



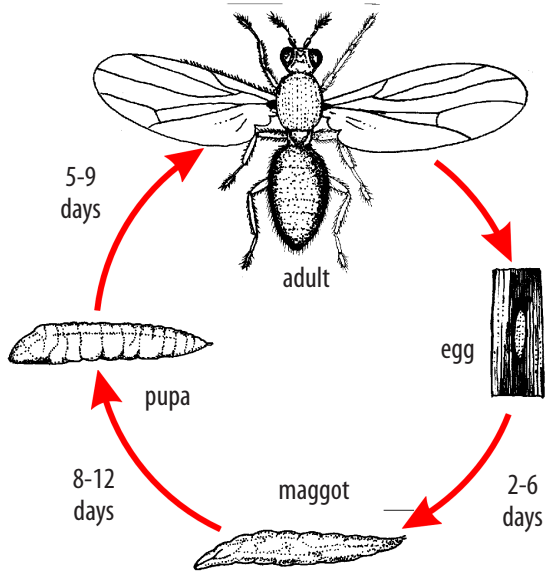
Damaged leaf tip

Adult whorl maggot facing head down. Whorl maggot cannot see the rice plant without its reflection on water surface.



Note pinhole feeding areas and the white and yellowish linear patches near the edge of the leaf.

Life cycle:
The white elongated, cigar-shaped eggs are laid singly on either surface of the leaves. Eggs hatch into maggots after 2-6 days. The maggot is transparent to light cream and moves down the leaf into the whorl on a film of water or dew, and feed within the developing leaf whorl. Larval period is 8-17 days. Maggots pupate between leaf sheaths. Pupal period is 5-9 days. There are overlapping generations under field conditions.



Life cycle of a whorl maggot

Management options

Cultural
- Densely planted seedbeds do not attract adult flies.
- Transplanting older seedlings (25-30 days) avoids damage.
- Draining the field at 3-4 day intervals during the first 30 days after transplanting reduces egg-laying.
- Adults are not attracted to light traps, and they feed on decaying matter.
- Direct seeding discourages maggot buildup because the plant covers the water surface more rapidly.
- Dense planting decreases egg-laying.
- Plants that cover the water surface such as azolla help prevent infestation.
- More potassium increases plant tolerance to maggots, as cell walls get thicker because of greater silica uptake.
- Adult flies are strongly attracted to fishmeal baits.
- High-tillering varieties are more tolerant than low-tillering varieties.

Biological
- Small wasps and field crickets kill eggs.
- Big wasps kill maggots.
- Water-borne and aerial-borne spiders eat adults.

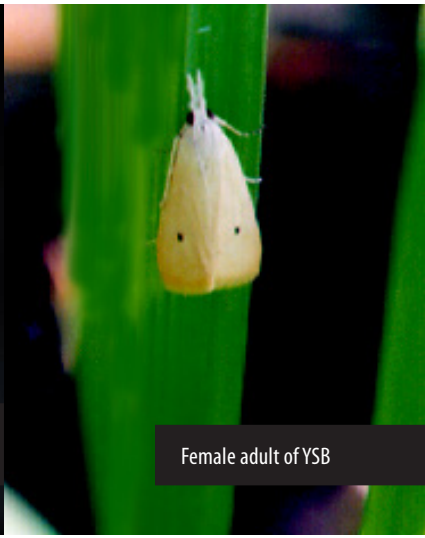
Chemical
- Maggot control in seedbed is less expensive. Treat seedlings by soaking them overnight in a slurry of systemic insecticide and zinc oxide (ZnO_2) powder solution before transplanting.
- Broadcast granules or mix systemic granules during the last harrowing before transplanting.
- Foliar sprays are effective only at 1-2 weeks after transplanting (WAT).

Yellow Stem Borer (YSB)

Tagalog names: dilaw na aksip, dilaw na bagumbong

Egg mass of YSB

Larva of stem borer inside rice tillers



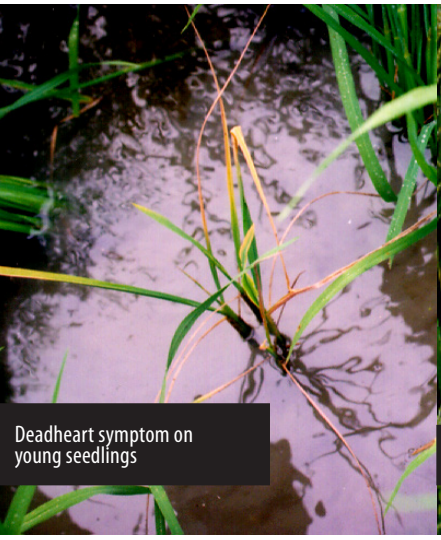
Female adult of YSB

Identifying marks:
The male and female adults are two different forms, and with distinct sexual characteristics. The female moth has one dark spot at the center of its bright yellowish forewings, while spots on the forewings of the male are not clearly seen. The wingspan is 22mm–30mm. The males are smaller than the females, and do not have yellowish hairs at the end of the abdomen.

Where to find:
Yellow stem borer is a notorious pest of deepwater rice. It is abundant in aquatic habitats where flooding occurs and where multiple rice crops are grown annually. Rice plants at the vegetative and early heading stages are preferred for egg-laying. Plants receiving high nitrogenous fertilizers are also favorable to larval survival.

Only one larva can be found in a stem. To detect the presence of moth, flush the borders of the field. To monitor larval densities, dissect tillers at tiller elongation and panicle initiation stages. For eggmasses, check seedbed or newly established crop at weekly intervals starting 3 weeks after transplanting up to 9 WAT. Egg-laying can peak at 3.5 eggmass/m^2.

Damage:
The larvae bore into the rice stems and hollow them out completely. In young plants, the central leaf whorl does not unfold, turns brownish, and dries up, although lower leaves remain green and healthy. Such symptom is referred to as **deadheart**. In older plants, the panicles dry up with unfilled grains and turn white. Such symptom is referred to as **whitehead**. Both deadheart and whitehead can easily be pulled out by hand. Older plants often break where the stem was hollowed out causing lodging.

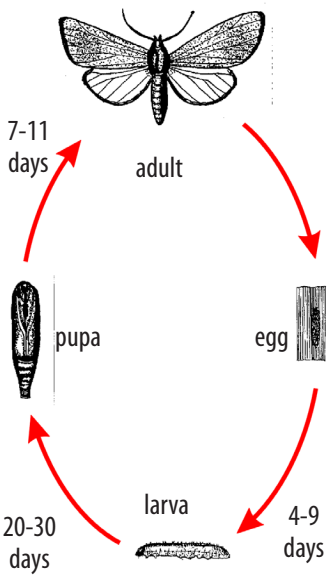

Deadheart symptom on young seedlings


Whitehead symptom at reproductive stage

Life cycle:
Eggmasses are laid in batches of 80-150 near leaf tips or on the leaf sheath, and covered with the brown anal hairs of the female moth. Eggs hatch in 4-9 days. All eggs in one eggmass hatch simultaneously. The newly hatched larvae crawl toward the tip of the plant and have silken threads, and are usually dispersed by wind to adjacent rice plants. Then they descend toward the base and crawl between leaf sheaths and enter the stems. Larvae are hairless, pale or yellowish, and 18mm-25mm long when mature. The larvae have small orange heads.

One larva can be found in a stem. Larval period is 30-40 days. Before pupation, the larva makes an exit hole through which the adult moth later escapes. Pupation takes place inside the stem, often below the soil. Larvae seal entrance holes with silk to make stems watertight. Adult moth emerges from pupa within 7-11 days. The adults can survive for 4-10 days without food. Adults are attracted to light traps.

Life cycle of a stem borer



White Stem Borer (WSB)

Tagalog names: puting aksip, puting bagumbong

Adult WSB. It has many hairs on the head.

Identifying marks:
The adult of this species looks similar to the YSB except that it does not have any dark spot on the forewings, in either sex. Hence, the WSB sexes look similar. Orange hairs are present at the end of the female WSB's abdomen, while in YSB they are yellowish. The wingspan of the adult female is 26mm-30mm, with males being smaller.

Where to find:
Predominant in rainfed areas where there is only one wet season crop per year, and where stubbles are left undisturbed during the dry season. Upland rice is susceptible to WSB species, as the larvae cannot survive extremely wet situations. Thus, this insect does not occur in areas with high rainfall. Early in the season, deadhearts are caused in the nurseries and in the young crop, while later in the cropping season subsequent generations cause whiteheads. WSB is presently found in the Visayas and Mindanao.

Damage:
The larvae bore into the rice stems and hollow out the stem nodes and internodes. Young plants exhibit deadhearts while older plants develop whiteheads. Older plants often break where the stem is hollowed out causing lodging.

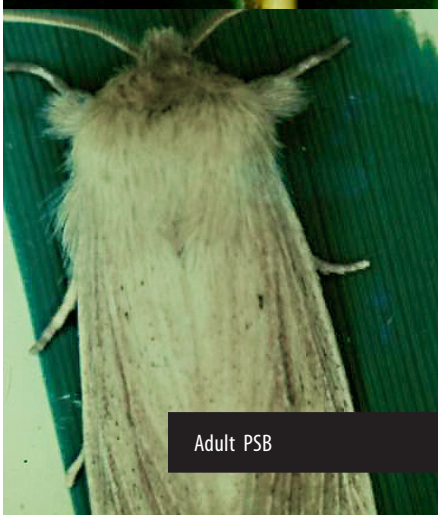
Life cycle:
Eggmasses are laid in batches of 80-150 on the leaf sheath, and covered with the brown anal hairs of the female moth. Eggs hatch in 4-9 days. Larvae are milky white and 18mm-25mm long when mature. They are more white-colored than those of YSB. Head capsule is black. Larval period ranges from 19 to 31 days. Larvae remain dormant at the base of the plants during the dry season. Pupation takes place inside the stem. Adult moth emerges from pupa within 7-11 days. After the crop is harvested, the larvae sleep in the lowest internodes of the stubbles. With the first rains, the larvae become active, pupate, and the moths emerge. Moths are especially seen in the early stages of the crop. Adults are attracted to light traps.

Pink Stem Borer (PSB)

Tagalog name: mala-rosas na aksip

Identifying marks:
The adult moth is fawn-colored with brown streaks on the forewings and white hindwings. There is a cluster of hairs on the neck. The wingspan of female moths is 3mm0-35mm. The male and female moths can be distinguished by their antennae; they are comblike in the male and threadlike in the female. The males are smaller than the females. The larva is purplish pink on the back and white on the abdomen. The head capsule is orange-red. The body is distinctly segmented with no stripes, and tapers toward the abdominal tips. Larvae are found at ground level inside the stem. The eggs are bead-like, and laid in rows within the leaf sheath and the stem. They are creamy white to dark and are not covered with hairs.

PSB larvae inside rice tillers



Adult PSB

Where to find:
PSB are abundant in upland rice grown near sugarcane or related grasses. They are also seen in upland rice fields of Claveria, Misamis Oriental (Northern Mindanao).

Damage:
Young plants typically show deadheart symptoms. The older plants have extensive parts of the stem hollowed out, with consequent physical weakening of the stem and a reduction of crop yield.

Life cycle:
Eggs are laid within the leaf sheath and hatch into larvae in 7 days. Larval duration lasts for 36 days before pupation. Larvae feed on many cultivated as well as uncultivated crops, which makes them capable to move to adjacent fields or border areas to complete their development even after the rice has been harvested. A single larva can damage many tillers, as they can come in and out of the rice tillers. They pupate either inside the larval tunnel within the stem or outside the stem between the leaf sheath and the stem. Adult moths emerge from pupae within 10 days. Adult survives for 4-6 days. Total life cycle takes 46-83 days.

Striped Stem Borer (SSB)

Tagalog name: guhitang aksip

Larvae of SSB inside rice tillers

Eggmass of SSB

Identifying marks:
Eggmasses are deposited on the basal halves of leaves and occasionally on leaf sheaths. They are scale-like, translucent white to dark yellow, and not covered with hairs. Larvae are dirty white, with five longitudinal purplish-brown stripes running down the dorsal surface of the body. The head capsule is brown. Larva measures 20mm-26mm long. Adult moths are dirty white to yellow-brown, with grey-brown scales. Adults are active in the evening.

Where to find:
SSB are abundant in areas that are not flooded. More eggs are laid on rice plants receiving high rates of nitrogenous fertilizer.

Damage:
Many larvae may be found in one rice stem. They damage rice from seedling to flowering, affecting leaves, stems, growing points, and the whole plant. The most vulnerable growth stages are tiller elongation and panicle exsertion. The most obvious field symptoms are deadhearts caused by larval feeding on growing points of young shoots. In later growth stages, the larvae cause whiteheads interfering with the flower development. Stems weakened by larval feeding may also lodge.

Life cycle:
Adult female lays 100-550 eggs, usually in batches of 60-70 eggs over a period of 3-5 nights. The egg stage is 5-6 days. After hatching, the larvae cluster beneath the leaf sheaths and later enter the stem to feed. The larvae pupate within stems by 30 days of feeding. The pupal period lasts for 6 days. The life cycle is completed in 35-60 days.

Management options (for all stem borers):
Stem borers are internal feeders. This makes them less susceptible to useful organisms, protects them from adverse environmental conditions, and non-systemic insecticides. They also adopt unique dispersal strategies: long-distance flights as crop approaches maturity (moths at this stage are attracted to light traps); short-distance flights after colonizing a rice crop (moths are not readily attracted to light traps). They are difficult to manage because of: lack of good level of resistance in the released cultivars; non-adoption of synchronous planting; and use of quick and efficient techniques for early detection of moths, eggmasses, larvae, and pupae. Spraying foliar insecticides early in the season on young crop stages interferes with the buildup of useful organisms. All these factors contribute toward the poor management of stem borers.

The vulnerable stages in the life cycle of stem borers are between the time when eggs are laid and when the larvae penetrate into the plant. High rainfall, exposure to beneficial organisms, and the inability of newly emerged larvae to chew a hole in the rice plant make many stem borers die. The management strategy for stem borers depends on integration of location-specific cultural practices, conservation and enhancement of useful organisms, and use of resistant varieties.

Cultural:
The following tactics are necessary for community-wide implementation at various crop stages. However, it would also depend on the prevailing local conditions.

Before sowing:
- Plowing/harrowing the rice field immediately after harvest turns under stubbles harboring larvae and pupae. They are either preyed upon by useful organisms or get dried up under the heat of sun. This is effective for managing yellow, white, and striped stem borers.
- If the population in stubbles is high, flooding the field before land preparation for the next crop and keeping it submerged up to a week can kill resident larvae.
- Spreading straw under the sun kills resident larvae in it.
- Delaying seedbed planting until moth's emergence to avoid egg-laying.
- Choosing right planting time minimizes stem borer population growth, as well as using seedbed trap crops to manually collect eggmasses, and also to know stem borer activity.
- Conserving and enhancing the action of indigenous useful organisms such as small and big wasps, carabid beetles, and spiders regulate stem borer buildup.
- Collecting eggmasses, larvae, and pupae of stem borers in containers with minute holes so that once the wasps emerge, they will disperse in the field.

At seedling stage:

- Monitoring seedbeds for eggmasses every after 5 days helps in effective pest management decision-making.
- Changing the method of seedling cultivation. For instance, using a plastic covering at the nursery stage reduces the possibility for adults to lay eggs.
- Periodically raising the level of irrigation water drowns the eggs, which are deposited at the base of tillers and in leaf sheaths.
- Cutting the tops of bundled seedlings before transplanting to remove eggmasses. This prevents eggmass carry-over from seedbed to transplanted field.
- Planting a trap crop. It is done by planting a susceptible rice variety ahead of the main planting time, applying N fertilizer, and installing light traps to attract moths for egg-laying. This should be done community-wide.
- Spraying pesticide when natural control is low helps bring down pest level.

After transplanting:

- Roguing infested plants to kill the larvae. This should be done for several years over a large area.
- Early and late plantings to avoid crop continuity and buildup of the borer population. This is location-specific. Asynchronous planting creates many oviposition periods with overlapping generations, as there is continuous supply of food. It also increases larval development. Encourage synchronous plantings (3-4 weeks duration) in the dispersal range of the moth (10-20 km). Crops that are established within a month from the first planting date are considered as regular-planted.
- Use of light traps to arrest the moths flying in the night. Peaks in the light traps depend on major planting seasons rather than environmental conditions.
- Removal of eggmasses from the field. It is more effectively done if timed based on light trap collections (10 days after a peak moth flight) or timed to coincide with susceptible growth stages—stem elongation and panicle exsertion (1 week before panicle exsertion). For a hectare, it takes approximately 4 days for a skilled person to remove eggmasses.
- Transplanted rice is more susceptible to damage than direct-seeded rice because transplanted rice is planted later, has lower plant density, proportionally lower flooding period, and longer maturity. In direct-seeded rice, there is vigorous growth, no standing water during vegetative stage, shorter time to mature, and it has narrow stems that are more hard, hence more first-instar larvae die. Thus, plant at a higher range of crop density.
- High amount of potash reduces stem borer incidence. Increased K reduces stem borer susceptibility as cell walls get thicker because of greater silica uptake.

- Incorporation of ash enriches the plant with silicon that affects stem borer development.
- Increased use of N and P favors stem borer attack. High nitrogen application increases crop duration and stem borer's survival, feeding rate, and larval size.
- Harvesting at the ground level removes majority of larvae of all species.

Crop rotation:
- Vigorous and well-nourished crop tolerates stem borers more than a stressed crop.
- Spot application of pesticide (bio-pesticides or systemic insecticides) is a judicious practice.

Varieties:
- Select varieties that have moderate resistance to stem borer.
- Modern cultivars mature early so they are less attacked.
- Tall varieties are more susceptible to attack. They have dense silica deposits in the stem.
- Select profuse-tillering varieties because of their high compensation capacity. This enables plants to compensate for deadhearts.

Biological
- High parasitization of eggmasses by small wasps can be known by rearing field-collected eggmasses.
- Long-horned grasshoppers, fire ants, and crickets are egg predators. Long-horned grasshopper prefers yellow and white stem borer eggmasses. Crickets and mirids feed on other stem borer species. They prefer naked eggs.
- Carabid beetles, lady beetles, fire ants, water beetle larvae, water striders, spiders, and fish prey on newly hatched larvae that fall on the water surface.
- Spiders, dragonflies, and damselflies prey on adults.
- Big predators of moths are frogs, ducks, and owls. Provide more perching places for owls in the field. They capture moths at night.
- The rice stubble decays with high moisture. It also encourages white fungal growth on the larvae and pupae residing in the stem.
- Bacteria (*Bacillus thuringiensis*) also infect the larvae. Both naturally occurring Bt and commercial Bt formulations infect larvae.

Chemical
- Insecticide use is difficult after stem borer larvae have entered the tillers.
- At tillering stage, sprays and granules are equally effective in flooded areas.
- From panicle initiation to flowering stages, granules are not effective and only spray formulations should be used.

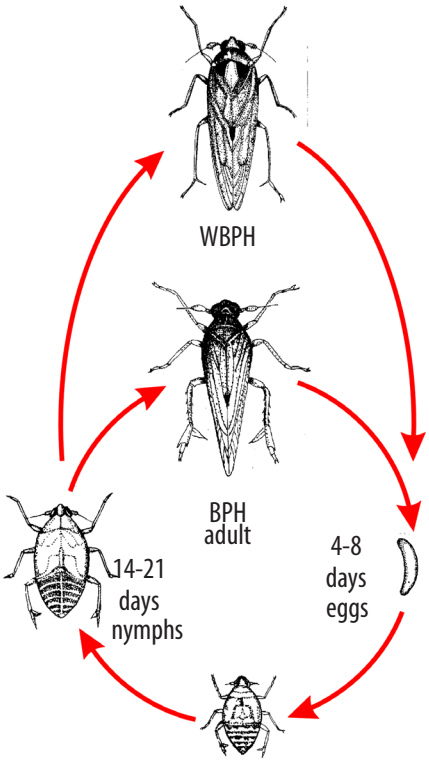
Brown Planthopper (BPH)

Tagalog names: kayumangging hanip/ ngusong kabayo

Nymphs of brown planthopper

Identifying marks:
Adults are 2.5mm-3.0mm long, brown, winged, or without wings. The legs are hairless and the hind leg has a large, mobile outgrowth.

Where to find:
Rainfed and irrigated wetland fields are preferred. It is rare in upland rice. Direct-sown fields are more prone to heavy damage than transplanted fields. All plant growth stages can be attacked, but the most susceptible growth stages are from early tillering to flowering. Increasing nitrogen levels, closer plant spacing, and higher relative humidity multiply BPH numbers.



Life cycle of a planthopper

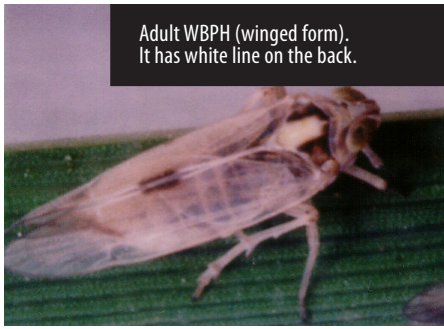
Damage:
Adults and nymphs cause direct damage by sucking the sap at the base of the tillers. Plants turn yellow and dry up rapidly. Heavy infestation creates brown patches of dried plants known as **hopperburn**. They also transmit virus diseases: ragged stunt, grassy stunt, and wilted stunt. Excreted honeydew on infested plants may also become a medium for sooty mold fungus.

Life cycle:
Eggs are laid in batches inside the leaf sheaths and on the leaf midrib. Nymphs are brown. Nymphs molt five times before turning to adult. Adults with long wings are attracted to light traps.

White-backed Planthopper (WBPH)

Tagalog name: puting ngusong kabayo

Identifying marks:
Adults are 3mm-4mm long, with a white marking on the back. They are either winged or wingless. The legs are not covered with hairs. They feed at the base of the rice plants. Adults may be collected by hand or by using sweep nets or sticky traps.



Adult WBPH (winged form). It has white line on the back.

Where to find:
Rainfed and irrigated wetland fields are preferred. It is rare in upland rice. Excessive nitrogen use, continuous submerged conditions in the field, closed canopy, and succulent rice plants favor WBPH buildup.

Damage:
Adults and nymphs cause direct damage by sucking the sap from young leaves. Heavy infestations make leaves dry and become brown patches of dried plants, referred to as hopperburn. The honeydew produced serves as a medium for mold growth, which imparts a smoky hue to the paddy field. They are not known to transmit any virus disease.

Life cycle:
Eggs are laid in batches inside the leaf sheaths. Nymphs are pale brown. Nymphs develop to adult in 11-12 days. The adults live for 18-30 days, with females living a little longer than the males. Adults are attracted to light traps.

Management options:
Resistant variety and biological control are the most appropriate management strategies. Routine and preventive spraying for stem borers and leaffeeders may lead to planthopper resurgence.

Cultural

20 days before transplanting:

- By changing planting distance, microclimate modification in the field is possible. Dense planting increases number of planthoppers.
- Seedbeds must be far from light sources to discourage hopper attack and virus infection by virus-infected hoppers.
- Plant early-maturing varieties to create a rice-free period in the year.
- Practice balanced fertilization. High nitrogen use increases planthopper attack. Split nitrogen into three applications during crop growth to reduce BPH buildup.

- Increased potassium reduces planthopper susceptibility as cell walls get thicker because of greater silica uptake.
- Grow only two rice crops per year and use early-maturing varieties to reduce continuous WBPH breeding.
- Plow under volunteer ratoons after harvest.
- Raise the level of irrigation water periodically to drown the eggs, which are deposited at the base of tillers and in leaf sheaths.
- Drain the field for 3-4 days to reduce planthopper numbers at initial infestation levels.
- Intensify weeding to reduce hopper density.

At tillering stage:
- Keep water level low to enhance growth of useful organisms.
- Intensify forecasting. At this stage, they tend to build up rapidly.

At milk stage:
- Drying and flooding the paddy alternately reduces their growth.
- To spare beneficial organisms, use selective insecticides only if pest infestation is high.
- There are new varieties that are resistant to WBPH.

Biological
- Avoid early application of pesticides to establish of refuge areas that encourage buildup of useful organisms.
- Small wasps attack WBPH eggs.
- Mirid bugs prey on eggs.
- Dragonflies and damselflies prey on moving adults. Similarly, spiders, water bugs, and lady beetles prey on mobile nymphs and adults.
- Dryinid kills nymphs.
- Fungus kills nymphs and adults.

Chemical
- Application of insecticides when long-winged adults are numerous kills useful organisms and not the planthopper eggs.
- Varieties with built-in resistance need not be sprayed.
- Young nymphs can be effectively controlled by useful organisms.
- At heading stage, use entomophagous fungus and botanical insecticides. Selective insecticides can also be used.
- Avoid 'preventive' and calendar-based use of pesticides as they cause pest resurgence.

Green Leafhopper (GLH)

Tagalog name: berdeng ngusong kabayo

Identifying marks:
They are slender insects, usually narrowing at the back. They have thin tapering antennae. The hind legs are covered with hairs. Adults are 3.2mm-5.3mm long, opaque green, with black markings on the head, face, wings, and wing tips.

Where to find:
Grasses found near irrigation canals and levees, and rice ratoons are favorable for feeding and egg-laying. Tillering and panicle initiation stages are most favorable for their multiplication, although seedling to booting stages are also susceptible. They jump readily when disturbed. They are active in summer and become sluggish during cold weather. Thus, their numbers decline drastically. To quickly detect them, either tap vigorously several plants, stopping now and then as one walks through a field, or sweep rice foliage with an insect net.

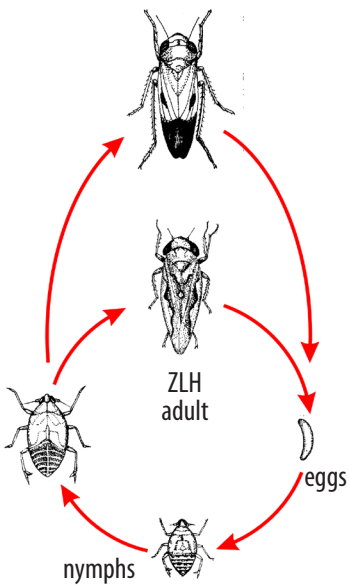
Damage:
Adults and nymphs cause direct damage to the rice plant by sucking the sap from leaf sheaths and leaf blades. GLH also cause indirect damage by injecting toxic chemicals and transmitting viruses (tungro, dwarf, transitory yellowing, and yellow-orange leaf) and a mycoplasma disease (yellow dwarf). They mostly confine themselves and feed on the leaf and leaf sheath of rice. Mild infestations reduce plant vigor and number of productive tillers. Heavy infestations cause withering and complete drying of the crop.

Life cycle:
Eggs are laid in small slits made in the soft parts of the leaf sheaths. Newly laid eggs are oblong, bent, pale yellow, and barely visible. The eggs hatch into nymphs in 6-12 days.

Adult and nymphs of GLH. It has black spots on wings of adult.

Eggs of hoppers inside leaf sheath

Life cycle of a leafhopper



Nymphs have varied color patterns on their back. The first-instar nymphs are numerous on the lower surface of older leaf blades, but from second instar onwards, they distribute themselves evenly on all the leaves. There are five instars before they become adult. Adults are attracted to light traps. On full moon, catches increase.

Zigzag Leafhopper (ZLH)

Tagalog name: guhitang ngusong kabayo

Identifying marks:
They are slender, small insects, usually tapering posteriorly with thin tapering antennae. They jump readily when disturbed. The hind legs are covered with hairs. They have white forewings with pale brown bands forming the shape of a W giving the zigzagged pattern. They can be found either on leaves in the upper parts of the rice plant or on tillers near the base.

Where to find:
ZLH are present in all rice ecosystems but only transmit virus diseases to wetland rice. They are highly mobile and colonize rice fields in the early growth stages. Sometimes, they are the most abundant leafhopper species on rice seedbeds and weed-covered levees between planting seasons.

Damage:
Adults and nymphs cause direct damage by removing sap from young rice leaves. They also transmit orange leaf, tungro, and dwarf viruses. Leaf tips dry and leaf margins become orange. Later, the entire leaf becomes orange and leaf margins curl. Damage appears first on older leaves. Nymphs and adults excrete honeydew, which causes sooty molds.

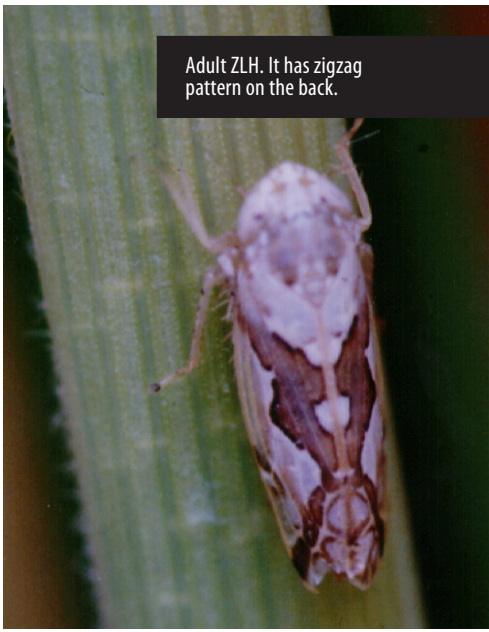
Life cycle:
Eggs are laid in rows within the leaf sheaths. Eggs hatch to nymphs in 7-9 days. Nymphs are yellowish brown. There are five instars lasting for 16 days, before they become adult. Adults are 3.5mm-4.0mm long and live for 10-14 days.

Management options (for leafhoppers):
Supplementing cultural control with resistant varieties is the best strategy to manage leafhoppers, and to maximize the beneficial effects of useful organisms.

Cultural
- Seedbeds should be raised, far from light sources, and covered with mesh cloth to limit virus infection and early damage by leafhoppers.
- Mobile nurseries planted to a set of different susceptible and resistant

varieties can be used to detect the percentage of virus infection before transplanting. The nursery boxes can be set under lights to attract leafhoppers. The percentage of infected seedlings can be determined by the iodine diagnostic test.

- Transplant older seedlings to shorten the susceptible vegetative period in the field.
- Early plantings in the dry season reduce the risk of insect-transmitted diseases.
- Remove grassy weeds and volunteer rice in fallow fields to help reduce leafhopper numbers.
- More nitrogen (N) fertilizer increases ZLH attack, but it also promotes tillering and plant vigor necessary to boost the crop's ability to compensate for pest damage. Therefore, optimal and timely use of N is important.
- More potassium increases resistance of the rice plant as cell walls get thicker because of greater silica uptake.
- Crop rotation with a non-rice crop during the dry season will remove weeds and volunteer rice plants. Similarly, in the uplands, if rice is intercropped with soybean, it will reduce GLH incidence compared with rice followed by rice.
- Dense planting increases the number of leafhoppers.
- Observing ratoon and volunteer rice for leafhopper numbers helps determine their density.
- Draining water from the field reduces their numbers.
- Many varieties resistant to GLH are commercially available. There are few varieties with resistance to virus diseases, but widespread planting of GLH-resistant varieties helps suppress the incidence of viruses.



Adult ZLH. It has zigzag pattern on the back.

Biological

- Small wasps kill hopper eggs.
- Dryinids, water bugs, dragonflies, damselflies, spiders, and nematodes attack nymphs and adults.

Chemical

- Systemic insecticide will be more effective. Granules incorporated in the soil are more effective than broadcasted or sprayed in seedbed.
- Apply insecticide only if GLH is prevalent in the area.

Seed Bug/Paddy Bug/Rice Bug

Tagalog name: atangya

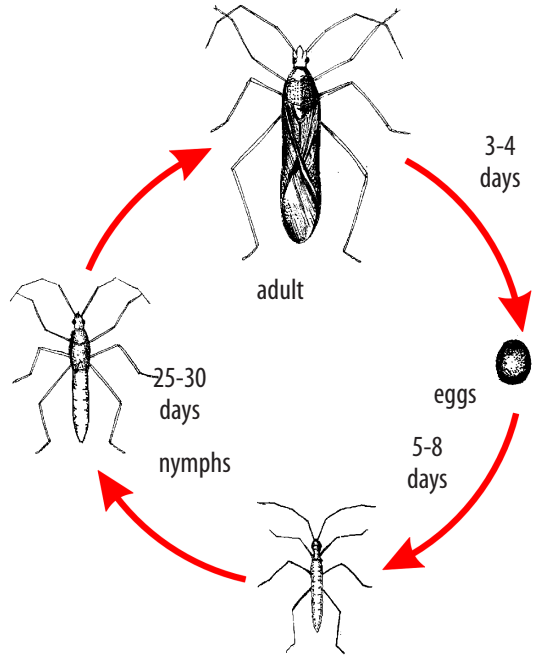
Rice bugs mating on top of rice panicle

Identifying marks:
Young nymphs are green while adults are greenish-brown. The adults are slender and about 15mm long. When the temperature is high and the insects are not feeding, they camouflage themselves on the plant by taking up a particular posture. The first and second instars often raise their abdomen when on the panicle, but when on the leaves, their whole body is straightened. The older nymphs and adults lower their abdomen flat against the panicle or leaf, draw the antennae and front legs together anteriorly against the substrate, and extend the middle and hind pairs of legs against the abdomen. When the plant is disturbed, nymphs drop to the lower parts of the plant while the adults fly a short distance. When handled or threatened, both nymphs and adults secrete an odorous substance that leaves an orange stain on the fingers.

Where to find:
Bugs are found in all environments but are prevalent in rainfed wetland or upland rice. They are destructive in areas where rainfall is evenly distributed throughout the year, and also in irrigated crops. Extensive weedy areas of rice fields, wild grasses near canals, staggered rice planting, rice fields adjacent to woodlands, and coconut plantations favor bug multiplication. Susceptible growth stages are from flowering to milky stage.

Damage:
Adults and nymphs appear in the young crop with the early rains. They suck sap from the developing grains at the milky stage. All soft milky grains are susceptible to attack. Panicles in heavily infested fields remain erect. Insect attack results in discolored or shriveled grains; off-smell of raw and cooked rice, and off-flavor of straws, which is unattractive to cattle. Before grain formation, the bugs feed on succulent shoots and leaves. Nymphs cause more damage than adults.

Life Cycle:
Eggs are laid in rows on dead or dry parts of the leaves or stem. Occasionally, they are laid on living leaves. They are red and flat. Eggs hatching to nymphs are dependent on high relative humidity. The egg stage lasts for 6-9 days. The nymphs are green. Nymphs turn to adults in 17-27 days after the fifth molt. Adults live up to 65 days under favorable conditions.



Life cycle of a rice bug

Management options

Cultural

- Eliminate grassy weeds from rice fields, levees, and surrounding areas either by cutting or burning to reduce habitats for egg-laying.
- Avoid staggered planting of fields to break continuous food source.
- Passing baskets or bags coated on the inside with sticky material could repel/capture bugs.
- Net and handpick bugs to reduce their numbers.
- Put attractants such as arasan or anything having bad odor like dead snails or rats. The bugs attracted can be burned or sprayed with chemicals to reduce their numbers.
- Awned (bearded) varieties are resistant.
- Varieties with panicles enclosed in the leaf sheath for longer time offer some mechanical resistance to feeding.

Biological

- Small wasps and long-horned grasshoppers kill eggs.
- Fungal pathogens infect nymphs and adults.
- Spiders, crickets, lady beetles, and long-horned grasshoppers feed on nymphs and adults.

Chemical

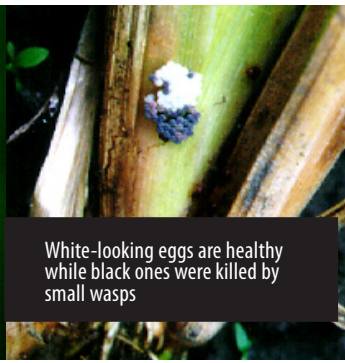
- Foliar sprays or dust formulations are effective. Spray or dust at flowering stage in the early morning or evening on calm days.
- Granular insecticides are ineffective.

Black Bug

Tagalog name: itim na atangya

Adult black bug

Female black bug guarding its egg mass



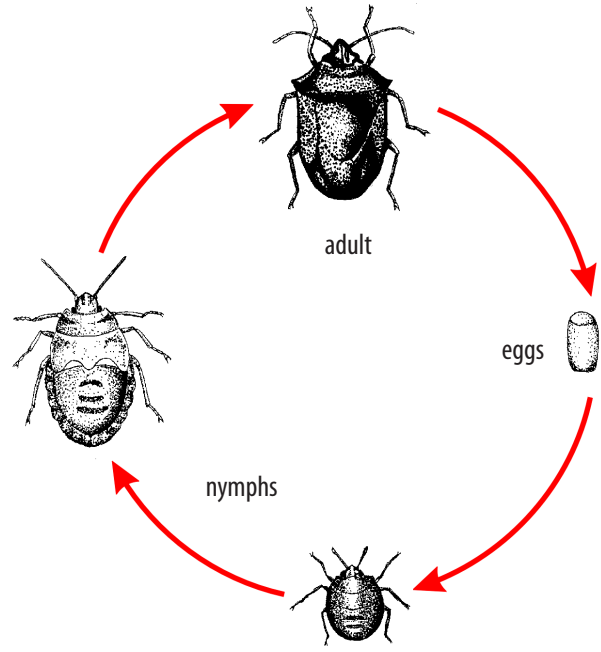
White-looking eggs are healthy while black ones were killed by small wasps

Identifying marks:
Adults are 8-9mm long and are brownish-black with a few distinct yellowish spots on the thorax that bears spines below the anterior angles. They are called shield bugs because of their shield-like appearance. They produce an offensive odor when disturbed. Young nymphs are brown with a green abdomen.

Where to find:
They prefer rainfed wetland and irrigated rice to upland rice. They also favor continuously cropped irrigated rice areas and poorly drained fields. They are usually found in large numbers between tillers at the soil level after the heading stage of the rice when irrigation has been stopped during the ripening stage. In flooded fields, they are always found on the rice canopy above the water level. Dry season rice crop is more prone to damage than the wet season crop.

Damage:
Susceptible growth stages are from seedling to flowering. During the day, the adults and nymphs suck plant sap at the base of stems, often just above water level. At night, they move up the rice plant and suck sap from the tillers. The adults prefer the stem nodes as feeding sites owing to the reservoirs of sap. Infestation at the tillering stage results in deadhearts, but continued feeding turns leaves reddish brown, reduces tillering, and causes stunting. When infestation is at the booting stage, the panicles fail to develop grains, that mimics the damage done by stem borers (whitehead). They can also feed on panicles during milky stage causing brown spots in injured grains. Their saliva is toxic. During severe infestations, young plants often die and the whole field appears burnt. Such damage is referred to as bug burn, which is similar to hopperburn caused by planthoppers.

Life cycle:
Round and greenish-pink eggs are deposited in batches of 40-50 on the basal parts of rice plants near the water surface. They are well-guarded by the female until they hatch. The nymphs develop to adults by 1 month, after changing their skin 4-5 times. Adults can live for up to 7 months. They are strongly attracted to light and often appear in swarms. They are carried to large distances by strong winds. Adults and older nymphs can survive under adverse conditions. They hide in cracks in soil, bunds or adjacent higher grounds to a depth of 30cm when there is acute water shortage, temperatures fall abruptly, and crop is harvested. Total life cycle takes 32-42 days. Adults are attracted to strong light.



Life cycle of a black bug

Management options:

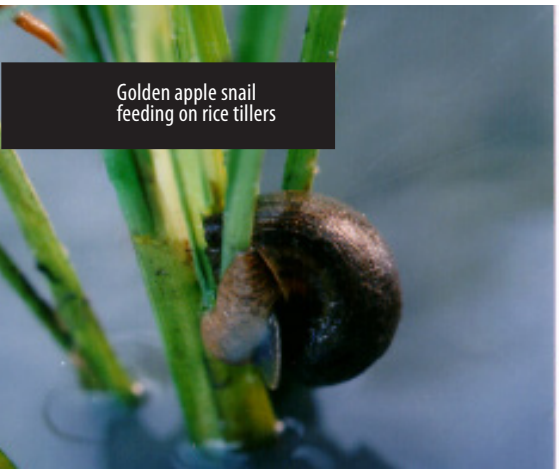
Cultural
- Removing weeds reduces the bugs' breeding sites and allows sunlight to penetrate to the base of the rice plants.
- Early-maturing varieties evade the damaging population of the pest and break its life cycle.
- Plowing immediately after harvest destroys their breeding sites.
- Flooding the field drowns eggmasses. Eggs submerged in water for 24h do not hatch.
- Light traps using mercury bulbs are effective in reducing egg-laying adults. Kerosene light traps are not bright enough to attract black bugs.
- Practice direct seeding.
- There are no commercially available resistant varieties but there is a tolerant variety, IR44526. IR1314 is recommended but it cannot be grown in areas where tungro is a problem.

Biological
- Small wasps (*Telenomus triptus*) kill black bug eggs.
- Frogs and ducks prey on nymphs and adults.
- Carabid beetles feed on eggs, nymphs, and adults.
- Green muscardine (*Metarhizium anisopliae*) attacks the nymphs and adults.

ORGANISMS WITHOUT BACKBONE

Golden Apple Snail (GAS)

Tagalog name: golden kuhol



Golden apple snail feeding on rice tillers

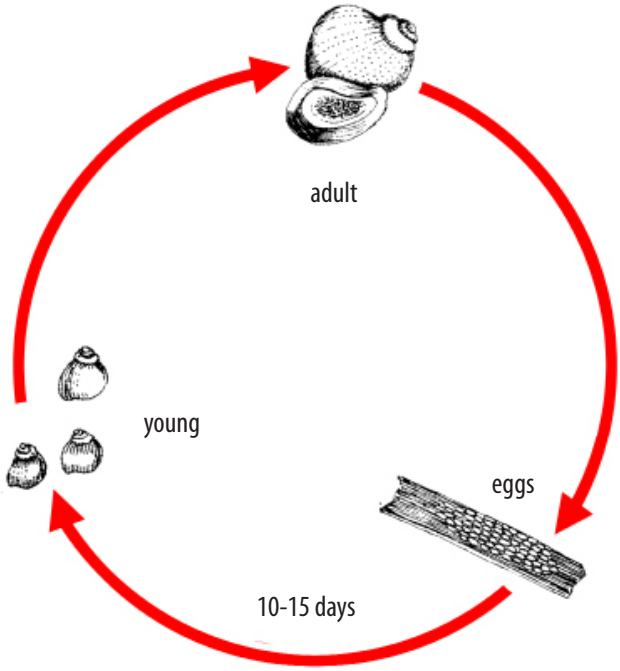
Egg mass of golden apple snail

Identifying marks:
Snail has a brown shell and creamy white to golden pinkish or orange-yellow succulent flesh. The most recognizable sign of the snail's presence is the pink eggmass, which is seen on vegetation and embankments.

Where to find:
Restricted to wetland rice fields that are flooded for at least parts of the year. The highest infestations are in Western Visayas, Central Mindanao, and Cagayan Valley. It can survive harsh environmental conditions with pollutants in the water or low dissolved oxygen levels. Ideal habitats for the snail are marshes, swamps, and irrigation canals lined with vegetation or rice fields.

Damage:
Rice plants are vulnerable to damage until 4-5 weeks after transplanting. The snail population should, therefore, be low from transplanting to about 1 month thereafter. At 4-6 weeks before harvest, snails do not cause yield loss anymore. The snail attacks the base of the young seedlings before devouring the upper parts. It prefers young plants and plant parts that are soft because it feeds by scraping plant surfaces with its rough tongue. Severely damaged rice fields have missing hills and floating fragments of rice plants.

Life cycle:
The female snail lid curves into the shell, while the male lid sticks out. They can breed year round under favorable field conditions such as continuous supply of water. Snails can breathe underwater or in the open air like a frog. They mate during the day among crowded plants for 3-4h The females deposit eggs at night on sticks, rocks, grasses, and any erect object above water surface. The eggmasses are pinkish-red and contain 50-500 eggs with 80% hatchability. They hatch within 10-15 days. Young snails feed on soft aquatic plants. Snails with a shell height of 1.5cm feed on young plants up to 4 weeks old. Those with a shell height of 6.5cm can feed on young plants up to 9 weeks old. Adults become voracious feeders. They grow fast and reach maturity (3.0-3.5cm in diameter). Leaves of papaya, cassava, gabi, kangkong, kamote, azolla, duckweed, water hyacinth, and other succulent plant materials attract the snails. During dry season, the snail buries itself and goes to sleep for more than 6 weeks. When the water penetrates the field, the snails wake up and come out of the soil to the water surface. The snails complete their life cycle in 60 days.



Management options:

For transplanted rice

- Raise healthy seedlings that are characterized by the following:
  - At 3-leaf stage or 21 days old before transplanting.
  - Erect leaves (instead of drooping) and yellowish green before pulling; long and fibrous roots.
  - Before transplanting, note the following important points:
  - Field should be well-leveled so that "water pockets" do not occur.
  - Level "water pocket" areas, or put attractants along the edges.
  - In "water pockets" place old newspaper, or any kitchen waste/ vegetable market waste to attract GAS. This will make picking them easier.

- During transplanting, maintain shallow water (1-2cm). This will make GAS immobile and prevent them from attacking transplanted seedlings.
- After transplanting, there is no need to introduce water until the soil cracks. Weeds begin to germinate at this point (1-2 leaf stage). Thereafter, irrigate the field and maintain water depth of 3cm. At this stage, GAS will feed on the weeds.
- Replant missing hills; critical periods for GAS management are up to 2-3 weeks after transplanting.
- Dry plowing is recommended after rice harvest to kill more snails.

For direct-seeded rice (DSR)
- Proper leveling of field is critical for GAS and weed control.
- Prepare canalets around the bunds to attract GAS. Put old newspapers / kitchen wastes / vegetable market wastes in the canalets as attractants.
- Broadcast pre-germinated seeds to saturated field (1-cm water level).
- Drain the field the following day after broadcasting.
- Irrigate the field up to 1-2cm water depth after 7-10 days of seed broadcasting.
- Apply metaldehyde (10kg/ha) if necessary after seeding.
- Do not apply niclosamide 250 EC prior to seeding because it delays germination, and growth and development of shoots and roots.

Cultural
- Handpick snails in the morning and afternoon when they are most active. Also, use attractants such as leaves of banana, papaya, gabi, and old newspapers to make snail-picking easier.
- Maintain shallow water level (2-3cm) starting from 3 days after transplanting. Alternate flooding and drying greatly reduces mobility and feeding activities of the snail.
- Construct small canals (25-cm-wide and 5-cm-deep) along the edges of rice paddies in DSR for faster and easier collection of snails. For transplanted rice, construct strips 5-cm-deep by passing the harrow during the last harrowing. Provide a distance of 10-15m between strips.
- Transplant older wetbed-grown seedlings that are less vulnerable. For early-maturing varieties, use 25-30-day-old seedlings; for late-maturing varieties, use 30-35-day-old seedlings.
- Modern high-tillering varieties can compensate for the damage.

Biological

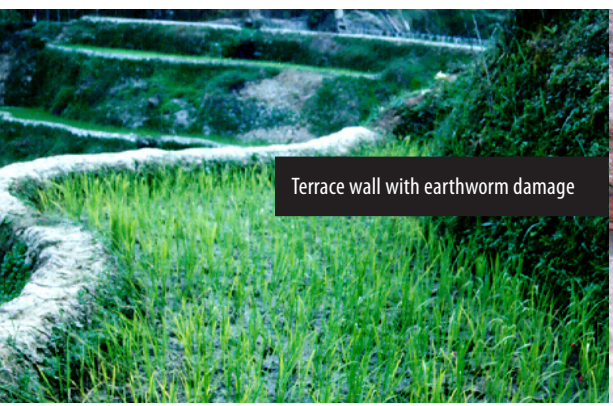
- Water birds such as kites and egrets feed on snails in rice fields but their numbers are normally too small to make much impact.
- Ducks and fish have the greatest potential. Herd ducks in rice paddies immediately after harvest through the last harrowing for the succeeding crop. Do this again 30-35 days after transplanting (DAT) for early-maturing varieties, and 40-45 DAT for late-maturing varieties. Fish that eat young snails could be kept in the drainage areas where snails collect and in trenches and ponds associated with rice-fish culture.
- Red ants and long-horned grasshoppers feed on eggs and newly hatched snails.
- Rats and snakes are predators of small snails.
- Use plants that contain toxic substances against GAS such as gugo (bark) [*Entada phaseikaudes K Meer*], tubang-kamisa (leaves) [*Blumea vaginalis*], tuba-tuba (leaves), gabi-gabihan (leaves) [*Monochoria vaginalis*], tobacco (leaves), Kalamansi (leaves) tubli (roots), makabuhay (leaves) [*Tinospora rumphii Boerl*], red pepper (fruit), and vulgarone B.

Chemical

- Use molluscicides (niclosamide and metaldehyde) if these directly hit the snail. Efficacy lasts 2-3 days.
- Use botanical anti-snail preparations such as dried tobacco leaves and neem to control their population.

Earthworm

Tagalog name: bulate, kolang (Cordillera)



Terrace wall with earthworm damage

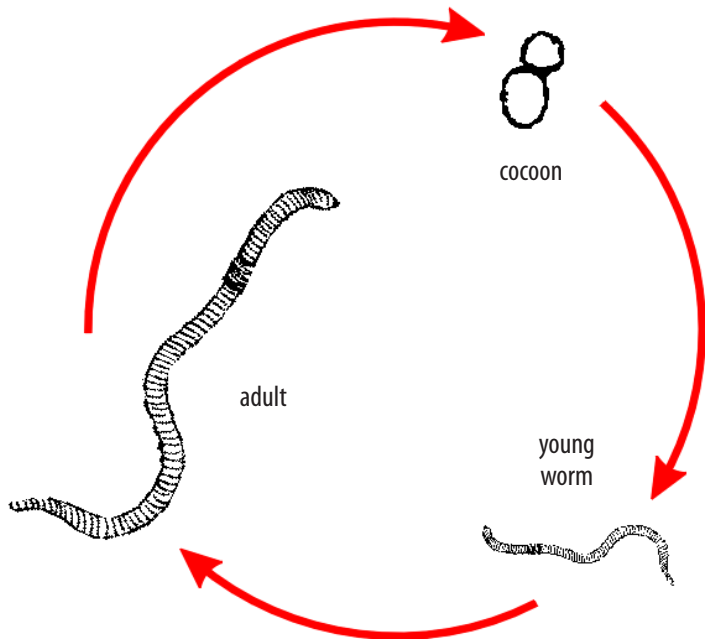
Earthworm from the rice terraces

Identifying marks:
It is a thin, long, slimy worm with numerous similar segments on its body. Usually red or brown in color. Abundant on the rice beds and in non-flooded rice fields.

Where to find:
Rice terraces in the Cordillera Region.

Damage:
These organisms tunnel in rice fields with young rice seedlings. The water in such paddies cannot be retained and thus young seedlings die owing to water shortage. Missing hills (black mounds), uneven plant height, and wilted plants are observed.

Life cycle:
Generally, earthworms are hermaphrodites or have both female and male sex organs. However, self-fertilization does not occur; they need a partner for reproduction. During mating, sperms are exchanged and stored in one of the segments of the worm. The cocoon casing is then produced by the "clitellum" (girdle-like structure near the anterior end of the body), and worm "backs out of the casing," depositing the sperms and cocoons into the casing as it passes over the appropriate segments. The cocoon (white in color and is of the size of a mungbean seed) then incubates in the soil for several months, depending on soil conditions (moisture and temperature), before one young worm or two (or some species) emerge. Earthworms have also a considerable power of regenerating and grafting.



Management options:

Cultural

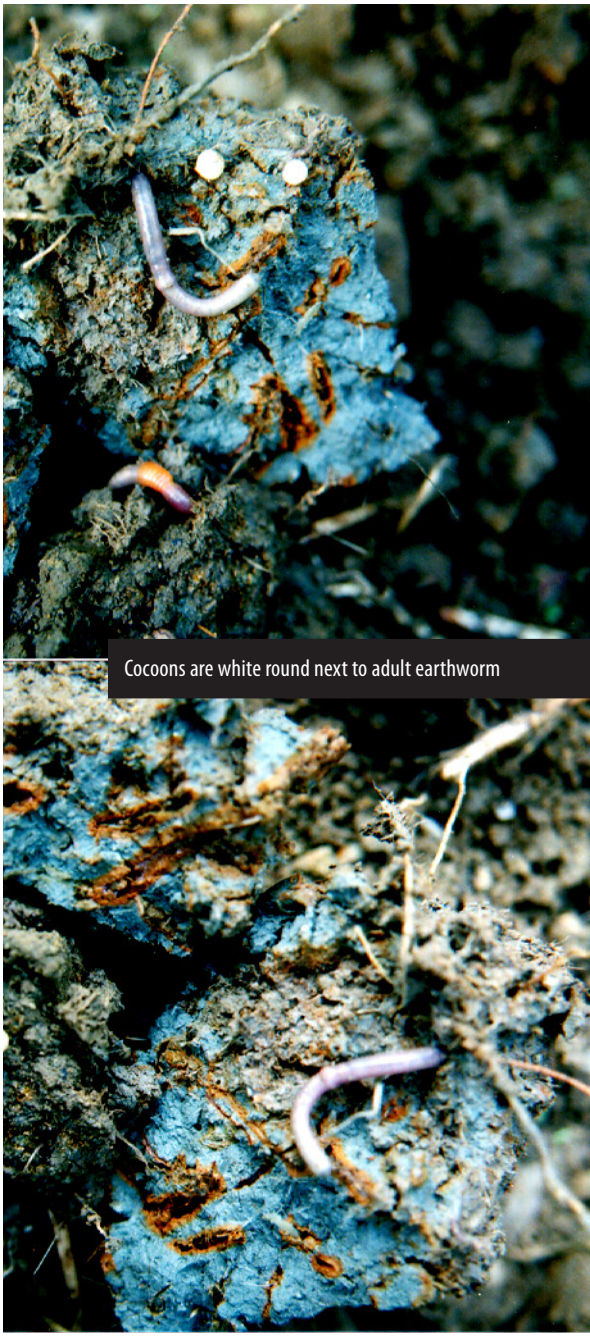
- Deep plowing is effective when their population is high.
- Construct small ponds for the river water to trap the earthworms before releasing the water to the rest of the fields.
- Place screens at the pond outlets to contain the big worms.
- Flooding the fields at 14cm depth for 2-3 months kills the worms.
- Transplant older seedlings (45-55 days old) for better tolerance.
- Transplant seedlings rather than resorting to direct seeding, as 3 weeks of seedling growth in the former can take place in a location free of earthworms.
- Plant seedlings closer to compensate for less tillering in older seedlings.
- Incorporate organic matter in the form of rice straw or weeds to discourage their breeding.

Biological

- Ducks, chickens, and pigs feed on earthworms.

Chemical

- They are susceptible to most pesticides but considering soil as the open ecosystem, the use of pesticides will not be economical and environment-friendly.



Cocoons are white round next to adult earthworm

Rat

Tagalog name: daga

Damage at soft dough stage on rice tillers

Identifying marks:
Paw marks and runways on wet soil surface, heaps of soil found along the bottom of bunds, cut tillers, and nests indicate presence of rats.

Where to find:
Damage is higher in the early season than at the ripening. Plants near uncultivated areas, roads, and canals are worst affected.

Damage:
They may cause extensive damage to seedbeds. The seedlings get eaten shortly after transplanting. As rice becomes older, rats cut tillers and eat portions of the developing panicles. When rat population is relatively low, rat damage tends to occur along the dikes. During heavy infestations, more damage occurs in the center of the rice field, resulting in eat-outs. Such damage is visible from a distance. They cut or bend tillers to eat ripening grains. Rats cut the damaged tillers near the base at a 45-degree angle. As rice panicles mature, rats feed on individual grains, often remaining at one plant for sometime. After harvest, small piles of hulls can be seen on the paddy water where rats have been feeding.

Life cycle:
Rats live 1 year or longer. Females may reproduce up to four times a year, averaging six rats per litter. One female rat can produce and wean 24

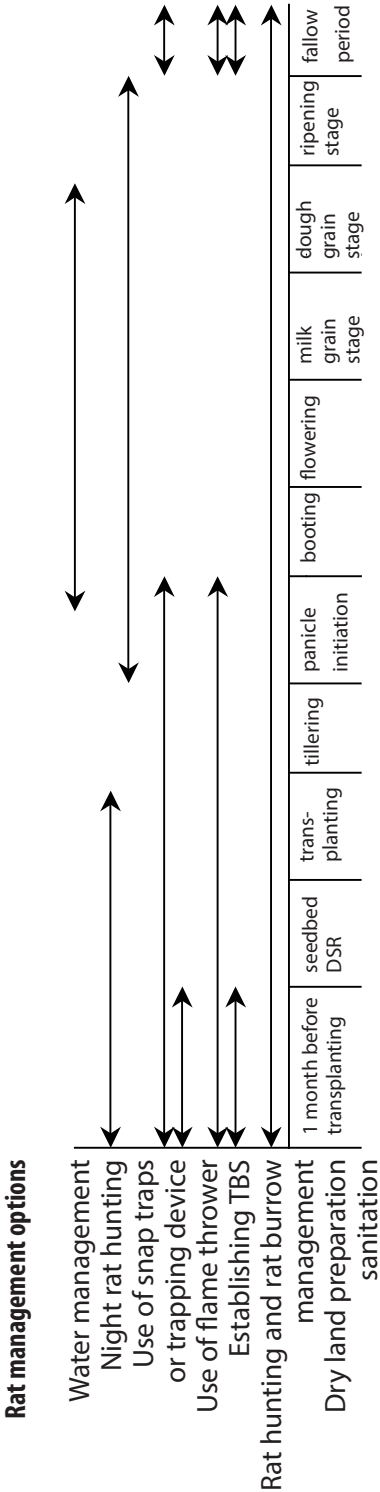
offspring in 1 year. A pair of rats and their offspring can produce more than 500 rats in 1 year if food, water, and other conditions are favorable.

Management options:
The number of field rats you kill or eat is not so important; it is the number that remains in the field that reduces the rice yield. No single method of rodent management fits all rice field situations. Hence, a community approach is needed in rat management.

Cultural
- Remove weeds along dikes, canal banks, and adjacent waste areas before transplanting and during the early stages of rice growth to reduce harborage sites.
- Plant at the same time as your neighbors to reduce heavy damage.
- Construct paddy dikes 6in high and 8in wide in irrigated rice. This makes dikes unsuitable for rats to burrow in.
- Dig or flood burrows to flush out rats from burrows. Burrowing is effective when done regularly in early crop age.
- Use cage traps that contain baits such as rice grains, coconut, or sweet potatoes.
- Community action between crops, before planting, or in waste areas adjacent to croplands is effective in reducing rat numbers.
- Frightening devices such as scarecrows or flags have very little effect as rats get adapted to such objects.
- Mechanical barriers such as electric fences and metal sheets have limited value as rats can climb, swim, dig holes, and gnaw through fences.

Biological
- Snakes, monitor lizards, and mongoose are important enemies of rats. Grass owls and black-winged kites are also predators. In general, predators are not common in extensive rice tracts.

Chemical
- In areas with extremely high rat populations, baiting with acute poisons before seedbedding or transplanting is necessary.
- Use chronic rodenticides and baits immediately after transplanting until 2 weeks before harvest to bring down the residual rat population and reproduction. Put 5-10 baiting stations for every hectare of rice field. Good baiting locations are alongside dikes.



Sanitation: should be done throughout cropping season and fallow period to discourage rat breeding in the area.

Dry land preparation: minimizes presence of GAS and weeds that serve as alternate feed of rats.

Rat hunting and rat burrow management: drive rats out of the burrows using water and cover all burrows with wet soil. This method is highly recommended during the start of the cropping season and when juvenile rats are collected in burrows.

Establishing Trap Barrier System (TBS): establish TBS one month before regular cropping season; catches peak during land preparation.

Use of flame thrower: it drives out rats from their burrows when there is no available water source or when the burrows are too deep, or are perpendicular to the ground. Use flame thrower safely and with caution; it also kills non target organisms.

Use of snap trap or other trapping device: traditional traps control rats entering rice paddies. Put them along dikes where rat footprints and pathways are observed.

Night rat hunting: using a head lamp, this method is effective during land preparation and before the rice canopy closes. Increase water depth to 3-5cm after the maximum tillering stage to minimize rat damage.

Sparrow

Tagalog name: Maya

Identifying marks:
These are the most common birds found in residential areas.

Where to find:
Most abundant in rice fields during the milky stage. Usually found during early mornings or late afternoons in flocks around rice fields adjacent to residential areas and fields near farm/coconut canopies.

Damage:
They come in flocks when the rice crop is at milky (soft dough) stage. They cut one half of the grain. Bird also eat grains at the nursery beds and in postharvest stage (open storage and threshing yards).

Management options:

Cultural control
Scaring them away is the only practical solution.

Resistant varieties
Grains with long serrated awns discourage birds from feeding.

USEFUL ORGANISMS

CATEGORY: INSECTS (MOBILE, SIX-LEGGED ORGANISMS)

AERIAL-BORNE


Adult mirid in search for prey on rice tiller

Mirid

Tagalog name: berdeng atangya

Identifying marks:
Adults are green with long folded wings and long antennae. Nymphs are also green, with long antennae but with short wings. They have black spot on the back. They are usually seen at the base part of rice tillers where planthoppers and leafhoppers are also located. Their presence in rice fields can be known by two ways. Tap the base of the rice tillers—planthopper and leafhopper nymphs will lodge along with the green-colored nymphs and adults on the water surface. In addition, they sting like mosquitoes, which is irritating. They are attracted to light traps and can fly.

Where to find:
They are present in wetland and dryland rice fields. During early hours of the day, they move on the upper half foliage. In most instances, a hopper-infested crop has abundant mirid numbers.

Food:
They search for eggs of planthoppers and leafhoppers by tapping their antennae on the leaf sheaths. On locating the eggs of their enemy in plant tissues, mirids pierce through their mouthparts and suck the egg contents. They prefer eggs of brown planthoppers and striped stem borers. They also eat young nymphs of planthoppers and leafhoppers. Each mirid consumes 7-10 eggs or 1-5 hopper nymphs a day.


Adult ground beetle

Ground Beetle

Tagalog name: tigreng salagubang

Identifying marks:
Adults are guitar-shaped and reddish brown. They have long thin necks connecting the head and abdomen. Black, shiny larvae (grubs) go into the soil before pupation.

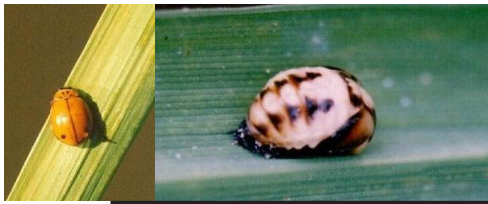
Adults and larvae can fly and feed on nymphs of plant/leafhoppers, and young larvae of leaffolders.

Where to find:
Present in dryland and wetland rice fields.

Food: They prefer planthoppers to leafhoppers. Others prey on hairy caterpillars, semiloopers, and newly hatched larvae of stem borers. They feed inside the folded leaves made by leaffolder larvae. They eat 3-5 larvae per day.

Lady Beetle

Tagalog name: pagung-pagongan



Larvae (crocodile shape)

Identifying marks:
Shape of the adult is like that of a Volkswagen (oval) car. They are mostly orange with or without spots on the wings. Larvae (grubs) are dark grey to brown, wingless, and resemble a crocodile. Adults can fly.

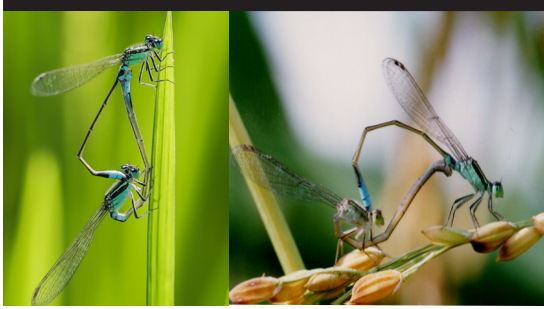
Where to find:
Present in dryland and wetland rice fields. The adults are mostly seen on the upper half of the rice canopy, especially on the leaf tips during early hours of the morning. Larvae inhabit mostly the lower part of the rice canopy where hopper nymphs are found.

Food:
Adults are abundant when rice is at the flowering stage and are observed feeding on the pollen. They prefer to feed on the slow-moving nymphs of planthoppers than on leafhopper nymphs. They also feed on newly hatched larvae of leaffolders and stem borers, and on exposed eggs of harmful organisms. The larvae are more voracious than adults.

Damselfly

Tagalog name: tutubing karayom

Damselflies mating even during flight



Identifying marks:
Adults can fly short distances, unlike the dragonfly. During early morning, they are seen sitting on leaf tips and drinking the dew. Nymphs do not have fully developed wings and often attach themselves to the lower part of the rice tillers. They can climb rice stems to search for hopper nymphs.

Where to find:
They occupy the lower canopy in older plants. In younger plants, they perch on the top canopy level.

Food:
They prey on adults and nymphs of planthoppers, leafhoppers, and leaffolder adults.

Dragonfly

Tagalog name: tutubi

Identifying marks:
Forewings are bigger than damselfly wings. Adults can fly long distances. Nymphs lack fully developed wings and are often attached to lower parts of the rice tillers. Their abundance is noticed over the rice canopy in early mornings, when it is cloudy and is about to rain, and when the field is being sprayed.

Adult dragonfly on rice canopy

Where to find:
They inhabit the top canopy level.

Food:
They prey on adult nymphs of planthoppers, leafhoppers, and moths of lepidoptera.

Cricket

Tagalog name: itim na kagaykay, kantitit

Adult cricket

Identifying marks:
Adults and nymphs are light to dark brown and aerial-borne. Antennae are longer than the body. They are smaller than long-horned grasshoppers. When rice canopy is disturbed, they hop from one plant to another.

Where to find:
Present in dryland and wetland rice fields. They are abundant in dry habitats and adjacent to levees. They are most active during early morning and evening.

Food:
Eggs of striped stem borers, dark-headed stem borers, leaffolders, armyworms, whorl maggots, and nymphs of planthoppers and leafhoppers.

Long-horned Grasshopper

Tagalog name: tipaklong sa kaparangan

Adult with long antennae

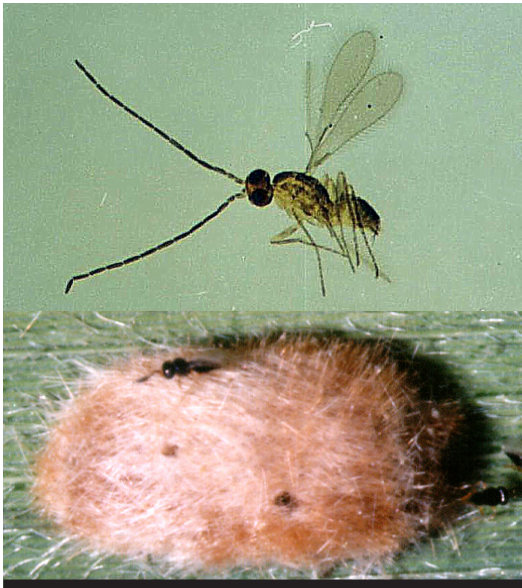
Identifying marks:
Adults and nymphs are green and aerial-borne. Antennae are longer than the body. The female ovipositor is frequently very long and curved. Nymphs do not have well-developed wings. Their presence is felt when the rice canopy is disturbed as they hop from one plant to another.

Where to find:
More abundant in dry habitats and older plants, and plants adjacent to the bunds. They are most active during early morning and evening.

Food:
They feed on eggmasses of stem borers, including those covered with hairs, and eggs of leaffeeders, eggmasses, and earhead bugs. They also eat nymphs of planthoppers and leafhoppers. One grasshopper can consume 3-4 yellow stem borer eggmasses in a day with average predation potential of 46 percent.

Small Wasp

Tagalog name: maliit na putakti



YSB/WSB egg mass with holes and small wasps emerging

Identifying marks:
It is not clearly visible to the naked eye. Adults are black, brown, dark yellow brown, or metallic blue-green. They resemble small ants with wings. All four wings are well-developed.

Where to find:
Abundant in wetland and dryland rice fields.

Food:
Eggs of leaffolders, skippers, short-horned grasshoppers, armyworms, green semiloopers, whorl maggots, stem borers, planthoppers, leafhoppers, black bugs, and seed bugs.

Indicators of small wasp activity:

A. Color change in the eggs of harmful organisms.
   (i) Can be seen externally (from original color to black): leaffolder, striped and pink stem borers, armyworm, green semilooper, whorl maggot, black bug.
   (ii) Cannot be seen externally: Yellow and white stem borers, planthoppers, leafhoppers, seed bugs.

B. Exit hole(s) on the eggs of harmful organisms.
   (i) One regular exit hole/egg: Leaffolders, skippers, striped and pink stem borers, green semiloopers, whorl maggots, planthoppers, leafhoppers, seed bugs.
   (ii) One irregular exit hole/egg: Black bugs.
   (iii) Several regular exit holes/eggmass: Armyworms, yellow and white stem borers.

Big Wasp

Tagalog name: malaking putakti

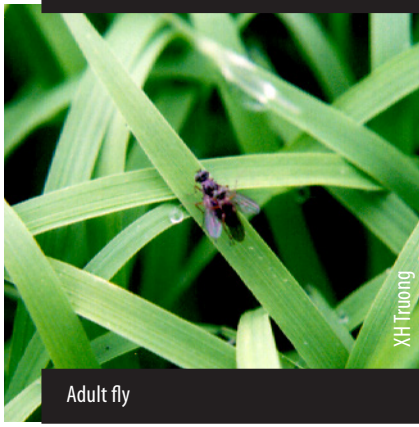
close up of a big wasp

Identifying marks:
It is clearly visible to the naked eye. Adults are red, black, brown, dark yellow brown, or metallic blue-green. Abdomen has long injection needle-shaped projection for laying eggs on the larvae and pupae of harmful organisms. All four wings are well-developed and aerial-borne.

Where to find:
Abundant in wetland and dryland rice fields.

Food:
Larvae and pupae of leaffolders, skippers, armyworms, green semiloopers, whorl maggots, and stem borers.

Tachinid Fly



Adult fly

Identifying marks:
Resembles a housefly. Adults are gray or black. The body is covered with spines.

Where to find:
Wetland and dryland environments.

Food:
Larvae of leaffolders, skippers, armyworms, and stem borers.

Ripple Bug

Identifying marks:
Adults are dark brown to black, broad-shouldered, and minute. Nymphs are also of the same color as that of adults. They live on the water surface. They live in the same niche as that of plant and leafhoppers. Their presence in the field can be known by spreading out four hills of rice and looking for them on the water surface. They also sting.

Where to find:
They prefer flooded rice fields as nymphs and adults are water-borne. Usually as the crop approaches maturity, ripple bugs develop wings, which help them migrate in search for young rice crops. During this time, they are usually observed near light sources.

Food:
Adults and nymphs wait on the water surface to kill the planthopper and leafhopper nymphs that fall onto the water. They also eat the newly hatched larvae of stem borers, which before entering the stem, must reach the lower leaf sheaths at the water surface. Larvae are also dispersed by the wind to several plants and during this process they fall onto the water surface. One water bug can prey on 4-7 hoppers per day.

NON WEB-FORMING SPIDERS

Wolf spider

Tagalog name: gagambang lobo


Wolf Spider

Identifying marks:
The abdomen is oval. The legs are long and tapered. The colors are usually dull, with gray, brown, and black predominating. They do not build webs but catch their prey directly. The eggs are enclosed in a silken sac attached on the females' posterior end of their abdomen. After hatching, the young (spiderlings) cling to the abdomen of the female.

Where to find:
In wetland or dryland rice fields. They are ground-dwelling and well-adapted for running. They readily colonize rice fields early in the cropping season. Wolf-spiders are found among tillers at the base of the plant and scamper across the water surface when disturbed.

Food:
An aggressive hunter, it searches plant and water surface for prey such as planthoppers, leafhoppers, caseworms, leaffolders, whorl maggots, newly hatched larvae, and moths of stem borers. It consumes 7-45 hoppers per day. It is the major predator of planthoppers and leafhoppers. Spiderlings also attack plant/leafhopper nymphs.

Lynx spider

Tagalog name: gagambang may tinik

Identifying marks:
Legs are conspicuously long with brown spines. They are adapted to jumping and climbing rapidly and jerkily among stems and leaves. The abdomen tapers to a point behind, and has reddish longitudinal band and four gray diagonal bands each on the laterals. They do not make webs and are wanderers. They catch their prey by stalking and pouncing. The female closely guards its cocoon-like eggmass on the foliage.

Where to find:
They prefer drier habitats and are active during the day. They colonize rice fields after canopy is developed, and live mostly on the upper part of the rice canopy.

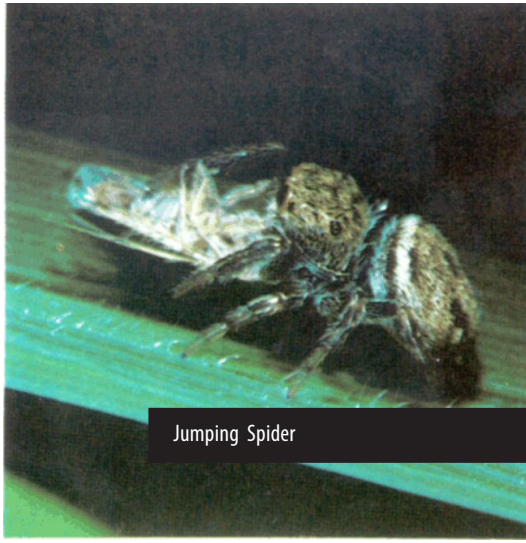
Food:
They hide from their prey, mostly moths, until within striking distance. They feed on planthoppers, leafhoppers, caseworms, leaffolders, stem borer moths, rice seed bugs, and whorl maggots. They consume 2-3 moths daily.

Lynx Spider

Jumping spider

Tagalog name: gagambang lumulundag

Identifying marks:
It measures 5mm-9mm in length. The body is usually compact and its stout legs are powerful. It is not quick to move when disturbed unlike the wolf spider. It has enlarged eyes with large front legs. It makes a catlike way of catching prey. It does not construct webs but spins cocoons for its egg sacs or to enclose itself during molting. Its body is with or without hairs.



Jumping Spider

Where to find:
Jumping spider prefers dryland habitats and remains within the rice foliage. It hides in a small retreat web in a folded leaf and folds another leaf within which it lies and waits for its prey.

Food:
It preys on planthoppers, leafhoppers, adult flies, and other small insects. This spider can consume 2-8 preys a day.

WEB-FORMING SPIDERS

Long-jawed spider

Tagalog name: gagambang pangahan

Identifying marks:
It is a long-bodied spider with long legs. It is commonly seen lying outstretched along a rice leaf. It builds its webs in grassy or bushy areas near water. The eggmasses are laid on the upper half of the rice plant and are enclosed in a cottony silk.

Long-jawed Spider

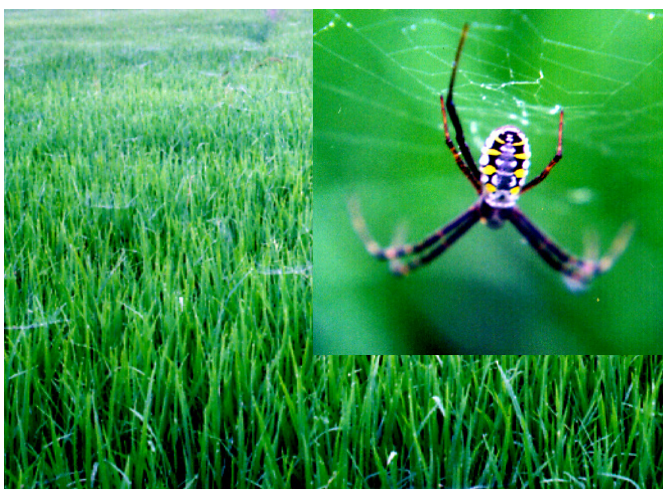
Where to find:
It prefers wetlands. It rests in the rice canopy at midday and waits in its webs in the morning. Ring-shaped webs are weak but can trap flying insects.

Food:
Adults and nymphs of planthoppers, leafhoppers, and adults of whorl maggots trapped in the web are quickly wrapped with silk. One spider kills 2-3 preys every day.

Orb spider

Tagalog name: gagambang pari; gagambang gumagawa ng bilog na sapot

Identifying marks:
It is a highly colorful spider. The legs are curved and the abdomen is large and swollen. Characteristically, it hangs head down from the center of the web. It relies on its webs to catch its prey.



Orb Spider. Note early morning webs on rice canopy.

Where to find:
It is a late colonizer of rice, but is found in all rice environments. During the day, it seeks shelter under leaves beside the web. During cloudy weather, the female waits at the center of the web and the male positions itself nearby.

Food:
To capture prey, this spider builds strong, sticky, highly specialized vertical orb webs. This web structure makes it more efficient in trapping their preys. It feeds on planthoppers, leafhoppers, caseworms, whorl maggots, stem borer adults, large butterflies, and grasshoppers.

Dwarf spider/Space-web spider

Identifying marks:
It is 1.5-2.3mm long and is often confused as a spiderling. Its abdomen is oval or globular with a double row of oval to triangular dark spots running lengthwise.

Where to find:
It is prevalent during the vegetative growth stage of rice. It prefers wetland habitats. It makes irregular webs within the base of rice tillers above the water line. Up to 30-40 spiders can be found at the plant canopy near the ground actively searching for prey.

Food:
It feeds on planthoppers and leafhopper nymphs, whorl maggots, and springtails. It eats 4-5 nymphs a day.

NON-INSECTS

☐ Green Fungus

Tagalog name: amag

Identifying marks:
It changes color from white to green and without any projection on the dead harmful organism.

Where to find:
High humidity, wind, and rain or irrigation water favor the spread of the fungus.

Food:
Infects planthoppers, leafhoppers, black bugs, and earhead bugs.

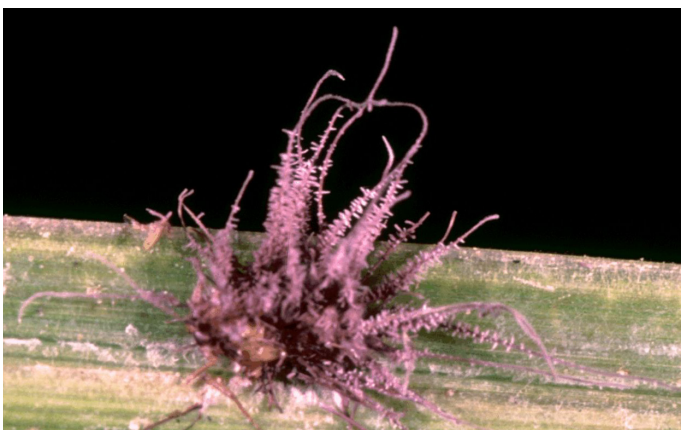
☐ Light Brownish Fungus with Projections

Tagalog name: amag

Identifying marks:
It has protruding structures from the infected harmful organisms.

Where to find:
It occurs in all rice environments. High humidity and wind favor dispersal.

Food:
Infects planthoppers and leafhoppers.



Fungus on hopper (long projections)

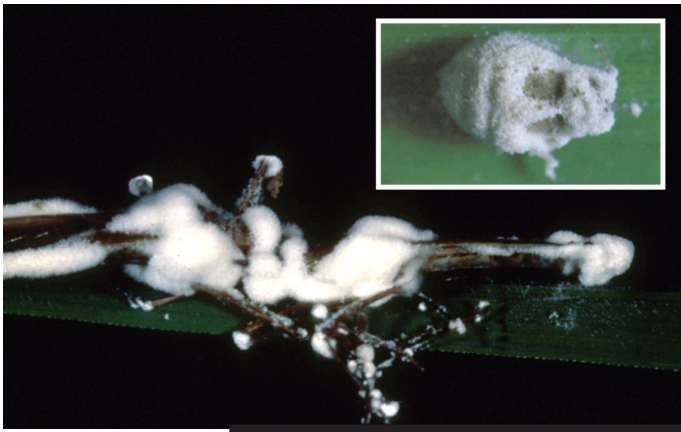
☐ White Fungus

Tagalog name: amag

Identifying marks:
Fungus color remains white throughout and there are no projections.

Where to find: It occurs in all rice environments. High humidity and wind favor dispersal.

Food:
Infects planthoppers, leafhoppers, stem borers, leaffolders, skippers, earhead bugs, and black bugs.



White fungus on rice black bug

☐ Virus

Tagalog name: bayrus

Identifying marks:
Larva becomes sluggish and stops feeding further on the rice canopy. Brown fluid oozes out of the larvae. The larva hangs with its head capsule upside down from the plant canopy.

Where to find:
It occurs in all rice environments.

Food:
Infects armyworms, leaffolders, and hairy caterpillars.

Virus-infected larva with its head suspended down

Table 1. Cultural Practices Useful in the Management of Harmful Organisms: Insects (six-legged organisms).

Practice	Planthopper	Leafhopper	Black bug	Stem borer
Synchronous Planting	■	■	■	■
Synchronous Harvesting	■	■	■	■
Harvesting at lower part of the plant			■	■
Mixed Varieties	■	■		
Short-Duration Varieties	■	■	■	■
Formation of Alleyways	■			
Sanitation	■	■	■	■
Fertilizer Management	■	■	■	■
Judicious Nitrogen Inputs	■	■	■	■
Water Management				
Draining off	■			
Flooding				
Flooding to crop height followed by spreading of kerosene-sawdust mixture to trap and poison the pests	■			
Early Irrigation/ Flooding Stubble				■

Table 2. Scientific and Common Names of Important Harmful and Useful Organisms in Rice Fields.

Organism Category	Scientific Name
HARMFUL ORGANISMS **Category: Insects (six-legged)**	
Root feeder	
Mole cricket	*Gryllotalpa orientalis (Burmeister)*
Leaf Feeders	
Leaffolder/Leaf roller	*Cnaphalocrocis medinalis (Guenée)* *Marasmia patnalis (Bradley)*
Caseworm	*Nymphula depunctalis (Guenée)*
Skipper	*Pelopidas mathias (Fabricius)*
Locust	*Locusta migratoria manilensis (Meyen)*
Short-horned grasshopper	*Oxya hyla intricata (Stål)*
Armyworm/Cutworm	*Spodoptera litura (Fabricius)* *Mythimna separata*
Whorl maggot	*Hydrellia philippina (Ferino)*
Stem Feeders	
Yellow stem borer	*Scirpophaga incertulas (Walker)*
White stem borer	*Scirpophaga innotata (Walker)*
Pink stem borer	*Sesamia inferens (Walker)*
Striped stem borer	*Chilo suppressalis (Walker)*
Sap Feeders	
Brown planthopper	*Nilaparvata lugens (Stål)*
White-backed planthopper	*Sogatela furcifera (Horvath)*
Green leafhopper	*Nephotettix spp.*
Zigzag leafhopper	*Recilia dorsalis (Motschulsky)*
Grain Feeders	
Seed bug	*Leptocorisa spp.*
Black bug	*Scotinophora spp.*
Category: Non-insects **(With and Without backbone)**	
Without Backbone	
Golden Apple Snail	*Pomacea canaliculata (Lamarck)*
Earthworm	*Polypheretima elongata (Perrier)*
With Backbone	
Rat	*Rattus tenazumi*
House Sparrow/Bird	*Ploceus philippinus*

Table 3. Local Names of Living Organisms Found in Rice Fields.

Insect pests	ILUKO	CEBUANO	ILONGGO
LEAF FEEDERS			
Whorl maggot	Ngilaw-ngilaw	Langaw-langaw	Langaw-langaw
Caseworm	Lukot-lukot		
Cutworm	Arabas	Harabas	Harabas/Tagos tos
Armyworm	Arabas	Harabas	Harabas/Tagos tos
Leaffolder			Likis-likis
Stem borer			Tamasok
White stem borer	Simut-simut		Puti nga Tamasok
Yellow stem borer	Duyaw a bukbok		Dulaw nga Tamasok
Striped stem borer	Guritan a bukbok		Guray-guray nga Tamasok
Pink stem borer	Derosas a bukbok		Rosa nga Tamasok
Locust/Short-horned grasshopper	Dudon	Dulon	Tibakla
SAP FEEDERS			
Brown planthopper	Ulmog	Ulmog	Olmog
White-backed planthopper	Ulmog	Ulmog	Olmog
Zigzag leafhopper	Ulmog	Ulmog	Olmog
Green leafhopper	Ulmog	Ulmog	Olmog
GRAIN FEEDERS			
Black bug	Dangaw	Tiyangaw	Tiyangaw
Rice earhead bug			Itom nga bakuko
ROOT FEEDER			
Mole cricket	Ararawan	Timos	Mara-mara

Table 3. (continuation)

NON-INSECT PESTS			
Golden apple snail	Bisukol	Kuhol	Ko-ol
Rat	Otot/Bao	Ilaga	Ilaga
Bird from milky stage to ripening stage of rice	Billit tuleng	Maya	Maya
Earthworm	Alumbayad/Alinta	Wa-te	
DAMAGE SYMPTOM			
Deadheart	Nalaylay nga uggot	Uban	Gi-tamasok
Whitehead	Uban		Gi-tamasok
Hopperburn	Na-ulmog	Sunog	Sunog/Laya
Bug burn	Na-ulmog	Sunog	Sunog/Laya
Folded leaf	Naglukot	Naglukot nga dahon	Lukot-lukot
Kuhol damage	Binisukol		Pol-pol

USEFUL ORGANISMS

SPIDER			
Web-forming spider	Lawwa-lawwa nga adda saputna	Damang nga may lawa-lawa	Damang/Udto-udto
Non web-forming spider	Lawwa-lawwa nga awan saputna	Damang nga walay lawa-lawa	Damang/Udto-udto
Spider on the water surface	Kuto-kuto ti danum		Damang/Udto-udto
WASP			
Big wasp	Alimbubuyog/Uyukan	Tambubuan	Tambubuan
Small wasp	Alumpipinig	Lampinig	Lampinig

Table 3. (continuation)

Useful organisms	ILUKO	CEBUANO	ILONGGO
BEETLE			
On foliage-Orange color	Bao-bao	Bao-bao	Bao-bao
Under water	Allokap		Tanga
HOPPING INSECT			
Long-horned grasshopper	Dudon	Apan-apan	Dahon-dahon
Field Cricket	Kuriat		Sirom-sirom
OTHER BIG PREDATORS			
Bird picking insects during land preparation	Sallapingaw		
Duck	Pato	Pato	Pato/Bebe
Frog	Tukak	Baki	Paka
Lizard	Alibot	Butiki	Tiki
Snake	Uleg	Bitin	Man-og

Table 4. Schematic Presentation of the Occurrence and the Vulnerability to Different Phytophages (harmful) Organisms.

CATEGORY OF HARMFUL ORGANISMS	HARMFUL ORGANISMS	CROP GROWTH STAGE	ENVIRONMENT
		1 2 3 4 5 6 7 8 9	
ROOT FEEDERS	Mole cricket		Upland, nonflooded
LEAF FEEDERS	Leaffolder		All environments
	Caseworm		Irrigated/rainfed wetlands
	Skipper		All environments, rainfed rice
	Short-horned grasshopper		All environments, rainfed
	Armyworm		All environments, upland
	Ear-eating caterpillar		All environments, upland, rainfed wetlands
	Whorl maggot		Rainfed, irrigated wetlands
STEM FEEDERS	Yellow stem borer		Irrigated, rainfed wetlands, deep water
	White stem borer		Upland rice
	Pink stem borer		Upland
	Striped stem borer		Upland
SAP FEEDERS	Brown planthopper		Rainfed, irrigated wetlands, transplanted rice
	Whitebacked planthopper		Rainfed, irrigated wetlands
	Green leafhopper		
	Zigzag leafhopper		All environments, wetlands
GRAIN FEEDERS	Seed bug		Rainfed wetlands, upland
	Black bug		Rainfed wetlands, irrigated rice
NON-INSECTS	Snail		All environments
	Earthworm		Rainfed, irrigated wetlands
	Rat		All environments
	Bird		All environments

(1) Seedlings and seedbed; (2) Tillering; (3) Stem Elongation; (4) Booting; (5) Heading; (6) Flowering; (7) Milky Stage; (8) Dough Stage; (9) Ripening

Table 5. Popular Rice Varieties in the Philippines (partial list).

AGRONOMIC CHARACTERISTICS									DISEASE & INSECT PEST REACTIONS*					
Variety	**Breeding Institution**	**Year Released**		**Ave Yield (t/ha)**	**Max Yield (t/ha)**	**Maturity (Days after sowing)**	**Height (cm)**	**Tillers #**	**Blast**	**Bacterial blight**	**Tungro**	**BPH**	**GLH**	
IRRIGATED LOWLAND (INBRED)														
NSIC Rc 222 *(Tubigan 18)*	**IRRI**	2009	TPR DWSR	6.1 5.7	10 7.9	114 106	101 98	14 278	I	I	I	MR	MR	I
NSIC Rc 216 *(Tubigan 17)*	**DA-PhilRice**	2009	TPR DWSR	6.0 5.7	9.7 9.3	112 104	96 92	14 285	S	I	S	MR	MR	-
NSIC Rc 160 *(Tubigan 14)*	**DA-PhilRice**	2006	TPR DWSR	6.4 5.6	7.3 8.2	122 107	- 96	- 314	I	I	S	MS	I	-
NSIC Rc 480 *(GSR 8)*	**IRRI**	2016		3.2 (RF) 3.4 (SAL)	4.4 4.4	107 121	96 98	94 13	I I	S S	S S	I I	I I	
NSIC 2015 Rc 402 *(Tubigan 36)*	**DA-PhilRice**	2015	DWSR TPR	5.5 5.5	14.0 10.0	107 114	96	395	S	S	S	I	I	-
NSIC 2016 Rc 440 *(Tubigan 39)*	**DA-PhilRice**	2016	TPR DWSR	5.5 5.3	10.8 9.0	109 102	95 91	14 320	I	S	S	I	I	-
NSIC 2016 Rc 436 *(Tubigan 37)*	**IRRI**	2016	TPR DWSR	5.7 5.4	10.0 10.2	107 101	93 92	14 301	I	S	S	I	I	-
NSIC 2016 Rc 442 *(Tubigan 40)*	**IRRI**	2016	TPR DWSR	6.1 5.5	10.8 10.7	113 105	103 99	14 320	S	I	S	I	I	-
PSB Rc 82 *(Peñaranda)*	**IRRI**	2000		5.4	12.0	110	100	15	R	I	S	I	MS	I
PSB Rc 18 *(Ala)*	**IRRI**	1994		5.1	8.1	123	102	15	I	I	I	I	I	MS
PSB Rc 10 *(Pagsanjan)*	**IRRI**	1992		4.8	7.5	106	77	16	R	I	I	R	MR	I
NSIC Rc 218SR *(Mabango 3)*	**DA-PhilRice**	2009	TPR	3.8	8.0	120	106	14	S	I	S	MS	I	MS
NSIC Rc 226 *(Tubigan 20)*	**DA-PhilRice**	2010	TPR DWSR	6.2 5.4	9.8 8.5	112 104	102 102	14 295	S	S	S	MR	MR	MS
NSIC 2014 Rc 358 *(Tubigan 30)*	**DA-PhilRice**	2014	TPR	5.4	9.1	114	98	14	S	I	S	I	MR	-

Table 5. (continuation)

AGRONOMIC CHARACTERISTICS									DISEASE & INSECT PEST REACTIONS*					
Variety	**Breeding Institution**	**Year Released**		**Ave Yield (t/ha)**	**Max Yield (t/ha)**	**Maturity (DAS)**	**Height (cm)**	**Tillers #**	**Blast**	**Bacterial blight**	**Tungro**	**BPH**	**GLH**	**Stem borer**
NSIC 2014 Rc 354 *(Tubigan 28)*	**DA-PhilRice**	2014	TPR	5.4	9.1	114	98	14	I	I	S	MR	MR	-
NSIC Rc 27 *(Katihan 3)*	**IRRI**	2014		2.6	-	107	84	62	S	S	S	MS	I	-
NSIC 2015 Rc 400 *(Tubigan 35)*	**IRRI**	2015	TPR DWSR	5.8 5.4	9.5 12.6	120 113	105 100	15 387	S	I	S	I	I	-
NSIC Rc 224 *(Tubigan 19)*	**DA-PhilRice**	2010	TPR	5.8	9.1	111	104	14	I	S	S	MR	MR	-
NSIC Rc 238 *(Tubigan 21)*	**IRRI**	2011	TPR	6.4	10.6	110	104	15	S	I	S	I	MR	I
NSIC 2016 Rc 438 *(Tubigan 38)*	**DA-PhilRice**	2016	TPR DWSR	5.4 5.4	10.3 9.6	106 102	95 92	13 306	I	S	S	I	I	-
NSIC 2018 Rc 506 *(Tubigan 41)*	**UPLB**	2018	TPR DWSR	5.9 5.8	10.0 8.7	111 104	99 96	13 277	S	S	S	I	I	-
NSIC 2018 Rc 508 *(Tubigan 42)*	**IRRI**	2018	TPR DWSR	6.0 5.8	10.4 10.8	110 105	97 94	14 293	I	S	S	I	I	-
NSIC 2018 Rc 510 *(Tubigan 43)*	**UPLB**	2018	TPR DWSR	5.7 5.4	10.3 9.8	110 104	105 106	13 275	I	S	S	I	I	-
NSIC 2018 Rc 512 *(Tubigan 44)*	**IRRI**	2018	TPR DWSR	5.6 5.6	10.2 10.1	113 105	92 93	13 275	I	I	S	I	I	-
NSIC 2018 Rc 514 *(Tubigan 45)*	**IRRI**	2018	TPR DWSR	6.0 5.3	9.9 10.9	112 103	95 92	13 273	I	S	S	I	I	-
NSIC 2019 Rc 580 *(Tubigan 46)*	**IRRI**	2019	TPR	5.5	7.9	111	108	14	R	I	S	I	I	-
NSIC 2019 Rc 582 *(Tubigan 47)*	**UPLB**	2019	TPR DWSR	5.6 5.2	8.5 8.5	109 104	105 101	14 257	I	I	S	I	I	-
NSIC 2011 Rc 246H *(Mestiso 30)*	**IRRI**	2011		7.2	11.4	106	103	14	S	S	S	I	I	MS
NSIC 2011 Rc 262H *(Mestiso 38)*	**PhilSCAT**	2011		6.4	10.4	114	113	14	I	I	S	I	MR	MS
NSIC 2011 Rc 202H *(Mestiso 19)*	**UPLB**	2009		6.7	10.7	110	108	13	I	S	S	I	MR	-
NSIC 2011 Rc 204H *(Mestiso 20)*	**UPLB**	2009		6.4	11.7	111	112	13	I	S	S	MR	MR	-

Table 5. (continuation)

AGRONOMIC CHARACTERISTICS									DISEASE & INSECT PEST REACTIONS*					
Variety	**Breeding Institution**	**Year Released**		**Ave Yield (t/ha)**	**Max Yield (t/ha)**	**Maturity (DAS)**	**Height (cm)**	**Tillers #**	**Blast**	**Bacterial blight**	**Tungro**	**BPH**	**GLH**	**Stem borer**
IRRIGATED LOWLAND (HYBRID)														
NSIC 2017 Rc 490H *(Mestiso 82)*	PhilScat	2017	6.2	11.9	114	109	13	S	S	S	S	I		-
NSIC 2018 Rc 516H *(Mestiso 90)*	Long Ping	2018	6.4	11.9	110	99	13	R	S	S	S	S		-
NSIC 2018 Rc 518H *(Mestiso 91)*	Syngenta	2018	6.4	11.9	110	110	14	I	S	S	I	I		S
NSIC 2018 Rc 520H *(Mestiso 92)*	Bayer	2018	5.9	9.7	112	106	13	I	I	S	I	S		-
NSIC 2018 Rc 522H *(Mestiso 93)*	Bioseed	2018	6.1	9.6	113	111	12	I	S	S	I	S		-
NSIC 2018 Rc 524H *(Mestiso 94)*	Bayer	2018	6.1	9.0	112	111	14	I	S	S	S	I		-
NSIC 2018 Rc 526H *(Mestiso 95)*	PhilSCAT	2018	6.0	10.6	113	108	13	I	S	S	S	S		-
NSIC 2018 Rc 538H *(Mestiso 96)*	PhilSCAT/ Long Ping	2018	6.3	10.4	113	104	13	R	S	S	S	I		-
NSIC 2018 Rc 540H *(Mestiso 97)*	SL-Agritech	2018	6.5	12.3	110	108	12	I	S	S	I	I		--
NSIC 2018 Rc 542H *(Mestiso 98)*	Prasad Seeds	2018	5.9	8.3	113	105	13	I	I	S	S	S		-
NSIC 2018 Rc 544H *(Mestiso 99)*	DA-PhilRice/ UPLB	2018	6.6	10.6	115	112	13	S	I	S	I	I		-
NSIC 2018 Rc 546H *(Mestiso 100)*	Bayer	2018	6.4	12.9	111	106	13	I	S	S	S	S		-
NSIC 2018 Rc 548H *(Mestiso 101)*	Bayer	2018	5.7	9.8	115	114	14	I	S	S	S	S		-
NSIC 2019 Rc 550H *(Mestiso 102)*	Long Ping	2019	6.0	10.2	112	98	12	I	I	S	I	I		-
NSIC 2019 Rc 552H *(Mestiso 103)*	DA-PhilRice/ UPLB	2019	6.6	11.4	110	103	13	R	I	S	I	I		-
NSIC 2019 Rc 586H *(Mestiso 104)*	Syngenta	2019	6.6	11.3	112	107	13	R	I	S	I	I		-
NSIC 2019 Rc 588H *(Mestiso 105)*	Pioneer	2019	6.6	12.7	115	110	14	R	I	S	I	I		-
NSIC 2020 Rc 614H *(Mestiso 106)*	Long Ping	2020	6.1	10.1	112	107	13	R	I	S	I	I		-

Table 5. (continuation)

AGRONOMIC CHARACTERISTICS								DISEASE & INSECT PEST REACTIONS*					
Variety	**Breeding Institution**	**Year Released**	**Ave Yield (t/ha)**	**Max Yield (t/ha)**	**Maturity (DAS)**	**Height (cm)**	**Tillers #**	**Blast**	**Bacterial blight**	**Tungro**	**BPH**	**GLH**	**Stem borer**
NSIC 2020 Rc 616H *(Mestiso 107)*	Long Ping	2020	6.5	13.0	108	106	13	R	I	S	I	I	-
NSIC 2020 Rc 618H *(Mestiso 108)*	Long Ping	2020	6.1	9.6	115	108	13	R	I	S	I	I	-
IRRIGATED LOWLAND (SPECIAL RICE)													
NSIC 2019 Rc 584 *(Japonica 7)*	IRRI	2019	3.3	6.2	112	91	13	R	I	S	I	S	-
RAINFED LOWLAND (DRY SEEDED)													
NSIC 2019 Rc 568 *(Sahod Ulan 26)*	DA-PhilRice	2019	2.8	5.3	114	96	72	S	I	S	I	I	-
NSIC 2019 Rc 570 *(Sahod Ulan 27)*	IRRI	2019	2.5	4.5	115	93	81	S	S	S	I	I	-
NSIC 2019 Rc 572 *(Sahod Ulan 28)*	DA-PhilRice	2019	2.8	4.5	109	99	74	S	S	S	I	I	-
NSIC 2019 Rc 574 *(Sahod Ulan 29)*	DA-PhilRice	2019	2.5	3.6	113	94	76	I	I	S	I	I	-
NSIC 2019 Rc 576 *(Sahod Ulan 30)*	IRRI	2019	2.5	4.3	113	93	95	S	I	S	I	I	-
NSIC 2019 Rc 578 *(Sahod Ulan 31)*	DA-PhilRice	2019	2.5	4.4	113	88	75	S	I	S	I	I	-
NSIC 2020 Rc 592 *(Sahod Ulan 32)*	DA-PhilRice	2020	3.1	5.7	105	96	81	I	I	S	I	R	-
NSIC 2020 Rc 594 *(Sahod Ulan 33)*	DA-PhilRice	2020	3.0	5.3	109	93	74	I	I	S	I	I	-
NSIC 2020 Rc 596 *(Sahod Ulan 34)*	UPLB	2020	3.0	4.8	113	96	69	I	I	S	I	I	-
NSIC 2020 Rc 598 *(Sahod Ulan 35)*	IRRI	2020	3.1	6.1	118	90	63	I	I	S	I	I	-
SALINE													
NSIC 2018 Rc 528 *(Salinas 26)*	DA-PhilRice	2018	2.9	4.9	133	90	15	S	S	S	I	I	-
NSIC 2018 Rc 530 *(Salinas 27)*	IRRI	2018	3.0	6.1	133	96	14	I	S	S	I	I	-
NSIC 2019 Rc 532 *(Salinas 28)*	IRRI	2019	2.9	4.7	132	90	13	I	S	I	S	I	-
NSIC 2018 Rc 534 *(Salinas 29)*	IRRI	2018	3.1	6.7	131	85	13	I	S	S	S	I	-
NSIC 2018 Rc 536 *(Salinas 30)*	DA-PhilRice	2018	2.7	4.8	133	87	12	S	S	S	I	I	-

Table 5. (continuation)

AGRONOMIC CHARACTERISTICS								DISEASE & INSECT PEST REACTIONS*					
Variety	**Breeding Institution**	**Year Released**	**Ave Yield (t/ha)**	**Max Yield (t/ha)**	**Maturity (DAS)**	**Height (cm)**	**Tillers #**	**Blast**	**Bacterial blight**	**Tungro**	**BPH**	**GLH**	**Stem borer**
NSIC 2019 Rc 554 *(Salinas 31)*	**IRRI**	2019	2.5	3.7	129	95	13	I	S	S	I	I	-
NSIC 2019 Rc 556 *(Salinas 32)*	**IRRI**	2019	2.6	4.2	129	90	13	I	I	S	I	I	-
NSIC 2019 Rc 558 *(Salinas 33)*	**DA-PhilRice**	2019	2.3	3.4	128	91	14	S	S	S	I	I	-
NSIC 2020 Rc 604 *(Salinas 34)*	**DA-PhilRice**	2020	3.2	5.1	104	95	13	R	I	S	I	I	-
NSIC 2020 Rc 606 *(Salinas 35)*	**IRRI**	2020	3.0	5.7	109	99	14	R	I	S	I	I	-
NSIC 2020 Rc 608 *(Salinas 36)*	**IRRI**	2020	3.0	5.4	110	109	14	I	I	S	I	I	-
NSIC 2020 Rc 610 *(Salinas 37)*	**IRRI**	2020	3.0	5.8	107	104	14	I	I	S	I	I	-
NSIC 2020 Rc 612 *(Salinas 38)*	**IRRI**	2020	3.3	4.9	109	99	14	R	I	S	I	I	-
COOL ELEVATED													
NSIC 2019 Rc 560 *(Cordillera 1)*	**DA-PhilRice**	2019	4.0	6.6	143	95	13	I	S	S	S	MS	MS
NSIC 2019 Rc 562 *(Cordillera 2)*	**DA-PhilRice**	2019	4.3	6.9	143	97	12	I	S	S	I	I	MS
NSIC 2019 Rc 564 *(Cordillera 3)*	**DA-PhilRice**	2019	3.8	5.0	143	92	13	I	S	S	MS	MS	MS
NSIC 2019 Rc 566 *(Cordillera 4)*	**IRRI**	2019	2.5	4.0	145	84	14	I	S	S	MS	MS	I
HEAT TOLERANCE													
NSIC 2020 Rc 600 *(PangMainit 1)*	**DA-PhilRice**	2020	5.7	7.1	109	95	13	I	I	S	I	I	-
NSIC 2020 Rc 602 *(PangMainit 2)*	**DA-PhilRice**	2020	5.6	7.3	110	96	13	I	I	S	I	I	-
SUBMERGENCE													
NSIC 2020 Rc 590 *(Submarino 2)*	**IRRI**	2020	3.9	4.4	144	121	11	I	I	S	I	I	-

NSIC - National Seed Industry Council
SR- Special Rice
TPR - Transplanted
DWSR - Direct Wet Seeded Rice

R - Resistant • MR - Moderately Resistant • I - Intermediate • MS - Moderately Susceptible • S - Susceptible
• BPH - Brown Plant Hopper • GLH - Green Leafhopper • PSB - Philippine Seedboard ton (t) = 20 sacks, 50 kilograms each
* Several varieties were rated resistant to tungro at the time of their release. These may no longer be resistant now.

Glossary of Terms

A

Abdomen - The posterior segment of the body in arthropods.
Adult - The mature stage of an insect that occurs after nymphal or pupal stages. Adults have mature sexual organs and usually have wings.
Agro-ecosystem - An agricultural area sufficiently large to permit long-term interactions among all living organisms and their nonliving environment.
Airborne (Aerial-borne) - Organisms carried by air.
Alternate host - Either of two or more hosts on which a harmful organism must develop to complete its life cycle.
Anal hairs - Tuft of hairs in the anal area of adult moths.
Antenna - A movable segmented organ of sensation on the head of insects, snails.
Aquatic - A living organism growing or living in water.
Armyworm - The larva of the family Noctuidae that often travels in large populations from field to field.
Asynchronous - The irregular planting schedule in a cropping season.
Attractant - Material with an odor that attracts certain insects. Also called lure.

B

Bacterium (pl. bacteria) - Primitive one-celled microscopic organism that lacks chlorophyll and multiplies by fission. Some bacteria infect rice and produce disease symptoms.
Bait - Foodstuff used for attracting pests. It is usually mixed with a poison to form a poison bait.
Bootleaf - The swollen area of the leaf with a developing panicle.
Booting stage - The reproductive phase of rice growth and development when the developing panicle causes a swelling of the culm.
Bugburn - The damage symptoms caused by black bugs.
Butterfly - Slender-bodied diurnal insect with broad often brightly colored wings.

C

Canopy - The foliage of the plant.
Caseworm - Insect whose larva lives in a case consisting of a piece of rolled rice leaves.
Caterpillar - Larva of a moth or butterfly.
Cocoon - A silken case inside which a pupa is formed.
Colonization - To establish a colony.
Contact - Poison material killing harmful organisms by contact cation, presumably by absorption through the cuticle.

Control - To reduce damage or pest density to a non-damaging level.
Crop hygiene - The removal and destruction of heavily infested or diseased plants from a crop so that they do not form sources of reinfestation.
Culm - The jointed stem of grass.

D

Damage - Destruction, injury, loss or reduction in value caused by feeding activities of harmful organisms (insects, rats, snails, or by disease infection).
Deadheart - Dead rice tiller caused by stem borer that girdles its base.
Deepwater - A deep place in land or in a body of water.
Defoliator - An organism that feeds on leaves, removes leaves or portions of leaves from a plant.
Deposit - Amount and pattern of active ingredient deposited per unit area of plant surface.
Detection - To recognize a harmful/useful organism.
Dew - Moisture condensed from the atmosphere, which forms as small drops on the surface of plants.
Diagnosis - The act or art of identifying a harmful/useful organism from its signs and symptoms.
Disease - A condition in which use or structure of any part of the living organism is not normal.
Dispersal - Movement of individuals out of a population (emigration) or into a population (immigration).
Diurnal - Active during the daytime.
Dormant - Alive but not growing. A resting stage in the organisms.
Dose; dosage - Quality of pesticide applied per individual, or per unit area, volume, or weight.
Drizzle - A light rain falling in small drops.

E

Ecoclimate - Climate within the plant (crop) community.
Ecology - The study of all living organisms in an area and their physical environments.
Ecosystem - The interacting system of the living organisms in an area and their physical environment.
Egg - In insects, the reproductive body in which the embryo develops and from which the nymph or larva hatches.
Eggmass - The group of round or oval reproductive body of various organisms, containing the embryo and covered by a shell or membrane.
Egg pods - Eggs that are produced in groups and in structures.
Embankment - To confine, support, or protect with a bank, as of earth or stone.
Emergence - The adult insect leaving the last nymphal skin or pupal case.

Entomophagous - An animal (or plant) that feeds upon insects.
Environment - The circumstances or conditions that surround an organism or a group of organisms.

F

Fallow - Land that is ordinarily used for crops but allowed to lie idle.
Fertilization - Application of fertilizer. Process of making fertile.
Flag leaf - The uppermost rice leaf originating just below the panicle base.
Fly - A two-winged insect such as housefly, fruit fly, and horsefly.
Flooding - A rising and overflowing body of water.
Foliage - Plant leaves are collectively called foliage.
Foliar - Relating to, or applied to leaves as spray.
Footprint - An impression of an animal's (such as a rat) foot in a soft or wet soil or on a tracking tile.
Foreleg - Front leg of an organism.
Fungus (pl. fungi) - An organism with no chlorophyll, reproducing by sexual or asexual spores, usually with mycelium with well-marked nuclei.

G

Generation - The period from any given stage in the life cycle (usually adult) to the same stage in the offspring.
Granular insecticide - Insecticide having a grainy structure.
Gregarious stage - The stage where locusts become colorful, move faster, and are attracted to other locusts. They form the oppressive swarms that can decimate crops.
Growth stage - Process of growth over a period of time.
Grub (white) - A scarabaeiform larva; thick-bodied, with a well-developed head and thoracic legs, without abdominal prolegs, usually sluggish in behavior; general term for larva of Coleoptera.

H

Harmful organism - An organism that causes injury or damage.
Hatching - The emergence of a nymph or larval insect from the egg.
Honey-dew - Liquid with high sugar content discharged from the anus of some plant-sucking hoppers.
Hopperburn - Drying up of rice plants caused by feeding of leaf and planthoppers that removes plant sap.
Host - The organism on which a parasite lives; plant on which a pest feeds.
Humidity - The amount of water vapor in the air.

I

Infect - To enter and establish a pathogenic relationship with a plant (host); to enter and persist in a carrier.
Infest - To occupy and cause injury to either a plant, soil, or stored products; to place insects on a plant or grain; to inoculate

Insecticide - A toxin effective against insects.
Insectivorous bird - A bird that feeds on insects.
Instar - The form of an insect between successive molts; the first instar being the stage between hatching and the first molt.
Internode - An interval or part between two nodes.

L

Larva - An immature stage of an insect occurring between the egg and pupal stages in insects having complete metamorphosis.
Leaf scraping - The removal of the epidermal portion of a leaf by the feeding of an insect.
Leaf sheath - The lower part of the leaf originating from a node and enclosing the stem (culm) above the node.
Leaf vein - Vascular bundle of the leaf, seen externally in monocotyledonous plants such as rice, as longitudinal ridge.
Lesion - Localized spot of diseased tissue on a plant part.
Levee - Dike made of soil to retain water in rice fields.
Life cycle - The stages in the growth and development of an organism that occur between the appearance of the individual and its death or reproduction.
Light trap - A device used to collect insects, consisting of a light source that attracts insects at night and a mechanism that traps the insects.

M

Maggot - A vermiform larva, legless, without a distinct head capsule (fly).
Maturity - To come to full development/ripen.
Midrib - Central vein of the leaf.
Migrate - To move from one place/country/region and settle in another.
Milk Stage - Stage of ripening phase of rice growth and development when the contents of the grain is at first watery, but later turns milky in consistency.
Molt - In insects, the process of shedding the skin.
Monitor - To make regular observations to determine the density or feeding activity of harmful organisms.
Mortality - Population decrease factor; death rate.
Moth - Usually nocturnal insect with antennae that is often feathery, with a stouter body, dull coloring, and wings proportionately smaller than those of butterflies.

N

Nocturnal - Active at night.
Node - The solid portion of the joint stem. Leaves, tillers, and adventitious roots arise from nodes on the stem.
Nursery - A place where seedlings are grown before transplanting in the field.

Nymph - In certain insects, the stage of development immediately after hatching; resembling the adult but lacking fully developed wings and sexual organs.

O

Organic Matter - Substance that is derived from living organisms, and usually serves as fertilizer
Organism - A living being (plant or animal).
Outbreak - A sudden increase in population of harmful organisms resulting in economic damage to the rice crop.
Oviposition - The act of laying or depositing eggs.

P

Panicle - The terminal shoot of the rice plant that produces grain.
Parasitic Fly - A two-winged insect that grows and feeds on or in an organism while contributing nothing to the survival of the host.
Pathogen - A specific living agent that causes infectious disease.
Pest - A harmful organism that causes damage to man's crops, animals, or possessions.
Pest management - The careful manipulation of a pest situation, after extensive consideration of all aspects of the life system as well as ecological and economic factors.
Pest spectrum - The complete range of pests attacking a particular crop.
Pesticide - A chemical which, by virtue of its toxicity, is used to kill pest organisms.
Pheromone - A substance secreted by an insect to the exterior causing a specific reaction in the receiving insects.
Planting - The act to plant.
Poison bait - An attractant foodstuff for insects, molluscs, or rodents, mixed with an appropriate toxicant.
Predator - One that destroys or devours a harmful organism.
Predominant - Most common or conspicuous; prevalent.
Prey - The organism on which a useful organism feeds.
Projection - An extension beyond the normal line or surface.
Pupa - A nonfeeding and usually inactive stage that occurs between the larval and adult stages of insect development.
Pupation - Passing through the pupal stage.

R

Rainfed - Dependent on rainfall.
Rate - The amount of active ingredient of a pesticide applied to a unit area.
Ratoon - New tillers that grow from the stubble of harvested plants. These new tillers constitute the ratoon crop.
Resistant variety - A variety that produces a larger amount of a good quality crop than other varieties when grown under the same conditions and exposed to similar populations of insects and diseases.
Reproductive stage - From panicle initiation to flowering; a stage when the plant matures sexually.

Ripening stage - From flowering to reproductive maturity.
Rodenticide - A pesticide effective against rodents.
Roguing - The removal of unhealthy or unwanted plants from a crop.
Root dip - Placing the roots of rice plants in a solution of insecticide for a period of less than 12h. After that it becomes a root soak.

S

Saliva - The watery mixture of secretions from glands in the mouth.
Sanitation - The act of making hygiene by maintenance of sanitary conditions.
Scent - The odor left by an organism on a surface passed over.
Sclerotium (pl. sclerotia) - Resting mass of fungus tissue often more or less spherical, normally having no spores.
Seedbed - The bed on which rice seeds are sown consisting of soil or banana leaves and plastic sheets.
Seed-borne - A living organism carried by the seed.
Seedling stage - From rice seed germination to tillering during which the plant grows to the five-leaf stage.
Semiaquatic - Partially living or growing in, on or near the water.
Silica sheath - A crystalline compound in rice leaves and sheaths.
Silken sac - A pouch-like structure that is smooth.
Spiderling - The young one of an eight-legged organism (spiders).
Spider - A useful organism that has a body with two main divisions, four pairs of walking legs. Some spin webs to catch their prey while others do not spin webs.
Spikelet - A unit on the rice panicle consisting of one or more flowers and their bracts.
Spray - To apply minute particles of liquids containing a pesticide.
Stem - For rice, a round, smooth-surfaced, upright portion of the plant consisting of hollow internodes joined by solid nodes.
Straw - Stalk of grains after threshing.
Stubble - The lower portion of the stem remaining in the field after rice has been harvested.
Susceptibility - The inability of a plant to resist the effect of a harmful organism.
Sustained baiting - A method of rat control in which a poisoned bait is continuously available in bait holders from shortly after transplanting until 2 weeks before harvest or until bait consumption stops.
Swarm - A large number of insects or other small organisms in motion.
Sweep net - A device for collecting insects from plants, consisting of a cone-shaped net attached to a handle that is moved in a 180° sweeping motion across plants.
Synchronous - Happening, existing, or arising at precisely the same time or period.
Systemic - A pesticide absorbed through the plant surfaces (usually roots) and translocated through the plant vascular system.

T

Tapping hills - To strike hills of rice with hand to dislodge/disturb insects.
Thorax - The middle part of the arthropod body.
Tiller - A stem and its leaves.
Tolerance - A tolerant rice variety that is infested by harmful organisms and may show damage or develop symptoms, but the crop yield is greater than that of susceptible varieties.
Tolerant variety - A plant variety marked to endure or resist the action of harmful organisms without grave or lasting injury.
Toxicity - Ability to poison, or to interfere adversely with vital processes of the organism by physicochemical means.
Translucent - Transmitting light but diffusing it sufficiently to cause images to be blurred.
Transplant - To remove seedlings from the nursery (seedbed) and plant in the field either by hand or mechanically.
Trap crop - Crop of plants grown especially to attract harmful organisms, and when infested either sprayed or collected and destroyed. Trap plants usually grow between the rows of the crop plants or else peripherally.

U

Upland - Ground elevated above the lowlands along rivers or between hills.
Useful organism - Organism that has beneficial utility.

V

Vector - An insect that transmits a disease.
Vegetative stage - From germination to panicle initiation.
Virus - A submicroscopic infectious agent that reproduces only in living cells.
Volunteer - Crop plant growing accidentally from shed seed; not deliberately cultivated.

W

Water-borne - Organism carried by water.
Waterline - The surface of the water.
Weed - A plant that is not valued where it is growing and is usually of rank growth.
Weeding - The act of removing unwanted plants (weeds).
Wetland (lowland) - Level area with levees prepared wet or dry that is flooded by water from either irrigation (irrigated) or rainfall (rainfed)
Whitehead - White, empty spikelet resulting from the attack of a stem borer that cuts the lower portion of the culm, stopping the flow of nutrients to the panicle.
Whorl - An arrangement of three or more leaves radiating from a single node.
Wingspan - Distance between the tips of the extended wings, as of an insect.

References

CABI (1997)Module 1. Crop protection compendium. CAB: International Compact Disc.

Henrichs, E.A. 1994. Biology and management of rice insects. Edited by: E.A. Henrichs. Published by: Wiley Eastern Limited New Age International Limited, 779 p.

Joshi, R.C. 1988. Seasonal abundance of arthropods in rice: influence of a pyrethroid insecticide (Deltamethrin) and rice varieties. PhD dissertation, University of the Philippines Los Baños, 147 p.

Kenmore, P.E. 1980. Ecology and outbreaks of a tropical insect pest of the green revolution, the rice brown planthopper (Nilaparvata lugens Stal). PhD dissertation, University of California, Berkeley, 226 p.

Reissig, W.H., E.A. Henrichs, J.A. Litsinger, J. Moody, L. Fiedler, T.W. Mew and A.T. Barrion 1986. Illustrated guide to integrated pest management in rice in tropical Asia. International Rice Research Institute, Los Baños, Philippines, 411 p.

Shepard, B.M, A.T. Barrion, and J.A. Litsinger 1987. Helpful insects, spiders, and pathogens: friends of the rice farmer. International Rice Research Institute, Los Baños, Philippines, 136 p.

Shepard B.M., A.T. Barrion, and J.A. Litsinger. 1995. Rice-feeding insects of tropical Asia. International Rice Research Institute, Los Baños, Philippines, 228 p.

Acknowledgment

We thank all the graduates of the Season-long Rice Specialists' Training Course on Rice Production who provided many of the local names of the organisms mentioned in this field guide. We acknowledge the assistance of PhilRice staff members and collaborators in the region, particularly Thelma Paranpan, Romeo Raros, Eliseo Batay-an, Rolando San Gabriel, Artemio Vasallo, Omega Balgos, Salvador Yabes, Paterno Rebuelta, Anita Antonio, Alejandra Estoy, Aurelia dela Cruz, Herminia Rapusas, Lina Flor, Emmanuel Tiongco, Fe dela Peña, and Victor Gapud, for providing field assistance, local names of some of the organisms, and comments to improve the content of this publication.

Lastly, we thank all the farmers who shared their ideas with us.

DEPARTMENT OF AGRICULTURE
PHILRICE
PHILIPPINE RICE RESEARCH INSTITUTE

Quality Rice. Quality Life.

We are a government corporate entity (Classification E) under the Department of Agriculture. We were created through Executive Order 1061 on November 5, 1985 (as amended) to help develop high-yielding and cost-reducing technologies so farmers can produce enough rice for all Filipinos. With our "Rice-Secure Philippines" vision, we want the Filipino rice farmers and the Philippine rice industry to be competitive through research for development in our central and seven branch stations, including our satellites, coordinating with a network that comprises 60 agencies strategically located nationwide. We have the following certifications: ISO 9001:2015 (Quality Management), ISO 14001:2015 (Environmental Management), and ISO 45001: 2018 (Occupational Health and Safety Assessment Series).

CONTACT US:

www.philrice.gov.ph
www.pinoyrice.com

prri.mail@philrice.gov.ph

DA-PhilRice

PhilRiceTV

DA-PhilRice Central Experiment Station
Maligaya, Science City of Muñoz, 3119 Nueva Ecija
PhilRice Text Center: 0917-111-7423

BRANCH STATIONS:

DA-PhilRice Agusan, Basilisa, RTRomualdez, 8611 Agusan del Norte
Telefax: (85) 806-0463; Mobile: 0908-880-8976; Email: agusan.station@mail.philrice.gov.ph

DA-PhilRice Batac, MMSU Campus, Batac City, 2906 Ilocos Norte
Mobile: 0919-944-3016; Email: batac_1.station@mail.philrice.gov.ph

DA-PhilRice Bicol, Batang, Ligao City, 4504 Albay
Mobile: 0998-936-1202; 0928-8016-954; Email: bicol.station@mail.philrice.gov.ph

DA-PhilRice Isabela, Malasin, San Mateo, 3318 Isabela
Mobile: 0947-996-2554; 0927-437-7769; Email: isabela.station@mail.philrice.gov.ph

DA-PhilRice Los Baños, UPLB Campus, Los Baños, 4030 Laguna
Tel: (49) 501-1917; Mobile: 0915-019-5150; Email: losbanos.station@mail.philrice.gov.ph

DA-PhilRice Midsayap, Bual Norte, Midsayap, 9410 North Cotabato
Mobile: 0938-374-1040; Email: midsayap.station@mail.philrice.gov.ph

DA-PhilRice Negros, Cansilayan, Murcia, 6129 Negros Occidental
Mobile: 0912-638-5019; 0936-160-2498; Email: negros.station@mail.philrice.gov.ph

SATELLITE STATIONS:

Samar Satellite Station, UEP Campus, Catarman, 6400 Northern Samar
Mobile: 0948-754-5994; 0921-555-5500

Mindoro Satellite Station, Alacaak, Santa Cruz, 5105 Occidental Mindoro
Mobile: 0919-495-9371; 0956-632-1002

Zamboanga Satellite Station, WMSU Campus, San Ramon, 7000 Zamboanga City
Mobile: 0975-526-0306; 0975-275-1175

DA-PhilRice Field Office, CMU Campus, Maramag, 8714 Bukidnon
Mobile: 0909-822-9813; 0975-174-3531

Liaison Office, 3rd Floor, ATI Bldg, Elliptical Road, Diliman, Quezon City
Tel: (02) 8920-5129